

**HOUSEHOLD LAND SIZE AND USE FOR SUSTAINABLE FOOD
SECURITY IN MAIZE FARMING: CASE OF LESERU SUB-LOCATION -
UASIN GISHU COUNTY**

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**DEPARTMENT OF URBAN AND REGIONAL PLANNING
SCHOOL OF BUILT ENVIRONMENT UNIVERSITY OF NAIROBI**

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DECLARATION

This is my original work and has not been presented in this or any other university.

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DEDICATION

I dedicate this project to my mum Mrs. Dinah Cheboi who has struggled bringing to bring me up with love and understanding and to my wife Ms. Jepkemoi Kandagor and children Reagan and Reuel for giving me humble time work on this research thesis.

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ABSTRACT

The growing population and the increased family lineage have been unstoppable over the years evidenced by the national census and population projections. This has encouraged the subdivision of land to accommodate the increasing households which have led to the reduction of land sizes and the changes in the land usage. There has been a need to assess the household land sizes and uses and its effect on food security in order to provide solutions to the frequent problems of hunger and over dependency on the government to provide relief food aid and avoid malnutrition and resultant deaths. The objectives of the study were to examine the current household land sizes and usage in the study area while assessing its impacts on food production and security. Analysis was done on the factors that influence the size and usage and take into consideration the processes of intergenerational transmission of land rights and usage. The study sought to assess the impact of land size and use on food security in the maize farming system of Uasin Gishu County using Leseru sub-location in Kamagut ward as a case study. Uasin Gishu County is one of the country's major food baskets and a leader in maize production due to its reliable rainfall patterns and productive land. The study targeted 1016 households in Leseru sub-location, Uasin Gishu County that have lived in the area for a period not less than three (3) years. The study used the survey method whereby data was obtained through household and 10 key informant interviews, observations, 3 focus group discussions, photography and review of existing documents. A sample size of 152 people was used and a sampling method which involved purposive sampling, convenient sampling as well as simple random sampling was applied in selecting the case study, formulating clusters and administering household questionnaires respectively.

The findings from the study enumerated that majority of the land holding sizes ranged between 2-5 acres with the land usage being agricultural particularly maize farming. The impacts of land sizes were that the households with larger land sizes had better chances of food security whereas mechanization and economies of scale played a key role in food production. Population growth and the geographical location of the land are some of the factors that influenced the size and use of land. The study presented models indicating the settlement pattern which affected land sizes and usage which include scattered, linear, clustered and communal settlement model. The hypothesis of

the study concluded that there was no significant relationship between the household land size and food security in the study area whereas a significant relationship was found between land usage and food sufficiency. The recommendations of the study were to implement the communal settlement model, consider doing appropriate zoning, implementation of the national land use policy and government consideration to provide subsidies and incentives to the farmers.

TABLE OF CONTENTS

| | |
|---|-------|
| DECLARATION | i |
| DEDICATION | ii |
| ACKNOWLEDGEMENT | iii |
| ABSTRACT..... | iv |
| TABLE OF CONTENTS..... | vi |
| LIST OF TABLES | xii |
| LIST OF FIGURES | xiv |
| LIST OF PLATES | xviii |
| ABBREVIATIONS AND ACRONYMS | xix |
| CHAPTER ONE..... | 1 |
| INTRODUCTION | 1 |
| 1.0 Introduction..... | 1 |
| 1.1 Land and Food Production..... | 3 |
| 1.2 Emerging Issues on Land and Food Production | 6 |
| 1.3 Statement of the Research Problem | 6 |
| 1.4 Research Objectives | 8 |
| 1.5 Research Hypothesis | 8 |
| 1.6 Scope..... | 9 |
| 1.6.1 Geographical Scope. | 9 |
| 1.6.2 Theoretical Scope of the Subject | 9 |
| 1.7 Justification of the Study | 11 |
| 1.8 Assumption of the Study..... | 12 |
| 1.9 Limitations of the Study..... | 12 |
| 1.10 Organization of the Report..... | 12 |
| CHAPTER TWO | 14 |

| | |
|--|----|
| METHODOLOGY | 14 |
| 2.0 Introduction..... | 14 |
| 2.1 Research Design..... | 14 |
| 2.2 Research Site and Population..... | 16 |
| 2.3 Data Needs | 16 |
| 2.4 Pilot Study..... | 17 |
| 2.5 Data Collection | 18 |
| 2.5.1 Interviews..... | 18 |
| 2.5.2 Observation | 19 |
| 2.5.3 Photography | 19 |
| 2.5.4 Document Reviews: | 21 |
| 2.6 Sampling Framework..... | 21 |
| 2.6.1 Sample Size..... | 21 |
| 2.6.2 Sampling Method..... | 21 |
| 2.7 Ethical Considerations | 22 |
| 2.8 Data Analysis Methods | 22 |
| 2.9 Data Presentation Methods | 22 |
| CHAPTER THREE | 23 |
| LITERATURE REVIEW | 23 |
| 3.0 Introduction..... | 23 |
| 3.1 Definitions of Concepts | 23 |
| 3.2 Household Land Sizes and Land Uses | 25 |
| 3.2.1 Household Land Sizes | 25 |
| 3.2.2 Household Land Uses | 27 |
| 3.2.3 Land Tenure System | 28 |
| 3.3 Impacts of Household Land Sizes and Uses | 29 |

| | |
|--|-----------|
| 3.4 Factors Influencing Land Use and Size | 33 |
| 3.5 Documentation of Inter-generational Transmission of Land..... | 36 |
| 3.5.1 Land Transmission and Acquisition | 37 |
| 3.5.2 Documentation of Intergenerational Transmission of Land | 40 |
| 3.6 Policy and Legislative Provisions..... | 45 |
| 3.6.1 Vision 2030 on Agriculture Sector | 45 |
| 3.6.2 Sustainable Development Goals | 45 |
| 3.6.3 Science, Technology and Innovation Strategy of Africa (STISA 2024).... | 46 |
| 3.6.4 Devolution and the County Government | 47 |
| 3.6.5 Evolution of the National Spatial Policy 2015-2045 | 47 |
| 3.7 Conceptual Framework..... | 48 |
| CHAPTER FOUR..... | 51 |
| BACKGROUND OF THE STUDY AREA/SITUATIONAL ANALYSIS..... | 51 |
| 4.0 Introduction..... | 51 |
| 4.1 Geographical Location..... | 51 |
| 4.1.1 National Context. | 51 |
| 4.1.2 Regional Context. | 51 |
| 4.1.3 Local Context..... | 52 |
| 4.2 Population and Demographic Characteristics | 52 |
| 4.2.1 Population Size | 52 |
| 4.2.2 Demographic Characteristics | 56 |
| 4.2.3 Population and Household Projections | 59 |
| 4.3 Climatic Conditions and Physiographic Features | 61 |
| 4.3.1 Climate..... | 61 |
| 4.3.2 Rainfall..... | 61 |
| 4.3.3 Topography and Altitude | 62 |

| | |
|--|----|
| 4.3.4 Geology | 63 |
| 4.3.5 Vegetation | 64 |
| 4.3.6 Hydrology | 65 |
| 4.4 Economic Activities | 65 |
| 4.4.1 Crop Production | 66 |
| 4.4.2 Livestock Production | 67 |
| 4.5 Human Settlement and Housing | 69 |
| 4.5.1 Human Settlement | 69 |
| 4.5.2 Housing | 69 |
| 4.6 Natural Resource Base | 71 |
| 4.6.1 Land | 71 |
| 4.6.2 Water Resources | 73 |
| 4.7 Social Infrastructure | 75 |
| 4.7.1 Health Facilities | 75 |
| 4.7.2 Educational Facilities | 77 |
| 4.7.3 Religious Facilities | 79 |
| 4.8 Physical Infrastructure | 79 |
| 4.8.1 Roads | 80 |
| 4.8.2 Railway Line | 81 |
| 4.8.3 Other Facilities | 82 |
| CHAPTER FIVE | 84 |
| RESEARCH FINDINGS, ANALYSIS AND CASE STUDIES | 84 |
| 5.0 Introduction | 84 |
| 5.1 Research Findings and Analysis | 84 |
| 5.1.1 Profiles of the Respondents | 84 |
| 5.1.2 Land Holding Arrangements and Income Sources | 93 |

| | |
|---|-----|
| 5.1.3 Land Sizes, Mechanization and Farm Yields | 96 |
| 5.1.4 Food and Livelihood Security Issues | 99 |
| 5.1.5 Intergenerational Transmission of Land | 102 |
| 5.2 Case Study on Household Land Sizes and Food and Livelihood Security Indicators..... | 114 |
| 5.2.1 Case Study of Family I | 114 |
| 5.2.2 Case Study of Family II | 116 |
| 5.2.3 Case Study of Family III..... | 116 |
| 5.2.4 Case Study of Family IV..... | 117 |
| 5.2.5 Case Study of Family V | 117 |
| 5.3 Hypothesis Testing | 118 |
| 5.3.1 Hypothesis A..... | 118 |
| 5.3.2 Hypothesis B..... | 120 |
| CHAPTER SIX..... | 122 |
| SUMMARY OF THE FINDINGS, CONCLUSION AND RECCOMENDATIONS | 122 |
| 6.0 Introduction..... | 122 |
| 6.1 Summary of the Findings | 122 |
| 6.1.1 Household Land Sizes and Usage..... | 122 |
| 6.1.2 Impacts of the Land Sizes on Food Production | 123 |
| 6.1.3 Factors Influencing the Size and Use of the Household Land..... | 124 |
| 6.1.4 Intergenerational Transmission of Land Rights..... | 125 |
| 6.2 Settlement Models | 125 |
| 6.2.1 Scattered Settlement Model | 125 |
| 6.2.2 Linear Settlement Model..... | 127 |
| 6.2.3 Clustered Settlement Model..... | 128 |

| | |
|--|-----|
| 6.2.4 Communal Settlement Model | 129 |
| 6.3 Conclusion | 131 |
| 6.4 Recommendations..... | 132 |
| 6.4.1 Implementation of the Communal Settlement Model..... | 133 |
| 6.4.2 Zoning | 134 |
| 6.4.3 Implementation of National Land Use Policy | 136 |
| 6.4.4 Government Subsidies and Incentives | 141 |
| 6.5 Areas of Further Research | 141 |
| REFERENCES | 143 |
| APPENDIX 1: STUDY WORK PLAN..... | 148 |
| APPENDIX 2: BUDGET | 149 |
| APPENDIX 3..... | 150 |
| HOUSEHOLD QUESTIONNAIRE..... | 150 |
| APPENDIX 4..... | 160 |
| FOCUS GROUP DISCUSSION GUIDE | 160 |
| APPENDIX 5..... | 163 |
| KEY INFORMANT SCHEDULE..... | 163 |
| APPENDIX 6..... | 164 |
| OBSERVATION LIST | 164 |
| APPENDIX 7..... | 165 |
| PHOTOGRAPHY LIST | 165 |
| APPENDIX 8..... | 166 |
| DOCUMENTS REVIEWS | 166 |

LIST OF TABLES

| | |
|--|-----|
| Table 1: Population per Village | 17 |
| Table 2: Effects of Land Use and Size on Farming | 31 |
| Table 3: Population Size | 55 |
| Table 4: Area and Population Density by Sub County | 55 |
| Table 5: Demographic Characteristics in Uasin Gishu | 58 |
| Table 6: Mean Monthly Average at Kapsoya Weather Station | 61 |
| Table 7: Average Landholding Size at Sub-county Level | 72 |
| Table 8: Age Groups | 85 |
| Table 9: Marital Status in Leseru Sub-location | 85 |
| Table 10: Household Size | 86 |
| Table 11: Area of Household Compound | 88 |
| Table 12: Size of Houses | 89 |
| Table 13: Rooms in Main Houses..... | 90 |
| Table 14: Areas of the Other Houses | 91 |
| Table 15: Land Use for Owned Land in Leseru sub location | 94 |
| Table 16: Land Ownership Before Subdivision..... | 96 |
| Table 17: Land Subdivision and Crop Yield | 97 |
| Table 18: Income Earned by the Inhabitants | 99 |
| Table 19: Families having Food Security | 100 |
| Table 20: Source of Proteins Consumed by the Community..... | 101 |

| | |
|--|-----|
| Table 21: Food types taken by the community..... | 101 |
| Table 22: Case Processing Summary..... | 119 |
| Table 23: Chi-Square Tests..... | 119 |
| Table 24: Case Processing Summary..... | 120 |
| Table 25: Chi-Square Tests..... | 121 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1: Incidence of Undernourishment by Developing Region | 4 |
| Figure 2: Research Design | 15 |
| Figure 3: Chain Relationships..... | 29 |
| Figure 4: Food Gap in Ethiopia | 30 |
| Figure 5: Conceptual Model of Household Food Security | 36 |
| Figure 6: Kiambu Land Cover for 1988 | 43 |
| Figure 7: Kiambu Land Cover for 1993 | 43 |
| Figure 8: Kiambu Land Cover for 2002 | 43 |
| Figure 9: Kiambu Land Cover for 2013 | 44 |
| Figure 10: Conceptual Model | 50 |
| Figure 11: Location of Leseru Sub Location in the National Context..... | 53 |
| Figure 12: Regional Context Map..... | 54 |
| Figure 13: Leseru Sub-location in the Local Context..... | 54 |
| Figure 14: Population Pyramid | 56 |
| Figure 15: Number of Births and Deaths | 57 |
| Figure 16: Uasin Gishu County Population Pyramid | 59 |
| Figure 17: Kenya Population Pyramid..... | 59 |
| Figure 18: Uasin Gishu Projected Population..... | 60 |
| Figure 19: Uasin Gishu Projected Households | 60 |
| Figure 20: Mean Monthly Rainfall Distribution | 62 |

| | |
|--|-----|
| Figure 21: Leseru Sub-location Topography | 63 |
| Figure 22: Leseru Sub-location Geological Map..... | 64 |
| Figure 23: Leseru Sub-location Hydrology Map..... | 65 |
| Figure 24: Health Facilities..... | 76 |
| Figure 25: Educational Facilities Map | 78 |
| Figure 26: Religious Facilities Map..... | 79 |
| Figure 27: Transport Networks | 80 |
| Figure 28: Physical Infrastructure Map | 83 |
| Figure 29: Gender Frequency | 86 |
| Figure 30: Land Inheritance..... | 87 |
| Figure 31: Household Education Levels..... | 87 |
| Figure 32: Number of Houses Structures..... | 89 |
| Figure 33: Walling Material in the Study Area | 91 |
| Figure 34: Floor Materials for the Houses | 92 |
| Figure 35: Roofing Material | 93 |
| Figure 36: Land Uses for Rented Land Parcels | 95 |
| Figure 37: Off-farm Income Generating Activities | 95 |
| Figure 38: Milk Production Within the Study Area..... | 98 |
| Figure 39: Changes in Yields after Subdivision | 100 |
| Figure 40: Survey of Kenya Topographical Sheet for Soy (89/4) – A section..... | 103 |

| | |
|--|-----|
| Figure 41: Turbo East/Leseru Block 7 Sheet - Part | 104 |
| Figure 42: Amendments for Turbo East/Leseru Block 7 | 104 |
| Figure 43: Map for Leseru Sub-division..... | 105 |
| Figure 44: Land Uses Classification for Leseru in 1988. | 106 |
| Figure 45: Land Uses Classification for Leseru in 1995 | 107 |
| Figure 46: Land Uses Classification for Leseru in 2002 | 108 |
| Figure 47: Land Uses Classification for Leseru in 2009 | 109 |
| Figure 48: Land Use Classification for Leseru in 2017 | 110 |
| Figure 49: Area Coverage by the Land Uses | 111 |
| Figure 50: Area Coverage Trend | 111 |
| Figure 51: Leseru Juakali Center | 112 |
| Figure 52: Upcoming Built-up Areas in Agricultural Farms at Maili tisa in Leseru. | 112 |
| Figure 53: Vegetation Cover..... | 113 |
| Figure 54: Reduced Agricultural Land | 113 |
| Figure 55: Bare Land Areas | 114 |
| Figure 56: Family I Arrangement | 115 |
| Figure 57: Family II Arrangement..... | 116 |
| Figure 58: Family V Arrangement..... | 118 |
| Figure 59: Scattered Settlement Model..... | 126 |
| Figure 60: Linear Settlement Model..... | 128 |

| | |
|---|-----|
| Figure 61: Clustered Settlement Model | 129 |
| Figure 62: Communal Farming..... | 130 |
| Figure 63: Communal Settlement Model..... | 131 |
| Figure 64: Communal Settlement Model..... | 133 |
| Figure 65: High Density Residential..... | 134 |
| Figure 66: Zoning Plan | 137 |

LIST OF PLATES

| | |
|--|----|
| Plate 1: Key Informant Interview | 20 |
| Plate 2: Focus Group Discussion | 20 |
| Plate 3: Maize Plantation at Leseru Sub-location | 67 |
| Plate 4: Dairy Cattle Farming | 68 |
| Plate 5: Mixed Livestock Farming | 68 |
| Plate 6: Housing Typology | 70 |
| Plate 7: Granary Typology | 71 |
| Plate 8: River Sosiani | 75 |
| Plate 9: Leseru Sub-location Schools | 78 |
| Plate 10: Roads improvements at Leseru Sublocation | 81 |
| Plate 11: Major Highway (A104) | 81 |
| Plate 12: Railways line across in Leseru Sublocation | 82 |

ABBREVIATIONS AND ACRONYMS

GDP – Gross Domestic Product

FAO – Food and Agricultural Organization

HA – Hectare

FAO – Food and Agricultural Organization.

D.C.C – Deputy County Commissioner.

M.C.A – Member of the County Assembly.

CIDP – County Integrated Development Plan.

A.S.L – Above Sea Level.

NLUP – National Land Use policy.

GPS – Global Positioning System

SPSS – Statistical Package for the Social Sciences

EMT+ - Enhanced Thematic Mapper Plus

IR – Inverse Relationship

UNICEF – United Nations Children’s Fund

CBS –Central Bureau of Statistics

LIS – Land Information System

ASAL – Arid and Semi-Arid Land

CoK – Constitution of Kenya

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The survival of humanity rotates around food availability and its security. Farmers have over the last four decades produced enough food that meets average per capita food requirements for a population that has doubled over the same period. However, the same period has experienced persistence hunger and marked fluctuation of food reserves in Kenya where agriculture is the backbone of the economy. Deloitte & Touche, 2016, Deloitte & Touche, 2017, postulate that Kenya's agriculture sector contributes immensely to the national economy. Its direct contribution to GDP in 2016 and 2017 was 25% and 26% respectively. The sector also contributes 27 percent to the GDP indirectly through linkages with other sectors such as manufacturing, service sectors and distribution. The government earns a 45 percent revenue from the agriculture sector which provides 75 percent of raw materials for local industries (Deloitte & Touche, 2017).

Agricultural exports from Kenya accounts for over 50% of the total earnings. It is estimated that 60 percent of the country's total employment is in agriculture with approximately 75 percent of Kenyans having at least partial involvement in agriculture. Overall, it provides livelihood opportunities for well above 80 percent of the population in rural areas. Trend analysis of national GDP and agricultural GDP growth rates from 1986 to 2014 shows that when agriculture performs well, the national GDP improves proportionately. This calls for sufficient attention and investment in the sector. FAO (2005); Marani (2012) and Bremner (2012), postulate that agriculture is the sole sources of food for both raw materials for industrial refined and packaged foods and food for direct consumption.

Sustained growth of the agricultural sector therefore will strongly influence the overall national economic performance and also contribute to food, nutrition and livelihood security. Knowledge of how different factors of production particularly land, relates with food and livelihood security can greatly contribute to the type of strategies that can be adopted in different farming systems for sustainable rural land utilization. These problems

are self-evident in Leseru sub-location, Kamagut Ward in Uasin Gishu County hence the need to inspect the connection between the land size use and sustainable food production in the sub-location. Uasin Gishu County is one of the country's major food baskets, particularly maize farming with reliable rainfall patterns and productive land. Agriculture forms an integral part of the economic livelihood of the county and its citizens. The research intends to examine the trend of land fragmentation over the years and the effects of the dwindling, reduced sizes of agricultural land on the maize production and yields. A specific insight was sought on the extent to which social capital impacts on the economic activities' growth.

In Kenya, maize is a staple food and it is grown both on large and small scale, a huge population of Kenyans cultivate it to earn a living. Maize is a grass family annual crop that grows to 2m high depending on the variety. Grains are found on the conical cob that grows from the stalk. The grains are either milled for flour or even consumed whole.

For animals, silage and crop residue from maize is used as feeds whereas the other use of maize is in industrial raw materials for starch and oil extraction. In Nepal, maize was planted in 849,892 ha with 2.02 tons as the average yield per hectare (CBS, 2006). The overall maize demand is estimated to rise by 4 to 8 percent annually in the next two decades owing to food demand. This expected increase in maize demand must be addressed through increase in maize production per unit area of land (Paudyal et al., 2001; Pingali, 2001). Nevertheless, agricultural production has either increased marginally or remained stagnant over the decades with maize not excluded either (Kaini, 2004).

Majority of small-scale farming households are involved in production of Maize which is the most staple food in Zambia. According to Govereh et al., (2003), fertilizer is utilized overwhelmingly on maize and advertising is dominated by maize sales amongst smallholders. The Zambian government is focused on improving productivity of maize as its core goal in a country where smallholder farmers in excess of 81 percent hold less than five hectares of land. In order to achieve this objective, the Zambian government has concerted efforts in subsidizing fertilizer costs as well as established programs for offering credit to smallholders to stimulate their agricultural productivity, enhance food security and reduce poverty through restructuring its agricultural policy. Each part of the maize

plant has monetary value: i.e. grain, stalk, tassel, cob and leaves can all be used to produce a variety of products. Over 87 percent of Kenyans depend on maize as their main diet. Per capita maize consumption in Kenya according to Nyoro *et al.*, (2004) varies between 98 to 100kgs which is equivalent to a minimum 2700 thousand metric tons annually. In addition, large scale production accounts for only 25 percent of the total production with small scale production covering the remaining 75 per cent (Export Processing Zone Authority, 2005). The key information gaps that this study wishes to fill include generation of data on the implication of current land size and land uses on food and livelihood security in a rural agricultural area of Kenya and particularly the Uasin Gishu county and taking into cognizance the intergenerational transmission of the land rights and land uses over the years.

1.1 Land and Food Production

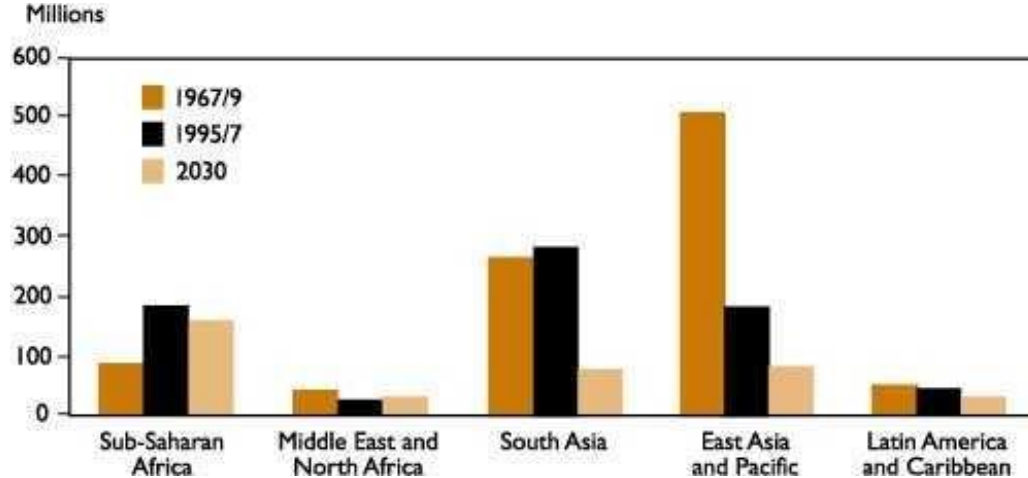
Land is an essential natural resource that we live on, we farm it for food, we exploit it for minerals, and we utilize it for several other major economic activities. S.Rahman, and M.Rahman, (2008), noted that the land exploitation is both for prosperity of humanity and the survival, and for the maintenance of all global ecosystems. A person may have a big parcel of land or a small parcel or even no parcel of land at all. People are so in need of parcels of land leading to so many means practised to acquire the said pieces of land for the many activities carried out.

According to Ricker-gilber (2014), increase in population density leads to reduction in agricultural products and lower household income in rural Malawi. This results from subdivision of land into smaller land sizes which also lowers income from farming. In Nigeria, Agbo et al (2014) found that an increase in population density in rural areas resulted in more land being used for settlement. This reduces land allocated to food production leading to food insecurity and the associated sufferings. In Ethiopia, Menberu (2014) found that increased density of rural population has led to a decrease in land for cultivation or development and an expansion in vegetation clearance, which is accompanied, with increased soil erosion. Bentley (1987) described land disintegration as a pattern of land proprietorship where an individual owns several parcels of land

that are scattered over a geographical space has also been found to affect agricultural productivity.

In Bulgaria, Natalia (2013) reports that land fragmentation has been a hindrance to the achievement of meaningful socio-economic growth, and is responsible for poor evolution of land markets, poor utilization of land resources and it discourages public and private investment. A study by Klaus (2012) found that Albania land ownership has been characterized as too fragmented for effective and optimal production to the extent that experts are advocating for state-initiated programs to consolidate the rural land holdings. According to (Dixon & Gulliver, 2001), Hunger due to unsustainable agricultural practices including land fragmentation is still predominant in many middle-income countries, particularly in Africa and South Asia. Despite the fact that the number of undernourished people increased in the above two regions as shown in Figure 1, the cumulative total started declining from late 1960s where it stood at 959 million between 1969 and 1971 to 790 million in 1995 and 1997. This is equivalent to half the actual undernourished individuals from 37 to 18 percent owing to significant growth in world total population.

Figure 1: Incidence of Undernourishment by Developing Region



Source: FAO 2000a.

There's a close relationship between hunger and poverty. Although lack of enough income to buy food is a major contributor to food insecurity at the household level, hunger is still responsible for poverty in households since it reduces labor productivity, disease resistance and depresses achievements in education.

A study by Muyanga and Jayne (2014) estimated that 40 percent of the country population in Kenya lives on 5 percent of its provincial parcel hence higher populations will require more land for settlement, resulting in less land being available for cultivation. Mahanta and Daisy (2012) have also observed that because rural peoples' livelihood is dependent on land as private or communal property, any change that leads to reduction of the land quantity and quality will end up reducing their livelihood. The study adds that high population density in areas with high ecological degradation and scarcity of cultivable land results in surplus labor and unemployment. Affected populations tend to diversify household income generating activities or tend to move to the near-by small and medium sized urban areas in search for livelihood opportunities.

It is noted that over 75 percent of the agricultural yields in Kenya is from small scale rain-fed cultivating or domesticated animals' production. While agricultural productivity in general appears to be rising in Kenya (Tegemeo Institute, 2014), densely populated areas with increased land pressures are a major threat to future household farm land size, food, nutrition and livelihood security. A recent study in Vihiga County (Kihima, 2017) found an average household land holding of one acre (0.41 ha.) and a Simon's Index of 0.65 reflecting a significant level of land fragmentation. According to Kihima, 2017, small land holdings lead to low farm yield, low household food availability, low income, high population and land related conflicts reported as 54% at households and 90% at the community level. Gicheru et al. (2010), also posits that land subdivision in Narok County where the smaller land units cannot support the pastoral life form has led to conflicts between various groups – especially the pastoralist Maasai and the inactive population, largely recent migrants. Another study by Tegemeo Institute in eight agro-ecological zones covering 26 districts found that more than 30% of the smallholder household farms in the sample control less than one acre of land (Tegemeo Institute, 2014). The per capita land owned and per capita land cultivated had declined over the 20-year period assessed by the study. This appears to be related to the intensifying population pressures and land fragmentation in many rural areas of the country.

1.2 Emerging Issues on Land and Food Production

Land has long been viewed as an abundant and under-utilized asset in Sub-Saharan Africa. However, spatial population and household survey databases show that rural population in Africa, Kenya included, reside in areas that are increasingly densely populated with all arable land is under cultivation or fully assigned. This study was informed by the desire to understand the feasibility of developing small holder agriculture in a growing population density and locked land frontiers in Kenya. The diminishing sizes of household land have become an hinderance to agricultural production in the densely populated rural areas of Kenya is a notable finding of this study. Further, another major finding is the increase in medium scale farms said to range between 5 and 50 hectares. This averaged twice the land they used for agriculture purposes indicating the inability to use land productively by farmers and a high level of land holdings for theoretical purposes.

The greatest proportion of medium scale farmers comprises mainly former or even current civil employees working in the public sector. They are believed to have huge earnings and savings from their non-farm activities especially jobs in urban areas that aided their ability to afford huge chunks of land. The rate at which previous farmers are increasing their farm sizes to join the medium scale club is at a very slow pace and thus just a few former farmers have the potential for managing a medium scale farmer. Another key finding of the study is that there's ostensibly a positive relationship between the size of the farm and farm productivity and efficiency. The medium scale farms relative produce a little bit more than smallholder farms. The most important policy implication emerging from this study is that shrinking of farm sizes could potentially be a major drag on efforts to reduce poverty and food insecurity, especially given the limited employment opportunities generated by the country's manufacturing and services industries.

1.3 Statement of the Research Problem

The inability to identify the specific opportunities, country development and agricultural growth needs as well as the failure to have focused and streamlined investment in areas where they'll have greatest impact on sustenance uncertainty and accomplished poverty to ensure sustainable livelihoods are the major challenges facing the world's developing

regions with Kenya included. Having in mind the specific end goal and objective is critical in the process of determining the availability and allocation of resources that can be facilitated by analyzing farming systems or frameworks to build up a comprehension of land sizes, linkages and local factors. Further, according to Dixon & Gulliver, (2001), the entire analytical process demands utilizations of the frameworks for various systems of farming to support the aggregation of areas that have similar opportunities for investments and developments challenges.

As earlier discussed, the major challenge in development of agriculture is land use limitations as a result of land fragmentation. Land fragmentation is contributed by transmission of land rights where an individual inherits land from their parents who then sub-divide the original land to distribute among their own children. The other contributor is when people buy pieces of land elsewhere due to pressure on existing original land and the contributor being the process of compulsory land acquisition where the government acquires private land for public use or public utilities then the owner is be compensated in monetary terms or in some cases given equivalent size of land elsewhere by the government. Decrease of farmland size due to subdivision due to intergenerational transmission and otherwise has resulted in non-economic farm sizes and holdings which hampers agricultural development leading to low food production and unsustainable livelihoods.

In Uasin Gishu County, land sizes may have largely affected food production and specifically maize which has led to food insecurity that has spiraled to the other parts of the county. In the recent past, the prices of maize product and flour has sky rocketed due to low supply to the market, increase in demand for maize flour probably due to the overdependence on “ugali” – a Kenyan delicacy made of maize as the major staple food. The government was then forced to import maize and subsidize the cost of the maize flour to cushion its citizens from the effects of hunger. It is in the light of this context that the study is conducted to establish the land sizes in Leseru sub-location and how this has affected food production and security.

The nature and causes of land subdivision and lower food production need to be explicitly understood so as to help in coming up with appropriate policy interventions. Various

studies as indicated above have been undertaken on the effect of land size on food, nutrition and livelihood security however, a national level systematic and scientifically conducted study has not been carried out in recent times. As such, the country lacks sufficient quantitative and qualitative data on land sizes and its' net effect on the food production to guide policy interventions and investment in agriculture for food and livelihood security.

1.4 Research Objectives

The study has its main objective being the assessment of the household land size and use for sustainable food and livelihood support in a maize production system in agricultural areas of rural Kenya.

The specific objectives include to:

1. Examine the current household land sizes and usage in Leseru sub-location, Kamagut ward in Uasin Gishu County.
2. Assess the impacts of household land sizes and uses on farming and food production in the study area.
3. Analyze the factors that influence the sizes and uses of household land in the study area.
4. To document the inter-generational transmission of land rights and usage in the study area.

1.5 Research Hypothesis

The Study examined the following hypothesis;

Hypothesis A

Null hypothesis (Ho): There is no significant relationship between the household land size and food security in Leseru sub-location.

Research hypothesis (Ha): There is a significant relationship between the household land size and food security in Leseru sub-location.

Hypothesis B

Null hypothesis (Ho): The land usage has no effect the maize production in Leseru sub-location.

Research hypothesis (Ha): The land usage has affected the maize production in Leseru sub-location.

1.6 Scope

The scope of the study is defined by the geographical location and the theoretical scope.

