

**ASSESSMENT OF HOUSEHOLD LAND SIZE AND USE FOR  
SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN GATIMU SUB-  
LOCATION, NYANDARUA COUNTY**

**BY**

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**DECLARATION**

This is to confirm that I, KINYUA, MICHAEL MURIUKI whose registration number and signature appears below undertook this research. I also confirm that this is my original work and has not been presented in this or any other university for examination or for any other purposes.

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**Certification**

This thesis has been submitted for examination with my approval as University Supervisor

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Date

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## **DEDICATION**

I dedicate this work to my wife, Priscilla, and my children, Stella and Collins, whose continued patience when I came home late and the moral support given encouraged me to burn the midnight oil to complete this thesis.

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## TABLE OF CONTENTS

<b>DECLARATION .....</b>	<b>ii</b>
<b>DEDICATION .....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT .....</b>	<b>iv</b>
<b>LIST OF TABLES.....</b>	<b>ix</b>
<b>LIST OF FIGURES.....</b>	<b>x</b>
<b>LIST OF MAPS .....</b>	<b>xi</b>
<b>LIST OF APPENDICES .....</b>	<b>xii</b>
<b>LIST OF ABBREVIATIONS.....</b>	<b>xiii</b>
<b>ABSTRACT .....</b>	<b>xiv</b>
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>INTRODUCTION .....</b>	<b>1</b>
1.1 Background of the study.....	1
1.2 Research problem statement .....	4
1.3 Research objective .....	6
1.3.1 Broad objective.....	6
1.3.2 Specific objectives .....	6
1.3.3 Research questions.....	6
1.4 Geographical and Theoretical Scope.....	6
1.5 Justification of the Study.....	7
1.6 Definition of Terms .....	8
<b>CHAPTER TWO.....</b>	<b>9</b>
<b>LITERATURE REVIEW.....</b>	<b>9</b>
2.0 Introduction.....	9
2.1 Background information on Agriculture in Nyandarua District .....	9
2.2 Theoretical Framework .....	10
2.2.1 Schultz’s Inverse Relationship Theory .....	10

2.2.2 Theory of Production .....	11
2.2.3 Global household Land Fragmentation and use .....	11
2.3 Household Land size and its impact on Food Production .....	12
2.4 Household Land fragmentation and size in Nyandarua County .....	14
2.5 Land uses and their impact on food and livelihood security .....	15
2.5 Current trends in household land size and use.....	17
2.6 Factors that influence the size and use of household land.....	18
2.7 Literature on Policy and Legislative provisions .....	20
2.7.1 The 1963 and 2010 Constitutions of Kenya.....	21
2.7.2 National Land Commission Act .....	21
2.7.4 National Spatial Plan 2015-2045 .....	21
2.8 Conceptual Framework .....	22
<b>CHAPTER THREE.....</b>	<b>24</b>
<b>RESEARCH METHODOLOGY .....</b>	<b>24</b>
3.1 Introduction.....	24
3.2 Research Design.....	24
3.3 Target Population .....	24
3.4 Sample Design .....	24
3.4.1 Sample Size Determination.....	24
3.4.2 Sampling Procedure.....	25
3.5 Data Collection Methods .....	26
3.6 Data Analysis Methods.....	27
3.7 Data Presentation .....	27
3.8 Ethical Considerations.....	27
<b>CHAPTER FOUR .....</b>	<b>29</b>
<b>STUDY AREA .....</b>	<b>29</b>
4.1 Introduction.....	29

4.2 Demographic Dynamics .....	30
4.3 Climate and physiographic features .....	31
4.3.1 Rainfall.....	31
4.3.2 Temperature.....	32
4.3.3 Hydrology.....	32
4.4.1 Physical infrastructure .....	33
<b>CHAPTER FIVE .....</b>	<b>38</b>
<b>RESEARCH FINDINGS.....</b>	<b>38</b>
5.1 Introduction.....	38
5.2 Response rate .....	38
5.3 Basic information of the respondents.....	38
5.3.1 Household data general information.....	40
5.4 Current household land size and its implication on food and livelihood Security .....	45
5.5.1 Main economic activity.....	54
5.5.2 Agricultural practice .....	54
5.5.3 Main crop land use activity on the farm .....	55
5.5.4 Main Animals/livestock land use activity on the farm .....	57
4.6 Food and nutrition security.....	59
4.6.1 Comparison of farm yields before and after subdivision .....	59
5.6.2 Food scarcity period.....	61
5.7 Descriptive analysis on views of land subdivision .....	63
5.8 Descriptive analysis on human settlement.....	67
<b>CHAPTER SIX.....</b>	<b>75</b>
<b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>75</b>
6.0 Introduction.....	75
6.1 Summary of Research Findings .....	75

<b>REFERENCES .....</b>	<b>83</b>
<b>APPENDICES .....</b>	<b>88</b>



## LIST OF TABLES

Table 4.1: Rainfall in Gatimu sub location.....	32
Table 4.2 Average temperature in Selected Centres in Nyandarua.....	32
Table 5.1: The Respondent’s profile .....	39
Table 5.2: Descriptive statistics for household information .....	41
Table 5.3: Descriptive statistics for household information .....	42
Table 5.4: Brothers and sisters present at the time of Inheritance .....	43
Table 5.5: Cultural practices around the use and inheritance of land .....	45
Table 5.6: Land Characteristics.....	46
Table 5.7: Owned land Characteristics .....	48
Table 5.8: Renting Conditions .....	50
Table 5.9: Parents land Characteristics.....	51
Table 5.10: Parents land Characteristics.....	53
Table 5.11: Reason for the preferred number of acres .....	53
Table 5.12: Main economic activity.....	54
Table 5.13: Main crop land use activity on the farm.....	55
Table 5.14: Main Animals/livestock land use activity on the farm.....	57
Table 5.15: Comparison of farm yields before and after subdivision .....	60
Table 5.16: Duration the family feeds from their farms .....	60
Table 5.17: Food scarcity period.....	62
Table 5.18: Views on Land subdivision .....	64
Table 5.19: Characteristics of human settlement .....	67
Table 5.20: Patterns of Human settlement .....	69
Table 5.21: Correlation analysis.....	74

## LIST OF FIGURES

Figure 1.1 GDP growth versus GDP from Agriculture .....	3
Figure 2.1: Conceptual Framework.....	23
Figure 5.1: Data collection process .....	38
Figure 5.2: The chief and sub-chief in Gatimu location together with village elders .	40
Figure 5.3: Equality during inheritance .....	44
Figure 5.4: Sister's inheritance status.....	44
Figure 5.5: Land ownership .....	46
Figure 5.6: Renting status .....	50
Figure 5.7: Land use .....	51
Figure 5.8: Agriculture practice .....	55
Figure 5.9: A subdivided farm with Maize planted on one section, bare land section and settlement section.....	57
Figure 5.10: Sheep grazing in an open field .....	59
Figure 5.11: Skipping meal because of food shortage.....	63
Figure 5.12: A Post advertising for subdivided land (50x100) in Gatimu sub-location .....	65
Figure 5.13: Organization of farms in the future .....	68

## LIST OF MAPS

Map 4.1: Nyandarua County and Gatimu Sub-location in a Regional Context.....	30
Map 4.2 Location of Gatimu Sub-Location.....	30
Map 4.3: Rainfall in Gatimu Sublocation.....	31
Map 4.4 Drainage system in Gatimu Sublocation, Nyandarua.....	33
Map 4.5: Infrastructure map.....	34
Map 4.6: Educational map.....	35
Map 4.7: Soil Map.....	36
Map 4.8: Human Settlement Map.....	37
Map 5.1: A map showing 1973 and 2018 land distribution.....	67

## **LIST OF APPENDICES**

Appendix I: Authorization letter from NACOSTI .....	88
Appendix II: Household Questionnaire .....	89
Appendix III:Key Informant Interview Schedule .....	100
Appendix IV: Observation List .....	103
Appendix V: Photography List .....	104
Appendix VI:Document Reviews .....	105
Appendix VII:Sampled Housholds.....	106

## **LIST OF ABBREVIATIONS**

GDP – Gross Domestic Product

FAO – Food and Agricultural Organization

SPSS – Statistical package for social sciences

SDP – Small holder Dairy Project

## ABSTRACT

The effects of land fragmentation on food and livelihood security has been experienced not only in Kenya and Africa but all over the world thereby necessitating adequate research to generate viable interventions. Various studies undertaken on impacts of land size and use on food and livelihood security especially in Ghana and Rwanda have shown that fragmentation has adverse effects on agricultural productivity. This has not been done in Nyandarua, specifically in Gatimu sublocation thereby resulting in a knowledge gap. This study assessed household land size and use for sustainable food and livelihood security in the dairy farming system of Gatimu Sub-location in Nyandarua County. The target population consisted of all the households in Gatimu sub-location who practice dairy and non-dairy farming from which a total of 140 households were sampled. Questionnaires were administered, focus group discussions done, key informants interviewed and documents analysed. The data obtained was coded, entered and analyzed using statistical package for social sciences (SPSS). Both descriptive and inferential analyses were conducted. The results revealed that the households in Gatimu sub-location who practiced dairy farming owned at least two pieces of land each and both measured approximately 0.99 acres. The findings also revealed that majority of the landowners supported land subdivision among their heirs due to the high population increase and high living standards in the country. The land in Gatimu sub-location however was found to be used for settlement and crop farming besides dairy farming in the area. A bivariate correlation analysis was done on the effects of household size on food and livelihood security and revealed that household land size was positively related to food and livelihood security while the main use of land was not associated with food security. Again the findings revealed that land ownership, total owned family land size, age of household head and the household size were significant factors affecting household land size and use. Therefore, the study recommended that land subdivision be highly controlled by setting minimum and maximum plot sizes in agricultural areas by the relevant authorities like the Government agencies involved in land administration so as to provide sufficient land size for agricultural activities. Other measures like educating children as a way of inheritance other than land are also encouraged.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background of the study**

The problem of land fragmentation has been experienced not only in Kenya and Africa but all over the world. Land fragmentation manifests in smaller pieces of land, multiple land pieces that are isolated and also many other sub-divisions. It results from inheritance and property transfers from parents to the children and also the issues of population pressure leading to consistently reduced sizes of land. Other characteristics include poverty and also literacy levels that then influence the use of land in agricultural production. These characteristics impacted the areas leading to reduced food production, environmental degradation, reduced output from the farms and also frequent quarrels in families (Ndirangu, 2017).

According to a report by FAO (2009), land sub-division has been experienced all over the globe both in developed and developing countries. However, the impact is most felt in developing countries mostly in Asia and Africa as opposed to the developed ones. In South America and Europe most of the countries have been found to have an average holding size higher than 5 hectares. Again, FAO (2009) indicates that in South America and Europe, 10 out of 10 and 23 out of 28 countries respectively had an average holding size higher than 5 hectares. In contrast, African and Asian countries were categorized to have had the least holding size with an average holding size of less than 5 hectares. In African countries to be specific, 16 out of 20 countries were found to have a holding size of less than 5 hectares showing that Africa has been greatly affected by land fragmentation. Kenya and specifically Nyandarua county had an early colonization which led to emergence of colonial villages, considered to be a source of increased pressure, disputes, insecurity and speculation.

Kenya has had a population increase on daily basis. According to KNBS (2010), the population in Kenya stood at 36.8 million with 596,268 being from Nyandarua County. Population growth has contributed to increasing demands for land which is used for housing, farming and recreation among others (Smith et al. 2010). The study focuses on Gatimusublocation which is in Nyandarua County and the issue of population growth and land fragmentation is not an exception.

## **Land agriculture and the economy**

The land holds a key position in growth, human existence and development. Since creation, the humans have used land and natural resources in meeting the needs of the humans and their needs may be material, social, cultural, and also personal spiritual. (Genesis 2:15). They have not fully utilized land for the purposes of livelihood in terms of production of goods and services, shelter and also food for recreation, leisure and trans-communication (Gikenye, 2016).

Consistently man has fragmented, modified and transformed land and continues to do so in various magnitudes and ways. The natural indigenous forests as well as other ecosystems are converted into agricultural areas both for livestock and farming production. The Wetlands have also not been spared and further converted into various uses thereby degrading the environment. However, many other forms of land uses occur whereby agricultural areas are slowly turned into commercial entities and also there are areas where income neighborhoods turn into slums.

According to Agricultural Sector Development Strategy, agriculture dominates the Kenya economy with farming being one of the most important sector. The agricultural sector that comprises six subsectors including industrial crops, horticulture, food crops, livestock, fisheries, and forestry contributes to 26% of the gross domestic product with the livestock-dairy subsector contributing 14 % of agricultural GDP and 3.5 percent of total GDP (Government of Kenya, 2008). The economic outlook of the year 2016 indicates the contribution of agriculture indirectly to the overall production was 27% (Mwavali, 2009). This was done mainly through linkages to manufacturing, distribution as well as other service sectors. In addition, the sector contributes about 0.75 of all the raw materials used in the production as well as 0.45 of the total government monetary allocation in terms of revenue.

Again, according to Mwavali (2009), in terms of export earnings, over 50% is indirectly and directly linked to agriculture. Approximately, over 75% of the total population work in the agricultural sector translating to about 60% of the total employment both directly and indirectly. In Kenya, the growth of the national gross domestic product is directly correlated to the agricultural gross domestic product. This means that any negative effect on agricultural production badly hurts the development and growth. The



Figure 1.1 shows a high correlation between Kenya's economic growth rate and growth rate of agriculture sector from 2004 to 2017.

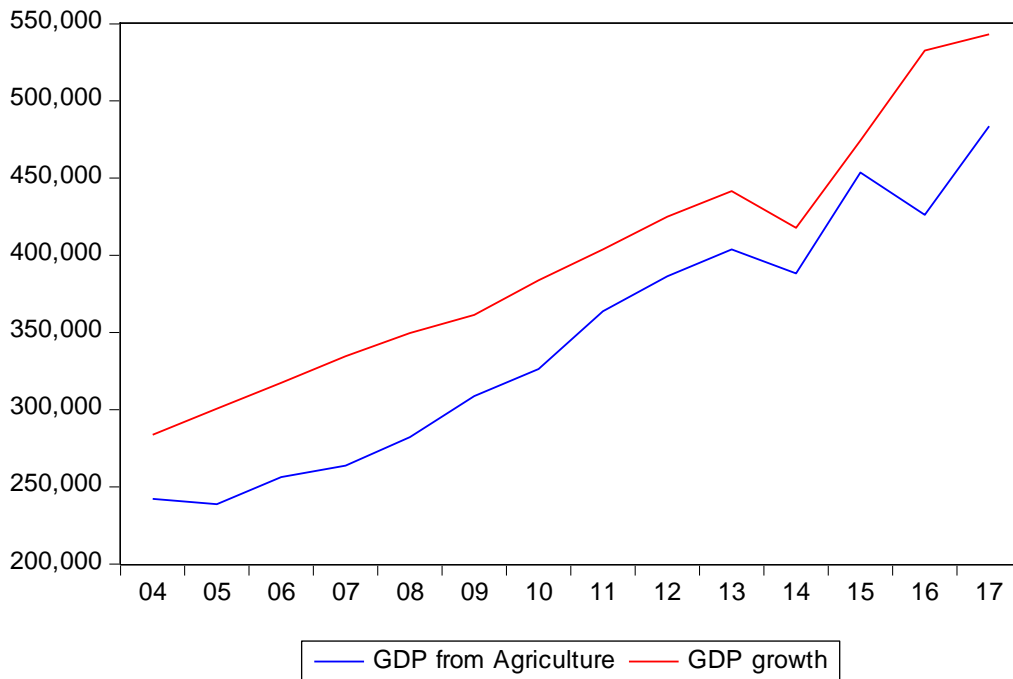
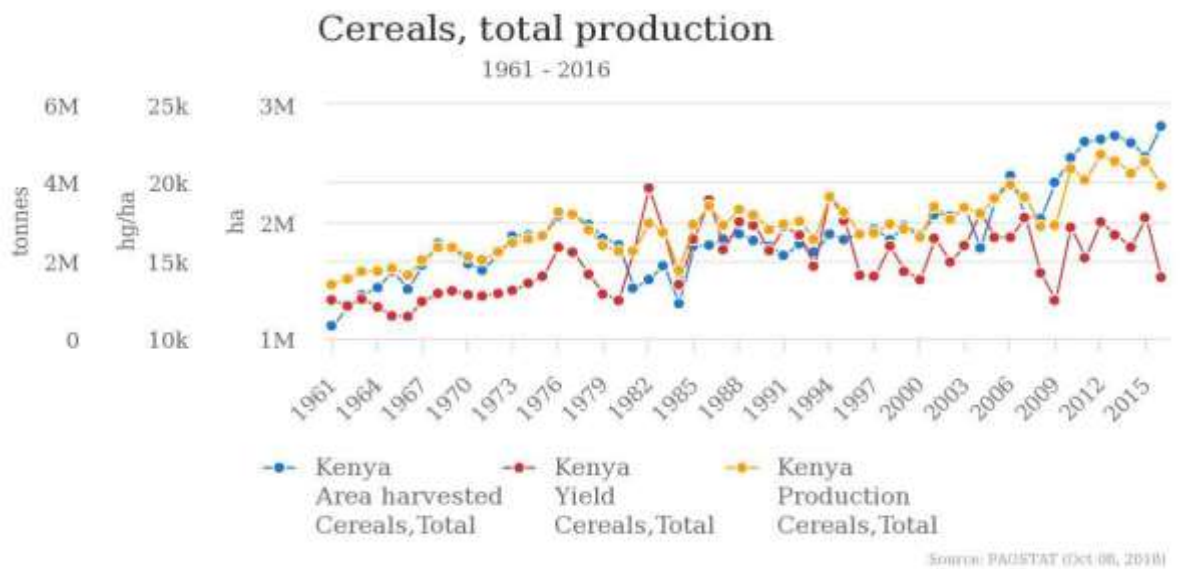


Figure 1.1 GDP growth versus GDP from Agriculture

Source: Researcher 2018



Source: FAO

Figure 1.0.2B land size versus production in Kenya

The agricultural sector comprises six subsectors including industrial crops, horticulture, food crops, livestock, fisheries, and forestry. Livestock-dairy industry is the single largest agricultural sub-sector in Kenya (Muriuki et al. 2004). It is believed that the Dairy subsector is even larger than tea. Therefore this industry plays a very key role in nutrition. This industry has grown tremendously over time. According to The Food Agricultural Organization (FAO) it is estimated that there are 5.5 million milking animals in Kenya (TechnoServe, 2008) and Kenya is the only country in Africa after SouthAfrica that produces milk for both export and domestic consumption. Again in a study conducted by SDP (2005), Kenyans are amongst the highest milk consumers in the developing world, consuming an estimated 145 litres per person per year, more than five times milk consumption in other East African countries combined.

Therefore, dairy and non-dairy farming is one of the most important industries for sustainable food and livelihood security. Dairy farming is mostly practiced in the highlands of Kenya with central Kenya being one of them. Therefore land size is an important factor that could greatly affect dairy farming. The study focuses on land sizes and their effect on food and livelihood security in Nyandarua County, Gatimu sub-location. The next section presents the problem of the statement.

## **1.2 Research problem statement**

All over the world and mostly in developing countries across the world and in Africa, land size has been a major challenge especially to food and livelihood security of its population. The agricultural sector which is a very important sector as it is involved in agricultural production has been a great victim of reduced land sizes through land fragmentation and subdivision. Land transformation is contributed by way of transmission of rights where beneficiaries inherit land from parents who sub-divide the original land to reallocate among themselves. Equally another contributor is when people buy land elsewhere mainly due to pressure on existing land or as a result of compulsory land acquisition where the government acquires part of one's land for public use.

Nyandarua County is one experiencing a high population growth rate at a 2.2% per annum with a population density of 488 people per square kilometer (KNBS, 2010). The county had an early colonization which led to emergence of colonial villages, considered to be a source of increased pressure land, disputes, insecurity and speculation. A rising population generally results in pressure on the land. This is because land is a finite resource and therefore its supply is inelastic. The population in Nyandarua is rising at an alarming rate of about 2.2% annually. From the 596, 268 in the year 2009 it will be expected to rise to about 892 361 in the year 2026 (Ndirangu, 2017). The land in some parts of the county is already being subjected to fragmentation into units and this can only be expected to increase if land fragmentation in the county remains the same. Decrease of farmland size due to subdivision has resulted in non-economic farm sizes and holdings which hampers agricultural development leading to unsustainable livelihoods.

Studies that have been undertaken on general impacts of land sizes and use on livelihood security especially in Ghana and Rwanda have shown that fragmentation has adverse effects on the agricultural productivity. (Blarel et. al, 1992). In China, on the issue of subdivisions and land fragmentation on farm productivity produced similar findings that size of land and use affects agricultural production and hence livelihood (Nguyen & Cheng, 1996). Studies have also been conducted in Kenya specifically in Vihiga County but not in Gatimusublocation. This means that there is need for a systematic and scientifically conducted study on effects of land size in an area that practices dairy and non-dairy farming system. This will provide sufficient quantitative and qualitative primary information on land sizes and its' overall effect on the food production so as to propose policy and investment measures for food and livelihood security.

### **1.3 Research objective**

#### **1.3.1 Broad objective**

The main objective of the study was to assess household land size and use for sustainable food and livelihood security in a dairy farming system of Gatimu sub-location, Nyandarua County.

#### **1.3.2 Specific objectives**

- i. To examine the current household land size and its implication on food and livelihood security in Gatimu sub-location
- ii. To establish the current land uses and their impact on food and livelihood security in Gatimu sub-location
- iii. Analyze the factors that influence the size and use of household land in Gatimu sub-location
- iv. Interrogate the intergenerational transmission of land rights and propose intervention measures that can lead to appropriate land size and food and livelihood security in Gatimu sub-location.

#### **1.3.3 Research questions**

- i. What is the current household land size and its implication on food and livelihood security in Gatimu sub-location?
- ii. What are the current land uses and their impact on food and livelihood security in Gatimu sub-location?
- iii. What factors influence the size and use of household land in Gatimu sub-location?
- iv. How is the intergenerational transmission of land rights and what interventions can lead to appropriate land size for food and livelihood security in Gatimu sub-location?

### **1.4 Geographical and Theoretical Scope**

The study was carried out in Gatimu Sub-location in Nyandarua County.

This study is based on two theories to explain the relationship between land size and use on productivity. The neoclassical model emphasizes the relationships between farm sizes, returns on investment and efficiency. The main issue is whether returns from production can explain the correlation between farm size and economic efficiency hence determination of “optimal” farm size (Chavas, 2001). This theory explains that Farm size growth can have positive consequences on farm competitiveness as there will

be economies of scale in terms of size of land which in turn reduces the production cost. According to the theory, Farm size may provide a further competitive advantage given that technical innovation is often biased towards large farms. This is so owing to the fact that some new technologies (e.g. mechanical) are more convenient only in farms operating over a given scale of production (Glauben et al., 2006). This implies that the size of land per household has a positive correlation with the production.

The second theory is the Theory of production that explains the various principles and factors of production. It explains the principles by which a business firm decides how much of each commodity it will produce to sell (its “outputs” or “products”), and how much of each kind of labor, raw material, fixed capital good, etc., that it employs (its “inputs” or “factors of production”). Economics, models, and theories are not dynamic as they are fixed to a period. So, economists base their models on the short run, medium run or long run (Benin, Pender & Ehui, 2003).

The production function is based on the factors of production of which land is prime factor. Others are labor, capital, materials, technology and time. Since production is dependent on these factors, any variation on them will affect the output

Below is an explanation of the Production function:

$Q = f(L_d, L, K, M, T, t)$  • where  $L_d$  = land and building;  $L$  = labour;  $K$  = capital;  $M$  = materials;  $T$  = technology;  $t$  = time and  $Q$  is total output

A place that is affected by land fragmentation there is less input in terms of land for production as there is less land for farming. Therefore plot characteristics like its size impact the input and this directly would affect the output on the farm.

