IMPLICATION OF HOUSEHOLD LAND SIZE AND LAND USE ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN A MAIZE FARMING SYSTEM OF KALONGO SUB-LOCATION, MAKUENI COUNTY

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B63/82690/2015

A Thesis Research Project Submitted in Partial Fulfillment for the Requirements of the Degree of Master of Arts in Planning

Department of Urban and Regional Planning

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December, 2018

DECLARATION

This thesis research project is my original work and has not been presented for a degree in any other University.

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This thesis research project has been submitted with my approval as the University supervisor.

Signed……. Date……

Prof. Karanja Mwangi

(Supervisor)

DEDICATION

To my lovely daughter, Alicia Layla Irungu, for all the days mum had to be away or came home late.

ACKNOWLEDGMENTS

The completion of this research project has taken valuable inputs of many people, to whom I am eternally grateful. First and foremost, my sincere gratitude goes to God Almighty, for enabling me throughout my academic journey.

I would like to acknowledge my supervisor, Prof. Karanja Mwangi for the valuable advice, guidance, patience and support he has given me throughout the research period. I also appreciate the input of other lectures in the Department of Urban and Regional Planning; Dr. Fridah Mugo, Prof. Elijah Ndengwa, Dr. Romanus Opiyo, Dr. Margret Ng'ayu and Dr. Jeremiah Ayonga whose brilliant insights expanded by conceptual skills.

The Deputy County Commissioner, Kilungu Sub-County, Mr. D. M. Ndege, thank you for your timely response in facilitating my research. Madam Regina Mutiso, Assistant Chief, Kalongo Sub-location, am grateful for the assistance you accorded me in convening the village headmen.

To all my colleagues of the Department of Urban and Regional Planning, Masters Class of 2015 and 2016, I really appreciate your input. Special appreciation goes to Eunice Mbithi and Harrison Kioko for always ensuring they communicate the scheduled research proposal classes in time.

The Principal Consultant at Renaissance Planning Ltd, Planner P. Mutuma Mbui, I will always be grateful to you for according me the time to undertake the study amidst the busy schedules at the company. My colleagues at Renaissance Planning Ltd, Mr. Phineas Mwiti and Mr. Augustine Mutuku, I really appreciate your assistance with the maps I required for the project.

To my best friend, colleague and confidant, Mr. Dominic Ndung'u, I truly appreciate your immense contribution in seeing this project to completion. You provided a convenient place for me to work from and literally pushed me to finalize the project, I will always be grateful.

Lastly, am grateful to all my research assistants; Daniel Kiio, Muindi Mutiso, Justus Kasimba, Florence Mbeneka, Albanus Kioko, Daniel Kyalo, Diana Mumo, Catherine Kalunde, Winfred Makau and Agnes Mutheu for your dedication and hard work during the data collection exercise. To all the key informants, respondents and participants in the focus group discussions, thank you for your cooperation.

ABSTRACT

The economy of the country is largely based on agriculture as the sector contributes about 30 percent of the Gross Domestic Product (GDP) and provides livelihoods to about 80 percent of the population (Kenya 2017c). The importance of agriculture to the national economy is also replicated in Makueni County as the sector employs over 78 percent of the population. Despite the importance of agriculture and its contribution to the economy, its productivity is being threatened by among other factors diminishing land sizes especially in the relatively high potential areas of the county. The phenomenon can be attributed to the land subdivision practices mainly for inheritance purposes. From literature, land fragmentation has both positive and negative effects. In addition, with the inheritance tradition still in place, land subdivision may be here to stay. However, the most critical issue would be establishing and maintaining an ideal land size so as to ensure sustainable food and livelihood security in the sub-location amidst all the pressures on land, thus the basis of this study.

The study assessed the current household land size and use and their impact on food and livelihood security, evaluated the factors influencing household land size and use, documented inter-generational transmission of land rights and use and recommended planning interventions for sustainable food and livelihood security in the maize farming system of Kalongo sub-location. Both secondary and primary as well as qualitative and quantitative data was collected for the study. The target population included the households; religious, community, political and opinion leaders; administrators and professionals within the sub-location. A representative sample from each category was selected for the study. A total of 140 households were interviewed, 3 focus group discussions held and 5 key informants interviewed. Data collection methods employed for the study included literature review, extraction of statistical data, conducting of interviews, instrument administration, field observation and photography. In addition, with the use of Arc GIS software, a chronological analysis of 5 years interval images for the area was undertaken to understand the changes that have taken place over time with regard to land size and use. The data was analyzed and presented in a meaningful form to aid in deciding on the necessary measures for ensuring food and livelihood security in the area.

The study established that though there exists a relationship between land size and agricultural production as land is a factor of production, there was no significant difference in the land size for households who were food secure and those who were food insecure, $t = -0.767$ and $p = 0.445$. There however exists a relationship between household land size and livelihood security. The chi-square test presents a p of 0.000 which is less than $\alpha = 0.05$. In addition, the study established that there is a significant relationship between maize land allocation and production, $p = 0.000$ is less than $\alpha = 0.05$. Some of the factors affecting household land size and use include population pressure/big household sizes, brothers at the time of inheritance, education level, off-farm income, settlement patterns, land ownership, fertility of the land and topography among others. Intergenerational transmission of land rights and use was evident in the sub-location as inheritance was the most common form of land acquisition. Some of the recommendations include: land consolidation, re-organization of the settlement, establishment of settlement schemes, curbing the selling of land, sensitize people on the environmental damages, social and economic loss brought about by land subdivision as well as educating children to make them less dependent on the land that belongs to their parents. The recommended ideal land size is 5 acres, which, if properly utilized would produce enough food for household consumption and a surplus for sale in the market.

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LIST OF ABBREVIATIONS

α	alpha
AEZ	Agro – Ecological Zone
ASAL	Arid and Semi-Arid Lands
ASDSP	Agricultural Sector Development Support Program
AWSC	African Women Study Centre
CBS	Central Bureau of Statistics
CGIAR	Consultative Group on International Agricultural Research
CIDP	County Integrated Development Plan
CoK	Constitution of Kenya
DFID	Department for International Development
DEB	District Education Board
EEA	European Economic Area
ECA	Economic Commission for Africa
FAO	Food Agriculture Organization
FDRE	Federal Democratic Republic of Ethiopia
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
GIS	Geographic Information System
Ha	Hectare
HRS	Household Responsibility System
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IJCEE	International Journal of Civil and Environmental Engineering
IJEN	International Journal of Engineering and Sciences
KAPAP	Kenya Agricultural Productivity and Agri-business Programme
KAPP	Kenya Agricultural Productivity Programme
km	kilometer
KNBS	Kenya National Bureau of Statistics
LDSB	Land Development and Resettlement Board
LM	Lower Midland Zones
MCA	Member of County Assembly
mm	millimeter

MoALF	Ministry of Agriculture, Livestock and Fisheries
NJAS	Wangenigen Journal of Life Sciences
p	Significance level
r	Correlation coefficient
SEKU	South Eastern Kenya University
Sig.	Significance level
SPSS	Statistical Package for Social Sciences
UM	Upper Midland Zones
WFP	World Food Programme

CHAPTER ONE
INTRODUCTION

1.0 Introduction

Worldwide, agriculture is the supplier of nutrition, a very basic human need. It supplies economically and culturally valued foods, sufficient nutrients, fibers and other commodities for human consumption and health. Since agriculture produces food and economic wealth, it is essential for inclusive development. The wealth component of agricultural production creates room for improved livelihoods through infrastructure improvements, education, better health care and results into more environmentally sound investments (International Fund for Agricultural Development (IFAD), (2013). According to Diamond (2005) agricultural development was vital during the growth and existence of early civilization.

Agriculture can play very vital roles in economic growth and reduction of poverty through its roles of providing employment, supplying affordable food and generating farm incomes. For countries that what to industrialize, agriculture forms the most common source of raw materials for the emerging industrial activities (Lai et al., 2015). According to Diao et al., (2010) majority of the population in Sub-Saharan Africa live in the rural areas. These areas are characterized by severe poverty and deprivation. It is evident that a big proportion of rural households depend on agriculture whether directly or indirectly. The sector contributes largely to the economy in general, thus becoming a key sector in the development of the continent.

The Royal Danish Embassy (2010) noted that agriculture is the most significant sector in the economy of Kenya. The sector directly contributes approximately 24 percent of the Gross Domestic Product (GDP) and 27 percent indirectly. This indirect contribution of the sector is mainly achieved through its linkages with other sectors like distribution, manufacturing and service related sectors. About one third of agricultural production in Kenya is exported. This corresponds to 65 percent of the total export for the country. In addition, the sector accounts for about 18 percent of total formal employment, with more than 5 million smallholder farmers practicing various agricultural related activities.

Agriculture is the backbone of the economy of Makueni County. The proportion of the population that is mainly engaged in small scale agriculture and pastoral activities

in the county is about 78,382 people which is equivalent to 26.2 percent of the employed labor force. Since the county has large rural populations, small scale agriculture and pastoralism comprise of the most important sources of subsistence and employment in the county. These activities account for a big proportion of agricultural production. This in turn support an agro-based manufacturing sector thus significantly contributing to the economy of the county (Kenya, 2017a).

For many developing countries, maintaining food security at both the country and household levels is still a major challenge. According to FAO et al., (2013) with respect to dietary energy supply in the period 2010 – 2012, about 870 million people are estimated to have been undernourished. This figure represents 12.5 percent of the world population. About 852 million undernourished people live in developing countries where there is a high prevalence of undernourishment which is currently estimated at 14.9 percent of the population. In most of the developing countries, there is massive pressure on the available land resources owing to the ever-increasing population size. This has led to numerous uncontrolled land sub-divisions for ancestral inheritance and succession purposes. This practice has left very minute land parcels for agricultural production. This then implies that; whatever food produced by a given household cannot sustain it till the next harvesting season.

1.1 Outcomes of Diminishing Land Sizes on Food Security

Increasing population size in some developing countries is causing eminent pressure on the available land resources. This has led to unregulated land sub-division to meet ancestral inheritance and succession needs. This practice results into very small land parcels for agricultural production, a situation that impact negatively on agricultural activity and food availability. In most scenarios, the little produced from the farms cannot sustain the households up to the next harvest season. This means there is perennial famine in the region (Obonyo, et al., 2016).

In Rwanda, the mostly densely populated country in Africa, fragmentation and small farm sizes are the two most challenging policy issues. The 2008 national agricultural household survey in Rwanda situates average holding size at 0.72 hectares per household which is fragmented in four parcels of 0.18 hectares on average. This suggests that the production to be generated from this will not allow the typical household to even meet their subsistence needs (Rwanda, 2009 in Ali and Deininger,

2013). Matchaya, (2007) found out that smallholder farmers in Malawi face food insecurity due to several factors among them lack of enough farming land. He further notes that insufficient land holding is becoming a critical problem due to the increased Malawi population.

1.1.1 Land Fragmentation Issues in Kenya

The history of land fragmentation dates back in the colonial times when, in the year 1961, Kenya begun a program of agricultural reform which was commonly referred to as the Million Acre Settlement Scheme. This program was aimed at facilitating the transfer of land ownership in the Rift Valley from the outgoing white settlers to about 35,000 African families. The Government of Kenya through the help of the British Government bought the land from the departing European settlers, subdivided and resold it as small-holdings to Africans. Thus, decolonization of the British Empire in Kenya was the beginning of land fragmentation in the country (Syagga, 2010).

A study in Ugunja Sub-County of Siaya County found out that low food production is a result of small land holdings (Obonyo et al., 2016). Households are no longer sustained by food harvested in one season to the next harvest season and have to go without sufficient food before the next harvest. The small landholdings in Makueni County which characterize the densely populated areas like Kalongo Sub-location make it hard for any economical agricultural production. As an adaption measure, the residents have resulted to subsistence farming which can hardly support them till the next harvesting period.

1.1.2 Livelihood Challenges from Diminishing Land Sizes

Livelihood comprises of the capabilities, assets and activities needed for a means of living (DFID, 2002). The World Bank (2005), found out that small land units resulting from land subdivision present difficulties in farming some crops and hindered farmers from shifting to more profitable crops. For instance, crops like fruits, though very profitable may not be viable for farmers with small and fragmented plots as they require larger plot areas. This situation affects the livelihoods of the farmers. As noted by Sklenicka et al., (2014), in some instances, the very small land parcels cannot be farmed individually. Their owners are therefore forced to become part of the wholes of large agricultural holdings, a process that gradually alienates owners from their land hence affecting their livelihoods. This alienation is very

evident in Czech Republic where there are more than 3.5 million land owners and only 30,000 farming entities.

As observed by Sklenicka (2006), due to uncoordinated fragmentation, many of the resultant parcels are not provided with roads of access since the exercise does not accompany construction of the prerequisite denser road network. In the Central European countries, land parcels without roads of access are not farmed by travelling across neighboring parcels. The owners of such parcels are forced to rent to the user of an adjacent parcel thus experiencing limitation with respect to possible tenants. This absence of competition significantly affects the rent values to the disadvantage of the owner (Vranken and Swinnen, 2006). Generally, the freedom of owners is limited in two aspects; farming their own land and their rental options. In addition, the market price of land is further decreased by the continuing land subdivision which often leads to loss of direct land access.

In addition, larger parcels have a price advantage and are more sought after as compared to their smaller counterparts. In some instances, small landholdings discourage infrastructure development with respect to transportation, irrigation, communication, and drainage which are key components to the enhancement of the livelihoods of the people (Mwebaza and Gaynor, 2002). In other instances, banks are reluctant to take small and scattered landholdings as loan collateral. This hinders farmers from obtaining credit to venture into businesses and investments, thus affecting their livelihoods (ibid).

The small land sizes in Kalongo sub-location in Makueni County have forced farmers to practice subsistence farming as opposed to commercial farming. The agricultural yields are so minimal to the extent that no surplus can be sold to earn an income to the farmers. It can therefore be deduced that, the small land sizes in the sub-location have impacted negatively on the livelihoods of the residents.

1.2 Statement of the Research Problem

A rapidly growing population, falling food production as a result of water scarcity and low resilience to climate change are the main issues that characterize Makueni County. As observed by Population Action International (2014), food insecurity in the county is increasing due to the combined effects of climate change and rapid population growth. As identified by Makueni County Integrated Development Plan

(CIDP) (2018), population dynamics and environmental degradation are critical development challenges. Approximately, 70 percent of the population is aged 30 years and below while 44 percent is less than 15 years. This young age structure of the county implies that, the population will keep on increasing for several other generations. This then raises the question of the possibility of growing enough food to feed this growing population amidst the diminishing land sizes.

The total arable land in Makueni County stands at 5042.69 km^2, which is equivalent to 74 percent of the total land. Agriculture is the main economic activity in the county since majority of the households depends on agriculture for their livelihood. Makueni County Annual Development Plan envisions a food secure county with agriculture employing over 78 percent of the population in its forward and backward linkages (Kenya, 2017b). To achieve this vision, the bottlenecks in agricultural production need to be eliminated.

Kenya (2016) confirms the importance of agricultural sector in the county. It specifies that the agricultural sector is an integral component of the economy of Makueni County. The sector employs approximately 78 percent of the population, contributing a similar percentage to household incomes. However, a decline in maize yields in the county has been observed since 1994. For instance, in 2013, there was a 70-90 percent crop failure in the agro-ecological zone (AEZ) LM5 of the county with major crops like maize, cowpeas and green grams registering 42 percent, 74 percent and 79 percent decreases in productivity, a phenomenon that left about 60,000 people dependent on food assistance. In 2013, the County received about 2 billion and 10.3 million Kenya shillings respectively from the major crop and livestock enterprises. In the livestock sector, the highest contribution of 89 percent came from milk whereas in the crops sector, mango, maize and cowpeas contributed 26 percent, 23 percent and 20 percent respectively (ibid).

A study done by African Women Study Centre (AWSC) of the University of Nairobi, (2015) found out that Makueni County is food insecure. Twenty one percent of the population are faced by hunger. On average, 19 percent of the residents suffer from prolonged food insecurity while over 17 percent of household members spends nights in hunger due to lack of enough food. The study also found out that the factors contributing to food insecurity in the county include small land sizes due to

fragmentation for inheritance. Inheritance is a cultural practice that leads to unproductive and uneconomical land parcels.

Wambua, (2013) in a study on the state and effects of food security on the livelihood opportunities in the semi-arid parts of Makueni District found out that the state of food security in Makueni County is characterized by considerable seasonal fluctuations that contribute to unreliable levels of food production at household level. He however noted some reliability in food production in the high potential zones of Kilungu and Mbooni hills. Nevertheless, this reliability is been distorted by diminishing land sizes in Kalongo Sub-location of Kilungu Ward. The size of land parcels are small and only produce crops that last in the field. This implies that, very little is stored to feed the households till the next harvesting season.

It is evident that land fragmentation which leads to small land sizes results to lower productivity and higher agricultural costs. This then impede higher agricultural production an aspect that triggers food insecurity in the sub-location. However, land fragmentation has some positive impacts with respect to cultivating various ecological zones, minimizing risks of production and optimizing the cropping activities schedules. It would appear that the existing traditional African practices that promote land inheritance and land fragmentation may be here to stay. Efforts to discourage division of land parcels to uneconomical sizes for agricultural production should therefore be made if food and livelihood security is to be ensured. The challenge is to come up with an ideal land size that is suitable for sustainable food and livelihood security in this maize farming system within the study area.

The research has achieved this by assessing the effects of diminishing household land sizes and uses on sustainable food and livelihood security in Kalongo Sub-location. In addition, the effect of existing land sizes and uses on food and livelihood security and existence of approximate landholding that may sustain an average rural household from a maize farming area has been examined.

1.3 Research Questions

The study sought to answer the following questions:

i. What are the household land sizes and uses in Kalongo Sub-Location?
ii. What food and livelihood challenges face people in Kalongo sub-location?

1.4 Research Hypothesis

The study has three research hypotheses.

1. Relationship between household land size and food security
    a. Alternative Hypothesis

Ha: Households that are food secure have significantly larger land parcels than households that are food insecure.

    b. Null Hypothesis

Ho: Households that are food secure have no significantly larger land parcels than households that are food insecure

2. Relationship between household land size and livelihood security
    a. Alternative Hypothesis

Ha: Households that are livelihood secure have significantly larger land parcels than households that are livelihood insecure.

    b. Null Hypothesis

Ho: Households that are livelihood secure have no significantly larger land parcels than households that are livelihood insecure.

3. Relationship between land use allocations and production.
    a. Alternative Hypothesis

Ha: Agricultural enterprises with large land allocations produce more yields.

    b. Null Hypothesis

Ho: Agricultural enterprises with large land allocations do not produce more yields.

1.5 Objectives

The study has overall and specific objectives.

1.5.1 Overall Objective

The overall objective of the study is to assess household land size and use for sustainable food and livelihood security in a maize farming system of Kalongo Sub-Location, Makueni County.

1.5.2 Specific Objectives

The study has the following five specific objectives:

1. To appraise household land size and its impact on food and livelihood security;
2. To assess effects of land uses on food and livelihood security;
3. To evaluate factors influencing household land sizes and uses;
4. To document inter-generational transmission of land rights and use and;
5. To recommend planning interventions for sustainable food and livelihood security.

1.6 Assumptions

The study assumes that there is a relationship between household land size and maize production in the study area. It also assumes that farm enterprises with large land allocations produce more yields as compared to those with small land allocations.

1.7 Justification and Significance of the Study

By the year 2050, global population is projected to grow by nearly 2.3 billion people (FAO, 2009). The fastest growth is expected to come from Sub-Saharan African region. Thus, producing enough food to meet demand for the growing population will be the major challenge for global agriculture. The smallholder farmers constitute the largest food contributors in the developing countries. However, given the rapidly growing population versus consequent land size fragmentation, there is very limited potential of increasing the productivity of farmland of the smallholders through area expansion. This then challenges the possibility of producing enough food to feed the population. Thus, a policy framework is required to ensure that the resultant plots after subdivision is of the minimum required land size for sustainable food and livelihood security. This study strived to establish the minimum land sizes for sustainable maize production in the sub-location and proposes interventions of maintaining that estimated minimum land size.

Currently, agriculture is the economic backbone in Makueni County. Since the county is located in an Arid and Semi-arid region, livestock keeping and cash / food crops are the main livelihoods for the area residents. Thus, identifying and addressing the bottlenecks of realizing optimal agricultural production in the county would aid in enhancing the economy of the county. The Constitution of Kenya (2010), article 43

(1) (c) makes it a fundamental right for every person to achieve freedom from hunger and to consume adequate food of acceptable quality. Since food security is a constitutional right, this study was therefore timely in identifying the hindrances in the attaining food security in the maize farming system of Kalongo Sub-location and by extension, Makueni County in regard to land sizes and land use allocations. Addressing the identified hindrances would then help in realizing this constitutional right. In addition, food security is among the Kenyan Government big four agenda, thus the study is in line with realizing this agenda.

The food insecurity issues associated with Kalongo Sub-Location do not apply to it alone, but also to the rest of the rural areas in the ASAL region. As noted by Musambayi (2013) vulnerability to food insecurity is more severe to the communities that reside in arid and semi-arid lands of the Country, where the study area is located as compared to their counterparts in the high agricultural potential areas. Researching on the impacts of household land sizes and uses on food and livelihood security would therefore enable the findings to be replicated in other similar rural areas.

1.8 Scope of the Study

The study was undertaken in Kalongo Sub-location. The Sub-location is located in Kikoko Location, Kilungu Ward, Kaiti Sub-County, Makueni County. Kalongo sub-location is the most densely populated sub-location in Kaiti Sub-County. It has a population density of 574 persons per square kilometer, which is quite high when compared to the county and sub county population density of 119 persons/km^2 and 316 persons/km^2 respectively. The sub-location covers an approximate area of 17.6 sq. km. The study focused on the relationship between land size, land uses and land tenure on food and livelihood security of the households within the sub-location.

1.9 Limitations of the Study

The study was undertaken against constraints of time and finance resources. Otherwise, with much time and sufficient finances, the study would be carried out in the entire ASAL region of the country. This would have helped establish the different dynamics on household land sizes, land use, food and livelihood security in these areas. As a result, conclusive recommendations would be made on the ideal land sizes suitable for the different ASAL areas.

1.10 Definition of Terms

Land fragmentation: Land fragmentation entails practicing farming activities on two or more geographically detached land pieces, where the distances between those parcels is taken into account (Bizimana et al., 2004). Van Dijk (2003), outlined four parameters under which land fragmentations could be defined. These parameters include; number of users, ownership fragmentation, internal fragmentation as well as fragmentation as a result of overlap of both ownership and use.

Food security: According to FAO, et al., (2013), food security occurs when everyone, every time, has physical, economic and social access to sufficient, nutritious and safe, food. Thus four parameters which are; availability, stability, accessibility and actual consumption can be used to measure food security.

Livelihood: This are the assets, capabilities and activities that are needed to achieve a means of living (DFID, 2002).

Livelihood security: This refers to sufficient and sustainable access to income among other resources to support a household in meeting its basic needs which include food, health, education and personal needs (Frankenberger, 1996 in USAID, 2009).

For this study, a household is considered food secure if the harvested food lasts for at least 12 months. On the other hand, a household is considered livelihood secure if it produces surplus for sale at the market.

CHAPTER TWO
METHODOLOGY

2.0 Introduction

This chapter presents the overall research design, indicating the data needs and the activities that were undertaken to acquire the required data. The research strategy provided a framework for designing a systematic study that addressed the study objectives/questions and added to the knowledge regarding the subject matter. In particular, the data needs were identified based on the study objectives.

2.1 Research Design

A research design is a description of the specific plan that a researcher intends to use in carrying out a study in a way that is best suited to achieve the research objectives. The study entailed three phases namely: conceptual, narrative and interpretation phases. The conceptual stage involved formulation of the research problem, questions and objectives. This was done with the help of the reviewed literature as the researcher familiarized herself with policies, theories and concepts related to the subject under study.

The narrative phase entailed the process of planning for the study. The researcher demarcated the study area extent where the surveys and observations were conducted. The data needs, research procedures and the techniques that were used to collect, analyze and present the data were also identified. The interpretation stage came after data collection, cleaning and analysis. At this point, the researcher endeavored to make sense out of the findings and answer each of the research objectives. An important part of this phase is hypothesis testing, in which case the researcher establishes whether or not there is an association between: land size and food and livelihood security and; land use allocation and farm gross margins.

This study further focused on establishing the relationship between land size and land use allocation with food and livelihood security. It is thus correlational in nature and the research approaches used were qualitative, quantitative and exploratory. Qualitative research focused on the manner in which people interpret their experiences and their surroundings. A qualitative approach was justified in this study by the need to explore and describe the perceptions that the policy makers have with respect to the relationship of land size, land use and land tenure with food and

livelihood security. On the other hand, the quantitative approach was employed in cases where there was need to give numerical accounts of the phenomenon. As an exploratory research, there was review of past literature that has been written about the subject under study. The aim of using this approach was to relate the findings of this study to the relevant theories that were earlier postulated by various scholars. This way, it was possible to understand the phenomena that have been studied in relation to the subject matter and to assess the validity of the study findings.

2.2 Target Population

The target population for the study consisted of all the households, community leaders, opinion leaders, religious leaders, political leaders, administrators and professionals in Kalongo sub-location, Makueni County. A representative sample was picked from each category of the target population.

2.3 Sampling Plan

Kalongo sub-location has a total of 2,053 households and 52 villages based on the 2018 data collected by Kenya Bureau of Statistics (KNBS) to aid in the 2019 census. Since the sub-location is homogeneous based on the ecological conditions and agricultural production, random sampling was used to select 10 villages for the study. The lists of households from the 10 villages were provided by the village headmen. These lists were used as the sampling frame for the study. The sampling size was calculated using the formula:

$$N = \frac{t^2 \times pq}{m^2}$$

Where:

N = Sample size

t = Confidence level, 95% confidence level, whose standard score is 1.96

m = Absolute precision or accuracy (5%)

p = Estimated prevalence to the diminishing parcel situation (90% of the total population)

q = 1-p

$$N = \frac{1.96^2 \times 0.9\ (1-0.9)}{0.05^2}$$

$$= \underline{138}$$

Thus, approximately a total of 140 households were interviewed. Proportionate random sampling was used to establish the number of respondents from each village based on the village population (appendix 9). The households selected for the survey were sampled using stratified random sampling method. Stratification was based on household headship i.e male, single and widowed headed households. From the three strata, proportionate random sampling was used to establish the number to be interviewed from each stratum. Systematic random sampling was then used to select the households to be interviewed (Appendix 10). The ticked households were the ones selected to be interviewed. In addition, extreme case sampling was done in order to identify five farmers with the largest land sizes and five with the smallest land sizes within the sub-location. This was done to help compare and contrast their experiences and opinions on future land size and land use practices.

Administrators that were interviewed included: Assistant Sub-County administrator, area chief and the area Assistant Chief. The professionals in the sub-location including teachers, medical staff, pastors and county physical planners were interviewed. The key informants for the study included the County Lands Officer, Physical Planner and the Agricultural Officer who were selected using purposive sampling. In addition, three gender sensitive focus group discussions were held. These groups consisted of representatives from all adult age groups: Over 65 years; 35-65 years; and 18-35years the attendance lists for the FDGs are attached as appendix 11.

2.4 Data Types

Both quantitative and qualitative data was collected. This study utilized both primary and secondary data. Primary data entailed the data which was acquired directly from the field while secondary data was obtained from review of literature.

2.5 Data Needs

The data needed for the study was guided by the research objectives as presented below:

2.5.1 Household Land Size and its Implications on Food and Livelihood Security

The data required included: the original and current household land sizes, agricultural production pattern over time, current land productivity status, relationship between land size and production as well as traditional and cultural issues on land subdivision. This data was obtained through review of literature on the available documents on the

subject under study, observations, interviews and instrument administration where the actual land sizes were measured.

2.5.2 Effects of Land Uses on Food and Livelihood Security

The data needed to address this objective were: existing land use allocations, land use changes over times and impacts of land uses on agricultural production. The data was sourced from literature reviews of written documents, observation, interviews and photography.

2.5.3 Factors Influencing Household Size and Use

The data required included: the existing policies, theories and concepts on land holding and their impact on agricultural production; factors influencing land size, factors affecting land use allocations and the actors behind land fragmentation and land use allocations. This data was sourced from literature review, observations and interviews.

2.5.4 Inter-Generational Transmission of Land Rights and Use

The data required for this objective included: historical trends on land transfers, land rights and access to land in the area. The data was sourced from literature review, observations, interviews and discussions.

2.5.5 Planning Interventions for Sustainable Food and Livelihood Security

The data required include: minimum land sizes, appropriate land use allocation and alternative possible scenarios for food and livelihood security in the sub location. The synthesis of the data in the above objectives aided in the formulation of the planning interventions for sustainable food and livelihood security in the sub-location.

2.6 Methods of Data Collection

Both qualitative and quantitative data was collected from various sources where multiple methods of data collection were employed. This was done to allow for triangulation hence improve validity of the findings. The sources of data were both primary and secondary while the methods included document examination, case study reviews, individual and group interviews, round table discussions, observation, oral history and instrument administration.

2.6.1 Literature Review

The researcher reviewed documented literature on the relationships between household land sizes and uses with food and livelihood security. In addition, land use change data was gathered from analysis of aerial photographs since 1956, remotely sensed image data of land sat, spot images of land use and land cover changes over the last 60 years. Other documents that were reviewed include population census reports, population structure maps, rainfall maps, temperature maps, dominant crop maps and soil maps. Case studies from other countries that have had high population growth, land subdivision and fragmentation problems in the rural areas were also reviewed to gather information on how they solved the problems.

2.6.2 Extraction of Official Statistical Data

The existing statistical data from statistical abstracts and economic reviews on the contribution of agriculture and specifically maize production in the Kenyan economy was extracted. This aided in building the case for the study.

2.6.3 Conducting of Interviews

The researcher conducted household and key informant interviews. Focus group and round table discussions were also conducted.

2.6.3.1 Household Interviews

With the help of a well formulated questionnaire of both structured and unstructured questions; data on the household land sizes, subdivision, fragmentation and land use allocations from household members was obtained through face to face interviews.

2.6.3.2 Key Informant Interviews

The key informants included the administrators, professionals and religious leaders. The interviews were conducted with the help of open ended customized interview guides. They assisted in obtaining the original ideas and thoughts of the respondents.

2.6.3.3 Focus Group Discussions (FGDs)

The identified representatives of the community formed the members for the FGDs. Through the aid of a well-structured discussion guide, the researcher led the group in discussing the food and livelihoods trends in the sub-location as a factor of land size and land use allocations.

2.6.3.4 Round Table Discussions

The researcher conducted round table discussions with the area Chief, Assistant Chief and the village elders. The discussions helped to gather data on food and livelihood trends in Kalongo sub-location as well as any institutional memories on land issues, land related conflicts and possible remedies.

2.6.4 Instrument Administration

With the use of the appropriate tools and instruments, the actual measurements of the household land size and land allocations for some land uses were undertaken. This acted as a validation of the data gathered via the interview method.

2.6.5 Field Observation

The researcher formulated a field observation checklist on all data needs. This was done so as to ensure all essential data that can be gathered through observation is captured. The checklist consisted of key features in the study area such as landscape, crop cover, farmlands, type of houses and materials used for house construction, farm boundary markers, household compound sizes and layout amongst others.

2.6.6 Photography

Still and aerial images were captured with the aid of a photography checklist that validated data obtained via field observation. It acted as evidence of the actual situation on the ground and provided a basis for comparisons with existing earlier photography of the area. This helped to visualize the levels of land subdivision and fragmentation in Kalongo Sub-location, the changes that have taken place over time and their implications on food security and livelihoods.

2.7 Methods of Data Analysis

Once all the required data was collected, several methods were adopted for its analysis. Quantitative data was analyzed by use of frequency distributions and measures of central tendency generated by use of Statistical Package for Social Sciences (SPSS). Statistical tests such as T-test, Chi-square and Correlations were undertaken with the right data sets to aid in measuring the associations and relationships between household land sizes and uses on the one hand and food and livelihood security on the other. T-test and chi-square model was used to undertake the hypothesis testing. The statistical tests assumed a confidence level of 95 percent and a significance level of 0.05.

Additionally, a detailed analysis of documents, maps and photographs was carried out to assess the relationships of different variables. Analysis of qualitative data involved both case and cross-case analysis subject to the variables identified to analyze the data. Spatial data was analyzed through Arc GIS.

2.8 Presentation of Data

The analyzed data was presented in acceptable and recognized formats that make it easily understood. Quantitative data was presented graphically with the aid of tables, bar graphs and pie charts. Descriptive data was presented through text narratives giving interpretations of the findings. Spatial data was presented through maps and figures.

2.9 Ethical Considerations

The researcher ensured the respondents confidentiality of the collected data. The research findings were solely for the purpose of the study and any publications will adhere to consent regulations that guide research world over. The research was based on objectivity, honesty and respect for intellectual property, confidentiality, social responsibility and non-discrimination.

2.10 Conclusion

The target population for the study included the households engaged in maize production; community, opinion, religious and political leaders; administrators and professionals in the study area. A total of 140 households were interviewed, 3 focus group discussions held and 5 key informants interviewed. The households selected for the survey were sampled using stratified random sampling method, and from each strata, proportionate random sampling was done to establish the number to be interviewed from each stratum. Extreme case sampling was done to identify farmers with the largest and smallest land sizes. Purposive sampling was done to identify the oldest members of the community and the key informants. The collected data was analysed and presented appropriately.

CHAPTER THREE
HOUSEHOLD LAND SIZE AND USE ISSUES IN MAIZE FARMING

3.0 Introduction

This chapter presents reviews of past documentation relating to a wide range of crucial issues underpinning this study at a global scale. Mainly, the chapter addresses various aspects of the relationship between land size and use on food and livelihood security. It expounds on the factors affecting land size and use, the intergenerational transmission of land rights and the ideal land sizes in various areas and for different farming systems. In addition, it highlights some of the theoretical frameworks upon which the study was pegged on. It also identifies some of the planning interventions that can help mitigate against the diminishing land size situation.

3.1 Land Fragmentation and Agricultural Productivity

Land fragmentation has been identified as one of the causes of reduced agricultural production. According to Tan, et.al, (2008), in a study undertaken to establish whether fragmented landholdings have higher production costs in China, it was found out that land fragmentation is often considered as the source of inefficiencies in crop productivity. This inefficiency is associated with production costs due to inefficient resource allocation; wasted space along borders, inadequate monitoring, suboptimal usage of factor inputs and the inability to use certain types of machinery. Mwebaza and Gaynor (2002) agrees with this viewpoint as they point out that land fragmentation is a major hindrance to efficient production system. This arises from the fact that continuous subdivision of farms results to uneconomical small sized land holdings. The other costs associated with land fragmentation include impeding farm mechanization and economies of scale.

However, land fragmentation proponents view it as a positive scenario where farmers can farm various ecological zones, optimize cropping activity schedules and minimize risk of production (Bentley, 1987). In addition, Mwebaza and Gaynor, (2002) points out that disjointed land with different biophysical conditions allows farmers to reduce risks such as drought, flood, and fire; diversify crop mixtures; and ease seasonal labor bottlenecks. Todorova and Lulcheva (2005) also observed that land fragmentation allows farmers to grow a wide range of crops with different ripening time. This

enables them to concentrate their labor at different plots at different time, thus avoiding the period of labor intension and household labor bottlenecks.