1.6.1 Geographical Scope

The study was carried out in Leseru Sub-location in Uasin Gishu County which is one among the 47 counties in Kenya found in the north of former Rift Valley province. Leseru sub-location is located in Turbo Constituency, Turbo sub-county within Kamagut ward in the current administrative units. This specific sub-location was chosen as the study area since it was found to be one of the most densely populated sub-location that is located in a rural setup in Uasin Gishu County. The sub-location has been experiencing rapid land fragmentation commonly regarded as subdivision in the recent past, this may be attributed to many factors including prospects of increased land value and accessibility that is expected with the construction of the proposed Eldoret by-pass road that is to traverse through the area. The other factor that prompted the choice is its' productive nature because 96% of the land in Leseru sub-location is suitable for agriculture.

1.6.2 Theoretical Scope of the Subject

This study is based on two theories that explain the land holding or land sizes and its influence on the agricultural productivity; and the overall problems associated with it including food insecurity and loss of livelihood. The relationship between the land sizes and the agricultural food production levels need to be investigated. According to Ben-Chendo et al. (2014), the land holding sizes determine not only the productivity but also influences the farmer's decision on whether to get involved in the practice or not. He discovered that if the landholding size of the farmers is small, the farmers tend to be discouraged to practice rice farming. This is based on a study that was done to establish the determinants of land holding size amongst rice farmers in southeast part Nigeria.

Another study by Tan et al., (2008) done in Jianxi province in China indicated that smallholder farmers with smaller parcels had limited use of modern technology while they

decreased the average distance to their farms. Further, the expansion of the size of the farm resulted to decreased aggregate cost of production a ton. Cornia, G. (1985) did an analysis for 15 developing countries on the connection between factor input, labor and output production for farms of various sizes found out that there is a positive connection between farm sizes and output in Peru, Thailand and Bangladesh.

The second theory by among others, Sen, A.K (1962) reported an inverse relationship between land size and productivity per hectare in Indian Agriculture. Sen concluded that small land sizes produced more as compared to large ones. This kind of relationship was attributed by the kind of management by small farms that used family labor that eventually reduced the supervision and monitoring costs if hired labor. The inverse relationship is further also supported by Feder, G. (1985) demonstrates that small farmers have high labor/plot ratios which could achieve higher output per hectare. The IR in this context is described by the failure of provincial markets for credit, land and labour, and in addition by the difference in labor benefits amongst the smaller and larger farms. Therefore, family or smaller scale labor has additional incentives than hired high scale labor to work intensively, since its outstanding claimant of the yield. This certainty is analyzed in relation to cutting of unequal distribution of landholdings, deducing that redistribution of land will lead to a positive outcome on farm production.

There are numerous factors which have prompted land subdivision in Leseru Sub-location. To begin with, the increasing household population and escalating poverty levels have triggered subdivision of the huge chunks of land which were primarily set aside for agricultural purposes. A quick look into the land ownership in the area in the late 1980's indicates that most of the land was majorly agricultural and minimum acreage stood at 5 acres contrary to what can be seen now where most of the land ownership is as little as 0.1 acres. As though not enough, it would be wise to put into consideration the increase in population which has made the land resource very scarce hence forcing those with land to sell it to the demanding population to meet their economic needs.

Over the last 5 years it can be noted that there is a rapid population growth in Kenya against the limited resource of land which has never been expanded or stretched. The government has been fighting to ensure that its citizens have a shelter to put their heads under hence

the need for settlement. It is against this background that the available agricultural land has suffered pressure for subdivision leading to decreased farming activities and food insecurity.

The above theories have been brought into context to explain if indeed the household land sizes in the proposed sub-location and the human settlement patterns in the different farming systems have had an impact on sustainable livelihood in the rural and agricultural areas.

1.7 Justification of the Study

In Kenya today, most households still depend on the Government to be ‘helped out’ famously said in Kiswahili “*serikali saidia*” in several occasions when hunger strikes, this is a sign of food insecurity and unsustainable livelihood. This is characterized by the over dependence by mostly the rural parts of Kenya on the national government who sometimes depend on the developed countries for food aid especially during droughts. Official estimates show in excess of 10 million Kenyans are food insecure most of whom rely on relief food to meet their dietary needs. The importation of maize by the government as from June through the end of October 2017 from Mexico, South Africa and Zambia to cover high demand and its plan to import yellow maize for animal feed through August 2018 is an indicator of how the country is suffering from food insecurity. This important aspect of life named food security has prompted the Kenyan government of the day to include it in the big four agenda

The study area, being one of the most productive region in the country, contribute to these issues at hand because the lower the production goes, the more the challenges the country may face. It is in the light of this that this research is undertaken to be able to clearly understand the semantics surrounding the agricultural sector and to assess the land sizes as a factor that may be contributing to food security hence sustainable livelihoods. In focus also should be the appropriate human settlement patterns in different farming systems in the study area that will help draw conclusion on the emerging problems. The results of the research have established the land sizes and its effect on food and livelihood security in Kenya. The recommendations given are expected to go a long way in streamlining land

sizes and use and to enable policy formulation aimed at enhancing sustainable food and livelihood security.

1.8 Assumption of the Study

All the land parcels in the study area has the same soil qualities and productivity is uniform.

1.9 Limitations of the Study

The challenges that were encountered during the study led to prolonged duration of the research. Below are the challenges that were encountered during the study: -

- **Inadequate Finances:** The essentiality of finances is to ensure adequacy in writing materials, typing of the study and field work expenses catering. Inadequate finances act as a key hurdle in the attainment of the expected output of the study.
- **Outdated Information:** Lack of up to date information was a key challenge that was experienced during the study. Some of the information that was gathered during the study was outdated hence rendering it less useful.
- **Language barrier:** Language barrier was a key challenge that was faced especially during data collection. Some of the sampled inhabitants within the study area were illiterate hence rendering it difficult to administer the questionnaires.
- **Lack of Cooperation:** Lack of cooperation was a key negative vice that was experienced during field data collection. Since the study entailed respondents who are mainly farmers, gathering data was quite a challenge.

1.10 Organization of the Report

This study is structure as per below format: -

Chapter 1: Introduction-This section encompassed the background information, overview of the concepts related to the topic, statement of the research problem, study objectives, hypothesis, scope of the study, justification, assumptions and limitations of the study.

Chapter 2: Research Methodology-The chapter consists of the research methods used to meet the data needs of each objective. The sampling techniques, the sampling frame,

sample size, study target population, methods for collection of data, its analysis and presentation techniques are all found in this chapter.

Chapter 3: Literature Review-This chapter focused on review of theories, concepts, together with related case studies and best practices. The document reviews for any relevant literature is undertaken in this chapter that results in a conceptual framework. The legal, policy and institutional constructs which confines the study undertakings are also elaborated in this chapter.

Chapter 4: Background to the Study Area-This chapter entailed the location of the study area in Kenya, its current situation being physical features, systems of transport and infrastructure network as well as the population features are discussed. The history of the area and the development evolution of the area. Also, the chapter provides an historical background of the study area.

Chapter 5: Research Findings, Analysis and Case Studies-This chapter presented the data collected from the survey exercise showing the state of affairs in the study area being a clear case of the problem statement. Further, analyzed data is presented inform of charts, graphs and other ways in this chapter.

Chapter 6: Summary of the Findings, Conclusion and Recommendations-The chapter entailed summarized the findings and the settlement models that were picked out from the study, concludes on the entire research and outlines the recommendations that would ensure maximum agricultural produce from varied agricultural land parcels. This chapter also highlights the areas of further research.

CHAPTER TWO

METHODOLOGY

2.0 Introduction

This chapter elaborates the procedures and methodology that were followed in conducting the research study. It discusses research design, research site, study population, sampling methods and procedures, research instruments, data collection procedures and data organization, analysis and presentation.

2.1 Research Design

According to Cooper & Schindler, (2014) a research design provides the route to responding to the objectives of the research by providing the required empirical evidence in an economical way. Collins and Hussey (2015) reiterated the same when they postulated several research design types comprising of descriptive survey that is correlational, meta-analysis or evaluative; causal comparative design and exploratory design.

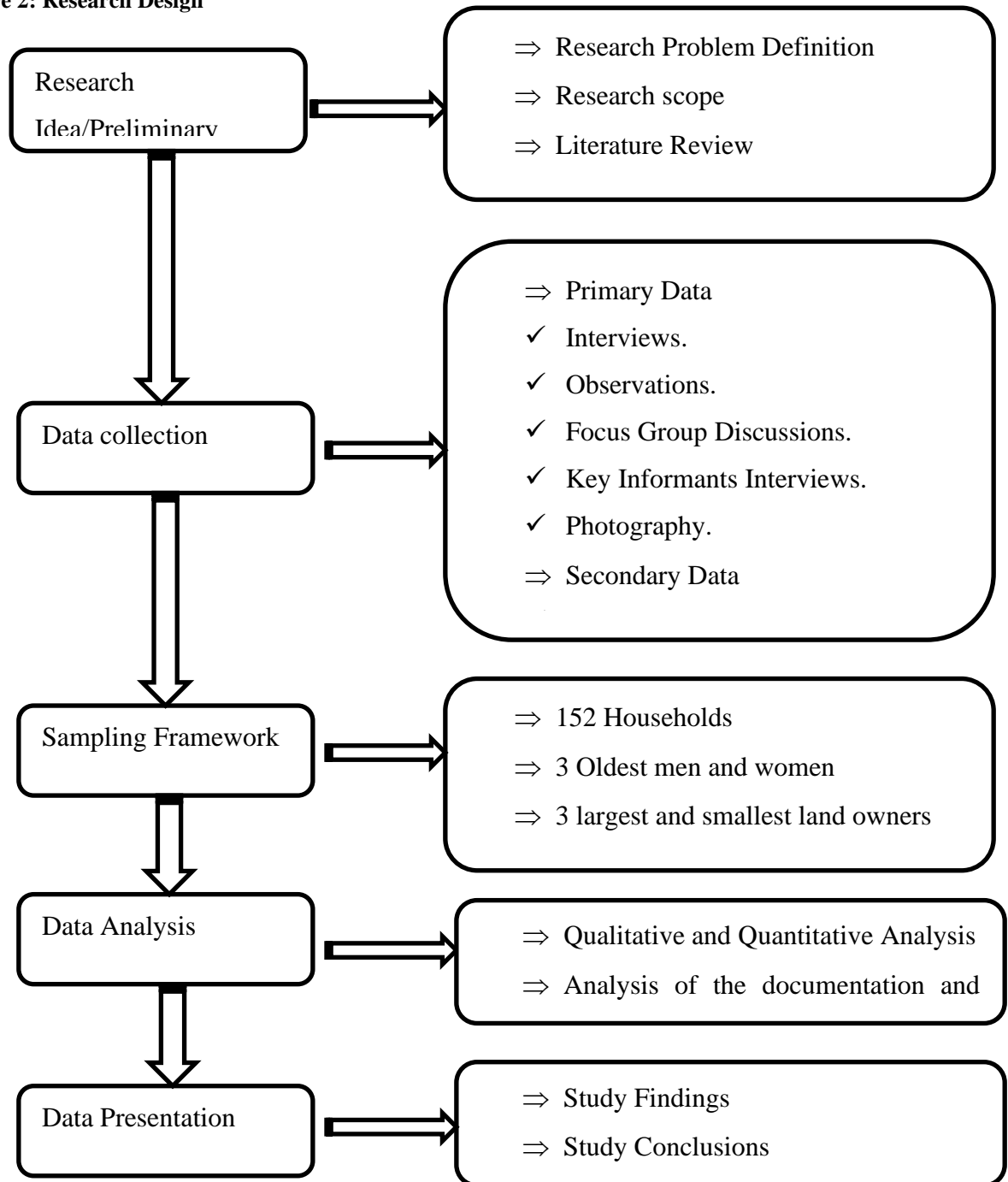
The study utilized a survey design that targeted populations being households, administrators, professionals and religious leaders. A case study approach was used in this research using the qualitative and the quantitative data sets.

Primary data was obtained during the interviews, observations, focus group discussions, key informants' interviews, photography and sketching about Leseru sub-location in the county was be used to examine the impacts of the household land size and land uses. Questionnaires were administered individually to the respondent in the collection relevant data for the study. The data collected was classified, compiled, and analyzed using descriptive statistics with the aid of MS-Excel and SPSS analysis packages, then presented in form of tables, pie charts and bar graphs. The hypothesis for the research was also tested and analyzed using Chi-square.

The secondary data was collected by examining existing documentation and Geospatial technology of satellite imagery known as Landsat Mapper (TM) and Enhanced Thematic Mapper Plus (EMT+) that was used to generate valuable information on the land use change detection over the years. The figure 2 describes the flow of the research design

form the research idea to the data collection techniques and the sampling framework, data analysis methods and presentation.

Figure 2: Research Design



Source: Author, 2018

2.2 Research Site and Population

The research study was conducted in Uasin Gishu County. One sub-location was selected from the county considering the population and the nature of the locality to ensure that agricultural activities take place therein. The highest populated sub-location in a rural set up was selected as ideal for the study. Leseru sub-location was settled on considering it is one of the sub-locations with the highest population in the county and is located in an agricultural zone of Turbo sub-county. Leseru sub-location has a total land area of 62.6 kilometers square and was formally part of Kamagut Sub-location but was awarded a sub-location in itself due to the large geographical size and increased population.

A population refers to group of individuals from which samples are taken for measurements. According to Borg & Gall, (2013), population is the universe of all members of a real or hypothetical set of people, events or objects to which an investigator wishes to generalize the results. Leseru comprise of 1017 household with a total population of 4,931 according to the current statistics from the area sub-chief. The target population of interest in this study consisted of 152 households/farmers living within Leseru sub-location who have been practicing agriculture for economic livelihood over a period of not less than three years before the study. They comprised those practicing the various types of farming systems ranging from crop production to animal keeping but specifically maize. The Table 1 shows the population of the sub-location per village that was sampled.

2.3 Data Needs

Data needs guided the process of answering the research objectives and hypothesis conclusively by making sure that everything is covered by setting a one-to-one correspondence in the crucial elements of the research proposal, i.e., the research objectives, the methodology, and the corresponding statistical analysis. In this study, the specific data needs included the household data, land holdings and sizes, land uses, food and livelihood security, views on land subdivisions, human settlement and the inter-generational transmission of land rights and usage in the study area.

Table 1: Population per Village

| No. | Village | No. of Households | Population |
|-------|-----------|-------------------|------------|
| 1 | Sosiot | 62 | 289 |
| 2 | Emkwen | 95 | 496 |
| 3 | Mokoiwo | 119 | 517 |
| 4 | Lekebet | 32 | 181 |
| 5 | Chepkumia | 18 | 106 |
| 6 | Kaptich | 80 | 395 |
| 7 | Singalu | 51 | 267 |
| 8 | Tamboiyot | 47 | 241 |
| 9 | Simatwet | 35 | 194 |
| 10 | Leseru B | 16 | 77 |
| 11 | Kapkiruk | 63 | 306 |
| 12 | Leseru A | 66 | 321 |
| 13 | Mokoiwet | 112 | 495 |
| 14 | Tungurwet | 81 | 341 |
| 15 | Kapkorio | 64 | 319 |
| 16 | Sukutek | 38 | 167 |
| 17 | Mile 9 | 38 | 219 |
| TOTAL | | 1017 | 4931 |

Source: Author, 2018

2.4 Pilot Study

The pilot study was done using Sosiot village of Leseru sub-location using simple random sampling. The research instruments were piloted in order to standardize them before the actual study. This helped in identifying the challenges that the interviewer and the respondent might encounter and determine if the items in the research instrument will yield the required data for the study. Using simple random sampling, 10% of the study sample size of 152 subjects was selected equivalent to 16 subjects this is according to Mugenda and Mugenda (2003) which states that a sample equivalent to 10% of the study sample is

enough for piloting the research instruments. After responding to the instruments, the necessary corrections were done to improve on their usability.

2.5 Data Collection

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

The researcher obtained an introductory letter from the University of Nairobi which was used to apply a research permit from the National Council of Science and Technology and Innovation (NACOSTI), and then proceeded to the study area for data collection. A covering letter was attached to the questionnaire to request the respondents to participate in the study. The area Chief and ward administrator were informed beforehand about the purpose of the study. A total of 152 households participated in the study and questionnaires administered to them.

2.5.1 Interviews

Data from members of households, administrators, professionals and religious leaders on land sub-division, fragmentation and use allocation and their impact on food, nutrition and livelihood security was collected using an unstructured questionnaire through face to face interviews. Group interviews, key informant interviews and round table discussions were also conducted using open ended customized interview guides. The idea for both individual and group interviews was to get responses in respondents' original words (thoughts). Administrators that were interviewed included: Chief, Assistant Chief, MCA, Ward administrator, area MP and former MP who are from the sampled sub-location. Professionals interviewed from the sub-location included male teachers, female teachers, medical staff, pastors within the Leseru sub-location. The other key informants from

outside the sub-location that were interviewed included the County Lands Officer, Physical Planner, County Surveyor and the Agriculture officer.

Patton (1990) recommends 5-8 persons for focus group discussions. A total of three focus groups of eight to twelve male and females in equal proportion were interviewed in focus group discussions. These included the youth focus group; women focus group and men focus group. Plate 1 and Plate 2 indicates the focus group discussion sessions with the chief and the youth respectively from the study area.

2.5.2 Observation

An observation checklist was formulated to ensure that all the data that need 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. The observation checklist is attached in appendix 6.

2.5.3 Photography

A photography schedule was formulated to ensure that all the data that need to be gathered through photograph 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. The photography list is attached in appendix 7.

Plate 1: Key Informant Interview



Source: Field Study, 2018

Plate 2: Focus Group Discussion



Source: Field Study, 2018

2.5.4 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 include 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. Case studies from other countries that have had high population growth, land subdivision and fragmentation problems in the rural areas was also be reviewed to gather information on how they solved the problems.

2.6 Sampling Framework

A sampling framework is a compressive outline of which measurements were taken at what times, in what manner, on which material, and by whom. Sampling plans for this research was designed in such a way that the resulting data contained a representative sample of the parameters of interest and allow for all questions, as stated in the objectives, to be answered.

2.6.1 Sample Size

The sample size of the research was determined using the formula adopted by Cochran 1963 with 8% significance level as indicated below;

$$n = N / [1 + N (e)^2]$$

Where; n – sample size

N – Population size

e – Level of significance

$$n = 4,931 / 1 + 4,931(0.08)^2 = 152$$

2.6.2 Sampling Method

Households were sampled using stratified random sampling method. Stratification was be based on gender and age of head of household. The sampling plan for households/farmers was 152 households done proportionately for male headed households, female headed

households, singles headed households, orphans headed households and child headed households. In addition, extreme case sampling will also be done in order to identify three farmers with the largest land sizes and three with the smallest land sizes for every farming system to compare and contrast their experiences and opinions on future land size and land use practices.

In addition, sampling using inter-generational lineage was done by identifying the three oldest men and the three oldest women in the sub-location. This was done to enable the team to document inter- generational land use practices, land size change and transmission of land rights. It also gave hints on the likely future trends under business as usual scenarios.

2.7 Ethical Considerations

The researcher assured the respondents of the confidentiality of the information provided, including their own personal information. The respondents were informed of the purpose of the study, that is, for academic purposes only. This was to enable them to provide the needed information without any suspicions.

2.8 Data Analysis Methods

Various methods were used to analyze the collected data. They include use of SPSS to generate frequency distributions and measures of central tendency. Qualitative data were analyzed using both case analysis and cross-case analysis depending on the variable in questions. Document analysis, analysis of maps and photographs was also undertaken. The Landsat satellite images were downloaded and classified using the Erdas imagine software for remote sensing.

2.9 Data Presentation Methods

The findings have been reported both descriptively and graphically using, tables, bar charts, histograms, pie-charts, graphs and polygons as determined by the researcher.

CHAPTER THREE

LITERATURE REVIEW

3.0 Introduction

This chapter is presenting an objective and a critical summary of published research literature relevant to the assessment of land sizes and uses in maize farming systems for sustainable livelihood in rural Kenya. The aim of the review was to create familiarity with current thinking and research on the above topic, justify the research and help in exploitation of the overlooked or understudied areas on the subject matter.

3.1 Definitions of Concepts

Land is defined as “a delineable area of Earth’s terrestrial surface that encompasses all features of the biosphere above or below its surface with those of near surface climate, soil and its forms of terrain, surface hydrology together with shallow lakes, marshes, rivers and swamps, near surface sedimentary layers and its accompanying ground water reserves, flora and fauna populations, patterns of human settlement and the physical outcomes of past and present human activities such as terracing, drainage structures, buildings, roads, water storage facilities amongst others (FAO, 2012).

Land Cover: This includes the physical components present at the earth’s surface. Land cover as defined by Turner, et.al, (1995) is the immediate bio-surface as indicated by the elements of physical environment such as soils, groundwater, vegetation cover and the biophysical state of Earth’s surfaces

Land Use is defined as the activity carried out on land for its utilization. This human activity on land can either happen in an urban or rural land. Farming and its associated activities are mostly the significant land use in the rural areas whereas urban land use is mostly commercial and residential.

Rural relates to the countryside life as opposed to the town or city characterized by farming and other traditional activities. The population in a rural set up is mostly sparse. Countryside lifestyle and agriculture are the major uses of rural land.

Population is the refers to the number of people who live in a given geographical area or within an administrative region such as country, county, location or a town

Density is defined as the proportion of a quantity to that of another.

Population Density is a measurement of size population per unit area. A population density is achieved when the total population of an area is divided by the total area of land or volume of water with the appropriate units of measurement mostly per square kilometer. In the case of human population density, the total number of human beings in a unit area like square kilometer or square mile is the population density.

Land fragmentation is referred to as a farm practice where a single farm is sub-divided into distinct parcels due to human and natural activities.

Land consolidation refers to changes in the land arrangement and readjustment of land tenure in a certain land territory in order to create integrated soil management units.

Land ownership: This refers to legal, contractual or customary arrangements through which individuals or organizations gain access to social or economic opportunities through land Ratcliffe (1976). According to Kivell (1993), land ownership is an integral part of both national and local economics which can be seen as part of the relationship between production sector and the consumption sector. Cox (1984) agrees with Kivell (1993) stating that land owners exert considerable influence over urban planning especially if they act in concert.

Land Policy: According to Baken (1992), land policy is the involvement by the government in the land market mainly through the enforcement of tax, planning regulations and provision of infrastructure and services all in the process of development

Farming systems is the organization unit of the farm comprising of households, cropping and livestock and all the enterprise in relationship to each other.

Food security is viewed as availability of adequate access to food at global, national, community and household level ensuring adequate food production, access and absorption (Pinstrup Andersen, 2009). This is geared towards ensuring availability of food, access and utilization as well as stability and sustainability overtime (Napoli et.al 2011). This is a situation when everybody, at all times is able to adequately access a sufficient quantity of affordable, nutritious and safe food for a healthy and active life. Food security in this case

is defined as a case when everyone, all people have the social, physical and economic access to safe, affordable and nutritious food at all times so that they can lead a healthy and active life (Kenya Food Security Steering Group, 2008).

Household as defined by (Beaman, 2011) consists of people or group of people that live together in a common dwelling unit where they share meals together and recognize some form of authority mostly of father or mother (man or woman) as the head of their household in a domestic entity comprising of the family members who live together along with other group of people who are not relatives.

Livelihood refers to how a human being or any living creature secures their necessities for living, it is about the means and ways of making a living, income or revenue.

3.2 Household Land Sizes and Land Uses

Land sizes vary from one household to another and this may determine what to be done to the land and how it can be managed and transmitted to the other generations. Land usage refers to the activities to which land is subjected to and is frequently determined by; public policies, monetary returns, socio-cultural practices and ecological zones.

3.2.1 Household Land Sizes

The parcel or holding size and their effects on the fragmentation of land and agricultural productivity are major drawbacks globally. A good example is in China where an exploration of the effects of land fragmentation and size of holding to rice farming was conducted. It was discovered by Ben-Chendo et al. (2014) that rice farmers held very small land sizes that had the effect of discouraging the practice of farming rice. A study by Tan et al. (2008) demonstrated that less technological advancements were applied by farmers who held more smaller parcel sizes with diminishing technological use as the plots got farther away. Contrastingly, an increase in the size of the farm was reported to have reduced the overall cost of production per ton. C. Bizimana et al. (2004) suggests that increased population ultimately results to reduction in the fragmentation of land holdings as well as the parcel size to smaller ones and therefore the size of the parcel is the core feature essential in describing use of land and measure its fragmentation levels. V.V.Kakwagh et

al. (2011) also comments that when landholdings are divided into several small parcels which are spatially dispersed coupled with their being farther away from the farm house in varying distances deters the development of agriculture in multiple ways. This could eventually have negative impacts on food and livelihood security.

An interesting scenario from the literature review that has been addressed in this research is the inverse of the observations above where some researchers concluded that the smaller the land sizes, the greater the production. It is possible for the inverse to happen since access to land is a limitation due to population pressure. Sen (1962) reported the inverse connection between the size of the farm and production per unit area in Indian agriculture implying that smaller farms produced more than larger ones. The relative advantage of relying on more on family labor for smaller farms than larger farms is more likely to reduce need for supervision and monitoring costs associated with hired labor explains more about the inverse relationship between productivity in smaller and larger farm holdings. In this regard, equity is therefore considered of little or no effect as far as efficiency in agricultural production is concerned and raises the concerns of redistributive reforms on land in most of the agrarian nations. Feder (1985) similarly demonstrates that smallholder farmers have relatively high work to land ratios with the possibility of attaining higher produce per hectare. In addition, different research findings in India show the inverse relationship between size of farm and its productivity including D. Mazumdar (1985). The inverse relationship was also found to exist in Philippines, Indonesia and Bagladesh by Berry & Cline (1975), Hossain (1977), and Herdt & Mandac (1981) correspondingly.

According to V. Obonyo et al., (2016) land fragmentation has more disadvantages than its merits especially when it comes to its effects on crop and livestock production, given that it decreases amount of crop yield, livestock rearing and encouraged land conflicts. Based on these findings, most of the residents of Ugunja sub-county did not advocate for land sub- division but instead opted for buying of land elsewhere. It was also concluded in that research that through land consolidation, most of the farmers could practice modern agriculture such as tilling using tractors and sparing other land spaces for animal grazing and growing of fodder for animal feeds. In Kenya, land sizes have been decreasing by the day thereby contributing to decline in food production. Consequently, the country has

suffered many cases of food insecurity due to rapidly growing population. This study seeks to point out the possibility of reduced maize production where land sizes have been consistently reducing.

3.2.2 Household Land Uses

This research establishes and operates on the basic understanding of land use as the economic, social and cultural activities that are carried out on land. The interactions between household land use and food security, both now and throughout the next few decades, are of paramount interest to policy, farming systems and sustainable human livelihoods at large. Land is the main and core natural resources from which human activities, economic, social-cultural, and infrastructural activities are carried out. Land use changes therefore are a common occurrence all times whether in the past or present and will definitely continue to occur even in the future (Lambin *et al.*, 2003; Moser, 1996). Land use changes have both positive and negative effects with which the negative effects are a major cause of concern worldwide owing to their influence on the wellbeing of humans and their food security. Deforestation and intensification farming are for instance very pervasive when aggregated globally with notable effects on core features of the earth systems (Lewis, 2006; Zhao *et al.*, 2006).

According to Belmont (2015), land-use, and particularly change in land usage, is perhaps the most important driver of environmental or ecological change as it leads to a significant number of the primary areas of concern: greenhouse gas emission, loss of biodiversity, alteration of hydrological cycles and soil degradation. Land-use change is happening globally due to human expansion dynamics and it ranges from entire scales changes in land cover (for instance, from the usual woodland to prairie or cropping), to changes in the strength of cropping on a given location (i.e, from one yield per year to two or more yields per year “intensification”), and also changes in the sort of cropping on a given location (i.e, from sustenance crops to vigor crops), or from yield production to preservation. The nature of changes in the agricultural technologies and practices employed (e.g., the use of manures or fertilizers, rotations, water and soil management, set-aside) can vary substantially in their impacts on hydrology, carbon storage, biodiversity, and so on. Change in land use

similarly impacts access to sustenance. It is a major driver of social change, particularly since the social structures translate into precise spatial association patterns (multifunctional land regions versus particular land regions; individual possessions right versus customary rights). Land usage change influences occupations and monetary systems, relocation patterns and societal cohesion, and on social customs and preferences. Alongside land use alteration, economic and societal value systems can change; market places and trade opportunities can open and close; and economic, cultural and social capitals can altogether be gained and lost.

3.2.3 Land Tenure System

Land tenure and food production are directly interlinked having an overall effect on the food security of a household, community and the nation in general. Land tenure insecurity is the risk of encroachment or eviction versus the degree of protection by the government against such encroachment and eviction (Jacoby, Li, and Rozelle 2002). According to Bessley 1995, the three-key implication of a proper tenure land system include: -

3.2.3.1 Credit Access Effect

This implies that legit land title deed can be used as a collateral to borrow money in order to invest. This is because it will act as a security to the lenders. In instances where an individual would like to borrow for investment, they can use their title deeds as security.

3.2.3.2 Investment Effect

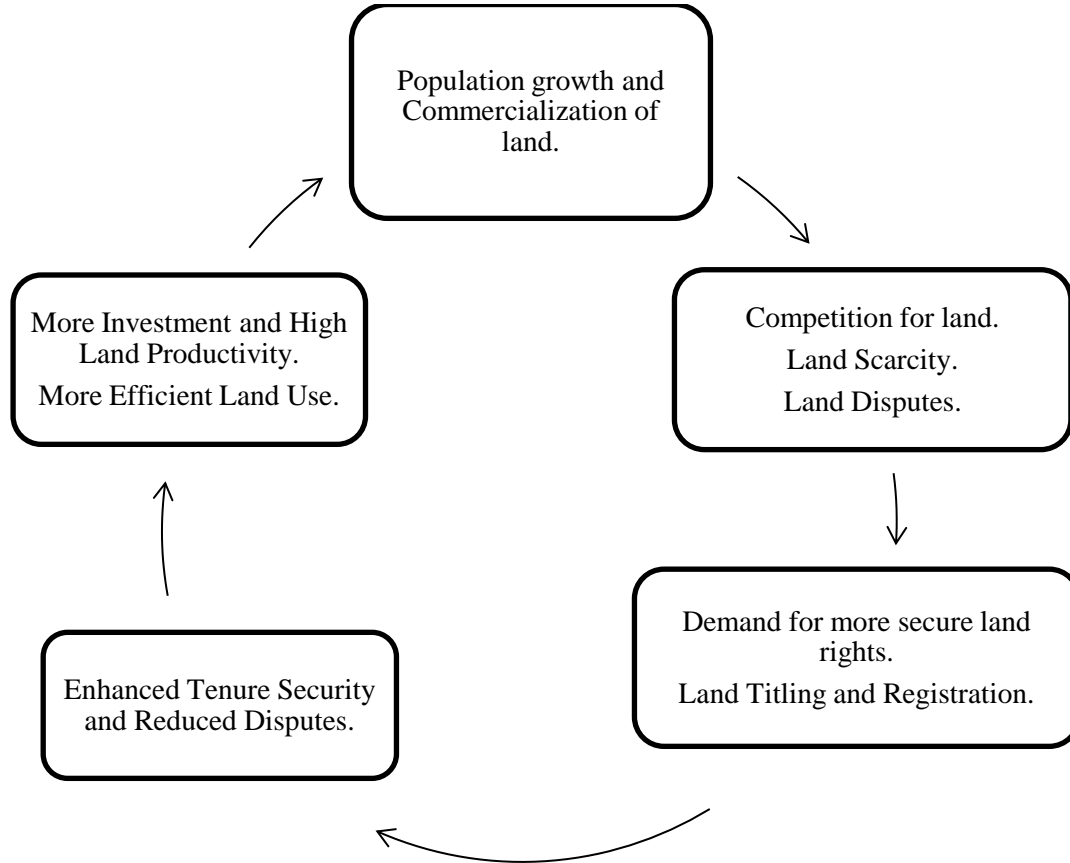
An individual is more likely to carry out a relatively highly profitable investment which could be a bit costly if there is security of tenure. In food production, this simply implies that, farmers with title deeds are most likely to invest more in their land parcels as opposed to those with uncertainty on their land ownership.

3.2.3.3 Transferability Effect

This implies that land can be passed on to a more productive individual. In incidences where the land owner feels that he/she is not in a position to reap maximum agricultural returns from the farm, one might decide to rent it out or sell the parcel.

The Figure 3 illustrates the logical chain relationship between land reform system and land tenure system. In the chain, population growth and commercialization of land matters are the key drivers that keep the cycle moving.