### **1.5 Justification of the Study**

According to a brief on ‘Climate Change and Food Security in Kenya’ it has been established that agricultural production in Kenya is dependent on rain-fed agricultural practices. Although reports indicate a rise in agricultural production, population increase that continues to exert more pressure on land and land related activities are major concerns for future household farm size and food security in general. According to Kihima 2017, a study in Vihiga county shows that the mean land holding size is 0.41ha translating to high degree of land fragmentation. The study concluded that small

size land holdings have many effects including reduced household food availability, land related conflicts as well as reduced income from agricultural activities.

This study provided an understanding of the relationship between plot characteristics that include size, shape, use etc. to food and livelihood security in the study area. It will also unearth the current trend regarding land transformation in the study to assist in policy making regarding the minimum and maximum land holding sizes allowable in an agricultural area. The study is necessary because it offers opportunity to address the actual impact of uncontrolled land fragmentation on food security and other forms of basic necessities in a rural settlement scheme. This study will add valuable knowledge in the area of settlement planning as well as suggesting significant policy statements through its recommendations. Such recommendations will inform policy formulations and influence the practice

### **1.6 Definition of Terms**

**Land transformation** this is applied to mean all the processes that alter the shape, size, area, use and ownership of land in the developmental course. In summary, it means the processes of subdivision, transfer of ownership, change of user, consolidation and fragmentation etc.

**Land Fragmentation** means dividing parcels of land into several portions that are spatially distributed and are under the same or different ownership.

**Change of user** means altering the original designated use of land

**Consolidation** combination of different parcels into a single unit.

**Transfers** refers to the change of ownership.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

This chapter presents the background, theoretical and empirical literature relevant to the research problem. The chapter also reviewed the previous studies to identify the research gaps that are required to be filled. Also included is the conceptual framework showing the relationship between the independent variables and dependent variable, critique of the past relevant studies, and the summary of the chapter.

#### 2.1 Background information on Agriculture in Nyandarua District

According to Pavel (2018), Nyandarua County is predominantly a mixed farming County with small scale farming. The settlement scheme plots increasingly supplementing the large scale farms that characterized its former "scheduled area" status (Gikenye, 2016). The upper highlands zones in the County are suitable for growing wheat, barley and pyrethrum and for rearing sheep, whereas, the lower highland zones are suitable for growing maize, beans, peas, horticultural crops and vegetables and for dairy farming. There has been too many sub-divisions of land in most high potential areas in the County and this has to be discouraged to enable the County realize its agricultural potential. Land settlement program in Nyandarua district started in October 1962 in Kipipiri division followed by Kinangop in December in the same year, Olkalou in May 1963, Oljoro-orok in September, 1963 and finally Ndaragwa Division in April 1964 (Nzomo, 2011)

The economy of Nyandarua County has for the longest time in history been established on agriculture and animal husbandry. This is still the same today. Over the years, there has been a shift in the variety of crops being cultivated and the methods of cultivation being used. Pyrethrum was the main crop of the then Nyandarua District during the colonial era as it was the crop being cultivated by the White Settlers who employed the use of cheaply available African labor. In the settlement schemes, with the subdivision of the large farms into small plots, the Africans continued to grow pyrethrum but on a small scale. (Gikenye, 2016). This led to smaller scale farms replacing the large scale farms over the years and turning the majorly pyrethrum (cash crop) growing area into a mixed farming area. There was a shift in the crop being grown from just pyrethrum to other different crops. The major crops being grown in terms of

cultivated acreage became maize, potatoes, pyrethrum, vegetables, beans and wheat, and other horticultural crops. The main farming areas of the county are concentrated on the upper parts of Kalou, Oljoro-orok and Ndaragwa Divisions and some parts of Kinangop. Dairy farming is also practiced in the area although in a very small scale with very small herds of cattle being reared. Sheep farming is also practiced especially in Kinangop and in very small scale in parts of Oljoro-orok and Kalou (Gikenye, 2016).

After independence, the government came up with the idea to form settlement schemes that would help continue the successes of the colonial masters with regards to farming. Martha (2013) concluded that these schemes in Nyandarua did not function well as intended or develop as the government had thought they would. Firstly, the original operational budgets of the settlers ended up being more theoretical than practical.

The planners of the settlement schemes had intended the settlers to grow specific crops and keep dairy cattle in the hope of raising a targeted income. But in practice the settlers were influenced by unpredictable external and internal factors, and the settlers were not able to meet their targeted incomes all the time (Nzomo, 2012)

## **2.2 Theoretical Framework**

This section discusses the theoretical frameworks that underpin this study on the impacts and causes of land fragmentation. The theories discussed here include the theory of production and the Schultz's inverse relationship theory.

### **2.2.1 Schultz's Inverse Relationship Theory**

Since the publication of the theory in 1964, more advocates and researchers have come up all over the world starting from Russia, Europe, Asia and Africa in support of the theory (Schmitz Kennedy & Schmitz, 2016). The theory advocates that the number of plots due to sub divisions from one single holding may only reduce the plot sizes but not the production instead it should motivate the farmers into improving their farming techniques through increased use of fertilizers, certified seeds and zero grazing techniques for livestock production. This ultimately will improve the yields and profits acting as dependent variables. The theory works well when other intervening or confounding variables like the level of education of farmers are improved and even farmers are assisted with farm inputs or loans.



Those who are opposed to the theory argue that the opposite may also arise where subdivision and fragmentation of farms leads to small acreages and low yields particularly when farmers are negative and not motivated about fragmentation (Hubbard and Smith, 2003). This might be so when little is done in terms of farmer's level of education and improvement of technology, the farms may deteriorate to the extent that yields become lowered. The theory was known as inverse relationship or negative relationship since it went against empirical studies and theories which believed that increase in fragmentation of farms will lower the farm sizes and violate the fundamental tenets of positive production and economies of scale hence production per unit would fall.

### **2.2.2 Theory of Production**

The Theory of production explains the principles by which a business firm decides how much of each commodity that it sells (its "outputs" or "products") it will produce. And how much of each kind of labor, raw material, fixed capital good, etc., that it employs (its "inputs" or "factors of production") it will use. Economics, models, and theories are not dynamic; they are fixed to a period. So, economists base their models on the short run, medium run or long run (Benin, et al, 2003). The difference in these time frames is the ability to change the factors of production. For example, in the short run, it is impossible to set up a new factory, but it's more plausible to hire a new worker. It shows that in a period, current output can change only so much. While in the long run, you can make many more changes.

A place that is affected by land fragmentation and subdivision there is less input for production because there is less land for farming. Other characteristics like the plot characteristics and its size therefore impact the input and this directly would affect the output on the farm.

### **2.2.3 Global household Land Fragmentation and use**

Land fragmentation can be said to be the division of land into several smaller parts for various reasons. There is no standard way of measuring land fragmentation. However, there are some factors that may be used to distinguish the extent of land fragmentation. Several authors have distinguished single indicators of land fragmentation from indices based on integrated indicators that utilize more than one variable. Most authors who tried to measure fragmentation have used a simple average of the number of parcels per holding (either regional or national), an average of holding size and an average of parcel

size. Some others developed more complicated descriptors. Others have suggested a land fragmentation index which takes into account the number of parcels in a holding and the relative size of each parcel while some calculated a fragmentation index as the percentage of a holding's land which is not adjacent to the farmstead.

While studying the land fragmentation problem in Albania, Pavel et.al (2018) conclude that two major issues that could result from land fragmentation are: (i) the consolidation policies that relocate and enlarge plots would have a significant impact on reducing agricultural production diversification; and (ii) land fragmentation contributes to the nutritional security improvement by increasing the variety of foodstuffs produced by subsistence farm households (Pavel, 2018). Land fragmentation is often caused or escalated by a variety of factors which include though not limited to population growth in an area, split distribution of land due to specialization in a given type of farming, inheritance etc.

Whereas land fragmentation can be said to be a success story in certain countries like the United Kingdom, the same may not necessarily be true for developing countries like Kenya. Land fragmentation may lead to both negative and positive effects depending on the specific case being considered e.g. it may lead to an increase in biodiversity hence production of more variety of crops. On the flip side it may lead to land degradation and increase on operational and opportunity costs which may at the long run have a negative impact on the farmers' performance and income (Pavel Ciaiana, 2018).

### **2.3 Household Land size and its impact on Food Production**

Land fragmentation affects both land and people living in those lands. The repercussions of land fragmentation are not only economic but also social. These socio-economic effects may lead to costly results on the owners of the land. Fragmentation limits the farmers desire to mechanize or modernize his or her farm. It inhibits the introduction of machinery and large scale irrigation. It may also be a hindrance to expansion of the farm (Pavel Ciaiana, 2018).

Fragmentation may have social and psychological impacts with consequently wider repercussions across the agricultural sector or within a certain community as a whole. More specifically, an organized land tenure structure in a rural community may raise the status of certain farmers and improve communication and cooperation among

them. Also, it may reduce inequalities among farmers which have less agricultural problems due to fragmentation. Social tension caused by disputes over ownership, especially in the case of shared and multiple ownerships. As a result, litigation sometimes leads to serious conflicts and court settlement.

A number of studies have already discussed the effects of land fragmentation in Nyandarua and other various places in the country such as Vihiga and Kisii. It may not be conclusively true to say that the effects of this act are similar through the areas but the effects are more or less the same. There is not so much material on factors that continue to enhance and sustain land fragmentation in Nyandarua county and specifically Gatimu sub-location in spite of the negative effects it has on production and socio economic well-being of the farming households (Mwavali, 2009). More research needs to be done in the area of cultural land inheritance system in Nyandarua to establish the reason for its persistence even when it is un-economical to sub-divide land further. Studies on land fragmentation in Vihiga County suggested that there was a general reduction in production and average sale of food crops caused by land fragmentation. The socio-economic effects of land fragmentation included food insecurity, reduced income, and increased disputes with neighbors (Mwavali, 2009).

Another major implication of land fragmentation is food security. This is because most of the original large-scale farms have been subdivided beyond economically sustainable production capacity. The government is already exploring measures to mitigate against this issue. Institutional and policy measures are being established to tackle the question of food in-security with regards to land fragmentation (Ndirangu, 2017).

Studies have shown before that the size of a firm affects food security as it influences the food production, farm income and farm efficiency. There is an existing relationship between farm size and economic efficiency due to the benefits of economies of scale. Efficiency associated with physical economies of scale can be characterized as technical efficiency, while efficiency associated with adjusting factor use and output mix to relative prices can be characterized as price efficiency - allocative efficiency. Overall economic efficiency is, therefore, a function of both price and technical efficiency.

These studies suggest that those households that possess larger farms are at increased chances of producing more food and cash crops and have increased space for crop diversification. However, the impact of farm size on food security varies with the agro-ecological zone, indicating that the influence of the agro ecological zone is significant. The minimum cut off farm size for food security status also varies with the agro-ecological zone. The previous studies have not sufficiently examined and compared the relationship between the agro-ecological zones (AEZs) and food security (Mpahlele et al, 2000; Water Management Institute, 2000). Within any AEZ, the households owning large farm sizes have better chances of producing more food and cash crops, and have more space for crop diversification. Large farms also generate large volumes of crop residues for livestock production which enhances food security. Therefore, the size of a land holding may be expected to have a positive effect on a host of such factors as household wealth, access to credit, capacity to bear risk and household income which individually or jointly influence a household's food security status. Agro-ecological zones interact with farm size in the determination of the minimum farm size that can guarantee the attainment of an acceptable food security status, based on the household food security index (HFSI) estimate for a household in a given AEZ (Springer, n.d.).

#### **2.4 Household Land fragmentation and size in Nyandarua County**

Over the years, there are several contributors that led to the escalation of land fragmentation. The factors that lead to an increase in land fragmentation in Nyandarua County are more or less the same to those that have continued to trigger land fragmentation in other areas. The major variables in studying the effects of land fragmentation are household land size and agricultural production.

Causes of land fragmentation may differ from one country to another. However, it is almost agreeable that the major causes of land fragmentation in Kenya are inheritance; population growth; land markets; and historical/cultural perspectives (Pavel Ciaiana, 2018). Inheritance can well be said to be the main cause of land fragmentation in Nyandarua County. The existing inheritance laws call for the equal distribution of land into equal portions among all heirs (Quisumbing and McClafferty, 2006). As a result, land fragmentation has become a continuous process with land holdings and land parcels getting smaller and smaller as they have been dispersed to successive generations.

Land Markets also play an important role in fragmentation. Poverty pushes families to sell their lands to others so as to meet other pressing needs such as education fee or medical expenses. Since land is a multi-purpose resource, land markets play an important role in the whole process of ownership restructuring, because people wish to acquire a piece of land not only for agricultural activities, but also for other reasons such as investments, enhancing personal prestige and status, and having secure current and future living conditions for the family. In principle, land markets contribute to further fragmentation of the existing holdings since, in most cases, farmers purchase land which is not continuous to their existing holdings or they (or other people) may purchase pieces of land as shares in other parcels. However, in some cases, land purchase may reduce land fragmentation when farmers acquire neighborhood pieces of land to expand their holdings.

Historically and culturally, most people practiced farming majorly to meet their own needs. Hence, most crops were food crops. The land therefore needed not be so big and the methods of production were rudimentary and not as advanced as today. What was considered as surplus was what the farmers would trade in. However, this may not be the case today. Technology has grown and markets have opened up. Hence, to reap from economies of scale, it is becoming necessary that land be owned on large scale. However, this requires that enough civil education is done. Otherwise, land will continually be fragmented leading to losses (Mwavali, 2009).

## **2.5 Land uses and their impact on food and livelihood security**

Physical problems arising from scattered plots, with issues including the "wastage" of labor time and of land, fencing costs, added transportation costs to move materials between plots, distance between parcels and the farmstead and limited access to lands. Loss of labor time is due to the need to travel between plots of land. . When parcels are spatially dispersed, travel time and hence costs in moving labor, machines etc. from one parcel to another, are increased (Varma, 2017). A consequent drawback is that parcels at a greater distance are cultivated less intensively. There is also land wastage based on the loss of land under boundary barriers and in corners and edges of plots which is not cultivated as effectively as interior space. The quantity of under-utilized land increases with the number of plots. Moreover, conflicts between land owners increases due to this problem.

Transportation costs rise due to extra movement between plots. Both the number of plots and inter-plot distances add to time and expenses consumed in transportation. Access to individual plots also may be impeded with fragmentation. Problems in achieving operational efficiency on the farm, including problems associated with farm equipment, with farming techniques and systems, with management and supervision of production, with pest control, and with the abandonment of distant or small plots (Kamauand, 2011). Due to both the reduced size of individual parcels and their frequently irregular shapes, introduction of new farm machinery may be inhibited. The use of modern machinery is difficult or may be impossible in tiny parcels and may require an excessive amount of manual work in the corners and along the boundaries. Specifically, irregular parcel shape prevents the proper cultivation of land, especially for some crops (e.g. vines, olives) which need to be cultivated in series. As a consequence of all this, a great decrease in productivity occurs and thus the income that farmers get from the land also reduces (Kilonzo, 2013)

Land division also causes some portion of land to remain futile. This is due to the absence of well-organized road structures that render certain land fragments inaccessible. Therefore, making them unproductive because they remain uncultivated or get deprived of various necessities. Often, small fields have inaccessible roads. Likewise, lack of a road linkage to access the small fields precludes the institution of other useful agricultural infrastructure such as drainage systems and irrigation. Furthermore, this problem leads to disagreements and conflicts amongst neighboring landowners ( Kenya Land Alliance , October 2014).

Land fragmentation is widely considered as a disadvantageous practice. However, there are some few advantages that may come out of the practice. Its prominent disadvantages are the fact that it inhibits mechanization, leads to inefficient production mechanisms and increases costs of production among others as discussed. While most studies tend to focus on the negative impacts of land fragmentation in agriculture, sometimes land fragmentation offers benefits and sometimes may be desirable or even necessary

Three major advantages of land fragmentation are risk management, crop scheduling and ecological variety. Risk management helps to minimize possible risks that may arise due to climatic and natural disasters. This is because there is a spatial

spread of the risk in case of such occurrences. This is due to the fact that there are a variety of crops which react differently to different climatic conditions. Crop scheduling may work well where parcels of the land are scattered at different altitudes since crops ripen at different times. Hence farmers may adjust their scheduling times according to the seasons of the different crops they plant (Ndirangu, 2017).

## **2.5 Current trends in household land size and use**

Kenya has not had a definitive National Land Policy all the way from independence. The absence of the National Land Policy together with presence of many land owners, resulted in complex land administration and management. The issue of land question has resulted in breakdown, fragmentation and administration issues and further disparities in ownership of land and poverty. This has resulted in social, political, environmental problems including deteriorating, squatting and land quality, conflicts and landlessness. All these factors collectively have led to less production of food and hence food insecurity.

The National Conference on Emerging Land Issues in Kenyan Agriculture and their Implications for Food Policy and Institutional Reforms held in 2014 suggested that one of the causes of reduction in agricultural productivity is the uncontrolled subdivision of land. Since farm size is inversely relational to agricultural mechanization, farmers with small units of production tend to only use traditional tools and implements leading to inefficiency of production. At the stakeholders' conference held in 2014, it was noted that one of the major contributors of land fragmentation was population growth. This results in land pressures and unsustainable forms of intensification. Rural populations in sub-Saharan Africa are highly concentrated in fertile areas. Up to 20 percent of Africa's land contains 83 percent of its rural people. Mounting population density is associated with a trend toward smaller farm sizes, more continuous use of land, reduced fallows, and only marginal increases in fertilizer use and irrigation. The conference noted that it would be of benefit if people migrated from such places. Migration to more sparsely populated rural areas continue to play an important role in relieving land pressures in densely populated rural areas provided that land continues to be accessible in the receiving areas and tribal conflicts do not arise ( Kenya Land Alliance , October 2014).

One of the major challenges and propellant of land fragmentation is the issue of succession and or property transfer. These can generally be classified into testate and interstate. The interstate means a person has died without making a will or even a testamentary disposition. Very few individuals in Gatimu sub-location just like in other communities create wills. Most people are unaware that indeed they can either create the wills themselves or can engage a lawyer to help them in creation of the wills. Both the interstate and the testate are problems of succession not only because they are triggers for land disputes, but because they fuel land fragmentation in every generation. This results in little plots, which cannot be cultivated on due to poor economic output. This then ultimately leads to poor production and then food insecurity in Gatimu sub-location.

## **2.6 Factors that influence the size and use of household land**

There are numerous measures that can be implemented to control land fragmentation. Policies can be put in place by the government as a mechanism to control land fragmentation. When a Government evaluates and considers that land fragmentation encompasses a problem for rational agricultural expansion, then it follows three strategies. Primarily, it promotes regulation concerning features that affect land fragmentation in order to inhibit deterioration of the problem (Pandey, 2006). Precisely, legal provisions, of which most of them are restrictions, encompass altering legislation concerning minimum size of parcel division, inheritance, absentee property-owners, leasing, deterrence of transfer to non-farmers, imposing a maximum limit on the size of a holding, etc. The current institutional framework of the EU, Some of these legal constraints that were applied in EU nations in the past, or they are presently implemented in non-European countries including Nepal and India could be deliberated as unconstitutional and illegitimate (Springer, n.d.).

Secondly, it may possibly apply the strategy that entails application of specific land management tactics to deal with certain problems precisely in agricultural areas. Mainly, the land management methods used to combat land disintegration in agriculture includes land funds and land banking; land amalgamation; voluntary parcel exchange; and cooperative agriculture.

Essentially, land consolidation is one of the core land management measure implemented as a resolution to land fragmentation. It encompasses the restructuring of



space through reconfiguring the land tenure construction in terms of landowners and parcels and the endowment of suitable infrastructure correspondent to the objectives of a scheme. Consequently, production as well as farmer's income are increased.

In the next chapter, an extensive analysis of land consolidation follows. Land funds and land banking entails the process undertaken by a landowner when he/ she does not have an intent of prolonging his landholding, but rather is interested in distributing it to other conventional farms. Hence, in such a case, his land may possibly be used as a land buffer. More precisely, a land buffer is obtainable for the enhancement of other farms and the building of agricultural structures such as irrigation, roads, as well as drainage structures (Troubat et al, 2014). The land buffer is a land fund that can be utilized as an agricultural policy instrument, and its use is known as land banking. Mainly, in Western Central European nations including Germany and the Netherlands Land funds and land banking have been commonly used. Voluntary parcel exchange embroils the interchange of parcels amongst three or more property-owners resulting in a well-organized spatial layout considering the intention is to group neighboring parcels of respective landowner. Some Western European countries have used this method for a very long time.

Cooperative farming encompasses the joint cultivation of land by a group of households. Some Asian countries including India mainly practiced it until 1970'. They considered it as an effective resolution to land fragmentation, through the construction of economically effective farm divisions. However, real-world practice has displayed negative outcomes, generally due to the hesitancy of landowners to take part in these programs. The landowners reluctance is due to contradictory interests and perceptions among them and the dread of losing their constitutional rights thus, leading to the collapse of the whole attempt (Setotaw, 2006). Thirdly, the third approach may probably entail applying precise land protection strategies/programs to preclude agricultural land from being advanced for commercial use or housing. This strategy has been practiced in the United States in areas/regions where there is a diversified land use, such as agricultural and housing. In specific, these policies, that is a clustering program; a purchase of development rights (PDR) program; and a transfer of development rights (TDR) program, focus on preventing agricultural land fragmentation, following urban sprawl. The PDR program embroils the use of publically owned monies for purchasing and funding to eradicate the expansion rights

on agricultural land. It is a farmland preservation instrument which is considered effective, fair to landowners and offers a perpetual solution. The common detriment is its high cost of enactment. A TDR program, which is applicable at a small scale, concerns an exact area to be secured from improvement (i.e. the sending area) and a region where improvement will be endorsed (i.e. the receiving area).

The program comprises of the transfer of the advancement rights of a parcel situated in the sending area to another one of the receiving region. This program, which is obligatory, is considered as the most aggressive and useful in terms of conserving farmland. As compared to the PDR and TDR guidelines, which entails a regional scale, cluster development plans emphasis on development of a site by site basis. Cluster programs are applicable with the zoning density, decreasing minimum parcel sizes and making sure that a portion of the site remains as undeveloped space (Smith and Subandoro, 2007).

In spite of the popularity of this strategy among numerous communities, it is not considered as an effective implement to safeguard agricultural land bases. A research revealed that TDR and PDR programs are the best suited and successful in regards to the total area of land secured. The clustering program ascertained incompetence in achieving the protection of a large parcels of land. On the contrary, TDR and PDR programs have accomplished better outcomes concerning an increase in the size and the continuousness of parcels than the clustering platform. Nonetheless it is important to note the fact that any land policy practical in one country may probably be inapplicable in the same manner in another country. Thus, a government, should investigate its prevailing conditions and environments of its country prior to considering embracing a land policy. Otherwise, many hitches can arise and failure will be unavoidable.

## **2.7 Literature on Policy and Legislative provisions**

These include policy and legal framework that guide land fragmentation. The constitution of Kenya is major guiding framework. The bill of rights guarantees every human being has the right to a uncontaminated and healthy environment that is sustainable (Seto & Reenberg, 2014). It also gives the right to social and economic rights which include acceptable standards of health, access to adequate and affordable housing and to reasonable standards of sanitation. The constitution also gives the

provision of access to adequate food of acceptable quality in conjunction with portable water.