There are four types of land fragmentation as presented by Van Dijk (2004) in Kadiji et al., (2017) namely: fragmentation of land ownership where various landowners use one piece of land; land use fragmentation where there are various users/tenants of a piece of land; internal fragmentation where there are many parcels utilized by each user and parcel shape, size and distance are the main issues considered; and separation of use and ownership where there is inconsistency between use and ownership. The major causes of land fragmentation are: land distribution and redistribution, inheritance rules and risky peasant agriculture.

It is thus evident that, fragmentation of land has both positive and negative impacts and should not therefore be abolished all together. The critical issue would however be estimating the minimum land size required to sustain food and livelihood security for a household. The six indicators of land fragmentation as outlined by King and Burton (1982) are; land size, number of parcels that a household owns, size and shape of the parcel as well as the spatial and size distribution of parcels. According to Bentley (1987) when measuring land fragmentation, one should capture at least one of the six parameters. Thus, this study used land size and number of parcels belonging to a household as the indicators of measuring land fragmentation in Kalongo sub-location as diminishing land sizes in the high potential agricultural areas in Kenya is a great concern to the policy makers.

3.2 Food and Livelihood Security

The concept of food security revolves around some intricate issues that comprise a wide range of interrelated economic, political, environmental and social factors. As defined by Devereaux and Maxwell (2001), food security refers to the level of attainment by local livelihoods to assure access to sufficient food at household levels. Food security exists when everyone, every time has economic and physical access to safe, sufficient and nutritious food (FAO, 2003). Thus, food availability, access and utilization are the three key parameters of food security. Lack of these three parameters either by way of farm produce or market purchase results into food insecurity (Wambua, 2013).

As documented by Boto et al., (2011), the world currently produces enough food for its populace. Globally, agriculture produces 17 percent additional calories per person than it produced 30 years ago. According to FAO (2002), this production is enough to guarantee a consumption of at least 2,720 kilocalories per person per day. However, the fact that many people in the world lack adequate lands to farm sufficient food quantities or abundant revenue to purchase adequate food quantities remains the main challenge. The world population is currently increasing by about 200,000 people per day. This implies that, more food will be required to feed an extra 2.5 billion people by 2050. Ironically, all this population growth will occur in the developing countries where majority of the populace is already struggling to meet their daily food requirements (FAO, 2013).

Food security is a subset of livelihood security. Livelihood security creates a sufficient condition to ensure food security. It entails access to the means to either generate income or produce food to meet dietary needs (Maxwell and Wiebe, 1998). There is indeed a close relationship between food and livelihood security as both are realized when both the poor and vulnerable groups of the society have sustainable livelihoods. Practically, food and livelihood security are connected in a bi-direction affiliation. Food production is a basic livelihood activity which for the rural households, it is a critical source of food access. The ability of the household to purchase food is also a key determinant of access to food. This aspect largely depends on the ability of the household to create income. This implies that, the quality and quantity of food consumed by a household is positively related to its food production capacity and income level (USAID, 2009). In addition, a household livelihood security is affected by its food security status. For instance, households with poor access or utilization of food tend to suffer more from illness. This in turn impairs their labor productivity hence their ability to undertake livelihood activities (ibid).

3.3 Categories of Land Holdings

The definition of small and large landholdings differs from one region to another. Baldev (1974) categorized farms in Haryana State in Northern India as small, marginal, big and large where the operational holding was up to 7.5 acres, 7.5 – 15 acres, 15 – 30 acres and above 30 acres respectively. In Tamil Nadu, the most productive state in Southern India, Duraisamy (1984) classified farm households into marginal, small, medium and big when the landholding is; less than 2.5Ha, 2.5-5Ha,

5-10Ha and above 10 Ha respectively. In Uttar Pradesh, the most populated state in India with more than 200 million inhabitants, Baldev (1989) classified farmers as big, medium, small and marginal farmers when the land holding is: above 5 Ha, 2.5 – 5 Ha, 1 - 2.5 Ha and below 1 Ha respectively. In Romania, European farm sizes are classified as small, medium and large if they measure 1 – 10 Ha, 10 – 50 Ha and above 50 Ha respectively.

The definitions of these categories; small, marginal, medium and large should not however be taken as uniform. For instance, a person who cultivates on one hectare of land near a wetland should not be considered as a marginal farmer. In the same respect, a farmer operating on 10 hectares of land in an arid zone may not qualify to be a big farmer. Thus, there are significant differences of farms of the same size in different ecological zones. According to FAO (2013) globally, there are over 570 million farms measuring less than 2 Ha in size and these small farms control up to 70 percent of farm land and produce more than 50 percent of the food consumed by the global population. Smallholder farmers are the main actors in the agricultural sector in many of the African countries. For instance, in Rwanda, about 60 percent of landholdings own 0.7 Ha and below with 50 percent farming on less than 0.5 Ha while 25 percent operate on less than 0.2 Ha (Rwanda, 2009).

3.4 Importance of Maize Production

Globally, maize is categorized as one of the most important cereals whether as food for human beings, animal feeds or industrial raw materials. It is indeed one of the leading crops in the world being cultivated in an approximate area of 142 million hectares producing a total grain of 637 million tons. For instance as documented by CBS, 2006 in Simiyu (2014), in Nepal, the area under maize crop was approximately 849,892Ha yielding on average 2.02 tons per Ha.

Grown in various agro-ecological zones and farming systems, maize is indeed a major staple food. In sub-Saharan Africa, it is consumed by people with varying socio-economic characteristics and food preferences. As noted by Macauley (2015), maize is the most important staple food in sub-Saharan Africa as rice or wheat is in Asia. Maize accounts for the highest percentage intake in the national diet in 16 African countries out of the 22 countries in the world which produce the commodity. In addition, it accounts for about 50 and 20 percent of the calories and protein consumed

in Eastern and Southern Africa as well as West Africa respectively. It is indeed a source of food security and economic wellbeing for an estimated 208 million people in sub-Saharan Africa. Out of the estimated 200 million Ha of cultivated land in sub-Saharan Africa, the crop occupies more than 33 million Ha (ibid).

3.5 Household Land Size and its Impact on Food and Livelihood Security

Various studies have confirmed that small land sizes lead to lower productivity and higher costs. Farmers with bigger land sizes invest more in machinery to exploit economies of scale, thus reaping more profit benefits. Mechanization on small land sizes requires costly investment in specialized machines that small scale farmers may be reluctant to make (Otsuka 2013, in Lai et al., 2015). Niroula and Thapa (2005) in a study of effects/causes of land fragmentation and lessons learned from land amalgamation in South Asia found out that farmlands are undergoing massive fragmentation. This situation accelerated the rate of farmlands degradation and constrained the development of agricultural activities. This impacted negatively on food and livelihood security.

Tan et al., (2008) in a study of whether fragmented landholdings have higher production costs, within the rice farmers in Northeastern Jiangxi Province, China found out that the changes in the number of farms and the distribution of farm sizes, as measured by the Simpson index, didn't impact on the total production costs per unit output. These changes however result to a shift between the cost categories. It was evident that farmers who had numerous small farm sizes had the tendency to use more labor and less modern technologies. The situation was however different for the farmers with less large farms. Thus, reducing the average distance to land parcels and increasing farm size tends to reduce the total costs of production per ton.

Individual farming of land parcels in most of European, China and Indian countries is unachievable as the farms are too small. Central and Eastern Europe countries like Slovakia, Romania, the Czech Republic, Slovenia, Macedonia, and Bulgaria are some of the areas with very small land parcels. In these countries the mean farmland parcel sizes range between 0.3 and 0.5 Ha (Sklenicka et al., 2014). In the developing countries, there is an inverse relationship of farm size and production. The situation is however different in Europe as modern farming methods only favor large production blocks. As a result, the parcel owners of the small farms are required to rent out their

lands and become part of the large agricultural holdings. For instance, in the Czech Republic, there are over 3.5 million land owners with only 30,000 farming enterprises. This phenomenon impacts negatively on the livelihoods of the farmers as the rental processes gradually alienate the owners from their lands (Sklenicka, 2016).

In addition, the tenants who rent the small neighboring plots tend to take lesser care of the parcels as compared to their owners. This reduces the farms productivity thus impacting negatively on food and livelihood security (ibid). A land monitoring exercise conducted in the Czech Republic for over 30 years established that land parcels which were frequently farmed by tenants had diminished organic matter content, evidence of effects from erosion, increased compaction, and overall decreased natural fertility. This then impacts on agricultural production hence food security.

Sklenicka (2016) also observed that, small land parcels attract considerably lower value as compared to large land parcels which are more preferred and attract high prices. In the Czech Republic for example, in the year 2008, land buyers gave about 44 percent more for 1 Ha parcels than for the average sized parcels of 0.4 Ha. They also paid 2.2 and 2.8 times more for 2 Ha and 8 Ha parcels respectively (Sklenicka et al., 2013). A similar scenario was also confirmed in England and Wales. Continuing land subdivision gradually leads to loss of direct access to land, a situation that further reduces the market price of the land. As observed by Sklenicka (2006), the failure to construct denser road networks after land subdivision makes most of the small land parcels inaccessible by road. In the Central European countries, the inaccessible farms cannot be accessed by travelling across neighboring parcels. Their owners are thus limited with respect to the possible tenants as they are forced to rent out their land parcels to the owner/user of the adjacent parcel. The non-existence of market forces results to underprized land parcels.

As observed by Mwebaza and Gaynor (2002) in Kadiji et al., (2017) small land parcels tend to discourage the development of infrastructure like transportation, irrigation, communication and drainage which is critical for optimal agricultural production and enhanced livelihoods. In addition, there are instances where banks are reluctant to take small, scattered land parcels as collateral. This hinders farmers from

acquiring credit for investments. Indeed, farmland is greatly devalued simply through subdivision, especially when the process is unregulated.

A study done by Thapa (2007) on the relationship between farm size and productivity in Nepalese Mid-Hills established an average land holding including forest/fallow land as 0.56 hectares and 0.50 hectares for cropland only. He also observed a significant decline in land holding size as the average land holding reduced from 2.8 acres in 1981 to 2 acres in 2001. He however observed an inverse association between farm size and productivity. This observation suggested that small farms are more productive than large ones. This could be explained by the fact that small farms tend to use family labor thus reducing monitoring and supervision costs.

However, the theory of inverse relation amongst farm size and production is not applicable in Vietnam as established by Dao (2013) as he analyzed technical efficiency of crop farms in the Northern region of Vietnam. These findings were echoed in Bangladesh by Rahman (2009) who observed a detrimental effect of diminishing land sizes on productivity and efficiency as a 1.0 percent land fragmentation increase decreased rice output by 0.05 percent while efficient reduced by 0.03 percent.

In the contemporary rural livelihood in Bangladesh, the land holding size of a farmer is a critical indicator of his well-being as noted by Gurung et al., (2016). They argued that relatively larger farm sizes generated sufficient food quantities and farm income. This ensures food and livelihood security for the households as opposed to their counterparts who operated smaller farm sizes. It is thus evident that increasing operated farm size either through land parcel consolidation or extending farm land is a reliable option of ensuring food and livelihood security as noted by Dixon et al., (2001).

3.5.1 The Situation in Africa

Declining mean farm size over time within densely populated smallholder farming areas is currently the major concern in Africa. In these densely populated areas, over 50 percent of the rural households control less than one hectare of land (Jayne et al., 2012). This souring disparity of land sizes affect sufficient food production for household subsistence as well as a surplus for sale. From the historical African context, fragmentation meant that farmers needed to move from one land parcel to

another. This phenomenon originates back from bush fallowing and shifting cultivation done by the pastoral communities like the Khoi-Khoi in South Western coast of South Africa in the neighborhood of Cape Town. The land fragmentation practice was common with traditional agriculture in Africa continent where ancestral or communal holdings were customary secured (Obonyo et al., 2016).

Adeniyi and Ojo (2013) in a study to establish the status of food security for rural farming households in south-western Nigeria found out that the model farmland size was less than three hectares across board hence low production levels and agricultural output in the area. A high proportion of the farmers operate on small farm sizes, mostly less than one hectare. This farm size is uneconomical to operate since it is not adequate for households to meet their subsistence needs, leave alone producing a surplus for sale. A study conducted by the International Food Policy Research Institute (IFPRI) found out that existence of extremely small farmland was the major constraint to food security in Ethiopia. Households with a mean landholding of 0.57 ha were food insecure as compared to households with 1.38 ha farmland who had abundant food quantities (Fisseha, 2014).

In Rwanda, the mean household land size stands at 0.72 hectares per household fragmented in four parcels with 0.18 hectares each on average. This small land sizes implies that the production generated cannot allow the household to even meet their subsistence needs (Ali and Deininger, 2013). Matchaya (2007) in a study of whether the size of operated area matter established that in Malawi, smallholder farmers face food insecurity due to among other factors, lack of enough farming land.

According to Gecho et al., (2014) due to the small farm size and low returns from farming activities, majority of rural households in Ethiopia are exposed to food insecurity and chronic poverty. The national survey conducted in 2003/2004 by European Economic Area (EEA) indicated that 63 percent of surveyed households were food deficit in Ethiopia. This evidence is supported by FAO (2010) in that about 61 percent people were undernourished in Ethiopia. Land shortage and fragmentation is seen as the major cause of food insecurity in Wolayta, Ethiopia (Eneyew and Bekele, 2012). Tefera and Tefera (2014) noted that agricultural production in Guraghe zone, Southern Ethiopia has deteriorated over time due to the high and increasing population and diminishing landholding sizes.

In East Africa, the available agricultural land is overly subdivided into small uneconomical plots. As observed by Salami et al., (2010) in Ethiopia, the farm sizes range from as low as 1.0 Ha per household. The situation is relatively better in Tanzania, Uganda and Kenya with an average farm size of 2.0 Ha, 2.5 Ha and 2.5 Ha respectively. Though these land parcels are relatively small, they surpass the African mean land holding of 1.6 Ha. They are however very low compared to those of North America, Latin America and Europe which approximate to 121 Ha, 67 Ha and 27 Ha respectively (Jayne et al., 2006).

3.6 Household Land Uses

The global increment in population greatly impacts on the eminent competition for land and soil resources. Ensuring land allocation to the highest value is critical in ensuring prudent and economical resource allocation (Hart et al., 2013). Food security depends to a greater extent on the quantity and quality of land resources available to a household as well as the ability of the household to mobilize resources for food production so as to achieve an active and healthy life (ECA, 2004).

As noted by Lubowski et al., (2006) in Mengxuan (2014) land use transformations are essential for social progress and economic development. Nevertheless, serious economic and environmental costs accompany these land use transformations/changes. Conversion of farmland into urban development or to non-agricultural uses like settlements decreases the quantity of land resources available for the production of food. The Northeast Regional Centre for Rural Development (2008) found out that the United States had experienced major land-use changes in the previous 25 years. For instance, the total pastureland, cropland and rangeland area reduced by 76 million acres in the adjoining 48 states from the year 1982 to 2003. In the same period, the total developed land area experienced a 48 percent increment which was equivalent to 36 million acres.

Globally, there is a lot of competition for the available land resources, a phenomenon that is negatively affecting agriculture as in most cases it is not able to bid for high value productive land. Thus, food security is probably being threatened by people who other than growing food, prefer to utilize land resources for other activities. The rivalry for land mostly for the provision of services as well as housing the ever growing population leaves less land for farming. As observed by Senauer and

Benjamin (2007) the growth in the production of biofuel crops is the major emerging threat to food insecurity over the years. This implies that the land that had been previously used for growing food crops is currently being used to supply the produce for biofuel. In Burundi for example, many farmers have turned into cassava production which is an excellent source of ethanol due to its high-starch content. This poses a threat to food security as more families will struggle even more to feed themselves as cassava is the food turned to when there is nothing else to eat, yet it has been dedicated to producing ethanol (Bertelson, 2008).

3.6.1 Effects of Household Land Uses on Food and Livelihood Security

The decline in high potential agricultural area forced farmers in Thailand to move away from the traditional food production methods and switched to mono-crops with high retail prices as a way of improving their economic well-being (Pitakpongjaroen and Wiboonpongse, 2015). In this regard, they adopted maize farming system as it fetched high retail prices as opposed to other food and cash crops. However, with time, due to soil degradation, there was need for agro-chemicals so as to increase maize productivity. This worsened the situation as farmers were forced to content with low incomes. They thus concluded that crop diversification and adopting of perennial fruit plants in farm land use allocation was critical in ensuring food and livelihood security of households.

Walangitan et al., (2012) on a study on optimization of land use and allocation to guarantee sustainable agriculture in the catchment area of Lake Tondano found out that households that allocated a large farming area to a single crop realized better yields that enabled them to support decent lives as compared to those that practiced mixed crop farming holding other factors constant. As noted by Gurung et al., (2016) most of the poor farmers in Bangladesh shifted from rice cultivation to aquaculture leaving a few rich farmers who could successfully manage the rice farming system. They noted various strains on the poor famers in adapting to the shift and the changes in the use of land. Farming systems diversification and intercropping by all rural households in Bangladesh was thus recommended as a way of realizing food and livelihood security. Some of the probable integrations would be rice and fish farming. They further recommended that land productivity, household income and family nutrition would be increased through diversification of rice cropping systems in rotation with other cereals and high-value crops.

Kansiime et al., (2017) observed that the farmed area size had a positive effect on output across all the farm types. Thus, allocating larger land parcel to a specific crop type results to higher returns. They also noticed that specialized farm types didn't yield much crop income as compared to diversified and off farm types. They thus concluded that livelihood strategies are more distinct with respect to the proportion of income emanating from farming activities, total cultivated area and proportion of land allotted to various agricultural activities other than off-farm income.

A study on the drivers of land use transformation and household determinants of sustainability in smallholder farming systems in Eastern Uganda by Ebanyat et al., (2010) observed increases in household cultivated lands declines and, in some cases, ultimate vanishing of some land uses. They found out that households allocated land to various farm enterprises based on the projected income from the farmed crop. In respect to this, farmers allocated the highest land proportions to cotton as it fetched high market prices. Subsistence food crops came in second in land use allocations while rearing of livestock declined.

3.7 Factors Affecting Size and Use of Household Land

Demetriou et al., (2013) identified four factors that contribute to the trend of land subdivision thus affecting land sizes. These factors are: population growth, inheritance, land market and historical/cultural perspectives. The effect of these and other factors to the size and use of household land is as discussed below:

3.7.1 Population Growth

There has been a gradual and steady decline in mean farm size over the past 50 years, as rural population growth has outstripped the growth in arable land. As a result, the densely populated areas have become a home to a substantial fraction of the rural population in Africa. In these areas, the scarcity of land is likely to impede any meaningful agricultural growth (Jayne and Muyanga, 2012). In addition, over 50 percent of the small scale farmers in Africa have an average farm size of 1.5 hectares. Due to the growing population densities, these areas have limited or no potential for further expansion (Jayne et al., 2003). Willy and Wawuda (2014) stipulates that the population growth challenges will revolve around the food-water-environment nexus, agricultural productivity, unemployment, land fragmentation and the role of agriculture in the provision of food and employment for livelihood enhancement.

Cotula et al., (2004) in a study on land tenure and administration in Africa established that, land is becoming increasing scarce in many areas. This is as a result of a variety of pressures emanating from increased rivalry for land resources amongst different land users including farmers, herders, foreign investors and urban elites. The pressure on land has been aggravated by the ever-increasing population. Rapid population growth leading to increasing land fragmentation has resulted to diminishing land holdings in Malawi to the extent that they are unable to adequately sustain the households. This state of affairs is confirmed by the World Bank (2003) who notes that smallholder farmers in Malawi own only 1 hectare of land on average. The Government of Malawi (2001) also noted that the land holdings per household have declined from 1.53 hectares in the year 1968 to 0.8 hectares in 2000 due to increased population densities. Matchaya (2007) in a study of whether operated size matter; evidence from agricultural production in Malawi established that, inadequate land holding is becoming a critical problem in the Country as the population continues to increase.

The increasing population growth in rural Ethiopia forced households to cultivate and make their living on extremely small sizes of land. For example, 29 percent of grain farmers in 2006/2007 had cultivated a land less than 0.5 ha per household (EEA, 2008). According to FDRE (2010), nearly 55 percent of all smallholder farmers operate on one hectare or less. Due to the increasing population pressure in Rwanda, the farm sizes have become very small and are further fragmented into tiny land sizes (Bizimana, 2009).

3.7.2 Inheritance

In a growing population, partible inheritance subsequently results to fragmentation hence small land sizes. This situation is brought about by the desire of the farmers to provide their heirs with land resources (Tan, 2005). Hristov (2009) in a study on assessment of the impact of highly fragmented land on the productivity and profitability of the farms, a case of Macedonia vegetable growers found out that the traditional practice of inheritance where fathers transferred property to heirs from one generation to another led to increasingly smaller holdings.

A culture of patrilineal succession and inheritance characterize most societies in Sub Saharan Africa. In these societies, properties including land are successively shared

among heirs or in other scenarios only the sons in a family (Holden and Mace, 2003). Inheritance laws require that family holdings are subdivided equally among the heirs. As a result, the farm sizes gradually fall and become increased fragmented into small plots, scattered over a wide area as the population increases (Bizimana et al., 2004). Adeniyi and Ojo (2013) points out that the predominance of small farm land sizes in South Western part of Nigeria is as a result of the traditional land inheritance practices where every family member is entitled to a share of farmland as an inheritance.

3.7.3 Historical and Cultural Perspectives

There is skewed land distribution in Nepal, a situation that could be attributed to the history of the country. After the unification of the country, land was basically used as a means of obtaining military and political patronage by the Government. This led to distribution of a larger section of the high potential land to powerful people in form of grant. As a result, about 15 percent of the total agricultural land is owned by 47 percent of the land owners with an average farm size of less than 0.5 Ha. The top 5 percent land owners on the other hand, occupy more than 37 percent of the land (Adhikari, 2008). About 10 percent of the women in Nepal own land parcels which are mostly less than 0.1 Ha on average. This implies that most of the female headed households have very tiny land parcels, a phenomenon that complicates their food security status. Compared to the mean land holding for the male counterparts of 1 ha/man, this land size is significantly very small. This is quite an irony since women form the highest proportion of the economically active population. They play a vital role in ensuring food security as, either as farmers or farm workers they are the most engaged in agricultural activities. (ibid).

As noted by Mengxuan (2014) as he analyzed the effects of land fragmentation on agricultural production cost in Gasu Province, the reform of the Household Responsibility System (HRS) in China fueled land fragmentation in the country. Currently, it is one of the countries facing the most severe land fragmentation. The reform abolished the traditional *Maoist* organization of the rural economy which promoted communal farmland ownership and management. Under the new HRS, each household is responsible for its own profits and losses. Family size and/or number of laborers are the key determinants of land allocation. The soil type, irrigation and drainage conditions as well as land use type form the criteria for the categorization of the plots into classes (Mengxuan, 2014). Each household then receives land from each

class, thus aggravating the land fragmentation problem. In addition, the boundaries and paths that separate the small land holdings further decrease the farmland. Since under this system, equality is the key principle of land distribution, regular readjustments are made to maintain the equality, an aspect which brings forth further fragmentation (Tan et al., 2006 and Mengxuan, 2014).

3.7.4 Inequalities in land access

In some parts of the world, countries with relatively low population densities and high cumulative land resource endowments, have pronounced inequalities in accessing land resources at the household level as discovered in Northern Mozambique (Muyanga, 2013).

3.7.5 Land Tenure

According to Cooper (2010) rights to land are consequently analyzed as vital contributors to the economic livelihoods and security of households and individuals. USAID (2016) argues that securing land rights for all impacts positively on food security and helps attain broader development outcomes. Secure land rights present an incentive for farmers to invest more on their lands hence improving agricultural productivity. As noted by Feder and Onchan (1987) there was increased investment, yield and input use as a result of land titling in Thailand while in Ethiopia, it led to increased land productivity by 40 - 45 percent in Tigray region. This implies that farmers with security of tenure, tend to optimally utilize their lands. In this regard, they are at liberty to make management decisions on how well to utilize their land parcels for immediate and long-term household needs.

African rural households depend on land to farm their food commodities. However, lack of land tenure rights is a major constraint in agricultural production (Masuku et al., 2014). The uncertainties with respect to land tenure and inadequate access to land is one of the most serious challenges facing smallholder farming in East Africa (Salami et al., (2010). Under – developed agricultural sector and food insecurity are the consequences of the challenges associated with tenure system. These challenges include insecurity of land tenure, lack of appropriate mechanism to transfer land rights and consolidate plots as well as unequal access to land. Secure land tenure offers a conducive environment for food security. This arises from the created incentives of investing labor and resources over the long run due to the existence of

appropriate land tenure arrangements (Espinosa, 2014). Ineffective land market activities in Macedonia extends land fragmentation issue and results to very small land parcels (Hristov, 2009).

3.7.6 Other Factors

Santiphop, et al., (2012) points out that market demand for better returns, crops that are easier to sell, low production costs, resource availability (land and inputs), and increasing commercialization coupled with household characteristics are the major determinants of household land use decisions. Leonard et al., (2011) explained that, in addition to the local environmental conditions, the age of a farmer, household size and structure dictate the extent of farm operations and the intensity of land use. Hristov, (2009) noted that land shortage in Macedonia results into massive land subdivision as everyone is eager to own a parcel thus resulting to very small land sizes. Briassoulis, (2001) points out that a variety of biophysical and societal factors play an essential role in land use decisions. She further explains that numerous symbiotic demographic, socio-cultural, technological, organizational, economic and institutional factors affect the decision of land managers on whether to maintain or change the current use of land.

Tittonell, (2007) suggested that land use resource allocation was on the basis of soil fertility with farmers allocating fertile areas for cropping activities and least fertile for grazing and perennial crops that did not require much fertility to yield. Deadman (2005) in a study on agent-based simulation models on household land use decisions in Altamira region, Brazil postulates that the types of agricultural activities engaged in by households is influenced by their characteristics, such as available capital resources and household labor. In his conclusions, he alluded that households make land use decisions based on the available household resources, the performance of past crops, and the characteristics of their property.

3.8 Inter-Generational Transmission of Land Rights and Land Use

As noted by Ellis (1992) in Hristov (2009) land is a limited, non-renewable resource which is seen as a source of livelihood as well as financial security. It is also transferred as wealth from one generation to another. Inheritance is one of the most common means by which physical property is transferred across generations in many Sub-Saharan African societies (Cooper, 2010). The prevalence of small land holdings

is as a result of the traditional land inheritance practices which entitles every family member to a share of the farmland. These land inheritance customs lead to unregulated land subdivision and wastage of arable lands in case of absentee farmers (Adeniyi and Ojo, 2013). The Yoruba culture in Nigeria dictates that after the demise of the farmer, his holdings which include land are to be divided amongst the children (Balogun and Akinyemi, 2017).

3.9 Ideal Land Sizes

As noted by Sklenicka et al., (2014) the mean size of a parcel economically viable for individual farming in the conditions of Central Europe is 1 Ha. However, the threshold changes with respect to the fertility and economic level among other specifics of a region. For instance, in Sub-Saharan Africa, the average farmer produces only one ton of cereal per hectare. This amount is less than 50 percent, 25 percent and 20 percent of the production of an Indian, China and American farmer (World Bank 2007). This implies that, ceteris paribus, a farmer in Sub-Saharan Africa would require relatively large farm sizes to ensure food and livelihood security as compared to their counterparts in India, China and America.

The State Government of Ballarat specifies a 40 Ha land size to be the minimum subdivision size in the farming zone in Ballarat. In addition, the farming zone contains provisions to allow subdivision to two lots for the purposes of creating a lot for an existing dwelling. However, an agreement on title preventing both parcels from being further subdivided is required (Brinckerhoff, 2010). According to Nega et al., (2002) in the area where *enset* (false banana) is used as staple food in Uganda, the land size needed for cereal production is 0.56 Ha to meet the minimum level of food needs for an average household. The Ministry of Agriculture and Food Security in Malawi established that, a smallholder should have at least 1.5 Ha of land to achieve the least levels of nutrition throughout the year (Tesfaye and Edriss, 2014).

3.10 Common Planning Intervention Practices

To address the agricultural production problems associated with small land sizes due to land fragmentation in Rwanda, a National Land Policy was put in place. The policy proposed among other measures; land consolidation to achieve economical plot sizes and prohibition of land subdivision below one hectare (Ali and Deininger, 2013). Considering the inverse relationship on land size and food and livelihood security, it

is essential to ensure efficiency in production and adopt technology for optimal farm yields. This will help in addressing the productivity challenges associated with small farm sizes. In Bangladesh for example, Rahman (2009) found out that owning key resources like land, draft animals and family labour increases efficiency significantly. Thus, empowering the rural communities to own these key production resources will also help in addressing the food insecurity problems.

Tan (2005) concludes that consolidation of small fragmented plots into a few larger parcels increases agricultural production. This is possible as land consolidation: reduces production costs, causes a shift from labor-intensive farming methods to mechanized agriculture, increases technical and input use efficiency and contributes to improvement of soil quality. Alemu et al., (2017) recommends the adoption of the legislation on land use and population growth control programs. This will aid in determining the ideal land sizes for sustainable production and improving land productivity. They further allude that diversification of agricultural activities, practicing of mixed use farming and strengthening of off farm activities, will aid in solving the food insecurity problem. Gurung et al., (2016) recommends adoption of mechanized form of production to increase rice productivity in Bangladesh. They further recommended provision of technological services, technical training and adoption of crop production technologies together with diversification as essential to increasing yields and enhancing farm productivity.

3.11 Theoretical Framework

From global literature, several theories exist that explain the possibility of a relationship between household land size and use and food and livelihood security. Some of those theories are; Schultz inverse relationship theory and the economic theories and concepts which include law of variable proportion and theory of production.

3.11.1 Schultz Inverse Relationship Theory

This theory was published in 1964 and deals with land holding sizes and productivity. The theory was popularly known as the inverse or negative relation theory since it went against empirical studies and theories which indicated that land fragmentation lowers farm sizes thus negatively affecting economies of scale and reducing agricultural production. It specifies that the number of parcels emanating from

subdivision of a single holding may only reduce the plot sizes but not the production. On the contrary, subdivision should motivate farmers into improving their farming techniques through increased fertilizer use, use of certified seeds and zero grazing techniques for livestock production. This will then improve the yields and profits. However, the theory only works well when other intervening or confounding variables like education level of the farmers and assess to inputs and machinery are looked into and enhanced as well.

The opponents of the theory however argue that, a different scenario might arise in a situation where farm fragmentation leads to small acreages and low yields especially when farmers are negative on the fragmentation exercise. This would especially arise when little effort is done to improve the education level of the farmers and adoption of technology. In other scenarios, the fragmentation may result to farm deterioration hence low yields.

3.11.2 Economic theories and concepts

The economic theories and concepts relevant to the study include law of variable proportion and theory of production.

3.11.2.1 Law of Variable Proportion

This law replaced the ancient traditional concept of "Law of Diminishing Returns." It points out that when a farmer increases output by utilizing more inputs, the quantity of fixed and the variable inputs is alerted. Thus, as more of inputs are employed and other variables are held constant, there eventually will be a point of yielding marginal contributions to total product. This law limits the use of a variable input while other resources are held constant. This implies that the use of fertilizer on a fixed land parcel for instance may increase production to a certain level then the output starts to diminish. Thus, despite the fact that increasing other factor inputs will increase production of a crop, the constrained land size may hinder optimal crop outputs after a while.

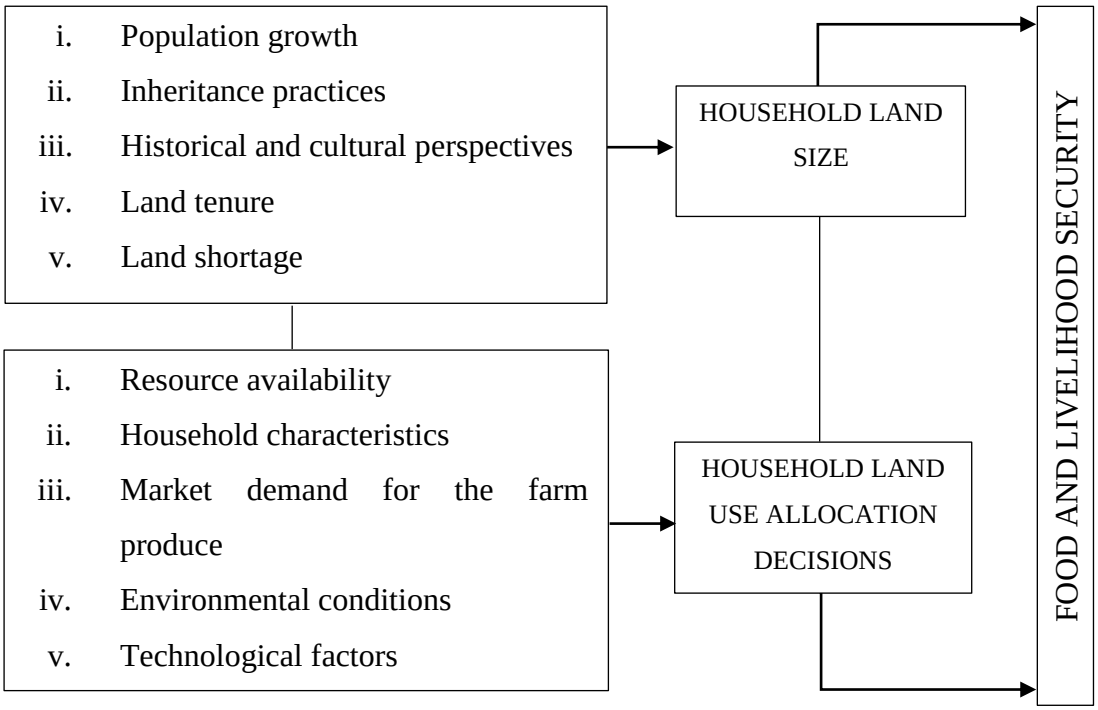
3.11.2.2. Theory of Production

The theory of production provides the basic economic principles and concepts that guide the farms on how to optimize crop production. The theory basically states that production is a factor of all inputs; land, labour, capital and entrepreneurship. This implies that, the size of land as an input has an impact on the total output produced.

3.12 Global Conceptual Framework

The factors that affect household land size globally are; population growth, inheritance, historical and cultural perspectives inequalities in land access, land tenure and land shortage. The factors that affect land use allocation decisions on the other hand include; resource availability, household characteristics, market demands for the farm produce, environmental conditions, technological factors and soil fertility. The interplay of these factors affect the ultimate household land size and use which then affects the food and livelihood security of an household as presented in Figure 1.

Figure 1: Global Conceptual Framework



Source: Author, 2018

3.13 Conclusion

From global literature there seem to exist a relationship between household land size and use and food and livelihood security. Some researchers have postulated a positive relationship between household land size and food security based on studies carried out at different parts of the world. In a few instances, researchers have established an inverse relationship between household land size and food and livelihood security. Research has also established a positive relationship between land allocation and food production as farm operations with the highest land allocations tend to produce more. Some of the factors that influence household land size and use include population growth, inheritance practices, historical and cultural perspectives, inequalities in

assessing land and land tenure among others. Inheritance is the most common means of land acquisition in sub-Saharan Africa, a phenomenon that exemplifies the existence of inter-generational transmission of land rights. The interventions proposed in addressing the food security problems associated with land size and use include; land consolidation, prohibition of land subdivision below the set minimum land size, adoption of technology for optimal farm yields and adoption of legislation on land use and population growth control programmes.