Figure 3: Chain Relationships



Source: Adapted from (Platteau 1996)

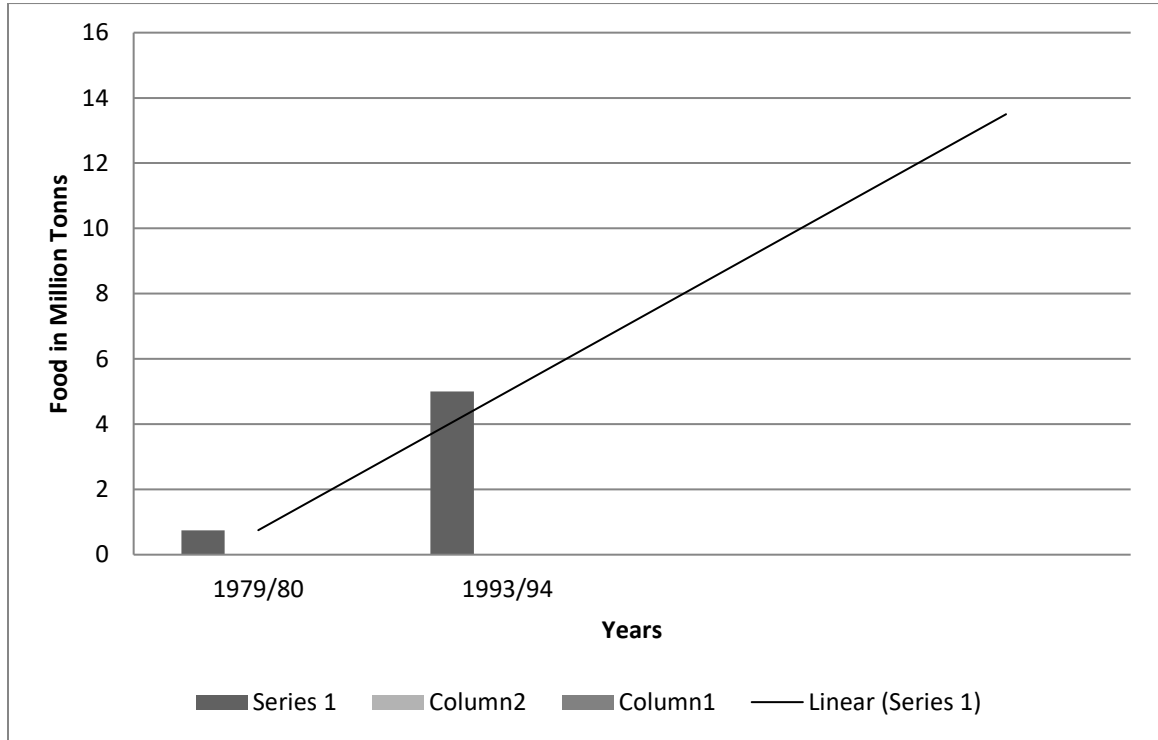
Poor management of land is attributed to weak rights to land and contributes to degradation of land due to insecurity of land tenure. As such, it causes overall negative effects on food production and results into reduced agricultural yields. In presence of tenure security, the owner has the will to invest as a result increased agricultural yields hence food security for the household, community and the nation in general (Hayes, Roth, and Zepeda 1997).

3.3 Impacts of Household Land Sizes and Uses

A 2010 report on the state of food insecurity by United Nation’s Food and Agricultural Organization (FAO) shows that close to a billion people across the world are under-

nutritioned with majority 98 percent of them living in developing nations (FAO, 2010). Ethiopia is according to FAO, 2010 one of the poorest nations on the earth with almost a quarter of her population being undernourished and experiencing chronic hunger. The Figure 4 shows the food gap a case of Ethiopia in Africa.

Figure 4: Food Gap in Ethiopia



Source: Befakadu and Berhanu, 2009.

Drought resulted to loss of an estimated a third of expected yield in Southern Mozambique pushing the government to request for surplus aid from international organizations to feed approximately some 650,000 individuals in 2001-2002. More than 70 percent of Southern Mozambique population relied on rain-fed agriculture exposing the country to more vulnerabilities of frequent water stresses though at varied places or different time scales (UNICEF, 2011b, 2011c).

Climate change results into fertilization effect on the plants due to the presence of excessive carbon dioxide in the atmosphere which has direct effect on plants life. This leads into low crop productivity because of reduced photosynthesis rate especially. The Table 2 summarizes the effects of land use and land sizes on farming as found out by different researchers.

Table 2: Effects of Land Use and Size on Farming

| Author | Country of Study | Measurement of Fragmentation | Effects of land use and size on farming |
|------------------------------------|---|--|---|
| <p>Blarel et al. (1992)</p> | <p>Ghana, Rwanda</p> | <p>The Simpson Index</p> <p>The number of parcels per farm</p> | <ul style="list-style-type: none"> • Land productivity is not adversely affected by the degree of fragmentation • A farmer's access to diverse agro-climatic conditions are increased by fragmentation and hence high possibility for diversified cropping patterns. • Fragmentation offers farmers a risk management tool, seasonal shortage of labor and cushion from food insecurity and thus not as inefficient as is largely assumed to be. |
| <p>Lerman (2005)</p> | <p>Four districts in Georgia</p> | <p>The Simpson Index</p> <p>The number of parcels per farm</p> <p>The average distance to the parcels in each farm</p> | <ul style="list-style-type: none"> • Increase in number of parcels decreases farm productivity with a non-statistically significant relationship. • There's a negative significant effect of fragmentation on productivity. • Productivity depends on both fragmentation and other variables like size of the farm. • Increase in crop specialization and fragmentation decreases total factor productivity. |

| | | | |
|-----------------------------|---|---|---|
| | | | <ul style="list-style-type: none"> • Increase in fragmentation decreases technical efficiency |
| Wan and Cheng (2001) | Four Provinces in China | The number of plots per farm | <ul style="list-style-type: none"> • Crop production outputs are adversely affected by land fragmentation. • Eliminating land fragmentation has potential to raise grain output to 71.4 million metric tons. The output gains are apparent in wheat and tuber production. • Land fragmentation elimination requires planting of individual crops on the same block at the family farm rather than allocating each family a single piece of land. |
| Hung et al. (2007) | Two Northern Vietnam provinces | The Simpson Index The number of parcels per farm | <ul style="list-style-type: none"> • Fragmentation is rampant on small farm sizes as compared to large-sized ones. • Crop productivity is negatively affected by fragmentation. • Increased monetary expenses and use of family labor are a result of fragmentation. |
| Jha et al. (2005) | Two contiguous villages in Southern India | The Januszewski Index | <ul style="list-style-type: none"> • There exists a positive relationship between size of farm, average plot size and yield. • The relationship between number of cultivated plots and yields for two dominant crop sequences is |

| | | | |
|--------------------------------|------------------|--|---|
| | | | <p>negative hence fragmentation is implied to have adverse effects on productivity of crops.</p> <ul style="list-style-type: none"> • Significant economies of scale exist in relation to both farm and plot sizes while slight economies of scale might be present in relation to number of plots. |
| Sundqvist and Andersson (2006) | Northern Vietnam | <p>The Simpson Index –</p> <p>The number of parcels per farm</p> | <ul style="list-style-type: none"> • Fragmentation of land positively affects its productivity. • The positive effects are attached to increase in use of fertilizers and the hours a farmer worked on the farm in relation to increase in plot numbers. • Labor productivity is not significantly correlated to land fragmentation. |

Source: Adapted from Boliari N, 2013

3.4 Factors Influencing Land Use and Size

Farming systems in sub-Saharan Africa have experienced changes in land usage, productivity and sustainability. Understanding of the drivers that have prompted change in land use in these systems and elements that impact the systems' sustainability is worthwhile to guide appropriate targeting of intervention strategies for development. A study conducted by Oyebanji (2003) on the factors that influence land use allocation patterns, location of towns and their growth and morphology and the procedures at play in formation of distribution patterns and uses indicate an interplay of several sorts of influence at work. Albeit various fields professionals manage the situation differently.

Litchfield (1969) stated that the sociologist is of the opinion that it is the human being and his psychology, which is the key to the process, his attitudes, interest, values, prejudice, likes and dislikes. The geographer believes that man's activities are naturally overwhelmed. He puts emphasis on items like elevation, relief, geology and climate. On the other hand, the economist argues that use of any piece of land is mainly because of the economies that are accrued from its use. A land parcel's accessibility to individuals and its circumstances in linkage to other parcels of land around it determine the economies to be accrued from this parcel if it is put to use. Quantum benefits derived from location of land provides primary explanations of the benefits accrued from it as compared to its established uses and existing or proposed communication or transportation demands.

The current land use, its specific ownership and setting geographically for which the parcel is located determine the process for land use decisions and so also the factors that contribute to changes in land use. Most decisions on use of land and its changes are commonly associated with farm units since agriculture is the most extensive form of land use albeit not always exclusively so. Physical environmental features guide use of land as they to a greater extent determine suitability of land for variety of uses. These factors become constraints on the range of options in cases of planned or contemplated land use changes by land managers since they somehow determine the final decision.

Land use changes can be triggered by demand variations since they affect related benefits. Similarly, benefits are also influenced by multiple other aspects including labor costs and accessibility, core inputs mainly raw materials, capital, potential substitutes among factors of production, end product costs, support by the state in form of tax subsidies/exemptions or even various incentives and the services that are associated with specific use of land. The land parcel size together with other parcels' competition, especially neighboring land parcels, affect the gains expected from the parcel and therefore the decisions on land use changes. Strong land development interests usually buy smaller parcels first in instances of keen competition for land. Land use decisions are also influenced by technological factors that impact on the accruing profits to land managers. Modern technologies availability and their ease of application on land have substantial effects on the employed

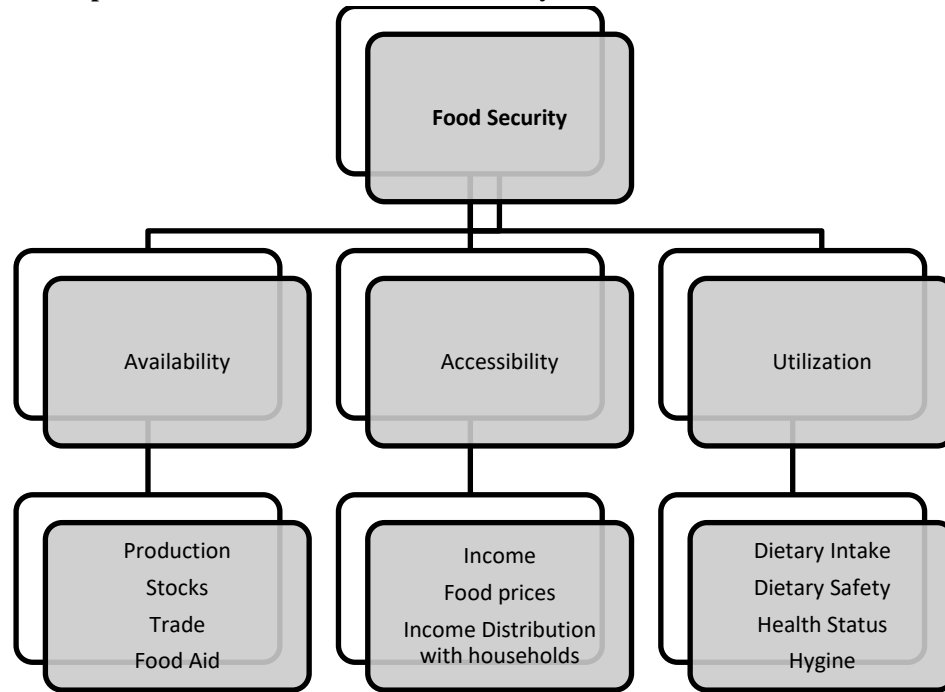
capital and labor productivity. For instance, it's difficult to mechanize mountainous regions which constraints the land use types in these areas. The potential for some kind of changes in land use is to an extent determined by the rate and ease of adoption of existing technologies to land managers. In a broader perspective, the knowledge resources endowed by land managers or obtainable by them such as traditional knowledge or technical assistance contribute largely to decisions on land uses. Decision making on land uses is directly or indirectly influenced by formal or informal institutional arrangements. Perhaps land tenure and ownerships are the most influential factors. Land use decision making in case of individual land ownership is quite different as compared to instances where land communally or state owned.

According to Gebre-Selasie 2005, the land holding per capita, household farm and off-farm activities income per capita, availability of livestock and land tenure are aspects that affect food productivity. In Mozambique, food and nutrition security are strongly linked to environmental conditions. According to (UNICEF, 2011b, 2011c), climatic conditions have adverse effects on the food production trends in a locality. This comprises of droughts and floods which have widespread agricultural losses to subsistence farming households. According to Sabates-Wheeler 2012, besides land usage and land size other factors that affect food production include:-

- Rapid Population growth.
- Land degradation.
- Extreme climatic conditions.
- Poor rural infrastructure.
- Low levels of agricultural technology

The three main elements that guide food securities include; food production, access and absorption (Khan, 2012). Food security is viewed as availability of sufficient access of food at global, national, community and household level (Pinstrup Andersen, 2009). This is geared towards ensuring availability of food, access and utilization as well as stability and sustainability overtime (Napoli et.al 2011). Figure 5 illustrates a conceptual model of a household food security.

Figure 5: Conceptual Model of Household Food Security



Source: (Napoli et.al 2011).

Tenure security should be observed to ensure high agricultural productivity. Tenure security ensures that the owner has the will to invest more in the given land parcels. This would lead to increased agricultural productivity in turn leading to food security for the households. The state has an important role to play in ensuring tenure security. According to Bruce 1986, the various interventions that the government should carry out include: -

- Land titling reforms to ensure proper tenure security
- Security of land tenure and land-to-the-tiller policies
- Tenure security and radical reforms on redistribution of land
- Market-assisted land redistribution reforms and tenure security
- Tenure security and low-cost land certification reforms
- Tenure security and customary tenure reforms

3.5 Documentation of Inter-generational Transmission of Land

Intergenerational transmission refers to the process in which physical assets are transferred from one generation to another. Nevertheless, the intergenerational transfer can as well

occur as inter-vivos where property is transferred among individuals who are alive mainly at strategic conditions. A good example was described in a study by Fafchamps and Quisumbing, 2008 who reported the possibility of parents transferring property to a child before they got married. This is also averred by Cheater (1983) and Shipton (2007). They reported parents transferring property when they are about to retire. Despite inheritance legal analyses focusing on property devolution at divorce or death, some recent researches and ethnographic studies record a broader range of property transfer catalysts. The African culture has always favored transfer of land ownership from parents to children which in turn leads to decrease of land under cultivation as a result of sub-division. The area under study also suffers from this effect and thus land use is changing with generational dynamics. This research study seeks to understand these dynamics and offer solutions that will alleviate food insecurity and economic livelihood.

3.5.1 Land Transmission and Acquisition

There are several modes of land acquisition that include; inheritance, registration, allocation, purchase, gifts, public auction, adverse possession and compulsory acquisition.

3.5.1.1 Inheritance

Inheritance is a very common means of property transfer presumed to be as a result of instances in the human lifecycle of birth, marriage and/or divorce, and death. Inheritance is the major mode of land acquisition in Sub-Saharan Africa according to Platteau and Baland (2000). Allocation is without doubt most of the work that Sub-Saharan countries focus on as far as inheritance of property is concerned. This is in congruence with poverty and asset computations where land is customarily the beginning point particularly in Africa. Land in Africa has for the longest time possible been considered as the primary origin of wealth, a symbol for power and social status since it is the basis upon which food, shelter and economic activities are obtained. Access to land rights is very critical due to its ability to offer access to resources like water and services such as electricity and sanitation coupled with the ability for long term investments like housing on land. An individual and a household's economic and livelihoods security are hugely considered to be dependent on access to land rights and so is the same for a community and entire nation's wider economic

development. Deininger, (2004) points out that most of poverty-oriented studies in the context of Africa have particularly delved on substantiating the significance of rights and access to land. He argues this is due to the fact that land holds the largest share of the poor's asset portfolio especially the rural poor in the entire African continent.

3.5.1.2 Registration

Registration of land entails the act of putting claim on land or attaching rights of ownership of a given parcel of land as long as such land hasn't been set aside for any public purposes including and not limited to national parks, game reserves, mining, forest reserves among other natural resources reserves. Such claims on land are frequent on ancestral land mostly inherited from parents. Land registration is considered legal if the claimed ancestral land is located within a declared land adjudication region in accordance to Cap 284 of the Land Adjudication Act. Alternatively, it can be registered if it lies within the consolidation area as guided by the Land Consolidation Act Cap 283. Under the Registered Land Act Cap 300, a claimant is issued with a title deed if the claim has been legally successful in accordance to the procedures of the above acts. It is through this process that majority of Kenyans have been able to legally acquire freehold land rights and title deeds to their land according to Kameri-Mbote, P., (2006).

3.5.1.3 Allocation

The allocation of land refers to the process of acquiring land from a local authority or the government for purposes of commercial, agricultural, industrial or even residential use. The process of land allocation starts when a local authority or the government advertises the parcels/plots available for allocation and then invites the applicants who meet the stipulated land allocation requirements. Individuals undertaking special projects are also allowed to apply for allocation of land directly to the commissioner for land. Their application should not be alienated and neither should it interfere with public interest. In cases where the allocation is to be done on a gazzeted land such as game reserves or forest reserves a degazzetment must be done in the official Kenya Gazette and a public opinion must be done before such degazzetment is done. Nevertheless, some dishonest officials have abused the allocation of Government and trust land where they act in complete disregard of the laid down laws and procedures as happened in the case of Mau forest.

3.5.1.4 Purchase

This is situation in which land is acquired on basis of a willing buyer and willing seller with value considerations attached to the said land. It is kick started by drafting a sell agreement that binds the terms and conditions of operations of both parties involved in the land buying/selling transaction. Upon successful drafting of a binding sell agreement, an official search is made by the parties involved in the transaction. After clearing with the specific land control board and a successful search is completed, a transfer of the land is done and registered in the appropriate land registry. Individuals who acquired land in the case of Mau forest through this method have a better chance of getting government compensation once eviction is undertaken.

3.5.1.5 Gift

This is the method where the beneficiary acquires land from the benefactor who might be a parent, spouse, a relative or a friend when they are still alive. The beneficiary of a gift has to pay stamp duty like that paid for purchased land, there is an exemption to paying stamp duty only when the gift is changing hands between spouses but they must declare in the land transfer form that the consideration is "love and natural affection" to enable the collector of stamp duty to give exemption. A marriage certificate or an affidavit must be sworn to prove that the benefactor and beneficiary are spouses.

3.5.1.6 Public Auction

This is land acquired from a loanee or guarantor who has defaulted in loan repayment from a financial institution, whereby the institution exercises its power of sale as a chargee to recover money owed. The auction is advertised in local newspapers or any other media. Then the date is set, where the interested buyers place their bids and the highest bidder secures the land. Sometimes the auction can be done through a private treaty between the financial institution and the purchaser hence no need for public auction. But it should be made clear that it is up to the purchaser to be sure of the physical site and condition of property.

3.5.1.7 Adverse Possession

Adverse possession of land is a way of acquiring land from a private registered proprietor who is not in physical possession of the land. The claimant must have stayed peacefully in

the land for a minimum of 12 continuous years known to the landowner without interruption. Once the claimant petitions the High Court and the facts are proved, then the claimant can be registered as the new owner. Many squatters have acquired land in this manner.

3.5.1.8 Compulsory Acquisition

Sometimes the Government requires land for various development projects like road expansion and other public utilities. If it doesn't have that land, it acquires it from private individuals through compensation. However, some individuals are difficult and refuse to surrender land thereby making the Government to evoke the Compulsory Land Acquisition Act. The land owners are compensated as per the valuation of the chief land valuer and where there is dissatisfaction; the aggrieved party can appeal in the High Court. Compulsory land acquisition must be for, and only for public utility.

3.5.2 Documentation of Intergenerational Transmission of Land

There is need to be informed on how the household land sizes and land uses have increased or reduced over the span of time as it has been passed from one generation to the other. This is of importance in determining the effect of these changes on food security and human livelihood. In the world over, land records kept by the government agencies that are in charge of the matters to do with land. This includes the spatial location of the land, ownership of the land, the size of the land owned, the status of land rate payments to the government among other information related to the specific parcel.

3.5.2.1 Land Sizes Documentation

Every government in most parts of the world has got a system of keeping land records all the time. This documentation order in most developed parts of the world is called Land Information System (LIS). This is a digitized system of keeping land records that has got spatial locations in form of maps and other attributes that include the owner and his/her details, the land tenure system, government's rates payments etc. According (Informatics, 2018), A Land Information System (**LIS**) is a Geographic Information System that is used land use mapping and cadastral. It is normally composed of present, reliable and accurate records of land cadaster and its associated attributes. It consists of a spatial data that

indicates the legal boundaries of land tenure. Further, LIS provides a critical base layer upon which integration to other spatial information systems is done. A LIS can as well be managed as stand-alone land record database solution that allows users to create, store, retrieve, view, update, analyze and even publish land related information.

The most important natural resource in majority of Kenyan societies is land which represents the basic foundation for majority of the country's economic activities. The purchase of a parcel of land is the most important single largest financial and legal transaction for majority of individual Kenyans in their lifetime. As such, land transactions of buying, selling, refinancing etc. represent a substantial element of the country's economy. Consequently, the country's economic competitiveness in the modern world is heavily reliant on the ability to firmly and quickly obtain land ownership in order to permit secure and effective land transfers. The frequent changes in land ownership mainly through land subdivisions and transfers are a result of an ever-growing population.

3.5.2.2 Land Usage Documentation

There is no better way of documenting intergenerational transmission of land usage than to use technologies that show the changes of land uses and land cover over a certain span of time. One of which is geospatial technology using satellite imagery and related methods like photography and archived information. Land use and land cover are according to Dimiyati et al., (1994) two separate terms that are interchangeably used in most cases. They form the basis upon which the status of land can be understood worldwide since it shows both past and present state of the earth's surface.

The analysis of land use and cover is a very essential component in environmental sciences and natural resources management. This is so due to the fact that land use and cover analysis aids in making informed decisions as far as sustainable development is concerned. Land cover acts as a secondary catalyst that measures the components of the earth surface as an essential element that impacts on the functioning and condition of the ecosystem. This gives the biophysical state of the surface of the earth. A well analysed land use and cover pattern of an area provides critical information on the socio-economic, natural, development and human livelihood conditions. The ever-increasing pressure on land from

populations and a very high demand for agricultural products delimits land each day just like any other natural resource Yadav et al., 2012).

In a study by (Achola, 2015) the analysis of the impacts of land use and land cover changes in an agricultural rich land within Kiambu county was conducted using GPS, Remote Sensing and GIS tools. The study focused on the long-term use and cover changes on land in Kiambu county. It adopted the use of time-series analysis of Landsat images for 1984, 1993, 2002 and 2013. Further, the analysis relied on satellite images of Enhanced Thematic Mapper plus (ETM+) and Landsat Thematic Mapper (TM) together with other auxiliary data.

In this study, the researchers concluded that there was a decline in agricultural land from 39.7 percent to 15.8 percent over the entire study period. This could be deduced to imply or indicate that the county was gradually becoming food insecure overtime noting its high rate of population growth that compounds the situation. Further, the findings showed that the built up/urbanising area was growing at a tremendous rate from 1.9 percent to 33.5 percent over the same period of time. This state of land use and cover changes in Kiambu county are best illustrated in Figures 6,7,8 and 9 for 1984, 1993, 2002 and 2013 years respectively.

Figure 6: Kiambu Land Cover for 1988

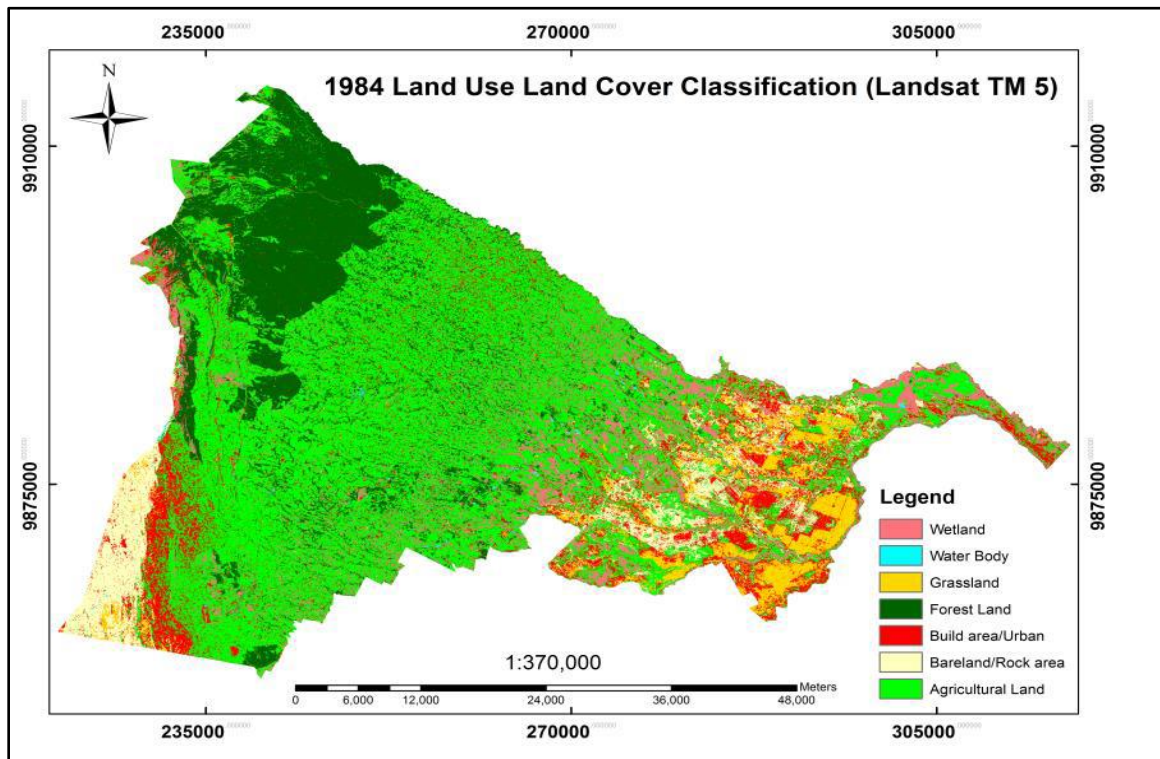


Figure 7: Kiambu Land Cover for 1993

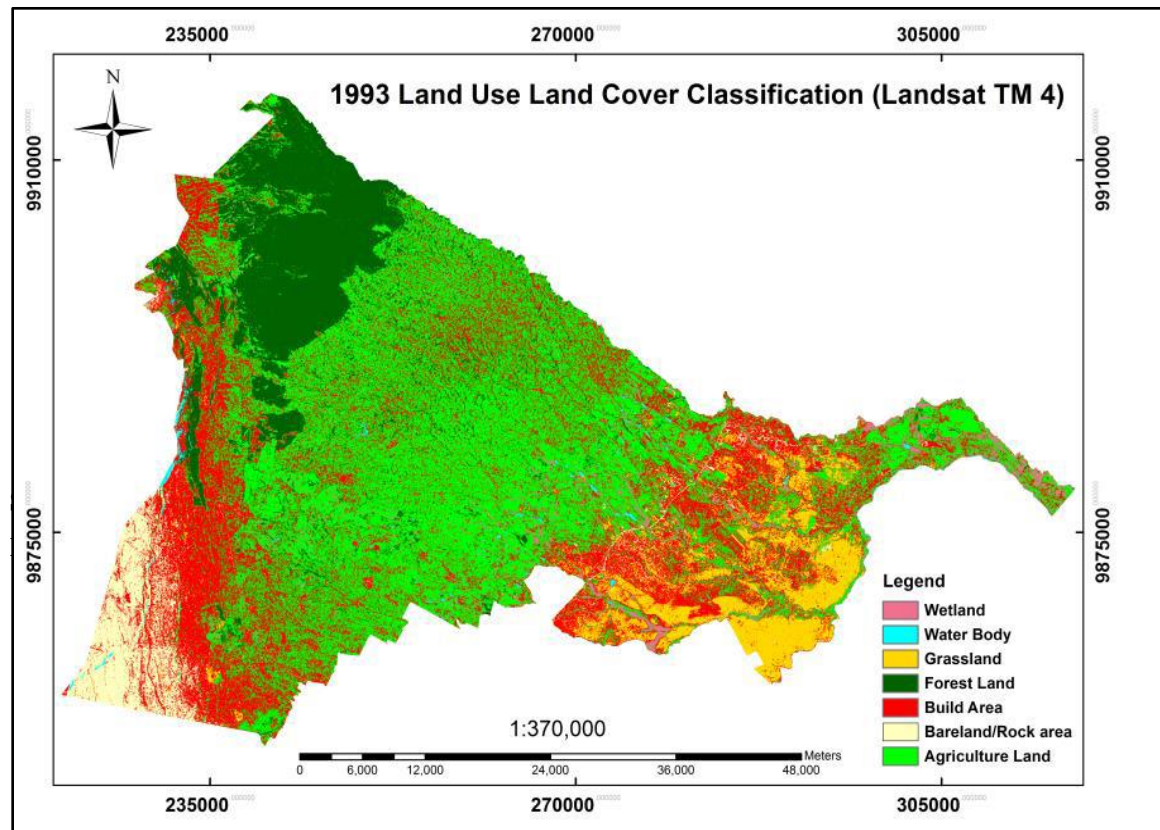


Figure 8: Kiambu Land Cover for 2002

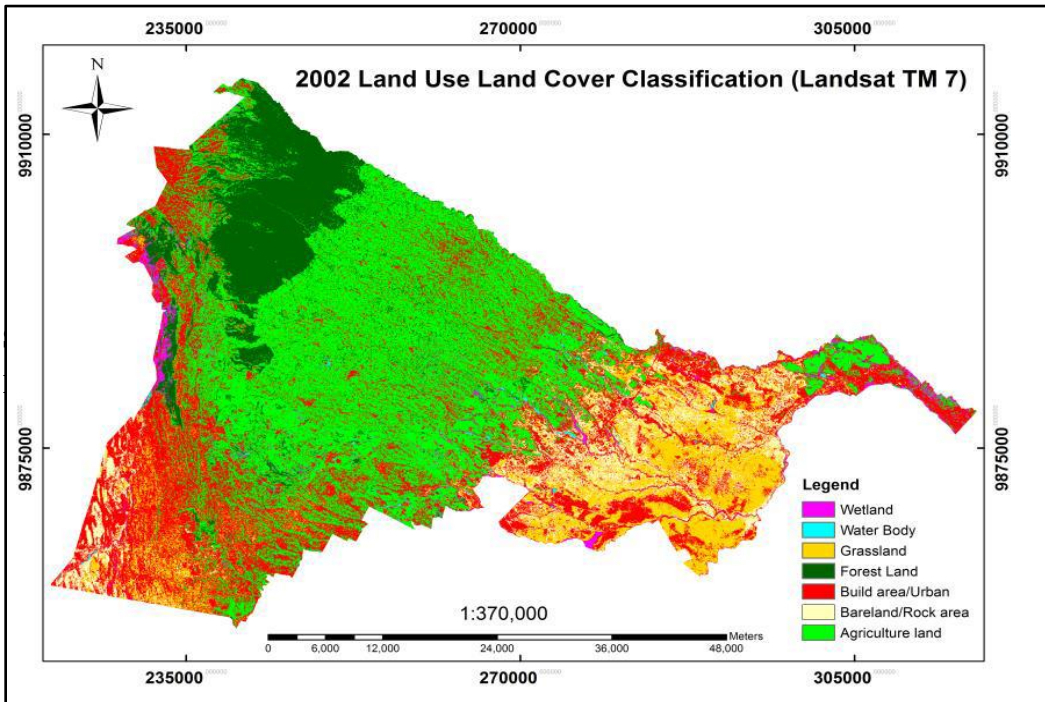
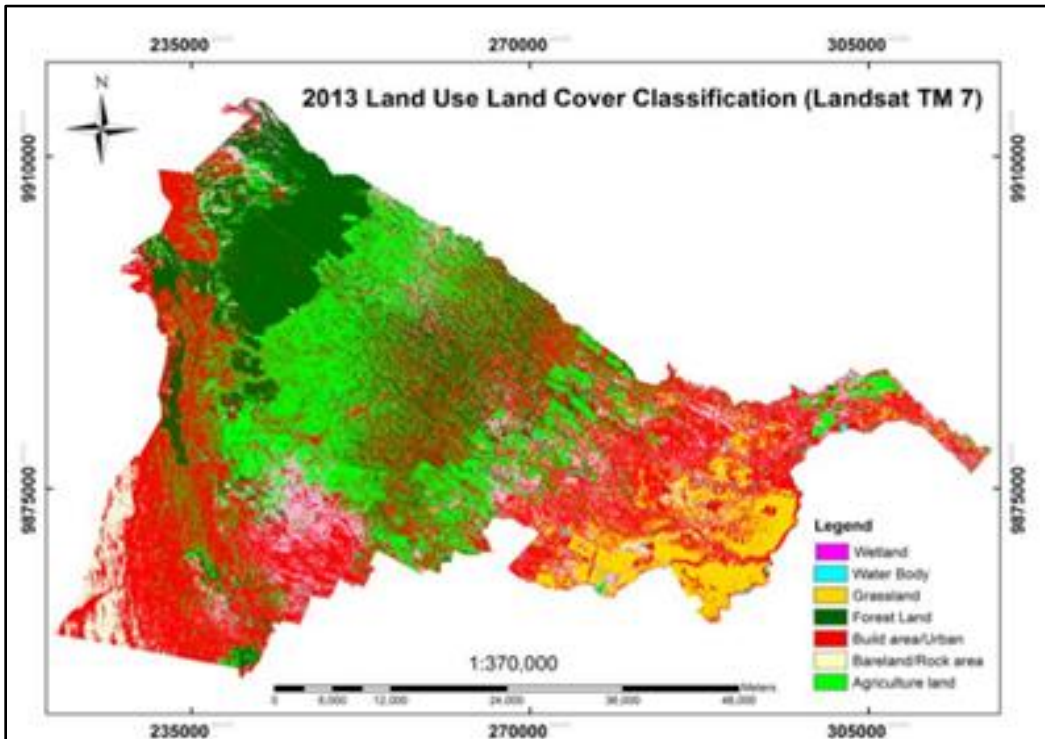


Figure 9: Kiambu Land Cover for 2013



Source: Achola, 2015

3.6 Policy and Legislative Provisions

There are several policy and legal provisions that regulate land use in Kenya while providing for agricultural development provisions across the country. Some of the most applicable ones on land use, size and food security are herein discussed as follows.