### **2.7.1 The 1963 and 2010 Constitutions of Kenya**

The 1963 constitution granted a lot of power on matters land to the president and the former county councils. The president in consultation with the county councils could allocate land to even individuals if he deemed fit. (Section 118). This led to a lot of Government land resting in the hands of private individuals in what was seen as land grabbing.

This is different with the 2010 constitution that has structure for the management of land and land related resources. The chapter of the constitution on Land and Environment provides for the use and management of the land in a manner that is equitable, efficient, productive, and sustainable. The principles include the power of the state to regulate the use of any land policy principles. The principles include the power of state to regulate the use of any land or any interest in or right over any land in the public interest as well as the management and protection of the environment for sustainable exploitation, management, utilization and conservation of the environment and natural resources.

### **2.7.2 National Land Commission Act**

The act provides for the administration and management of land. It guides the country towards efficient, sustainable and equitable land use. It seeks to promote positive land reforms for the improvement of the livelihoods of the people (Ezra, 2010). For effectiveness, it provides roles to the Government to review planning and development control legislation in harmonizing the governance structures, decision making processes and planning standards and regulations together with developing effective administrative and legal mechanisms for the regulation and development in freehold land in gazette and planned urban areas.

### **2.7.4 National Spatial Plan 2015-2045**

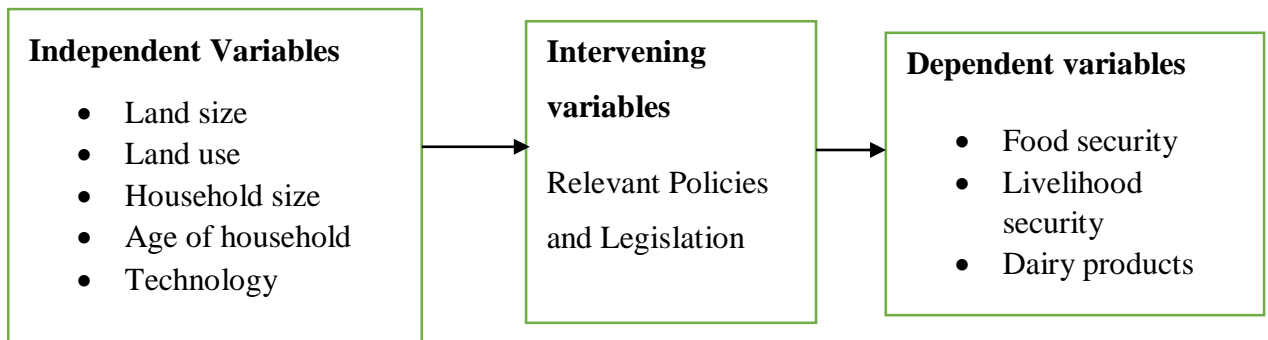
The National Spatial Plan marks a significant milestone in Kenya's development agenda. The plan has the national spatial vision that will guide the long term spatial development of the country for a period of 30 years. It covers the entire territory of Kenya and defines the general trend and direction of spatial development for the country. It aims at achieving an organized, integrated, balanced and sustainable development in the country and hence it will inform the future use and distribution of

activities by providing a framework for better national organization and linkages between different activities within the national space (Ezra, 2010). Additionally, the plan gives a framework for the efficient, productive, and sustainable use of land as advocated for both in the Constitution and the National Land Policy. Further, it provides strategies in facilitating sustainable exploitation of the country's huge potential in agriculture, tourism, energy, water, forestry and fishing. It is expected to reduce regional inequalities that have existed by ensuring that these regions are no longer perceived as low potential but as differently endowed.

## **2.8 Conceptual Framework**

The conceptual framework below captures food security as the major topic under study and the various factors that are critical to food security. These include the issue of land fragmentation, plot characteristics, household characteristics and government interventions. Furthermore, there are sub-factors that are critical to food security through the major factors. For instance, the issue of land fragmentation is affected by the community cultural significance associated with land and the issue of land inheritance. Other factors include plot characteristics within the study area and the factors like size of the plot, land access, distance from homestead and the irrigation status and how these factors contribute to land size that ultimately affects food security.

**Figure 2.1: Conceptual Framework**



The conceptual framework captures the relationship between the characteristics mentioned above the food security. Land fragmentation reduces the arable land available for farming and progressively this affects food production and hence food insecurity. The issue of land fragmentation is associated with cultural practices and the value attached to land through the inheritance. One is considered not a fully member of a community if they do not belong a piece of land, their ancestral land (Pandey, 2006). This issue of land fragmentation has been propelled by a number of factors that include the population pressure where the numbers of people have been progressively increasing causing strain on the available pieces of land.

The household characteristics like the age, the economic status of a person and the number of the household directly affect the production on the farms. The elderly and the young people form part of the family who are predominately inactive in terms of food production and hence security. The middle age form part of the productive age who engage in economic activities to support and feed the family. They enhance and contribute substantially to the food security.

In the same way, the government intervention acts a moderator in the whole structure. The government intervention through subsidies, tax credits, incentives and extension services enhance and support food production and hence security. When there are policies that help the farmers in the study area from both the county and national government in their agricultural production then this will translate into food security. The government intervention enhances all the other factors mentioned including household characteristics, cultural issues with land fragmentation, and attitudes of the farmers in achieving food security.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The previous chapter helped to identify the various variables that would enable the achievement of the objectives of the study. It therefore, elaborated on the issue of land sizes and land use, their causes and how they impact livelihood security. This chapter elaborates on how the relevant data was collected and analyzed in order to achieve the objectives of the study. The chapter covers: research design, target population, sampling design, data collection, variables in the study, data analysis and ethical issues.

#### **3.2 Research Design**

A research design is defined as the plan or outline used to generate answers to a research problem (Orodho, 2008). It is the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data (Kothari, 2011). The study adopted a descriptive research design. This is because a descriptive research design provides a detailed examination of a single subject group or phenomena to understand the study area and make conclusions.

#### **3.3 Target Population**

According to Mugenda and Mugenda (2003), a population refers to the entire group of individuals, events or objects having a common observable characteristic. The target population in this study consisted of all the households of Gatimu sub-location in Nyandarua County. These included those with relatively large farms and the ones with small farms.

#### **3.4 Sample Design**

The sampling design is discussed in two sections namely: sample size determination and sampling procedure.

##### **3.4.1 Sample Size Determination**

In determining the sample size, population for the whole sublocation was put into account. Gatimu sub-location had 13,600 people (KNPHS, 2009) and therefore, the formulae by Mugenda et al (2003) for sample size calculation where the population is above 10,000, was used. The sample size was determined at 95% confidence level with a margin error of 5%.

Sample size (n) was calculated based on Mugenda et al (2003) Where:-

$$n = \frac{z^2 p q}{d^2}$$

n= Desired sample size

Z= standard normal deviate. Usually 1.96 for 95% confidence interval.

p = Proportion of target population estimated to have particular characteristics assumed to be 0.9 (90%)

q = is the population without characteristics under investigation

$$q = 1-p$$

d = is the margin of error. (5% is used for this case)

Therefore, the sample size was obtained as follows:

$$n = (1.96)^2 (0.90) (0.10) / (0.05)^2$$

$$= \text{approx. } 138.29 \text{ households}$$

Hence, n was found to be approximately 140 households

The households were proportionately divided to the villages as shown in Table 3.1.

### 3.4.2 Sampling Procedure

Having computed the sample size, sampling frame which consisted of a list of all the households in the sub location was obtained for all the villages within the sub location. The sampling frame had a list of 1401 households. The sampling frame was classified according to villages and the head of each household. This was done with the assistance of the local administration and the village elders. After obtaining the number of households in each village, the sample for each village was obtained by dividing the households in that particular village by the total population and then multiplying the results with the sample size.

Assuming that:

The households in that particular village=B

Total number of households in the study area =C

Sample size = D

The number of households to be sampled for each village (sample) = A

Then  $A \text{ (Sample)} = (B \cdot D) / C$

Simple random sampling method was used in selecting the households to be surveyed by allocating numbers to each household on a piece of paper, shaking and then picking at random before shaking again for the consecutive pickings by different persons. The number of households picked per village is as shown below:

Table 3.1 – Sample size from each village

VILLAGE	NUMBER OF HOUSEHOLDS	NUMBER SAMPLED
Gatimu(Jamuhuri)	361	36
Gatimu(Baraka A)	120	12
Gatimu(Baraka B)	170	17
Gatimu(Kisima)	280	28
Gatimu(Muhindi)	220	22
Gatimu(Turbo)	200	20
Gatimu(Nyairobi)	50	5
<b>TOTAL</b>	<b>1401</b>	<b>140</b>

### 3.5 Data Collection Methods

Both quantitative and qualitative data was collected from multiple sources, using multiple methods by multiple investigators. The sources of data was both primary and secondary and the methods included document examination, individual and group interviews, observation, oral history and instrument administration.

**Interviews:** Data from members of households, administrators, professionals and religious leaders on land sub-division, fragmentation and land use allocation and their impact on food, nutrition and livelihood security was collected using an unstructured questionnaire through face to face interviews. Group interviews and key informant interviews were also done.

**Instrument administration:** Actual measurements of the household land size and land allocations for different land uses was done.

**Document reviews:** 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 reviewed



included studies undertaken on the subject and also in the study areas. Others included population census reports, population structure maps, temperature maps, rainfall maps, soil maps and dominant crop maps.

**Observation:** An observation checklist was formulated to ensure that all the data that needed to be gathered through observation is captured. This consisted of key and relevant features in the study areas such as landscape, forests, type of houses and materials used for house construction, farm boundary markers etc. Photography was also used to amplify evidence of study phenomena.

### **3.6 Data Analysis Methods**

Data Analysis is the method of processing data to make meaningful information from it (Sounders, et al, 2009). In this study, the data was coded and analyzed using SPSS version 24 statistical software. The data was then analyzed using descriptive statistics and inferential statistics. Descriptive statistics included mean, standard deviation, range, frequencies and percentages while inferential statistics include Pearson's bivariate correlation and a t-test which was run to examine the linear relationship among the independent and the dependent variables in the study.

### **3.7 Data Presentation**

The analysed data after analysis was presented in the form of tables and charts. The analysis was done per the research objectives.

### **3.8 Ethical Considerations**

There was need for written consent from the participants before starting the interviews. The study participants were clearly informed that the participation in the research was voluntary, confidential and anonymous, and that non-participation would not affect the services they sought in anyway. Furthermore, they were informed that even when they consent to participate, they would be free to withdraw their participation at any time during the study, without any consequences. All aspects of the research were explained to the participants.

Information obtained from, on and about a participant during the research was treated with confidentiality. To achieve anonymity of the data gathered from respondents,

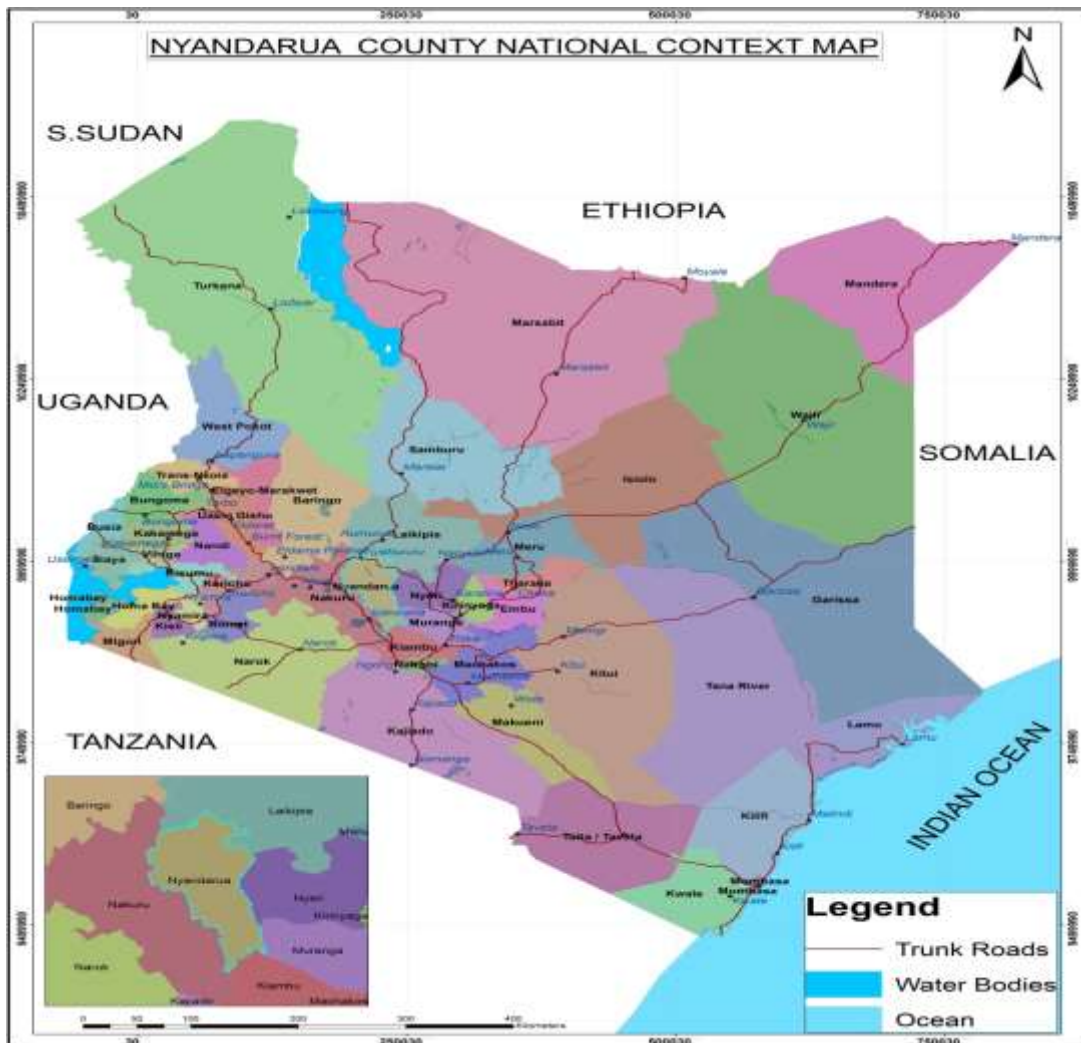
personal data (like names) were left out of the data collection instruments. This helped to ensure that the participants are confident to participate in the research process without any feeling of intimidation or repercussions for participating in the research

## CHAPTER FOUR

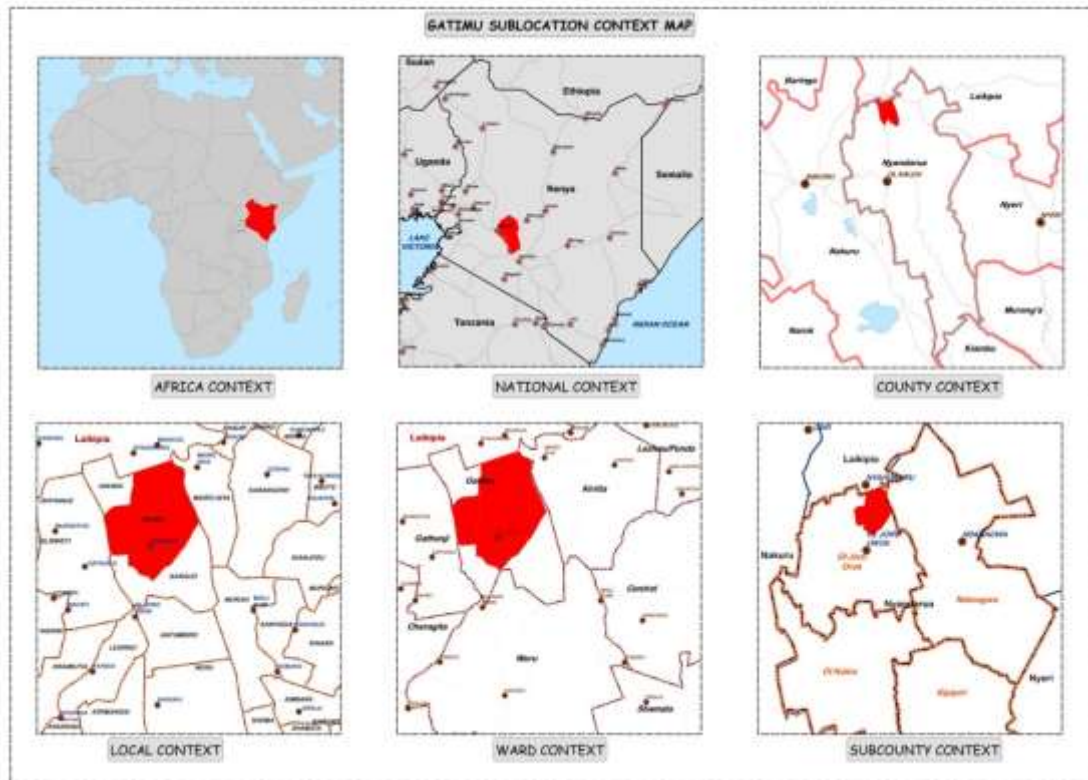
### STUDY AREA

#### 4.1 Introduction

This chapter outlines the general locality and the physical attributes of the study area in particular, Nyandarua County in the National Context. Nyandarua County lies in the Central part of Kenya between latitude  $0^{\circ}8'$  North and  $0^{\circ}50'$  South and between Longitude  $35^{\circ} 13'$  East and  $36^{\circ}42'$  West. Olkalou, the county headquarters is about 150 kilometres North West of Nairobi. However, Magumu Ward in Kinangop Sub County is just 40 kilometres from the capital. It is linked to the other counties through the major trunk roads. To Nairobi, it is connected via A104, to Mombasa through A109 and to Kisumu via A1. The location of Nyandarua County in Kenya is shown in the map below.



Map 4.1: Nyandarua County and Gatimu Sub-location in a Regional Context



Map 4.2 Location of Gatimu Sub-Location

**Source: Author 2018**

The study area is in Nyandarua west Sub-County that is divided into five divisions namely: Oljoroorok, Gathanje, Gatimu, Weru and Boiman divisions. Gatimu division is further divided into three locations namely, Gatimu, Kiwaja and Gikingi. The study area lies in Gatimu location that has six sub-locations. These are Gatimu, Madaraka, Kiwaja, Kanguu, Gikingi and riverside. Gatimu sub-location has 1,401 households according to the data availed by the area Chief, distributed as follows according to villages: Jamhuri (361), Baraka A (120), Baraka B (170), Kisima (280), Muhindi (220), Turbo (200) and Nyairobi (50).

#### 4.2 Demographic Dynamics

According to 2009 Kenya National Population and Housing Census (KNPHC), Nyandarua County is the fourth most populated county in the former central province and takes position thirty one at the national level with 596,268 people; with 292,155 (49%) being male and 304,113 (51%) being female.

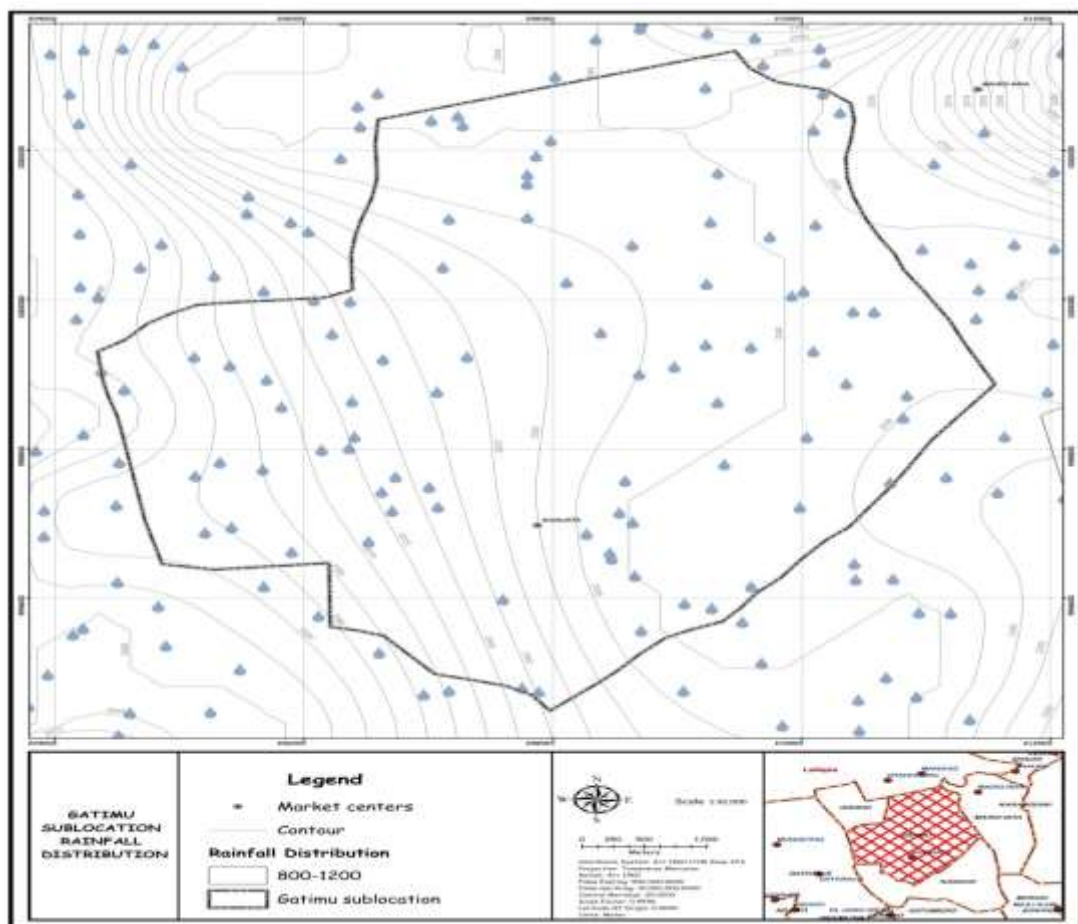
Gatimu sub-location had 13,600 people of which 6,584 were male while 7,016 were female. The total number of households was 3,675 with a population density of 350.65

### 4.3 Climate and physiographic features

#### 4.3.1 Rainfall

Nyandarua County has a cool and temperate climate with reliable rainfall which is generally well distributed throughout the year. In a typical year, the County experiences two rainy seasons: long rains from March to May with a maximum rainfall of 1,600 mm and short rains from September to December and with a maximum rainfall of 700 mm. The average annual rainfall of the county is 1,500 mm.

Gatimu sub-location experiences a lot of rainfall in July - August and least in May. Below is a rainfall map distribution and a chart showing Oljoro-Orok division where Gatimu sub-location is located.