CHAPTER FOUR
HOUSEHOLD LAND SIZE AND USE FACTORS IN MAIZE FARMING ZONES IN KENYA

4.0 Introduction

This chapter reviews literature relating to a range of issues underpinning this study in the Kenya context. Just like chapter three, the literature focuses on aspects of the relationship between land size and use on food and livelihood security. The factors affecting land size and use, the intergenerational transmission of land rights and the ideal land sizes in various areas and for different farming systems have also been expounded. The conceptual framework that has guided the study has also been presented.

4.1 History of Land Fragmentation in Kenya

Land fragmentation in Kenya dates back to the colonial period when the colonialist expropriated land to establish settlement schemes for the settlers at the start of the twentieth century. As per the crown land legislation introduced in 1902 by the colonial administration, the crown had original title to all the land that had been expropriated for the settlers (Syagga, 2010). In addition, the legislation distinguished between the fertile highlands that were the preserve of the white settlers and the reserves which were basically marginal and relatively non-productive for the natives. In this respect, the Africans became tenants of the crown, with just mere temporary occupation land rights (ibid). The White Highlands measured approximately three Million hectares shared between 3600 white families. Approximately, half of the white highlands comprised of high agricultural potential land which was suitable for cash crop farming. The rest was suitable for large scale livestock farming. The remaining 26 percent of the arable land was shared by about six million Africans as about 68 percent of the country is inaccessible and unsuitable for farming, (Kanyinga, 2009).

The African indigenous systems with regard to land acquisition was completely changed. Individual families became the medium of land acquisition as opposed to the original clan or kinship networks (Verma, 2001). As a result of population increment, congestion and landlessness become the character of the Native Reserves. The practice of free rural-to-rural migration which was originally done to ease population

congestion became impossible with the new land system boundaries introduced by the colonial administration. Due to land overuse and overgrazing in the native area, there was a great significant reduction in land productivity. The colonial administration however didn't pay any attention to the congestion in the reserves as this phenomenon worked for their benefit. The landless migrated into the highlands in huge numbers in search of wage labor. This increased supply of labor against a constant demand led to the provision of cheap labor for the settler economy (Muyanga, 2013).

With time, there were aggressive political unrests in the Native Reserves due to the continued neglect and harsh economic conditions. To address the unrests, the colonial government formulated a plan to increase African Agriculture in the country. The *swynnerton plan* as commonly known introduced land amalgamation, adjudication and registration process. It changed the system to a more individualized one as it gave individuals rights to land ownership. The plan strived to promote the purchase of land by Africans thus removing all the legal racial barriers in agricultural land ownership (ibid).

Subsequently, various settlement schemes and land purchase programs were initiated. However, the problem of landlessness experienced by the Africans was not successfully addressed. For instance, in the year 1960, a Land Development and Resettlement Board (LDSB) was created to supervise the resettlement of about 20,000 families. The scheme had the intention of buying about 240,000 acres in the white highlands, subdividing them into 100-acre farms then distributing the farms to a selected group of Africans. In this regard, it gave credit facilities to the Africans who wished to purchase the subdivided farms (Syagga, 2010). The scheme was later transformed to the *Million-Acre Settlement Scheme* during independence negotiations. In the year 1971, the scheme was closed after about 1.25 million acres had been used to resettle the Africans. Since then, the practice of land subdivision in the country has continued to grow, much of which is unregulated. This has resulted to uneconomical land sizes which cannot sustainably support agricultural production (ibid).

4.2 Categories of Land Holdings

According to the Kenya Land Alliance (2009) currently, the landholding for Uasin Gishu and Trans-Nzoia Counties is 10 and 7 acres respectively. In Central Kenya, particularly in Nyeri, the per capita arable land availability declined from 0.58

hectares in the year 1969 to 0.19 hectares in 1993. This translates to a 67 percent loss. The mean land holding size in Makueni County is 1.58 Ha which is equivalent to 3.95Acres. This land size is relatively higher than the Kenyan mean holding of 0.97Ha per household (Kenya 2017a). However, based on the ASAL conditions of Makueni County, this land size may be too small for any meaningful agricultural production.

The Kenyan legislations that deal with land issues have not adequately addressed important land questions such as the minimum and maximum land holdings. Article 68 (i) (c) of the Constitution of Kenya only obligates the Parliament to pass legislation to determine the minimum and maximum land holding sizes with respect to private land within one and half years after the endorsement of the Constitution (Kenya 2010). To operationalize the article, Section 160(1) (f) of the National Land Act, 2012) mandates the Commission or the Cabinet Secretary to make regulations prescribing the minimum and maximum land holding. However, this is yet to be done (Willy and Wawunda, 2014).

4.3 Importance of Maize Production

In Kenya, maize is a staple food and provides large proportions of calorie needs to both urban and rural consumers. Although smallholder farmers retain much of their produce for consumption, they form the largest producers of maize. Approximately, 3.5million smallholder farms are engaged in maize production accounting for about 75 percent of total maize production. The remaining 25 percent of production which constitute of approximately 1,000 farmers is taken up by large farms (Nyoro, 2002). The estimated national average maize yield per hectare is at 1.8 tons which is equivalent to twenty, 90kilogram bags. However, these yields are very low when compared to international maize production. For instance the 1.8 tons per hectare is about one twentieth of the yields realized in Argentina. In addition, maize yield differs by ecological conditions as some of the farmers in the high potential maize zones are able to realize between 4 to 6 tons per hectare. This indicates the potential of increasing maize productivity (ibid).

As documented by Kenya Agriculture Research Institute (2008) apart from producing maize for grain, the use of maize forage as animal feeds is becoming very important in smallholder mixed farms in the country. This type of forage contributes up to 24

percent of the total cattle feed in Kenya, thus making maize production very important for both grain and fodder.

4.4 Household Land Size and its Impact on Food and Livelihood Security

Kenya (2010) indicates that the arable land in the country has been subdivided into very small sizes that are becoming uneconomical for agricultural production. Thus, these small land holdings challenge adequate food production hence contributing to food and livelihood insecurity especially in the rural households with no off-farm income. A study conducted by Kassie et al., (2012) in 88 villages covering five districts of maize-legumes farming systems in Kenya concluded that the probability of being food secure increased with farm size, quality of land and level of education.

Kiplimo and Ngeno (2016) in a study on the effect of land fragmentation on farm level efficiency, found out that there was a positive association between the total mean land holding size, average production scale and the resultant average farm output. They thus concluded that continuous decrease in farm size was likely to affect farm production. As observed by Willy and Wawunda (2014) diminishing land sizes in Kenya will be a major obstacle to achieving better livelihoods and food security given the limited employment opportunities generated in the manufacturing and services industry in the country.

In a study on land fragmentation and food insecurity in Ugunja Sub-County, Siaya County, Obonyo et al., (2016) observed very small landholdings whose low food productions coupled with poor food access from other sub-counties could not sustain the households up to the next harvest thus the problem of severe perennial famine in the area. Ogechi and Hunja (2012) observed that in Keumbu region of Kisii County, agricultural land fragmentation, population increase and urbanization processes had resulted to a decrease in agricultural land and food production thus leaving the households food and livelihood insecure. Ndirangu et al., (2017) also found out that land size impacts on the contribution of a farm to the food and livelihood security of a household. This is through its effect on the produced food quantities and amount of farm income generated. Mbuthia et al., (2017) while studying on household food security in Kitui County established that farm size is a key factor of household food security. They explained that households with large farm sizes were food secure all

year round as opposed to those with small land sizes whose harvest could not sustain them till the next harvest season.

4.5 Household Land Uses and their Impact on Food and Livelihood Security

Ogechi and Hunja, (2016) found out that only about 15 to 17 percent of the Kenyan total land area has adequate fertility and receives sufficient rainfall for farming. In addition, only 7 to 8 percent of the land can be classified as first-class land since a great proportion of the Kenyan land is either arid or semi-arid. They however noted that the preference of cash crops over food crops in those first-class areas in the country worsen the food situation. They also found out that in the earlier 1990s, majority of people had two to four acres of land under food crops but with time, this acreage reduced significantly to pave way for cash crops and settlements as population increased. Thus, construction of houses and other nonfood uses of agricultural farmlands have decreased food supply. This could be attributed to the reduction of the area under food crops in the country over time.

Carter and Wiebe, (1990) in Ali and Deininger (2013) found out that in Kenya, profits per acre increase monotonically with farm size. However, the output per acre and size relationship is U-shaped with a minimum at about 5 Ha. This may be attributed partially to crop composition as maize and beans are gradually replaced with pasture or cash crops as the predominant crop at a farm size of about 12-25 Ha. Germany Development Cooperation (2017) reported that Kenya is forced to import basic food stuffs at higher costs owning to among other factors population growth and unsustainable land use patterns which put massive pressure on the available productive land. It is thus eminent that farm use allocations of a household greatly impact on its food and livelihood security.

4.6 Factors Affecting Size and Use of Household Land

The main factors affecting size and use of household land in Kenya are population growth and inequalities in accessing land as discussed below:

4.6.1 Population Growth

Many rural Africans live in increasingly densely populated areas where all arable land is under cultivation. About 50 percent of the Kenyan rural population lives in areas that exceed a population density of 250 persons per km^2 with 40 percent residing on 5 percent the arable land in the country. This has resulted to a long-term decrease in

farm size and reduced fallows (Willy and Wawuda, 2014). Muyanga (2013) observed that inputs and agricultural intensification increase with a population density of up to about 600 -700 persons per square kilometer. However, a rising population density beyond this threshold is accompanied by a drastic decrease in agricultural intensification. He further observed that smallholder farm sizes are slowly decreasing in the country with about 14 percent of the rural population residing in areas that exceed the 600 persons per km^2 population density threshold while an additional 20 percent is fast approaching this threshold.

Obonyo et al., (2016) observed that, there is the scarcity of land for food production in Kenya as the number of people in need of land for building has significantly increased to the extent that most agricultural farmlands in the country are small spared portions of lands within the homesteads.

4.6.2 Inequalities in Accessing Land

Jane et al., (2006) noted that in most of all the countries in sub-Saharan Africa, there are significant pronounced inequalities with regard to distribution of the available land. In these countries, households in the top per capita quartile own about 5 to 15 times more lands than the households in the bottom quartile. For instance, in Kenya, the average farm sizes for the bottom and top land quartiles were 0.58 Ha and 6.69 Ha respectively.

4.7 Inter-Generational Transmission of Land Rights and Land Use

Muyanga (2013) found out that most of the land subdivisions that are resulting to small land sizes especially in the high potential agricultural areas in the country are as a result of the customary land transfer practices from parents to male children. The constitutional requirement that advocates for equal consideration of all children irrespective of their gender during inheritance of family assets is likely to magnify the land subdivision and fragmentation problem. Obonyo et al., (2016) notes that land inheritance in Ugunja Sub-County, Siaya County as a result of customary practices is one of the main contributing factor to land fragmentation. Their findings postulated that ancestral tenure was the main form of tenure system, while land inheritance as a form of land acquisition accounted for 68.3 percent of the population, purchase stood at 26.3 percent, leasing at 2.7 percent while land offered as a gift accounted for 1.5 percent of the population.

4.8 Ideal Land Sizes

Jane and Muyanga (2012) observed that in the high density rural areas in Kenya the farm sizes are currently below 1.2 Ha on average. With this in mind, envisioning further land subdivision by the current generation for inheritance purposes or producing enough food for the current population is indeed an uphill task. They however recommended that in the high potential areas, less than one-hectare piece of land may be enough to sustain smallholder farmers while 10 ha or more may be required for the semi-arid areas (ibid). Ndirangu et al., (2017) established that the minimum farm-size that could ensure attainment of food security was above 2 Ha in the sunflower farming system and 0.5 Ha in the tea and coffee farming systems. The study recommended the discouragement of further subdivision below the minimum farm sizes if sustainable food security was to be realized.

4.9 Common Planning Intervention Practices

Obonyo et al., (2016) recommends reviewing of settlement policies to encourage land consolidation so as to increase food production. They further recommend family planning sensitization programs to control population growth hence reduce pressures on land. Various interventions of ensuring food security in Makueni County are already in place. Two of them include: the Agricultural Sector Development Support Program (ASDSP) and Kenya Agricultural Productivity and Agribusiness Program (KAPAP).

ASDSP was established in 2010 with the goal of transforming Kenyan agriculture to a commercially-oriented sector as a way of reducing food insecurity. It is supported by the Kenyan and Swedish Governments. In Makueni County, this program promotes capacity building amongst the farmers and acts as an avenue for bringing together various sectors in the agricultural sector. If effectively operational, this program could help ensure a food secure county (Kenya, 2016). KAPAP, the second phase of the Kenya Agricultural Productivity Program (KAPP) was started in 2004 by the Kenyan Government and the World Bank. It has facilitated several trainings of farmers on issues such as soil conservation and fertilizer and pesticide use. It has also enabled farmers to adopt climate risk adaptation strategies such as value addition in the mango value chain (ibid).

4.10 Policy, Legal and Institutional Framework

This section outlines the policy, legal and institutional framework governing land and land use, agriculture and food security in the country.

4.10.1 Policy Framework

The policies that address land and food security issues include: Sustainable Development Goals (SDGs), National Land Policy, Kenya Vision 2030 and the National Land Use Policy.

4.10.1.1 Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) were formulated to build upon and replace the Millennium Development Goals (MDGs) formulated in the year 2000, for the period until 2015. SDGs are universal and are to be applied in both developed and developing countries. However, various countries have different ambitions and goals with regard to the challenges they face and thus the difference in priorities of these countries. SDG 2 which aims to end hunger, achieve food security, improve nutrition and promote sustainable agriculture is the epitome of this research (UNDP, 2015).

4.10.1.2 National Land Policy, Sessional Paper No. 3 of 2009

The policy under section 89 stipulates that land rights can be acquired through inheritance. It also alludes that despite the enactment of the Law of Succession Act which was meant to synchronize the existing succession systems, customary and religious systems largely characterize transmission of land rights. This practice largely discriminates against the women and children. The policy also recognizes the importance of sustainable land use practices in the attainment of food security and self-sufficiency. This then calls for the need to resolve uncontrolled subdivision of land among other land related problems. Section 190 of the policy recognizes that, land is required for the production of food. However, high potential agricultural land is gradually being converted to urban land uses. This impends attainment of the productivity capacity of the country and food security in the long run.

Section 121 recognizes the impact of population growth on land holdings. Coupled with high demand for land, population pressure has led to excessive land fragmentation into uneconomical units. Section 122 stipulates that the Government shall safeguard the land by ensuring that all land subdivisions are done as per the specified guidelines for different ecological zones. This will be done through; 1)

putting in place a system to determine economically viable minimum land sizes for various zones and; 2) promoting conformity of land subdivisions with the set minimum economically viable land sizes. However, number 1) as stated is yet to be achieved, making it difficult to actualize number 2) (Kenya, 2009).

4.10.1.3 Kenya Vision 2030

This development strategy is a long term blue print for comprehensive development of the country. By the year 2030, the vision seeks to transform the country into an industrializing, middle income economy which provides a high-quality life to all citizens. It is founded on three pillars namely; the economic, social and the political pillar. Agriculture is one of the keys sectors under the economic pillar. As a realization of the vision, the country intents to encourage a commercially oriented, innovative and modern agricultural sector. To accomplish the aim, a few issues will need to be undertaken among them: increasing crop and livestock productivity, introduction of land use policies to ensure optimal utilization of medium and high potential lands as well as expanding the areas under irrigation fed agriculture within the ASAL region (Kenya, 2007).

4.10.2 Legal Framework

The various pieces of legislation that touch on matters land and agriculture include the Constitution of Kenya 2010, the Land Act, and Agriculture Act among others. The relevant articles and sections are as discussed in the respective legislations.

4.10.2.1 The Constitution of Kenya, 2010

Article 43 (1) (c) states that everyone has the right to freedom from hunger and to consume adequate quality food. Although this is a progressive right, measures of attaining food security should be put in place so as to ensure attainment of this constitutional right. Article 60 (1) stipulates that land resources in the country shall be owned, utilized and managed in an equitable, productive, efficient and sustainable manner. In addition, certain principles will also be adhered to with regard to land utilization among them: security of land rights, equitable access to land, and sustainable/productive land resources management (Kenya, 2010b). From literature, it is evident that unregulated land subdivision results to uneconomical farm sizes, a phenomenon that hinders their optimal productivity and sustainability. This calls for

the formulation of a mechanism of controlling land subdivisions so as to ensure that the resultant sub-plots are still economical.

4.10.2.2 The Land Act, No. 6 of 2012

Section 159 of the Act deals with minimum and maximum land holding acreages. The section does not however, give the specific acreages. Section 159 (1) (a) only states that the minimum land holding acreage shall be subject to the provision of article 66 (1) of the Constitution of Kenya which does not state the minimum and maximum land holdings either (Kenya, 2012a). With the current pressures being experienced in the high potential areas of the country, there is an urgent need of specifying the recommended minimum land holding acreages in these areas. This measure will help protect these lands from further fragmentation, thus promoting their productivity.

4.10.2.3 Agriculture Act, 2012 Revised

This is an Act of parliament that provides for the promotion and maintenance of steady agriculture, conservation of soil and its fertility as well as stimulation of agricultural land development in accordance with the accepted practices of good husbandry and land management (Kenya, 1986).

4.10.4 Institutional Framework

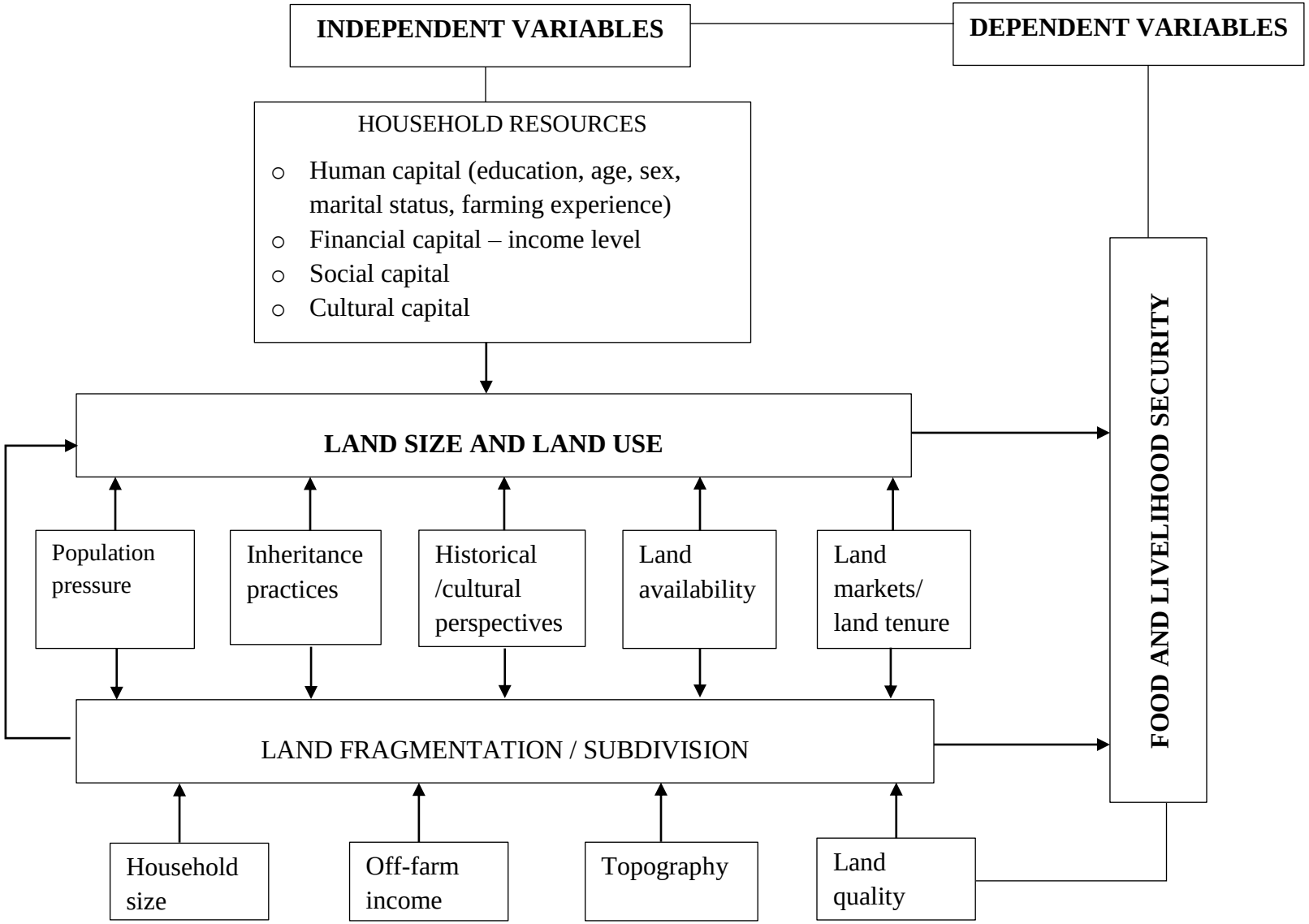
The National Land commission (NLC) is the institution authorized to oversee land related matters in the country. Under the National Land Commission Act, NLC is mandated to perform among other functions; guiding the National Government on an inclusive programme for the registration of land titles in the country, carrying out research with regard to land and utilization of natural resources and; making the necessary recommendations to the appropriate authorities based on the research conducted (Kenya, 2012b).

4.11 Integrated Conceptual Framework

From Kenyan literature, there seems to exist a relationship between farm size and production. Some of the factors that affect household land size and use are mainly population pressure and inequalities in land access. Thus, both global and local literature agree on a possible relationship between household land size and use and food and livelihood security. Scholars, both global and Kenyan have outlined various factors that influence household land sizes and uses. Among these factors include population growth, inheritance, historical / cultural perspectives, inequalities in land

access, prevailing land markets and land tenure, land availability, household demographic factors and available household resources. Some attempt has also be made to postulate the ideal land sizes in some regions and in a few farming systems. However, there is no literature on the ideal farm sizes in a maize farming system and especially in the ASAL region of the country, the basis of this research. The conceptual framework that guided the study is as represented in Figure 2.

Figure 2: Integrated Conceptual Framework



Source: Author, 2018

CHAPTER FIVE
KALONGO SUB-LOCATION

5.0 Introduction

This chapter presents the location, history, physiographical features, population factors, demographic factors, socio-economic characteristic, land and land use, social and physical infrastructure of the study area with reference to Makueni County.

5.1 Location

Kalongo Sub-location is located in Kikoko Location, Kilungu Ward, Kaiti Sub-County in Makueni County. The spatial coverage of Makueni County is approximately 8,034.7 Km^2. The county is surrounded by several counties. It borders Machakos County to the North, Kitui County to the East, Taita Taveta County to the South and Kajiado County to the West. The county is situated between Latitude 1º 35´ and 3^0 00' South and Longitude 37º10´ and 38º 30´ East. Kalongo Sub-location borders Musalala Sub-Location to the North and North East, Wautu Sub-Location to the South and West, Kisekini Sub-Location to the West and Ndiani Sub-Location to the North West. The study area covers an approximate area of 17.6 sq.km.

Table 1 shows the area covered by various administrative units in Makueni County.

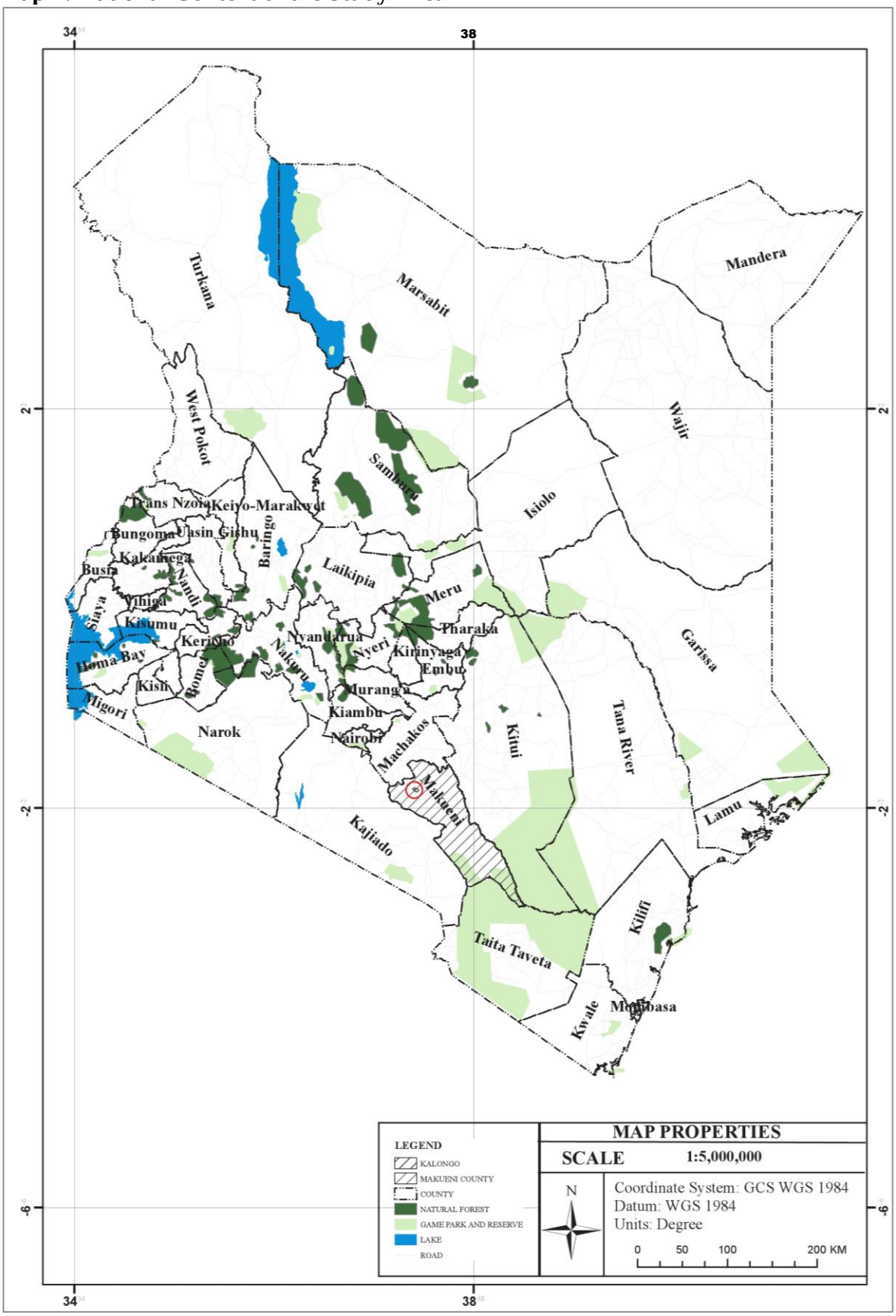
Table 1: Area Coverage

No.	Administrative Unit	Size (km^2)
1.	Makueni County	8,034.7
2.	Kaiti Sub-County	422.9
3.	Kilungu Ward	97.2
4.	Kalongo Sub-Location	17.6

Source: Makueni County Integrated Development Plan, 2013: Pages 2, 5 and 6

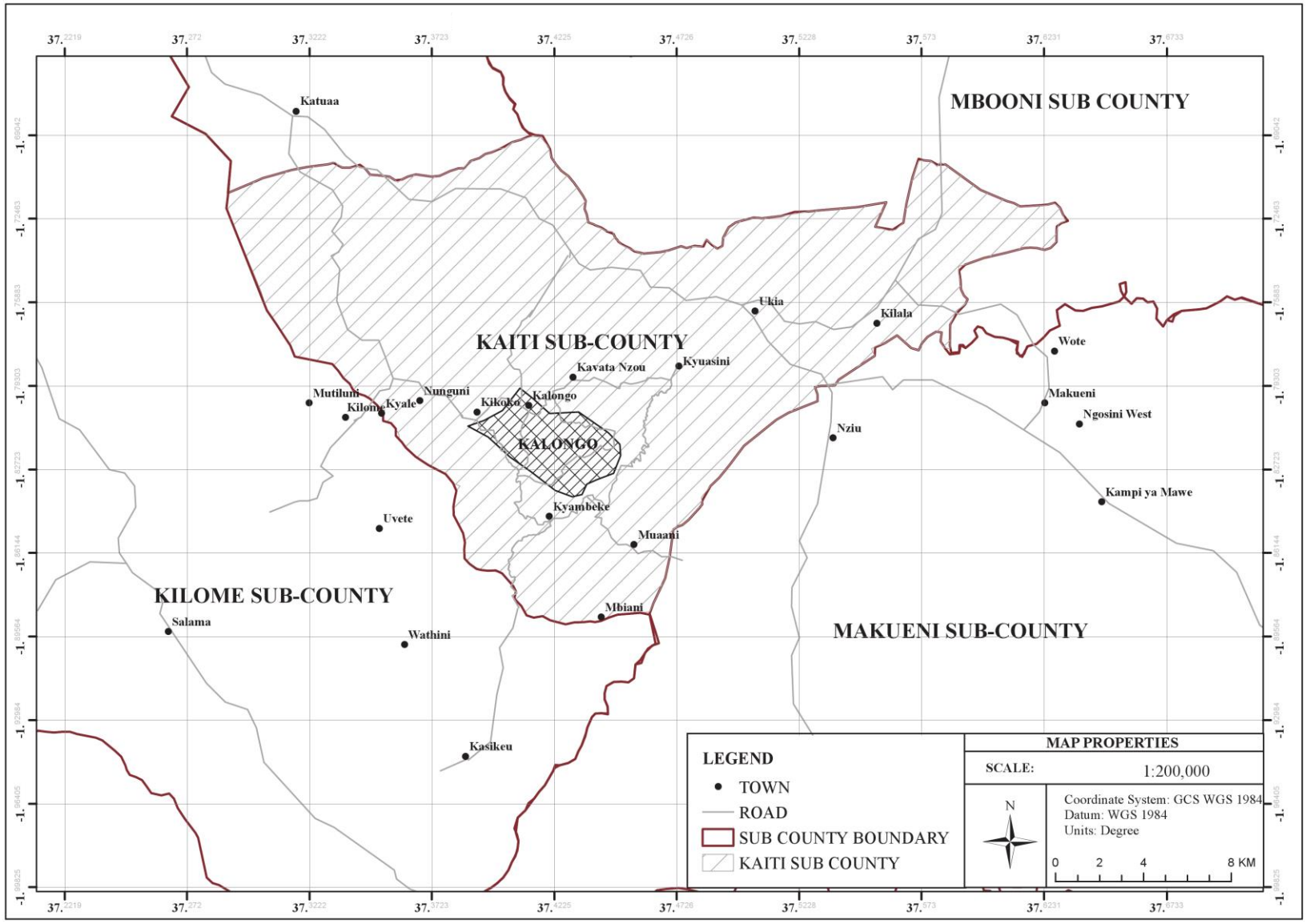
The size of Kalongo sub-location is 18.1 percent, 4.2 percent and 0.2 percent of the Ward, Sub-County and County areas respectively. Map 1 – 4 shows the location of the sub-location in the national, sub-county, ward and sub-location context:

Map 1: National Context of the Study Area



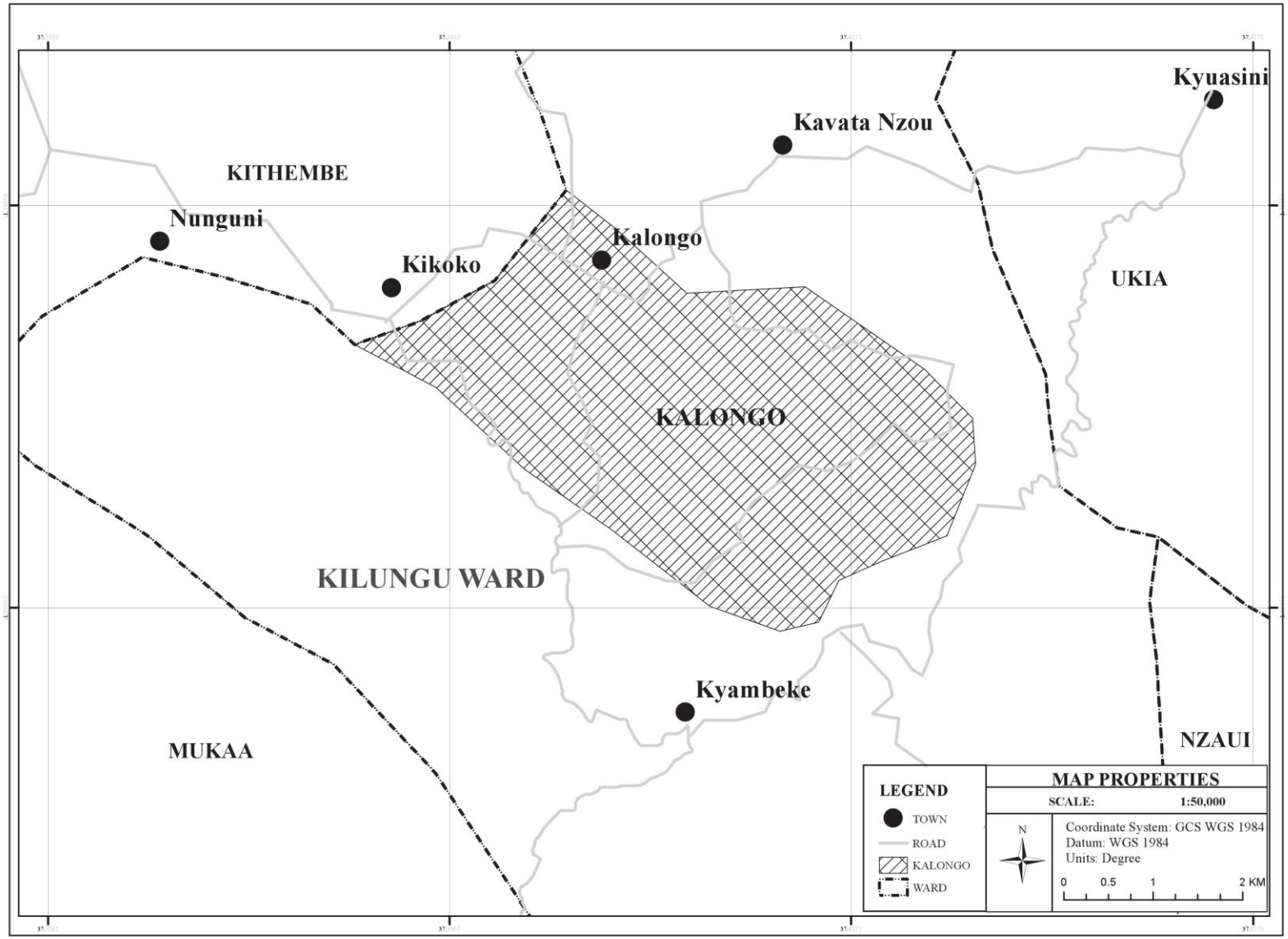
Source: Kenya GIS Data

Map 2: Study Area in Kaiti Sub-County Context



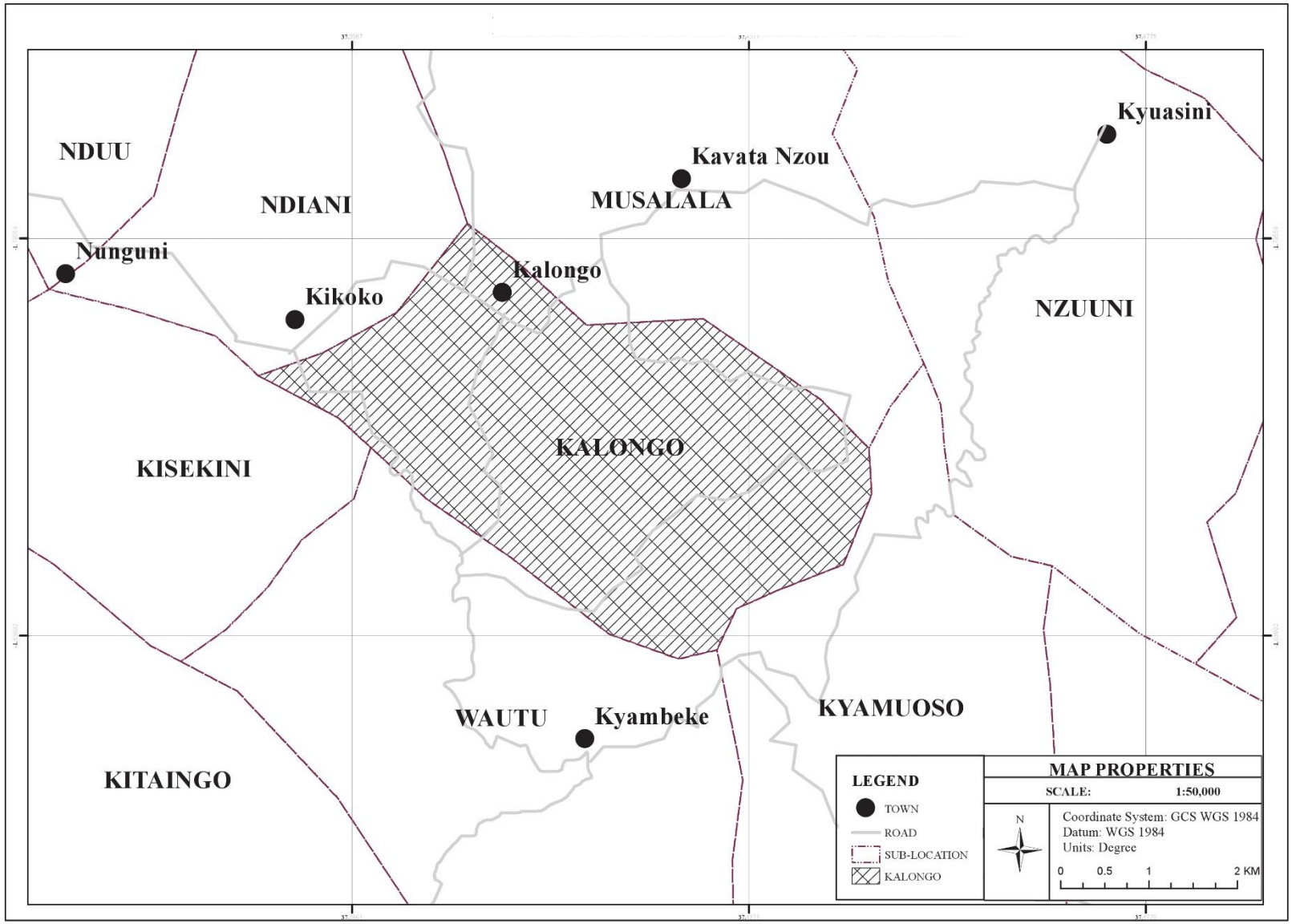
Source: Kenya GIS Data

Map 3: Study Area in Kilungu Ward Context



Source: Kenya GIS Data

Map 4: Sub-Location Context



Source: Kenya GIS Data

5.2 History of Kalongo Sub-Location

The first settlements in Kalongo sub-location were established in the 1920s. The first structure comprised of a makeshift kiosk located at the current police post at the market. The kiosk provided low order goods to the herders who brought their livestock to graze in the area. It also doubled up as a catechism class for the Roman Catholic faithfuls. The area had plenty of sugarcane and the herders would feed on them as they looked at their animals. The name Kalongo emanated from the joints in the sugarcane locally known as "*yiongo"*. The people would share the sugarcane based on the joints, thus the name Kalongo was coined.