3.6.1 Vision 2030 on Agriculture Sector

The objective of Vision 2030 on enactment was to maintain a sustained economic growth at the rate of 10 percent for a period of 25 years spanning between 2005 and 2030. This will be achieved through efficient use of resources, tracking of land use pattern, raising human resource productivity to international levels, transforming key agricultural oriented institutions to enhance private sector and household level growth in agriculture, improving harvests in key crops, increasing specialization of smallholder farmers to concentrate on cash crop production to at least 2 to 3 key crops a plot and increased crop and livestock productivity. Other strategies included in the Vision 2030 blueprint comprise of new policies on land use that enhance better use of medium and high potential land for farming. Developing a master plan on agricultural land use is one of the major flagship projects focused on agriculture in the Vision 2030 while the environment flagship project is mapping land use pattern in Kenya. This study reveals the exact situation on the ground in the maize farming systems such as the current overall productivity level of the different farm enterprises, the land being utilized and possible ways of ensuring profitable and efficient ways of utilizing the rural land resources.

3.6.2 Sustainable Development Goals

The main aim of sustainable goal number two is to end hunger, improve nutrition, achieve food security and promote agriculture sustainably. The efforts to contain hunger and malnutrition have since 2000, according to the SDG review report of 2017, advanced significantly. According to the report, continued and focused efforts must be adopted if ending food insecurity, hunger and malnutrition for everyone is to be achieved particularly in Africa and Asia. Additional agricultural investments together with increased agricultural spending by governments and food aid are direly required to raise the capacity for

productivity in agriculture. This study is contributing to generation of information that is be useful for guiding investments in revolutionizing agricultural productivity in rural Kenya. This includes data such as the optimal land size to sustain a household in the maize farming system, the land uses and practices that are positively correlated to food security, the land tenure transmission rights procedures that can lead to sustainable management of land resources and settlement patterns that enhance efficient land utilization.

3.6.3 Science, Technology and Innovation Strategy of Africa (STISA 2024)

An estimated 239 million Africans, according to the African Union, 2014, are facing food insecurity challenges. Further, an estimated 30 to 40 percent of children below 5 years of age continue to suffer from chronic undernutrition at this very vital stage of both their physical and cognitive development for survival. As a result, the African Union has put emphasis on agriculture and rural economy development by use of tools like the comprehensive Africa Agriculture Development Program (CAADP) to accelerate socioeconomic transformation and poverty alleviation in the entire continent.

Further to achieving these objectives, the African Union member states heads of government in January 2013 adopted a declaration to end hunger in Africa by the year 2025 together with representatives from other international organizations, farmers, civil society organizations, academia, private sector, youths, cooperatives and other interested partners. As part of the strategy to end hunger, the African Union has formulated the Science, Technology and Innovation Strategy of Africa (STISA 2024) which has six priority areas of intervention. This study aims at generating information and knowledge that if adopted shall contribute to sustainable way of achieving food and nutrition security, which will therefore contribute to generation of information that feeds into priority area number one focused on alleviation of hunger and attaining food security. Its associated research and innovation areas include agriculture or agronomy in terms of cultivation techniques, seeds, climate and soil.

3.6.4 Devolution and the County Government

The implementation of particular national government policies together with county planning and development and agriculture are among the functions devolved to county governments by Schedule 4 of the Kenya Constitution 2010. This study aimed at identifying the most critical land sub-division and fragmentation challenges that need to be addressed and the most affected geographical areas that need attention. It also ensured sufficient stakeholder participation by involving them in analyzing the land sub-division and fragmentation challenges, generating the possible solutions and recommending strategies for implementing the solutions.

3.6.5 Evolution of the National Spatial Policy 2015-2045

According to the colonial agricultural policy that was Swynnerton Plan of 1954, the ownership of land was restructured in regions inhabited by Africans. According to the policy, the land tenure systems that were resembled the European ones were adopted with indigenous Africans being conferred permanent ownership of land. Further, progressive African farmers were offered the opportunity to grow cash crops by the policy provisions. The plan called for provision of infrastructure facilities and agricultural inputs to promote agricultural productivity in the areas deemed to be of high agricultural potential. The neglect and marginalization of the ASALs was the greatest drawback of the policy in that it contributed to uneven development in different areas.

A subsidiary legislation of the Land Planning Act cap 203 was enacted in 1961 as the Development and Use of Land (Planning) Regulations. The main objective of this legislation was to make provisions for land use and development. The legislation called for land use planning to put into considerations public utilities especially health facilities and convenience of communal facilities. This ideally was a call for proper planning applications in land use and development density in an area. It was this legislation that was adopted in the subdivision of farming reserves formerly held by the Europeans, the planning for key trunk road infrastructure and in the planning of the peri-urban areas. Further, the act created a central authority that guided land use and development on it. This study is in line with the National Spatial Policy particularly on two objectives being the

optimization of land and natural resource use for sustainable development and the creation of functional and livable human settlements in urban and rural areas.

3.7 Conceptual Framework

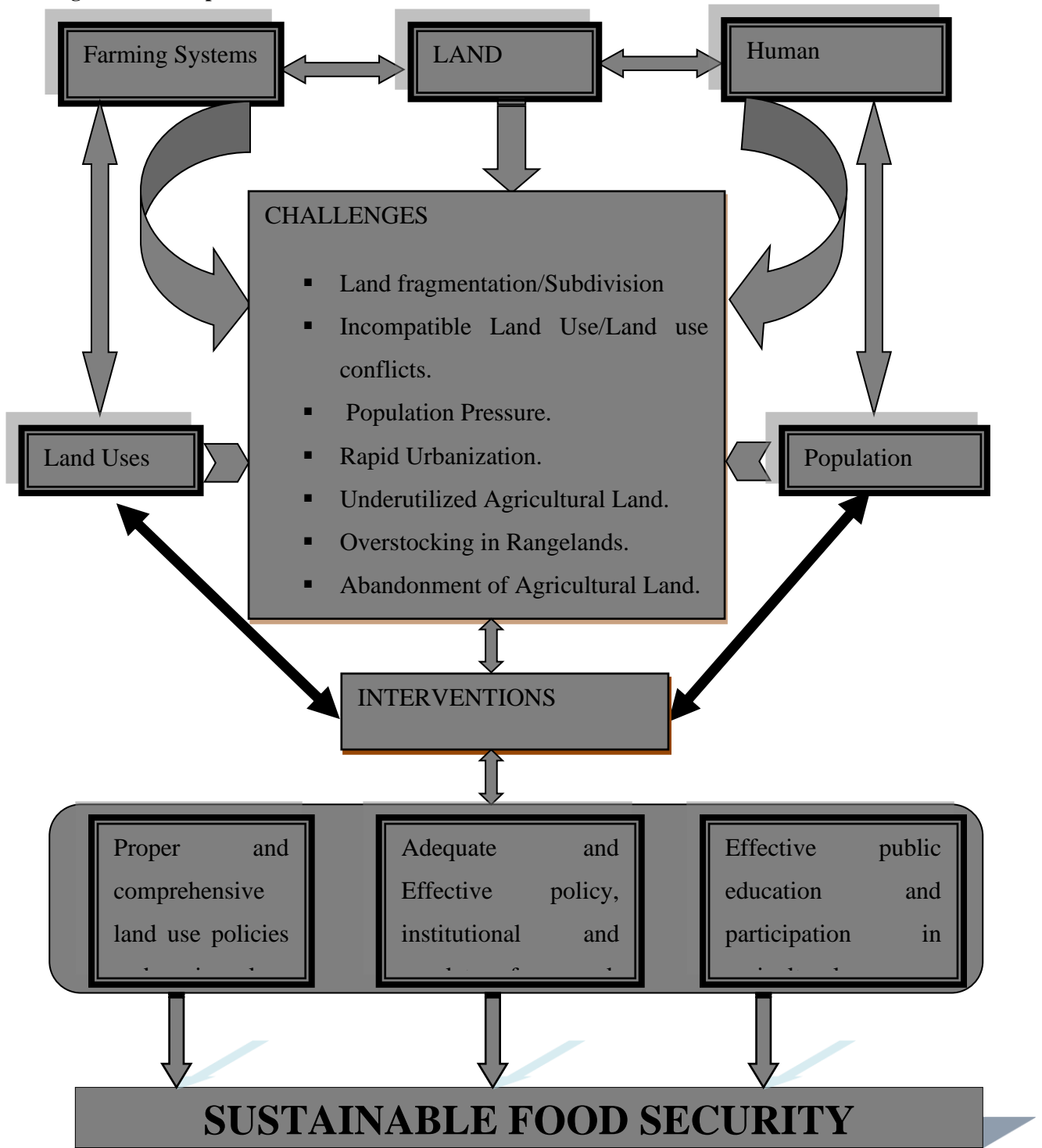
Land is one of the core factors of production together with capital and labor. Land is inelastic unlike the other factors of production. With limited land resource, it must be used wisely to attain food security. In Kenya, the demand for land resources exceeds supply. The country continues to face the challenges of incompatible land uses, land use conflicts, population pressure, rapid urbanization, poor land use planning, underutilized agricultural land, rangelands overstocking, desertion of agricultural activities, rampant subdivision of land that's hugely uncontrolled, inadequate planning mechanisms, and limited capacity for planning at all levels. The productivity in agriculture is declining as a result of uncontrolled subdivision of parcel. Given that farm size has an inverse relationship with agricultural mechanization, farmers with small units of production can only use traditional tools and implements leading to inefficiency of production. According to Republic of Kenya (2010), the trend could be changed, given that the Kenyan Constitution Article 66 makes provisions for the state to regulate land and property use. Additionally, Section C (1) of Article 68 requires that the parliament enacts a legislation recommending minimum and maximum land size that can be held as private land though the regulations to operationalize the constitutional requirements are not yet in place.

In smallholder farming areas land pressures and unsustainable forms of intensification is due to population growth. Sub-Saharan Africa is characterized by high concentration of rural populations in fertile areas, with 83 percent of the continent's rural population lives in 20 percent of the entire Africa's total land mass. The continued trend towards small land sizes together with continued land overuse, decreased fallows, marginal growth in use of fertilizers and dismal adoption of irrigation are all attributed to an ever-increasing population across the entire continent. Great advantage can be accrued by migrating from these areas by the skilled and educated populations though it poses major constraints. Further, the rapid rate of urban migration provides more challenges of growing unemployment and underemployment as can be attested by the rapid growth of shanty

towns and slums in urban areas. As long as tribal conflicts don't arise and land is accessible in sparsely populated areas, migration to these areas would be very critical in relieving land pressures in the rural areas that are already experiencing pressures of high population densities. This has however led to land sub-divisions and fragmentations leading to smaller pieces of land in the rural areas.

Mounting population pressures on land are contributing to land scarcity which harbors agricultural production since land is used for human settlements and associated activities rather than for agricultural purposes. The smallholder farming areas are experiencing pressures on land mainly due to growth in population densities in these areas. Several counties such as Uasin Gishu, Trans Nzoia, and Kisii are currently more populated than Nairobi city was in the 1980s. This results to unsustainable forms of agricultural intensification. Initially rural areas were known to be mainly for agricultural practices but land use has since changed with the ever increasing population pressure. In this regard food security has been compromised resulting in rural-urban migration for economic sustainability. The Figure 10 indicates the conceptual framework of the study where the land is the major factor that determines the farming systems and the pattern of human settlement. These factors affect the land uses and the population respectively leading to various challenges that may be experienced and therefore a need for interventions that should guide in enhancing food security. Figure 10 provides a schematic design showing interrelationship between the various components of study

Figure 10: Conceptual Model



CHAPTER FOUR

BACKGROUND OF THE STUDY AREA/SITUATIONAL ANALYSIS

4.0 Introduction

Chapter four outlines the general location and the characteristics of Uasin Gishu county as well as the sub-location being in focus. It defines, illustrates and describes the geographical location of Leseru sublocation, its demographic dynamics that includes the population, growth rates, gender compositions, mortality rates and growth projections. The chapter also outlines the climatic conditions and physiographic features then considers the socio-economic and cultural profiles and also the social and physical infrastructure.

4.1 Geographical Location

The geographical context illustrates the study area in its national, regional and local context.

4.1.1 National Context

Uasin Gishu County lies between the longitudes 340°50' East and 350°37' West and 00°03' South and 00°55' North latitudes. The county is located some estimated 330Km North West of Nairobi in Kenya. The county has a total land area of 3342.2Km². Leseru Sub-location is located within Uasin Gishu County. The location of Uasin Gishu County and the Leseru Sub-location in Kenya is shown in the Figure 11.

4.1.2 Regional Context

Uasin Gishu County borders Trans Nzoia County to the North while it shares boundaries with Kericho, Nandi and Bungoma Counties to the South, South West and West respectively. Further, Elgeyo Marakwet and Baringo Counties are the other counties that have common border with Uasin Gishu county to its East and South East correspondingly. The county is linked by road and air to major town centres in the region such as Kisumu,

Kitale, Kakamega, Kapsabet, Iten and Eldama Ravine. The Figure 12 illustrates Uasin Gishu in the regional context.

4.1.3 Local Context

Uasin Gishu County is divided into six subcounties of Turbo, Ainabkoi, Moiben, Soy, Kapseret and Kesses which are divided further into 30 sub-locations among them is the study area which is the Leseru Sub-location which is in Turbo sub-county. Leseru sub-location is bordered by Kapkong sub-location to the West, Kiplombe to the East, Sosian, Simat and Kapsaos to the south as shown in Figure 13.

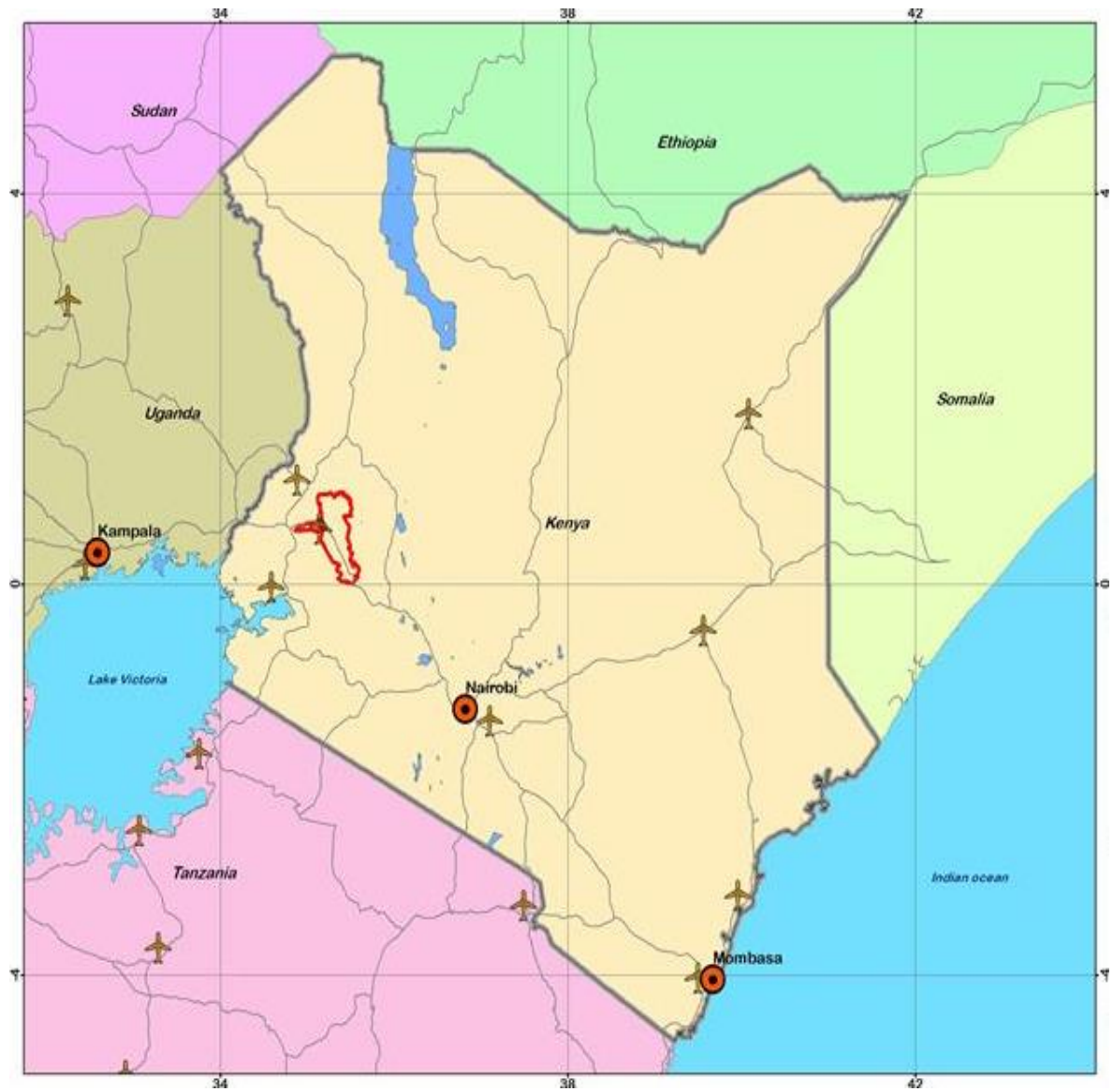
4.2 Population and Demographic Characteristics

The population and demographic characteristics for the sub-location is mirrored from the county studies that have been done recently; this gives the best situational analysis on the study area. Various aspects have been studied under population and demography. In respect of population, attributes such as population size have been observed. The demographic characteristics that have been studied include birth rates, death rates, fertility rates, life expectancy, household headship and dependency ratio among others. Issues of population and demography are important in establishing the current and future need for land and matters that are closely related to food and livelihood security.

4.2.1 Population Size

During the 2009 national census, Uasin Gishu County had a total 202,291 households. The total number of persons was 894,179 with 448,994 males (50.21%) and 445,185 females (49.79%). Table 3 shows the breakdown of the population per sub-county.

Figure 11: Location of Leseru Sub Location in the National Context



Source: Author, 2018

Table 3: Population Size

| Sub-County | Male | Female | Total | Households |
|--------------|----------------|--------|----------------|----------------|
| Soy | 117,975 | | 116,935 | 234,910 |
| Turbo | 78,257 | | 78,488 | 156,745 |
| Ainabkoi | 50,983 | | 52,059 | 103,042 |
| Moiben | 69,869 | | 68,540 | 138,409 |
| Kesses | 60,028 | | 59,232 | 119,260 |
| Kapseret | 71,882 | | 69,931 | 141,813 |
| Total | 448,994 | | 445,185 | 894,179 |

Source: Kenya National Population and Housing Census, 2009

Uasin Gishu County population density stands at 267 persons per square kilometer. The county has an annual population growth rate of 3.8% (*Uasin Gishu CIDP, 2013*). At the Sub County level, Turbo has the highest population density with 486 persons per square kilometer as shown in Table 4 whereas Moiben is the most sparsely populated Sub-County in Uasin Gishu with 178 persons per Km².

Table 4: Area and Population Density by Sub County

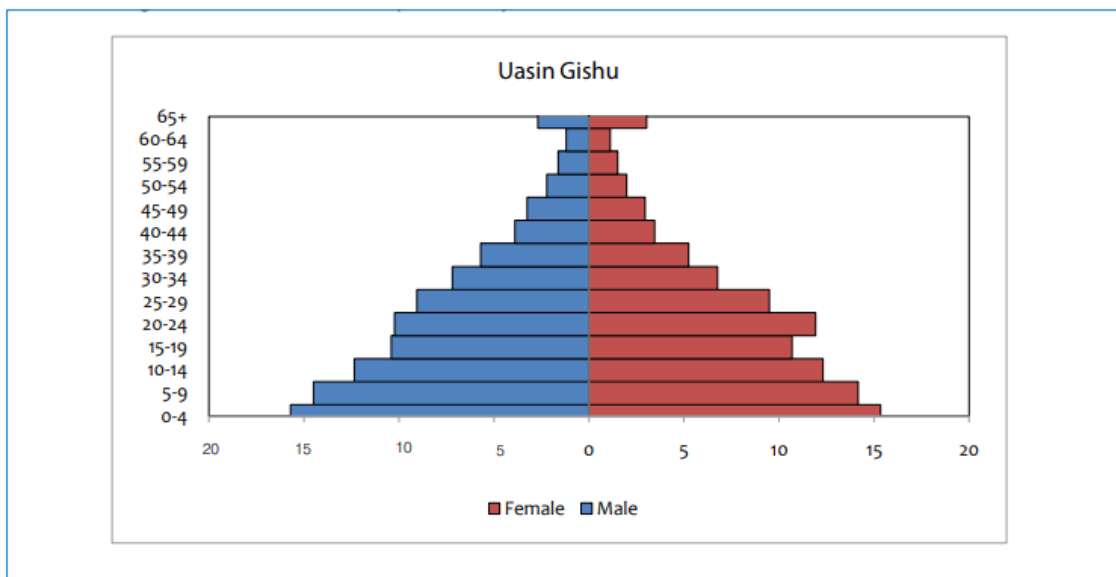
| Sub County | Area (Km ²) | Population Density |
|------------|-------------------------|--------------------|
| Soy | 768 | 306 |
| Turbo | 322.7 | 486 |
| Ainabkoi | 479.9 | 215 |
| Moiben | 777.1 | 178 |
| Kesses | 696.7 | 171 |
| Kapseret | 300.8 | 471 |

Source: Kenya National Population and Housing Census, 2009

The county population structure shows a very young population with children aged between 0 to 14 years having the largest share of the population at 42 percent. the county though is facing population growth challenges with declining fertility rates where majority

of the households at 42 percent have between 0 and 3 members with households having between 4 and 6 members declining to 37.9 percent. This reflects the population structure in the sub-location under study.

Figure 14: Population Pyramid



Source: Exploring Kenya’s Inequality; Uasin Gishu County, 2013

Leseru sub-location in particular, has an area of 62.6Km² and had a population of 4,971 making it one of the sub-locations in a rural set up with a high population in the county. The total number of households in the area census was found to be 1,017.

4.2.2 Demographic Characteristics

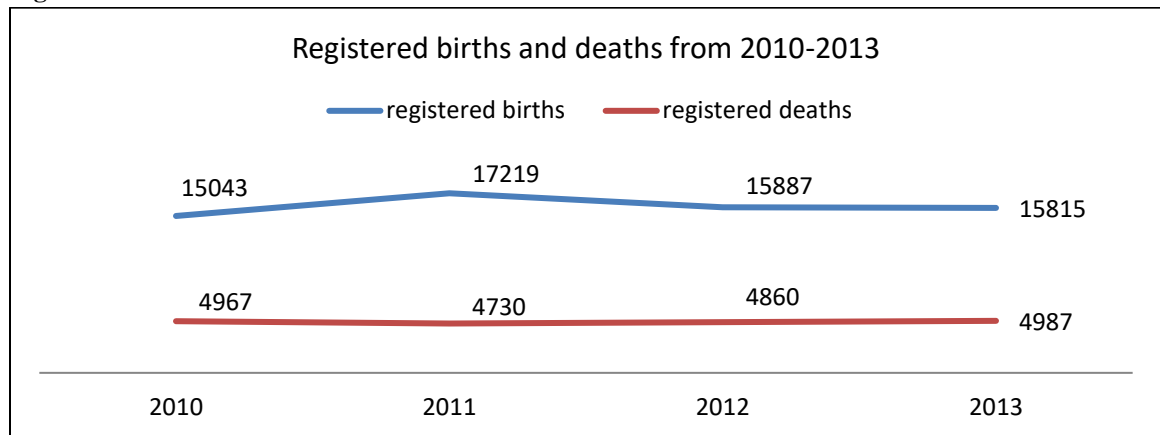
This constitutes the population dynamics in the study area as indicated by the birth and death rates, life expectancy, sex ratio and fertility rates.

4.2.2.1 Birth and Death Rates

According to the Uasin Gishu County Development Profile, 2012, the CBR for Uasin Gishu in 2012 was 49.4/1000 whereas the national CBR was lower at 38.4/1000. In the same year, the CDR for Uasin Gishu was 7/1000, also lower than the national CDR of 10.4 deaths per 1000 population annually. The number of births registered in the County from 2010 to 2013 was higher than that of deaths registered for all years. The number of births fluctuated significantly from 2010 to 2011 but remained relatively the same in 2012 and

2013 whereas the number of deaths remained relatively constant throughout the period. This is as shown in the Figure 15.

Figure 15: Number of Births and Deaths



Source: Statistical Abstract, 2014

4.2.2.2 Infant and Child Mortality Rate

IMR in Uasin Gishu in 2012 was 48/1000 whereas the national IMR was higher at 52/1000. CMR on the other hand was 12/1000 in that year compared with the national CMR of 24/1000.

4.2.2.3 Maternal Mortality Rate

The MMR for the county was 41 deaths per 100,000 women; much lower than the national MMR of 495/100,000.

4.2.2.4 Life Expectancy

Uasin Gishu County has a high life expectancy of 65.9 years. This is higher than the national life expectancy (58 for males and 61 for females).

4.2.2.5 Average Household Size

In 2009, the average household size for Uasin Gishu was 4.4 which rose to 5.2 in 2012. The national average household size was 4.4 in 2012.

4.2.2.6 Sex Ratio

The sex ratio for the county in 2009 was 100.9:100 indicating that males were more than females during that period. The sex ratio for Kenya was 99:100 in 2012.

4.2.2.7 Total Fertility Rate

The TFR for the county in 2012 was 4.7, higher compared to the national TFR of 3.9 in that year. By 2014, the TFR for Uasin Gishu County had dropped to 3.6 while that for Kenya remained constant (*Kenya Demographic Health Survey, 2014*).

4.2.2.8 Household Headship

In Uasin Gishu County, male headed households are 75.6% whereas female headed households were 24.4% (*Kenya National Housing Survey, 2012/13*). During that period, male headed households constituted 72.1% while female headed households took a 27.9% proportion of the households at the national level. The demographic characteristics of Uasin Gishu County are summarized in the Table 5.

Table 5: Demographic Characteristics in Uasin Gishu

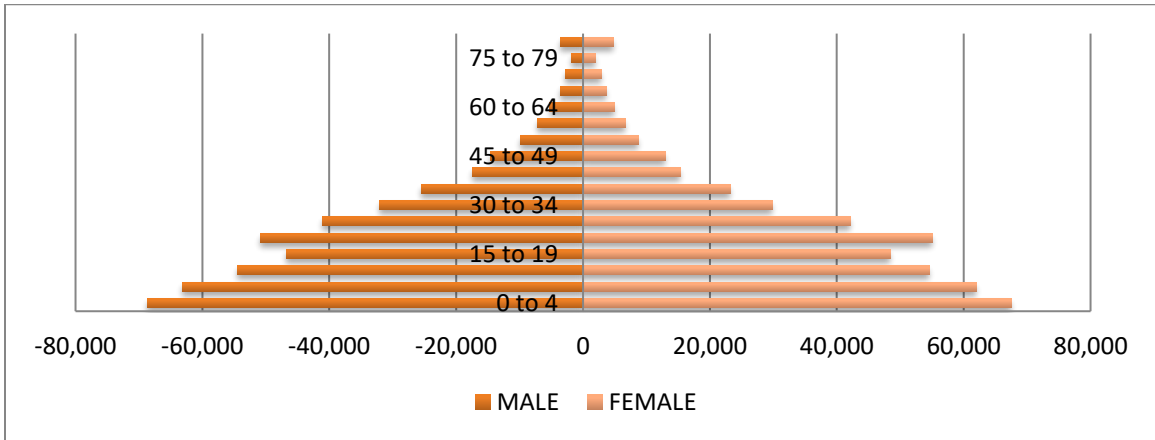
| Attribute | Uasin Gishu County (2012) | National (2012) |
|-------------------------|----------------------------------|------------------------|
| Crude Birth rate | 49.4/1000 | 38.4/1000 |
| Crude death rate | 7/1000 | 10.4/1000 |
| Infant mortality rate | 48/1000 | 52/1000 |
| Child mortality rate | 12/1000 | 24/1000 |
| Maternal mortality rate | 41/100,000 | 495/100,000 |
| Life expectancy | 65.9 | Males: 58 Females: 61 |
| Average household size | 5.2 (4.4-2009) | 4.4 |
| Sex ratio | 100.9:100 | 99:100 |
| Labor force | 55.67% | 51.9% |
| Dependency ratio | 79.5:100 | 92:100 |
| Total Fertility rate | 4.7 | 3.9 |

Source: Uasin Gishu County Development Profile

4.2.2.9 Age-Sex Structure

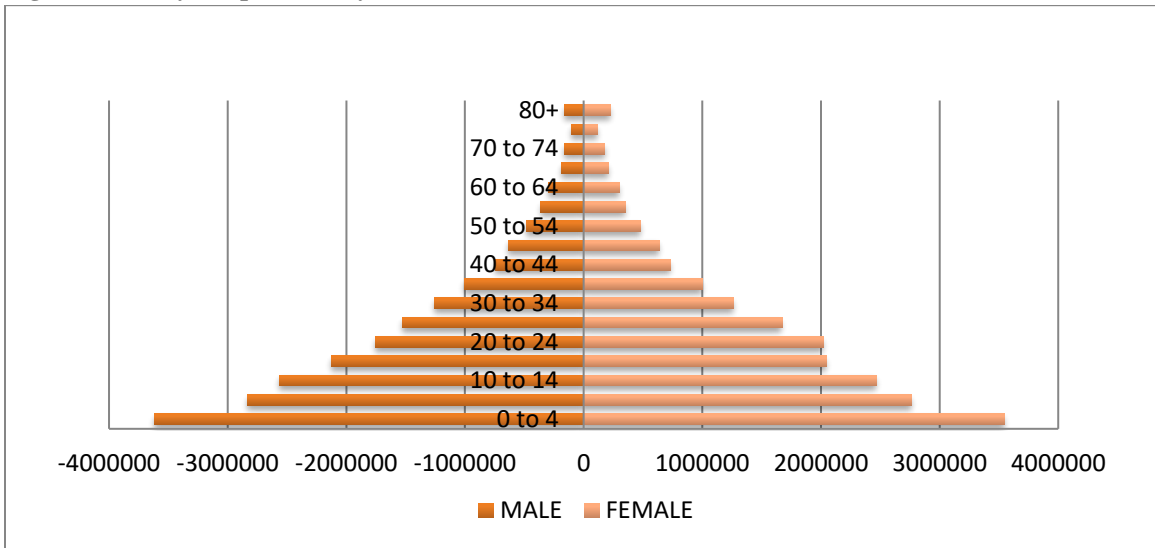
Uasin Gishu County has a young population with most people falling between the age of 0 and 34 as illustrated by pyramids in Figures 16. The population decreases gradually until the 15 to 19 cohort; it increases for both sexes in the 20 to 24 age cohort and then gradually decreases onwards. It is observed that the age-sex structure for Uasin Gishu is similar to that of Kenya since it is also a predominantly young population.