**Map 4.3: Rainfall in Gatimu Sublocation**

Source: Author 2018

**Table 4.1: Rainfall in Gatimu sub location**

Station	Average Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oljoro-Orok	29	30	52	121	11	90	130	148	74	59	87	57

Source: <https://en.climate-data.org>, 2017

### 4.3.2 Temperature

Being on the Highlands the county experiences moderate to low temperatures. The highest temperatures are recorded in the month of December, with a mean average of 21.5<sup>0</sup> C while the lowest are recorded in the month of July, with a mean average temperature of 13<sup>0</sup> C (Nyandarua County Statistical Abstract,2014). Variation of the temperature has adverse effects especially on maize cultivation; when cold air during clear nights on the moorlands of the Aberdare Ranges flows down the Kinangop and Olkalou Plateaus causing night frost almost monthly Gatimu sub-location experiences relatively low temperatures similar to Oljoro-Orok station where it is located as shown below:

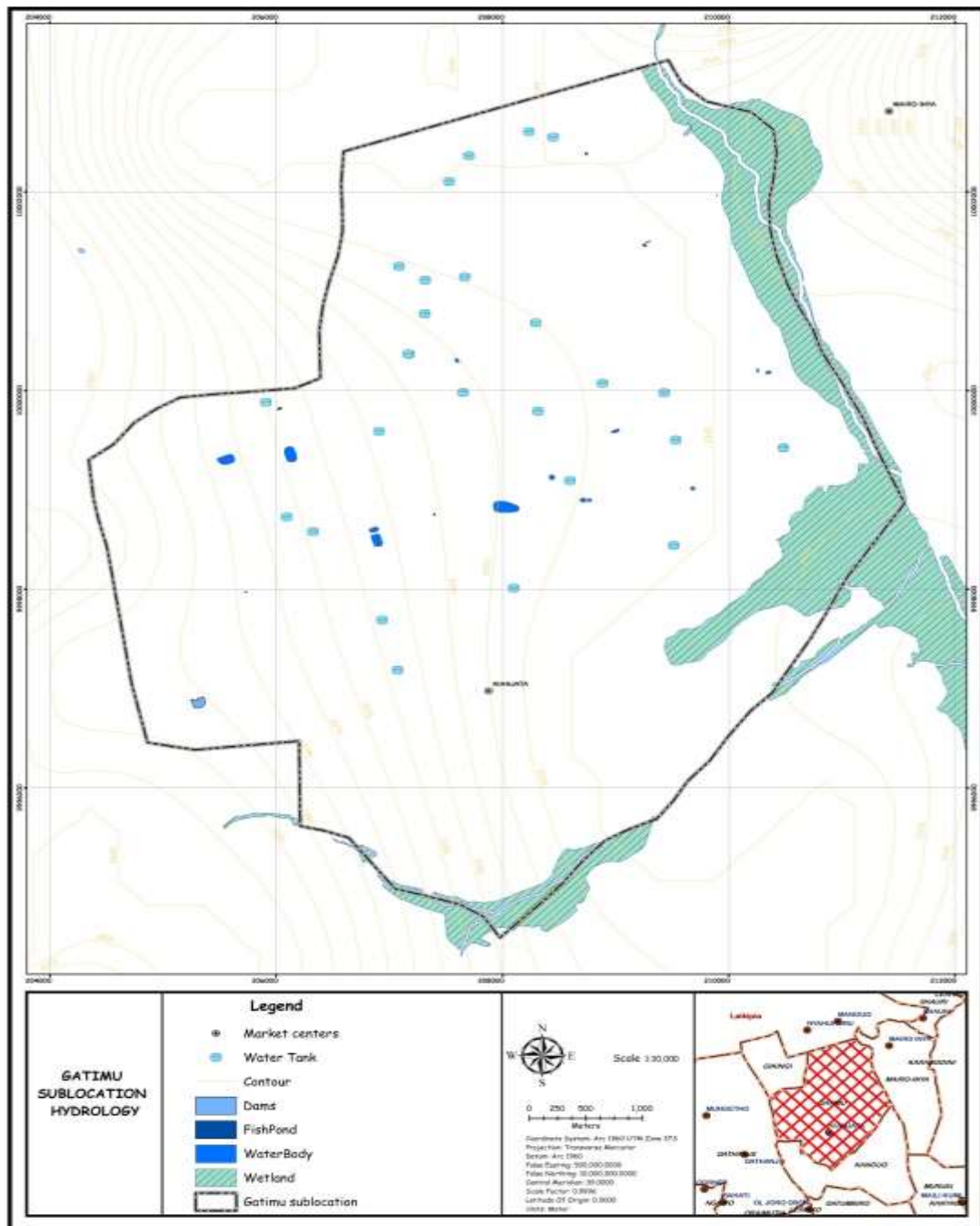
**Table 4.2 Average temperature in Selected Centres in Nyandarua**

Station	Average Temperatures ( <sup>0</sup> C)											
	Jan	Feb	Mar ch	Apr	May	Jun e	July	Au g	Sept	Oc t	Nov	Dec
Olkalou	14.5	14.9	15.3	15.2	14.7	13.7	13.3	13.2	13.5	14	14.1	14
Oljoro-Orok	14.0	14.6	15.0	15.0	14.4	13.4	13.0	13.0	13.0	13.7	13.9	13.9
Engineer	13.5	13.9	14.4	14.3	13.6	12.4	11.7	11.7	12.4	13.5	13.5	13.2
Njabini	12.9	13.3	13.7	13.7	12.8	11.7	10.8	11	11.7	12.9	12.9	12.7
Miharati	14.4	14.8	15.3	15.1	14.6	13.6	12.9	13.1	13.6	14.3	14.1	14
Ndaragw a	14.5	15.0	15.4	15.6	15.0	14.2	13.7	13.6	14.0	14.5	14.4	14.2

Source: <https://en.climate-data.org>, 2017

### 4.3.3 Hydrology

The drainage system in Nyandarua is greatly influenced by the geological structure, topography and land use. There are two rivers within Gatimu sub-location and a wetland on the eastern side. River EwasoNarok passes through Gatimu sub-location



**Map 4.4 Drainage system in Gatimu Sublocation, Nyandarua**

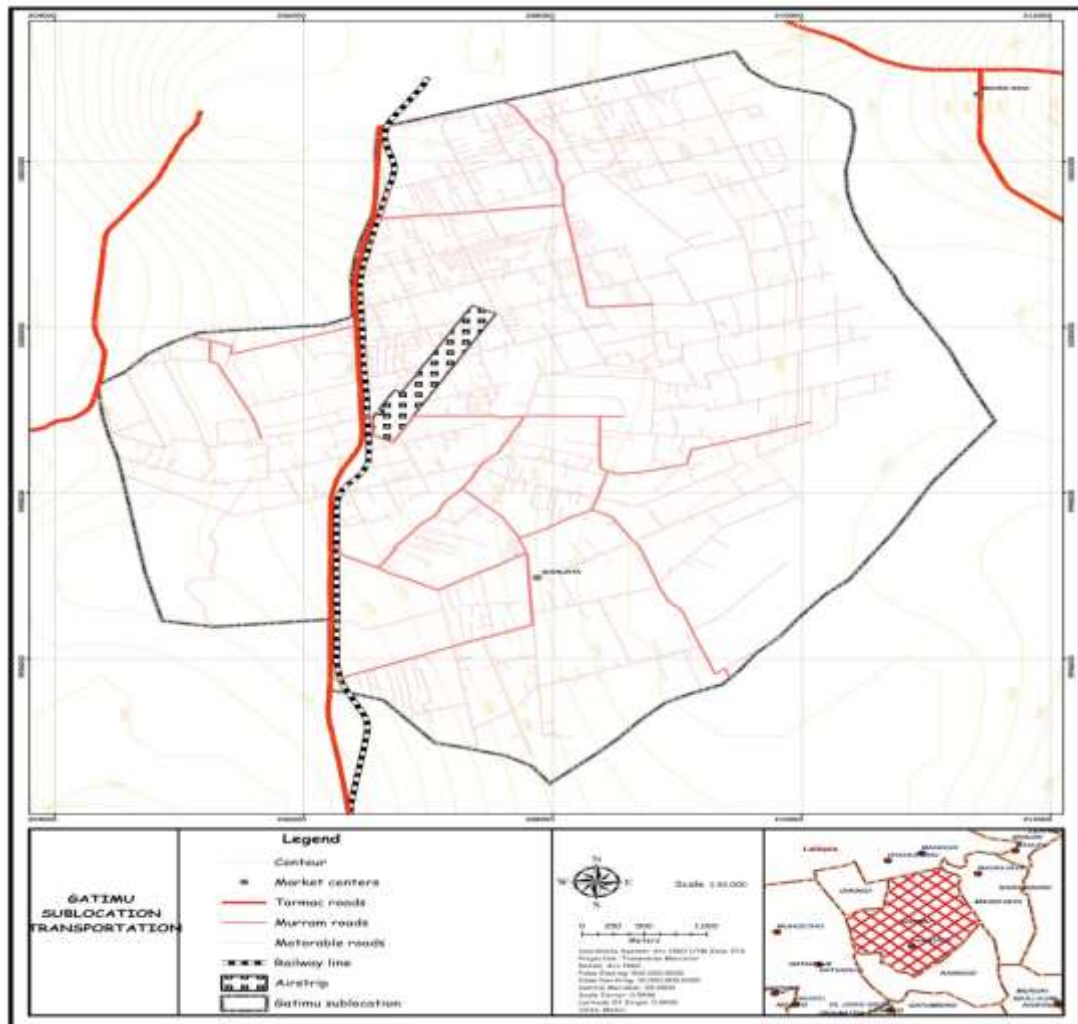
**Source :Author 2018**

#### **4.4 Social economic/ cultural profile**

##### **4.4.1 Physical infrastructure**

The County is mainly linked by road, the dominant mode of transport, to major town centres in the region which include Nakuru, Nyeri and Nyahururu. The county is linked

to Nyahururu and Gilgil (in Nakuru County) by the C77 road which passes through Gatimu Sublocation before connecting to the Nyahururu-Nyeri Road; class B5. There is also an air strip in Gatimu Sub-location that offers air transport facilities. The railway line also passes through the sub-location connecting the county to Nyahururu and Gilgil towns though it is not operational.



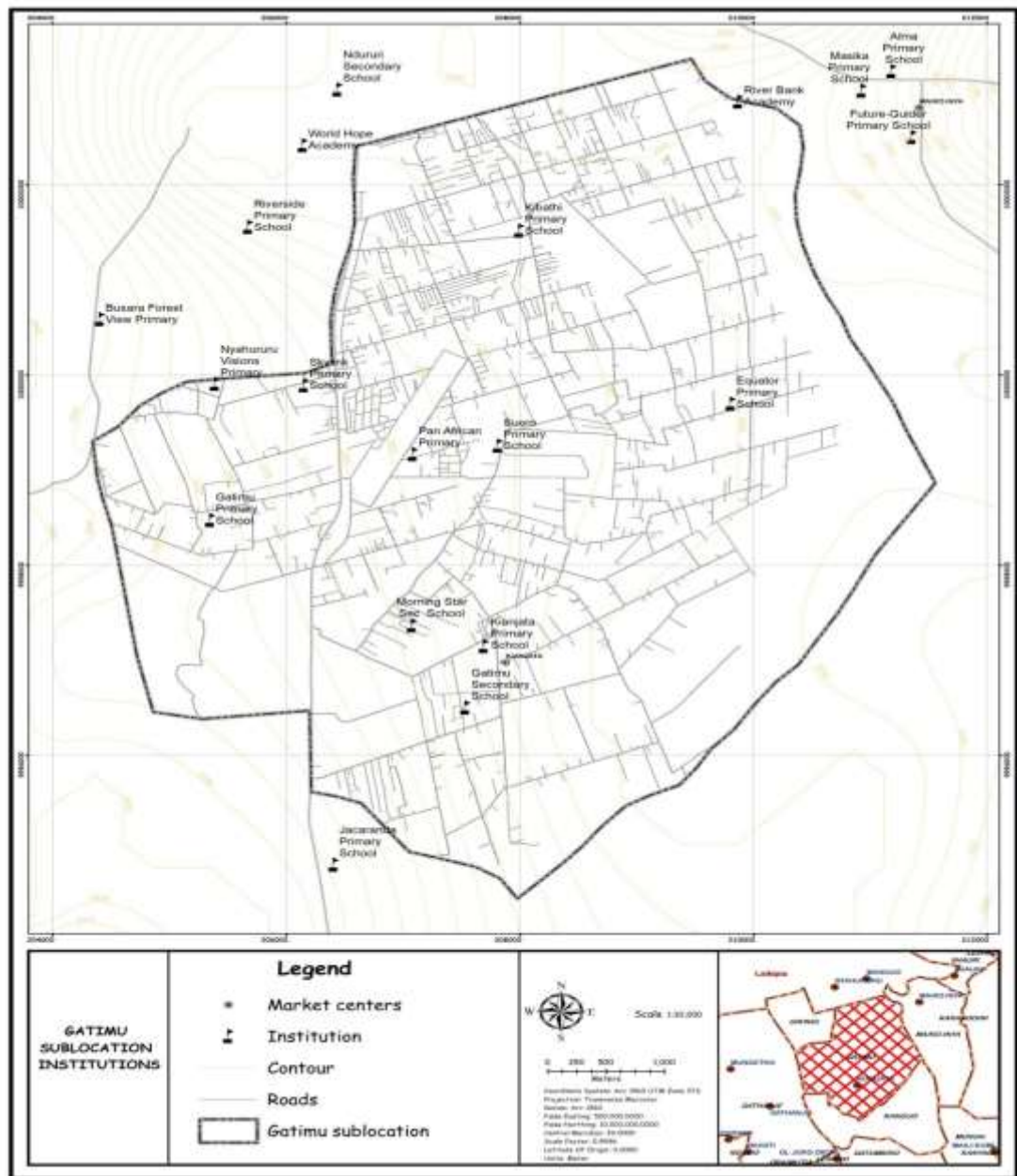
**Map 4.5: Infrastructure map**

Source: Author, 2018

#### **4.5 Educational institutions**

There are 9 primary schools and 2 secondary schools within Gatimu Sub location. The below map indicated the spatial location of various educational facilities within the area.



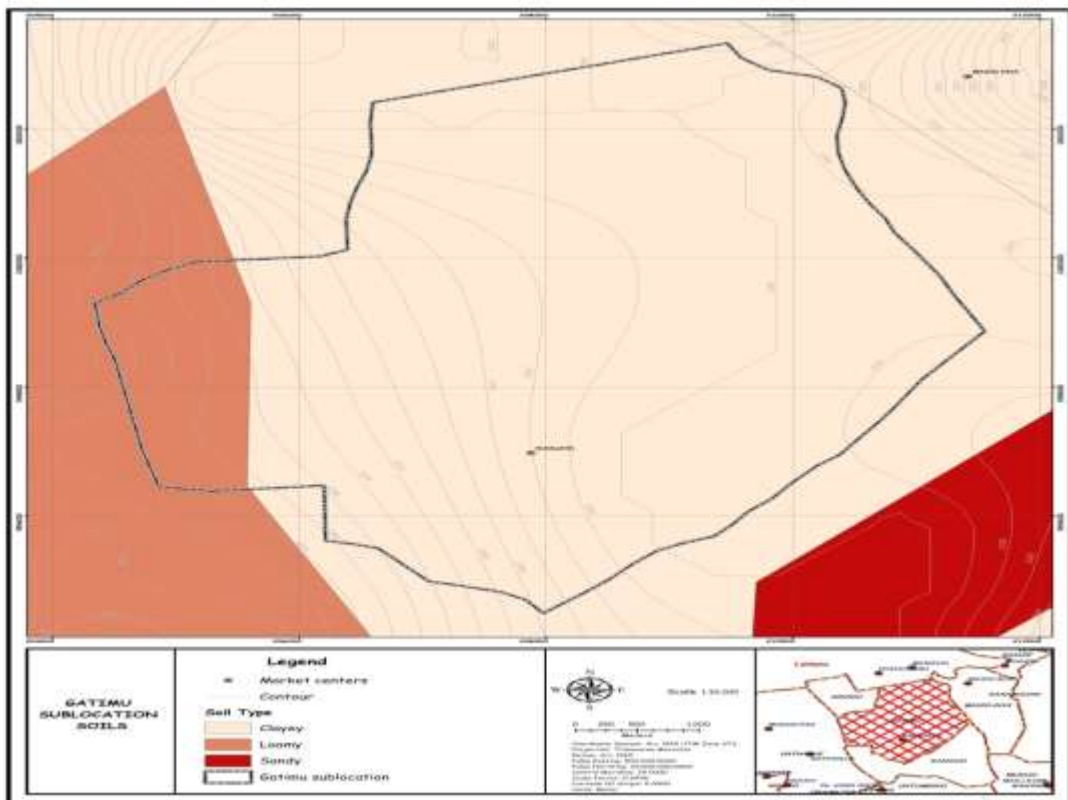
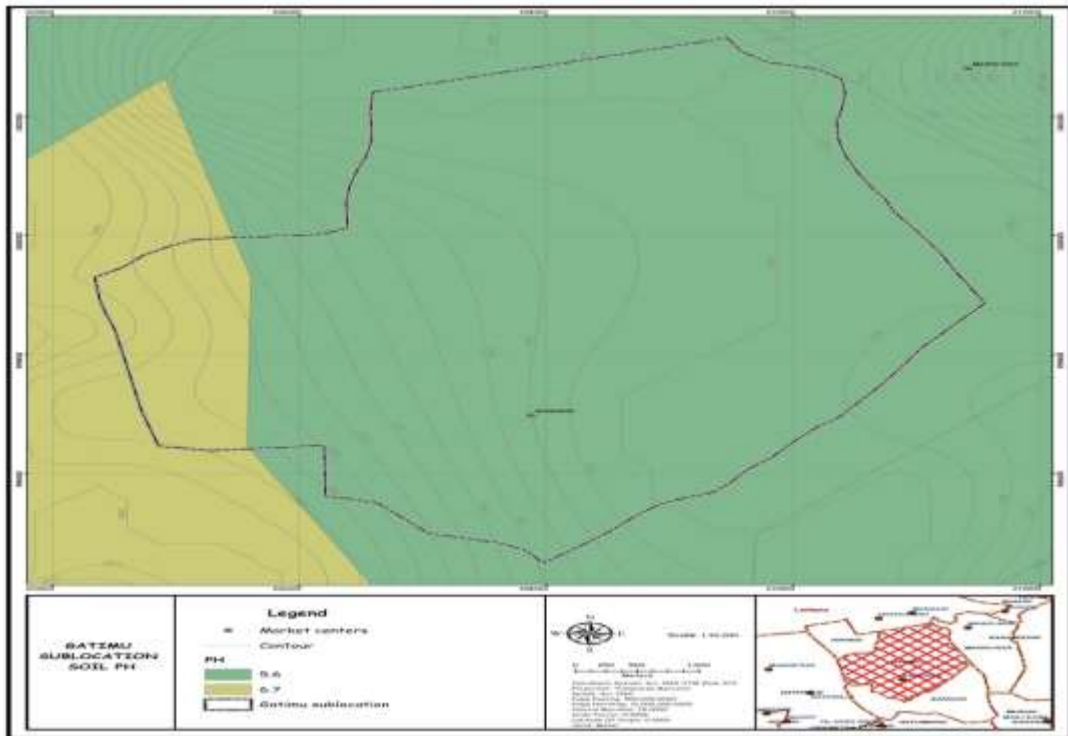


**Map 4.6: Educational map**

Source: Author 2018

#### 4.6 Soil map

About 95% of the soil in Gatimu Sub-location is clay with a P.H. value of 5.6.

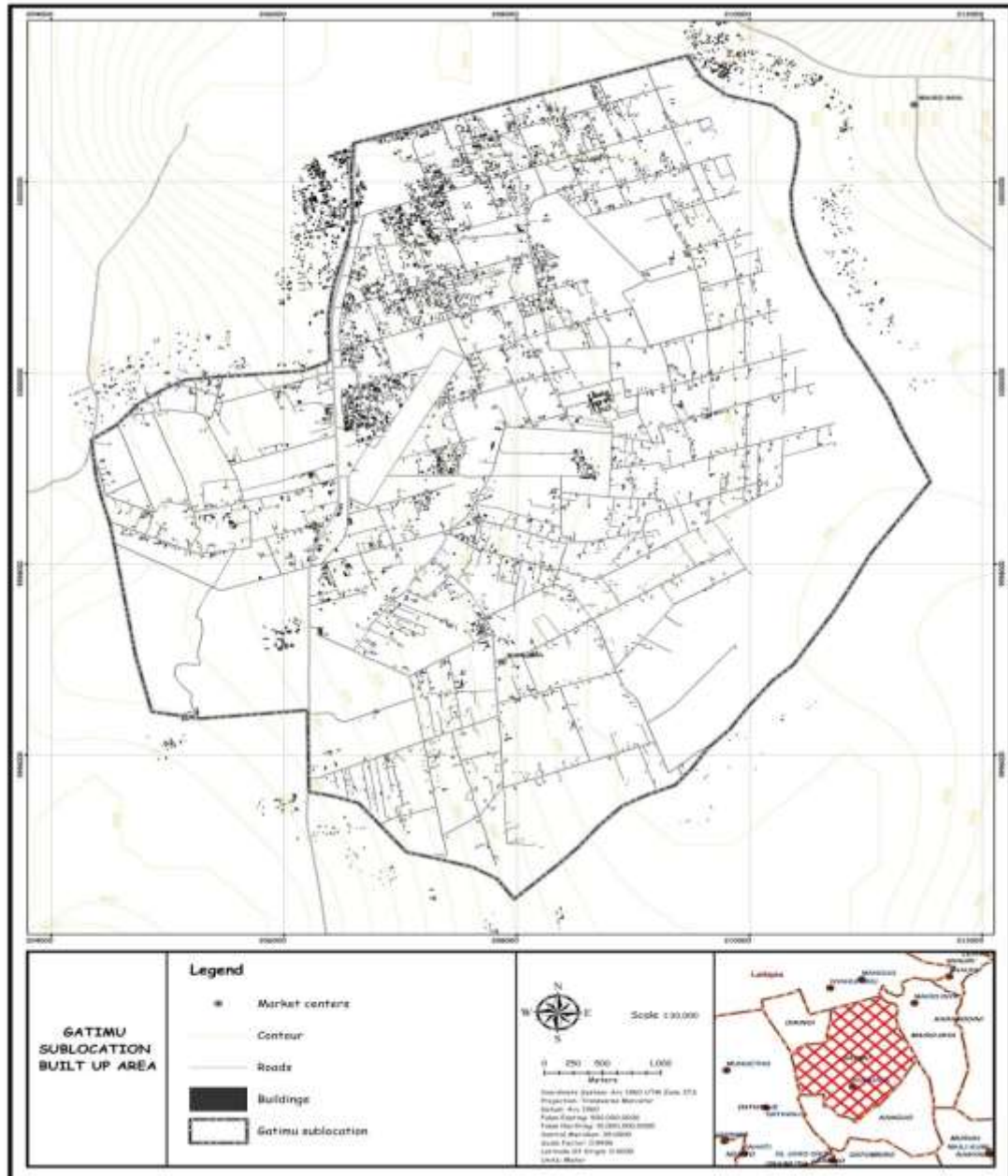


**Map 4.7: Soil Map**

#### **4.7 Human Settlement Map**

Gatimu sublocation lies within oljoorok salient settlement scheme which was part of the white highlands before it was allocated to the natives through the settlement fund

trustee. The allottees were allocated equal settlement plots that have since been subdivided to meet the demand of the rapidly growing population. Below is a human settlement map for the sublocation.



**Map 4.8: Human Settlement Map**

Source: Author, 2018

## CHAPTER FIVE

### RESEARCH FINDINGS

#### 5.1 Introduction

This chapter presents the research findings. The results are presented in the form of tables, figures, charts, photos, maps as well as in text form. The analysis comprises of descriptive and inferential statistics and is presented according to the objectives.

#### 5.2 Response rate

The study targeted all the households within Gatimu sub-location in Nyandarua County that practice dairy and non-dairy farming and from these it used 140 households as the sample size which was selected randomly. The head of the household responded on behalf of the household. The questionnaires were fully responded to, registering a response rate of 100%. This was excellent and sufficient for the analysis (Mugenda and Mugenda, 2008).



**Figure 5.1: Data collection process**

#### 5.3 Basic information of the respondents

This section presents the basic information of the respondents as well as the households.

### 5.3.1 Respondents profile

The profile of the household heads was taken. This included their villages, marital status, their gender and age. The results were as presented in Table 5.1.