5.3 Physiographical Features

This section outlines the physical and topographical features as well as the ecological and climatic conditions of the study area.

5.3.1 Physical and Topographical Features

Makueni County is located within the arid and semi-arid zones of the former eastern province of the Republic of Kenya. The volcanic Chyulu hills lying along the Southwest border of the County in Kibwezi East and West Sub-counties as well as Mbooni and Kilungu Hills in Mbooni and Kaiti Sub-counties respectively are the major physical features in the county. The county has a generally low-lying terrain rising up to 600m above sea level in Tsavo National Park at the Southern boundary of the county. The main river in the county is a perennial river namely Athi River. The river is fed by numerous tributaries which include: Kiboko, Kambu, Mtito Andei, Kaiti and Thwake. In addition, there are a few other streams which flow from Kilungu and Mbooni Hills though their flow gets irregular as they flow downstream. The presence of these rivers presents a high potential irrigation fed agriculture whether in small or large scale. The study area does not have major rivers; only gullies are in existence.

5.3.2 Ecological Conditions

Located at the ASAL region of the country, arid and semi-arid conditions characterize most areas within the county with some areas being prone to frequent droughts. The driest part of the county is its lower side receiving an annual rainfall of 300mm to 400mm. This erratic rainfall patterns can barely sustain the major staple food in the county. The abandoning of the drought resistance traditional crops makes livestock rearing the only feasible economic activity. The County is categorized into several

agro-ecological zones (AEZs) as discussed by Jaetzold et al., 2010 in Kenya (2016). These zones are as outlined in Table 2.

Table 2: Agro ecological Zones of Makueni County

No.	Zone	Location	Characteristics
1.	UM 2: Main coffee zone	Located at an altitude of 1400m – 1700m	Receives about 980mm – 1200mm of average rainfall annually
2.	UM 3: Marginal coffee zone	Located at an altitude of 1400m – 1830 m	Receives on average an annual rainfall of 950mm – 1050 mm
3.	UM 4: Sunflower maize zone	Located at an altitude of 1520m – 1770m	Receives on average an annual rainfall of about 800mm – 950 mm.
4.	UM 5: Livestock Sorghum zone	Located at an altitude of 1460m – 1710 m	Receives an average annual rainfall of 600mm – 750 mm
5.	LM 3: Cotton zone	Located at an altitude of 1160m – 1350 m	Receives an average annual rainfall of about 800mm – 900 mm
6.	LM 4: Marginal Cotton Zone	Located at an altitude of 1160m – 1280 m	Receives on average 700mm – 850 mm of rainfall annually
7.	LM 5: Lower Midland Livestock – Millet Zone	Located at an altitude of 790m – 1220 m	Receives about 650mm – 750 mm of average rainfall annually

Source: Kenya, 2016: Page 26

Locally, the AEZs are broadly understood as the upper zone which includes Kilungu and Mbooni Sub – Counties. This zone is popular for production of milk, maize, avocado and vegetables; the middle zone comprising of Wote area is suitable for the production of maize, mango, oranges and beans and the lower zone that is, Kibwezi areas are suitable for production of pastures and beef cattle. Kalongo sub-location is located in AEZ, UM 4 or the upper zone as broadly locally understood.

5.3.3 Climatic Conditions

The county has two rainy seasons, the short and the long rains. The short rains are experienced in the months of November and December while the long rains occur in

March and April. Mbooni and Kilungu Sub-counties, being the hilly parts of the county receive the highest rainfall amount of 800-1200mm per year. These areas have a high potential for crop production. The change in altitude causes climate variations and extreme differences in temperatures. For instance, the highland areas of Kilungu and Mbooni hills are usually cold with temperatures as low as 20.2^0 C and rises up to 24.6^0 C. The lowland areas to the South like Kitise are very hot with temperatures going as high as 35.80 C. This phenomenon causes high evaporation thus worsening the harsh climatic conditions. Being an ASAL County, the area has high temperatures throughout the day and low temperatures at night.

5.4 Population Factors

This section presents the size of population, structure of population and the density of population in the study area.

5.4.1 Size of Population

Makueni County is estimated to have about 977,930 inhabitants, up from 884,527 during the 2009 population census. The county has a population growth rate of 1.4 percent which is significantly lower than the country population growth rate of 2.6 percent. If the growth continues at such a pace, based on same the estimation, the county population will be 1.1 million people by the year 2027. The county has a high rural population which is equivalent to 67 per cent of the total population as compared to 33 per cent of the county urban population (AWSC, 2015). According to the Housing and Population Census of 2009, Kalongo sub-location had a population size of 10,110 people. Using the population growth rate of 1.4 percent, the population size of the sub-location stands at 11,458 people comprising of 6071 females and 5387 males. Table 3 outlines the size of population for the County, Sub-County and Kalongo sub-location in 2009, and the projected population in 2018.

Table 3: Size of Population

Geographical Unit	**Size of Population**	
	2009	**2018**
Makueni County	884,527	977,930
Kaiti Sub – County	120,116	136,126
Kalongo Sub-location	10,110	11,458

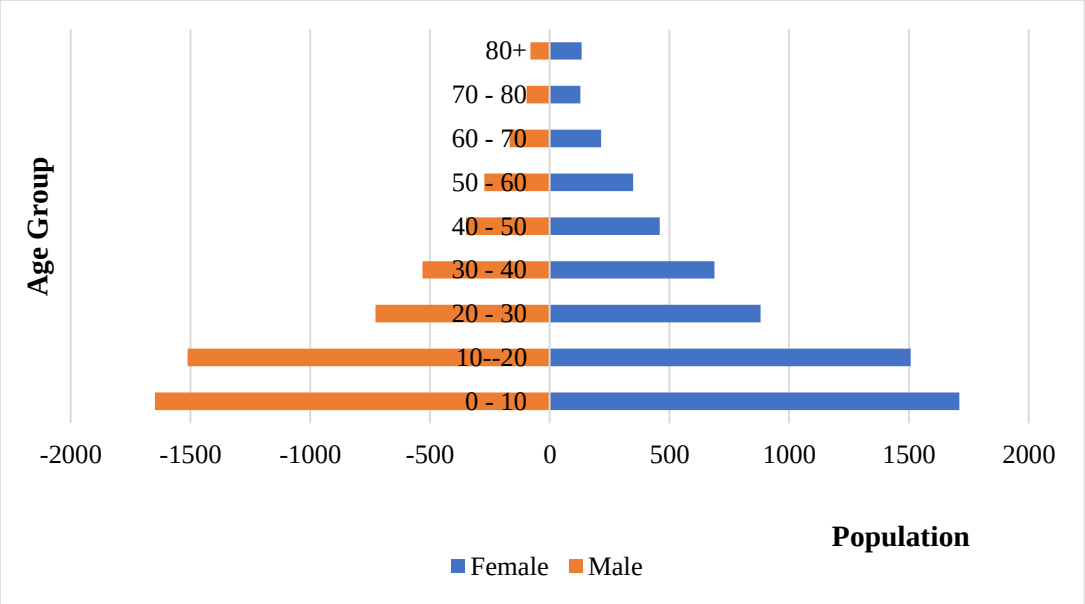
Source: KNBS, 2009

This implies that Kalongo sub-location population is 8.4 percent and 1.17 percent of the Sub – County and County population respectively. The sub-location has a total of 2,053 households as per the 2009, housing and population census.

5.4.2 Structure of Population

Makueni county population displays a spread-out population pyramid. The proportion of the population within the young age groups in the county is the highest. The domination of young population is a major trait of Makueni, probably resulting from a relatively high population growth rate. The county has a high fertility rate of 5 children per woman. Life expectancy in the county is slightly higher at 67 years compared to the national one which is 62 years. The population situation of Makueni County is replicated in Kalongo sub-location as there are larger numbers in the younger age groups as shown in Figure 3.

Figure 3: Population Pyramid



Source: KNBS, 2009

5.4.3 Density of Population

The county has a population density of 119 persons/Km². There is a greater concentration of people in upper zones with Kaiti Sub County where Kalongo sub-location is located recording the highest density of 316 persons per Km². Lower zones have smallest density for instance, Kibwezi East is the least inhabited Sub County with 53 residents per Km². The variation in density has resulted from diverse climatic and socio economic conditions in the six Sub Counties. The study area has a

population density of 574 persons per square kilometre, a density that is higher than the County and Sub-County population densities.

5.5 Demographic Factors

This section outlines the birth and mortality rates of Makueni County.

5.5.1 Birth Rate

The Crude birth rate (‘000) in the county stands at 36.2. In areas where migration is not that pronounced, births and deaths are the major demographic processes that help to drive population changes. The total fertility rate in the county stands at 5.1 children per woman. Fertility is indeed a key parameter that helps defines the size, structure and composition of a population (Kenya, 2017a).

5.5.2 Mortality Rate

The mortality rates in Makueni County are slightly lower than the national rates (Table 4). However, crude death rate is slightly higher in the county than in the country.

Table 4: Mortality Rates of Makueni County

No.	Category	Rate	National Statistics
1.	Infant mortality	53/1000	54/1000
2.	Under five mortality	61/1000	79/1000
3.	Maternal mortality	400/100,000	495/100,000
4.	Crude death rate	11.9/1000	10.4/1000

Source: Makueni, 2016: page 2

5.5.3 Migration.

As per the 2009 housing and population census, migration rate in the county was 10.1 percent while the nation migration rate was 20.9 percent. Migration of the population from rural to urban areas had increased due to better economic, health, trade, education and cultural infrastructure in upcoming urban centre in the county such as Malili, Mtito Andei, Makindu, Wote, Kibwezi, Emali among others (Kenya, 2017a).

5.6 Socio-Economic Characteristics

The county has erratic rainfall pattern which is unevenly distributed. This results to massive crop failures hence triggering food insecurity. Subsistence agriculture, dairy farming, beekeeping and small-scale trade are the main economic activities practiced

in the county. Maize, green grams, beans, pigeon beans, cassava, sorghum, fruits and cotton are some of the crops grown. The area boasts of being one of the producers of the best quality fruits in the country. Some of the fruits grown in the area include; bananas, mangoes, paw paws oranges, and avocadoes are produced in the area (AWSC, 2015).

Makueni is a county of multiple cultures an aspect that exhibits a strong development potential. The main inhabitants are the Akamba people who belong to the Bantu ethnic group. They speak Kamba language (Kikamba) as a mother tongue and are closely related in language and culture to the Kikuyu, Embu, Mbeere and Meru. The county also has a cosmopolitan way of life especially in areas along the Nairobi-Mombasa highway. The main religious denomination is the catholic with 290,300 persons while different protestant denominations together have 557,700. Islam has 4,900 and the other faiths 12,200 (Kenya, 2013).

5.7 Land and Land Use

The total arable land in the county is about 5,042.69 km^2. This translates to approximately 74 percent of the total county area. Since agriculture is the main source of livelihood for majority of the population, most of the land is used for agricultural purposes. Kilungu and Mbooni West Sub Counties have a high potential for horticulture and dairy farming. This is mainly attributed to the favorable climactic conditions. Fruit and cotton production as well as livestock rearing is mostly done in the lowlands areas. Agricultural sector contributes about 78 percent of all household income. The farm sizes in the county are both small and land scale farms. The mean land size for the small scale farms is approximately 3.44 Ha while that of the large scale farms is 30.4 Ha. A total 65,453 Ha is under food production while 23,356 Ha is under cash crop growing (Kenya, 2013).

5.7.1 Land Ownership Status

The mean land holding size of the County stands at 1.58 Ha while the national mean land holding is 0.97 Ha per household. This implies that, the county is relatively doing better in terms of land sizes as compared to the national statistics. About 19.8 percent of the land owners have title deeds. This is equivalent to 186,814 land owners. The proportion of the land owners with title deeds in the county is quite low when

compared to the national statistics as nationally, 39.4 percent of land owners have tittle deeds (Kenya, 2013).

5.8 Social Infrastructure

This section outlines the educational and health facilities in Makueni County and Kalongo sub-location.

5.8.1 Educational Institutions

The county has a total of 1,819 primary schools comprising of 914 Government owned and 68 privately owned schools. There are 398 secondary schools with an enrolment of 90,955 and 86 percent retention rate. Two public universities have their campuses in the County. The South Eastern Kenya University (SEKU) has a campuses in Wote and Mtito Andei, with land set aside for a 3rd campus in Mbooni. The University of Nairobi has a research centre at Kibwezi and an extra mural centre at Wote. The County also hosts one private University at Kibwezi West Sub County, Lukenya University. There are a number of middle level colleges with campuses in the County including two medical training colleges in Wote and Makindu towns, Kibwezi teachers training college and Riccatti College in Wote town (Kenya, 2017). Kalongo sub-location has several primary and secondary schools as outlined in Table 5.

Table 5: Primary and Secondary Schools in Kalongo Sub-location

No.	Primary schools		Secondary schools	
	Public	**Private**	**Public**	**Mission**
1.	Matua Primary School	Little Angel Academy	Kikoko Girls Secondary School	St. Teresa Secondary School
2.	Thomeandu Primary School	Vision Academy	Precious Blood Kilungu	St. Thomas Acquinas Secondary School
3.	Kyangela Primary School	St. Mary Academy	Kisekini Secondary School	_
4.	Kiakutuku Primary School	_	Iyokoni Secondary School	_
5.	Kisekini Primary School	_	Kyamatheka Secondary School	_
6.	St. Teresa DEB	_	_	_
7.	St. Joseph's Primary	_	_	_

	School			
8.	Kalongo Primary School	_	_	_
9.	Iyokoni Primary School	_	_	_
10.	Kyamtheka Primary School	_	_	_

Source: Field Survey, 2018

5.8.2 Health Facilities

The County has a total of 156 public health facilities (Table 6). These include Nine Level 4 hospitals which offer in patient services, 21 level three hospitals previously referred to as health Centres and 125 dispensaries. In addition, there are 2 private hospitals, 36 clinics and 27 dispensaries that complement the efforts of the Government (Kenya, 2017a). Kalongo sub-location has two health facilities namely: Kikoko Mission Hospital and Kyanganda Dispensary.

Table 6: Health Facilities in Makueni County

No.	Level of Health Facility	Total Number of facilities
1.	Level 4	9 and include; Makindu Hospital, Makueni Hospital which is the County Referral Hospital, Mbooni, Sultan Hamud, Matiliku, Kathonzweni, Kilungu, Tawa and Kibwezi hospitals
2.	Level 3	21
3.	Dispensaries	125
4.	Private hospitals	2
5.	Clinics	36
6.	Private dispensaries	27

Source: Kenya, 2017a: page 25

5.9 Physical Infrastructure

Physical infrastructure includes transportation, water and sanitation, energy and telecommunication facilities.

5.9.1 Transportation

There are three main modes of transportation in Makueni County namely: road, railway and air. Road transport is the only existing mode of transport in Kalongo sub-location though the other modes are still accessible.

5.9.1.1 Road Transport

The County has fairly a good road network though most of the roads have earth surface type. This makes them inaccessible during the rainy season. The current road coverage is estimated at 3,203.5 Km. Bitumen roads taking 453.8Km; gravel 555 Kms while surface roads take up 2,198.6Kms. The bitumen roads are the Nairobi-Mombasa highway from Konza to Tsavo River, Katumani – Wote - Makindu Road, Salama – Mukaa - Nunguni road, and Itangini –Tawa - Kikima road. The major bus parks in the County are Emali and Nunguni bus parks which have been constructed by the County Government (Kenya, 2017a).

The study area has a network of access roads. The major roads include Kikoko – Kyuasini Road, Kilungu Road, Musalala Road and Ndiani Road. Most of the access roads are earth roads in poor state making them impassable during the rainy season (Plate 1).

Plate 1: Poor State of an Access Road

Source: Field Survey, 2018

5.9.1.2 Railway Transport

The standard gauge railway which runs from Mombasa to Nairobi is strategically located within the county as it has two major stations in the county. The railway runs

from Old Konza railway station to old Man-eaters railways station with major stations at Mtito Andei and Emali. It also has passenger stop rest facilities at Sultan Hamud and Kibwezi (Kenya, 2017a). To access the train services from the study area, one can board at Emali station.

5.9.1.3 Air Transport

Makindu town hosts the only airstrip in Makueni County. There are also private air strips along Athi River, around Kiboko, at Mikululo and at a David Shedrick site. The Airstrip at Makindu town is underdeveloped but has the potential to be upgraded. There are no air strips within the study area (Kenya, 2017a).

5.9.2 Water and Sanitation

This section presents the sources of water for the residents of Makueni County as well as the types of sanitation they use for their liquid waste disposal.

5.9.2.1 Water Supply

The main water sources for the County are rivers, protected springs, boreholes, water pans and surface dams (Table 7). Approximately 12,671 households have access to piped water with 27,752 households being able to access potable water. The current water demand in the County is at 22,113m^3/day. However, the developed sources have a capacity to produce an average of 13,607m^3/day. This presents a water deficit of 8,507m^3/day (Kenya, 2017a).

Table 7: Water Sources in Makueni County

No.	Water source	Number
1.	Permanent rivers	2
2.	Protected springs	4
3.	Boreholes	117
4.	Water pans	289
5.	Surface dams	159

Source: Kenya 2017a: page 50

The residents of Kalongo Sub-location source their water from Nduani Spring, located a few metres from the market centre. The water is of good quality though possible threats of pollution might be eminent since the area is not fenced. With the help of certain containers, the residents fill their jerricans (Plate 2). The water from Nduani

spring is used for both domestic and agricultural use. Its flow waters the farms downstream.

Plate 2: Nduani Spring

Source: Field Survey, 2018

5.9.2.2 Sewer Systems

The major towns in the County do not have a sewer reticulation system for their liquid waste disposal. The acute water shortage in the county further complicates the sanitation issue. The residents of Kalongo Sub-location have embraced the use of pit latrines for their human waste disposal with about 80 per cent of the households having access to pit latrines.

5.9.3 Energy

The rural electrification programme has significantly expanded the coverage of electricity in the county. Currently, more than 2,000 rural households are connected to the national grid. For the connected households, electricity is the main lighting energy source. In addition, tapping on the long hours of sunshine experienced in the county, solar energy could become a reliable renewable energy source. However, due to lack of financial resources as well as inadequate knowledge on the installation and

utilization technologies, solar energy has not been significantly exploited. Due to the low level of electricity connectivity, majority of the people use paraffin for lighting as represented by 69 percent of the population. Electricity and solar comes in as the subsequent lighting energy sources at 5.9 percent 3.8 percent respectively. Majority of the population use firewood for cooking as represented by 84.8 percent of the households with 11.1 percent using charcoal. The high use of fuelwood for cooking has detrimental effects to the environment (Kenya, 2017a).

5.9.4 Posts and Telecommunications

According to Kenya (2013) the county has only one registered private courier service provider. However, the private sector, through the use of the public service vehicles that connect the county to Nairobi and other major towns offer courier services. There are about 13 post offices and 7 sub-post offices located in different geographical areas all over the county. Community, regional and national radio services are available within the county. There is however a poor television signals. There are approximately 37 cyber cafes located at the major urban centres. Approximately, 85 percent of the population has access to mobile phones. The high mobile phone ownership has created new opportunities in the banking sector through the mobile banking programmes.

5.10 Conclusion

Located in the ASAL region of the country, the climatic conditions of Kalongo sub-location are not very favorable for agricultural production. The absence of major water bodies rule out the possibility of fully adopting irrigation fed agriculture. Thus, relatively large land parcels would be ideal if sustainable food security is to be achieved. However, the household land holdings are being threatened by the increased population densities which have exerted immense pressure on the available land resources especially in the high potential areas. This pressure has emanated from the need to acquire arable land resulting to the clearance of vegetation cover to create land for settlements and farming. The clearing of vegetation has resulted to land degradation while the increment in human settlements has led to the decrease in the amount of land available for farming. This situation affects the amount of food produced in the sub-location and Makueni County in general. This calls for the need to develop policies and regulations on land use and settlements so as to ensure attainment of food security.

CHAPTER SIX
DATA ANALYSIS AND RESULTS

6.0 Introduction

The study focused on the effects of diminishing household land sizes and uses on sustainable food and livelihood security. It examined the implication of the current land sizes and uses on food and livelihood security and estimated the approximate land holding that can sustain an average rural household in the farming system. The information was obtained after administering household questionnaires to the residents of Kalongo sub-location; interviewing of key informants, County Lands Officer, County Physical Planner and County Agricultural Officer; conducting of Focus Group Discussions and use of photography. This chapter is therefore a compilation of the research findings of primary data collected from the household questionnaires, interview schedules, observation checklist among other methods of primary data collection.

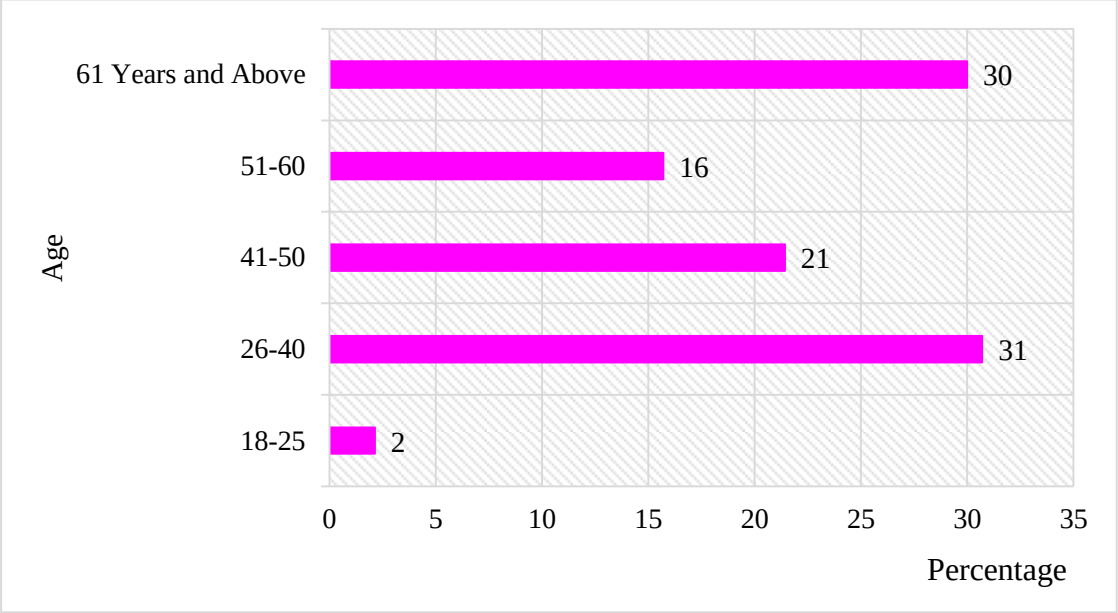
6.1 Respondents Characteristics

This section discusses the characteristics of the respondents with respect to their age, marital status and gender.

6.1.1 Age

For the household questionnaires, 140 respondents from 10 villages within the sub location were interviewed. The respondents chosen for the study were the household heads or their spouses and were thus aged 18 years and above. Data collected indicated that most of the respondents are aged between 26 and 40 years as represented by 31 percent of the respondents. The respondents aged 61 years and above followed very closely at 30 percent (Figure 4). The high proportion of respondents aged 61 years and above indicates that, life expectancy at the sub-location is quite high. This is evidenced by some residents who are over 90 years of age. The high life expectancy could be attributed to improved access to health care and proper eating habits.

Figure 4: Age Characteristics

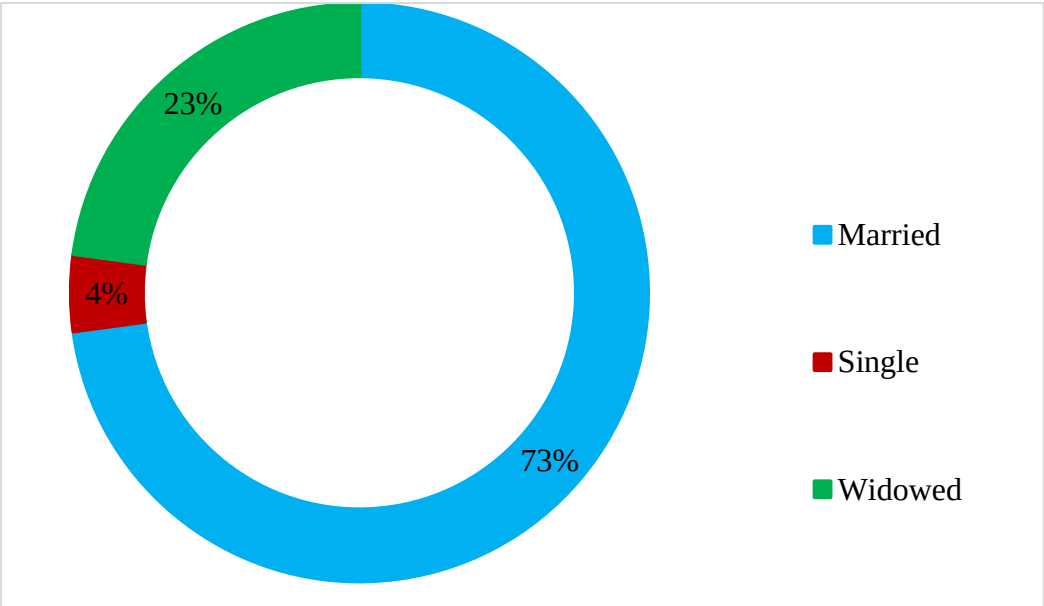


Source: Field Survey, 2018

6.1.2 Marital Status

The respondents interviewed were married, single or widowed. The single respondents included those who had established their homesteads away from the compounds of their parents but were yet to get married. They were selected as they formed part of the list of households as provided by the village head men.

Figure 5: Marital Status



Source: Field Survey, 2018

About 73 percent of the respondents are married as compared to 23 percent and 4 percent who are widowed and single respectively (Figure 5). Over 98 percent of the widowers in the sub-location are females aged over 60 years. This implies that, life expectancy for females is quite high as compared to those of males.

6.1.3 Gender

Approximately, 55 percent of the respondents are males as compared to 45 percent of the female respondents. This implies that, there is a notable dominance of males in making of major decisions affecting the running of the household. The dominance is however not that significance as the ratio fits so well in the constitutional gender ratio requirements.

6.2 Household Characteristics

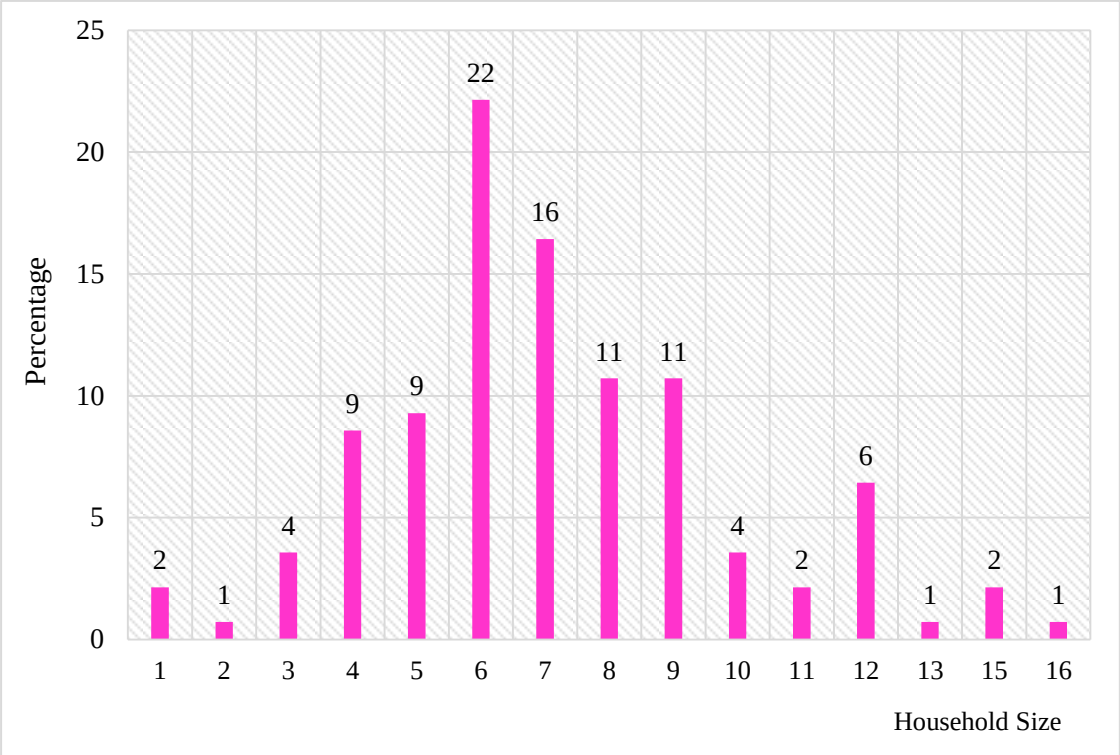
This section discusses the household size, number of sons and daughters, education level, economic activities and engagement in non-farm income generating activities by the household heads.

6.2.1 Household Size

The household size in Kalongo sub-location ranges from 1 to 16 members with a mean household size of 7.14 and a standard deviation of 2.817. Households with 6 members are the majority as represented by 22 percent of the respondents. Those with 2, 13 and 16 members are the least. In aggregate, majority of the households within Kalongo sub-location have between 6-10 members as represented by 67 percent of the respondents. Households with 11-15 people account for about 5 percent while about 2 percent households have over 15 members. Only 25 percent of the households have a household size of 1-5 people (Figure 6).

The relatively big household sizes are a factor of the high fertility rates and high life expectancy in the sub-location and the county in general. The big household sizes have an implication on the size of subsequent land sizes as tradition dictates that the land should be subdivided to the heirs. In addition, big household sizes imply many mouths to feed thus impacting on the food security for the households.