Figure 16: Uasin Gishu County Population Pyramid



Source: Kenya National Population and Housing Census, 2009

Figure 17: Kenya Population Pyramid



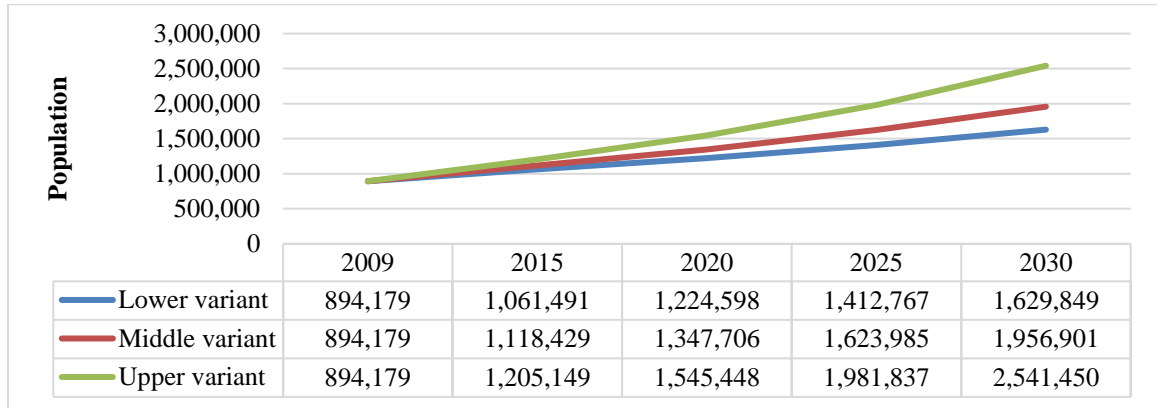
Source: Kenya National Population and Housing Census, 2009

4.2.3 Population and Household Projections

4.2.3.1 Population Projections

The population growth rate for Uasin Gishu County from 1999 to 2009 was 3.8% (middle variant). That for the entire country was 2.9% (lower variant). The Country urban growth rate on the other hand was 5.1% (upper variant).

Figure 18: Uasin Gishu Projected Population



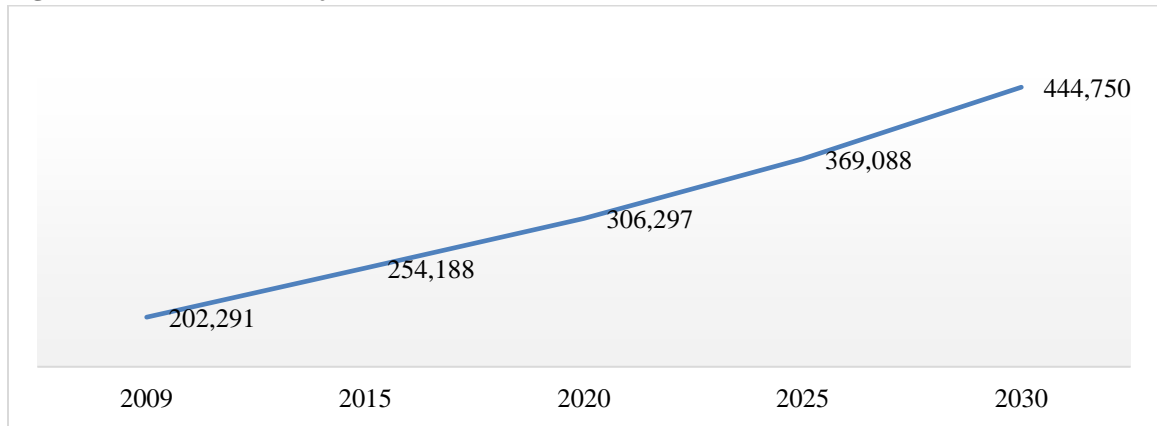
Source: KNPHC, 2009

At an annual growth rate of 3.8%, the population of Uasin Gishu County that is at 894,179 is expected to be about 1,956,901 persons by the year 2030. For the Leseru Sub-location case the population is projected to be 7,238 persons.

4.2.3.2 Household Projections

The average household size in Uasin Gishu county is 4.4 members according to the Kenya National Population and Housing Census of 2009. The table below shows the projected households for the county using its population growth rate of 3.8%. It is assumed that the average household size remains constant throughout the years.

Figure 19: Uasin Gishu Projected Households



Source: KNPHC, 2009

The county which had approximately 202,291 during the 2009 census is projected to have 444,750 households by the year 2030. In the sub-location context, the current house holding in the year 2018 of 1,017 households is projected to have 1,481 household by the

year 2030. This is an increase of 464 households in 12 years, the current land sizes will greatly be reduced if the projected population and household is anything to go by. This is expected to have proportionate impact on the food security of the Leseru sub-location.

4.3 Climatic Conditions and Physiographic Features

4.3.1 Climate

Leseru sub-location has a cool and temperate climate with well distributed reliable rainfall throughout the year. In a typical year, the county receives most of its rain between March and September, with 2 peaks: Jul -August and April-May. November-March is the driest period. On average, the county receives between 900mm-1700mm of rainfall annually. Temperatures average 18°C with minimum and maximum recorded temperatures ranging between 9.8 °C and 26.1 °C respectively.

4.3.2 Rainfall

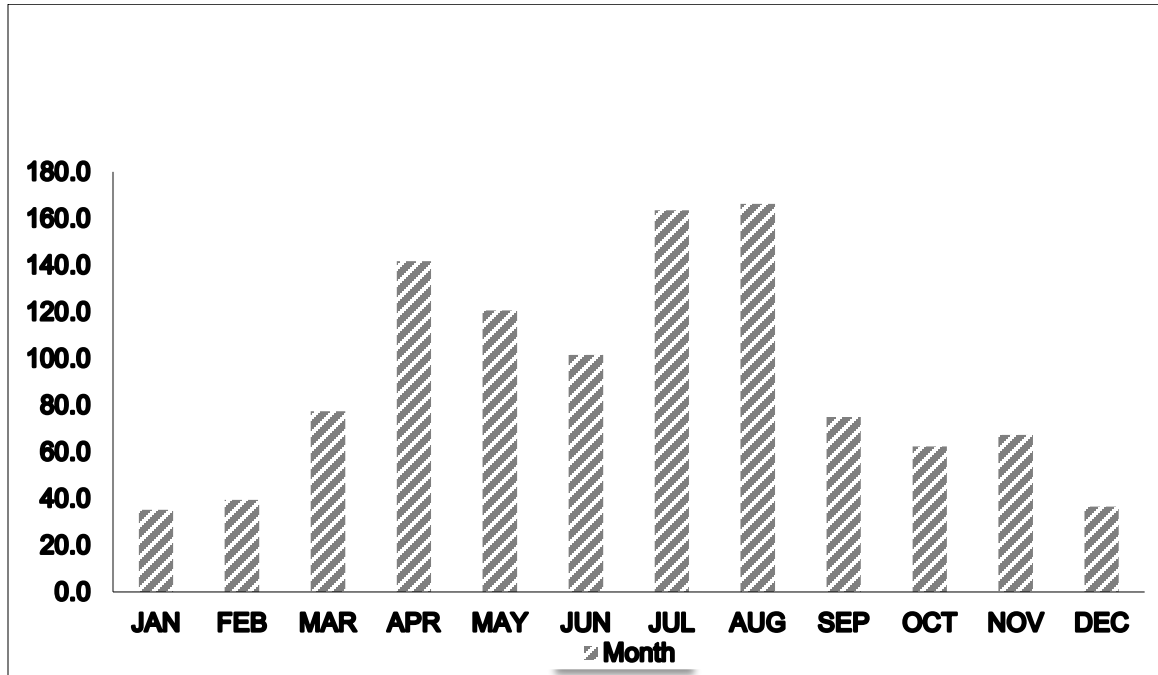
Data from the Kapsoya weather station in Uasin Gishu has been identified as most appropriate to represent the rainfall pattern in the study area. The mean monthly rainfall for the Kapsoya weather station (Station No. 8935181) is shown in Table 6 and Figure 20. The other available rainfall data is from the Eldoret airport station (Station No. 8935115) which is within the county and near the study area.

Table 6: Mean Monthly Average at Kapsoya Weather Station

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------|------|------|------|-------|-------|-------|-------|-------|------|------|------|------|
| Average | 36.1 | 39.4 | 77.4 | 141.7 | 120.6 | 101.6 | 163.5 | 166.2 | 74.9 | 62.4 | 67.3 | 36.5 |
| e | 4 | 5 | 8 | 1 | 8 | 1 | 4 | 3 | 3 | 1 | 3 | 9 |

Source: Kenya Meteorological Department

Figure 20: Mean Monthly Rainfall Distribution



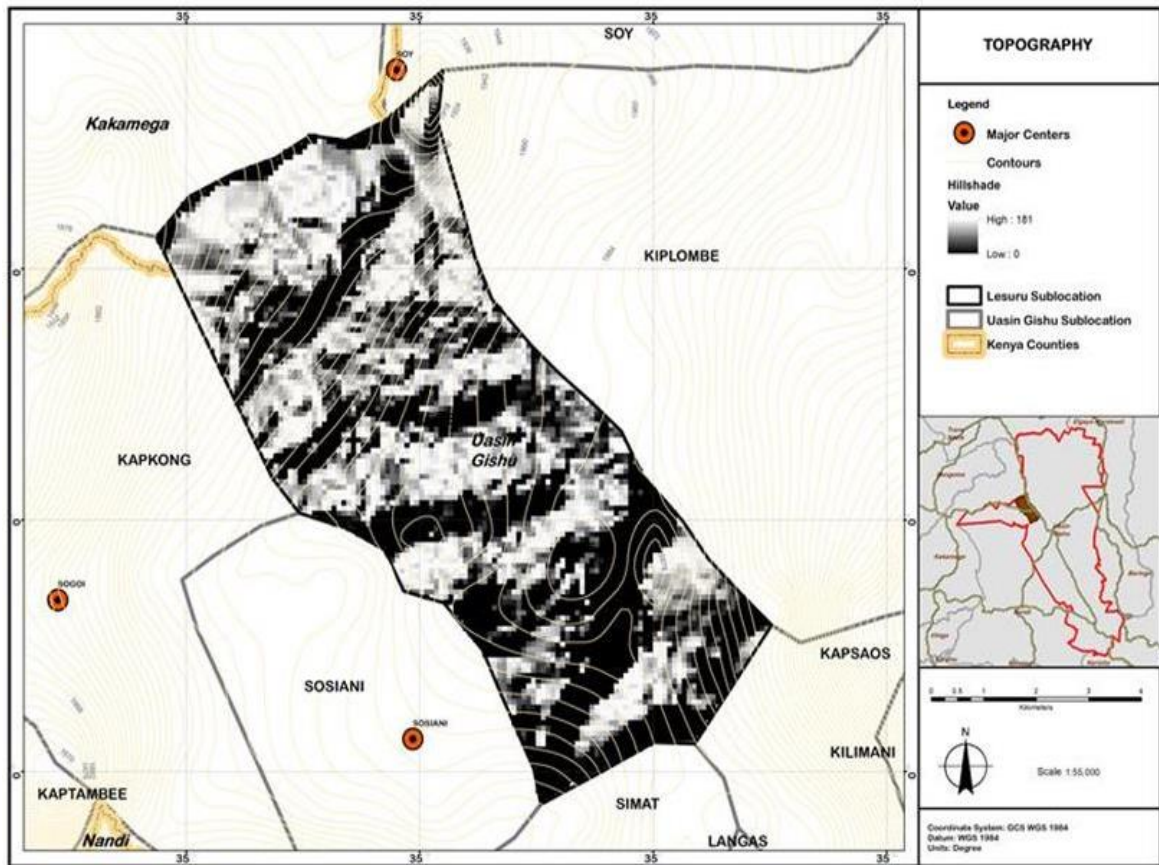
Source: Meteorological Department

4.3.3 Topography and Altitude

Uasin Gishu County lies within the Great Rift Valley and is generally located on a highland with an undulating topography consisting of hilly sections with a mixture of gentle and steep gradients. Some sections of the county are relatively flat including parts of Eldoret Town. Eldoret Town is the largest urban center and is located at an altitude of about 2085 m ASL. Timboroa is the highest point of the urban centers with an altitude of about 2773 m ASL and is one of the coldest areas in Kenya with foggy and misty conditions being commonplace.

Leseru in particular has got a moderate terrain as shown in Figure 21. This gives it a suitable condition for agricultural activities since mechanized farming is easily carried out in a flat terrain.

Figure 21: Leseru Sub-location Topography

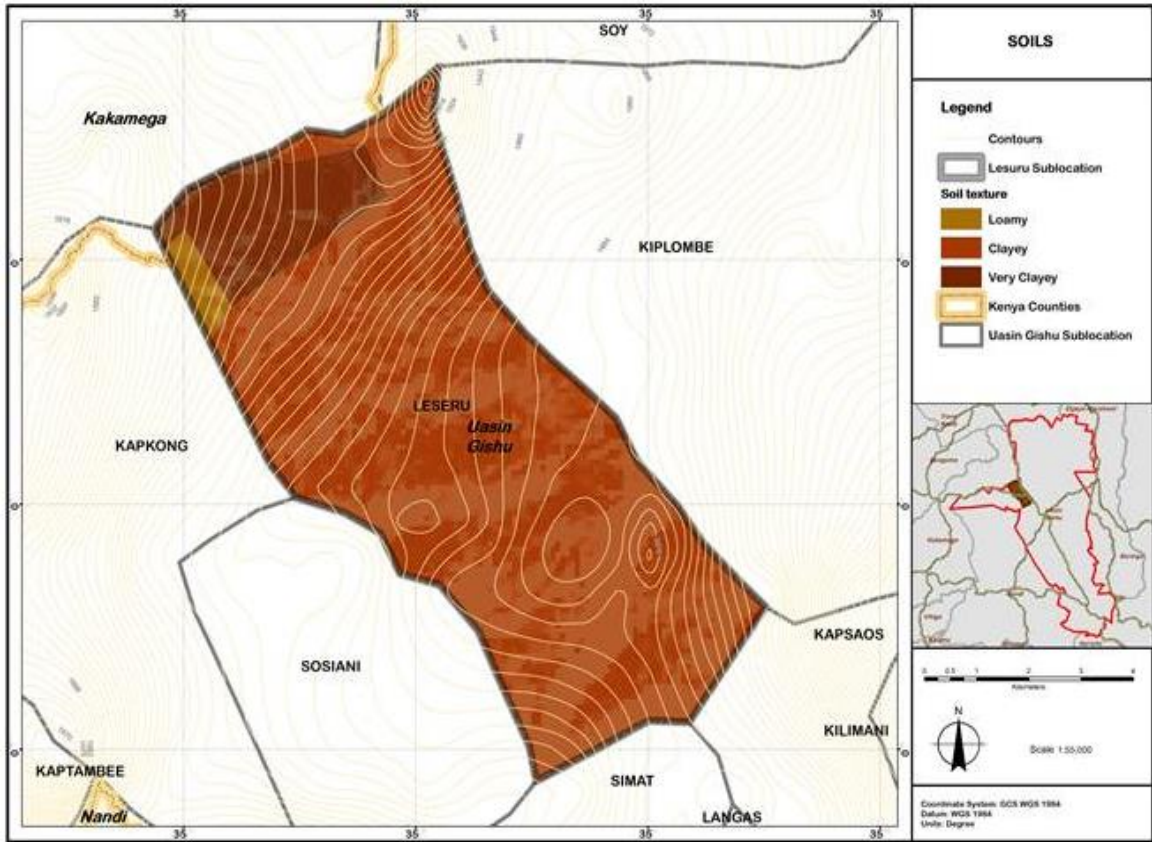


Source: Author, 2018

4.3.4 Geology

Leseru sub-location is endowed with rich agricultural soils thus the entire county is classified as arable. These support the production of maize, wheat, sunflower, beans and pyrethrum among other crops. The predominant soil types are loamy and clayey. Leseru sub-location soils distribution is as shown in the Figure 22;

Figure 22: Leseru Sub-location Geological Map



Source: Author, 2018

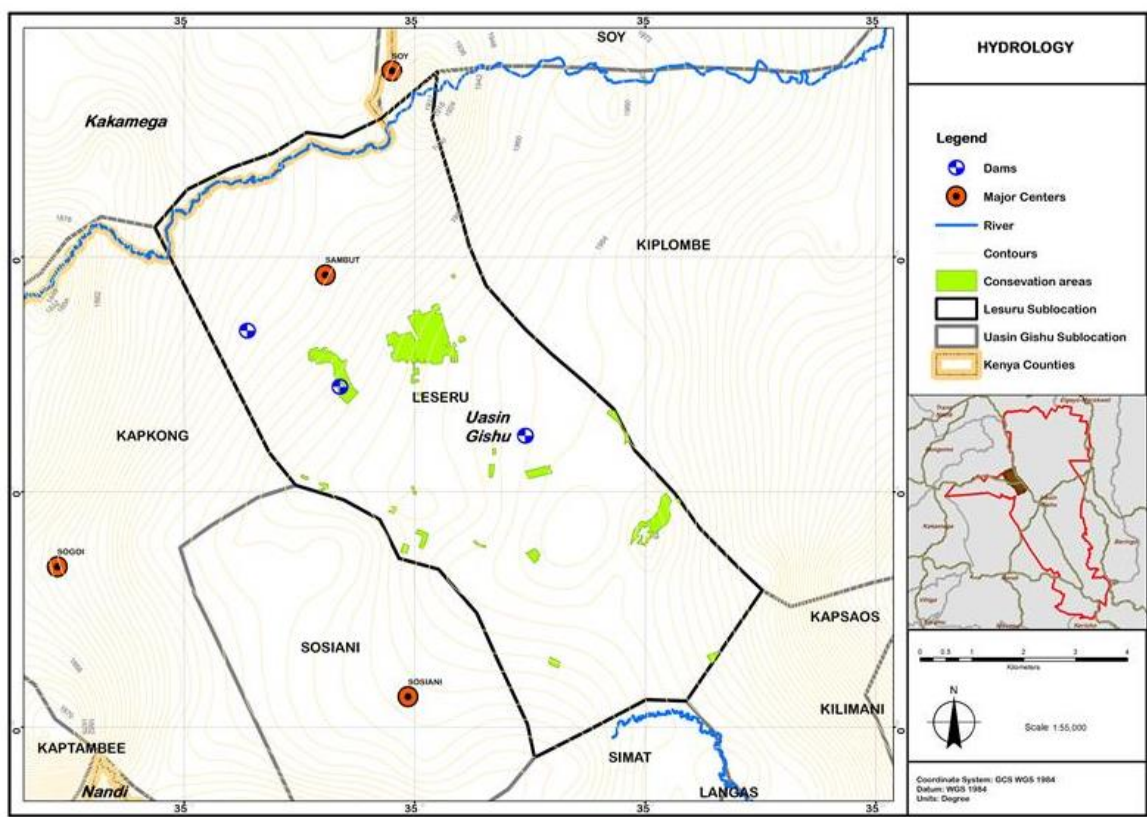
4.3.5 Vegetation

Leseru area is characterized by vegetation cover which is largely influenced by the highland climate and ecological condition. Exotic tree species that dominate the surroundings in the area include gravellias, wattle trees, eucalyptus and jacaranda trees. Some indigenous trees and shrubs such as datura species and several species of grass are also present. Agriculture is extensively carried out in the study area with maize and wheat being the dominant crops. Apart from the crop cover within the agricultural lands, the rest of the vegetation cover is either grassland or forest. Indigenous tree species include *Juniperus procera*, *Acacia meansii*, *Olea africana*, and *Podocarpus gracillior*. Cypress, grevillea and eucalyptus are among the most dominant planted species in the county.

4.3.6 Hydrology

The location's hilly terrain aids in the free-flow of storm water, therefore ensuring that flooding is a rare phenomenon in most parts of the county. However, some sections are relatively flat and often experience flooding during rainy seasons. The area is part of the Lake Victoria catchment and the river and streams traversing its landscape drain their water into the lake.

Figure 23: Leseru Sub-location Hydrology Map



Source: Author, 2018

4.4 Economic Activities

Leseru sub-location is an agricultural area; this makes agriculture the major economic activity in the area. Due to high population, families live on small land holdings which are adjudicated. Most families live on lands which have Title Deeds. It is patriarchal system and the man is the head of household. He owns the land and decides how it is used at any

one time of the year. The study area traverses agriculturally potential area characterized by medium-sized agricultural farmlands measuring approximately 2-4ha on average.

4.4.1 Crop Production

According to the CIDP, over 80% of the rural households in Uasin Gishu are supported by agriculture. Moreover, 18.3% of the population of Uasin Gishu is employed in their respective agricultural holdings (*Exploring Kenya's Inequality; Uasin Gishu County, 2013*). The County and the sub-location is endowed with good climate and soils which favour agriculture. A total of 66 agricultural extension officers and 28 agricultural officers are employed by the County Government to serve the county's 30 wards/ sub-locations as reported in the CIDP.

The major crops grown in the sub-location are beans, maize, finger-millet, wheat, Irish potatoes and sorghum. Also, other crops grown include vegetables like tomatoes, kales, cabbages and carrots. Uasin Gishu is known as Kenya's bread basket producing about a million bags of wheat and 4.5 million bags of maize annually. According to the CIDP, 80 percent of the county's rural population earn their livelihood from agriculture as their source of income and food. The maximum agricultural potential of the county has however not been realized. It was noted that farmers lack significant occupation between planting and harvesting which also causes a lull in the economic development of the County. The Plate 3 shows the large-scale maize farming being practiced.

Plate 3: Maize Plantation at Leseru Sub-location



Source: Field Study, 2018

4.4.2 Livestock Production

Livestock farming is carried out all over Uasin Gishu County and is usually integrated with crop farming. There is however a higher concentration of livestock in Moiben and Ainabkoi areas (*Uasin Gishu District Environment Action Plan, 2009*). Most farmers practice free range grazing as shown in Plate 4 and Plate 5 whereby the animals are allowed to mix up; zero grazing is rare and is practiced on dairy cows where present. Indigenous herds of cattle are almost being phased out with the majority either being exotic or cross breeds.

In Uasin Gishu County, more than 160,000 households source their livelihood from the livestock subsector which accounts for approximately 79.2% of the total number of households. There are 375,847 dairy animals of which 81,838 are high grade, 93,611 sheep, 27,216 goats and 7,492 pigs (*Uasin Gishu CIDP, 2013*). Chicken are also kept in the county but by few farmers.

Plate 4: Dairy Cattle Farming



Source: Field study, 2018

Plate 5: Mixed Livestock Farming



Source: Field study, 2018

4.5 Human Settlement and Housing

4.5.1 Human Settlement

Human Settlements refer to permanent or temporary communities in which people live and work from. It can range from a small number of dwellings grouped together in hamlets, to the largest of cities and their surroundings in urbanized areas. An analysis of human settlement patterns in a region is critical especially for planning development; as planning is primarily practiced to benefit the people and their future generations.

The pattern of human settlement in a region is majorly influenced by a number of dynamics that characterize a particular area. Factors such as soil fertility; availability of natural resources; level of economic development and urbanization among others play a big role in influencing the settlement patterns in Uasin Gishu County. Settlements in Leseru sub-location is particularly influenced by land ownerships, infrastructural development, topography, proximity to urban centers, availability of natural resources and security.

Semi-clustered/ Scattered type settlement is where the built-up area is less compact as compared to the clustered settlement. It may result from segregation or fragmentation of a large compact village. In Uasin Gishu County this type of settlement pattern is mainly found in the rural hinterland like the Leseru sub-location.

4.5.2 Housing

Housing refers to building structures in which people live and shelter; as well as the concomitant services that come with it. Therefore, in essence, a house/housing should offer protection, comfort and a sense of belonging to its users. The Constitution of Kenya, 2010 (*Article 43 1(b)*) recognizes housing as a social right for every Kenyan and as a result, the government is committed in making sure that this right is achieved progressively.

Housing in Uasin Gishu can be grouped into three broad categories according to their building materials: permanent, semi-permanent and temporary housing. Permanent housing structures are where the wall materials are mostly made of stones or bricks with cement. Semi-permanent structures are the structures whose walls are built with a

combination of permanent and temporary materials i.e. timber and bricks or stones. Temporary housing structures are the dwelling units that are mostly made of mud, sticks or grass.

Housing conditions are an indicator of the degree to which people live in decent conditions. Materials used in the construction of the floor, roof and wall of a dwelling unit are also indicative of the extent to which they protect occupants from the elements and other environmental hazards. It is important to note that availability of materials, costs, weather and cultural conditions have a major influence on the type of materials used.

Plate 6: Housing Typology



Source: Field study, 2018

Plate 7: Granary Typology



Source: Field study, 2018

4.6 Natural Resource Base

Natural resources in the area include land, water resources, drainage basins etc. These resources are discussed herein below:

4.6.1 Land

According to the CIDP, land holding in the rural areas of Uasin Gishu County averages 5 acres whereas those within Eldoret Municipality have 0.25 acres. Land uses vary across the entire county. A cumulative 919 land less households were in 2012 distributed to various settlement schemes with 658 of these households settled at Turbo Settlement Scheme while 161 and 100 other households were settled in Jabali and Maili Tisa settlement schemes respectively. Maili Tisa settlement scheme is located within the study area. These landless households originate from other counties while others are squatters in gazetted forests such as the Mau Forest and government land while yet others are landless as a result of disposing of their family land. According to Article 60 subsection 1 of the Kenya Constitution land should be held, used and managed in equitable, productive, efficient and productive manner. This shall be achieved in accordance with the principles of land rights

security, equitable access to land, sustainable and productive land rights management and the principle of sound conservation and protection of ecologically sensitive areas.

Furthermore, *Article 66 (1)* on the Regulation of Land Use and Property indicates that “the state may regulate the use of any land, or any interest in or right over any land, in the interest of defense, public safety, public order, public morality, public health or land use planning”.

4.6.1.1 Land Sizes

Uasin Gishu County covers an area of 3,345.2 Km² and has a total population of 894,179 found in a cumulative 202,000 households spread across the entire county, KNPHC (2009). The county has six sub-counties of Soy, Turbo, Moiben, Kesses, Ainabkoi, and Kapsaret. The county has a total 2,995 Km² of arable land while hilly and rocky non arable land covers a total 332.78Km² while water mass and urban areas categorized as non-arable land occupies some 23.4Km² and 196Km² respectively.

The average land holding sizes in the county are highest in the hinterland rural areas where they average 5 hectares while they are smallest in the urban and peri-urban areas where they average 0.25hectares in within Eldoret town which is a major municipality and urban area in the county. Small scale farmers hold on average 3 ha while large scale farmers have large farm sizes extending to 50 hectares and beyond (*Uasin Gishu County Development Profile, 2013*). Within the six Sub Counties the average landholding size is as follows:

Table 7: Average Landholding Size at Sub-county Level

| Sub-County | Average Landholding Size (Acres) |
|------------|----------------------------------|
| Ainabkoi | 7.2 |
| Turbo | 4.3 (Study Area) |
| Soy | 4.9 |
| Moiben | 4.14 |
| Kapsaret | 1.9 |
| Kesses | 2.9 |

Source: Uasin Gishu County Development Profile, 2013

4.6.1.2 Land Tenure

The system through which rights to land are determined and documented is land tenure. The change of land ownership from one party or owner to another is land disposition. There are various land tenure systems adopted and applicable in Kenya. In general, land in Kenya is held as private, trust or government land. The land that is held in trust for the citizen by the county governments, formerly by the municipal or town councils' clerks, is trust land. Trust land is more prevalent in Uasin Gishu county as land is held by the county government of Uasin Gishu on behalf of the residents. Also, leasehold land tenure is present in the county mostly in her urban areas where 99-year leases are issued to residents. Further, in the rural areas, lease tenure systems are present in cases where African natives acquired by way of purchase the previously held European colonial settlers with the rest of the county rural areas having freehold land tenure system including the study area of Leseru sub-location. These combinations of land tenure systems in the county is both an advantage and a constrain in that it's difficult to enforce land regulations in areas where land is held on freehold basis.

The County of Uasin Gishu has 409 registration sections with a total of 116,939 titles having been issued. Almost 2/3 of the land parcels have been titled with the owners having collected them (*Uasin Gishu CIDP, 2013*). The Lack of legal documents can be attributed to factors such as customary land inheritance or the death of original land owner.

4.6.2 Water Resources

Rivers, boreholes, dams, shallow wells and springs are the main water resources in Uasin Gishu County. Moiben river together with Sergoit, Sosian, Nzoia and Kipkarren rivers and their tributaries are the main rivers that drain Uasin Gishu County. A total 120 dams are in place in Uasin Gishu county. These dams were constructed for recreation purposes by the colonial government. They are currently major water sources for majority of households in the county. Additionally, a total 250 boreholes have been drilled in the county with 170 of them being registered. Majority of the households have shallow wells that provide water to the household. The destruction of water catchment areas threatens the very existence of most of these water sources with the water tables reducing.

The most affected water catchment areas include the Kaptagat, Timboroa and Kapchemutwa forests. Efforts are being made to restore these water towers through regulated forest use and afforestation by the Water Resource Management Authority (WRMA). Supply of water is threatened by water pollution due to poor sanitation and discharge of effluents to water bodies. Industrial effluents are the major pollutants to rivers that flow through urban areas like the case of Sosian River. Another emerging source of river and water pollution is the sipping of residuals emanating from chemical fertilizers applied in the farms. Eldoret Water and Sanitation (ELDOWAS) is the main water service provider (WSP) in the county. The scheme serves most parts of the county especially the urban areas including Moi's Bridge, Turbo, Sambut, Eldoret Town, Sosian, Burnt Forest, Kipkabus and Ngeria.

The once vibrant community water supply schemes have since stalled or collapsed owing to huge operational costs. Investment in development of new water supply strategies and revival of the defunct community water supply schemes are critical steps that ought to be taken to improve the supply of water across the county. Access to potable water stands at 42 percent of the total population in Uasin Gishu County with 90 percent of the county population having access to safe and clean water within a radius of 2 kilometers. Leseru sub-location has got Sosiani river tributary shown in Plate 8 at a close proximity and has a new water project that is coming up near Kamagut high school to add on to the existing infrastructure.

Plate 8: River Sosiani



Source: Field work, 2018

4.7 Social Infrastructure

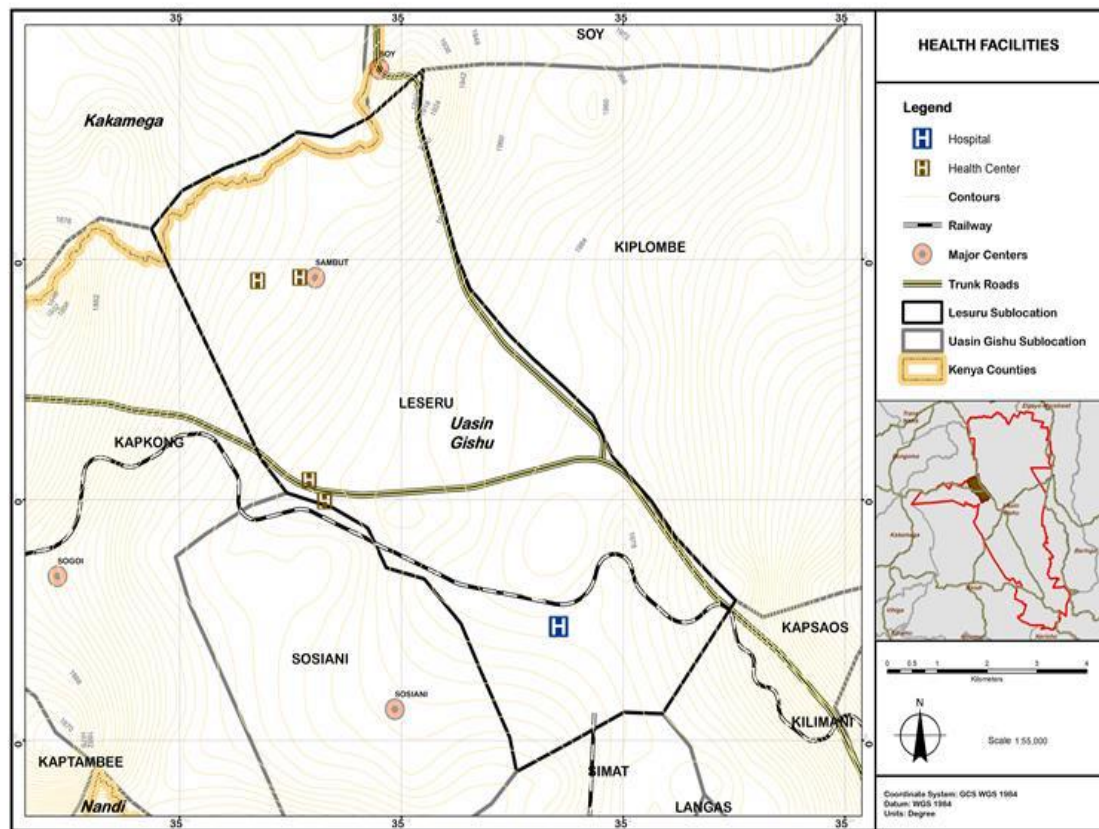
Social infrastructure refers to a wide range of facilities and services including health facilities, education, recreational facilities, community centers, cultural centers and religious institutions.