**Table 5.1: The respondent's profile**

Variable		Frequency	Percent	Cumulative Percent
Villages	Gatimu(Jamuhuri)	36	25.7	25.7
	Gatimu(Baraka A)	12	8.6	34.3
	Gatimu(Baraka B)	17	12.1	46.4
	Gatimu(Kisima)	28	20.0	66.4
	Gatimu(Muhindi)	22	15.7	82.1
	Gatimu(Turbo)	20	14.3	96.4
	Gatimu(Nyairobi)	5	3.6	100.0
	Total	140	100.0	
Marital Status	Married	111	81.6	81.6
	Single	13	9.6	91.2
	Widowed	9	6.6	97.8
	Divorced	1	0.7	98.5
	Separated	2	1.5	100.0
	Total	136	100.0	
Gender	Male	44	32.4	32.4
	Female	92	67.6	100.0
	Total	136	100.0	
		<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
Age of the household head		132	47.29	14.451

The results indicated that the respondents came from seven villages namely Jamuhuri, Baraka A, Baraka B, Kisima, Muhindi, Turbo and Nyairobi. From these, majority, 25.7%, came from Jamuhuri. Others were Kisima at 20%, Muhindi 15.7%, Turbo 14.3%, followed by Baraka B and Baraka A at 12.1% and 8.6% respectively and finally the least came from Nyairobi who were 5% of the total respondents.

The results showed that majority of the household heads, 81.6%, were married, 9.6% were single, 6.6% were widowed and 1.5% were separated while 0.7% were divorced.

Again majority of the respondents, 67.6%, were female while 32.4% were male and on average they were aged 47.29 with a standard deviation of 14.451.



**Figure 5.2: The Chief and Asst- chief in Gatimu location together with village elders**

### **5.3.1 Household data general information**

The household data was analysed in this section. The information comprised of the household size, education level of the household members and also the inheritance status and cultural practices behind land inheritance. The results were as presented in Table 5.2.

**Table 5.2: Descriptive statistics for household information**

Sub location name		N	Min	Max	Mean	SD
Gatimu (Jamuhuri)	What is the size of your household	36	2	12	5.75	1.918
	How many sons	33	0	6	2.36	1.295
	How many Daughters	28	1	5	2.21	1.166
Gatimu (Baraka A)	What is the size of your household	12	2	11	5.33	2.425
	How many sons	10	0	6	2.00	1.764
	How many Daughters	12	0	5	2.00	1.477
Gatimu (Baraka B)	What is the size of your household	23	3	11	6.00	1.931
	How many sons	21	1	8	2.62	1.830
	How many Daughters	21	0	4	2.10	.944
Gatimu (Kisima)	What is the size of your household	27	2	10	5.41	2.024
	How many sons	26	0	4	1.81	1.167
	How many Daughters	25	0	7	2.08	1.498
Gatimu (Muhindi)	What is the size of your household	22	2	9	5.14	1.781
	How many sons	19	0	6	2.37	1.499
	How many Daughters	17	1	3	1.76	.831
Gatimu (Turbo)	What is the size of your household	21	3	14	5.86	2.798
	How many sons	21	0	4	1.81	1.365
	How many Daughters	19	0	8	2.42	1.895
Gatimu (Nyairobi)	What is the size of your household	14	3	11	5.64	2.678
	How many sons	12	0	8	2.25	2.094
	How many Daughters	11	1	6	2.55	1.508

The results in Table 5.2 shows descriptive analysis of household information. The results were presented according to the villages sampled from. Respondents from Gatimu (Iria-Ini) and Gatimu (Baraka B) had the highest number of household members with an average of 3 sons and 2 daughters.

On average, each household in Gatimu location had 6 members with 2 daughters and 2 sons. The results also indicated the education level and the occupation of the husband and wife in the household.

**Table 5.3: Descriptive statistics for household information**

Variable		Husband		Wife		
		Frequency	Percent	Frequency	Percent	
Education level		-	-	3	2.4	
		-	-	1	.8	
	Primary	50	46.3	53	41.7	
	Secondary	41	38.0	57	44.9	
	Tertiary	17	15.7	13	10.2	
	Total	108	100.0	127	100.0	
Occupation	Business	14	16.5	20	22.5	
	Farmer	20	23.5	44	49.4	
	Civil servant	6	7.1	3	3.4	
	Casual work	9	10.6	4	4.5	
	Housewife	-	-	6	6.7	
	Pastor/Bishop	1	1.2	1	1.1	
	Tailor	-	-	2	2.2	
	Chef	1	1.2	-	-	
	Driver	7	8.2	1	1.1	
	Nurse/Medic	2	2.4	2	2.2	
	Teacher	6	7.1	1	1.1	
	Foreman	2	2.4	-	-	
	Electrician	2	2.4	-	-	
	Athletee	1	1.2	-	-	
	Carpenter/Masonary	6	7.1	-	-	
	Masonary	5	5.9	-	-	
	Army/Police	1	1.2	-	-	
	Retired	1	1.2	1	1.1	
	Accountant	1	1.2	-	-	
	Salonist	-	-	1	1.1	
	Banking	-	-	1	1.1	
	Secretary	-	-	2	2.2	
		Total	85	100.0	89	100.0

The results revealed that majority, both the husband and the wife, were farmers (23.5% and 49.4% respectively) and majority of the husbands had primary education as their



highest education level (46.3%) while majority of the wives had secondary as their highest level of education (44.9%).

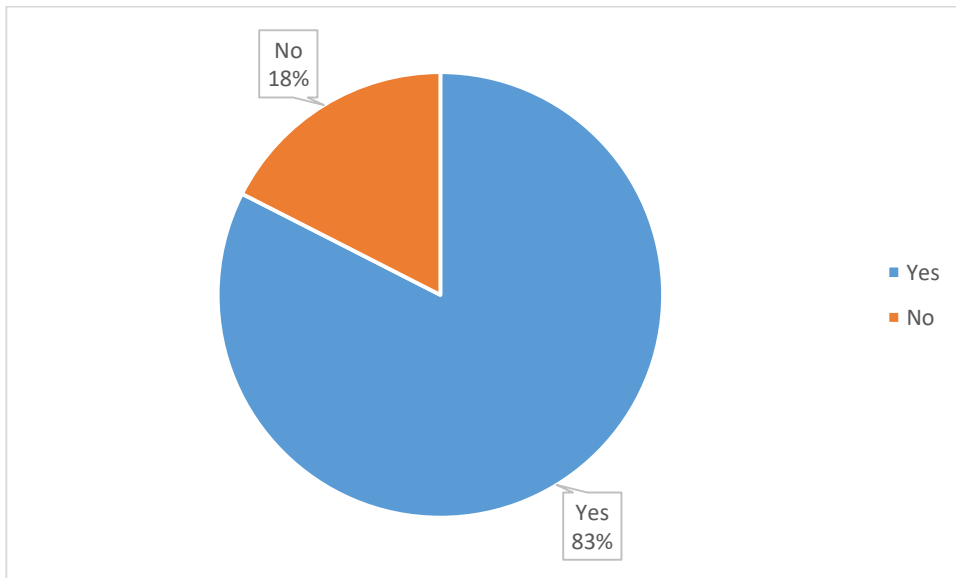
### Information on Inheritance

The study sought to understand how inheritance was conducted among the respondents in terms of the number of brothers and sisters the respondent had at the time of land inheritance, whether all received equal shares as well as whether there were any cultural practices around the land use and inheritance.

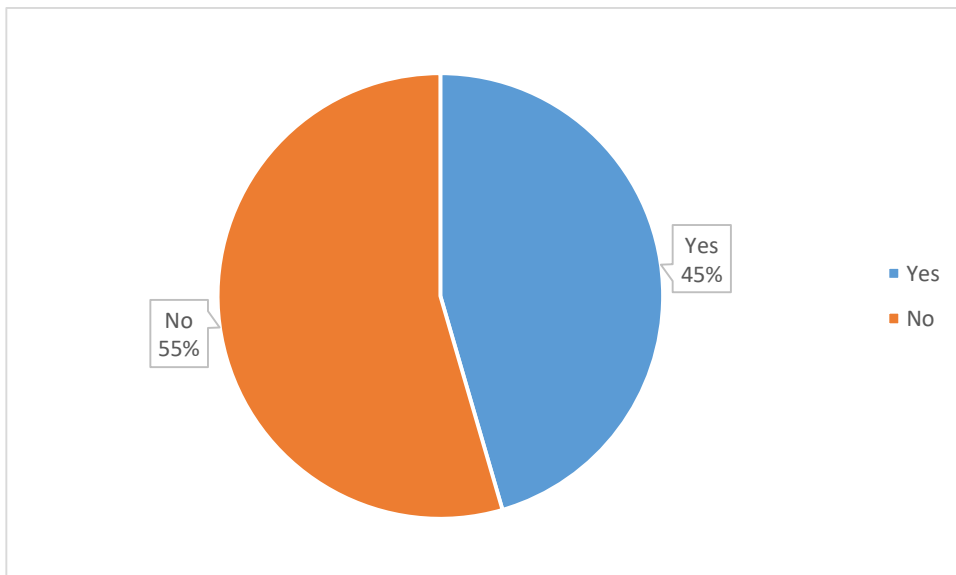
**Table 5.4: Brothers and sisters present at the time of Inheritance**

Sub location name		N	Min	Max	Mean	SD
Gatimu (Jamuhuri)	How many sons	33	0	6	2.36	1.295
	How many Daughters	28	1	5	2.21	1.166
	How many acres did each of your sisters inherit	0				
	How many sons	10	0	6	2.00	1.764
Gatimu(Baraka A)	How many Daughters	12	0	5	2.00	1.477
	How many acres did each of your sisters inherit	5	.25	2.00	.9000	.67546
	How many sons	21	1	8	2.62	1.830
	How many Daughters	21	0	4	2.10	.944
Gatimu(Baraka B)	How many acres did each of your sisters inherit	12	.50	10.00	1.9167	2.60099
	How many sons	26	0	4	1.81	1.167
	How many Daughters	25	0	7	2.08	1.498
	How many acres did each of your sisters inherit	6	.50	10.00	2.1667	3.84274
Gatimu(Kisima)	How many sons	19	0	6	2.37	1.499
	How many Daughters	17	1	3	1.76	.831
	How many acres did each of your sisters inherit	2	1.00	6.00	3.5000	3.53553
	How many sons	21	0	4	1.81	1.365
Gatimu(Turbo)	How many Daughters	19	0	8	2.42	1.895

Gatimu(Nyairobi)	How many acres did each of your sisters inherit	1	1.00	1.00	1.0000	.
	How many sons	12	0	8	2.25	2.094
	How many Daughters	11	1	6	2.55	1.508
	How many acres did each of your sisters inherit	5	.50	1.00	.6500	.22361



**Figure 5.3: Equality during inheritance**



**Figure 5.4: Sister's inheritance status**

The results showed that the respondent had an average of 3 brothers at the time of inheritance and 82% of them said that they received an equal share while 18% said

otherwise. Again the results indicated that the respondent had an average of 2 sisters at the time of inheritance and 55% said that they did not inherit land while 45% indicated that they did. For those who inherited land the results also indicated that they inherited an average of 1.7232 acres.

**Table 5.5: Cultural practices around the use and inheritance of land**

Response	Frequency	Percent	Cumulative Percent
Yes	29	24.0	24.0
No	88	72.7	96.7
Not aware	4	3.3	100.0
Total	121	100.0	

The results in Table 5.5 shows that 72.7% said there were no any cultural practices around the use and inheritance of land, 24% said there was while 3.3% said they weren't aware.

#### **5.4 Current household land size and its implication on food and livelihood**

##### **Security**

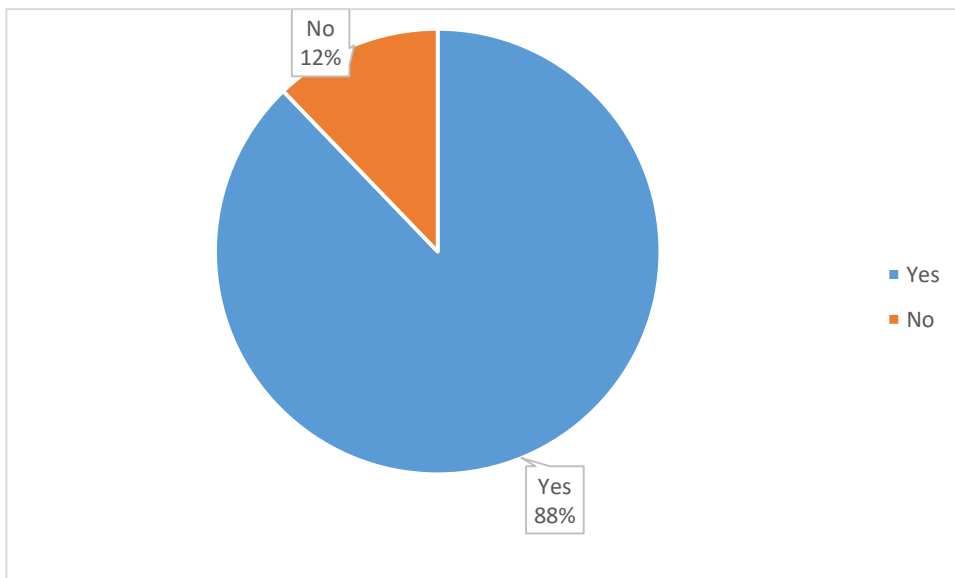
The first objective of this study aimed at examining the current household land size and its implication on food and livelihood security in a dairy farming system of Gatimu sub location. This section discusses the household land size, food and livelihood security and finally the impact of household land size on food and livelihood security.

##### **Land holding arrangements**

The first objective of the study sought to explain the current household land size and its implication on food and livelihood security in Gatimu sub-location. Therefore the respondents were asked questions seeking to meet the objective. First the respondents who were the household heads were asked whether they owned land, if yes, how many pieces they owned, the total land size owned by the family, use of the land and spatial location. The responses were given as below:

#### 5.4.1 Land ownership

The study evaluated land ownership status of the respondents and the results were as indicated in Figure 5.5.



**Figure 5.5: Land ownership**

The results indicated that 88% of the respondents owned their own land while 12% did not legally own land.

#### 5.4.2 Owned land characteristics

Table 5.6 shows the characteristics of household land. The analysis showed land characteristics according to the villages.

**Table 5.6: Land Characteristics**

Sub location name		N	Min	Max	Mean	SD
Gatimu (Jamuhuri)	What is the total owned family land size in acres	31	.125	9.500	1.064	1.93
	How many pieces of land do you own	32	.25	5000.0	157.38	883.67
	Spatial location and distance (Km)	0				
Gatimu (Baraka A)	What is the total owned family land size in acres	10	.125	9.500	1.97	3.028
	How many pieces of land do you own	11	1.00	5000.0	910.36	2021.97
	Spatial location and distance (Km)	0				
Gatimu (Baraka B)	What is the total owned family land size in acres	20	.125	1.750	.712	.532
	How many pieces of land do you own	21	1.00	5000.0	477.57	1503.50
	Spatial location and distance (Km)	0				
Gatimu (Kisima)	What is the total owned family land size in acres	21	.125	5.000	1.089	1.409
	How many pieces of land do you own	24	.50	5000.0	834.31	1903.02
	Spatial location and distance (Km)	2	0	2	1.08	1.308
Gatimu (Muhindi)	What is the total owned family land size in acres	20	.125	5.000	.962	1.48
	How many pieces of land do you own	20	.50	3.00	1.32	.765
	Spatial location and distance (Km)	0				
Gatimu (Turbo)	What is the total owned family land size in acres	14	.125	1.000	.401	.220
	How many pieces of land do you own	18	.25	5000.0	278.76	1178.26
	Spatial location and distance (Km)	0				
Gatimu (Nyairobi)	What is the total owned family land size in acres	11	.125	5.500	1.488	1.683
	How many pieces of land do you own	13	.50	5000.0	386.65	1386.13
	Spatial location and distance (Km)	0				

Check the numbers highlighted yellow?

The results showed the total family land size owned, the number of land pieces owned and the spatial location and the distance of the land from the homes of the respondents. The results indicated that, on average the households in Gatimu sub-location who practice dairy farming own an average of 0.99013 acres of land and each household owns an average of 2 pieces and the spatial location and distance is 1.08 km on average.

The study went ahead to find out some of the characteristics of the land owned in terms of acquisition mode, main use of the land, tenure system and ownership document issued. The results were included in Table 5.7.

**Table 5.7: Owned land characteristics**

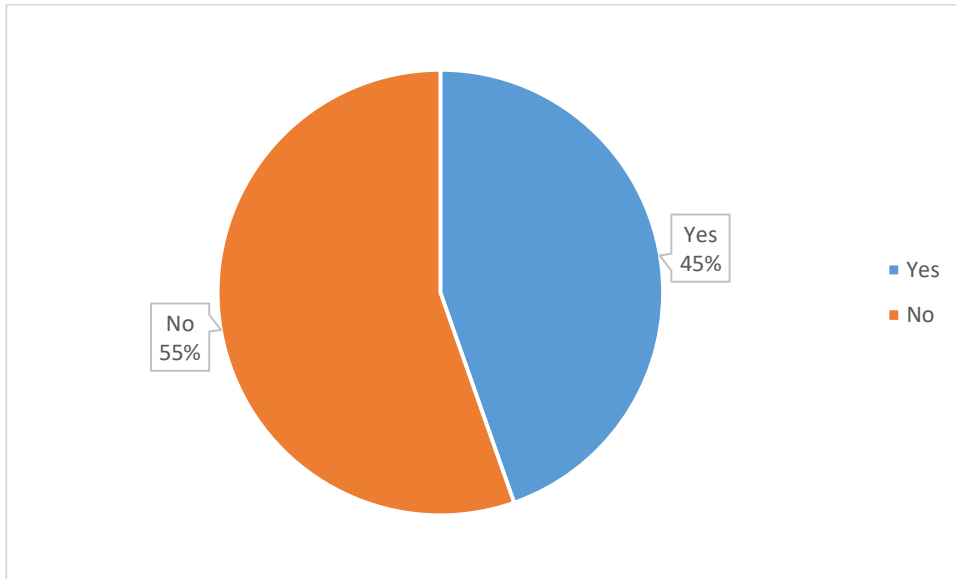
Sub location name		Frequency	Percent
Gatimu (Jamuhuri)	Bought	28	93.3
	Inherit	1	3.3
	Lease	1	3.3
	Total	30	100.0
Gatimu (Baraka A)	Bought	7	77.8
	Inherit	1	11.1
	Lease	1	11.1
Gatimu (Baraka B)	Total	9	100.0
	Bought	13	72.2
	Inherit	5	27.8
Gatimu(Kisima)	Total	18	100.0
	Bought	14	82.4
	Inherit	3	17.6
Gatimu(Muhindi)	Total	17	100.0
	Total	14	100.0
Gatimu(Turbo)	Bought	19	100.0
	Bought	10	90.9
Gatimu(Nyairobi)	Inherit	1	9.1
	Total	11	100.0
	Bought	6	60.0
Gatimu(Jamuhuri)	Inherit	4	40.0
	Total	10	100.0
	Farming	12	37.5
	Homestead	15	46.9
Gatimu(Baraka A)	Settlem./Farming	5	15.6
	Total	32	100.0
	Farming	3	30.0
	Homestead	6	60.0
Gatimu(Baraka B)	Settlem./Farming	1	10.0
	Total	10	100.0
	Farming	13	61.9
	Homestead	7	33.3
Gatimu(Kisima)	Settleme./Farming	1	4.8
	Total	21	100.0
	Farming	8	33.3
	Homestead	15	62.5
Gatimu(Muhindi)	Settleme./Farming	1	4.2
	Total	24	100.0
	Farming	4	21.1
Gatimu(Turbo)	Homestead	9	47.4
	Settleme./Farming	6	31.6
	Total	19	100.0
Gatimu(Turbo)	Farming	1	5.9
	Homestead	9	52.9

	Settleme./Farming	7	41.2
	Total	17	100.0
	Farming	3	23.1
	Homestead	7	53.8
Gatimu(Nyairobi)	Settleme./Farming	3	23.1
	Total	13	100.0
	Freehold	29	96.7
Gatimu(Jamuhuri)	Lease	1	3.3
	Total	30	100.0
	Freehold	7	87.5
Gatimu(Baraka A)	Lease	1	12.5
	Total	8	100.0
Gatimu(Baraka B)	Freehold	18	100.0
Gatimu(Kisima)	Freehold	17	100.0
Gatimu(Muhindi)	Freehold	19	100.0
Gatimu(Turbo)	Freehold	11	100.0
Gatimu(Nyairobi)	Freehold	9	100.0
	Title	29	96.7
Gatimu(Jamuhuri)	Lease document	1	3.3
	Total	30	100.0
	Title	8	88.9
Gatimu(Baraka A)	Lease document	1	11.1
	Total	9	100.0
Gatimu(Baraka B)	Title	18	100.0
Gatimu(Kisima)	Title	17	100.0
Gatimu(Iria-Ini)	Title	14	100.0
Gatimu(Muhindi)	Title	19	100.0
Gatimu(Turbo)	Title	11	100.0
Gatimu(Nyairobi)	Title	11	100.0

The results in Table 5.7 revealed that majority of the respondents, 86.1% bought their land, 11.9% inherited while 2% had leased land. The household's main use of the land were found to be homestead as indicated by the majority, 51.2%, followed by dairy farming, 31.4%, followed by those who do both dairy farming and settlement. Majority of the households had the tenure system as freehold indicated by 98% of the respondents while the rest 2% indicated lease. Finally, on the ownership document used, majority of the respondents, 98% indicated Title as the ownership document they were issued while 2% of them said they were issued a lease document.

#### 5.4.3 Renting characteristics

The study sought to understand the renting characteristics of the households in Gatimu sub-location. Figure 5.6 and Table 5.7 shows the results.



**Figure 5.6: Renting status**

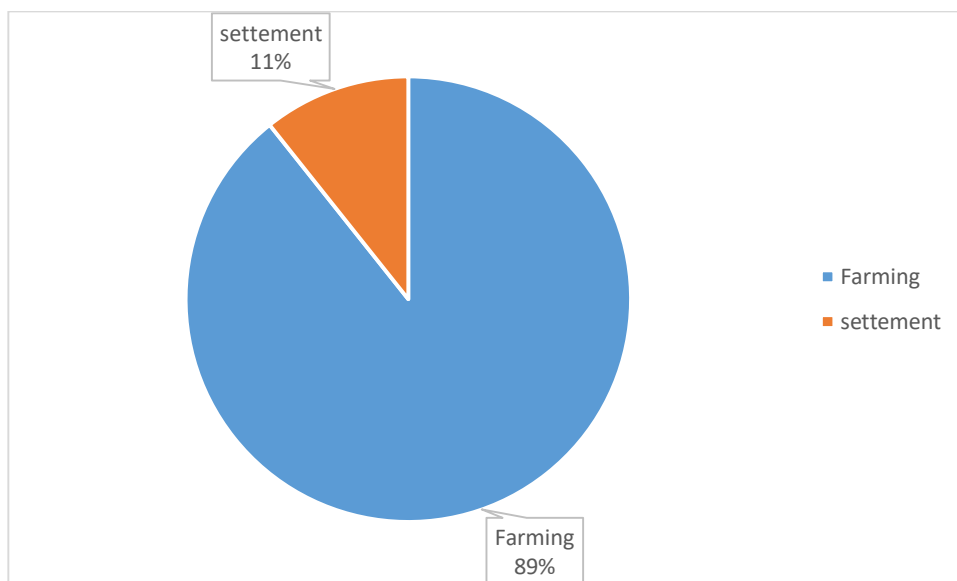
From Figure 5.6, majority of the respondents, 55%, said they did not rent any land while 45% said they did. Majority of the households in Gatimu sub-location own land and therefore those renting the land are not very many.