Figure 6: Household Size

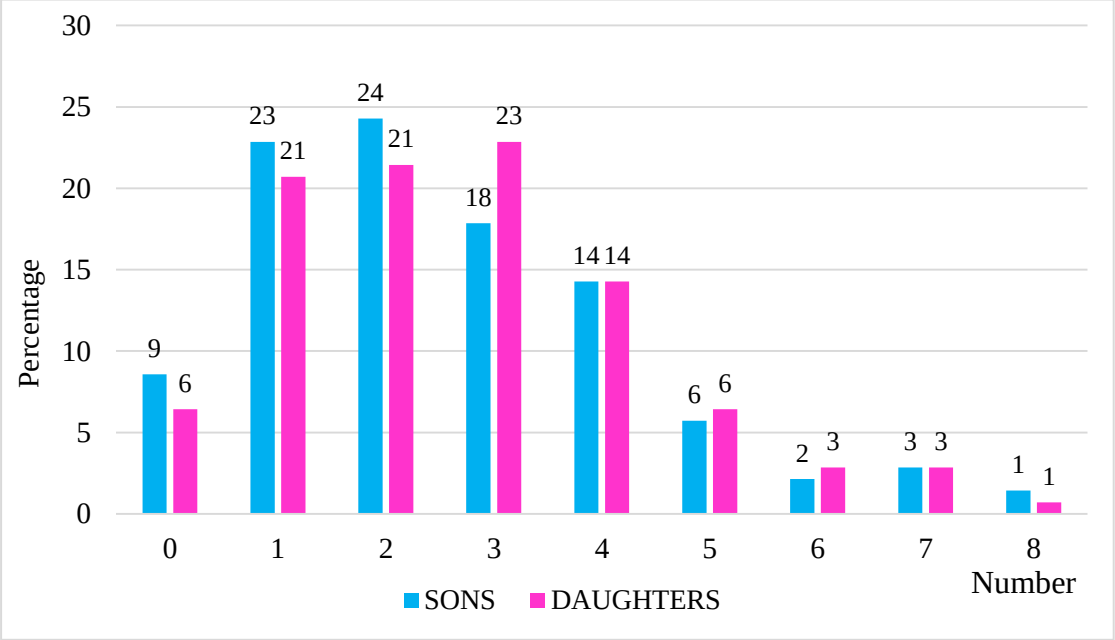


Source: Field Survey, 2018

6.2.1.1 Number of Sons and Daughters

The number of sons per household ranges from 0 to 8 with a mean of 2.55 which is equivalent to 3 sons per household and a standard deviation of 1.768. Households with 2 sons are the majority as represented by 24 percent of the respondents. The number of daughters on the other hand ranges from 0 to 8 as well with a mean of 2.68, an equivalence of 3 daughters per household and a standard deviation of 1.696. Households with 3 daughters are the majority as represented by 23 percent of the respondents. A small proportion of the households, 9 percent and 6 percent have either no sons or daughters respectively (Figure 7).

Figure 7: Number of Sons and Daughters



Source: Field Survey, 2018

Approximately, 85 percent of the households have 1-5 sons with only 6 percent households having 6-8 sons. The number of sons a household has have direct impact on the subsequent household land size as tradition dictates equal share of the family land amongst the sons as heirs. This implies that, holding other factors constant, the household land sizes will continue to diminish as fathers subdivide their farms to their sons for inheritance purposes. The households with many sons, will be highly affected by the reduced land sizes problem as the lands will be subdivided into relatively more portions.

Just like the sons, households with 1-5 daughters are the most as represented by 87 percent of the respondents. Households with 6 to 8 or no daughters are the least as represented by 7 and 6 percent of the respondents respectively. The number of daughters a household has doesn't have any direct impact on the household land size. This could be explained by the fact that the Kamba culture dictates that female members of the household are not entitled to land inheritance. Females are viewed as a mode of wealth creation from the dowry payed when they are married off to their suitors.

6.2.2 Education Level

The literacy level for the parents is relatively low. About 52 percent and 59 percent of the fathers and mothers respectively have attained primary education with only 9 percent and 7 percent having attained tertiary education (Table 8). In addition, there is a significant proportion of the mothers with no education as represented by 15 percent of the respondents. The literacy levels tend to increase for the children with a higher number attaining secondary and tertiary education. The proportion of the population which has attained primary education is the highest. This could be attributed by the presence of relatively younger families whose children are still in primary schools.

Table 8: Level of Education

Category	**Education level in percentage (%)**				
	None	**Pre-Primary**	**Primary**	**Secondary**	**Tertiary education**
Father	8	6	52	24	9
Mother	15	6	59	14	7
1st Child	2	4	40	43	12
2nd Child	2	8	43	34	12
3rd Child	4	7	43	34	12
4th Child	2	9	47	26	17
5th Child	2	10	37	33	18
6th Child	4	9	47	28	17
7th Child	0	5	48	33	14

Source: Field Survey, 2018

The level of education has a direct impact on the occupation opportunities available for the populace as well as their livelihoods. Those who have attained tertiary level of education tend to have a variety of job offers within their areas of specialty as compared to those with none, pre-primary and primary education level who have to be contented with farming or any manual/casual jobs available. Thus, with respect to food and livelihood security, households whose members have higher education levels are more food and livelihood secure as compared to those whose members have low education levels.

Conducting a paired sample test for the education level of the father and his occupation shows different means of 31.13 and 60.63 respectively. The test also shows a strong positive relationship between the education level of the father and his occupation. The correlation coefficient (r) stands at 0.535 and a significance (p) of 0.000. The paired sample table (Table 9) shows that the mean difference of -29.5 between the education level of the father and occupation of the father is statistically significant since sig is less than alpha, that is 0.000 is less than 0.05. There is thus a significant difference between the occupation type engaged in by fathers with high level education and those with low or no form of education.

Table 9: Education Level of Father and his Occupation

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Education Level of the father Occupation of the Father	-29.5	41.2	3.9	-37.2	-21.8	-7.6	112	.000

Source: Field Data Analysis, 2018

6.2.3 Occupation

Farming is the main occupation for both the household head and the spouse as represented by 61 percent and 64 percent of the population respectively. The low literacy levels also translate to the low proportion of fathers and mothers involved in formal employment (Table 10). The dominance of farming as the main occupation diminishes within the children as formal employment and business tend to dominate. However, there is still a significant proportion of the population with no form of employment. The proportion of children who are unemployed are mainly the young ones who are still in school.

Table 10: Occupation

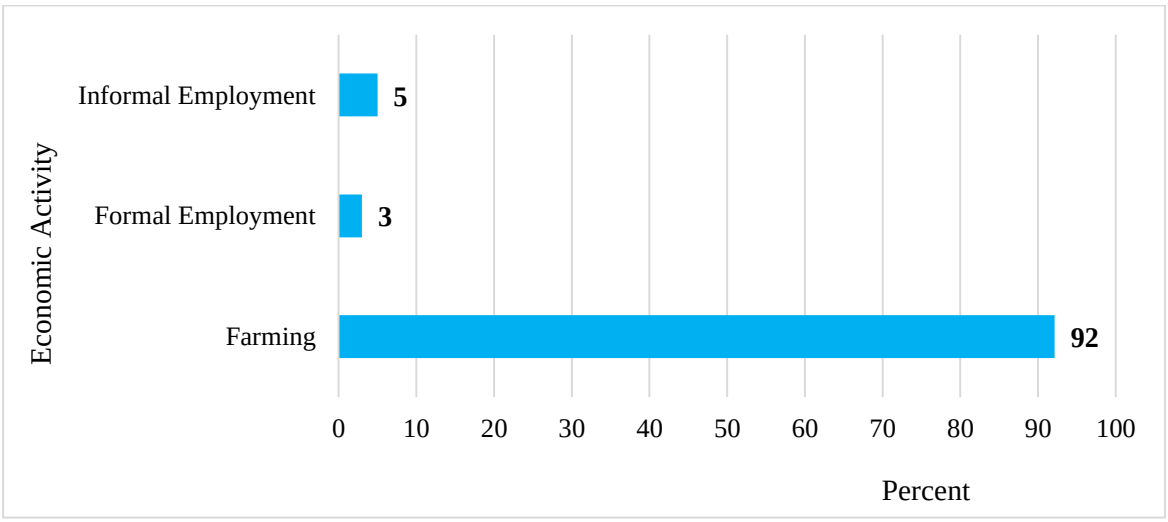
Category	Occupation in percentages (%)					
	None	Farmer	Formal employment	Informal employment	Business	Retiree
Father	8	61	8	13	6	2
Mother	2	64	9	0	5	0
1st Child	20	32	15	12	20	0
2nd Child	9	31	25	9	25	0
3rd Child	36	36	22	4	4	0
4th Child	14	19	24	29	14	0
5th Child	14	21	36	21	7	0
6th Child	14	29	43	0	14	0
7th Child	18	18	54	18	0	0

Source: Field Survey, 2018

6.2.3 Economic Activities

The main economic activity in the sub location is farming as represented by 92 percent of the respondents. Other forms of economic activities are formal and informal employment accounting for 3 percent and 5 percent respectively (Figure 8). Those in formal employment include: teachers, nurses, doctors, engineers and chefs. Those in informal employment on the other hand include masonries, casual laborers, fruit and vegetable vendors as well as those engaged in informal business activities.

Figure 8: Main Economic Activity



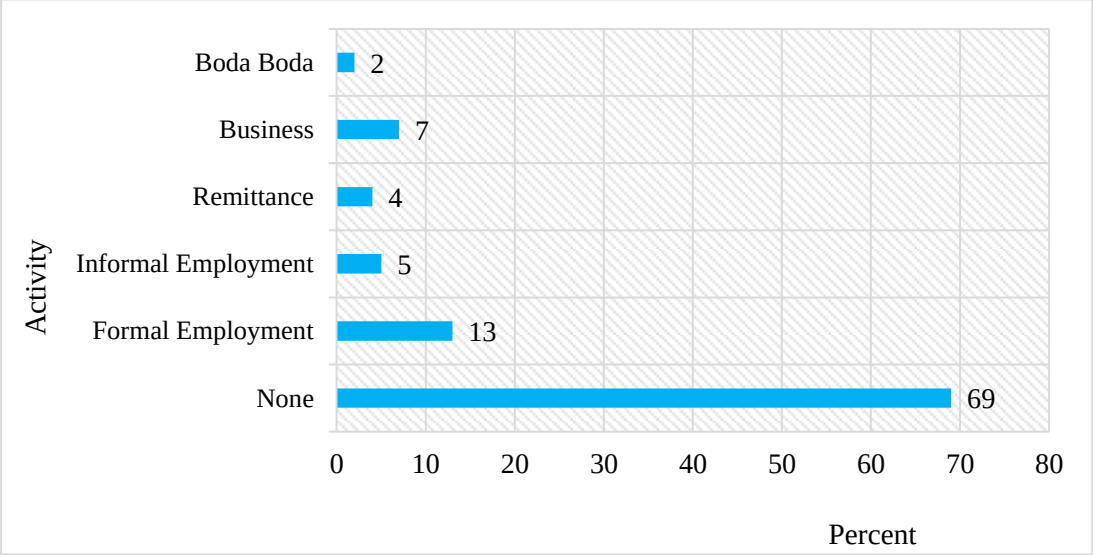
Source: Field Survey, 2018

The over-dominance of farming as the main economic activity signifies the importance of agriculture both for food production and livelihood enhancement.

6.2.3.1 Off- Farm Income Generating Activity

Despite the fact that farming is the main economic activity, 31 percent of the residents engage in some off-farm income generating activities like boda boda, business/trade, formal and informal employment. A small segment of the old age cohort depend on the monthly remittances from their children as shown in the chart below. Engaging on non-farm income generating activities provides an extra income to the households. This enables them to access adequate and quality food as well as enhance their livelihoods. However, a big proportion of the residents which is equivalent to 69 percent do not engage in any off-farm income generating activity (Figure 9). This phenomenon can be seen as negatively affecting their livelihoods. With the diminishing farm yields as a result of reduced farm sizes coupled by other factors, these households are likely to go hungry as they do not have any additional income to purchase food commodities.

Figure 9: Off-Farm Income Generating Activities



Source: Field Survey, 2018

An independent sample test was done to establish the significance of the relationship between off-farm income and food security. The variables used for the test are off-farm income generating activities and skipping of meals in the last three months because of food shortage. Levene's test is the test for equality of variances and the sig, 0.001 is less than 0.05. Since the test does not satisfy the assumption of equal

variances, the equal variance not assumed is adopted. The T-test for equality of means gives a sig. of 0.271 which is greater than 0.05 (Table 11). This shows that there is no significant food security difference for households engaged in off-farm income generating activities and those not engaged. This could be explained by the fact that, 18 percent out of the 31 percent engaged in non-farm income generating activities are in informal employment or casual laborers. Thus, the amount of income generated is very insignificant to adequately sustain the food requirements of a household.

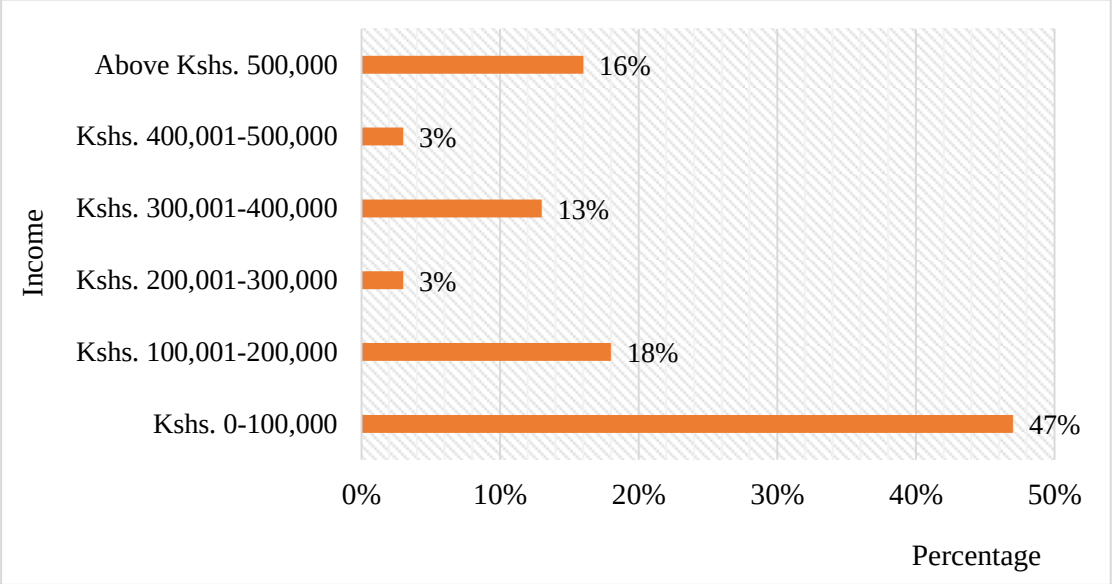
Table 11: Off-Farm Income Generating Activity and Food Scarcity

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Off-Farm Income Generating Activities	Equal variances assumed	11.612	.001	1.844	102	.068	9.486	5.144	-.718	19.690
	Equal variances not assumed			1.145	14.034	.271	9.486	8.282	-8.274	27.246

Source: Field Survey Data Analysis, 2018

Of the 31 percent of the residents with an off-farm income generating activity, about 47 percent earn on average an annual income of less than Kshs. 100,000 with only 15 percent earning above Kshs. 500,000 (Figure 10). This implies that, majority of those engaged in these activities are not better off per see as they have to depend on less than Kshs. 10,000 per month for all their household needs.

Figure 10: Average Annual Income



Source: Field Survey, 2018

An independent sample test was done to establish the significance of the relationship between off-farm income and food security. The variables used for the test are off-farm average annual income and skipping of meals in the last three months because of food shortage. Levene's sig, 0.583 is greater than 0.05 thus the test satisfies the assumption of equal variances. The T-test for equality of means gives a sig. of 0.804 which is greater than 0.05 (Table 12). This shows that there is no significant food security difference for households with off-farm income and those without. This could be explained by the fact that the amount of annual off-farm income is too insignificant that is, less than Kshs. 100,000, to sustainably ensure food security.

Table 12: Off-Farm Income and Food Scarcity

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Annual Income of off-Farm	Equal variances assumed	.303	.583	.249	102	.804	3.222	12.939	-22.44	28.886

Activity	Equal variances not assumed			.249	17.293	.806	3.222	12.944	-24.05	30.496

Source: Field Survey Data Analysis, 2018

6.3 Research Findings per Objective

The study had five research objectives whose findings are as discussed below:

6.3.1 Household Land Size and its impact on Food and Livelihood Security

This objective examined land ownership status, original family land sizes, current household land sizes, food production situation and evaluates the impacts of the land sizes on food and livelihood security.

6.3.1.1 Land Ownership Status

Approximately, 89 percent of the households own land as compared to 11 percent of the households with no land parcels of their own. About 90 percent of the households who own land own either 1 or 2 pieces, 9 percent own between 3-5 pieces while only 1 percent own over 5 pieces of land. This implies that, land fragmentation with respect to the number of pieces owned is not quite pronounced in the sub-location as most of the households own only one land parcel. However, the 10 percent of the households with more than 3 land parcels should not be ignored as this form of land fragmentation has implication on food production.

The percentage of the households who do not own any land could be categorized into two. First, those whose parents have very small land parcels probably an eighth of an acre to allow any further subdivision to their sons for inheritance purposes. In this situation, there is neither space for farming or erection of housing structures. The sons and their families are therefore forced to sleep in their parents houses and undertake any manual jobs available for survival. This situation which applies to several cases in the sub-location is driving families to abject poverty and loss of traditional customs which do not allow adult sons to sleep under the same roof with their parents. It is thus imperative that this unregulated land subdivision practices are gradually rendering people landless and with no means to produce their own food. Since farming is the form of livelihood in the sub-location, this practice is also interfering with the livelihoods of the population.

Second, there are instances where parents are adamant to subdivide their lands to their sons for fear of them selling out the land parcels. In this case, the parents allocate a portion of their lands to the sons to farm and construct residential structures but do not confer the exclusive ownership land rights. This scenario is quite pronounced in the sub-location, even in households with more than 5 acres of land. This situation arose due to the need to protect the ancestral lands from being sold off to outsiders as the upcoming generations do not put into consideration the prevailing traditional customs. To many of the young generations, land is just a property that can be sold off to raise funds for other family needs. As echoed by the County Lands Officer, land subdivision for sale was the main land transaction in the sub-location. This necessitated the need to derive mechanisms to protect the ancestral lands as, as per the customs, inherited land should neither be sold nor leased to outsiders.

6.3.1.2 Tenure status

Freehold is the main form of tenure system in the sub-location with inheritance accounting for 86 percent of the first land parcel owned while purchase accounted for 14 percent. The form of land acquisition changes on the other subsequent land parcels with purchase becoming the most dominant form of land acquisition (Table 13).

Table 13: Form of Land Acquisition

No.	Land Parcel No.	Form of Land Acquisition	Percentage (%)
1.	1	Inheritance	86
		Purchase	14
2.	2	Inheritance	44
		Purchase	56
3.	3	Inheritance	40
		Purchase	60
4.	4	Inheritance	43
		Purchase	57
5.	5	Purchase	100

Source: Field Survey, 2018

The County Government of Makueni launched a titling process for all the land parcels in Kilungu Sub-County where Kalongo sub-location is located. As a result, all the households interviewed have tittle deeds to the land parcels they own. As reported by

the County Lands Officer, the titling process was free for the households with small land sizes of less than 5 acres, however, those with large land sizes were required to make certain payments to the County Government before being awarded the tittle deeds. In this regard, some of the households in the sub-location are yet to collect their tittle deeds form the County Lands Office as they have not paid the required fees.

Out of the 140 households interviewed, only 1 household which correspondents to 0.7 percent of the respondents rented land to add on to the owned parcel. The rented parcel was located approximately 2km from the homestead of the farmer and measured an approximate area of 5 acres. The parcel was rented for a period of 10 years for an annual rent amount of Kshs. 10,000. The farmer had the leasehold agreement between him, the lessee and the lessor.

6.3.1.3 Land Size of the Parents before Subdivision

Conducting of interviews with the oldest members of the community revealed that, the land sizes were quite big chunks of land covering various ridges at the time when people begun settling in the sub-location. However, this situation begun to change gradually as parents sub-divided their lands to heirs for inheritance. At the time of undertaking the study, several generations had settled in the sub-location, thus the relatively small land parcels.

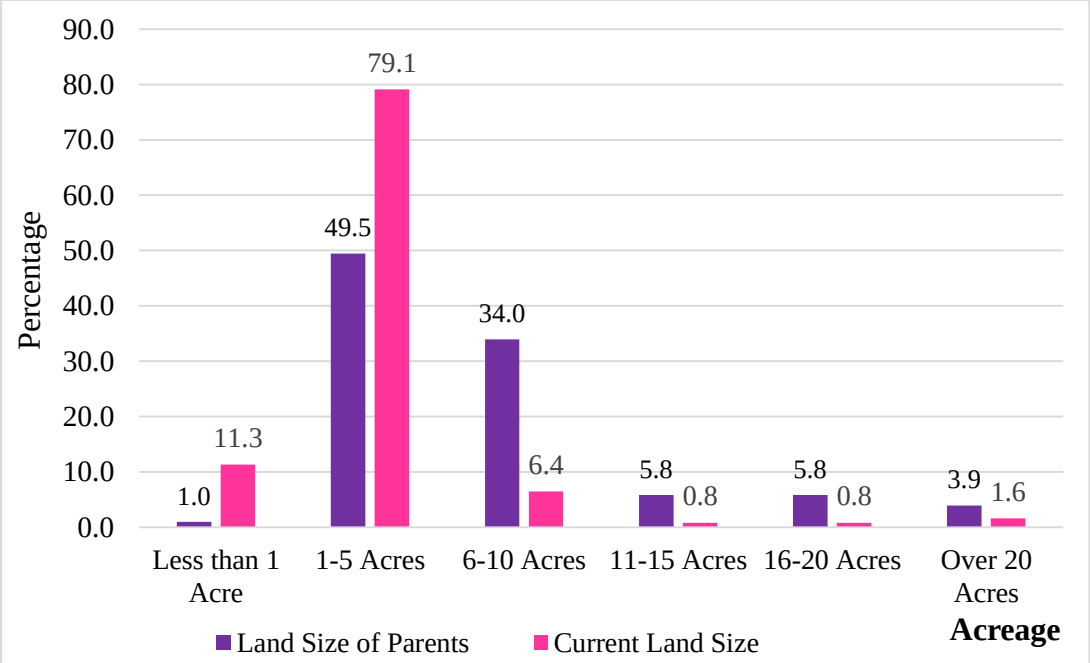
Administration of questionnaires to the households revealed that, land sizes of the parents before subdivision were between 0.25 to 30 acres with a mean land size of 11 acres. About 50.5 percent of the land sizes of the parents ranged from 0.25 to 5 acres with only 15.5 percent having land sizes of over 10 acres. Only 3.9 percent had a land size of over 20 acres with the largest land size recorded at 30 acres (Figure 11). The existence of relatively small family/parent land sizes could be explained by the fact that, a lot of generations have settled in the sub-location since its inception and land subdivision for inheritance purposes have been eminent. This led to gradual decline of the land parcels.

6.3.1.4 Current Household Land Size

The current household land sizes in the sub-location ranges from 0.125 to 30 acres with a mean land holding of 6.7 acres. Thus, the smallest land size measures approximately an eighth of an acre, though there are instances where land sizes along

the river banks measure a few square feet as all the household members want a share of the riparian land since its deemed more productive. Majority of the households which is equivalent to 79.1 percent of the repondents have land sizes measuring between one and five acres (Figure 11). Approximately, 11.3 percent of the households have a land size of less than one acre while those with more than 5 acres form the least segment of the population as represented by 9.6 percent of the respondents. However, there were a few outliers with three households owning 20, 28 and 30 acres of land respectively. However, these households had to purchase additional land parcels to add on to the inherited ones.

Figure 11: Household Land Size



Source: Field Survey, 2018

Conducting a paired sample test for the land size of the parents before subdivision and the current land size shows different means of 27.64 Acres and 2.4 Acres respectively. The test also shows a moderate positive association between the size of land for the parents and the current land size. The correlation coefficient (r) stands at 0.302 and a significance of 0.001.

Table 14: Land Size Before and After Land Subdivision

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Current Land Size (Acres) Parents Land Size Before Subdivision	-25.24	35.53	3.34	-31.87	-18.62	-7.55	112	.000

Source: Field Data Analysis, 2018

The paired sample test (Table 10) shows that the mean difference of -25.24 between the land size of the of the parents before subdivision and the current land size is statistically significant since sig. is less than alpha, that is 0.000 is less than 0.05. There is thus a significant difference in the parents land size before subdivision and the current household land size.

6.3.1.5 Farm Yields

Approximately, 78 percent of the interviewed households practiced agriculture with only 22 percent not engaging on agricultural activities. The 22 percent who don't engage in farming activities are composed of those whose land parcels are too small to the extent that no space is left for cultivation once they have erected residential structures. Some of the crops grown include: maize; beans arrow roots; sweet potatoes; vegetables like kales, cabbages, tomatoes and spinach; fruits like; avocado, bananas, paw paws and oranges; coffee, cassavas, millet and peas. The reared livestock on the other hand includes cows, goats, sheep and chicken.

Owing to the small land sizes among other factors that influence farm yield, approximately 94 percent, 95 percent and 94 percent of the households harvest less than 500kgs of maize, beans and vegetables respectively. Only about 3, 4 and 3 percent of the households harvest over 1,000kgs of maize, beans and vegetables respectively.

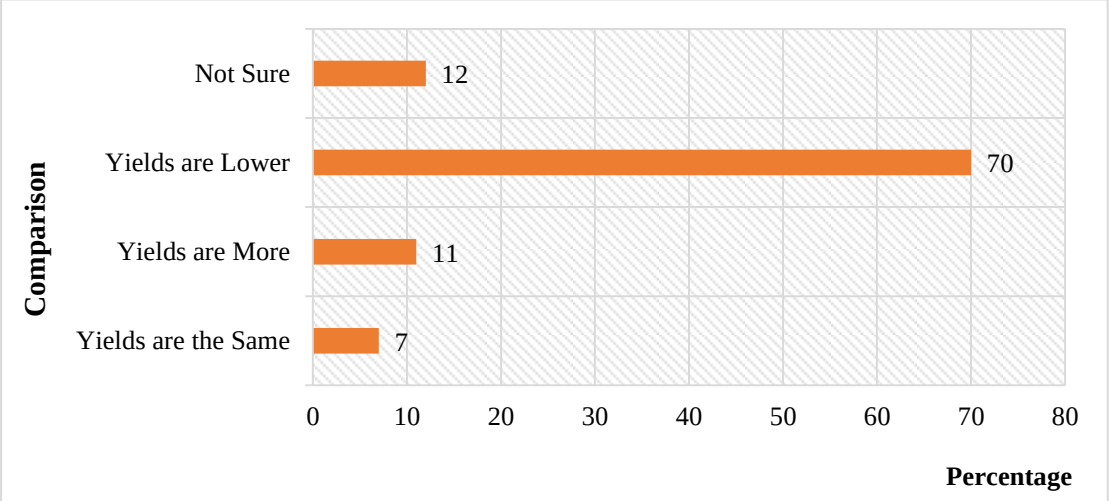
Due to lack of grazing fields, the number of livestock that is cows, goats and sheep kept is quite low as about 99 percent of the households have 1-5 animals with majority rearing 1 cow and a few goats. Only one household out of the 140 interviewed has 6 cows. The number of chicken is also quite low with most

households rearing less than 10 chicken. However, there was a household with 100 chicken. Milk production is also very low as 77 percent of the households who rear cows only get 1-5 litres of milk per day. Production of eggs is also quite low, with the highest production recorded at 20trays per annum. Manure is also part of the farm yields whose surplus is sold after being used as organic fertilizer to individual farms.

6.3.1.6 Comparison of Farm Yields

When asked to compare the current yields with the previous ones before land subdivision, 70 percent of the respondents indicated that, the yields are currently lower by a quarter - 57 percent, half - 34 percent or three quarters – 9 percent. About 11 percent specified that the yields are more, a phenomenon that they attributed to use of modern farming methods like certified seeds, fertilizers and adopting of irrigation fed agriculture as opposed to overreliance on rain-fed agriculture. A few of the respondents, that is 7 percent indicated that the yields are the same, an occurrence that was attributed to the use of the same farming methods while 12 percent were not sure about the changes in the yields (Figure 12).

Figure 12: Yield Comparison Before and After Subdivision

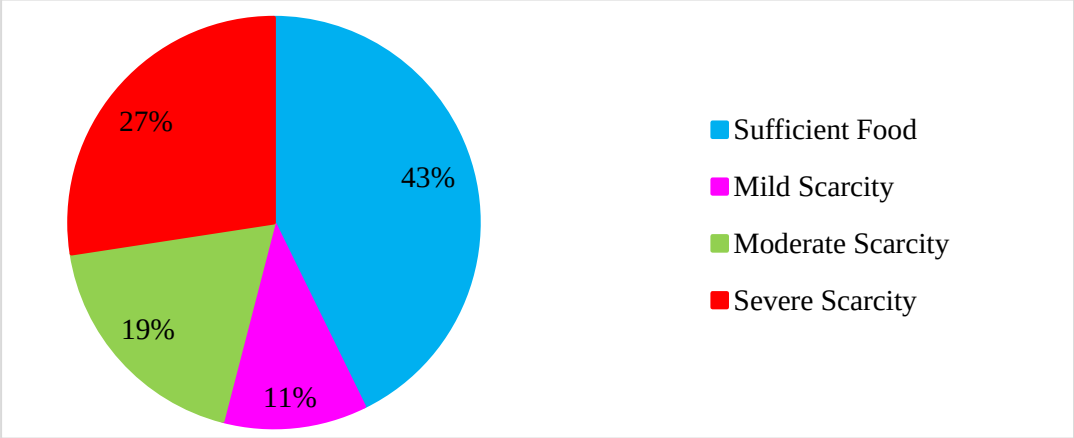


Source: Field Survey, 2018

6.3.1.7 Current Food Situation

The current yields are sufficient to about 43 percent of the households since they last for 12 months or more after the harvest. However, a significant proportion of the households which translates to 27 percent of the population struggle with severe food scarcity as the harvested farm yields last up to 3 months or less (Figure 13).

Figure 13: Intensity of Food Scarcity



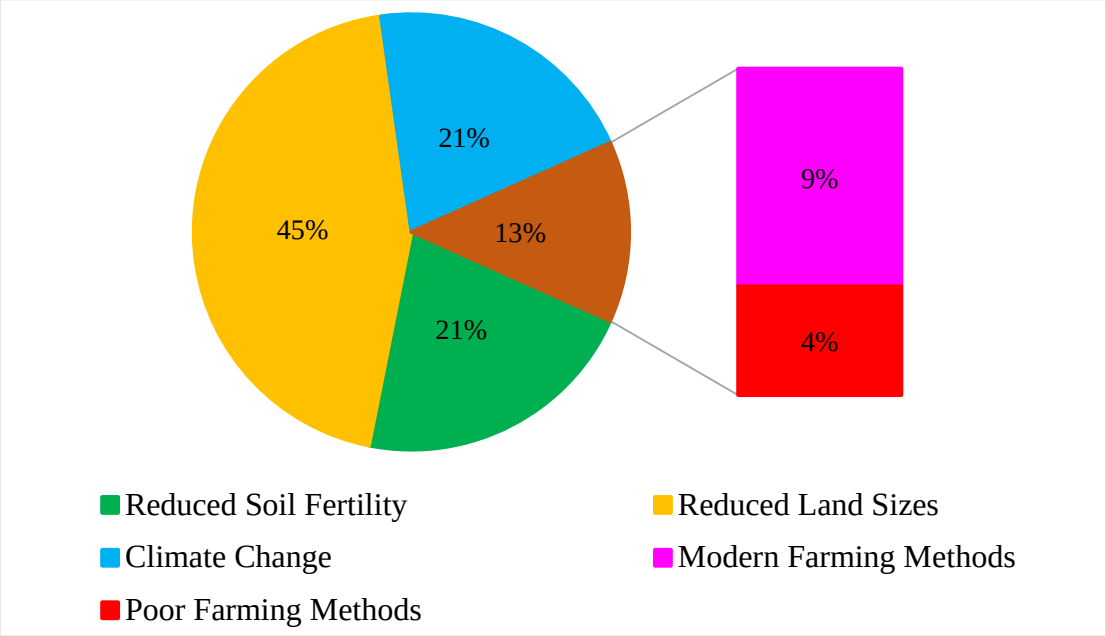
Source: Field Survey, 2018

About 19 percent encounter moderate food scarcity as the harvested produce last for at most 6 months while 11 percent have mild food scarcity with the harvested farm yields lasting up to 9 months. Households that are food insecure are forced to buy food commodities to supplement the deficit, thus eating up on the finances that could be budgeted for other productive household expenditures. This phenomenon ends up affecting their livelihoods. In certain instances, households are forced to skip some meals due to food in availability as represented by 13 percent of the households who agreed to have skipped a meal in the last three months due to food scarcity.

6.3.1.8 Impact of Current Land Sizes on Maize Production

From descriptive analysis, there seems to exist a relationship between land sizes and agricultural production. Households with bigger land sizes tend to harvest more farm yields as compared to those with small land parcels. For instance the farmer who cultivates maize on 25 acres of land harvests 40 tons of maize. This is quite a lot of produce as compared to the produce of the farmers with small land sizes of 0.125 acres who can only produce a few tens of kilograms of maize. Thus, there could be a probable correlation between the diminishing land sizes and farm yields. Out of the 70 percent of the respondents who indicated that farm yields were lower, 45 percent attributed it to reduced land sizes, 21 percent to reduced soil fertility and climate change while 4 percent attributed it to poor farming methods (Figure 14).

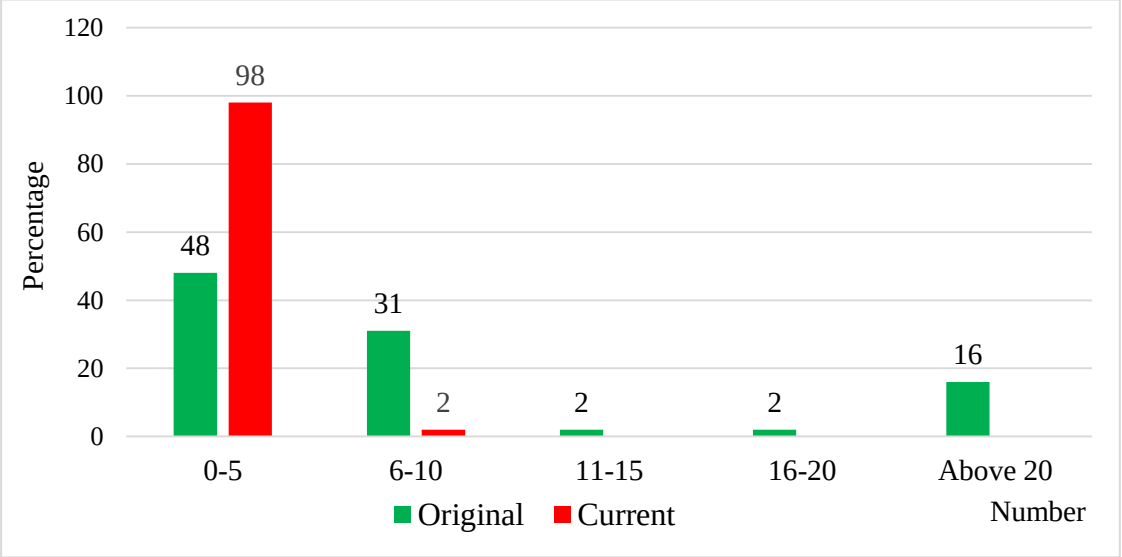
Figure 14: Reasons for Reduced Farm Yields



Source: Field Survey, 2018

This implies that diminishing land sizes has the greatest impact on agricultural production as compared to the other factors that result to reduced farm yields. In addition, when asked if small land parcels lead to low crop yield, 93 percent agreed while only 7 percent disagreed. A Pearson correlation analysis was conducted to examine the association between household land size and maize production. The results revealed a weak positive non-significant relationship; $r = 0.103$, $p = 0.280$. Thus, having a relatively large land size does not necessarily lead to more maize production. Other factors like how much of the household land is allocated to maize production sets in. With reference to livestock production, about 86 percent retaliated that small land parcels have resulted to low number of cattle kept. The reduction has been from 20 animals and above that is 100, 50, and 30 to 0 – 10 animals (Figure 15).