4.7.1 Health Facilities

The data from the CIDP indicates that there are 170 health facilities in Uasin Gishu County classified between level 2 and level 6 hospitals. Majority of these health facilities are found within the Eldoret Municipality and have catchments extending to neighboring countries of South Sudan, Uganda and Rwanda. Moi Teaching and Referral Hospital is the highest categorized hospital at Level 6 in the county and serves most of the country's North Eastern region together with the entire catchment areas of Uganda, Rwanda and South Sudan with Ethiopia not excluded as well. Despite having multiple health facilities in the county, they aren't sufficient to meet the health needs of the wider catchment region they serve including ability to meet health needs for which they were initially intended to serve. A decongestion of Moi Teaching and Referral Hospital will do great justice to the health sector in the

county. This can be achieved by erecting Level 4 health facilities in each of the six sub-counties and other level 3 and 2 hospitals mandated to manage all ailments that can be handled by lower level hospitals. Further, additional health facilities ought to be put up in the hinterland rural areas for those populations having limited access to health facilities due to poor road infrastructure and longer distances from nearby health centers. The county residents have to travel on average 7Kms to access a health facility. This distance is far much higher than the recommended average distance of 5Kms. Within Leseru sub-location, there are well distributed health center's as shown in the Figure 4.7.1 below which include; -Trinity Mission Hospital, Sambut Health Center, Cherumei Health Center, Mercy Health Center, Schemer's Community Health Center.

Figure 24: Health Facilities



Source: Author, 2018

4.7.2 Educational Facilities

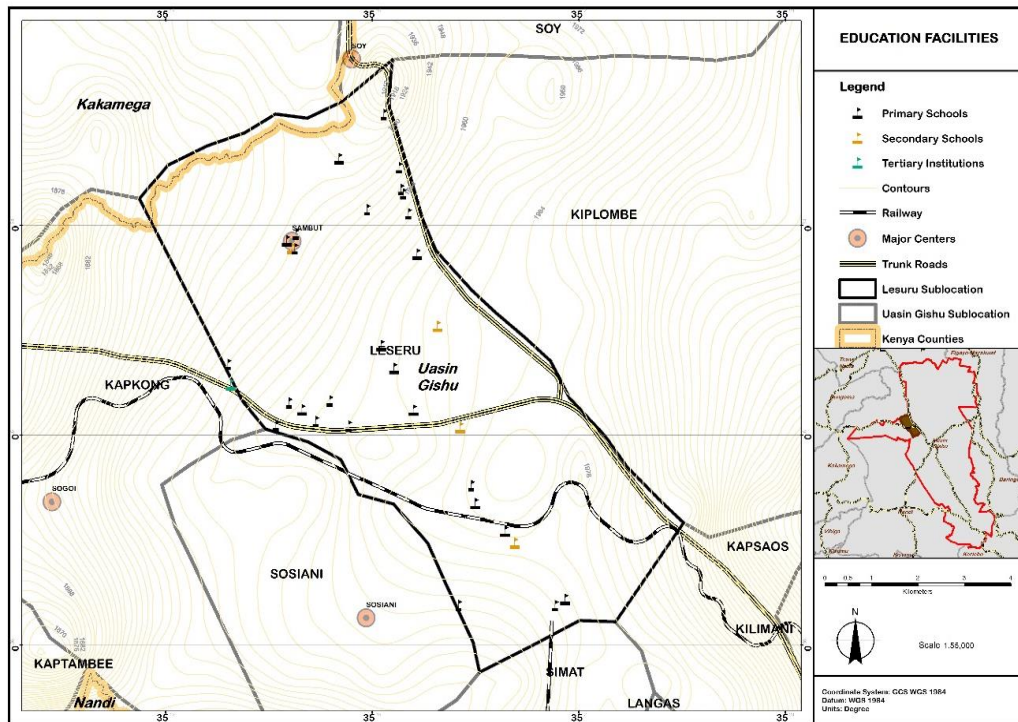
Education is an important social infrastructure that acts as a stimulant of growth and development in improvement of human resource that enhances quality productivity in the economy. Education facilitates in production of skilled labor and also enhances understanding of various development projects and their inputs to the economy. Under Kenya Vision 2030, the goals for education include integration of all special needs education into learning and training institutions, achieving an 80% adult literacy rate, increasing the school enrolment rate to 95% and increasing the transition rates to technical institutions and universities from 3% to 8% by 2012. Education services in Uasin Gishu County and the study area include pre-primary, primary, secondary and tertiary education. Education service providers include the national government, County government and the private sector which comprise of religious organizations and individuals. The Figure 4.7.2 shows the spatial location and distribution of the educational facilities in the study area which include: -Sambut Primary School, Mokoiywo Primary School, Kamagut Primary School, Kaptich Primary School, Kuresiet Primary School and Chemalal Primary School among other private schools. There are a number of secondary schools in the sub-location as well as indicated by their signposts located at the main highway as shown in Plate 9.

Plate 9: Leseru Sub-location Schools



Source: Field work, 2018

Figure 25: Educational Facilities Map



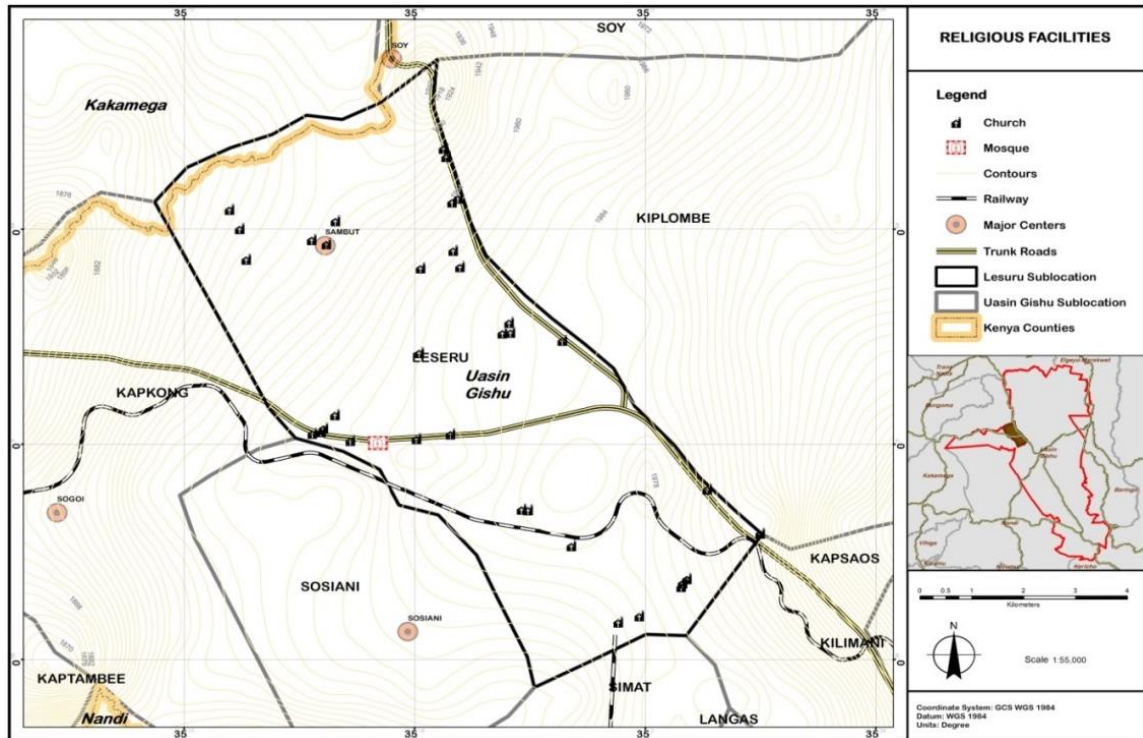
Source: Author, 2018

4.7.3 Religious Facilities

Religious institutions are important in society to facilitate spiritual growth of communities and helps in constructing moral set up of communities.

In Leseru sub-location there are various religious groups including Christians and Muslims. This is evidenced by presence of various Mosques and churches as shown in Figure 26 that include AIC, PCEA, ACK, PAG and Catholic churches.

Figure 26: Religious Facilities Map



Source: Author, 2018

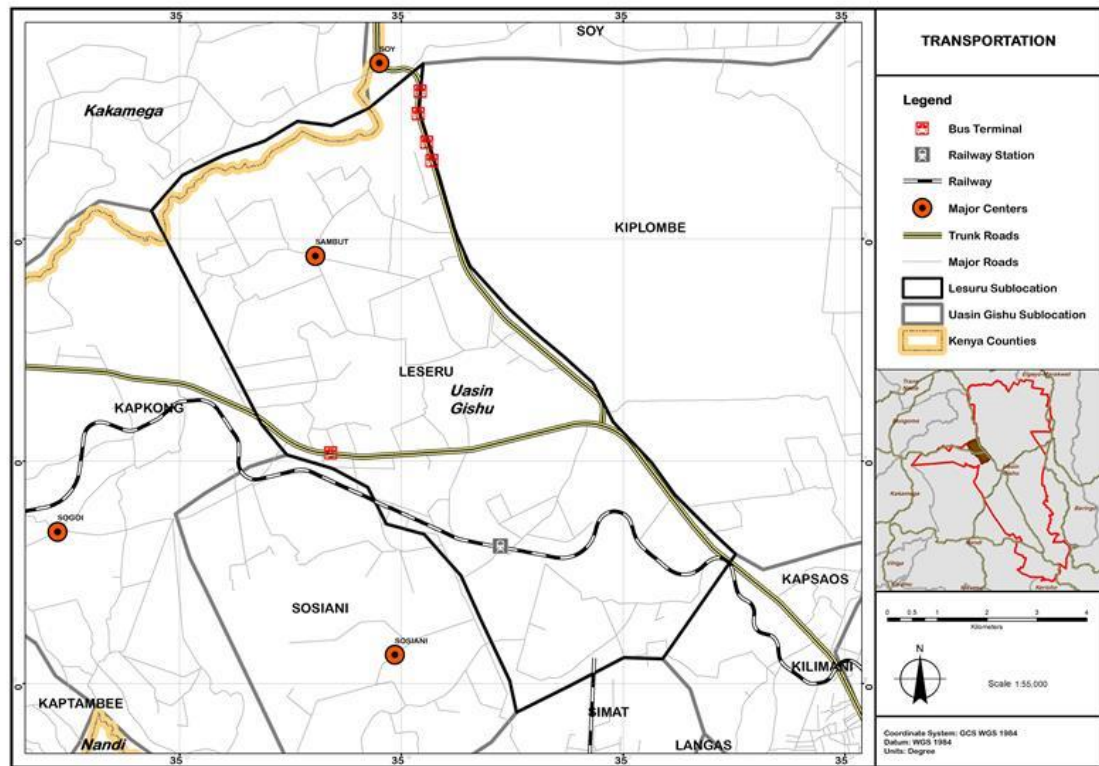
4.8 Physical Infrastructure

Physical infrastructure is composed of the roads, railways, airports, power supply, water supply, sewer system and solid waste collection system. Infrastructure facilities play an important role in fostering economic growth and enhancing public welfare. The availability and adequacy of urban infrastructure services is an important indicator of county livability. The Figure 27 shows the distribution of the physical infrastructure in the sub-location.

4.8.1 Roads

Road transport is the dominant mode of transport in the County. The road network in Leseru sub-location comprises about bitumen surface roads, murrum roads and earth surface feeder roads. Most feeder roads are however impassable inhibiting transportation of commodities from rural areas to markets.

Figure 27: Transport Networks



Source: Author, 2018

Plate 10: Roads improvements at Leseru Sublocation



Source: Field work, 2018

Plate 11: Major Highway (A104)



Source: Field work, 2018

4.8.2 Railway Line

The county and the study area are served by the Kenya Uganda Railway which passes through Eldoret and Turbo. There are 8 railway stations with 179 Km of railway line passing through the county which are operational. The 8 railway stations are Eldoret, Soy,

Springfield Halt, Moi's Bridge, Kitale bus terminus, Leseru, Turbo and Kipkaren. The railway line creates a significant advantage to the sub-location with regard to the transportation of raw materials to factories and finished goods to markets particularly between Mombasa and Nairobi and Eldoret.

Plate 12: Railways line across in Leseru Sublocation

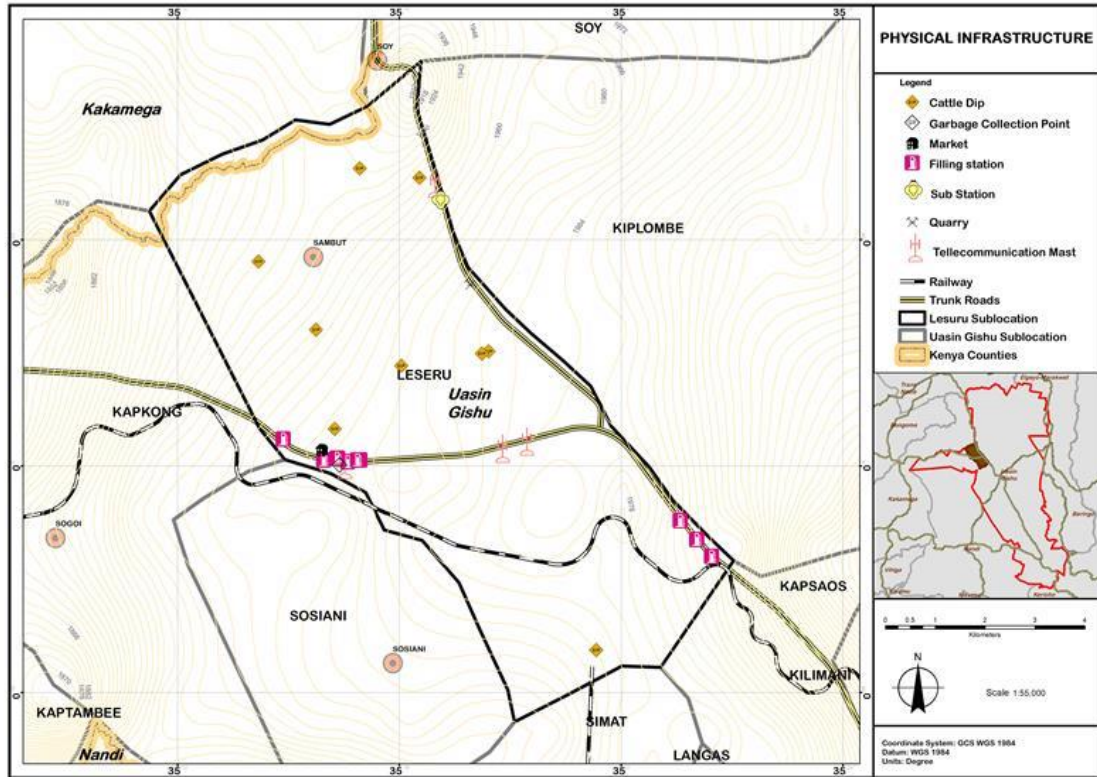


Source: Field work, 2018

4.8.3 Other Facilities

The sub-location also has several other infrastructures in place that include the markets, cattle dips, garbage collection points, fuel filling stations and telecommunication masts as shown in Figure 28

Figure 28: Physical Infrastructure Map



Source: Author, 2018

CHAPTER FIVE

RESEARCH FINDINGS, ANALYSIS AND CASE STUDIES

5.0 Introduction

The chapter discusses in detail the research findings and the case study analysis. It is structured into two sections namely the presentation of study results with a critical discussions and analysis of the results. This section gives an illustration of the respondent's profiles, the household information, the land holding arrangements, the land uses, food and livelihood security issues, views on land sub-division and the human settlement. The second section presents the case studies that were analysed based on information gathered as a result of household questionnaires, focus group discussions and the key informants' interviews as per the methodology of research that was applied.

5.1 Research Findings and Analysis

The study compiled the findings from the household interviews conducted.

5.1.1 Profiles of the Respondents

The responses of the research were analyzed using SPSS and the results compiled and discussed.

5.1.1.1 Age

The majority of the sample studied consisted of the young adults below 50 years who added upto 63.2% of the total sample size within the planning area. The implication of the result suggests that the greatest population is composed of people who are still energetic, productive and can be usefully engaged for economic development that requires manpower.

Table 8: Age Groups

| Age Groups | Percentage | Frequency |
|----------------|------------|-----------|
| 21-30 | 21.1 | 32 |
| 31-40 | 23.0 | 35 |
| 41-50 | 19.1 | 29 |
| 51-60 | 19.7 | 30 |
| 61-70 | 11.2 | 17 |
| 71-80 | 3.9 | 6 |
| Above 80 years | 2.0 | 3 |
| Total | 100 | 152 |

Source: Field Survey, 2018

5.1.1.2 Marital Status

Within Leseru Sub-location, at least 66.9% of the respondents were married with the average number of children within the households ranging between 2 -4 children. Table 9 represents marital status of the respondents interviewed in Leseru sub-locatoin.

Table 9: Marital Status in Leseru Sub-location

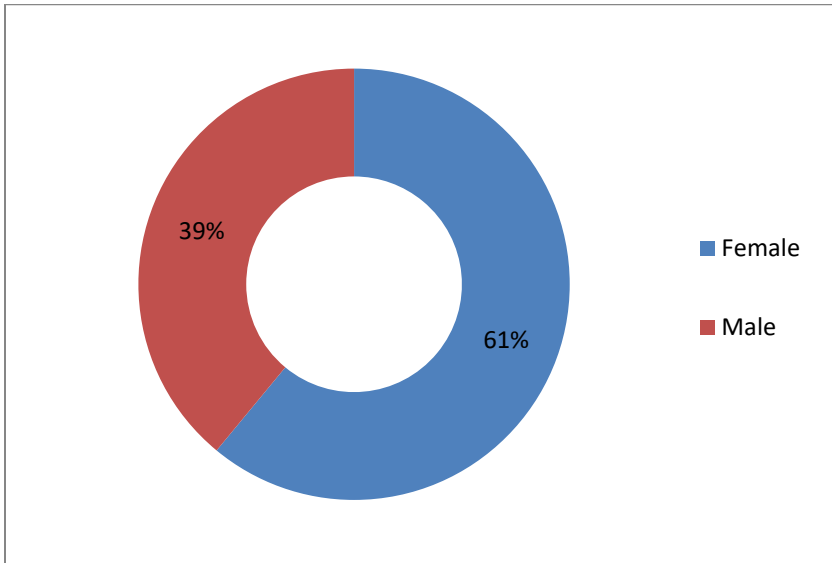
| Marital Status | Household Size | | | | | | Total | |
|----------------|----------------|-----|-----|-----|------|-----|-------|-------|
| | <2 | 3-4 | 5-6 | 7-8 | 9-10 | >10 | | |
| Married | 1 | 35 | 39 | 20 | 5 | 1 | 101 | 66.9% |
| Single | 0 | 6 | 9 | 4 | 0 | 1 | 22 | |
| Widowed | 2 | 9 | 4 | 5 | 0 | 1 | 21 | |
| Divorced | 0 | 2 | 2 | 1 | 0 | 0 | 5 | |
| Separated | 0 | 2 | 1 | 0 | 0 | 0 | 3 | |
| | 3 | 54 | 55 | 30 | 5 | 3 | 152 | |

Source: Field Survey, 2018

5.1.1.3 Gender

The finding analysis has shown that female gender dominated the sample size under which the research was conducted. The female respondents were 61% while the male added up to 39% of the total sample. This implies that decisions should be gender sensitive and should consider the female.

Figure 29: Gender Frequency



Source: Field Survey, 2018

5.1.1.4 Household Size

The size of household is heterogeneous hence each household has its own size. The small size of the households suggests the element of birth control practiced in the community.

Table 10 illustrates household size within the study area.

Table 10: Household Size

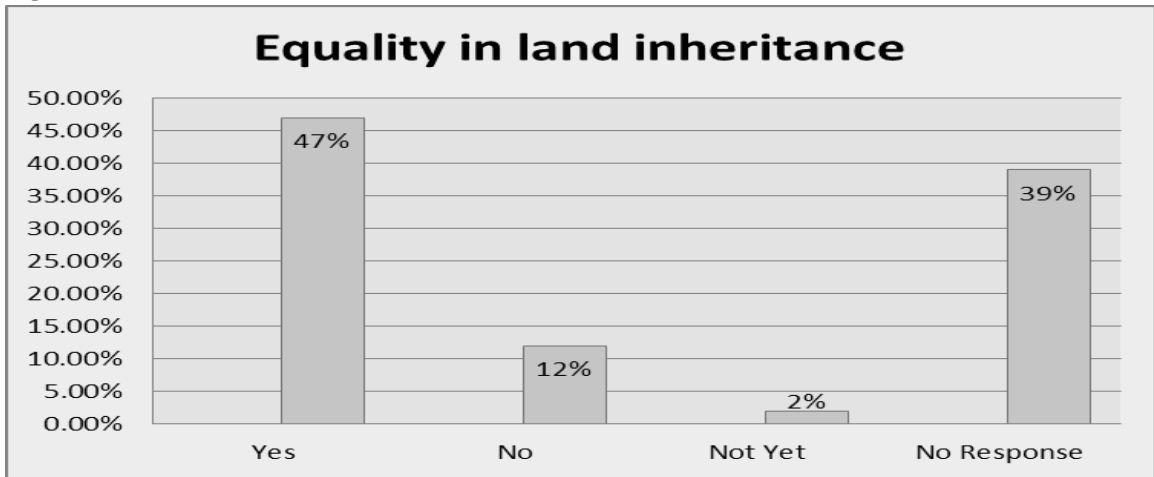
| Number of Children per family | Percentage |
|-------------------------------|------------|
| <8 members | 75% |
| 3-8 members | 22.4% |
| < 3 members | 2.6% |

Source: Field Survey, 2018

The number of the households determines the size of land each will inherit in the community. The findings of the study have revealed that 93.4% of the respondents have less than four male born sons. The more the number of sons in a given household the smaller the pieces of land each will share from the land inheritance and vice versa. The data collected indicated that 54% of respondents inherited 2-5 acres, 36% inherited Less than 2 Acres and the remaining 10% inherited more than 5 acres. Having a larger household size may force other sons to buy land elsewhere for their settlement and other economic activities. At least 53.9% of the sampled population have between one to two children.

Land inheritance in is equally shared as indicated by 47 percent of the respondents. Figure 30 illustrates equality in land inheritance within the study area.

Figure 30: Land Inheritance

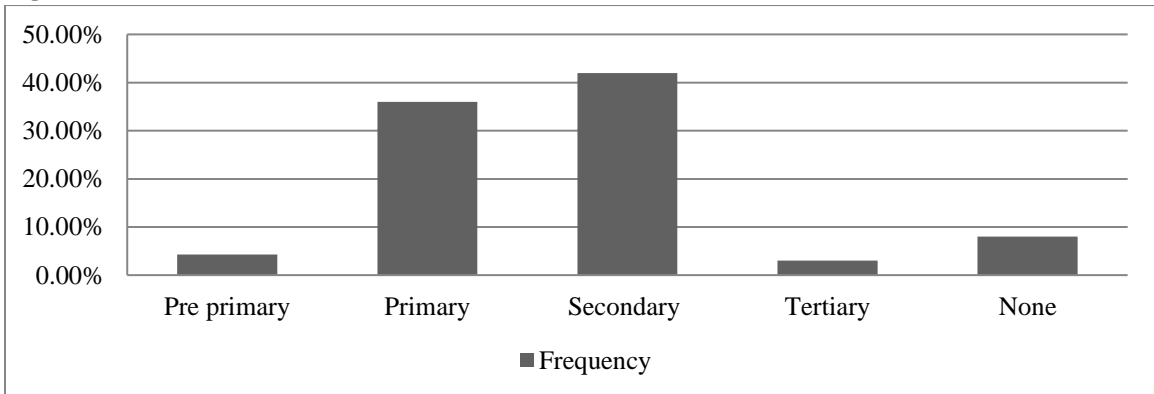


Source: Field Survey, 2018

5.1.1.5 Household's Education Level

According to the study findings, 92% of the respondents had attained formal education. This implies high literacy level which can be used as an avenue to educate and sensitize the community on the development aspirations and settlement arrangements that can be employed for having sustainable food, diet and economy. Figure 31 indicates household education levels within the study area.

Figure 31: Household Education Levels



Source: Field Survey, 2018

5.1.1.6 Household's Land Inheritance Issues

Considering the land inheritance, the study found out that only male born sons are guaranteed for sharing the family land. However, the community gave their opinion as to whether this was a cultural or natural practice. At least 43% of the respondents have disagreed with any cultural existence while 35% have agreed there are cultures related to land inheritance in the community. This scenario could allow members of the community to start selling small pieces of land they have inherited in attempt to meet family needs due to lack of strong community cultural control.

5.1.1.7: Houses Typology

Most of the families settled in compound area of between 400 and 800 square meters as represented by 29.6% of the total sample while cumulatively, 55.3% live in an area below 1200 meters square.

Table 11: Area of Household Compound

| Homestead Compound | | | | | |
|--------------------|----------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Less than 400 | 16 | 10.5 | 10.5 | 10.5 |
| | 400-800 | 45 | 29.6 | 29.6 | 40.1 |
| | 801-1201 | 23 | 15.1 | 15.1 | 55.3 |
| | 1202-1602 | 20 | 13.2 | 13.2 | 68.4 |
| | 1603-2003 | 9 | 5.9 | 5.9 | 74.3 |
| | 2004-3004 | 33 | 21.7 | 21.7 | 96.1 |
| | More than 3004 | 6 | 3.9 | 3.9 | 100.0 |
| | Total | 152 | 100.0 | 100.0 | |

Source: Field Survey, 2018

The most of the community family members established main houses that takes the size of between 20- and 40-meters square at 25.0% followed 21.1% that constructed their main house to a size of between 41- and 60-meters square. Table 12 represents the size of houses in square meters.

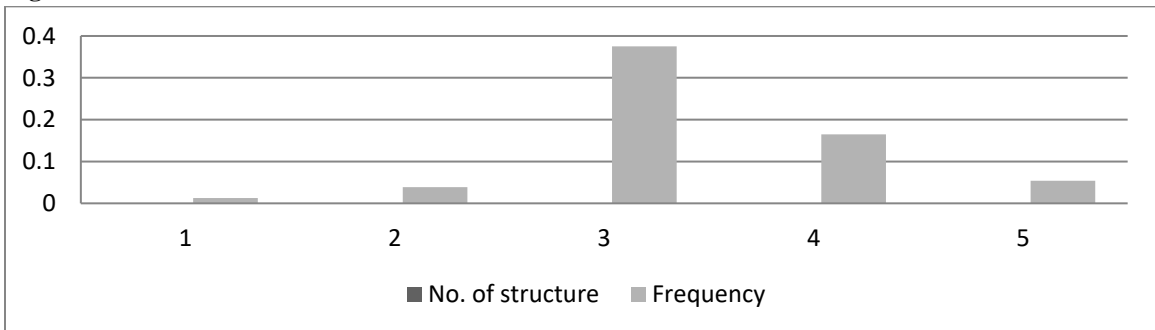
Table 12: Size of Houses

| Main House | | | | | |
|------------|-----------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Below 20 | 2 | 1.3 | 1.3 | 1.3 |
| | 21-40 | 38 | 25.0 | 25.0 | 26.3 |
| | 41-60 | 32 | 21.1 | 21.1 | 47.4 |
| | 61-80 | 22 | 14.5 | 14.5 | 61.8 |
| | 81-100 | 11 | 7.2 | 7.2 | 69.1 |
| | 101-150 | 21 | 13.8 | 13.8 | 82.9 |
| | 151-200 | 11 | 7.2 | 7.2 | 90.1 |
| | 201-250 | 5 | 3.3 | 3.3 | 93.4 |
| | Above 250 | 10 | 6.6 | 6.6 | 100.0 |
| | Total | 152 | 100.0 | 100.0 | |

Source: Field Survey, 2018

The households had a few numbers of housing structures and that has been confirmed by 37.5% and 36.8% of the community living in 2 and 1 house respectively whereby those who have 3 and 4 houses are represented by 16.4% and 5.2% of the community members. This implies that the community in the study area does not have large family members and polygamy is practiced by few individuals as shown in Figure 32.

Figure 32: Number of Houses Structures



Source: Field Survey, 2018

Majority of the households have partitioned their main houses into few number of rooms. 78.3% of the households portioned their main houses below four rooms and out of

which 44.7% have between three and four rooms within the main house to serve the household needs such as store, sitting room, bedroom and maybe dining or children's room.

Table 13 represents rooms in the main house.

Table 13: Rooms in Main Houses

| Main House Rooms | | Frequency | Percent |
|------------------|----------|-----------|---------|
| Valid | 1-2 | 51 | 33.6 |
| | 3-4 | 68 | 44.7 |
| | 5-6 | 26 | 17.1 |
| | 7-8 | 4 | 2.6 |
| | 9-10 | 1 | 0.7 |
| | Above 10 | 2 | 1.3 |
| | Total | 152 | 100.0 |

Source: Field Survey, 2018

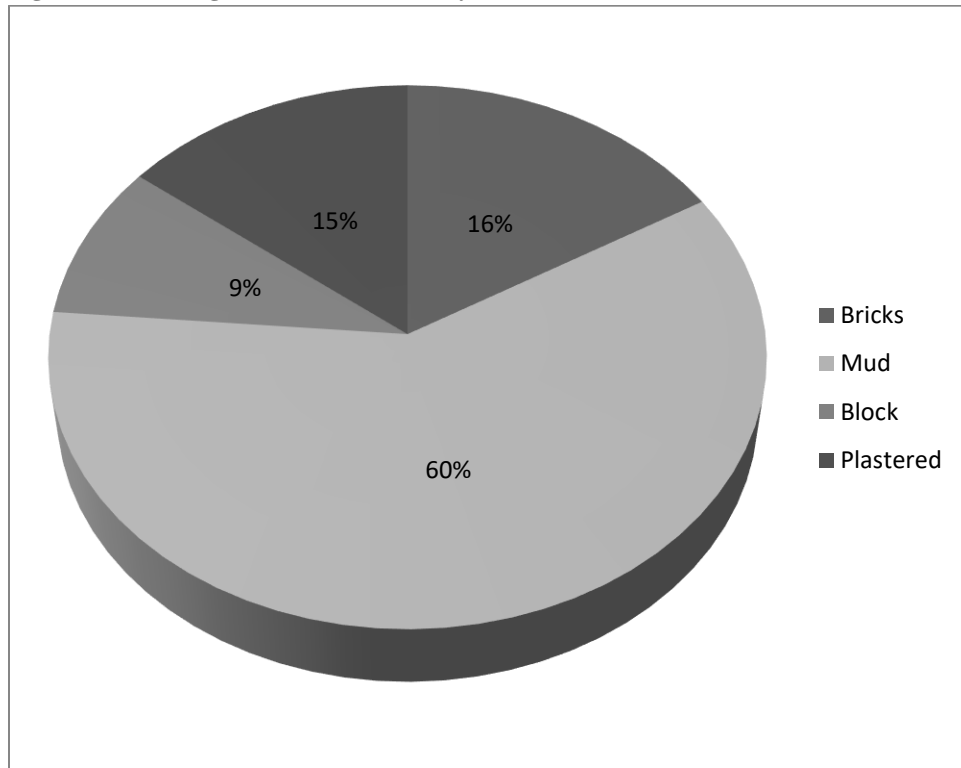
The area covered by other houses within the compound averagely takes 16 and 30 area in square meters which is represented by 44.7% of the compound while 27.6% of the compound have houses that cover below 15 square meters. The other houses include the granary, chicken structure and structures for other livestock kept.