**Table 5.8: Renting conditions**

	N	Minimum	Maximum	Mean	Std. Deviation
Spatial location and distance (km)	4	.3	.9	.413	.3250
Size in acres	58	.010	5.000	1.13379	1.127833
Duration of renting	57	1	18	4.75	4.815
Cost of renting (annually)	53	500	500000	44471.70	131627.895

The results in Table 5.8 revealed that those who were renting their land rented 1.13379 acres on average for a duration of 5 years at a cost of Kes 44,471.70 annually. The land was located at a spatial location and distance of 0.413 Km from their homes. Finally, majority, 89%, of the respondents indicated that the land rented was used mainly for farming while 11% indicated that it was used for settlement.





**Figure 5.7: Land use**

#### 5.4.4 Parent's land subdivision

This section shows the characteristics of the land owned by the parents of the respondents. These characteristics included, whether there have been any land subdivision in the household, and if there have been any, the number of heirs. The results were as indicated in Table 5.9.

**Table 5.9: Parents land Characteristics**

		Frequency	Percent	Cumulative Percent
Sub-division status	Yes	52	48.2	48.1
	No	56	51.8	100.0
	Total	108	100.0	
Opinion about sub-division land among heirs as a country	Yes	96	75.0	75.0
	No	32	25.0	100.0
	Total	128	100.0	
Reason to Support subdivision of land	Land is expensive	32	49.2	49.2
	Land is limited	7	10.8	60.0
	Lack of finance	3	4.6	64.6
	Population increase	1	1.5	66.2
	Inherit parents land	5	7.7	73.8

	Transferring land rights	4	6.2	80.0
	people have different skills	13	20.0	100.0
	Total	65	100.0	
Reason for not supporting land sub-division	Community farming	2	14.3	14.3
	enhance commercial agriculture	3	21.4	35.7
	Reduces productivity	6	42.9	78.6
	Promote urbanization	1	7.1	85.7
	Promote land ownership	2	14.3	100.0
	Total	14	100.0	
	Major problem of subdivision of land	Low Productivity	15	12.1
Dispute		67	54.0	66.1
Less Yields		11	8.9	75.0
Low Living Standards		2	1.6	76.6
Loss of soil fertility		12	9.7	86.3
Reduced farming space		17	13.7	94.4
Total		124	100.0	

The findings revealed that majority of the parents, 51.8% have not done any land subdivision yet while 48.2% have. 75% of the respondents were in support of land subdivision among heirs and indicated that it was because buying land has become very expensive and scarce and the flow of money to purchase has become inadequate and there has been a population increase. The respondents also indicated that they were transferring land rights. Also, the people had different skills which would add value to the land and hence supported land subdivision. Up to 25% of the respondents did not support land subdivision because it would reduce productivity and so they encouraged communal farming, enhanced commercial agriculture and promotion of urbanization. Some again who did not support land subdivision among heirs said they supported land

ownership of individuals and not relying on the family land. The study went ahead and investigated the major problems associated with land sub-division and found that it results to reduced productivity (12.1%), brings dispute in the family (67%), low living standards among the people (1.6%) and reduced farming space (13.7%).

**Table 5.10: Parents land characteristics**

	N	Minimum	Maximum	Mean	Std. Deviation
How big was your parents land parcel before any sub-division	131	1	20	5.37	3.740
If there has been any subdivision then how many heirs or beneficiaries?	48	1	9	3.35	1.907
In your opinion, given the crops grown and livestock reared in this sub location, how much land would be enough for your household?	109	1	200	20.59	31.228

Results in Table 5.10 revealed that the parents land parcel before land subdivision was 5.37 acres and the results indicated that approximately 3 heirs have benefited from the land subdivision. The respondents said that they required at least 20.59 acres of land to grow crops and rear livestock comfortably in Gatimu sub-location. According to Table 5.11 the reasons given were that the land would be sufficient for farming (77.8%), would increase productivity (11.1%) and that that is what they would be able to financially support (11.1%).

**Table 5.11: Reason for the preferred number of acres**

		Frequency	Percent	Cumulative Percent
Explain your reason for the preferred number of acres	Sufficient for Farming	28	77.8	41.7
	Financial support	4	11.1	52.8
	Increase productivity	4	11.1	100.0
	Total	36	100.0	

## 5.5 Land uses and impact on food and livelihood security

The study also sought to understand the land uses and the impact they have on food and livelihood security.

### 5.5.1 Main economic activity

The study sought to understand the main economic activity the household head engages in. The results were as presented in Table 5.12

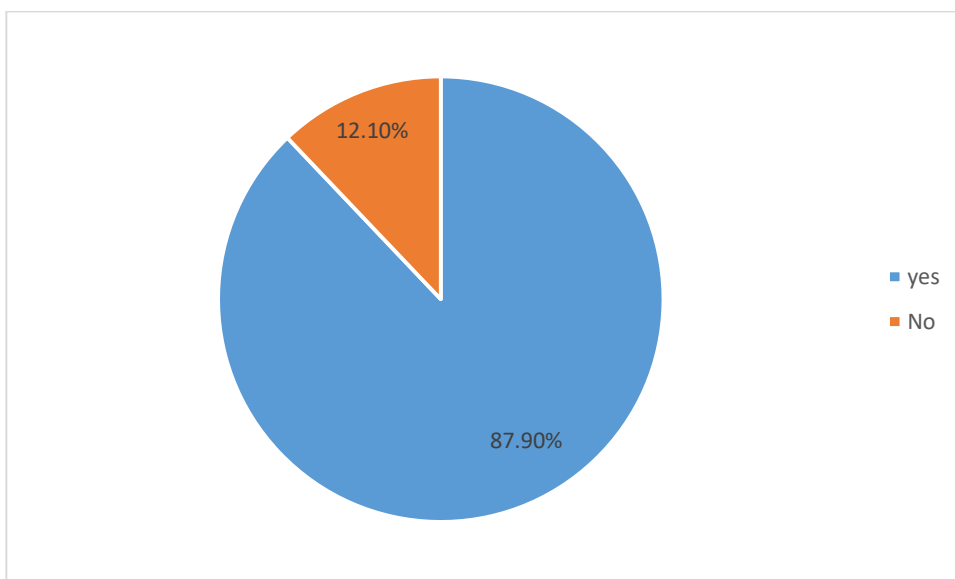
**Table 5.12: Main economic activity**

	Frequency	Percent	Cumulative Percent
Business	35	28.5	28.5
Casual work	9	7.3	35.8
Pastor/Bishop	1	.8	36.6
Farming	66	53.7	90.2
Driver	9	7.3	97.6
Athlete	1	.8	98.4
Others	2	1.6	100.0
Total	123	100.0	

The results indicated that majority, 53.7%, engaged in farming as their main economic activity, 28.5% were in business, 7.3% were casual laborers, 7.3% again were drivers, pastor/bishop were 0.8%, athletes were 0.8% while 1.6% were into other employments.

### 5.5.2 Agricultural practice

The household heads were asked whether they practiced any form of agriculture and their answers were as presented in Figure 5.8.



**Figure 5.8: Agriculture practice**

The results indicated that nearly all, 87.9% of the households practice agriculture while 12.1% did not.

### 5.5.3 Main crop land use activity on the farm

The study sought to find out the main crops planted on the land and the results were as presented in Table 5.13.

**Table 5.13: Main crop land use activity on the farm**

Crop	N	Percent	Area in M2	Average Yield per season	Units consumed (Kgs)	Units sold (Kgs)	Average income earned (Ksh)
Maize	110	48.9%	28.75	209.41	83.67	161.74	22806.25
Kales	18	8.0%	12.63	14.0	5.67	12.90	412.00
Beans	34	15.1%	3.9	20.16	11.71	-	-
Potatoes	46	20.4%	24.27	368.81	195.90	215.38	12105.00
Peas	12	5.3%	0.25	38.50	8.50	30.00	800

Horticulture	5	2.2%	0.166	4016.67	275.00	3725.0	61375.0
			7			0	0
Total	22	100.0					
	5	%					

The results indicated that Maize (48.9%) was the most common crop planted on the farm occupying an average area of 28.75 square metres. The production was found to be 209.41 kgs per season on average. From all the yield, an average of 83.67 kgs were consumed by the household while an average of 161.74 Kgs were sold out making an average income of Ksh. 22, 806.25. Potatoes (20.4%) was the second most common crop planted on the farm occupying an average area of 24.27square metres. The production was found to be 368.81 kgs per season on average. From all the yield, an average of 195.90 kgs were consumed by the household while an average of 215.38 Kgs were sold out making an average income of Ksh. 12,105.00. The third crop grown on the farm was beans (15.1%) and was found to occupy an average area of 3.9 square metres. The yield was found to be 20.16 kgs per season on average. From all the yield, an average of 11.71 kgs were consumed by the household while none was sold. Kales followed with 8% of the respondents saying they grew it on an average area of 12.63 square metres of the farm. The average yield per season was found to be 14 kg and on average 5.67kgs were consumed while 12.9% was sold earning the household owner an approximate of Ksh. 412. Peas was found to be the second least popular crop grown on the farm. The respondents indicated that the crop was grown on an average area of 0.25 square metres and yielding an average of 38.50 kgs per season. Out of the total yield, an average of 8.50kgs is consumed by the household while an average of 30kgs is sold making an average of Ksh. 800. Horticultural crops (2.2%) were the least grown on the farm by households occupying an area of 0.1667 square metres. The average yield per season was found to be 4,016.67 kgs and on average 275 kgs were consumed

while 3,725 is sold earning the household owner an approximate of Ksh. 6,1375.00.

Check the accuracy of this!



**Figure 5.9: A subdivided farm with maize planted on one section, bare land section and settlement section**

#### 5.5.4 Main Animals/livestock land use activity on the farm

The study sought to find out the animals/livestock reared on the farm and the results were as presented in Table 5.14.

**Table 5.14: Main Animals/livestock land use activity on the farm**

Livestock type	N	Percent	No. of Animals	Average Yield/Animal/Year	Units consumed	Units sold	Average income earned (Ksh)
Chicken	64	31.8 %	13.14	115.72 kgs	46.81kgs	72.20kgs	36194.18
Sheep	40	19.9 %	4.15	3.40 sheep	1.80 sheep	2.00 sheep	10000.00
Cows	75	37.3 %	3.76	136.4000	54.76 ltrs	107.59ltrs	8991.67

Rabbit	3	1.5%	17.67	23.33 rabbits	5.33 rabbits	10.67 rabbits	
Goats	15	7.5%	3.73	123.00	52.86	-	-
Pigs	4	2.0%	3.50	1.00	1.00	-	-
Total	20	100.0					
	1	%					

The results in Table 5.13 shows that 31.8% of the respondents reared an average of 13 chicken on their farm. The chicken yielded approximately 115.72 kgs of meat in a year. An average of 46.81 kgs were consumed while 72.20 kgs were sold giving an annual income of approximately 36, 194.18. The results indicated that the rearing of cows was the most popular in the sub-location as 37.3% of the respondents reared cows. Each respondent reared an average of 4 cows and on an annual basis, each household yielded an average of 136.4 litres of milk. An average of 54.76 litres were consumed within the household while 107.59 litres were sold earning an average of Ksh. 8,991.67. Sheep (19.9%) were the third most popular animals reared in Gatimu sub-location. The findings revealed that each farmer reared an average of 4 sheep where an average of two sheep are consumed within the household while an average of 2 are sold giving an income of Ksh. 10,000.00. Goats were also found to be reared in Gatimu with 7.5% of the respondents saying so. An average of 18 goats are reared by each individual and an average of 52.86 litres of milk consumed within the household. There is no milk sold and therefore no income. Pigs were also found to be reared in Gatimu sub-location with each of the respondents having an average of 4 pigs. They were mostly reared for household consumption where an average of 1 pig is consumed in a year. The respondents did not rear the pigs for commercial purposes.





**Figure 5.10: Sheep grazing in an open field**



#### **4.6 Food and nutrition security**

This section of the study is on food and nutrition security.

##### **4.6.1 Comparison of farm yields before and after subdivision**

The respondents were asked to compare the yield they used to get before and after fathers farm sub-division. The results were as presented in Table 5.15.

**Table 5.15: Comparison of farm yields before and after subdivision**

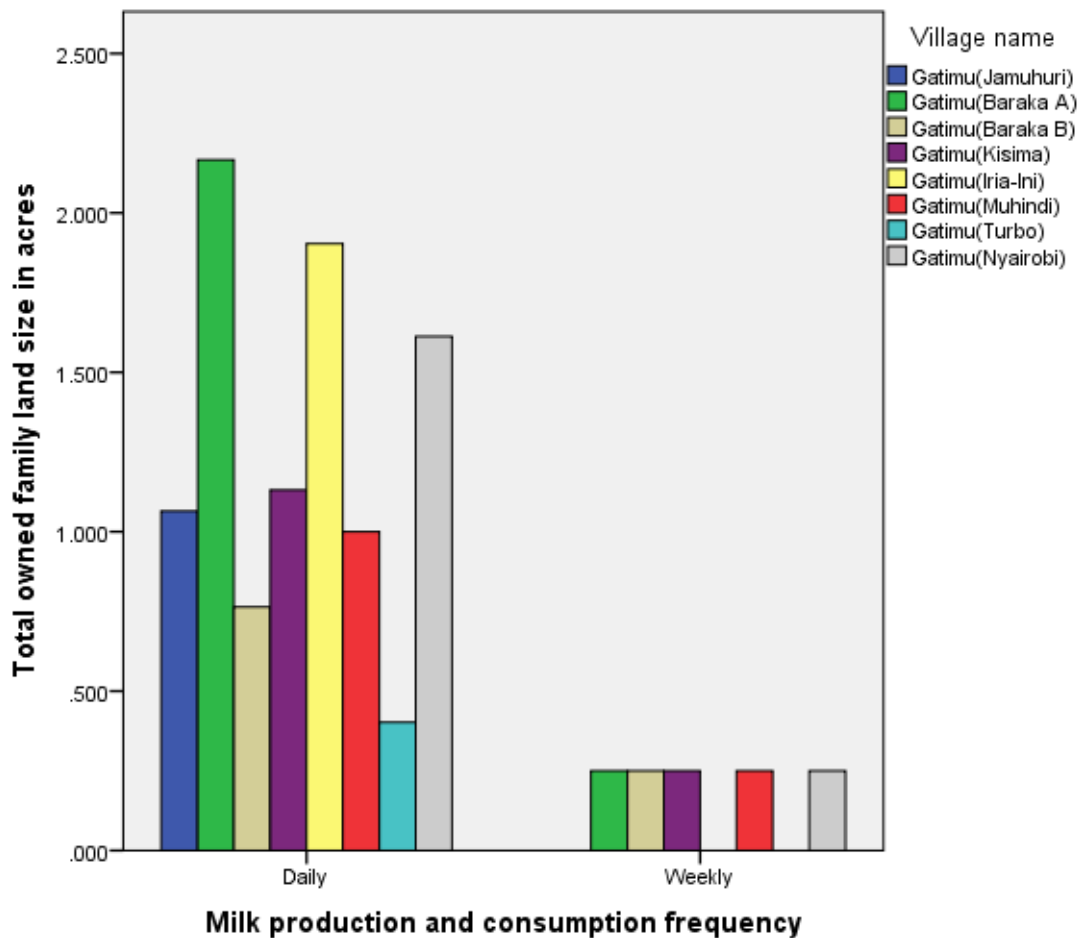
Variable		Frequency	Percent	Cumulative Percent
Yield comparison	Yields are the same	8	6.2	6.2
	Currently yields are more	49	37.7	43.8
	currently yields are lower	68	52.3	96.2
	I'm not sure	5	3.8	100.0
	Total	130	100.0	
Amount of change in yield	A quarter	14	11.2	11.2
	Half	100	80.0	91.2
	Three quarters	11	8.8	100.0
	Total	125	100.0	
Reason for the change in yield	Climate	37	30.6	30.6
	Land size	54	44.6	75.2
	Fertility decrease	4	3.3	78.5
	Land sub-division	4	3.3	81.8
	Fertility	8	6.6	88.4
	Improved farming methods	6	5.0	93.4
	Lack of farm input	8	6.6	100.0
Total	121	100.0		

The results in Table 5.15 indicated that majority, 52.3%, agreed that the yield were lower after sub-division of land, 37.7% said they were more, 6.2% said there was no change while 3.8% said they were not sure. The respondents said that the yield from their farms fed their families for an average of 8 months as seen in Table 5.16.

**Table 5.16: Duration the family feeds from their farms**

	N	Minimum	Maximum	Mean	Std. Deviation
For how many months in a year does the current yield from the farm feed your family?	109	2	12	8.22	3.178

The study went ahead and examined the frequency of milk production and consumption in the seven villages of Gatimu sub-location given the different total household land sizes.



**Figure: 5.11 Milk production and consumption in the villages of Gatimu sub-location given different land sizes.**

The findings showed that those who had larger land sizes made a daily production and consumption of milk while those with less land sizes had weekly production and consumption of milk on average.

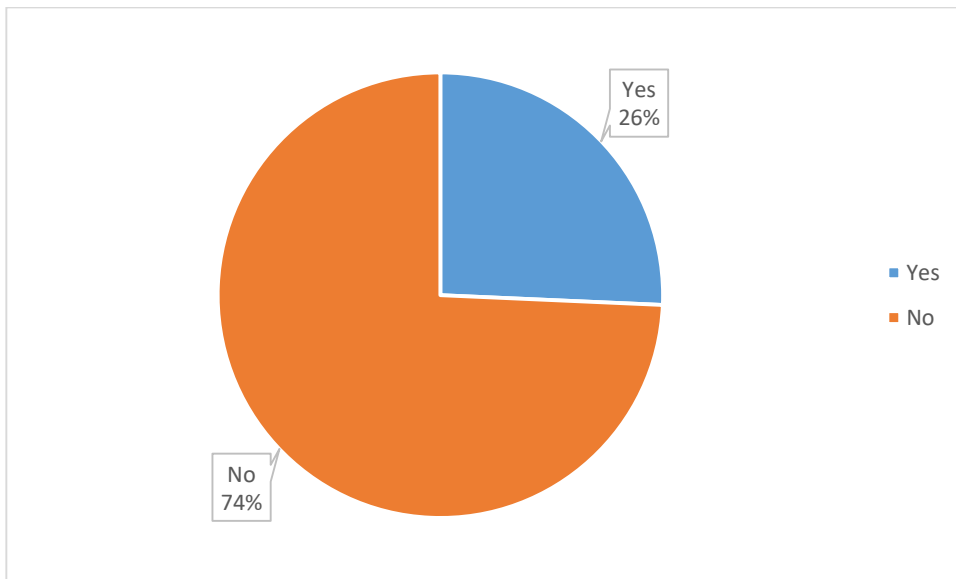
### 5.6.2 Food scarcity period

The study again sought to analyse the period food is scarce and again the intensity of the scarcity. The results were presented in Table 5.17.

**Table 5.17: Food scarcity period**

		Frequency	Percent	Cumulative Percent
<b>At least 12 months</b>	Business	17	85.0	85.0
	Driver	1	5.0	90.0
	Carpenter	1	5.0	95.0
	Farming	1	5.0	100.0
	Total	20	100.0	
<b>9 Months</b>	Business	27	96.4	96.4
	Casual labour	1	3.6	100.0
	Total	28	100.0	
<b>6 Months</b>	Business	20	87.0	87.0
	Farming	3	13.0	100.0
	Total	23	100.0	
<b>3 Months</b>	Business	6	54.5	54.5
	Casual labour	3	27.3	81.8
	Farming	2	18.2	100.0
	Total	11	100.0	

The results indicated that when the food is sufficient (at least 12 months), the respondents are into business (85%) as the other income generating activity, 5% are into driving, carpentry and farming each. When there's mild scarcity, the respondents are into business (96.4%) as the other income generating activity and casual labour (3.6%). When there's moderate scarcity, the respondents rare into business (87%) and farming (13%) as other coping strategies. Finally, when there is severe scarcity (3 months), the respondents employ business (54.5%), casual labour (27.3%) and farming (18.2%) as the coping strategies.



**Figure 5.11: Skipping meal because of food shortage**

Figure 5.11 revealed that majority of the respondents, 74%, said they have never skipped a meal because of food shortage which while 26% have skipped.

### **5.7 Descriptive analysis on views of land subdivision**

This section is on the different views on land subdivision. The results were as presented in Table 5.18.

**Table 5.18: Views on land subdivision**

<b>Statement</b>	<b>Agree (%)</b>	<b>Disagree (%)</b>	<b>Not sure (%)</b>
Land fragmentation exists due to population pressure	120 (95.2)	4 (3.2)	2 (1.6)
Small sub-divided parcels lead to low crop yield	108 (85.7)	9 (7.4)	9 (7.1)
Small-sub divided parcels lead to high crop yield	7 (5.6)	114 (91.9)	3 (2.4)
Modern farming techniques can easily be applied on small land sizes	64 (50.8)	54 (42.9)	8 (6.3)
With small land sizes, number of cattle kept has gone down	97 (77.0)	18 (14.3)	11 (8.7)
Land fragmentation has made people adopt new farming techniques and skills	58 (46.0)	60 (47.6)	8 (6.3)

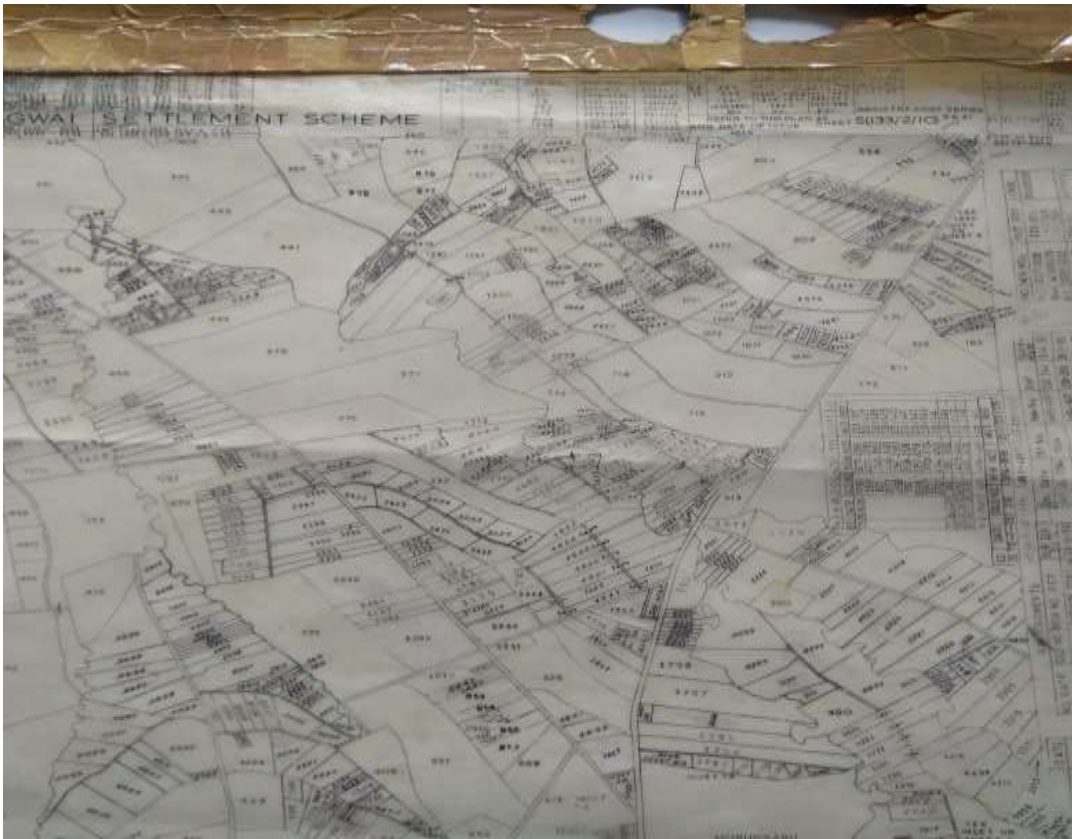
The results indicate that majority of the respondents, 95.2%, agreed that Land fragmentation exists due to population pressure. 85.7%, who were the majority also agreed that small sub-divided parcels lead to low crop yield while 91.9% of the respondents disagreed that small-sub divided parcels lead to high crop yield. The findings also revealed that majority, 50.8%, agreed that modern farming techniques can easily be applied on small land sizes while 42.9% disagreed and 4.6% were not sure. 77% of the respondents agreed that with small land sizes, number of cattle kept has gone down, 14.3% disagreed and 8.7% were not sure. Finally, the results indicate that 47.6% disagreed that land fragmentation has made people adopt new farming techniques and skills while 46% agreed and 6.3% were not sure.