Figure 15: Number of Cattle Kept



Source: Field Survey, 2018

A paired sample test for the initial number of livestock kept before land subdivision and the current number shows different means of 33.16 and 28.5 respectively. The test also shows an almost perfect association between the initial number of livestock and the current livestock number. The correlation coefficient (r) stands at 0.981 and a significance of 0.000. The mean difference of 4.805 between the initial and current number of livestock is statistically significant since sig. is less than alpha that is 0.000 is less than 0.05 (Table 15). This shows that there is a significant difference in the initial and current number of livestock.

Table 15: Difference between Initial and Current Livestock Number

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Initial Number of Livestock Current Number	4.805	8.366	.787	3.246	6.365	6.105	112	.000

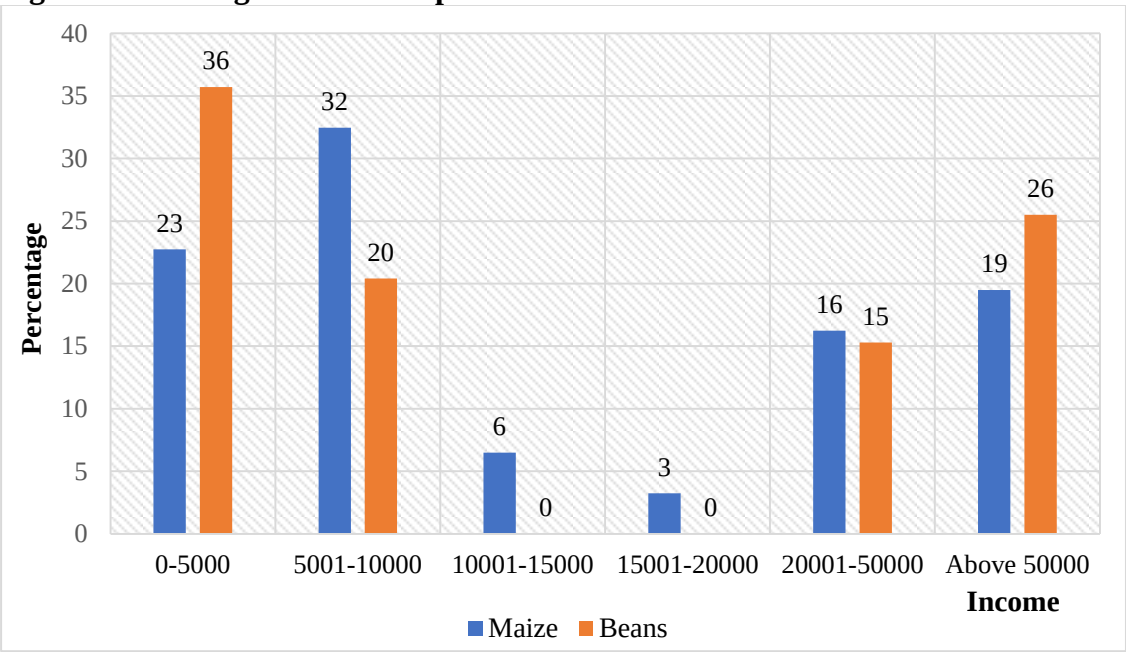
Source: Field Survey Data Analysis, 2018

6.3.1.9 Impact of Current Land Sizes on Livelihood Security

Most of the harvested maize yields are consumed at the household level with only 16 percent of households with surpluses to sell. Out of these households with surpluses, 83 percent, 4 percent and 13 percent sell less than 500kgs, 500-1000kgs and over

1000kgs of their produce to the market. The proceeds realized from the sale is also very low. At the minimum, maize is sold at Kshs. 25 per kilogram while beans fetch at least Kshs. 65. During good seasons, maize fetches around Kshs. 40-70 while beans fetches between Kshs. 70 to over 100. About 32 percent of the households earn an annual income of Kshs.5001-10000 from the sale of maize with only 19 percent earning above Kshs. 50,000. Approximately 36 percent of the households earn Kshs. 5000 or less from the sale of beans. However, a significant proportion of the respondents earn above Kshs. 50,000 from beans (Figure 16).

Figure 16: Average Annual Crop Income



Source: Field Survey, 2018

With only 19 percent and 26 percent of the residents earning above Kshs. 50,000 from the sale of maize and beans respectively, majority of the households who mainly depend on agriculture have to survive with less than Kshs. 100 per day for their needs. This amount is quite small to the extent that the households can't sustainably support their livelihoods. A few outliers also do exist. For instance, the farmer with 30acres of land producing 40 tons and 12 tons of maize and beans respectively earns on average Kshs. 10 Million and Kshs. 5 Million annually from the sale of maize and beans respectively. In addition, the farmer with 28 acres earns on average Kshs. 1.8 Million and Kshs. 2 Million annually from the sale of maize and beans respectively. These two scenarios indicate that, the size of land as a factor of production has a significant

impact on the amount of farm yields produced. Thus, the larger the land size, the more the farm yields produced.

A Pearson correlation analysis was conducted to examine the correlation between household land size and average annual income from the sale of maize. The results revealed a weak positive non-significant relationship; $r = 0.107$, $p = 0.261$. Though the relationship is very weak, an increase in household land size would also imply a slight increase in the average annual income from maize.

6.3.2 Effects of Land Uses on Food and Livelihood Security

Household land use allocations are determined by the profitability of the crop as well as its importance in the food chain. Originally, the main crops grown were maize and beans. However, with time, farmers started planting various tree species due to their accrued benefits as they are sold as timber or fuel wood and are easily managed. Other crops that have been emerging include vegetables like kales, cabbages, tomatoes; fruits like bananas and avocado and tubers which include sweet potatoes, arrow roots and cassavas. The introduction of vegetables as a major crop came as a result of the need to provide the commodity for household consumption. However, the surplus is sold to provide some income to the farmer. The introduction of other crops like fruits, vegetables and tubers impacted positively on food and livelihood security as these crops supplemented the original maize and beans. As over 70 percent of the farmers own 0.125 to 4 acres, there are no signifant land use allocations for the various crops grown. Mixed cropping characterizes most of the farms where maize, beans, coffee, bananas and other crops are grown on the same land (Plate 3).

Plate 3: Mixed Cropping

Source: Field Survey, 2018

A Pearson correlation analysis was conducted to examine the connection between household land size and total land under maize production. The results revealed a positive non-significant relationship; r = 0.103, p = 0.280. Though the relationship is non-significant, land allocated to maize production increases with increase in household land. The weak relationship can be attributed to the fact that majority of the households practice mixed cropping as their land sizes are too small for any distinct land use allocations. Thus, the slight change in household size may not lead to a significant change to the land allocated to maize farming.

This mixed cropping agricultural practiced negatively affects the productivity of the crops grown as they compete for any available nutrients. This then implicates on the food and livelihood security for the farmers as the little maize produced can't sustain the household leave alone having surplus for sale. In a few instances however, and especially the households with relatively larger land parcels, there exists some distinct areas for maize growing and other various crops. However, amidst these crops, a few tree species have been planted to provide fuelwood or to generate some income from the sale of the products; timber, charcoal and firewood. In addition, to the tree species,

some fruit trees like bananas and avocados have been grown within these crop growing sections.

6.3.2.1 Household Land Use Allocations

Maize growing on average has the highest land allocation. For instance, the farmer with the largest land size of 30 acres has allocated about 25acres to maize farming followed by beans at 5 acres. This scenario is replicated in the rest of the sub-location though at a smaller scale. Since majority of the farmers own at most 2 acres of land, the land allocated to maize farming measures approximately less than 1 acre as represented by 63 percent of the population. About 36 percent farm maize on 1-3 acres, while only 1 percent has over 5 acres of land allocated to maize farming. There however exist some outliers as indicated above with one farmer allocating 25 acres of land to maize farming.

For beans farming, the situation is still the same as about 77.2 percent of the farmers have allocated less than 1 acre of land for beans production. About 20.7 percent have 1-3 acres for beans production with only 2.1 percent allocating 4 acres and above for beans production. The highest area under beans production measures approximately 10 acres.

A Pearson correlation analysis was conducted to examine the relationship between the total land allocated to maize production and maize yields. The results revealed a weak negative non-significant relationship; $r = -0.068$, $p = 0.475$. In addition, a paired sample test was conducted to establish if there is a significant difference in maize production for households with different land allocations for maize. The test gave a t of -1.632 and a p of 0.105 (Table 16). The results indicated that there is no significant difference in maize production between households who have allocated larger land parcels to maize production and those who have allocated smaller land parcels. Thus, allocating more land for maize production does not necessarily lead to more maize production. Other factors that affect maize production like poor rainfall patterns, poor farming methods, failure to use certified seeds and soil fertility sets in.

Table 16: Area Allocated to Maize and Yield of Maize

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Area under Maize Yield of Maize	-293.09	1908.98	179.58	-648.89	62.74	-1.632	112	.105

Source: Field Survey Data Analysis, 2018

An independent sample test was done to establish the significance of the relationship between area allocated to the production of maize and food security. The variables used for the test are; area allocated to the production of maize and skipping of meals in the last three months because of food shortage. Levene's sig, 0.005 is less than 0.05 thus the test does not satisfy the assumption of equal variances. The T-test for equality of means gives a sig. of 0.056 which is greater than 0.05 (Table 17). This shows that there is no significant food security difference for households who have allocated larger land sizes to maize production and those who have allocated smaller land sizes to the same.

Table 17: Maize Land Allocation and Food Security

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
									Lower	Upper	
Area allocated to maize production	Equal variances assumed	8.437	.005	2.52	102	.013	29.45	11.71	6.23	52.68	
	Equal variances not assumed			2.06	15.44	.056	29.45	14.27	-.89	59.80	

Source: Field Survey Data Analysis, 2018

Plate 4 shows a section of a farm with maize farming as the most dominant land use allocation while plate 5 shows a small section of a farm under banana plantation.

Plate 4: A Maize Growing Section

Source: Field Survey, 2018

Plate 5: A Banana Plantation

Source: Field Survey, 2018

6.3.2.2 Factors Affecting Food Security

From field survey, several factors affect food security of a household. These factors include household land size, household size, education level of a father, occupation of the father among other factors. Based on the duration of food availability recorded for the households interviewed, an average of these factors were computed to establish if the conditions were different for the food secure and insecure households (Table 18).

Table 18: Factors Affecting Food Security

Factor (Mean / Highest Percentage)	**Duration of Food Availability**			
	12 months	**9 months**	**6 months**	**3 months**
Land size	2.5 acres	2 acres	2 acres	2.2 acres
Household size	8	6	7	6
No. of sons	3	2	2	2
No. of daughters	3	3	3	3
Education level of father	Secondary school -	Primary school	Primary school and below	Primary school and below
Occupation of father (%)	Formal employment – 60	Farmer – 60	Farmer – 40	Farmer – 79
Education level of mother	Primary school	Primary school	Primary school and below	Primary school and below
Occupation of mother (%)	Farmer – 70	Farmer – 70	Farmer – 50	Farmer – 82
Off-farm income generating activity (%)	Formal employment – 38 None – 42	None – 65	None – 85	None - 87.5

Source: Field Survey, 2018

From the analysis, it can be deduced that, household land size did not contribute much to food security as it was almost the same for the food secure and insecure households. In fact, households whose harvested food lasted them for at most 3 months had a bigger mean land size of 2.2 acres as compared to households with food availability for up to 9 months who had 2 acres. Household size also did not affect food security as the food secure households had the biggest families of 8 people as

compared to the food insecure households who had 6 family members. Factors that can be seen to directly affect food security of a household include; education level and occupation of the father as well as engagement in off-farm income generating activities. Household heads for the food secure households had at least secondary level of education and were engaged in formal employment. Those in the food insecure households had attained primary level of education or below and the main occupation engaged in was farming.

6.3.3 Factors Influencing Household Land Size and Use

There are several factors that influence household land size and use in the sub-location. These include: population pressure, household size - number of sons, education level, income which mainly results from off-farm income generating activities, traditions and customs, settlement patterns, land ownership, land quality and topography.

6.3.3.1 Population Pressure/ Household size

Kalongo sub-location is the most densely populated sub-location in Kilungu Sub-County. Big household sizes which translate to high population densities in the sub-location have led to reduced land sizes as parents subdivide the lands to their sons. In certain instances, these increased population densities have resulted to landlessness as the land parcels have been overly subdivided to the extent that there are no more lands to subdivide. For instance, there are a few scenarios where young families with no space to build their houses have to reside in the houses belonging to their parents and depend on manual jobs for survival. In addition, big household sizes have resulted to increased settlements which have in turn reduced the size of land available for agricultural production. These impact negatively on food and livelihood situation in the sub-location, as it is majorly depended on agriculture.

The size of the household also influences various land use allocations. With more mouths to feed, households with big household sizes tend to allocate bigger portions of their land for food production. Those with small household sizes on the other hand can allocate big proportions of their lands to commercial farming like growing of fruit trees and vegetables as well as planting of trees for sale as timber, fuel wood or charcoal.

6.3.3.2 Education Level

The household heads for the three households with 20, 28 and 30 acres of land in the sub-location have attained tertiary level of education. In addition, the children in these households have also attained tertiary level of education. This implies that, they can access better job opportunities thus enabling them to purchase additional land parcels to supplement the ones inherited from their parents. For instance, the household with 30 acres of land, originally inherited 5 acres from its parents and later bought additional 25 acres to meet their family needs.

6.3.3.3 Number of Sons and Brothers at the Time of Inheritance

Traditionally, parents are required to subdivide their lands to their sons. As a result, the number of sons a household has implicates on the size of subsequent parcels as all sons are entitled to land inheritance. In addition, the number of brothers the household head had at the time of inheritance influenced the possible land sizes available for inheritance. About 90 percent of the respondents indicated that all the brothers inherited the same land size compared to 10 percent who reported they inherited different land sizes. This implies that, ceteris paribus, the more brothers one had at the time of inheritance, the smaller the size of land he inherited. For instance, two households that own a total land of 0.5 acres, at the time of inheritance had 5 and 8 brothers respectively. In addition, one household that owns 0.125 acres had 5 brothers at the time of inheritance.

6.3.3.4 Income from Off-farm Activities

The kind of off-farm income generating activities a family engages in depends on among other facts, the skills and expertise required for the exercise. This implies that people who have attained tertiary level of education have access to better job opportunities as compared to those without. The income obtained from these activities can be used to purchase additional land parcels to supplement the exiting lands. For instance, the household head whose household has a total land size of 20 acres fragmented on 7 pieces is a retiree who worked as a medical officer. From the income obtained, he was able to purchase all these land parcels.

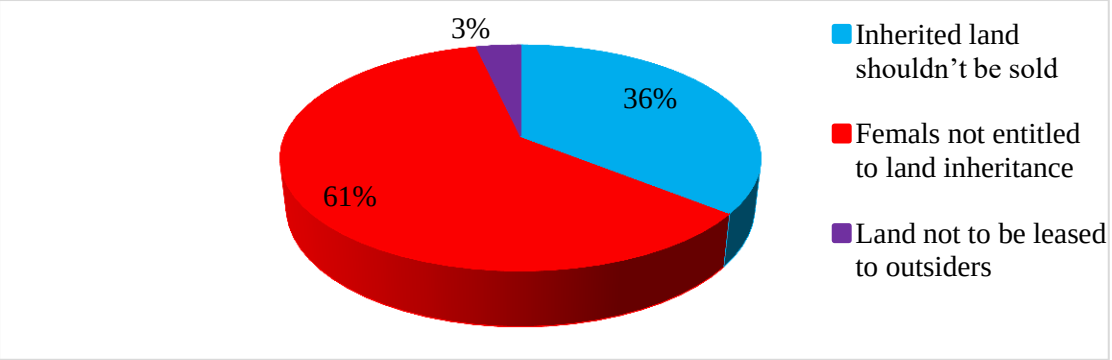
6.3.3.5 Traditions and customs

About 30.7 percent of the respondents agreed to the existence of cultural practices that surrounded the use and inheritance of land. Some of these practices include;

restrictions to the sale of inherited land, non-entitlement of women to land inheritance and land not to be leased to outsiders (Figure 17). Restricting sale of inherited land has both pros and cons. It helps protect the land from the household members who are tempted to sale off their parcels to cater for certain household expenses. Thus, these households will be able to maintain a productive land size and make wise land use allocations since they are the sole land owners. On the other side, this restriction would mean less available land for the households with small land sizes and capability to acquire additional lands. It would also result to idle lands in case the owners cannot optimally utilize them.

The main cultural practice on land inheritance is non-entitlement of females to land inheritance from their parents. Females are expected to get a share of land from their husbands. A problem sets in though once they get separated from their husbands and left with no lands to fend for their children. This is quite an irony since women are the main actors in food production both as farmers and workers in agricultural farms. This cultural practice could be affirmed by the fact that only 7 percent of the respondents postulated that the sisters they had at the time of inheritance were given a portion of the family land while 93 percent did not receive any share. Restricting leasing of land exclusively to the locals could result to sub-optimal land utilization especially if the locals do not have the prerequisite farm inputs to fully utilize its potential.

Figure 17: Cultural Practices on Land Use and Inheritance



Source: Field Survey, 2018

6.3.3.6 Topography

The terrain of the area is significantly steep. This has influenced the land available for farming and the household land use allocation decisions in a number of ways. The steepness has forced the farmers to concentrate their structures in one compound as

the foundation required for the construction of stable structures is quite expensive. The steepest areas are allocated to the planting of trees as they do not require routine maintenance. The less steep areas are allocated for growing of food crops like maize, beans and cassavas as they require constant weeding so as to produce bumper harvest (Plate 6).

Plate 6: A Typical Terrain of the Area

Source: Field Survey, 2018

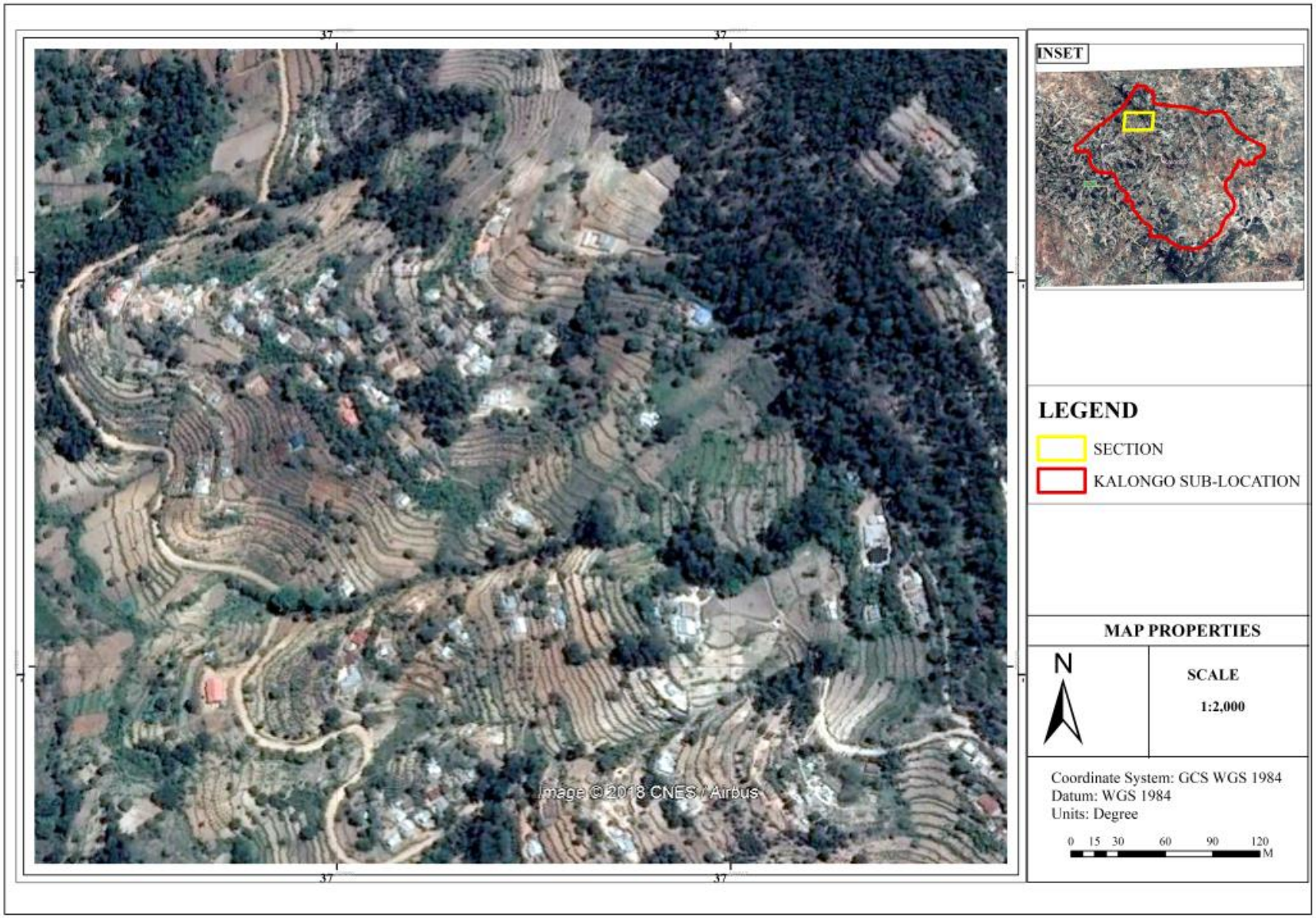
6.3.3.7 Settlement Patterns

Scattered settlements are the most common pattern of human settlement in the area as sons, once given their share of the family land, tends to erect structures away from the compounds of their parents. The scattering of settlements limits the amount of space available for farming. Comparing the satellite imageries for as section of the sub-location in 2012 and 2017, there has been significant changes to the number of settlements in the sub-location (Figures 18 and 19). This increase in the number of settlements is as a result of increased population densities hence the need to clear more lands for settlement.

Figure 18: Selected Area North of Kalongo Sub-location, 2012

Source: Google Earth, 2018

Figure 19: Selected Area North of Kalongo Sub-location, 2017



Source: Google Earth, 2018

Based on figures 18 and 19, there has been significant changes in the number of settlements within a span of 5 years. The vegetation cover has also diminished and the land is becoming bare. Settlements have been scattered all over the area (Plate 7). However, at the household level, there is a little bit of clustering of structures within the compound. This is necessitated by the hilly terrain which makes construction an uphill task as one has to adopt the building to the site. As a result, one foundation is prepared and levelled, which becomes the mother foundation for all the structures in that homestead.

Plate 7: Existing Settlement Patterns

Source: Field Survey, 2018

6.3.3.8 Land Ownership

From the focus group discussions, it emerged that lack of land ownership rights affected food production as farmers cultivating on rented or family lands tend to not take good care of the farms. In terms of land use allocation decisions, farmers on rented or family lands have little choice on the kind of plants to grow as the choice depends on the rent duration.

6.3.3.9 Fertility of the Land

The quality of the land with respect to the soil fertility and moisture content influenced the decision of the households with respect to land use allocations.

Farmers allocated the most fertile areas to cropping activities and the least fertile areas to grazing activities. Plate 8 shows a grazing field which is basically a bare rocky land with hardly any vegetation safe for the short grass which is struggling to grow. Areas along the river banks were allocated to crops like vegetables which include kales, tomatoes and cabbages; arrow roots; bananas and sugarcane as these crops require relatively higher moisture content for them to flourish.

Plate 8: Grazing Lands

Source: Field Survey, 2018

6.3.4 Inter-Generational Transmission of Land Rights and Use

Intergenerational transmission of land rights was evident in the sub-location. From the household interviews, inheritance was the main mode of land acquisition for all the households with only one piece of land. About 89.5 percent of the respondents pointed out that all the brothers they had at the time of inheritance got an equal share of the family land with only 10.5 percent inheriting non-equal shares. As per the household interviews, inheritance also formed the main reason why people subdivided their lands. In addition about 38 percent of the respondents were okay with the continuation of subdivision for among other reasons carrying on of the inheritance practices as represented by 23 percent of the respondents. This implies that,

inheritance of land has been there throughout the generations. Thus, most of the farmers feel obligated to pass on their properties to their children just as their parents passed their lands to them. In addition, interviewing the oldest members of the community revealed that, for various generations, land rights were basically transferred by passing them over to the upcoming generations. This explains why land inheritance is the most common way of land acquisition in the sub-location.

One of the household heads revealed that he obtained a 1 acre piece of land as inheritance from his father, as the land was shared equally among the 5 brothers he had during inheritance. The father had also obtained the 5 acres he shared amongst his sons from his father who shared his 30 acres piece of land equally amongst his six sons. The household head further revealed that he had already shared his 1 acre piece of land to his five sons each obtaining 0.2 acres of land. Each of his sons was further entitled to share his land amongst his heirs. This scenario is the typical situation in the entire sub-location. Thus, the subsequent land sizes depend on the number of sons a household has as land rights are transmitted from one generation to the other (Table 19).

Table 19: Effects of Intergenerational Transmission of Land Rights on Land Size

No.	Generation	Number of Sons	Owned Land Size (Acres)
1.	Great grand – father	6	30
2.	Grand father	5	5
3.	Father	5	1
4.	Son	2	0.2
5.	Grand son	1	0.1

Source: Field Survey, 2018

Initially, Kalongo was a grazing land for the herders who came from afar areas. Thus, livestock rearing was the dominant form of land use in Kalongo during the period of 1920s. After the first settlements were established crop farming was introduced with the dominant crops being maize and beans. About a century later since the inception of Kalongo, maize and beans are still the most dominant crops grown, though a few others have been introduced (Table 20). Due to the decreased land sizes, the initial land use of livestock keeping can no longer be sustained since it requires relatively large land sizes. A few adoption measures have been put in place like zero grazing

and adoption of irrigation fed agriculture to increase the harvest seasons. By the 7th generation, the land sizes would be too small to support any agricultural activity. As a result, erection of settlement structures will be the only land uses in the area. This scenario is already happening since the unregulated land subdivisions have rendered a proportion of the young population, sons, landless.

Table 20: Intergenerational Transmission of Land Use

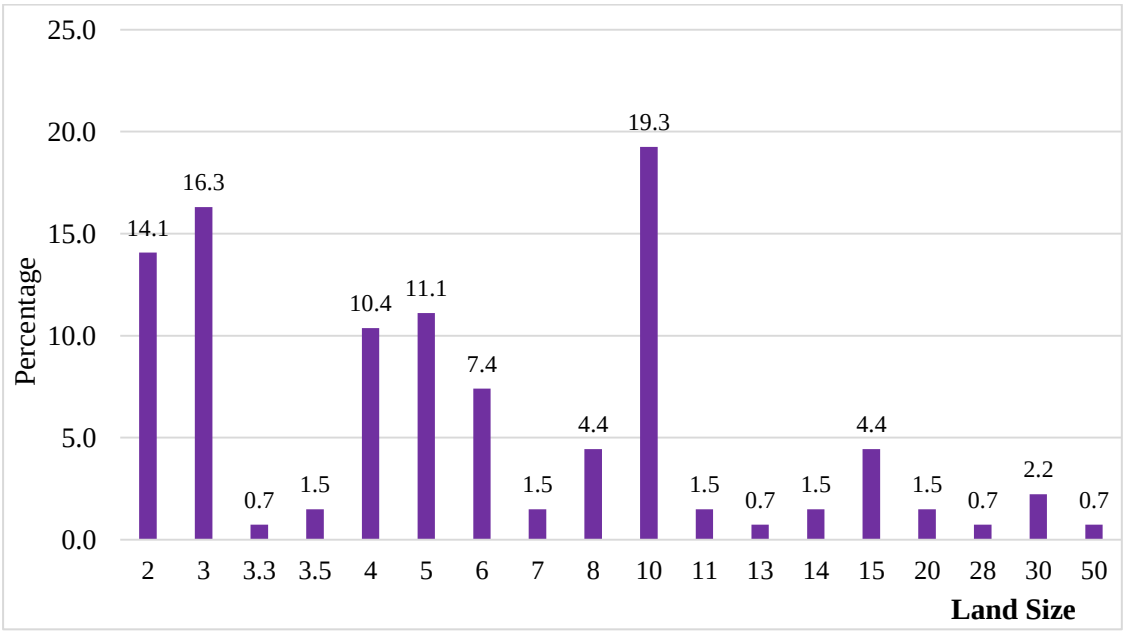
No.	Generation	Land Uses
1.	Great - great grand parents	Livestock keeping
2.	Great grandparents	Livestock keeping and crop production, growing of maize, beans and sugarcane
3.	Grandparents	Livestock keeping but at a small scale and crop farming; growing of maize, beans and sugarcane. Introduction of other crops like tubers and fruit trees.
4.	Father	Zero grazing of at most 3 cows, growing of food and cash crops. The dominance of maize farming begins to diminish with crops like trees, fruits and vegetables gaining in dominance.
5.	Son	No livestock keeping, subsistence farming, commercial tree farming
6.	Grandson	Settlement, subsistence farming and commercial tree farming
7.	Great grandson	Settlement

Source: Field Survey, 2018

6.3.5 Possible Policy Options to Achieve Sustainable Food and Livelihood Security

The respondents recommended a land size ranging from 2-50 acres with a mean land holding of 13 acre as the ideal land size for sustainable food and livelihood security in the sub-location. About 20.4 percent of the respondents are contented with 2-3 acres of land while a 10 acre piece of land is the most preferred land size as represented by 19.3 percent of the population. However, households with relatively large land sizes still prefer larger land sizes of 20 acres and above for their sustenance (Figure 20).

Figure 20: Enough Land Size



Source: Field Survey, 2018

From the key informants' interviews and the focus group discussions, a minimum land size of 5 acres was recommended as the ideal land size for sustainable food and livelihood security in the sub-location. This land size is almost double the mean land holding for the food secure households which is 2.5 acres. The additional 2.5 acres would ensure enough production for household consumption and a surplus for sale to the market. The income from the sale of surplus produce would enhance the livelihoods of the people. They will be in a position to meet other levels of human needs besides the basic needs. This land size would also enable agricultural diversification which is key in the attainment of food security. To attain this land size as a way of ensuring food and livelihood security in the maize farming system of Kalongo Sub-location, several policy interventions were proposed. These include:

6.3.5.1 Educating the Children

Ensuring that children attain tertiary level of education will increase their job opportunities and would, thus be able to purchase their lands rather than depending on the lands of their parents.

6.3.5.2 Establishment of Settlement Schemes

From the focus group discussions, a resolution was made to involve the Government in establishing new settlement schemes to decongest this densely populated rural area.

This proposal was reiterated in the household interviews as about 8 percent of the respondents recommended for provision of more lands to the people as a way of addressing the unregulated land subdivision in the sub-location.

6.3.5.3 Land Consolidation

Discouraging individual land ownership and encouraging farmers to jointly cultivate their farms and divide the farm produce depending on individual farm size and input contribution

6.3.5.4 Reorganization of the Settlements

The current settlement patterns in the sub-location are unsustainable as settlements are scattered all over. Reorganization would entail construction of clustered settlements probably high rise buildings for residence in specific areas leaving the other areas for agricultural production. This will reduce the buildings foot print and create more space for farming.

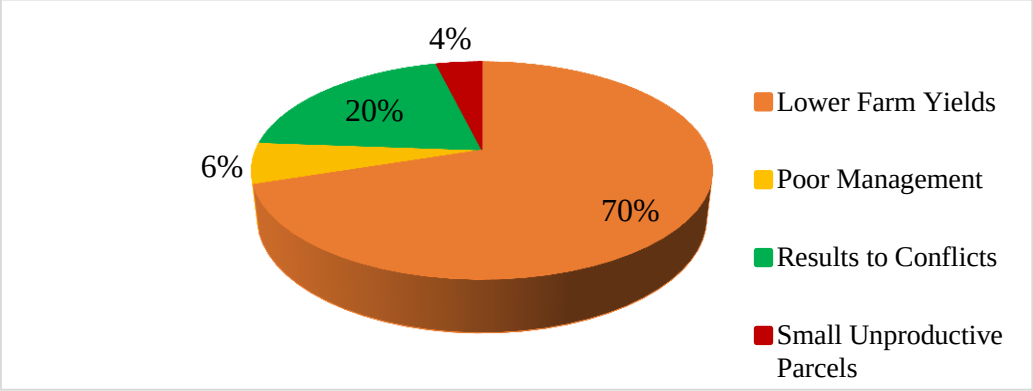
6.3.5.5 Curb Selling of Land

As gathered from the key informants interviews and focus group discussions, land subdivision was mainly done for sale so as to raise money for school fees among other households' expenses. In addition, most youths tended to sale off their land once it was formally transferred to them by their parents. As a result, most parents resulted to informal land allocations to their children to protect the ancestral lands. Curbing of land subdivision for sale would thus help in attaining and maintaining the minimum land sizes for sustainable food and livelihood security.

6.3.5.6 Sensitizing people on the dangers of land subdivision

Some of the problems of land subdivision identified included: reduced farm produce, small unproductive parcels and family conflicts in situations where some of the family members are not satisfied with the sizes allocated to them (Figure 21).

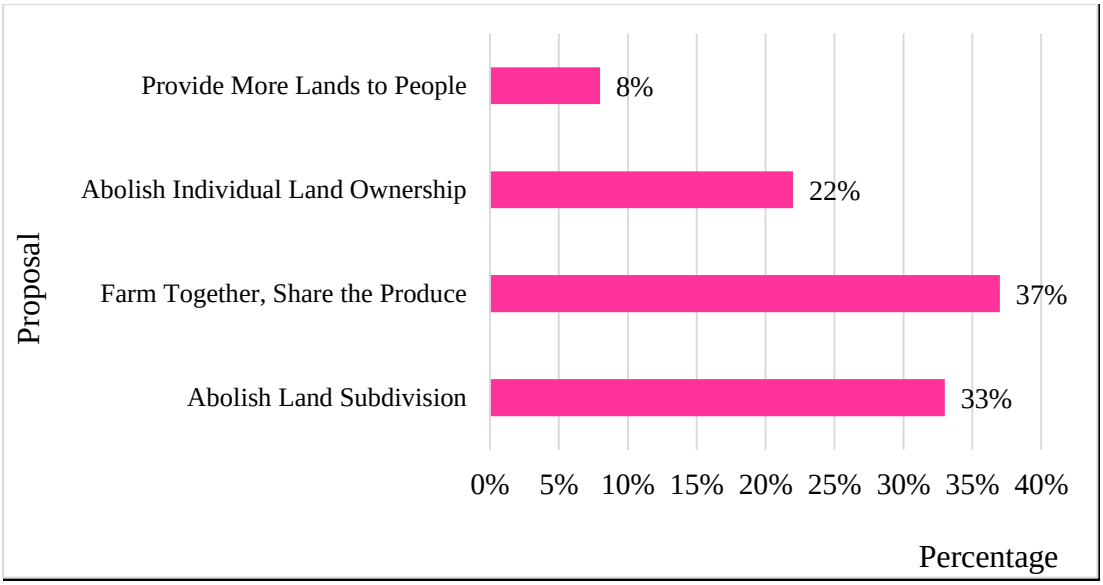
Figure 21: Problems of Land Subdivision



Source: Field Survey, 2018

Sensitizing the residents on those challenges would help them make better informed decisions on the utilization of land resources. This could be done through formulation of scenarios on how further land subdivision would affect their agricultural production and general welfare in the future. About 35.7 percent of the respondents agreed to continuation of land subdivision in the country while 64.3 percent were against its continuation. Those for the idea cited reasons such as reducing family and land conflicts and carrying on inheritance tradition since they also benefitted from the share of their parents lands. Those against the idea made several proposals to curb land subdivision (Figure 22).