Table 14: Areas of the Other Houses

| | | Frequency | Percent |
|-------|----------------|-----------|---------|
| Valid | 1-15 | 42 | 27.6 |
| | 16-30 | 68 | 44.7 |
| | 31-45 | 15 | 9.9 |
| | 46-60 | 6 | 3.9 |
| | 61-85 | 3 | 2.0 |
| | 86-120 | 3 | 2.0 |
| | 121-155 | 2 | 1.3 |
| | Not Applicable | 2 | 1.3 |
| | No Response | 11 | 7.2 |
| | Total | 152 | 100.0 |

Source: Field Survey, 2018

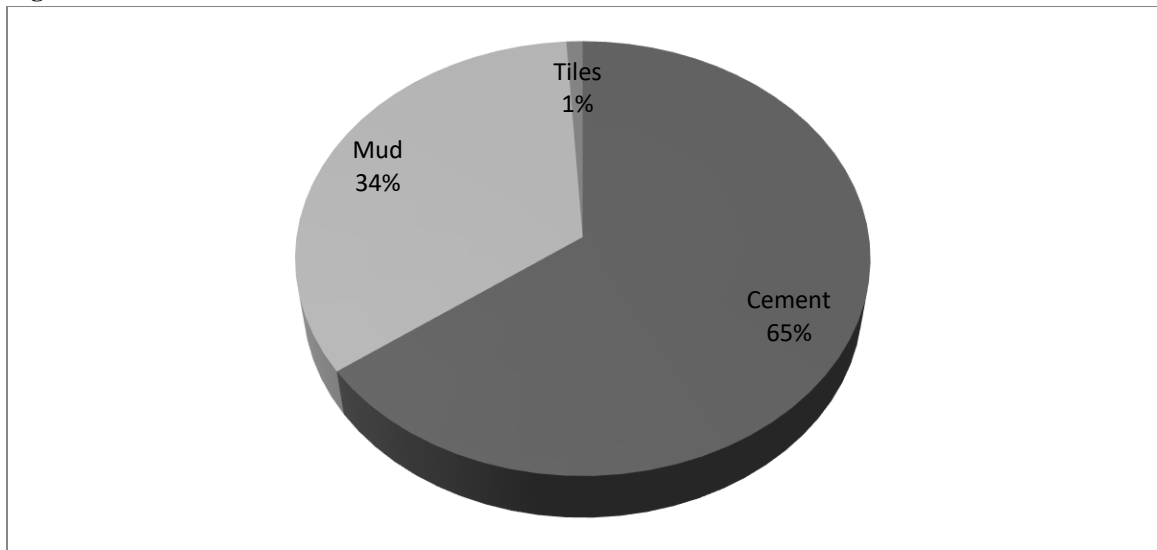
Figure 33: Walling Material in the Study Area



Source: Field Survey, 2018

In terms construction for houses, most of the house's walls are constructed using mud which is the simplest and available construction material everyone can afford. That gives a relative building orientation and typology to be similar in the community. At least 59.87% of the community has mud walled houses while 16.45% and 14.47% have houses that are built of bricks and plasters respectively. That suggests that there are a few members in the community that have modern houses constructed using bricks and plasters. Within the study area, at least 65% of the houses have cemented floors. The floors with mud surface entail 34% and 1% of the houses have their floors tiled. Figure 34 represents floor material used in the study area.

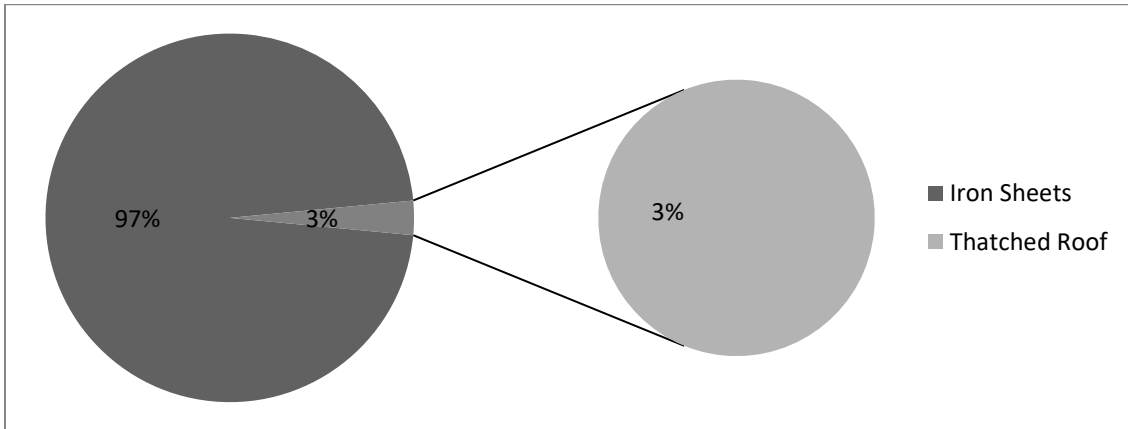
Figure 34: Floor Materials for the Houses



Source: Field Survey, 2018

The roofing characteristic is dominated by iron sheet regardless of the floor and wall material of construction. Only 3% of the community has houses that are constructed using the grass and other non-sheet materials.

Figure 35: Roofing Material



Source: Field Survey, 2018

5.1.1.8: Settlement Pattern

The study found out that linear pattern of settlement is preferred and majority of the inhabitants have lived using the linear pattern. According to 42 percent of the inhabitants, they prefer linear settlement to scattered and clustered settlements. This could be due to the desire to live where there is accessibility of roads, water and communication purposes. Since most of the community is agricultural farmers there is need for living near the road to be able to transport agricultural produce from the farms. This is therefore the key pull factor of the linear form settlement in the study area.

5.1.2 Land Holding Arrangements and Income Sources

5.1.2.1 Land Holding Arrangements

The findings indicated that 89% of the respondents owned land while 11% had none. This implies that it is easy to manage and control one's land independently for the profitability of his or her household needs based on the land use activities chosen to practice. The community members do not own many pieces of land. According to the findings, 76.3% own less than four pieces while 69.7% own one or two pieces.

According to the data collected, at least 54% of respondents inherited 2-5 acres, 36% inherited Less than 2 Acres and the remaining 10% inherited more than 5 acres. Leseru, Kaptich and Tebeswet are the main areas where majority of the people settled and owning

land. According to the respondents, 49% acquired land through inheritance while 37% acquired it through buying. Freehold land tenure system dominates in the study area.

5.1.2.2 Owned Land Characteristics

The inhabitants within the study area who own land are at least 93%. According to 98% of the respondents, the main tenure system in the study area is freehold while 2% have a leasehold tenure system. According to the respondents, the land acquired by inheritance entail 45%, that bought entail 44% while only 9% have both bought and inherited parcels of land. The table 5.1.2a indicates the main use of land:

Table 15: Land Use for Owned Land in Leseru sub location

| Land Use | Frequency |
|-------------------------------------|-----------|
| Agriculture | 42% |
| Residential | 47% |
| Mixed (Agriculture and Residential) | 11% |

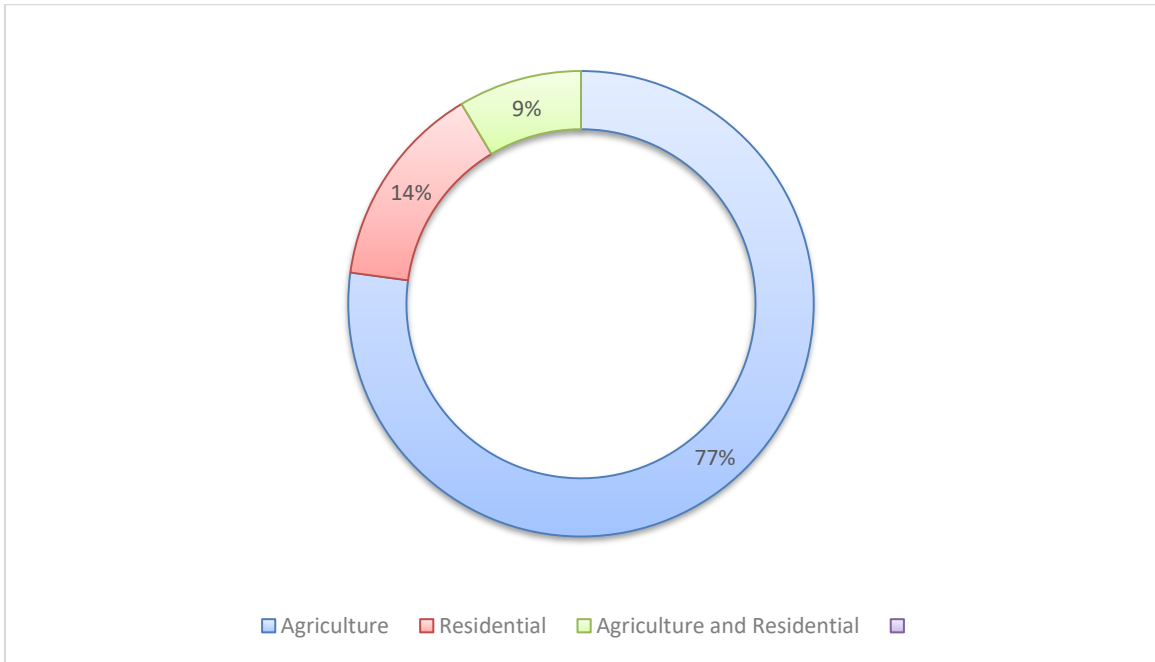
Source: Field Survey, 2018

Land use practices vary considerably across the sub-location. It is noted that most of the land traversed is agricultural land. The centers within the sub-location have small scale commercial business premises as the economic activity. Residential settlements are concentrated at the centers and scattered at the hinterlands. Other uses present include; education, transportation, public purpose and public utilities.

5.1.2.3 Rented Land Characteristics

According to 33% of the inhabitants, they indicated that they had rented land parcels. Agriculture is the main land use of the rented land parcels having 77% of all the rented parcels. The tenure system of 94.4% of the rented land is freehold system while 6.6% have leasehold tenure system. Within Leseru sub location, 51.5 % of rented land parcels were bought while only 27.3% of the parcels were inherited. Atleast 64% of the rented parcels have title deeds, 28% have sales agreement while 7% have sales agreement. Figure 36 indicates the land uses for the various parcels.

Figure 36: Land Uses for Rented Land Parcels

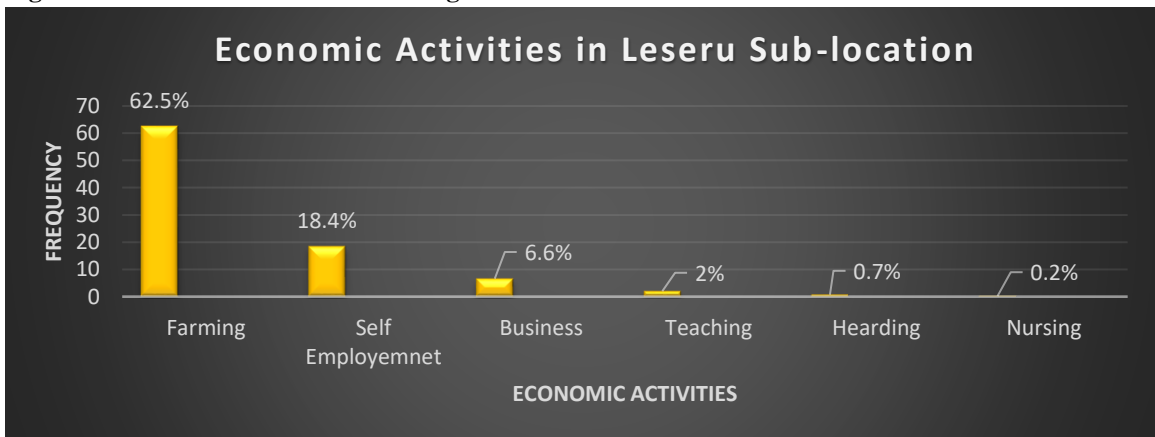


Source: Field Survey, 2018

5.1.2.4 Off-Farm Income Generating Activities

Agriculture is the main economic activity in the study area and is practiced by 62.5% of the inhabitants within the sub-location as shown in Figure 37. Agricultural farming is the main practice as indicated by 93.4% of the respondents. The inhabitants within the sub-location are composed of 18.4% who are self-employed while 6.6% engage in business activities.

Figure 37: Off-farm Income Generating Activities



Source: Field Survey, 2018

5.1.3 Land Sizes, Mechanization and Farm Yields

The analysis on the sizes of land owned and the factors of production was done.

5.1.3.1 Land Sizes

Comparatively the size of land owned by the family before subdivision was higher than the current available size. Even though 23.7% and 19.7% of the sample size as illustrated in Table 16 showed that they owned between 10-20 and 2-5 acres respectively, at least 60% of the population possess between 1 and 30 acres.

Table 16: Land Ownership Before Subdivision

| Land owned before Subdivision | Ownership |
|-------------------------------|-----------|
| Less than 1 acre | 1.8% |
| 2-5 acres | 26.3% |
| 6-9 | 10.5% |
| 10-20 | 31.6% |
| 21-31 | 7.9% |
| 32-72 | 13.2% |
| 73-123 | 6.1% |
| 124-204 | 1.8% |
| More than 205 | 0.8% |

Source: Field Survey, 2018.

The field survey identified that, family land in the study area is divided amongst the male children within the family. With the culture of land subdivision taking place in the community, there will be significant reduction in the size of land owned by the family depending on the number of male children in a given household and family demands. According to respondent's at least 52.63%, state that land subdivision practices go on in Leseru sub-location.

According to 35% of the respondents, land subdivision should be encouraged within the sub-location and the country in general. According to 67.8% of the respondents, the main cause of land subdivision was seen to be population pressure.

5.1.3.2 Mechanization

Even though 73.7% of the respondents use new farming technology and skills, the efforts are being thwarted by the decreasing land sizes. There is an eminent hindrance to economies of scale due to the fact that smaller parcel requires almost the same attention and input with the bigger parcel. If one calculated the expenses given to a larger parcel and divide to an acre, it will be eminent that cost will be lower than a single acre that is tilled on its own.

5.1.3.3 Crop Yield

Maize farming does better in the first season than in the second season and the production varies from higher producers to low producers. There is more maize consumed than that which is sold as illustrated in Table 17.

The price of maize per bag ranges between Kshs.1800-2000 and Kshs.3000-3200 minimum and maximum respectively.

Table 17: Land Subdivision and Crop Yield

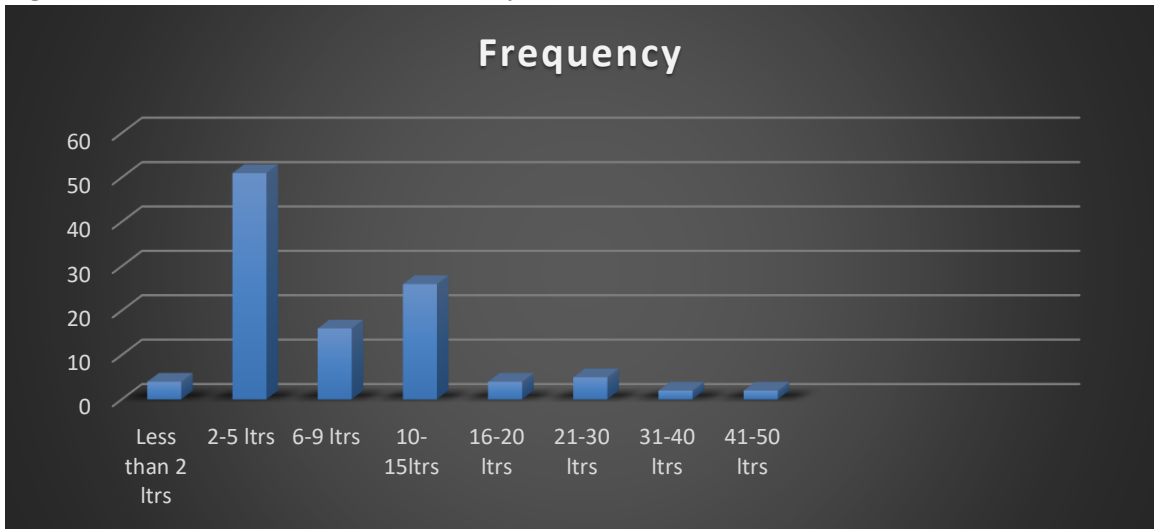
| | Area of crop (Acres) Yield of crop (Bags) Consumed | | | | | | |
|------------------------------------|--|-------|-------|-------|-------|-------|-------|
| | Sold | | | | | | |
| 90.8% of the community plant maize | 1-5 | 55.5% | <5 | 8.5% | 6.0% | 13.9% | 86.4% |
| | 6-10 | 6.0% | 6-26 | 24.3% | 15.6% | 57.0% | 43.0% |
| | 11-15 | 2.6% | 27-27 | 10.5% | 6.6% | 11.5% | 88.5% |
| | 16-20 | 3.8% | 28-48 | 17.8% | 20.7% | 8.6% | 91.4% |
| | 21-25 | 2.1% | 49-69 | 9.9% | 25.2% | 3.9% | 96.1% |
| | 26-30 | 5.9% | 70-90 | 2.0% | 5.8% | 2.0% | 98.0% |
| | >31 | 7.0% | >91 | 27.6% | 25.3% | 3.9% | 96.1% |
| | 79.6% of the community plant beans in first season | <5 | 13.2% | 1-4 | 8.6% | | 75.5% |
| 6-10 | | 2.6% | 5-9 | 2.5% | - | 68.2% | 31.8% |

The study found out that 90.8% of the community plant maize while 79.6% of the community plant beans in first season. The analysis found out those beans has no specific money value in terms of price and its production is very low. Generally, the community sells more of their agricultural produce than they consume.

5.1.3.4 Livestock Yields

The study showed that there are dominant livestock kept in the community. Majority of the farmers keep small number of cows that ranges below five. At least 78.9% of the community have cows between one and five while 53.9% of the farmers do not have chicken. According to the findings as illustrated in Figure 38, more milk is sold than the milk consumed and the price per liter cost of milk in the market ranges between Kshs.30 and Kshs.40

Figure 38: Milk Production Within the Study Area



Source: Field Survey, 2018

Most of the respondents never said whether the eggs produced are for domestic consumption or for market because higher percentages were not able to give information regarding that aspect.

The average income from the study area data gathered, majority earn below Ksh.3000 every month which is an indicator for the need for proper planning intervention to be done to convert the community land and produce into useful income resources.

Table 18: Income Earned by the Inhabitants

| Income (Kshs) | Percentage |
|----------------------|-------------------|
| 1000-1500 | 14.61% |
| 1501-2001 | 7.87% |
| 2002-2502 | 41.57% |
| 2503-3003 | 30.34% |
| 6008-7008 | 2.25% |
| 8010-9010 | 2.25% |
| >10000 | 1.12% |

Source: Field Survey, 2018

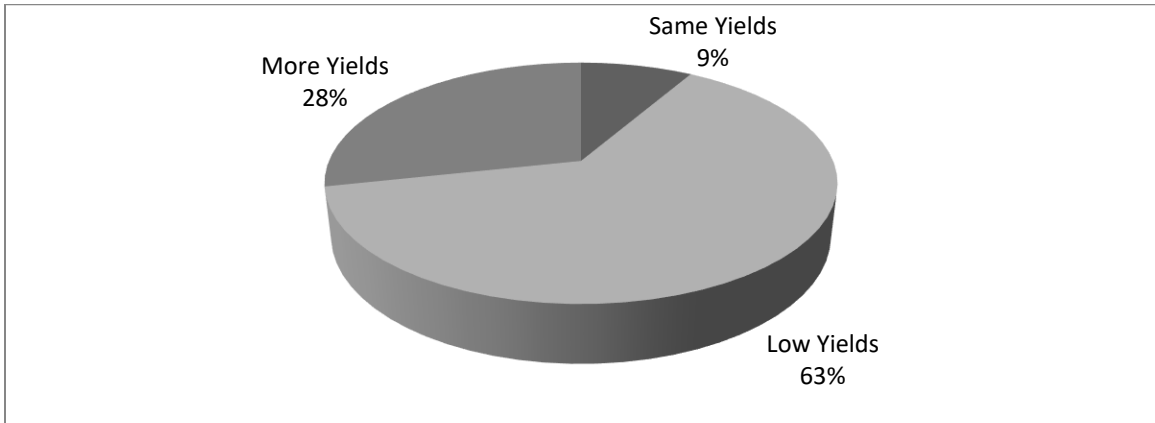
There is a reduction in the yield from both the crops and livestock and that could be attributed by the rampant cases of land subdivision which interferes with soil fertility and management. The yield has gone down by a half which is reflected both from the livestock keeping and the farming.

5.1.4 Food and Livelihood Security Issues

5.1.4.1 Yields Variations due to Sub-division

There is evidence of farm yields reducing with time and season. That could be contributed by the facts that there is increasing land subdivision which comes with other land use changes. Figure 39 is an illustration of comparison of farm yields as a result of subdivision in Leseru sub-location.

Figure 39: Changes in Yields after Subdivision



Source: Field Survey, 2018

5.1.4.2 Yields and Household Food Security

The community is having food security and 61.20% of the family members shown in the Table 19 do harvest or have food lasting them throughout the year. The inhabitants within the community have enough food for their consumption whereby 93% of them have never gone without a meal.

Table 19: Families having Food Security

| Months | Families having Food Security |
|-------------|-------------------------------|
| 0-3 Months | 6.50% |
| 3-6 Months | 14.80% |
| 6-9 Months | 17.50% |
| 9-12 Months | 61.20% |

Source: Field Survey, 2018

5.1.4.3 Household Food Types

The analysis on food consumed in the household as shown in Tables 20 and 21 examined what the members take on breakfast; lunch and supper on daily basis. 76.3% of the community do take tea alone during breakfast without any other food while the 21.7% do use both tea and bread. At lunch time the common meal the households use is found to be Ugali and vegetables which used by 53.3% of the community members while 25.0% depend on *Githeri*. Moreover, the supper meal is also dominated by *Ugali* and vegetables at 97.4%. This imply that the community is mostly feeding on carbohydrate food type and vitamin while protein is lacking in the main meals. Protein in the form of milk dominates

the daily meal taken but not in the main food used by the household. This suggests that the morning tea is prepared using the milk for breakfast purposes otherwise generally protein meal food type is not commonly used in the community.

Table 20: Source of Proteins Consumed by the Community

| Meal | | Daily | Weekly | Monthly | Annually | Not Using |
|-----------|---|-------|---------|---------|----------|-----------|
| Milk | % | 63.2 | 28.3 | 5.9 | - | 2.6 |
| Beans | % | 11.8 | 72.48.6 | 8.6 | 2.0 | 4.2 |
| Chicken | % | - | 11.2 | 38.8 | 28.9 | 21.1 |
| Fish | % | - | 8.6 | 23.0 | 17.1 | 51.3 |
| Beef | % | 2.0 | 38.8 | 28.3 | - | 30.9 |
| Pork | % | - | 2.0 | 2.0 | 5.3 | 90.7 |
| Mutton | % | 1.3 | 31.6 | 32.2 | 5.3 | 29.6 |
| Goat meat | % | 0.7 | 30.3 | 44.1 | 5.3 | 19.6 |
| Fruits | % | 34.9 | 53.9 | 6.6 | 1.3 | 3.3 |

Source: Field Survey, 2018

Table 21: Food types taken by the community.

| Main Food Types | | | | |
|----------------------------------|-----------|---------|---------------|--------------------|
| Breakfast | | | | |
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Tea | 116 | 76.3 | 76.3 | 76.3 |
| Tea and Bread | 33 | 21.7 | 21.7 | 98.0 |
| Valid Strong Tea | 2 | 1.3 | 1.3 | 99.3 |
| Porridge | 1 | .7 | .7 | 100.0 |
| Total | 152 | 100.0 | 100.0 | |
| Lunch | | | | |
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Ugali and Vegetables | 84 | 55.3 | 55.3 | 55.3 |
| Githeri | 38 | 25.0 | 25.0 | 80.3 |
| Rice and Dengu | 5 | 3.3 | 3.3 | 83.6 |
| Valid Rice and Beans | 21 | 13.8 | 13.8 | 97.4 |
| None | 1 | .7 | .7 | 98.0 |
| Not Applicable | 3 | 2.0 | 2.0 | 100.0 |
| Total | 152 | 100.0 | 100.0 | |
| Supper | | | | |
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Ugali and Vegetables | 148 | 97.4 | 97.4 | 97.4 |
| Valid Ugali, Vegetables and Milk | 3 | 2.0 | 2.0 | 99.3 |
| Rice and Dengu | 1 | .7 | .7 | 100.0 |
| Total | 152 | 100.0 | 100.0 | |

Source: Field Survey, 2018

5.1.5 Intergenerational Transmission of Land

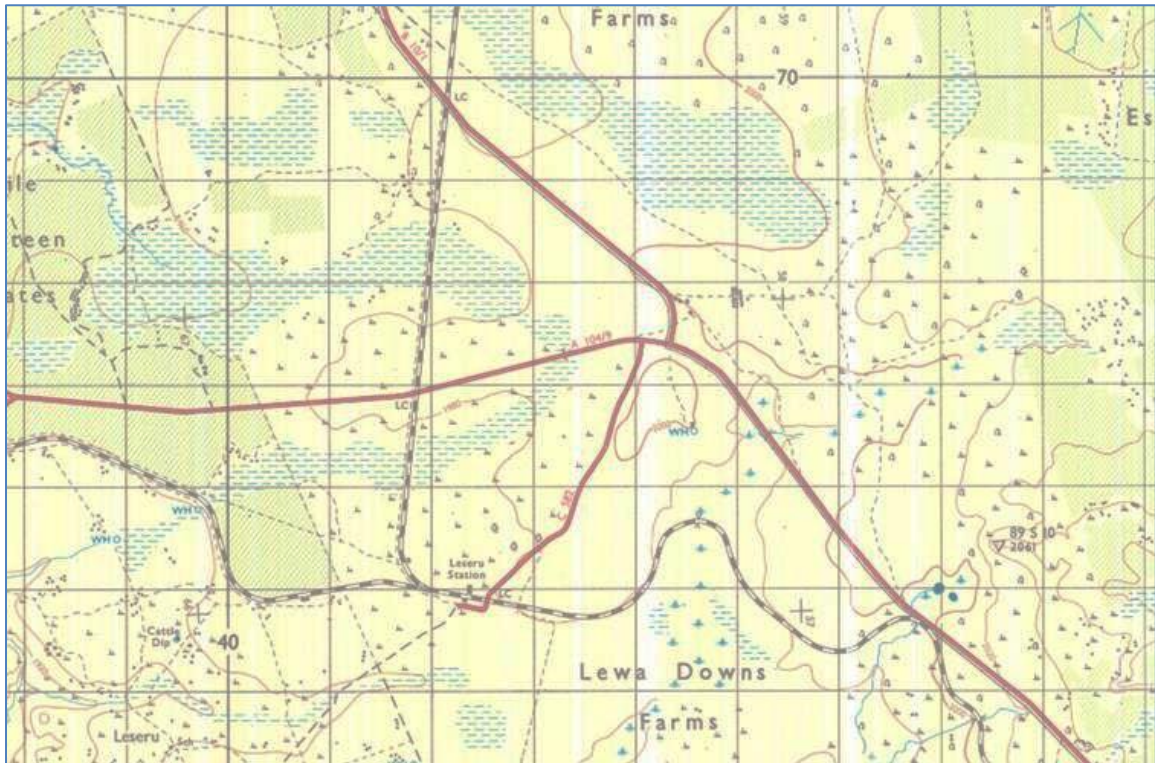
5.1.5.1 Variation of Land Sizes Over Time

The history of Leseru sub-location is an important aspect that informs on how the transmission of the land has been done over the years. The information obtained from the key informants and the focus group discussion forum indicated that the local community (Kalenjin) lived with the Maasai before the white settlers came in between 1914 and 1939. The white settlers chased the local community who then dispersed to Tanzania, Narok and some migrated to Uganda for safety.

The colonial masters consolidated the land and used it for agriculture until 1939 when some of the locals came back and bought the same land that they owned. Other members of the community came back during independence year 1963 and found that the white settlers had left the land to their fellow Africans a long ago. They had to buy back the land although some people who didn't have the resources had to settle as squatters in some land that had been allocated by the government for public use. It was until 1939, when land subdivision began, initially the total land size was about 44,000 Acres where 13,000 Acres were allocated to Leseru society, 8,500 Acres were allocated to the government's department of defence (DOD), 3,000 Acres to Chemalal farmers and the remaining to Lewa downs farms.

The Government of Kenya through its Survey department with the support of the British Government's Ministry of Overseas Development under the special commonwealth Africa assistance plan prepared the topographical sheet partly shown in Figure 40 that shows the situation of the area in the year 1969.

Figure 40: Survey of Kenya Topographical Sheet for Soy (89/4) – A section



Source: Survey of Kenya

The map shows the vast lands that had not been subdivided and had minimal agricultural activities taking place.

The independent Government of Kenya though the Survey of Kenya officially did land adjudication in the year 1996 and the sub-location had two adjudication areas namely; -

- Turbo East/ Leseru block 7 and
- Kiplombe/ Kiplombe block 5/ Kaptich

The Registry Index Map (RIM) as sampled in Figure 41 shows one of the adjudication sections in the sub-location indicating the land sub-division with amended status up to the year 2012.

Figure 41: Turbo East/Leseru Block 7 Sheet - Part



Source: Survey of Kenya

In the RIM sheets, the amendments are indicated within the sheet as shown in Figure 42, indicating the parcel subdivided and the resultant plots from the subdivision.

Figure 42: Amendments for Turbo East/Leseru Block 7

| KENYA LAND SYSTEM | | G.M.P. VALUES IN METRES | | DISTRICT | |
|---|---|-------------------------|------|----------------------------|----------|
| Compiled by Survey of Kenya 1955 | | 1:5000 | | TURBO EAST/LESERU DISTRICT | |
| <p>Scale: One inch = 100 metres approx.</p> <p>Boundaries shown are those of the original survey and may differ from those shown on the ground.</p> | | | | | |
| AMENDMENTS | | | | | |
| No. | AMENDMENTS | ED. | PUB. | ED. | DATE |
| 1 | SUBDIV 181 TO 483-485 MUT/004/202/15/05 | 2ND | ED | PUB | 11-8-04 |
| 2 | TO 487-488 MUT/004/202/15/10 | SUBDIV | 182 | 3D | 3-10 |
| 3 | AMEND 182 TO 489 MUT/004/202/15/10 | 3RD | ED | PUB | |
| 4 | SUBDIV 162 TO 505-508 MUT/004/202/15/10 | 4TH | ED | PUB | 18-10-10 |
| | | 5TH | ED | PUB | 05-03-12 |

SCALE 1:5000

Source: Survey of Kenya

After a series of subdivisions over the years, the current status of the sub-location is shown in the Figure 43.

Figure 43: Map for Leseru Sub-division



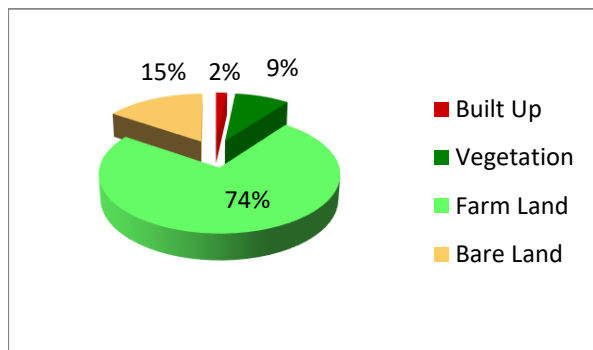
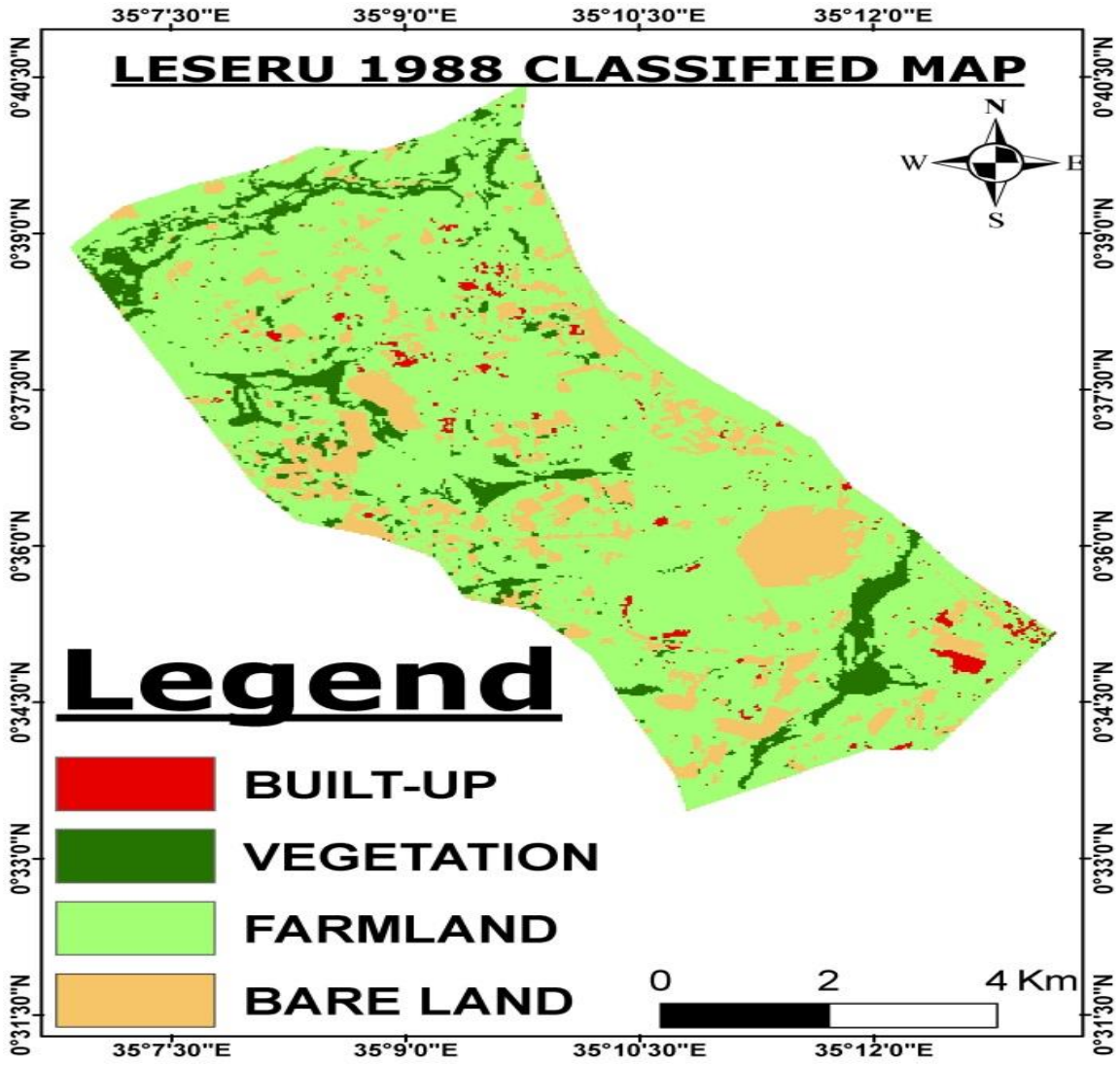
Source: Author, 2018

5.1.5.2 Variation of land Uses Over Time

In this study, Remote Sensing (RS) and Geospatial Information Systems (GIS) was used. This is because of its ability to handle spatial, multispectral and temporal data, their availability and efficiency in data manipulation was used. The tools became very handy in analyzing, accessing, monitoring of land use/land cover changes in the sub-location.