**Figure 5.12: A post advertising for subdivided land (50x100) in Gatimu sub-location**

#### **5.71 Document analysis on land size**

In order to understand the trend of land size in Gatimu sub location, registry index maps and aerial images were analyzed. Majority of the plots had been subdivided into smaller portions owing to the increased population among other factors. This is evidenced by the comparison of a similar map at different times as shown:







**Map 5.1: A map showing 1973 and 2018 land distribution**

From Map 5.1 The trend of land subdivision over time can be noted.

### 5.8 Descriptive analysis on human settlement

This section shows the characteristics of human settlement. The results are as seen in Table 5.19.

**Table 5.19: Characteristics of human settlement**

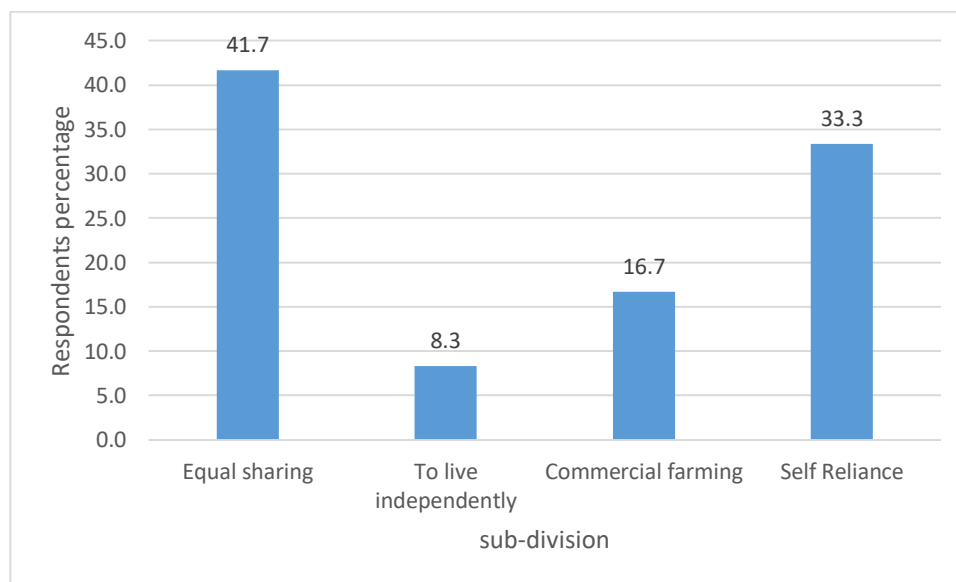
	N	Minimum	Maximum	Mean	Std. Deviation
Total area of homestead compound (Sq. metres)	132	.063	50000.000	3606.47803	8648.906153
Main house - total area (Square metres)	129	.50	8000.00	1412.4612	1672.91618
Main house number of rooms	126	1	10	3.79	1.477
Indicate the total number of other houses in the compound	102	0	10	2.06	1.540

Estimate total area of the otherhouses in the compound (Square metres)	79	1	1000	230.95	218.723
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The results revealed that the average total area of homestead compound was 3606.49 square metres and a standard deviation of 8648.91. The main house on average covered 1412.46 square metres and had an average of 4 rooms as indicated by a mean value of 3.79 and a standard deviation of 1.477. The compound comprised of an average of 2 houses and the estimated area of the other houses in the compound was 230.95 square metres.

### 5.8.1 Organization of farms in the future

The respondents were asked to propose ways of how farms should be organised in the future and the response was presented in Figure 4.11.



**Figure 5.13: Organization of farms in the future**

The results show that majority, 41.7%, said the land should be equally shared among the heirs, 33.3% suggested people to be self-reliance, 16.7% suggested that the heirs

once the subdivision is done to try and do commercial farming while 8.3% suggested that the heirs once land sub-division is done to live independently.

### 5.8.2 Patterns of Human settlement

The respondents were asked to rank the patterns of human settlement in the order of preference and the results were as presented in Table 5.20.

**Table 5.20: Preferred patterns of human settlement**

	Responses		Percent of Cases
	N	Percent	
Scattered	22	28.2%	28.2%
Linear along the roads	3	3.8%	3.8%
Clustered low density	52	66.7%	66.7%
Clustered high rise	1	1.3%	1.3%
Total	78	100.0%	100.0%

The findings in Table 5.21 shows that clustered low density (66.7%) was ranked highly in the order of preference followed by scattered (28.2%), followed by linear along the roads (3.8%) and finally, clustered high rise (1.3%) was less preferred.

### 5.9 Hypothesis Testing

This study sought to test several hypotheses. The findings were as presented below.

#### **H<sub>01</sub>: There is no effect of household land size on food and livelihood security in Gatimu sub-location**

The first objective sought to examine the effect of household land size on food and livelihood security in Gatimu sub-location. To meet this objective a bivariate correlation analysis was conducted to examine the significance of the relationship. An independent t-test was conducted to examine whether there existed a significant difference in land size of those who were food secure and those who were not.

**Table 5.20a: Bivariate Correlation analysis**

		Size of household land in acres	Food Security
Size of household land in acres	Pearson Correlation	1	
	p-value		
	N	116	
Food Security	Pearson Correlation	0.203*	1
	p-value	0.048	
	N	95	109

\*. Correlation is significant at the 0.05 level (2-tailed).

The findings in Table 5.20a revealed a significant linear relationship between Food and livelihood security and the household land size. This was indicated by a p-value less than 0.05 ( $p=0.048 < 0.05$ ) leading to rejection of the hypothesis and concluding that household land size had an effect on food and livelihood security in Gatimu sub-location. The relationship was found to be moderate and positive. This indicated that the more the household land size the more food secure a household is as the food obtained would sustain them for a longer period.

An independent sample t-test was also conducted to validate the findings by testing whether the household land size had an effect on food and livelihood security. Those who had sufficient food (had food all the 12 months) and those who had scarcity (3 months and below) had their land sizes compared and the results presented in Table 5.20b.

**Table 5.20b: Independent t-test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2- tailed)	Mean Differe nce	Std. Error Differe nce	95% Confidence Interval of the Difference	
								Lower	Upper	
Size in acres	Equal variances assumed	5.306	.189	2.25	93	.027	.61478	.27328	.07209	1.1574
	Equal variances not assumed			2.07	46.8	.044	.61478	.29713	.01695	1.2126

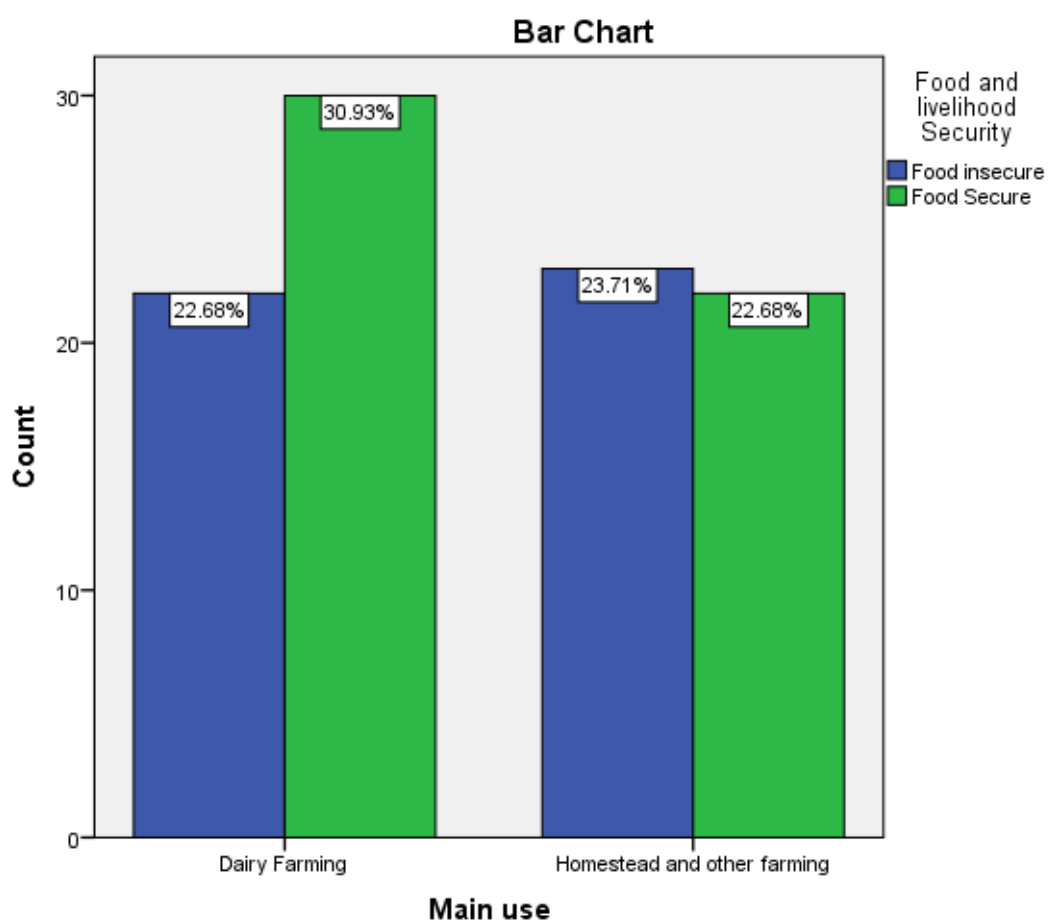
The results indicated that there was a significant difference in the land sizes of those who were food secure and those who were food insecure,  $t=2.25$ ,  $p=0.027$ . Therefore this validated the findings that household land sizes have an effect on the food and livelihood security.

**H<sub>02</sub>: There is no effect of land uses and their impact on food and livelihood security in Gatimu sub-location**

The second objective sought to examine effect of main land uses and their impact on food and livelihood security in Gatimu sub-location. Land in Gatimu sub-location was found to be used mainly for farming and human settlement. A cross tabulation and a Chi-square test were used to examine whether food and livelihood security was associated with land use. The results were presented in Table 5.20 c.

**Table 5.20 c: Main use \* Food and livelihood Security Cross tabulation**

	Food and livelihood Security		Total	Chi-square (p-value)
	Food insecure	Food Secure		
Dairy Farming	22	30	52	0.752 (0.386)
Main use Homestead and other farming	23	22	45	
Total	45	52	97	



**Figure 5.14: Main land use and food security**

The findings revealed that those who did dairy farming, majority, 30.93% were food secure unlike those who did other farming and used land for homestead which revealed that majority were food insecure. However, the chi-square results revealed that though there was an effect of the use of land on food and livelihood security, there was no significant association between main land use and food and livelihood security, chi-square = 0.752, p=0.386.

These residents were found to practice business and other forms of income generating activities other than dairy farming supporting the findings.

**H<sub>03</sub>: Demographic factors and land ownership characteristics do not influence the size and use of household land in Gatimu sub-location**

The third objective aimed at analysing factors that influence the size and use of household land. The factors identified were Land Ownership, Total owned family land size, Age of household head and Household size. Pearson's correlation coefficient was applied to investigate the significance, strength and direction of the relationship between size and use of household land (which is the dependent variable) and land ownership, total owned family land size, age of household head and household size, which are the independent variables.

Pearson's correlation values range from  $-1$  to  $1$ .  $-1$  indicates a perfect negative relationship,  $0$  indicates that there is no relationship between the variables while  $+1$  indicates a perfect positive relationship. Again an absolute Pearson's correlation value of  $0.5$  indicates a strong linear relationship between the variables while a value below  $0.5$  indicates a weak linear relationship. The sign of the Pearson's correlation coefficient value indicates the direction of the relationship. Finally, the resultant p-value less than  $0.05$  at  $95\%$  confidence level indicates that the linear relationship between variables of interest is statistically significant. Therefore, a correlation analysis was performed in this study and the findings were presented in Table 5.21.

**Table 5.21: Correlation analysis**

		Size and use of househol d land	Land Ownersh ip	Total owned family land size	Age of househol d head	Househol d size
Size and use of household land	R	1				
	P					
	N	116				
Land Ownership	R	.291**	1			
	P	.002				
	N	116	139			
Total owned family land size	R	.833**	.240*	1		
	P	.000	.010			
	N	107	114	114		
Age of household head	R	.224*	.029	.279**	1	
	P	.018	.739	.003		
	N	111	131	109	132	
Household size	R	.250**	.075	.247**	.399**	1
	P	.007	.381	.008	.000	
	N	115	138	113	131	139

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

\* . Correlation is significant at the 0.05 level (2-tailed).

r = Pearson's correlation coefficient

p = p-value

According to the results in Table 4.23, there was a significant linear relationship between Land Ownership and Size and use of household land,  $r = 0.291$ ;  $p = 0.002$ . The findings also revealed that there was a very strong significant linear relationship between total owned family land size and size and use of household land,  $r = 0.833$ ;  $p = < 0.0001$ . This was indicated by significant p-values less than 0.05 at 95% confidence level. There was a significant linear relationship between age of household head and size and use of household land,  $r = 0.224$ ;  $p = 0.018$  and finally the results showed that there was a significant linear relationship between household size and size and use of household land,  $r = 0.250$ ;  $p = 0.007$ .



## **CHAPTER SIX**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **6.0 Introduction**

This chapter gives a summary of the research findings, makes conclusions, recommendations and suggestions for further research as discussed under the research objectives. The study aimed at examining the current household land size and its implication on food and livelihood security, establishing the current land uses and their impact on food and livelihood security, analyzing factors that influence the size and use of household land and interrogating the intergenerational transmission of land rights and use in Gatimu sub-location.

#### **6.1 Summary of Research Findings**

This section presents a summary of the findings of the research objectives. The research objectives were: to examine the current household land size and its implication on food and livelihood security, to establish the current land uses and their impact on food and livelihood security, to analyze factors that influence the size and use of household land and to interrogate the intergenerational transmission of land rights and use in Gatimu sub-location. They were established after realizing a research gap through literature review in assessing household land size and use for sustainable food and livelihood security in Gatimu sub-location.

The study adopted a descriptive research design and targeted all households in Gatimu sub-location. The household heads responded on behalf of the household. A sample size of 140 households was used where a simple random sampling method was used to include a household into the sample. Data was collected using questionnaires and interview guides and the data was coded and analyzed using SPSS version 24. Analysis involved descriptive and inferential procedures where under descriptive method frequencies and percentages, mean and standard deviation were used while under inferential analysis procedure, Pearson's bivariate correlation method was used to examine factors influencing the size and use of household land in Gatimu sub-location.

##### **6.1.1 To examine the current household land size and its implication on food and livelihood security in Gatimu sub-location**

The first objective of this study was to examine the current household land size and its implication on food and livelihood security in Gatimu sub-location. From the findings majority of the households own at least 2 pieces of land approximately 0.99 acres and were located 1.08 Km away from the place of residence. It was established that those respondents with larger land sizes had higher frequency of production and consumption of milk in all the seven villages of Gatimu. This indicated that the larger the land, the more the production and consumption of milk.

The findings from Pearson's correlation coefficient under hypothesis testing revealed that there was a significant linear relationship between household land size and food and livelihood security. The relationship was found to be moderate and positive. This indicated that the more the household land size the more food secure a household is as the food obtained would sustain them for a longer period. Independent t-test confirmed the findings by revealing that there was a significant difference in the land size of those who were food secure and those were not.

#### **6.1.2 To establish the current land uses and their impact on food and livelihood security in Gatimu sub-location**

The second objective of the study aimed at establishing the current land uses and their impact on food and livelihood security in Gatimu sub-location. The main economic activity of the households in Gatimu sub-location was agriculture and business. Those in agriculture were found to practice crop and livestock farming. Under crop farming, Maize was the most common and occupied the biggest section of land followed by potatoes. However, horticulture was the least popular but those who practiced got more yield and earned a higher income as compared to the rest. They got a total of Ksh. 61,375 per annum on average. Other crops that were planted included Kales, beans and peas.

Livestock or animal keeping was also a common farming practice in Gatimu sub location. The households were found to keep cows, Rear chicken, keep goats, sheep, rabbits and pigs. Cows were found to be the most common followed by rearing of chicken. However, chicken was found to give more income as compared to all others. Rabbits, goats and pigs were kept for household consumption as opposed to business. The findings revealed that each farmer reared an average of 4 sheep where an average of two sheep are consumed within the household while an average of 2 are sold giving

an income of Ksh. 10,000.00. Goats were also found to be reared in Gatimu with 7.5% of the respondents saying so. An average of 18 goats are reared by each individual and an average of 52.86 litres of milk consumed within the household. There is no milk sold and therefore no income. Pigs were also found to be reared in Gatimu sub-location with each of the respondents having an average of 4 pigs. There mostly reared for household consumption where an average of 1 pig is consumed in a year.

The study revealed that for majority of those who had inherited subdivided land, the yields were less by half as compared to the yield before subdivision and the reason behind the reduced yield was the reduced land size. Other reasons were climate change, inadequate farm input, farming methods and fertility decrease of the soil.

Finally, the study established that for the households in Gatimu sub-location the yield from their farms fed their families for an average of 8 months. When there is scarcity of food, the members of the household do business as their main alternatives to agriculture so as to get money to buy food. Other activities include: driving, carpentry and casual labor.

Cross tabulation and a chi-square test were used to examine whether there was an association between main land use and food and livelihood security. The findings revealed that there was no significant association. This might have been contributed by people being in other income generating activities such as business, employment etc.

### **6.2.3 To analyze factors that influences the size and use of household land in Gatimu sub-location**

The third objectives aimed at analyzing factors influencing the size and use of household land in Gatimu sub-location. A bivariate correlation analysis in Table 5.23 was conducted to identify significant factors and the research findings revealed that there was a significant linear relationship between Land Ownership, Total owned family land size, Age of household head and the Household size and Size and use of household land.

#### **Land ownership**

Majority of the households in Gatimu-sub location were found to own land and on average owns about two pieces. This was a key factor affecting size and use of household land. If one owns land then this increases the land size and also increases the use of the land.

#### **Total owned family land size**

Again, from the research findings of the study, total land size owned by a household was also found to be a significant factor. This was a strong factor and the more the land size the more it influences the use of the land.

#### **Age of household head**

Age of the household head was also found to be a key factor influencing land use and size. A household head acts as the vision bearer of a particular household and therefore every decision made influences greatly the direction that particular household takes. Age on the other hand is associated with maturity. Therefore, the more a household head advances in age, the wiser the decisions are and results to increased land size and use.

#### **Household size**

The size of a household was again found to be a significant factor influencing the size of the land and its use. The more the members in a household the more land is required influencing the land size and the more utilized it becomes.

#### **6.1.4 To interrogate the intergenerational transmission of land rights and use in Gatimu sub-location**

Finally, the study sought to interrogate the intergenerational transmission of land rights and use in Gatimu sub-location. The findings revealed that that majority of the parents in Gatimu sub-location had not subdivided their land while those who had were the minority. On further interrogations, majority of the respondents supported land subdivision among heirs arguing that buying land had become very expensive bearing in mind there was inadequate flow of money. Again, they argued that when land is subdivided, the people maximize on the land due to the different skill applied to better it. On the other hand, those who did not support land subdivision argued that land

subdivision reduces productivity and encouraged people to farm communally so as to maximize on the land.

During subdivision of land there are problems associated with it. The study revealed that reduced productivity, brings dispute in the family, low living standards among the people and reduced farming space were the major problems resulting from land subdivision. The results revealed that land fragmentation exists due to population pressure, small sub-divided parcels lead to low crop yield, modern farming techniques can easily be applied on small land sizes, with small land sizes, number of cattle kept has gone down and that land fragmentation has made people adopt new farming techniques and skills.

## **6.2 Conclusions**

The study revealed that households in Gatimu sub-location owned at least 2 pieces of land approximately 0.99 acres each and were located 1.08 Km away from the place of residence. The study again went ahead to conclude that the land for most households was acquired through buying and partly through inheritance and was mainly used for homestead. Majority of the land owners did not lease their land while for those who did, they rented approximately 1.1 Km for a duration of 5 years at approximately Ksh 44,471 per year and used the land majorly for farming.

The study also concluded that Agriculture and Business are the main economic activities practiced by households in Gatimu sub-location. In agriculture both crop farming and livestock farming are practiced. Under crop farming, Maize was found to be the most popular crop and occupied the biggest section of land followed by potatoes. Horticulture was the least popular but those who practiced got more yield and earned a higher income as compared to the rest. Other crops that were planted included Kales, beans and peas. Under livestock farming, households were found to keep cows, rear chicken, keep goats, sheep, rabbits and pigs. Cows were found to be the most common followed by rearing of chicken. However, chicken was found to give more income as compared to all others. Rabbits, goats and pigs were kept for household consumption as opposed to business.

The study concluded that there was a significant linear relationship between household land size and food and livelihood security. The relationship was found to be moderate and positive indicating that the more the household land size the more food secure a household is as the food obtained would sustain them for a longer period.

Again, the study concluded that the main use of land did not significantly affect food and livelihood security. This was associated with people having other forms of generating income other than dairy farming.

The study again concluded that Land Ownership, Total owned family land size and the age of household head were the significant factors of Household size and Size and use of household land in Gatimu sub-location. This was because they influenced the household size and use of the land owned by the households.

The study went ahead to conclude that although there was subdivision of land in Gatimu sub-location, majority of the households had not subdivided. However, majority encouraged land subdivision arguing that it would bring about maximization of land use through the different skills possessed by the different people. Again they argued that land had become inadequate and there was a continuous and rapid population growth.

### **6.3 Recommendations**

Traditional land inheritance ought to be reconsidered or abolished as it has been one of the major contributors to the continued land subdivision. Other forms of inheritance to be considered could be education where parents educate their children relevant skills which would earn them a living in a different manner.