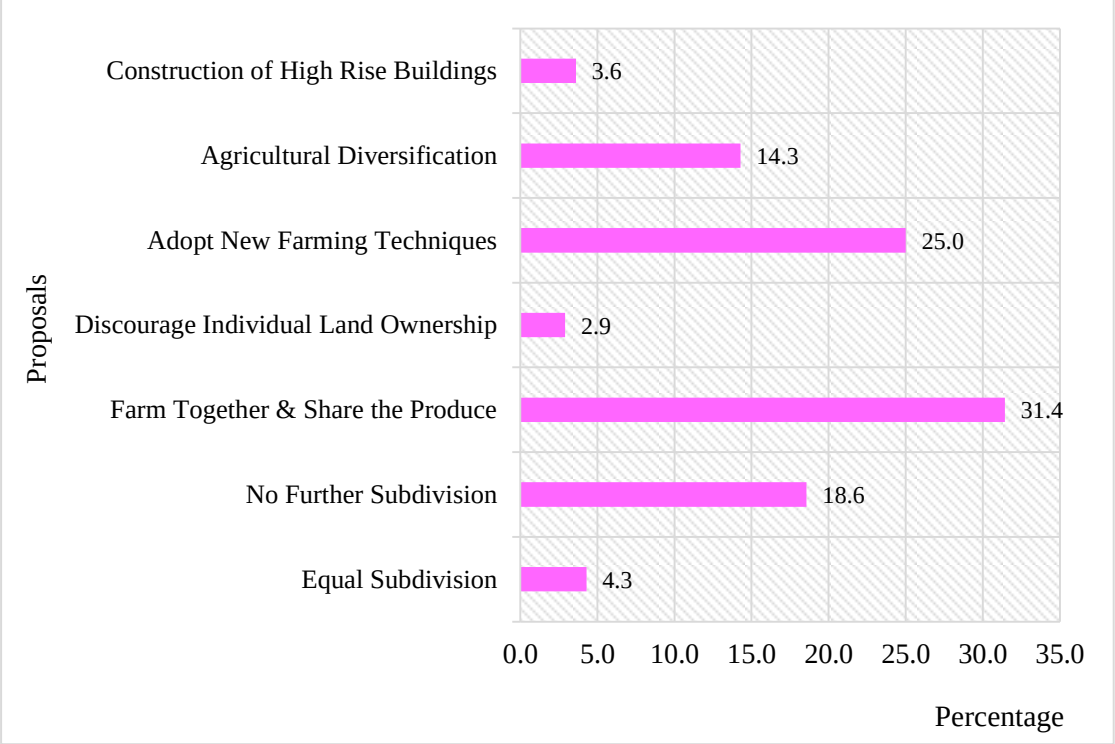
Figure 22: Proposals to Curb Land Subdivision



Source: Field Survey, 2018

From the household interviews, majority of the respondents indicated that a 10 acre piece of land was adequate for their sustainable food and livelihood security. Some of the proposals on future organization of farms include: construction of high rise residential buildings to create more space for farming, agricultural diversification to ensure production of a variety of produce, discouraging individual land ownership, jointly farming the land and sharing the produce. About 31.4 percent proposed joint cultivation of the farms and sharing the produce. However, approximately 4.3 percent still belief each son should get an equal share of land from parents (Figure 23).

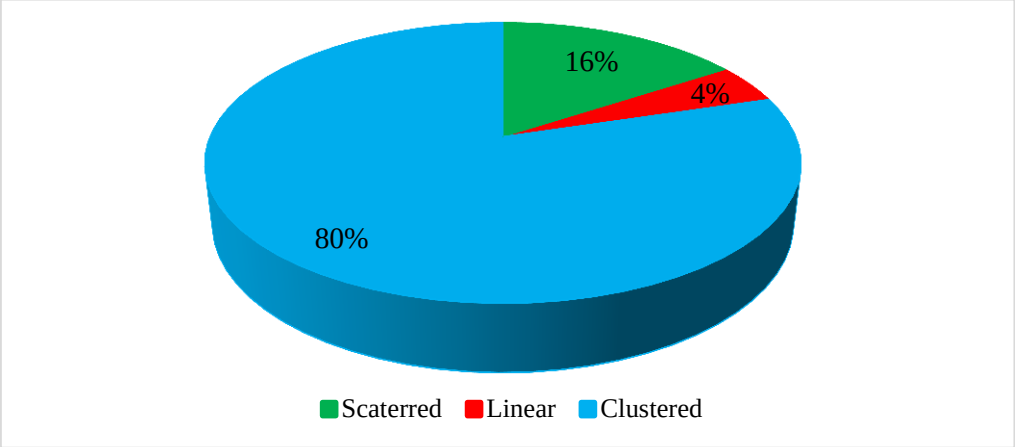
Figure 23: Future Organization of Farms



Source: Field Survey, 2018

Asked to rank possible patterns of human settlement in order of their preference, about 80 percent of the respondents preferred clustered form of settlement as compared to 16 percent and 4 percent who preferred scattered and linear settlements respectively (Figure 24).

Figure 24: Preferred Pattern of Human Settlement



Source: Field Survey, 2018

The preference of clustered pattern of settlement implies that, the population is already aware of its associated benefits with regard to freeing the agricultural land.

6.4 Hypothesis Testing

This section presents the empirical results from the assessment of land size and use on food and livelihood security. Various tests were employed to evaluate how the various variables interacted.

6.4.1 Household Land Size and Food Security

1. Alternative Hypothesis:

Ha: Households that are food secure have significantly larger land parcels than households that are food insecure.

2. Null Hypothesis:

Ho: Households that are food secure have no significantly larger land parcels than households that are food insecure.

An independent sample test was done to establish the significance of the relationship between household land size and food security. Household land size in acres and skipping of meals in the last three months because of food shortage were the variables used for the test. Levene's sig, 0.860 is greater than 0.05 thus the test satisfies the assumption of equal variances. The T-test for equality of means gives a T of -0.767 and a sig. of 0.445 (Table 21). This shows that there is no significant difference in the land sizes of those who were food secure and those who were food secure.

Table 21: Household Land Size and Food Security

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Household Land Size (acres)	Equal variances assumed	.031	.860	-.767	102	.445	-.287024	.374082	-1.029013	.454965
	Equal variances not assumed			-.738	16.853	.470	-.287024	.388673	-1.107596	.533548

Source: Field Survey Data Analysis, 2018

Decision: Support the null hypothesis (**Ho**) as there is no significant relationship between land size and food security.

Conclusion: The null hypothesis (**Ho**) is supported. Thus, households that are food secure have no significantly larger land parcels than households that are food insecure.

Thus, despite 45% of the respondents attributing the reduction of farm produce to reduced land sizes, they have devised their own adaptation measures and when the stored harvest depletes, some use their off-farm income to purchase the quantities of food required. Thus, despite the size of land owned, most households are food secure.

6.4.2 Household Land Size and Livelihood Security

1. Alternative Hypothesis:

Ha: Households that are livelihood secure have significantly larger land parcels than households that are livelihood insecure.

2. Null Hypothesis

Ho: Households that are livelihood secure have no significantly larger land parcels than households that are livelihood insecure.

A chi-square test of association was conducted to establish the relationship between land size and livelihood security. The variables used for the test were the household land size and the average annual income from the sale of maize. The value of the chi-square statistic is 278.893 and a 168 degrees of freedom and a p of 0.000 (Table 22). The results may not however be meaningful as one of the assumptions of chi-square has been violated since 96.9 percent of the cells have an expected count of less than 5. Thus, the p value was used determine the significance of the relationship between land size and livelihood security.

Decision: Reject the null hypothesis (**Ho**) as there is a significant relationship between household land size and livelihood security, $p = 0.000$ is less than $\alpha = 0.05$. There is no sufficient evidence to conclude that household land size is not a determinant of livelihood security.

Conclusion: The alternative hypothesis (**Ha**) is adopted. Thus, households that are livelihood secure have significantly larger land parcels than households that are livelihood insecure.

Table 22: Land Size and Annual Income from the Sale of Maize

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	278.893[a]	168	.000
Likelihood Ratio	59.152	168	1.000
Linear-by-Linear Association	1.272	1	.259
N of Valid Cases	113		
a. 189 cells (96.9%) have expected count less than 5. The minimum expected count is .01.			

Source: Field Survey Data Analysis, 2018

6.4.3 Land Use Allocations and Production

1. Alternative Hypothesis:

Ha: Agricultural enterprises with large land allocations produce more yields.

2. Null Hypothesis:

Ho: Agricultural enterprises with large land allocations do not produce more yields.

A chi-square test of association was conducted to establish the relationship between maize land allocation and production. The variables used for the test were land allocated to maize farming and total maize production. The value of the chi-square statistic is 865.163 and a 495 degrees of freedom and a p of 0.000 (Table 23). The results may not however be meaningful as one of the assumptions of chi-square has been violated since 99.4 percent of the cells have an expected count of less than 5. Thus, the p value was used determine the significance of the relationship between land allocation production.

Table 23: Land Use Allocation and Production

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	865.163[a]	495	.000
Likelihood Ratio	338.387	495	1.000
Linear-by-Linear Association	.516	1	.472
N of Valid Cases	113		
a. 541 cells (99.4%) have expected count less than 5. The minimum expected count is .01.			

Decision: Reject the null hypothesis (**Ho**) as there is a significant relationship between maize land allocation and production, $p = 0.000$ is less than $\alpha = 0.05$. There is no sufficient evidence to conclude that maize land allocation is not a determinant of production.

Conclusion: The alternative hypothesis (**Ha**) is adopted. Thus, agricultural enterprises with large land allocations produce more yields.

6.5 Conclusion

The household size in the sub-location ranges from 1 to 16 members with a mean household size of 7.14. The relatively big household sizes are attributed to the high fertility rates and high life expectancy in the sub-location and county in general. Farming is the main economic activity as represented by 92 percent of the respondents. Only about 31 percent of the population are have non - farm income generating activities. About 89 percent of households own land as compared to 11

percent with no land parcels of their own. Freehold is the main form of tenure system in the sub-location with inheritance accounting for 86 percent of the first land parcel owned while purchase accounted for 14 percent. The household land size has significantly decreased over the years. Thus, there is a significant difference in the parents land size before subdivision and the current household land sizes. The decrease in land size has led to reduction in farm yields. However, there is no significant correlation between land size and food security. Some of the factors affecting food security are; education level and occupation of the father as well as engagement in off-farm income generating activities. The factors influencing land size and use on the other hand included population pressure, education level, income from off-farm activities, traditions and customs among others. Intergenerational transmission of land rights and use were also evident in the sub-location.

CHAPTER SEVEN
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMENDATIONS

7.0 Introduction

Agriculture is the economic driver of Kalongo Sub-location and Makueni County in general. It employs about 92 percent of the population in the sub-location and like 100 percent of all exports from the sub-location are agricultural products mainly bananas and avocados which are packaged at the market centre. Agriculture is the main source of livelihood for the majority of the population. It is thus the highest employer in the study area. The significance of the agricultural sector and specifically growing of maize for food is expected to continue for several years. The sector is however surrounded by a myriad of challenges among them diminishing land sizes.

7.1 Summary of Findings

This section is discussed with reference to the study objectives.

7.1.1 Impact of Land Size on Food and Livelihood Security

This objective examined the land ownership status, household land sizes and the food production situation. Land ownership in the sub-location is quite high as about 89 percent of the respondents own land. The 11 percent who don't own any land is as a result of landlessness brought about by the unregulated land subdivision or a deliberate effort by the parents as a way of protecting the ancestral land from sale. Freehold is the main form of tenure system in the sub-location with inheritance accounting for 86 percent of the first land parcel owned while purchase accounted for 14 percent. There has been a significant reduction of the household land size over time. The land size of the parents ranged from 0.25 to 30 acres before subdivision. However, the current land size ranges from 0.125 to 30 acres with land parcels along the rivers banks measuring a few square feet. About 79.1 percent own 1-5 acres of land.

Approximately, 78 percent of the respondents engaged in agricultural activities, a percentage that amplifies the importance of agriculture in the sub-location just as contained in the literature review. Due to the small land parcels owned by majority of the farmers, the amount of maize produce harvested is also very low. The same situation is replicated to the number of livestock reared as there are hardly no grazing

fields. The farm yields have been decreasing over time, a phenomenon that 45 percent of the respondents attributed to reduced farm sizes.

The research findings tend to agree with the reviewed literature. Many scholars have associated the decrease in farm production with the diminishing land sizes. Based on the theory of production, land, being a factor of production will influence the amount of agricultural produce. Thus, the decreasing farm sizes have a direct impact on agricultural production. However, from the independent sample test conducted between land size and food security, there is no significant difference in the land sizes of those who were food secure and those who were food secure, $t = -0.767$ and $p = 0.445$. There however exists a relationship between household land size and livelihood security. The chi-square test presents a p of 0.000 which is less than $\alpha = 0.05$.

7.1.2 Effects of Land Uses on Food and Livelihood Security

This objective assessed how the current land use allocations impacted on food and livelihood security. The study established a change with respect to the crops that were originally grown and those that are currently grown. Maize and beans were the originally grown crops. However, with time, a variety of tree species, vegetables, fruits and tubers were introduced. This introduction of more crops positively impacted on food and livelihood security as they acted as supplements to maize and beans. There are no significant land use allocations for the various crops grown as over 70 percent of the farmers own 0.125 to 4 acres. As a result, mixed cropping characterize most of the farms as all crops are grown on the same land. This mixed cropping agricultural practice negatively affects the productivity of the crops grown as they compete for any available nutrients this implicating on the food and livelihood security for the households.

Maize farming on average has the highest land allocation followed by beans. A chi-square test of association was conducted to establish the relationship between maize land allocation and production. The value of the chi-square statistic is 865.163 and a 495 degrees of freedom and a p of 0.000. There is thus a significant correlation between maize land allocation and production, $p = 0.000$ is less than $\alpha = 0.05$.

7.1.3 Factors Influencing Household Land Size and Use

The research established several factors that influenced household land size and use in the sub-location. Among these factors are: population pressure, household size, number of sons, brothers at the time of inheritance, education level, off-farm income, traditions and customs, settlement patterns, land ownership, fertility of the land and topography. Most of these factors were also postulated in the literature review as influencing household land size and land use allocation decisions.

7.1.4 Intergenerational Transmission of Land Rights and Use

Intergenerational transmission of land rights was evident in the sub-location as inheritance was the main mode of land acquisition. From the household interviews, inheritance was the main reason why people subdivided their land with about 38 percent of the respondents agreeing to further land subdivision for among other reasons, carrying on the inheritance practices. From literature review, Africans customs and traditions dictates that fathers should subdivide their properties, land included, to their heirs, thus resulting to inter-generational transmission of land rights. The research findings confirmed existence of similar customs and traditions. This intergenerational transmission of land rights have greatly led to the decline of the household land size over time and is projected to render many families landless in the long-run. Land uses have also being transmitted over the generations but with reduced land sizes some land uses like livestock rearing are becoming distinct.

7.1.5 Possible Policy Options for Sustainable Food and Livelihood Security

The research aimed at establishing an ideal land size for sustainable food and livelihood security in a maize farming system of Kalongo Sub-Location. From the household interviews, a minimum land size ranging from 2-50 acres and a mean of 13 acres was recommended. From the key informant interviews and the focus group discussions, the recommended minimum land size was 5 acres. Thus, based on the opinion of the experts, the ideal land size recommended for sustainable food and livelihood security in the sub location is 5 acres. Some of the proposals recommended to attain and maintain this minimum land size include: educating the children thus empowering them to purchase lands elsewhere, establishment of settlement schemes, land consolidation, reorganization of the settlements, curbing selling of land and sensitizing the people on the dangers of land subdivision. From literature review, some of the possible policy recommendations included land consolidation, ensuring

efficiency in production and adopting technology for optimal farm yields, adopting legislation on land use and population growth control programs among others. Thus, the research recommendations are in line with the recommendations by various scholars.

7.2 Conclusion

This study assessed household land size and use for sustainable food and livelihood security in a maize farming system of Kalongo Sub-location, Makueni County. It sought to establish the ideal land size to realize food and livelihood security in the sub-location which has been recommended as 5 acres at a minimum. The conclusions of the study have been done per objective as discussed.

7.2.1 Impact of Land Size on Food and Livelihood Security

Household land size doesn't have a direct effect on food security as the mean land holdings were almost similar for food secure and insecure households. The T-tests conducted also revealed that there was no significant difference on land size for food secure and insecure households. Some of the factors that directly contributed to the food security of a household were; education level and occupation of the father as well as engagement in off-farm income generating activities. However, there existed a relationship between land size and livelihood security as households with relatively big land sizes, earned more from the sale of maize as compared to those with small land sizes. The high annual earnings impacted positively on their livelihoods.

7.2.2 Effects of Land Uses on Food and Livelihood Security

Maize growing has the highest land allocation in the sub-location. The Pearson correlation analysis conducted to examine the association between the total land allocated to maize production and maize yields revealed a weak negative non-significant relationship; $r = -0.068$, $p = 0.475$. This revelation was also affirmed by the paired sample test which gave a t of -1.632 and a p of 0.105. The results indicated that there is no significant difference in maize production between households who have allocated larger land parcels to maize production and those who have allocated smaller land parcels. In addition, the independent sample test done to establish the significance of the association between area allocated to maize production and food security showed no significance difference, $t = 2.06$ and $p = 0.56$.

7.2.3 Factors Influencing Household Land Size and Use

The factors that influence household land size and use in the sub-location include: population pressure, household size, number of sons, brothers at the time of inheritance, education level, off-farm income, traditions and customs, settlement patterns, land ownership, fertility of the land and topography.

7.2.4 Intergenerational Transmission of Land Rights and Use

Land rights and use have been transmitted over the generations since the 1920s when the first settlements were established in the sub-location. Inheritance has been the most common means of land acquisition in the sub-location as fathers are required to subdivide and share their land amongst their sons. This practice has led to the gradual decline in land size, a phenomenon that will soon render many landless and with no livelihood means. The diminishing land sizes have affected the transmission of land uses with livestock rearing, the initial land use in the area becoming hard to practice as it requires relatively large land sizes.

7.2.5 Possible Policy Options

To achieve the recommended minimum land size of 5 acres per household, several proposals have been made. These include; educating the children to ensure they are not dependent on the land of their parents, land consolidation to ensure economical land sizes, establishment of settlement schemes, re-organization of the settlements at the household level by establishing more clustered patterns of settlements, curbing the sale of land and sensitizing the people on dangers of land subdivision. To ensure food security, the factors that direct impact on food security should be addressed. These factors include education level and occupation of the father as well as engagement in off-farm income generating activities. The population needs to be sensitized on the importance of education as this directly influences the job opportunities available for the populace. Agricultural diversification and establishment of agro-processing plants would also help in providing off-farm income generating activities, a key factor in food security.

7.3 Recommendations

From the reviewed literature and research findings, it is evident that land fragmentation exists due to among other factors, inheritance practices and population pressure. This implies that, to effectively address the land fragmentation problem,

strategies directed towards tackling the structural changes of land subdivision are paramount. Some of the strategies include; modifying the inheritance practices through promotion of collective land utilization by the heirs, setting out the recommended minimum land sizes for different ecological zones and formulating rules to prevent further land subdivision beyond the recommended minimum land sizes, investing in the development of rural infrastructure to ensure market accessibility for the agricultural produce as well as promoting off-farm employment opportunities by investing in agro-processing industries as this will help to release pressure on the land. In addition, the factors that directly affect food security should be addressed if food security is to be realized. Sensitization programs should be carried out on the importance of education as it enables one to have relatively higher paying job opportunities which is a key determinant of food security. Promotion of non-employment opportunities will not only reduce pressure on land but will also provide off-farm income generating activities which help in the realization of food security.

7.4 Areas of Further Research

The probable areas of further research include: Impact of irrigation, infrastructure development, credit access and environmental factors on sustainable food and livelihood security in a maize farming system. From the literature review, it emerged that crop diversification was key to ensuring food and livelihood security, thus this research could be extended to examine the effect of crop diversification for sustainable food and livelihood security in a maize farming system. In addition, another research could be developed to establish the particular combinations of the crops so as to inform farmers on how and what to choose in cropping so as to get better productivity gains.

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APPENDICES

Appendix 1: Research Authorization Letter

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
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Ref: No. **NACOSTI/P/18/98186/23796**

Date: **19th July, 2018**

Catherine Kamanthe Katuma
University of Nairobi
P.O. Box 30197 – 00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of household land size and use for sustainable food and livelihood security in a maize farming system of Kalongo Sub-Location, Makueni County"*** I am pleased to inform you that you have been authorized to undertake research in **Makueni County** for the period ending **19th July, 2019.**

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

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

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Makueni County.

The County Director of Education
Makueni County.

Appendix 2: Household Questionnaire

DECLARATION: Information generated through this questionnaire will be held professionally and will be used solely for research purposes.

Sub-location……..……..……..

Questionnaire No……..….

Name of Interviewer…….……..…….……..…..…

Date of Interview…….……..…….

Telephone No. of Interviewer…….

1.0 Respondent Profile
Tick (√) in the bracket provided, the appropriate answer.

1.1 Name of the respondent (Optional)…….
1.2 How old are you? (Years).....
1.3 Marital status
Married ( ) Single ( ) Widowed ( ) Divorced ( ) Separated ( )

1.4 Gender or respondent
Male ( ) Female ( )

2.0 Household Data
2.1 What is the size of your household? ……..……....
2.2 How many are Sons? …….……
2.3 How many are Daughters? …….……
2.4 What is the number of other males living in your household? ……...
2.5 What is the number of other females living in the household? ……..
2.6 What is the highest education level attained by the household members?

Household members	**Age**	**Education levels**					Occupation
		None	**Pre-primary**	**Primary**	**Secondary**	**Tertiary**	
Father							
Mother							
Son / Daughter							
1.							
2.							
3.							
4.							
5.							

2.7 How many brothers did you have at the time of land inheritance?…….
2.8 Did all of them inherit equal share of your parents' land?.....
2.9 How many sisters did you have at the time of inheriting land?..……..
2.10 Did any of them inherit land from your parents?.....
2.11If yes to 2.10 above, how many acres did each inherit?.....
2.12 Are there any cultural practices around the use and inheritance of land?
.....
.....

3.0 Land holding arrangements

3.1 Do you own land?

Yes ( ) No ( )

3.2 If yes, how many pieces of land do you own?.....
3.3 What is the total owned family land size in acres?.....
3.4 Owned land characteristics

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

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 of renting	Cost of renting (annually)
1					
2					
3					
4					
5					
	Total				

3.9 Off-farm income generating activities

Other Source of Income	Frequency	Estimated amount per year (Ksh)

3.10 How big was your parents` land parcel before any sub-division?.....acres

3.11 Have they done any sub-division?

.....
.....

3.12 If there has been any sub-division then to how many heirs or beneficiaries?

……

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

…..……
……
……..

3.14 If yes to 3.13 why do you think so?

.....
.....

3.15 If no to 3.13 what do you think we should do as a country?

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

3.16 State one major problem of land subdivision to a farmer

……

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

.....
.....

3.18 Explain your reason for the preferred number of acres in 3.17 above

……
……..……
……..……
……..……
…….

4.0 Land uses, Food and Livelihood Security

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

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

4.2 Do you practise any agriculture?

Yes ( ) No ( )

4.3 If **Yes to 4.2**, what are the main crop and livestock land use activities on the farm?

Activity	**Area (Acres or Sq. Metres)**	**Yield (kgs) (other) in Seasons**		**Use (Kgs) (Other)**		**Price per unit weight**		**Average income to the family (Kshs.)**
CROPS		**Season 1**	**Season 2**	**Consumed**	**Sold**	**Min**	**Max**	
1								
2								
3								
4								
5								
LIVESTOCK TYPE	**No. Animals**	**Yield/Animal/Year**		**Use (Kgs) (Other)**		**Value (Ksh)**		**Average income to the Family**
				Consumed	**Sold**			
1								
2								
3								
4								
5								

Food and nutrition security

4.4 Compare the yield you get currently in your farm and the yields that used to come from your father's farm before sub-division.

Yields are the same ( ) Currently yields are lower ( )

Yields are more ( ) I`m not sure ( )

4.5 By how much has the yield change? A Quarter ( ) Half ( )
Three Quarters ( )

4.6 What do you think is the reason for the changes in yield?

……..
……
……

4.7 For how many months in a year do the current yields from your farm feed your family?

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

4.8 If not 12 months – how many months in a year do you have the following situations

Intensity of scarcity		**Duration of far yield availabilit (months)**	**Coping Strategies Employed**
a	Sufficient food	At least 12 Mont	
b	Mild Scarcity	9 Months	
c	Moderate Scarcity	6 Months	
d	Severe Scarcity	3 Months	

4.9 In the last 3 months, has your family ever skipped a meal because of food shortage?

Yes ( ) No ( )

4.10 In a typical week, what are the main food types that your household feeds on?

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Frida**	**Saturday**	**Sunday**
Morning							
Lunch							
Supper							

4.11 How often do you take the following meals?

Type of Meal/Food	**Frequency of intake (Daily, Weekly, Monthly, Annually, Other)**
Milk	
Beans	
Chicken	
Fish	
Beef	
Pork	
Mutton	
Goat Meat	
Fruits	

Views on Land Subdivision

Give your opinion or comment on the effect of land sub-division or fragmentation on food security. State whether you agree or disagree with the comment.

4.12 Land fragmentations exists due to population pressure

Agree ( ) Disagree ( ) Not sure ( )

4.13 Small sub-divided parcels lead to low crop yield

Not true ( ) Agree ( ) Disagree ( ) Not sure ( )

4.14 Modern farming techniques can easily be applied on small land sizes

Agree ( ) Disagree ( ) Not sure ( )

4.15 With small land sizes, number of cattle kept has gone down

Agree ( ) Disagree ( ) Not sure ( )

4.16 If you agree in 4.15 above, the change was from how many to how many?

.....
.....

4.17 Land fragmentation has made people adopt new farming techniques and skills

Agree ( ) Disagree ( ) Not sure ( )

5.0 Human Settlement

5.1 Sketch the current arrangement of the homestead?

Home compound parameters	**Remarks**		
Total area of homestead compound (Sq. Metres)			
Main house total area (Square metres)			
Main house number of rooms			
Main house construction materials	Floor	Wall	Roof
Total **number** of houses Total **area** of other houses (Square meters)			
List other structures in the homestead (granary, firewood store, cowshed, chicken house, dog house etc.)			

5.2 Given the way land is being sub-divided among heirs - what is your proposal on how farms should be organized in the future

……..……
…….

5.3 Given the following possible patterns of human settlement – rank them in your order of preference.

a. Scattered
b. Linear
c. Clustered
d. Others - Specify

5.4 Do you have any additional remarks?

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

Appendix 3: Interview Schedule for County Lands Officer

Name of respondent……..…….....

Position of respondent……..

Gender of respondent…….....

Name of Interviewer…….

Schedule Number…….

Interview Guide Questions

1. What are the most common land transactions in Kalongo Sub-location?
2. What is the average land holding size in the sub-location?
3. Are there significant changes to the average size of land holdings? Specify the changes?
4. What has brought about these changes?
5. How would you rate the level of land subdivision and fragmentation in the sub-location?
6. What are the common reasons for land subdivision in the sub-location?
7. What are the effects of land subdivision and fragmentation in the area?
8. What is the most form of land acquisition in the area?
9. On average, how many households have title deeds for their farms?
10. Are there any issues of land conflicts in the area? If yes, what kind of conflicts?
11. What do you think should be done to solve challenges associated with land subdivision and fragmentation?
12. What would you suggest to be the ideal land size for sustainable food and livelihood security in the sub-location?
13. How do we achieve and maintain the minimum land size?

Appendix 4: Interview Schedule for County Physical Planner

Name of respondent……..…….....

Position of respondent……..

Gender of respondent…….....

Name of Interviewer…….

Schedule Number…….

Interview Guide Questions

1. How would you rate the level of land subdivision and fragmentation in the sub-location?
2. What are the stages followed when undertaking a land subdivision process? Are the outlined stages dully followed by the applicants in the sub-location?
3. What would you say are the effects of land subdivision and fragmentation in the area?
4. What do you think should be done to solve challenges associated with land subdivision and fragmentation?
5. Are there significant changes to the average size of land holdings? Specify the changes.
6. What has brought about these changes?
7. What is your opinion on the relationship between diminishing land sizes and food and livelihood security?
8. What are the most common forms of land use patterns in Kalongo Sub-location?
9. What is the most common form of human settlement in the sub-location?
10. Would you propose any kind of rearrangement to the existing human settlement patterns?
11. What do you think should be the ideal land size for Kalongo residents to realize sustainable food and livelihood security?
12. How do we achieve and maintain the minimum land size?

Appendix 5: Interview Schedule for County Agricultural Officer

Name of respondent……..…….....

Position of respondent……..

Gender of respondent…….....

Name of Interviewer…….

Schedule Number…….

Interview Guide Questions

1. What are the main crops grown in Kalongo Sub-location and what are their total production per annum?
2. What proportions of the total land is occupied by the listed crops?
3. Where do the farmers sell their surplus produce?
4. What are the types of livestock reared in the sub-location and what are their average annual production?
5. What is the average land holding in the sub-location?
6. Are the average land holdings adequate for sustainable food production?
7. What would you propose to be the ideal/minimum land size required to produce enough maize to feed a household till the next harvesting season?
8. How do we achieve and maintain the minimum land size?

Appendix 6: Focus Guide for Group Discussion

Focus Group: Demographic Details Questionnaire

Age……..

Gender Male ☐ Female ☐

Name (Optional)…….

Occupation …….....

How long have you resided in this locality?

Years…….

Months……..

Focus Group: Consent details

Thank you for accepting to participate. We are interested to hear your valuable ideas, facts and opinions on how population growth has affected your land sizes and land use decisions in relationship to food and livelihood security and so be able to provide policy recommendations and viable solutions to the county and national governments and national land management agencies.

a. *The purpose of the study is to examine the impacts of household land size and use on household food and livelihood security. We hope to learn things that can help come up with solutions to land management and enhance sustainable food and livelihood security once implemented.*
b. *The information you give us is completely confidential and your name shall not be associated with anything you say in the discussions. We understand how important it is to keep the information private. We will ask all participants to keep the information very confidential.*
c. *You may refuse to answer any question or withdraw from the discussions at any time*
d. *If you have any questions now or after the discussions, feel free to contact me or any other team member through the contacts provided below*
e. *We may have to tape the discussions so as to be able to capture the thoughts, ideas and opinions we hear from the group*
f. *Please check below box to confirm you agree to participate*

This is to confirm that I give my consent to voluntarily participate in the group discussions as long as the stated above consent details are strictly adhered to and that I was not coerced to participate in the discussions but voluntarily decided to partake in its deliberations.

Questions

1. When did you settle in the sub-location and where did you migrate from?
2. What are the reasons for settling in the sub-location?
3. How did you acquire the land you reside on?
4. What was the original size of the farm land?
5. What kind of crops did you grow and what types of livestock did you keep when you first settled in the area?
6. Have there been changes in the types of crops grown and types of livestock reared?
7. What kind of crops do you currently grow? What's the average acreage per crop?
8. What is the total production per harvest season? Is it adequate for your household? How long does it last?
9. What type and number of livestock do you currently keep?
10. What are the reasons for these changes?
11. Have the land/farm size you reside on changed overtime? What is the current land size? What brought about these changes?
12. Are there other land parcels owned by your household apart from the one you reside on? How many parcels? What is the average distance of location from the homestead? What kind of farm activities are undertaken in these other farms?
13. Has farm productivity been changing over time? Why is it so?
14. Do you own the land parcels you occupy? Any ownership documents?
15. Is productivity dependent on ownership of land?
16. What is the settlement pattern in your homestead? Does it affect the available space for farming?
17. How much land would you say is adequate for you to produce enough food to last you till the next harvest season?
18. How do we achieve and maintain that adequate land both for the current and future generations?

Appendix 7: Checklist for Field Observation

The following was observed during the field survey:

1. Land sizes
2. Settlement patterns
    a. Linear
    b. Clustered
    c. scattered
3. Housing structures
    a. Type of structure
    b. Number of structures
    c. Arrangement of the structures
4. Field crops
    a. Type of crops
    b. Area allocated for each crop
    c. Condition of the crops
5. Demarcations of farm sizes
    a. Physical or imaginary boundaries
6. Accessibility of the farms
    a. Road sizes
    b. Road conditions

Appendix 8: List of Plates

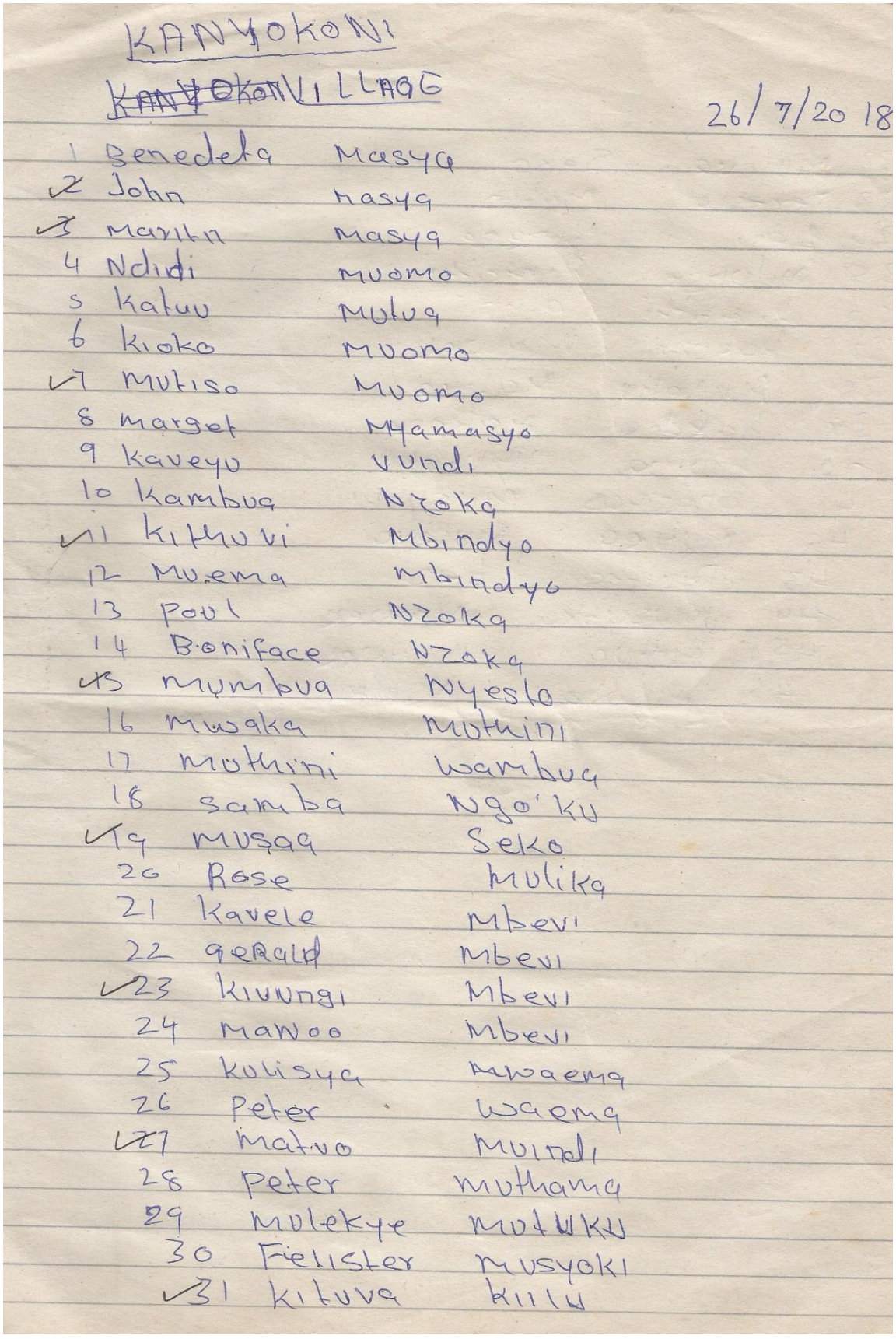
The photographs of the following items were captured during the field survey:

1. House structures
2. Cultivated farms
3. Uncultivated farms
4. Demarcations of farms
5. Cases of malnourished individuals, if any

Appendix 9: Number of Households Selected

Village	**No. of Households**	**Number Selected**
Nditikwa	50	50/559 x 140 = 13
Kitende	54	54/559 x 140 = 14
Ndiani	41	41/559 x 140 = 10
Mukowe	53	53/559 x 140 = 13
Mutuyu	49	49/559 x 140 = 12
Kanyokoni	46	46/559 x 140 = 12
Kyamatheka	65	65/559 x 140 = 16
Kitheuni	45	45/559 x 140 = 11
Kivaku	66	66/559 x 140 = 17
Kikoko	90	90/559 x 140 = 23
Totals	**559**	**140**

Appendix 10: List of Household Respondents



KANYOKONI

~~KANYOKO~~ VILLAGE

26/7/2018

1	Benedeta	Masya
2	John	Masya
3	Marika	Masya
4	Ndindi	Muomo
5	Katuu	Mulua
6	Kioko	Muomo
7	Mutiso	Muomo
8	Margret	Myamasyo
9	Kaveyu	Vundi
10	Kambua	Nzoka
11	Kithuvi	Mbindyo
12	Muema	Mbindyo
13	Paul	Nzoka
14	Boniface	Nzoka
15	Mumbua	Nyesio
16	Mwaka	Muthini
17	Muthini	Wambua
18	Samba	Ngo'ku
19	Musaa	Seko
20	Rose	Mulika
21	Kavele	Mbevi
22	Gerald	Mbevi
23	Kivungi	Mbevi
24	Mawoo	Mbevi
25	Kulisya	Mwaema
26	Peter	Waema
27	Matvo	Muindi
28	Peter	Muthama
29	Mulekye	Mutuku
30	Fielister	Musyoki
31	Kituva	Kiilu

NDIANI VILLAGE
HOUSEHOLD HEAD.

1	GEORGE MBETA	33	JOSEPH MASYA
2	MUSYOKI GEORGE	34	NGALA MASYA.
3	ONESMUS KILONZO	35	JOYCE KYALO
4	MUANGE KILONZO	36	KYALO MUTUKU
5	HAURELIA MUTHIANI	37	JOSEPH MBANI
6	DANIEL M. MUTHIANI	38	NDUKU MUTISYA
7	MUUTE MALEU	39	WAMBUA KAKUI
8	CAROLINE M'NDIVE	40	MUSYOKA MALEU
9	KILAVI NDIVE	41	MAINGA KILAVI
10	FRANCIS MUIA.	42	
11	~~ELIZABETH~~ NDUNGI MUIA.		
12	KITHUKA NGELEO		
13	MUNYAE KITHUKA		
14	MARY KATIMA.		
15	NZAVI MUNUVE		
16	RICHARD KAKUI		
17	KATOMBI MUNGUTI		
18	~~HANA~~ MUSYOKI MUNGUTI		
19	KATHEKA NDIVE		
20	MUTISO KATHEKA		
21	BENARD MWOLOLO		
22	MUSAU MWOLOLO		
23	GEORGE MBOTI		
24	MUTAITI KITAKA		
25	NDULU NDIVE		
26	PETER NDULU		
27	MEIKI MAWEU		
28	FRANCIS MUTUSE		
29	JAMES MUTIE		
30	MUTIO MALUVA		
31	MUSIU MUTIO		
32	CHARLES MUTIO		

NDITIKLOA VILLAGE 26/7/2018

1.	MWETU	MUEIZLE
2	WAMBUA	MWETU
3.	IZYALO	ANDREW
4.	MUITHAMIA	ANDREW
5.	IZIOIZO	ANDREW
6.	MARITINA	IZALEIZYLE
7.	IZAMINA	MANTHI
8	ILIA	MANTHI
9.	PATRICK	MAIZENGA
10	PAUL	IZIMUTU
11	PETER	MBOYA
12	MASIIZA	MBUVA
13	EMMANUEL	MUSIOKA
14	MUITHOIZA	MANTHI
15	AMOS	MASIIZA
16	ISAAC	MASIIZA
17	HANNAH	IZASENE
18	MUTINDA	IZASENE
19	MWATU	IZASENE
20	MWANGIANGI	IZILO
21	STEPHEN	MALELU
22	PENNAH	JONES
23	MAIZIGA	JONES
24	MARY	IZYULE
25	JUSTUS	IZILIA
26	MONTHE	MWILU
27	MWALUMI	MWOLOLO
28	MOSES	MUITHIANI
29	MUITHUSI	MUITHIANI
30	MUITHIMI	IZIANGUTU
31	STEPHENA	MUITHIANI
32	IZIANGUTU	MUITHIANI

33	IKALOMBU	MALELU			
34	MULI	MALELU			
35	MBUMBA	MATHUVA			
✓36	JACKSON	MATHUVA			
37	ELIZABETH	MBULU			
38	SUSAN	MASILA			
39	MBUMI	ARON			
✓40	JOSEPH	MBALUTU			
41	CHRISTINE	OMULOTA			
42	MBULU	MUINDI			
43	BENARD	MALONZA			
✓44	JOHN	MUINDI			
45	KINTULUA	KITUSE			
46	MAVIMBU	KITUSE			
47	BALA	KITUSE			
✓48	JOSEPHAT	KITUSE			
49	KIMWELI	MUINDI			
50	KITENDI	MULEKE			

1	ALEXANDER	M	MASHIKO
2	CHRISTOPHER	M	MWAIWA
3	MULIKO	G	MWAIWA
4	ELIZABETH	M.	MASILIA
5	CHRISTINE	SIKU	MUVEVI
6	GEORGE		KITUSA
7	MULINGE		PAUL
8	MANGENDI		MWAU
9	PAUL	N	MUSAU
10	MWAU		NZOVI
11	ROSE		MWATU
12	DAUD		KING'OLA
13	MUTUNGA		KING'OLA
14	MULWA		KING'OLA
15	MUTEVU		MULWA
16	KASWE		KING'OLA
17	MUNIAE		MASAI
18	MICHAEL		JACKSON
19	ELIZABETH	M.	MUTUKU
20	ANDREW		MUTUKU
21	MARY	K	TIMONAH
22	SOPHIA		DAVID
23	DOROTHY	N.	NDAVANI'IO
24	PATRICK		MULANI
25	ONESMUS	M	MULANI
26	ONESMUS	M.	MWAIWA
27	MARIETAH		SIMON
28	BENARD	M.	SIMON
29	MUTUKU		KING'OO
30	ELIZABETH		KAMULU
31	KALO		KAMULU
32	MULYO		KAMULU
33	MBAI		MBUTIA
34	MUTETE		MBUTIA
35	TELESIA		NDENGWA
36	MUTUA		NDENGWA
37	MUTUKU		MUTEMWA
38	KILATHA		MUTEMWA
39	MUSAU		MUTEMWA
40	MARCO		MANIENZE
41	OSCAR		MANIENZE
42	NOEL		MANIENZE
43	MUTUA		MANIENZE
44	PETER		MANIENZE
45	BENARD		MANGA

49	KAVITA	BENARD
50	ELIZABETH	NDAMBUKI
51	NYAMASYO	NDAMBUKI
52	GERALD	MALUKU
53	MUTUA	MASILA
54	MUSYOKI	MASILA
55	NDUKU	BENARD
56	MWINI	MASILA
57	MUTETI	MASILA
58	DICTOR	MUTUNGA
59	PAUL M.	MUTUNGA
60	MULWA	MUTUNGA
61	MWAU	MUTUNGA
62	Benard	Mangia
63	KIOKO	BENARD
64	KIM	BENARD
65	KYALO	BENARD

Ngunguni Households

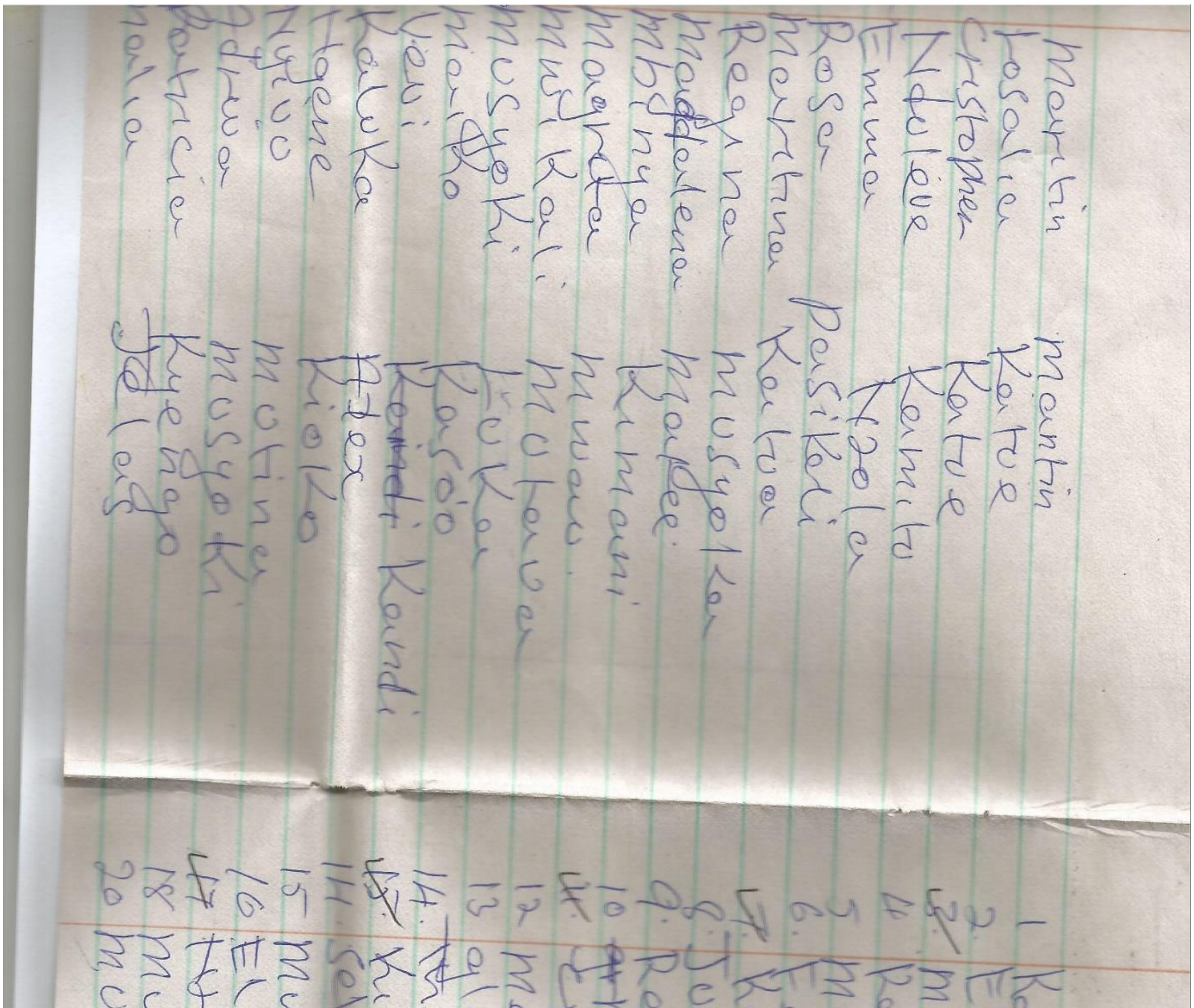
Ngunguni

1	Mutie	Kimolo
2.	Mutuku	Kimolo
3	Mutu	Kimolo
4.	Musinga	Kimolo
5	Agatha	Nyamai
6	Samuel	Nguku
7	Musoki	Sammy
8	Victo	Samuel
9	Mutava	Ngondi
10	Roi	Mutava
11	Nzoka	Mutava
12	Kanyila	Ngondi
13	Geoffery	Ngaluka
14	Nzoka	Kanyila
15	Mololo	Kanyila
16	Martine	Muthoka
17	Muthoka	Ngondi
18	Peter	Muthoka
19	Nzoka	Martine
20	Mary	Kandu
21	George	Kandu
22	Ignasius	Kandu
23	Jacinta	Mutua
24	Jonathan	Kandu
25	Marietta Francis	Makau
26	Peter	Mulwa
27	Musyoki	Mweteeli
28	Kimuya	Mulinge
29	David	Mulinge
30	Alex	Mwendwa
31	Mulinge	Jimmy
32	Leonard	Kimeu
33	Mbeeta	Julu

34	Nzesya	yulu
35	Mutua	yulu
36	William	Makenzi
37	Antony	Makenzi
38	Wambua	makenzi
39	Mutuku	katoto
40	Kanuu	katoto
41	Mukiki	kivikivi
42	Mulu	kivikivi
43	Saul	kivikivi
44	Kivungi	kivikivi
45	Kioi	kivikivi
46	Kalete	Henery
47	Mulei	Henery
48	Geoffery	kimeu
49	Muasya	kiteti
50	Seemu	kimuya
51	Morison	Nyamai
52	Julius	Nyamai
53	Teresia	Nthiya

KITHEUNI VILLAGE.

1. MWAIWA NYAMAI
2. NDAMBUKI NGONYO
3. AMOS NGWATU
4. KASUE MUTETI
5. MASENGE MUTUKU
6. MUEMA MUTUKU
7. PATRICIA TITO
8. MBEVI MUTUKU.
9. MUSYOKI MUSAA
10. KILONZO MUSAA
11. ESTHER MULEI
12. MARIA KASIMU
13. NDULU KASIMU
14. KASYIMI KASIMU
15. MUSEMBI KASIMU
16. MUTUA KASIMU.
17. JOSEPH MWEI
18. FRANCIS NGOLANGE
19. KYALO KIMANTHI
20. JIMMY KAVILU.
21. IHANO KAWUWI
22. GABIEL
23. MUTHAMA MUTISYA
24. MUSYOKA MUTISYA
25. MUTISYA MWISA
26. SAMUEL KYEVA
27. MUSYOKI KILO
28. TERESIA KILO
29. MWINI JOHN.
30. MUASYA MWISA
31. MARTIN MWISA
32. CHRISTINE MUTHENIA
33. SILA MWISA
34. MUVENGEI MUEKU
35. MUENDO MUVENGEI
36. VINCENT MASAI
37 MULU MASAI
38. KAVULUNZE KYENGO
39. NYELELE KAVULUNZE
40. VETERO MULU.
41. MBITHI KYENGO
42. KAMENE MULEI
43. MARONZA MUSAU
44 MUIA MUSAU
45. KYALO KAMULU



KIIEMBE VILLAGE

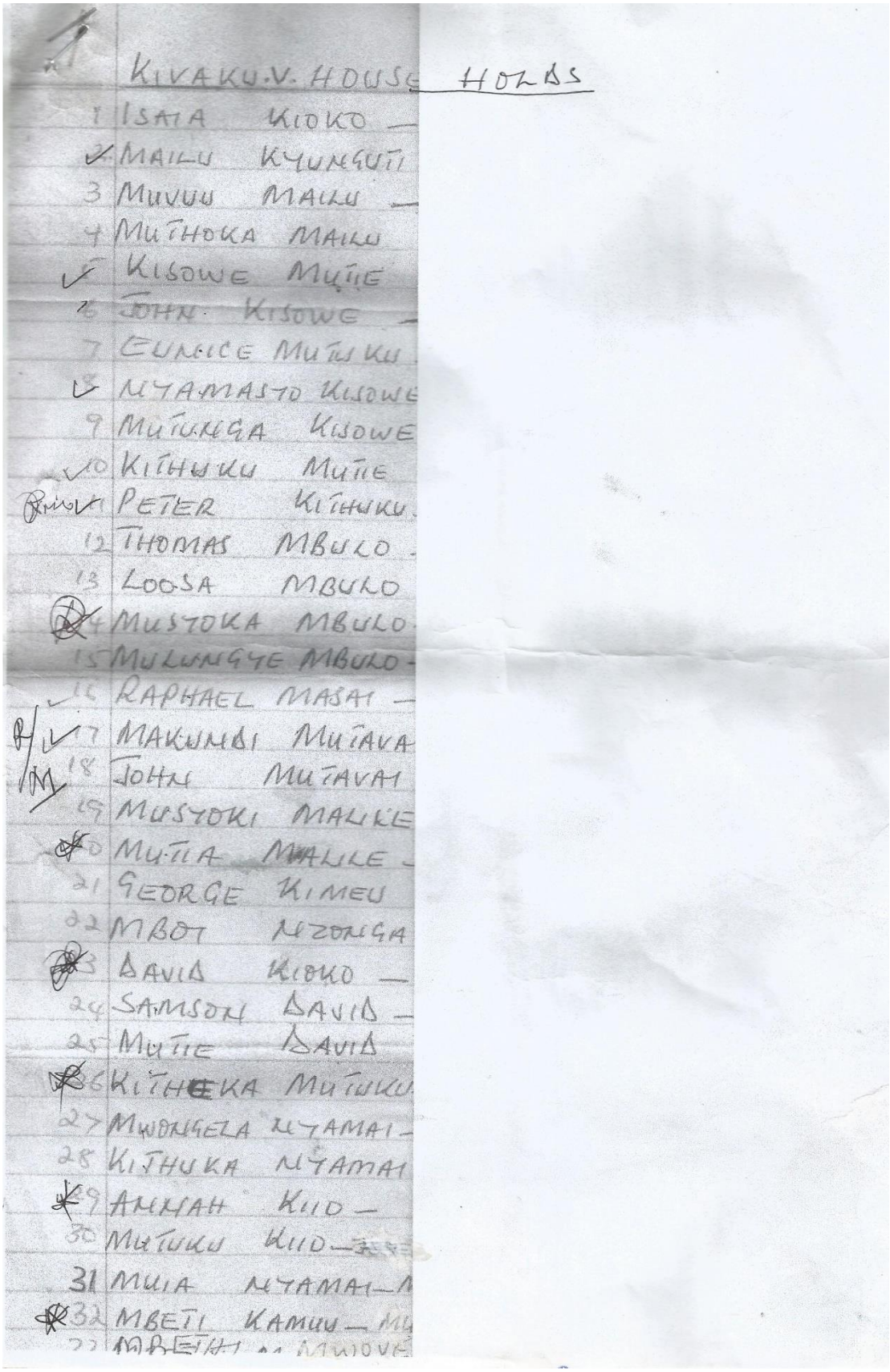
1	Kavuu	Ndilo
2.	Elizabeth	Katumbi
~~3~~.	Martha	yulu.
4	Ramuu	Wambua
5	Muli	Kimuya
6.	Fenster	Wayua
~~7~~.	Kilonzi	Kimuya
8.	Junice.	Kioko
9.	Regina	Mutua
10	~~a~~ Maria	mutisya
~~11~~	Cristina	Musyoka
12	Mary	mutua
13	gladys	Kyalo
14.	~~Theresia~~	Kitivi
~~15~~.	Kituku	Kilonzo,
14.	Selvester	~~Kioko~~ Kitali
15	Mwikali	Selvester
16	Elizabeth	Mwanzia
~~17~~	~~Nzula~~	Mwisa
18	Mwikali	mutuku
20	mueni	Kimbi

Martin	mantin
Rosalia	Katue
Cristopher	Katue
Ndulève	Kamitu
Emma	Nzola
Rosa	pasikali
Martina	Katua
Regina	musyoka
Magdalena	makee.
mbinya	Kimani
Magreta	mwau.
mwikali	Mutava
musyoki	Kuka
martho	Kasoo
Veni	~~Kaindi~~ Kaindi
Kaluka	~~Alex~~
Ngene	Kioko
Nyivo	motina
Adriwa	musyoki
Patricia	Kyengo
Malia	Jelas

42 David Nzuve
43 grace Mawee
44 mako Makesi
45 Kitela Makesi
46 Agnes Mbiu
47 Mwanie Kristopher
48 Mutunga Mailu
49 John Mwandeto.
50. Stela Muia
51. Kioko Maiko
52 Mwikali Sammy
53 John Katue
54 Nduku Masundo.

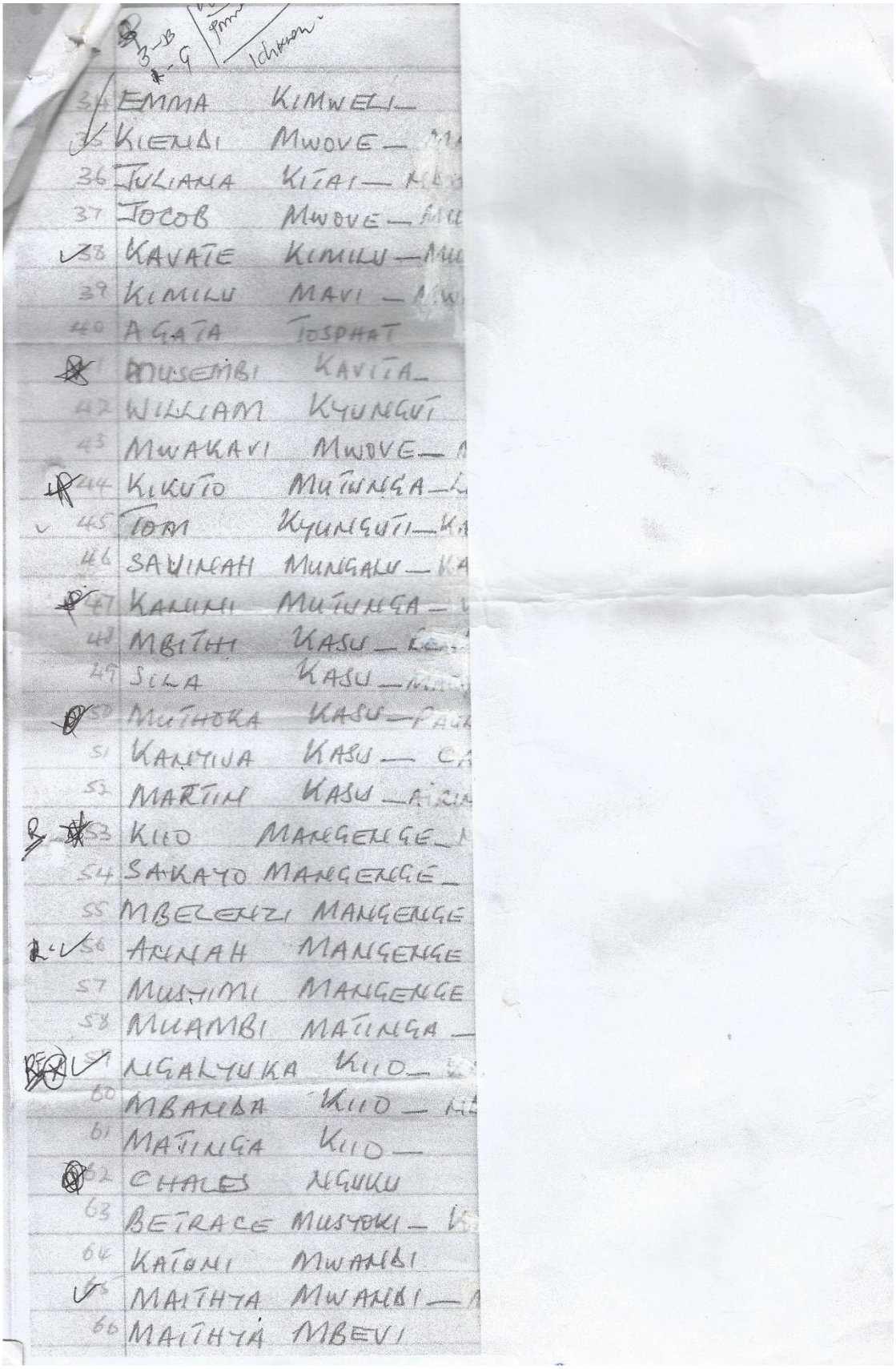
MUTUYU VILLAGE

1	Kitumato Joseph	Kitumbg
2	Ngonyo	Kasimu
3	Mulinge	Ndivo
4	Kisaulu	Kitivi
5	Mutema	Kitivi
6	Ngengele	Mbenig
7	Musya	Mbenig
8	Samuel	Ndambuki
9	Kiio	Ndambuki
10	Thomas	Kiio
11	Mboya	Muindi
12	Muthama	Muindi
13	Kala	Mutholg
14	Nyamasyo	Mutholg
15	Matiku	Kiluvg
16	Makau	Mutug
17	Nyamasyo	Mutug
18	Matheka	Maluku
19	Kinyungu	Maluku
20	Andrew M.	Maluku
21	Nthambi	Maluku
22	Mbula	Maluku
23	Mwangangi	Maluku
24	Mang'endi	Maluku
25	Martin	Maluku
26	Mutembei	Martin
27	Muthiani	Maluku
28	Ndulu	Musombg
29	Meli	Musing
30	Mutunga	Musyoki
31	Wanza	Ndivo
32	Katuli	Makeung
33	Maluni	Makengg
34	Nthasyo	Nyamai
35	Damacint	Nyamai
36	Kamandi	Nyamai
37	J. Ngundo	Maithyg
38	Mulidi	Ngundo
39	Kithuma	Kitengele
40	Kilonzi	Kithumg
41	Kyukwag	Mutisyg
42	Mwosa	Mutisyg
43	Nzioki	Mutisyg
44	Francis	Kyumg
45	Maithyg	Kitengele
46	Musyimi	Maithyg
47	Mutungi	Kyumg
48	Kimonde	Kasimu
49	Mwendwa	Kimonde



KIVAKU.V. HOUSE HOLDS

1 ISAIA KIOKO
2 MAILU KYUNGUTI
3 MUVUU MAILU
4 MUTHOKA MAILU
5 KISOWE MUTIE
6 JOHN KISOWE
7 EUNICE MUTUKU
8 NYAMASYO KISOWE
9 MUTUNGA KISOWE
10 KITHUKU MUTIE
11 PETER KITHUKU
12 THOMAS MBULO
13 LOOSA MBULO
14 MUSYOKA MBULO
15 MULUNGYE MBULO
16 RAPHAEL MASAI
17 MAKUMBI MUTAVA
18 JOHN MUTAVAI
19 MUSYOKI MALULE
20 MUTIA MALULE
21 GEORGE KIMEU
22 MBOI NZOKIGA
23 DAVID KIOKO
24 SAMSON DAVID
25 MUTIE DAVID
26 KITHEKA MUTUKU
27 MWONGELA NYAMAI
28 KITHUKA NYAMAI
29 AMMAH KIID
30 MUTUKU KIID
31 MUIA NYAMAI
32 MBETI KAMUU
33 MBETHI MWOVE



35	EMMA	KIMWELI
36	KIENDI	MWOVE
36	JULIANA	KITAI
37	JOCOB	MWOVE
38	KAVATE	KIMILU
39	KIMILU	MAVI
40	AGATA	JOSPHAT
41	MUSEMBI	KAVITA
42	WILLIAM	KYUNGUTI
43	MWAKAVI	MWOVE
44	KIKUTO	MUTUNGA
45	TOM	KYUNGUTI
46	SAMUNAH	MUNGALU
47	KALUMI	MUTUNGA
48	MBITHI	KASU
49	SILA	KASU
50	MUTHOKA	KASU
51	KANYUA	KASU
52	MARTIN	KASU
53	KILO	MANGENGE
54	SAKAYO	MANGENGE
55	MBELENZI	MANGENGE
56	ANNAH	MANGENGE
57	MUSYIMI	MANGENGE
58	MUAMBI	MATINGA
59	NGALYUKA	KILO
60	MBANDA	KILO
61	MATINGA	KILO
62	CHALES	NGUKU
63	BETRACE	MUSYOKI
64	KATONI	MWAMBI
65	MAITHYA	MWAMBI
66	MAITHYA	MBEVI

NDIANI VILLAGE
HOUSEHOLD HEAD.

1. GEORGE MBETA
2. MUSYOKI GEORGE
3. ONESMUS KILONZO
4. MWANGE KILONZO
5. HAURELIA MUTHIANI
6. DANIEL M. MUTHIANI
7. MWUTE MALEU
8. CAROLINE M'NDIVE
9. KILAVI NDIVE
10. FRANCIS MWIA.
11. ~~ELIZABETH~~ NDUNGI MWIA.
12. KITHUKA NGELEO
13. MUNYAE KITHUKA
14. MARY KATIMA.
15. NZAVI MUNUVE
16. RICHARD KAKUI
17. KATOMBI MWINGUTI
18. ~~HANA~~ MUSYOKI MWINGUTI
19. KATHEKA NDIVE
20. MUTISO KATHEKA
21. BENARD MWOLOLO
22. MUSAU MWOLOLO
23. GEORGE MBOTI
24. MUTHITI KITAKA
25. NDULU NDIVE
26. PETER NDULU
27. MEIKI MAWEU
28. FRANCIS MUTUSE
29. JAMES MUTIE
30. MUTIO MALUVA
31. MUSIM MUTIO
32. CHARLES MUTIO
33. JOSEPH MASYA
34. NGALA MASYA.
35. JOYCE KYALO
36. KYALO MUTUKU
37. JOSEPH MBANI
38. NDUKU MUTISYA
39. WAMBUA KAKUI
40. MUSYOKA MALEU
41. MAINGA KILAVI
42.

Appendix 11: FGD Attendance List

Focus Group Discussion Guide – MALE

Focus Group: Consent details

Thank you for accepting to participate. We are interested to hear your valuable ideas, facts and opinions on how population growth has affected your land sizes and land use decisions in relationship to food and livelihood security and so be able to provide policy recommendations and viable solutions to the county and national governments and national land management agencies.

- *The purpose of the study is to examine the impacts of household land size and use on household food and livelihood security. We hope to learn things that can help come up with solutions to land management and enhance sustainable food and livelihood security once implemented.*
- *The information you give us is completely confidential and your name shall not be associated with anything you say in the discussions. We understand how important it is to keep the information private. We will ask all participants to keep the information very confidential.*
- *You may refuse to answer any question or withdraw from the discussions at any time*
- *We may have to tape the discussions so as to be able to capture the thoughts, ideas and opinions we hear from the group*

Record of FGD participants

No.	Name	Age (Years)	Gender	Marital status	Land owned (if any) (acres)
1.	GEORGE MBETA IVUKU	59	M	Maried	1½ (ACRES)
2.	PETER MBOTA MALENGA	33	M	MARRIED	2 ACRES
3.	ISAIA K KIOKO	60	M	MARRIED	3½ ACRES
4.	AMOS MUSA NGWATU	48	M	MARIED	2 Hq.
5.	ALEXANDER. M. MASYUKO.	66	M.	MARIED	4 HAS
6.	PETER MUTUA	65	M.	MARIED	2 H.
7.	ANDREW M. MALUKU	52	M	MARRIED	½ H.
8.	JOSEPH KIMATU	67	M	MARRIED	1 ACRE
9.	HENRY KYALO	64	M	MARRIED	2ACRES
10.	NICODEMUS MUANGE	70	M	MARRIED	1 ACRE

1

Focus Group Discussion Guide - FEMALE

Focus Group: Consent details

Thank you for accepting to participate. We are interested to hear your valuable ideas, facts and opinions on how population growth has affected your land sizes and land use decisions in relationship to food and livelihood security and so be able to provide policy recommendations and viable solutions to the county and national governments and national land management agencies.

- *The purpose of the study is to examine the impacts of household land size and use on household food and livelihood security. We hope to learn things that can help come up with solutions to land management and enhance sustainable food and livelihood security once implemented.*
- *The information you give us is completely confidential and your name shall not be associated with anything you say in the discussions. We understand how important it is to keep the information private. We will ask all participants to keep the information very confidential.*
- *You may refuse to answer any question or withdraw from the discussions at any time*
- *We may have to tape the discussions so as to be able to capture the thoughts, ideas and opinions we hear from the group*

Record of FGD participants

No.	Name	Age (Years)	Gender	Marital status	Land owned (if any) (acres)
1.	STELLAMARIS MUNYASIA	54	F	Married	1 ACRE
2.	BENENDETTA KIWAKO	46	F	Married	½ ACRE
3.	CHRISTINE KIMEU	46	F	Married	1½acre
4.	REGINA MUTUNGA	49	F	Married	½ acre
5.	ROSE JOHN	40	F	Married	1½ Acre
6.	MARY MUASYA	42	F	Married	¼ acre
7.	CRISTABEL MUANGE	43	F	Married	½ Acre
8.	ANNAH KISINGA	47	F	Married	1 Acre
9.	AGNES KIMINZA	47	F	Married	1 Acre
10.	SUSAN PETER	50	F	Married	½ Acre

Focus Group Discussion Guide – YOUTHS

Focus Group: Consent details

Thank you for accepting to participate. We are interested to hear your valuable ideas, facts and opinions on how population growth has affected your land sizes and land use decisions in relationship to food and livelihood security and so be able to provide policy recommendations and viable solutions to the county and national governments and national land management agencies.

- *The purpose of the study is to examine the impacts of household land size and use on household food and livelihood security. We hope to learn things that can help come up with solutions to land management and enhance sustainable food and livelihood security once implemented.*
- *The information you give us is completely confidential and your name shall not be associated with anything you say in the discussions. We understand how important it is to keep the information private. We will ask all participants to keep the information very confidential.*
- *You may refuse to answer any question or withdraw from the discussions at any time*
- *We may have to tape the discussions so as to be able to capture the thoughts, ideas and opinions we hear from the group*

Record of FGD participants

No.	Name	Age (Years)	Gender	Marital status	Land owned (if any) (acres)
1.	Daniel Kilo Nzeugu	20 Years	Male	Single	N/A
2.	Abbunas Kioko Mutuku	27	Male	Single	N/A
3.	Jostus Kasimba Mutie	24 Yrs	Male	Single	N/A
4.	Diana Mumo Mutungi	21yrs	Female	Single	N/A
5.	Agnes Muthea Kilonzi	20 yrs	female	single	N/A
6.	Winfred Mwikali Makau	28 Yrs	female	Single	N/A
7.	Muiruri Martin Munyao	23yrs	Male	Single	N/A
8.	Catherine Kalunde Mutioka	25 Yrs	Female	married	N/A
9.	Florence Mbeneka Masani	20 yrs	female	Single	N/A
10.	Daniel Kyalo	25 Yrs	Male	Single	N/A