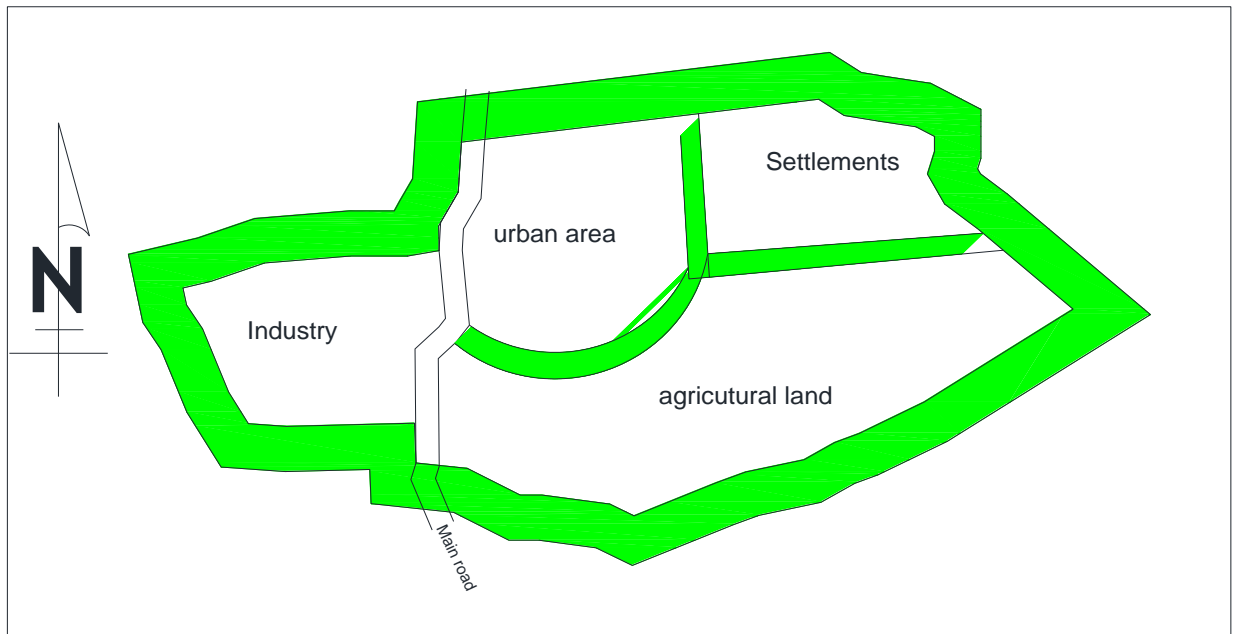
The sub-location should have rural land use spatial plan to guide transformation of its social-economic structure

The study also proposes Planning land use and land tenure in order to resolve the issues related to agricultural sub division. This aims to integrate socio- spatial, economic, and environmental and the political with the best land management principles so as to

realize maximum benefits from land and land based resources. This will help in the achievement of intra and inter-generational equity.

Owing to the above then, a model of settlement similar to Howard's garden city approach pioneered has been proposed for this sub location. The area is spatially located near the Municipality of Nyahururu with 58% of the people being in business, an aspect that supplements the agricultural potential of the area. This qualifies the proposed model of planning where people will conduct their affairs together with nature. This approach will have residential areas, green belts, industrial parks combined with agricultural areas that will act as magnets to the proposed design.

This will assist in addressing the urban problems witnessed in the agricultural



hinterland. It will also curb land subdivision besides being a response to enhanced quality of life thereby safeguarding the environment. The proposed design is illustrated below.

#### **6.4 Areas of further research**

The study identified land ownership, total owned family land size, age of household head and the Household size as significant factors affecting the size and use of household land, however, this is not exhaustive and therefore a further study is

encouraged to identify intervention opportunities for land size control as well as strategies to control the negative impact.



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## APPENDICES

### Appendix I: Authorization letter from NACOSTI



#### NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/23352/23613**

Date: **20<sup>th</sup> July, 2018**

Kinyua Michael Muriuki  
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 dairy farming system of Gatimu Sub Location, Nyandarua County*" I am pleased to inform you that you have been authorized to undertake research in **Nyandarua County** for the period ending **19<sup>th</sup> July, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nyandarua 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  
Nyandarua County.

The County Director of Education  
Nyandarua County.

## Appendix II: Household Questionnaire

### HOUSEHOLD QUESTIONNAIRE

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

---

Sub-location Name.....

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 of 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.							
6.							
7.							
8.							
9.							
10.							

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?.....

2.11 If 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 in Acres	Mode of acquisition	Main use	Tenure System	Ownership document
1						
2						
3						
4						
5						
	<b>Total</b>					

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					
	<b>Total</b>				

3.9 Off-farm income generating activities

Other Sources 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, given the crops grown and livestock reared in this sub-location, how much land would be enough for your household?.....

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 units) in Seasons		Used (Kgs) (Other Units)		Normal price per unit weight (Min-Maximum)		Average income to the family (Kshs.)
		Season 1	Season 2	Consumed	Sold	Min	Max	
<b>CROPS</b>								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

LIVESTOCK TYPE	No. Animals	Yield/Animal/Year	Use (Kgs) (Other Units)		Value (Ksh)	Average income to the Family (Ksh)
			Consumed	Sold		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

4.4. What is your main source of cooking energy?

- a. Firewood   b. Charcoal   c. Gas   d. Crop residues   e. Kerosene   f. Electricity   g. Other – specify

4.5 What is the cost of the cooking fuel per (i) Day?                      (ii) Week?



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

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
<b>Morning</b>	a.							
	b.							
	c.							
<b>Lunch</b>	a.							
	b.							
	c.							
<b>Supper</b>	a.							
	b.							
	c.							

4.13 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	
Beans	
Green/Yellow grams	
Njahi	

### 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.

4.14 Land fragmentations exists due to population pressure

Agree ( )                      Disagree ( )                      Not sure ( )

4.15 Small sub-divided parcels lead to low crop yield

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

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

Agree ( )                      Disagree ( )                      Not sure ( )

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

Agree ( )                      Disagree ( )                      Not sure ( )

4.18 If you agree in 4.15 above, the change in this sub-location is from an average of what number to what number of cattle

.....  
..

4.19 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 family house construction materials	Floor	Wall	Roof
Total <b>number</b> and Total <b>area</b> of other houses (Square meters)			
List other structures in the homestead  (e.g. 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 question for us?.....

### Appendix III: Key Informant Interview Schedule

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

---

Name of respondent.....

Position of respondent.....

Gender of respondent.....

Name of Interviewer.....

Schedule Number.....

#### Interview Guide Questions

- a) What is the most common tenure arrangement in Gatimu Sub-location?
- b) What is your opinion on land subdivision?
- c) What are the effects of land subdivision in the area?
- d) What are the most common forms of land use patterns in Gatimu Sub-location?
- e) What is the most common form of human settlement?
- f) What do you think should be done to solve challenges associated to land subdivision?

## Appendix 4: Focus Group Discussion Guide

### 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

Thanks 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*
- *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*
- *We may have to tape the discussions so as to be able to capture the thoughts, ideas and opinions we hear from the group*
- *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.

## **Introduction**

- Introduce myself and my team, issue the demographic details sign in sheet. Review details of who we are and what we are doing, the purpose for the information, and why we asked you to participate.
- Explain the process of the discussions; find out if any member has participated in FGD before.
- Give logistics of the discussions like details of expected length of discussions, freedom of participants, details of cloakrooms, refreshments etc.
- **Set ground rules to guide the discussions**
- Turn on tape recorder
- Probe for any questions or concerns from participants before starting
- Participants to introduce themselves
- Discussions begin, sufficient time to be allocated to members to think before responding to questions, be able to probe further for more details.

## **Questions**

- a) Let's start the discussion by talking about our history of origins and when we settled here, what brought us here and what size were our farms
- b) Has the land/farm sizes changed overtime, what brought about this changes?
- c) Has productivity been changing overt time? Why is it so?
- d) Is productivity dependent on ownership of land?
- e) Is the farm produce sufficient? How long does it last?
- f) Considering the time we settled here and now, has our land uses changed?
- g) And how come we settled to plant rice as opposed to the other crops?
- h) What settlement patterns have come up since we settled, are the same houses enough or many others have come, does this affect land size and use?

#### **Appendix IV: Observation List**

The following will be observed during the field survey for primary data collection

- Land sizes
- Settlement patterns
- Housing structures
- Field crops and sizes allocated to each
- Demarcations of farm sizes

## **Appendix V: Photography List**

The photographs of the following items shall be captured during the field survey

- Housing structures
- Cropped farms
- Non-cropped farms
- Demarcations of boundaries
- If possible, aerial photographs showing the land sizes and well delineated boundaries
- The people at their natural state as much as possible (with their consent)

## **Appendix VI: Document Reviews**

The following documents shall be reviewed

- Maps in time intervals of 10years beginning 1954
  
- Photographs indicating historical changes in the land size and use in the study area since 1954
  
- Hospital/dispensary/clinic record sheets on dietary related diseases such as marasmus, kwashiorkor and malnourishment

Appendix VII: Sampled Households

TUBER HILL ESTATE

1. JOHN MANGURO
2. STANLEY MUGO
3. AGNESS WAKATHA
4. GRISTON GATHIMA
5. FELIX WANJOHI
6. ELIJAH MAIKIAH
7. DAVID GITAH
8. KENNETH NJORGE
9. PETER MBOGO NJUGUNA
10. ABEL MURORI OPEWA
11. SUSAN MUTURI
12. NATASHON NDUNGU
13. ZIPPORAH WANJIKI
14. WAIRIMU MWANGI
15. GEORGE GITONGA
16. ESTHER NDUKA MUCHINA
17. ~~STADHUP~~ KINGORI
18. JOHNAH WANJURI
19. GRACE GATERU
20. FREDLIC GITHUA KAMENJU.
21. FRANCIS MATAYO
22. PETER NJUGUNA KIMANI
23. DOMINIC KIMANI
24. FREDLIC MACHARIA
25. JANE WANJURI KUNGU
26. MARY NJERI WACHIRA
27. VERONICA WANJURI NJORGE
28. JOSEPH NJURU
29. PAUL WACHIRA
30. HARRISON MWANGI
31. WILSON MANA WAKATI
32. JAMES MUNDIA
33. TIMOTHY KAGECHE
34. JOHN NJURU



TOBORHILL ESTATE

35. JOSPHAT ATANGU
36. ELIUD MACHARIA
37. FRANCIS MWENJE
38. FRANCIS NDEGWA MUTONYI
39. JOSEPH MWANGI
40. JOSHUA NJOROGE
41. IBRAHIM NJOROGE
42. NAFTALY MUGO
43. JOSEPH NDUNGU
44. BERNARD GACHERU
45. STEPHEN MURAGURI
46. JOSEPH M. KANGETHE
47. MARY WANJIRU KARIUKI
48. MARY WAIRIMU .B.
49. FRANCIS MAINA RUKWARO
50. ALICE WAMORO KARANU
51. MOSES NGUGI
52. JOSEPH MWANGI MACHARIA
53. LOISE GICHOGO
54. SAMSON WAKIARA
55. ROBINSON GATHUKA
56. MIKSON KARIUKI
57. JOHN RINTARI
58. HANNAH WANJIRU
59. JANE WAMBUI KAMAU
60. PATROBA MARANGA
61. STEPHEN MWANGI
62. ~~RAKERA~~ WANJIRU MURITU
63. LUCY WAMBUI NDEGWA
64. JOSPHAT M. NJUGUNA
65. DAVID KARANJA
66. PETER KIMANI
67. BENSON KABIRU KARURI
68. EDWIN MUREITHI
69. FRANCIS MUNGA

# TOBORHILL ESTATE.

70. WASHINGTON NDERITU KOMU
71. CHARLES MWANGI KIHUMBA
72. AGNESS MWIKALI NGATIA
73. JOSEPH MBURU
74. FRANCIS KAMUKA
75. JAMES MURAGURI
76. CHARLES MAINA
77. PETER MAINA
78. JOSEPHINE WAKARISI PETER MAINA
79. NAKTAU NJIROGE
80. MOSES GAKUNGA
81. BENSON RUKWARD
82. JOHN KAMAU (MUWALIMU)
83. SAMUEL MAINA CHEGE
84. JOSEPH MWANGI (MAMA NJOE)
85. BENEDICT MUKUMBU
86. ALFRED MURETHI MAINA
87. FRANCIS KAMUKA
88. LUCY WAMBUI MWANGI
89. NDEGWA MACHARIR

~~IRIAN~~

IRIA-INI

- 1 Elizabeth Waruiru Kaborothe
- 2 Louise Wanjiru.
- 3 Joseph Maina.
- 4 Paul Mungai Ritho.
- 5 Benard Njuguna Muizuri.
- 6 Joseph Njuguna.
- 7 James Mutua
- 8 ~~Jos~~ Stephen Githabara
- 9 Stephen Githabara Mwangi.
- 10 John Njoroge.
- 11 Virginia Njoki Ritho.
- 12 Macharia Gichini.
- 13 Stephen Ndirangu.
- 14 David Ndiritu.
- 15 John Kamau.
- 16 Samuel Koeh.
- 17 Josphat Kimani.
- 18 Stephen Mwangi.
- 19 Samuel Kamau.
- 20 James Gichuru.
- 21 Kahuka
- 22 Peninah Njeri Kinyanjui.
- 23 Joyce Kariuki
- 24 Elizabeth Wangui.
- 25 Mary Wangari Njoroge.
- 26 John Kungo.
- 27 Ngatho.
- 28 Gakonyi
- 29 David Wachira
- 30 Moses Njine.
- 31 Benjamin Waihenya
- 32 John Njanga

- 33 Beth Ngina.
- 34 Eunice Wanjiru.
- 35 David Mbugua Ikama
- 36 John Mwangi.
- 37 James Ndichu Nga'nga'
- 38 Watiri Nga'nga.
- 39 Peter Mathenge.
- 40 Daniel Kahiga
- 41 Ghales Macharia.
- 42 Susan Wanjiku Ikama.
- 43 Wanyaine Ikama
- 44 Lucy Wangari Mwangi.
- 45 Peter Njoroge.
- 46 James Maina
- 47 Francis Karanja
- 48 Dama Githugu
- 49 Eliud Mwanu.
- 50 Veronicah Waruguru Thuo.
- 51 Zacha Ezekiel Mwenda.
- 52 Maigua Mwenda.
- 53 Judy Njiri Njau.
- 54 Stephen Ndungu.
- 55 Milkah Wanjiru Kamau.
- 56 James Njira.
- 57 Gatanga Gaituo
- 58 Simon Kiru
- 59 John Mugo.
- 60 David Kimuhu
- 61 Joseph Kiama
- 62 Joseph Kamau Njoroge.
- 63 Samuel Ndungu Njoroge.
- Paul Njuguna.

- 33 Beth Ngina.
- 34 Eunice Wanjiru.
- 35 David Mbugua Ikama
- 36 John Mwangi.
- 37 James Ndichu Nga'nga'
- 38 Watiri Nga'nga'.
- 39 Peter Mathenge.
- 40 Daniel Kahiga
- 41 Ghales Macharia.
- 42 Susan Wanjiku Ikama.
- 43 Wanyaine Ikama
- 44 Lucy Wangari Mwangi.
- 45 Peter Njoroge.
- 46 James Maina
- 47 Francis Karanja
- 48 Sama Gituugu
- 49 Eliud Mwanu.
- 50 Veronica Waruguru Thuo.
- 51 Zacha Ezekiel Mwenda.
- 52 Maigua Mwenda.
- 53 Judy Njeri Njau.
- 54 Stephen Ndungu
- 55 Milkah Wanjiru Kamau.
- 56 James Njeru.
- 57 Gitanga Gatho
- 58 Simon Kiaru
- 59 John Mugo.
- 60 David Kimuhu
- 61 Joseph Kiama
- 62 Joseph Kamau Njoroge.
- 63 Samuel Ndungu Njoroge.
- Paul Njuguna.

- 65 Francis Mwangi.
- 66 David Wachira Macharia.
- 67 Beth Wanjiru
- 68 Esther Wanjeri.
- 69 Mwangi Inama
- 70 Mary Ngonyo Macharia.
- 71 George Kimani Ngugi.
- 72 Stephen Ngugi Kimani.
- 73 John Kariuki.
- 74 Hiram Githongo.
- 75 Matu Wlahome.
- 76 Joseph Macharia Gakuya.
- 77 James Kimani Gachocho.
- 78 Mwangi Kariuki.
- 79 Simon Mbogo Kenja.
- 80 Ngware Mubani
- 81 Evan Murimi Mubani.
- 82 Benard Mwaniki
- 83 Wilson Maina.
- 84 Halison Ndungu Njambi.
- 85 Francis Ndungu Ritya.
- 86 Wilson Maina
- 87 Ndegwa Mutonyi.
- 88 Gialia Njeri Kibororo.
- 89 Wambugu Maina.
- 90 Nduru
- 91 Josphat Mithigi.
- 92 Mwangi Macheru
- 93 Gideon Kinyua
- 94 John Kuria.
- 95 Samuel Kamau Ndegwa
- 96 David Karanja Kamau.

- 97 Samuel Muiga Matheno
- 98 Wambugu
- 99 Joseph Githinji
- 100 Ndiritu Maina
- 101 John Njogu
- 102 John Mwangi Gitau
- 103 Benjamin Githinji Ngure
- 104 Maina
- 105 Samuel Gichia
- 106 Margaret Wambui Wachira
- 107 Antony Wachira
- 108 Henry Gitonga
- 109 Ephraim Maina
- 110 Bernard Njuguna
- 111 Kamara
- 112 Patrick Njuguna
- 113 Karia Kahure
- 114 Kelvin Kago
- 115 Wangechi Mwaniki
- 116 Julius Wachira
- 117 Peter Gitani
- 118 Joan Macharia
- 119 Benson Kinya
- 120 George Gathuri
- 121 Kariuki
- 122 Joel Mutura
- 123 John Mwangi
- 124 Francis ~~Kariuki~~ Mithamo
- 125 Muchiri Mithamo
- 126 Kamau Mithamo
- 127 Kariuki Mithamo
- 128 Stephen Githuki

RIA - IN1

- 129 Harry Kahara.  
 130 Mufonyi  
 131 Ndera Kamau.  
 132 Charles Kamau Muiuri.  
 133 John Macharia.  
 134 Marion Mutyoni.  
 135 Geoffrey Kigitu.  
 136 Mary Njeri Muteti.  
 137 George Njagi  
 138 George Waweru.  
 139 Mwai Karue.  
 140 Wanjiru Karue.  
 141 Raphael Mwangi Gichuru.  
 142 Mureithi Wangohi  
 143 Kariuki Ruga  
 144 Njoroge Kariuki  
 145 Kimani Mugogo.  
 146 Simon Mugogo.  
 147 Kimunya Kimani.  
 148 Gitau Kimani.  
 149 Kamau  
 150 Samuel Maina  
 151 Wanyeki.  
 152 Kahiga.  
 153 Wachira Ndikwe.  
 154 Wangui Kimani.



BARAKA A

Chart way

Alfresco Garden

Nyama Choma  
Roastaction Hall



Entertainment  
"Live Shows"

Starehe Swimming



Pool  
The Zodiac



Banqueting Room

The Virgo



Conference Room

The Aries



Conference Room

The Scorpio



Conference Room

The Luke



Dinning Room

Tangerine Members



Lounge

- 1 Peter Kimani Njenga
- 2 Ester Wangira Kimani
- 3 Ann Wairimu Kimani
- 4 Maitha Nyambura Kimani
- 5 Susan Wacha Kimani
- 6 Jane Wangiku Kimani
- 7 Peter miringu Njani
- 8 Mary ngatiti
- 9 Rahab Wangare Mwangi
- 10 Sarah Wangaci
- 11 Andrew Gakore Njogu
- 12 Mary ngaki Kimulu
- 13 Roisa Wangare Kanga
- 14 Ceatia Njeri Kibororo
- 15 John Mwangi Komau
- 16 Angenes Nduta Mwangi
- 17 Radia Wangui Gakore
- 18 Ezekiel Njogu
- 19 Ben Wangiku Wangichi
- 20 Jacinta Mumbi
- 21 Jane Walthora Wangichi
- 22 Samuel Nduta Thauri
- 23 Nancy Mwangi Kairu
- 24 Jane Nduta Kinuthia
- 25 Peter Ngujiri Mwangi
- 26 John Nganga Njenga
- 27 Elena Wangira Munga
- 28 Mary Wangui Munga
- 29 Jane Njeri Munga

Alfresco Garden

Nyama Choma

Roastaction Hall

Entertainment  
"Live Shows"

Starche Swimming

Pool  
The Zodiac

Banqueting Room

The Virgo

Conference Room

The Aries

Conference Room

The Scorpio

Conference Room

The Luke

Dinning Room

Tangerine Members

Lounge

BARAKA A 2

- 30 Cecilia M. Munguiri  
31 Moses Njeng'a  
32 Ester Wangira  
33 Pauline Njeri  
34 Paul Muthie  
35 Sarefina Muthoni  
36 Joseph Wanderi  
37 Grace Wanderi  
38 Titus Mutunga Katururu  
39 Ester Mutunga  
40 Mary Muckari Mutunga  
41 Alice Ndũko Mutunga  
42 Mary Muckari Mutunga  
43 Sainabu Mweni Mutunga  
44 Hasen Kioko Mutunga  
45 Mary Wangira Mwangi  
46 Paul Mathenge Rubia  
47 Margaret Wangiku Aduku  
48 Elizabeth Wangeci Gatimwa  
49 Robert Gichane  
50 Joyce Muthoni Wangeci  
51 Philip Kagiri Wangeci  
52 Joseph Mbagie Karanja  
53 Redia Wangeci Mbagie  
54 Isaac Njeru Mbagie  
55 Penina Waihera Xijenga  
56 Salome Njenga Munene  
57 Ann Wangiku Muga  
58 Godfrey Muga

BARAKA A 3

Alfresco Garden

Nyama Choma

Roastaction Hall

Entertainment  
Live Shows

Starehe Swimming

Pool

The Zodiac

Banqueting Room

The Virgo

Conference Room

The Aries

Conference Room

The Scorpio

Conference Room

The Luke

Dinning Room

Tangerine Members

Lounge

59 Joseph Kariuki Marii

60 Hana Wanjira Njanja

61 Samuel Wageraka Nganga

62 Alice Muringo Mwangi

63 David Mwangi Karuru

64 Martin Muiru Kihumba

65 Naomi ~~Muriuki~~ Muiru

66 Rehema Mumbi Muiru

67 Samuel Sithingi ~~Muriuki~~ Muiru

68 Caldine Wangui Kihumba

69 Elizabeth Wangare Nganga

70 Edith Kiande Muriuki

71 Evaline Wanjira Wanjui

72 Peterson Mugendi Njeru

73 Martin Wacira Wanjui

74 Eda Ajoki Mburu

75 James Gitonga Mwangi

76 Virginia Warimu Muriithi

77 Beth Gatroni Warimu

78 Suel Mboya

79 Irene Ambasa Mboya

80 Florence Mataisi Mboya

81 Bonfas Akoko Mboya

82 Titus Kamau Karanja

83 Jane Wangui Kamau

84 Samuel Kibera Wacira

85 Ruth Njeri Kirigo

86 Margret Gakenia Kirigo

87 Peter Mugo Kimani

**BARBARA A H**

Alfresco Garden



Nyama Choma

Roastaction Hall



Entertainment  
"Live Shows"

Starehe Swimming



Pool

The Zodiac



Banqueting Room

The Virgo



Conference Room

The Aries



Conference Room

The Scorpio



Conference Room

The Luke



Dinning Room

Tangerine Members



Lounge

- 88 Agnes Wanjiru mugo
- 89 William Wangeci mugo
- 90 Lydia Wangeci Kiritu
- 91 David Mwaniki Kingua
- 92 Sakari Mwangi Wambugu
- 93 Amatasia Wangare Ndungu
- 94 Rudya Wangui Rukwero
- 95 Monica Wambui Karanja
- 96 Joseph maina Karoki
- 97 Grace Ajoki Wangeli
- 98 John Kimanu Mwangi
- 99 Daniel Mwangi Kimanu
- 100 Elizabeth Wangare Ng'anga
- 101 Edith Kiarie Muriuki
- 102 Mary Nyambura Kimanu
- 103 Monica Wanjiku Macharia
- 104 Lucy Wanjiku Ngetta
- 105 Elizabeth Wangare Waitira
- 106 Peter Ng'anga Lemoa
- 107 Zakari Mwangi Wambugu
- 108 Julius Kanyi Mbagie
- 109 Eliud Ng'anga Kiarie
- 110 Christopher Mungai Kariuki
- 111 Hana Wanjiru Mungai
- 112 Martha Ngendo Mungai
- 113 Damons Waitira Mungai
- 114 Pauline Wakuu Wanjiru
- 115 Francis Kiiru Ng'anga
- 116 Monika Wanjiku Njoroge