The study employed the use of time-series/ epochs analysis of Landsat images for the period 1988, 1995, 2002, 2009 and 2017 as illustrated in the Figures 44, 45, 46 and 47. From the classification done, the land that was farmed during the year 1988 constituted 74% whereas the open space that remained bare was at 15%, vegetated area at 9% and only 2% was built up.

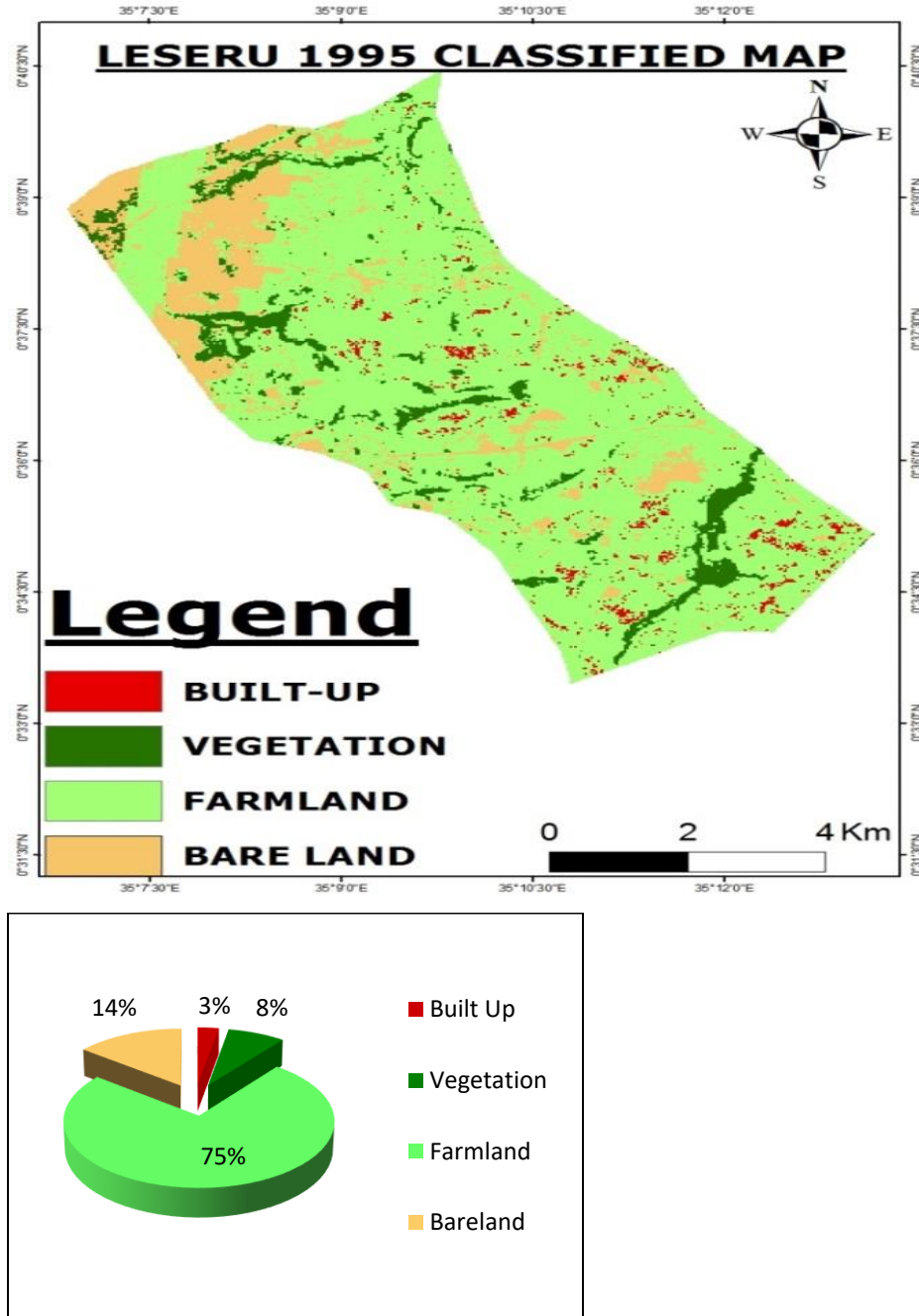
Figure 44: Land Uses Classification for Leseru in 1988.



Source: Author, 2018

In the year 1995, there was a 1% increase on the built-up area and the farmland where as the vegetated and bare land areas dropped by 1% each as shown in Figure 45. This suggested that some vegetation was removed or cut, and bare land used for farming and buildings.

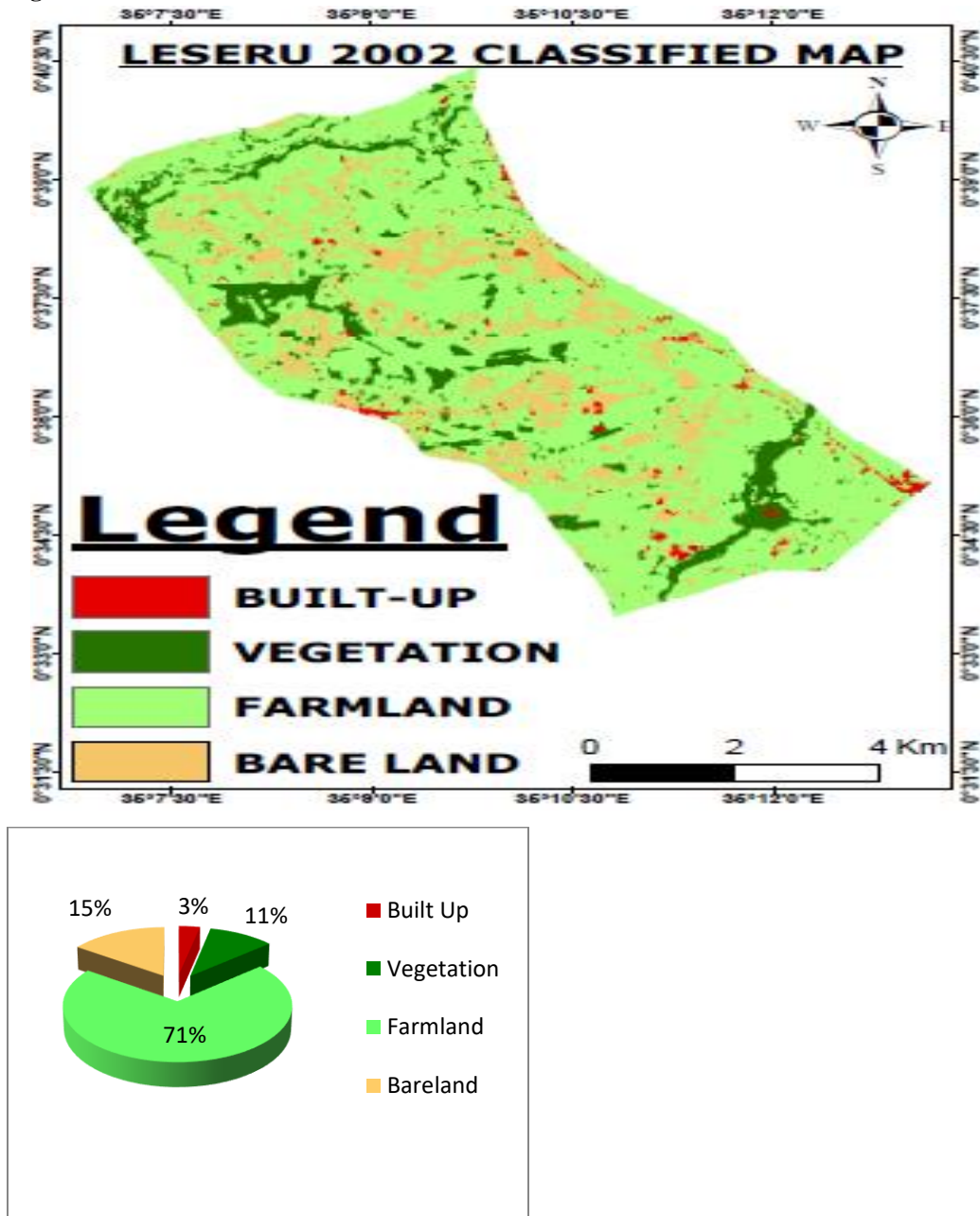
Figure 45: Land Uses Classification for Leseru in 1995



Source: Author, 2018

In the year 2002, there was no change on the built-up area but the farmland areas reduced drastically by 4% which is 2.5Km² or 618.5 Acres. The vegetated area increased, and the cause could be the increasing built up areas that force people to plant trees in the compound but the bare land areas increased by 1% meaning that some people did not till their land during the year. The changes are as illustrated in Figure 46.

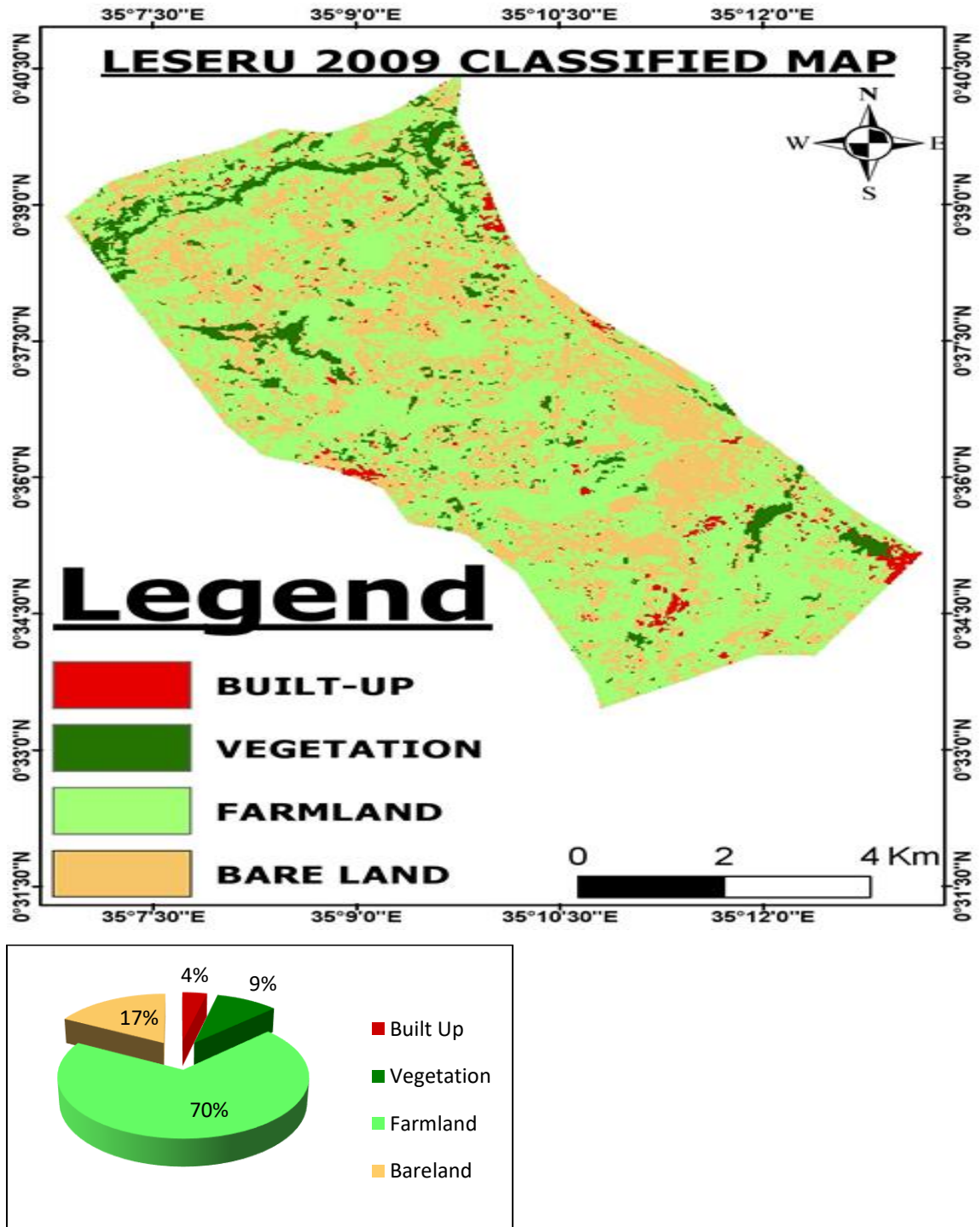
Figure 46: Land Uses Classification for Leseru in 2002



Source: Author, 2018

In 2009, the built-up area increased further by 1% whereas the vegetation reduced by 2% the farmland reduced by 1% and the bare land increased by 2% as shown in Figure 47.

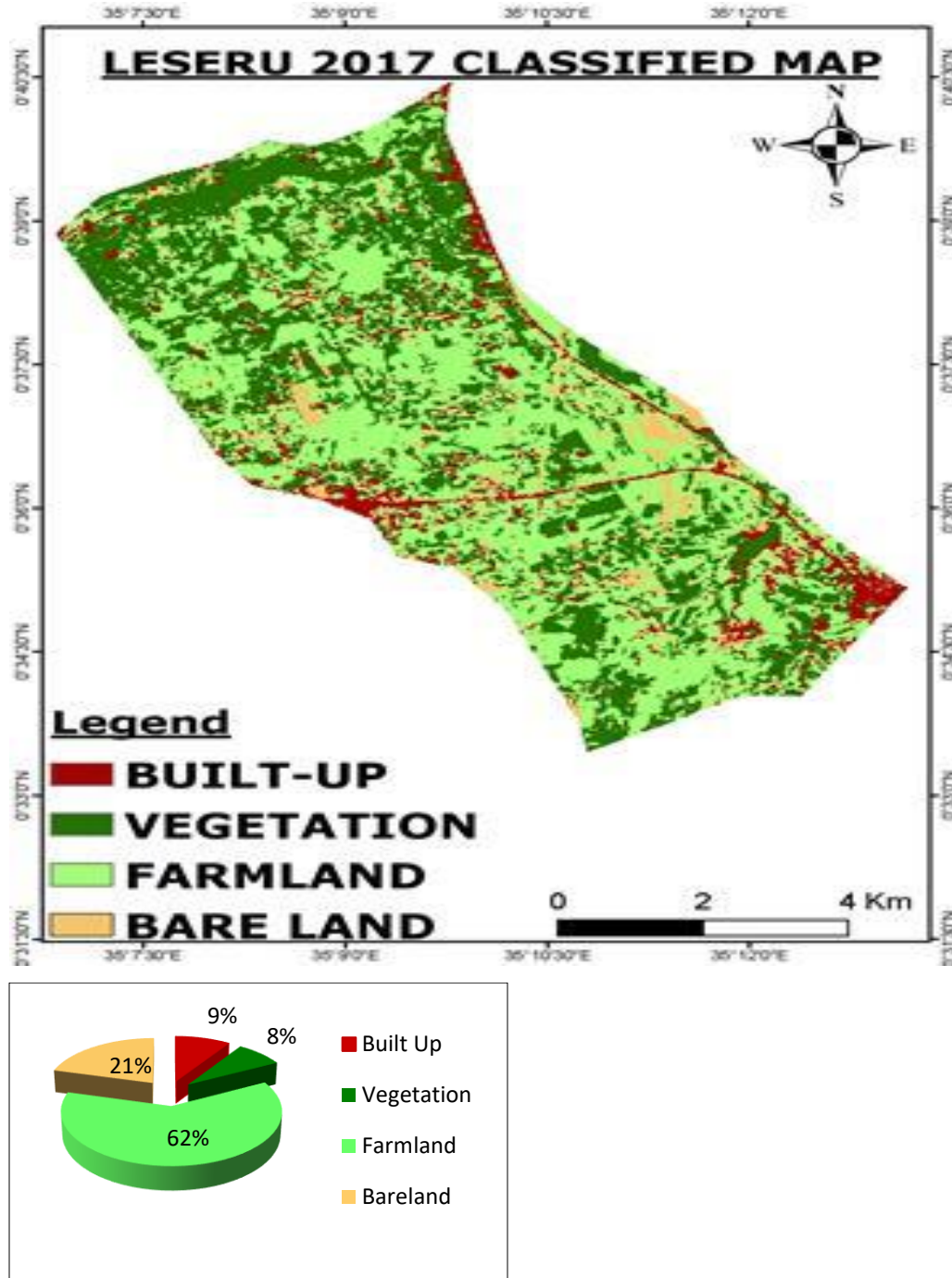
Figure 47: Land Uses Classification for Leseru in 2009



Source: Author, 2018

In 2017, there have been drastic changes where within a span of 8 years, the built-up area increased by 5%, vegetation decreased by 1%, farmland has reduced by whole 8% and bare land increased by 4% as illustrated in Figure 48.

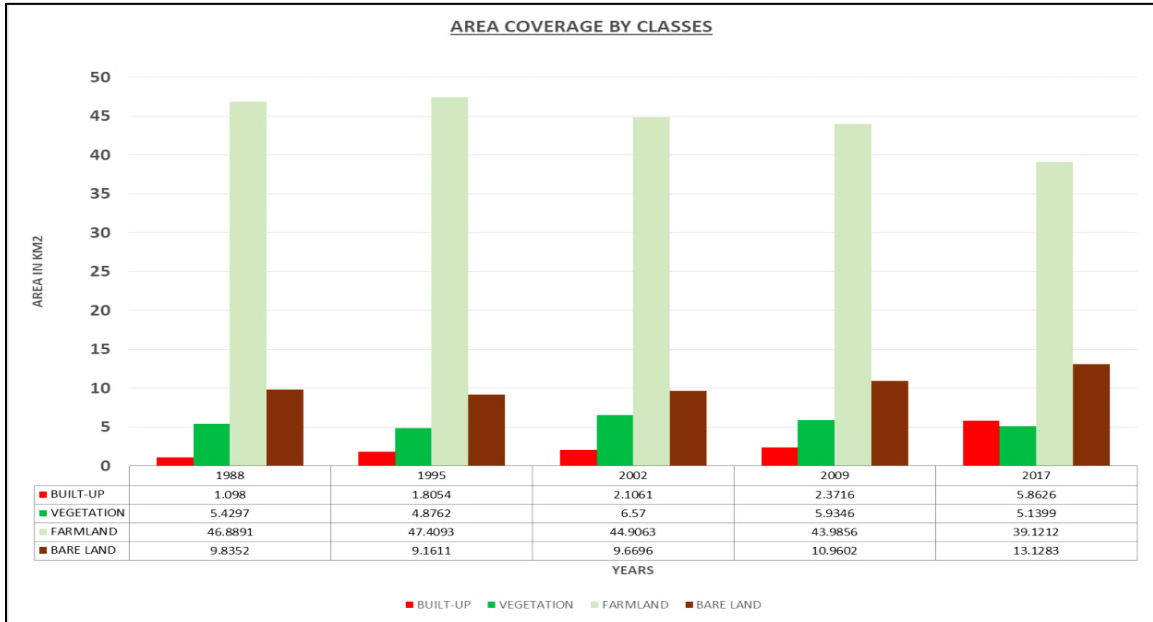
Figure 48: Land Use Classification for Leseru in 2017



Source: Author, 2018

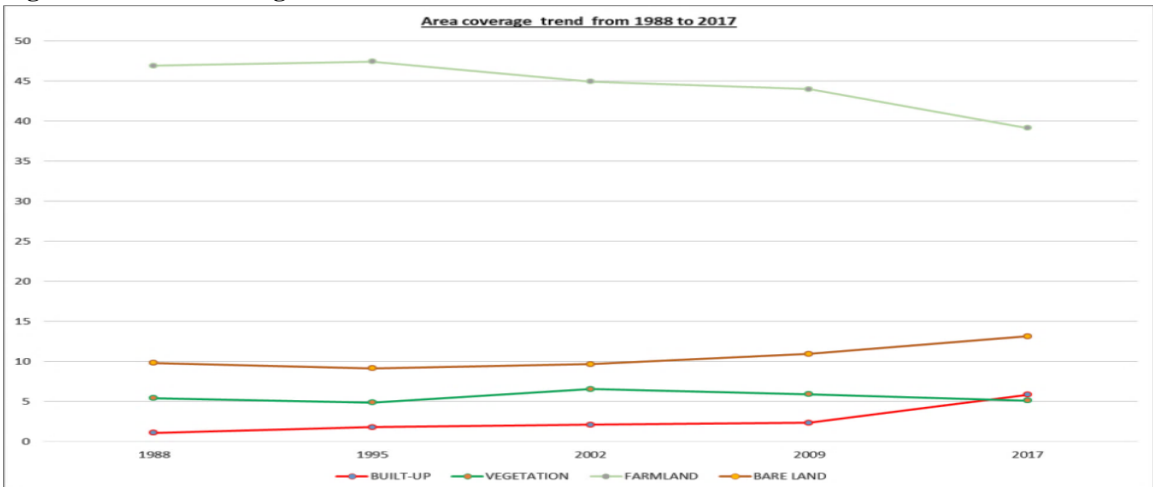
Considering the satellite imagery for the four epochs 1988, 1995, 2002, 2009 and 2017 the area coverage for the various land uses are as tabulated in Figure 49.

Figure 49: Area Coverage by the Land Uses



Source: Author, 2018

Figure 50: Area Coverage Trend



Source: Author, 2018

From 1988 to date, the built-up area has increased from 1.098Km² to 5.8626km² in other terms from 271.3 Acres to 1448.7 Acres. This is due to the population increase in the sub-

location. As the population increases, the demand for housing goes up as well and as households subdivide land, the construction of new houses for the new families also takes place. Another observation is that the commercial centers are increasing to cater for the growing population. This then increases the built-up area as confirmed by the satellite imagery. The satellite image shown in Figure 51 shows the upcoming commercial center at the Leseru - Jua Kali market and the built-up areas that are upcoming at the farms in Figure 52

Figure 51: Leseru Juakali Center



Source: Geo-eye Satellite Image, 2018

Figure 52: Upcoming Built-up Areas in Agricultural Farms at Maili tisa in Leseru



Source: Geo-eye Satellite Image, 2018

The vegetated area has marginally decreased from 5.4297Km² to 5.1399km² in acreage from 1341.7 Acres to 1270 Acres. The drop could be attributed to deforestation due to the need to clear the forest to get wood for construction or to create space for settlement. The

small decrease is explained by the need for some people to plant trees in the compounds, along the fences and some in the farms for commercial purposes. The satellite image shown in the Figure 53 illustrates this.

Figure 53: Vegetation Cover



Source: Geo-eye Satellite Image, 2018

The farmland area has significantly reduced from 46.8891Km² to 39.1212km² in acreage from 11586.5 Acres to 9667.1Acres. The drop is attributed to the sub-divisions of land that paves way for other land uses including residential, commercial and open spaces. The satellite image shown in the Figure 54 illustrates this.

Figure 54: Reduced Agricultural Land



Source: Geo-eye Satellite Image, 2018

The bare land/open ground area has increased from 9.8352Km² to 13.1283km² and in acreage from 2430.3 Acres to 3244.1Acres. This increase is attributed by the cattle farming

spaces that has been left or the cows and the need for compounds to the new homesteads resulting from land sub-division. The satellite image shown in the Figure 55 illustrates this.

Figure 55: Bare Land Areas



Source: Geo-eye Satellite Image, 2018

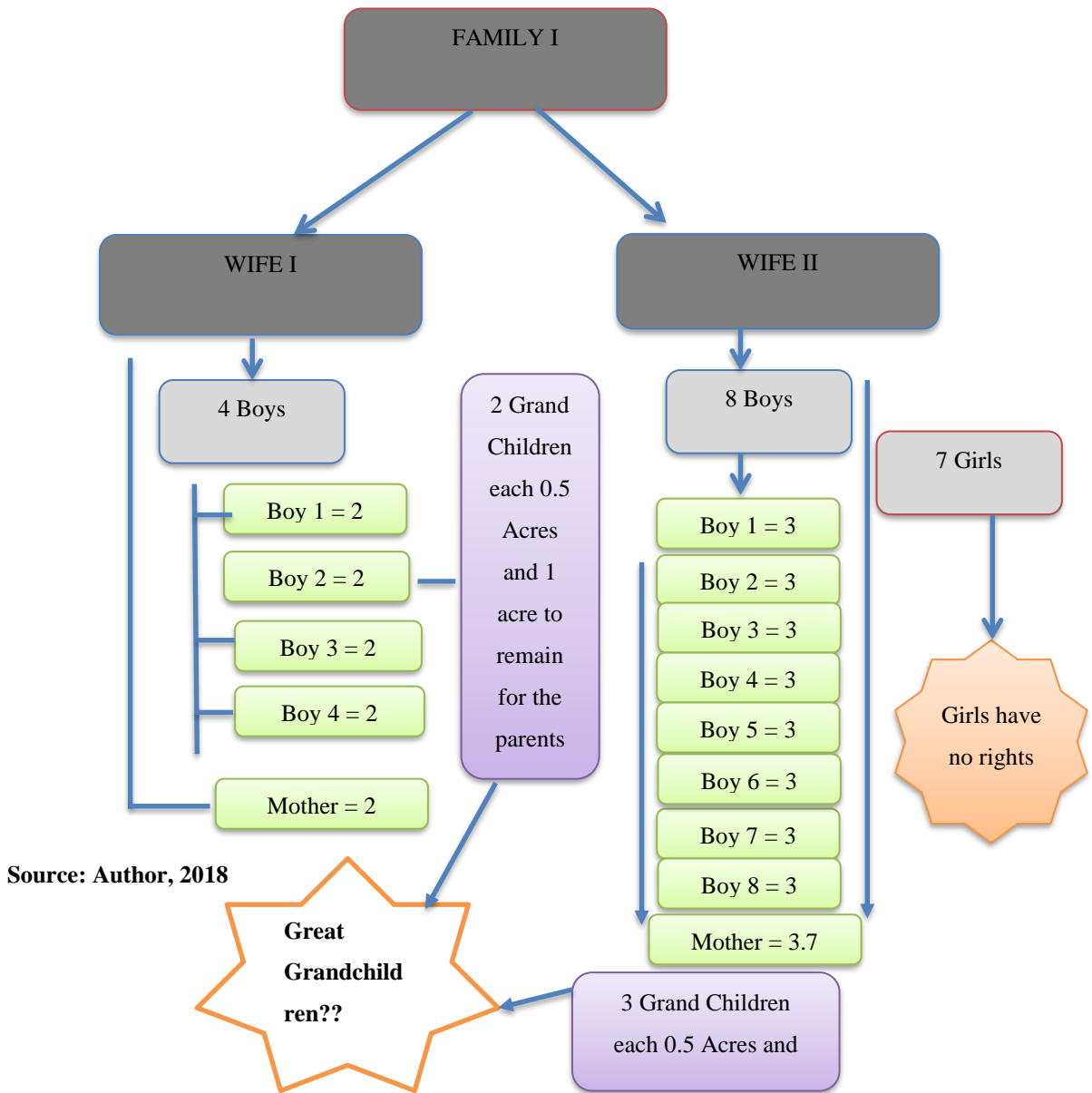
5.2 Case Study on Household Land Sizes and Food and Livelihood Security Indicators

To further breakdown on the effects of sub-division or lack of it, 5 families were picked out from the focused group discussion and their history over the years on how they have managed the land issues.

5.2.1 Case Study of Family I

The first case is the family of Mr. Tanui who is deceased but had two wives and 19 children. The first wife has 4 children while the second wife has 15 children as illustrated in Figure 56.

Figure 56: Family I Arrangement



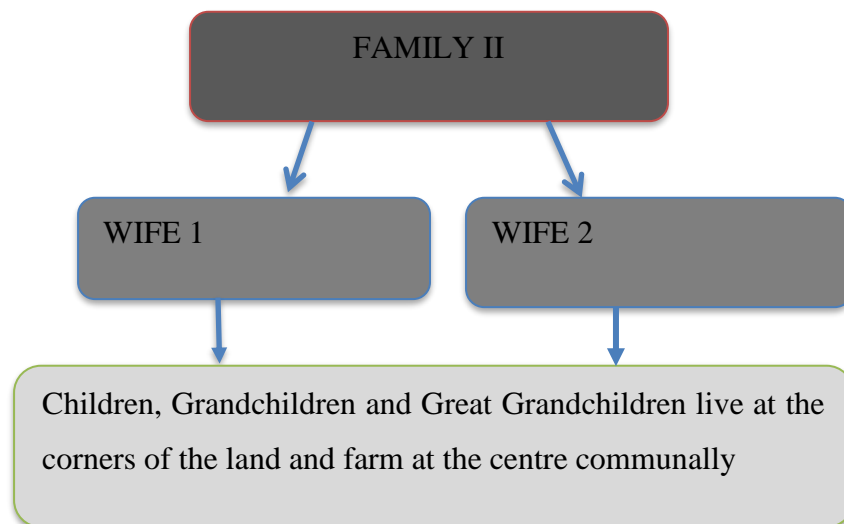
Source: Author, 2018

After the subdivision over just three decades, an individual grandchild has remained with an average of 0.5 Acres which is proving to be not only hard to subdivide further to the great grand-children that are due in less than 10 years and leaving the family with just enough food for the existing population of the household. This means that there will be no extra income from the sale of extra farm products and that the food insecurity issue is expected to come through.

5.2.2 Case Study of Family II

The case for family II seemed unique among the rest and gave a different view on the land subdivision issue. The household head had 200 Acres and he married two wives then subdivided the land into two portions of 100Acres each among the two wives as illustrated in the Figure 57. From that point, no land was subdivided but the arrangement was that the children to stay at the corners of the land and farm together collectively at the remaining portion of the land. Grazing is also done communally, where there was land specifically left for grazing the livestock from all homesteads but in the evening the cows are moved to their respective families. In this home, the grandmother and the son who is also the sub-chief for the location confessed having enough food and surplus for sale.

Figure 57: Family II Arrangement



Source: Author, 2018

5.2.3 Case Study of Family III

In the case of family III, the father has got 10 Acres of land and 10 children. Each of the 10 children is expected to be given 1 acre. However due to the difficulty of dividing amongst and remaining with land for the parents, the father decided to give 0.5 acres to each of the children to farm and the remaining portion remained for the housing. The first son has got 5 children and the second has got 4 children. The children have been encouraged to just live within the compound but go out to look for their livelihood and jobs

then come back in the evening to the homestead. From the analysis, if each of the remaining children will have an average of three children, then that home will have at least 30 grandchildren within a 10-acre piece of land and together with their parents, then it will not only be hard to further sub-divide the land but the provision of enough food will not be realized. As confessed by the household head, the food produced currently is not enough to feed the family to the next season and so the external income sources are depended on. The hesitation of this household head to subdivide land equally, reflects the challenge of ensuring that the children receives a portion of the land and transfer further to the grandchildren.

5.2.4 Case Study of Family IV

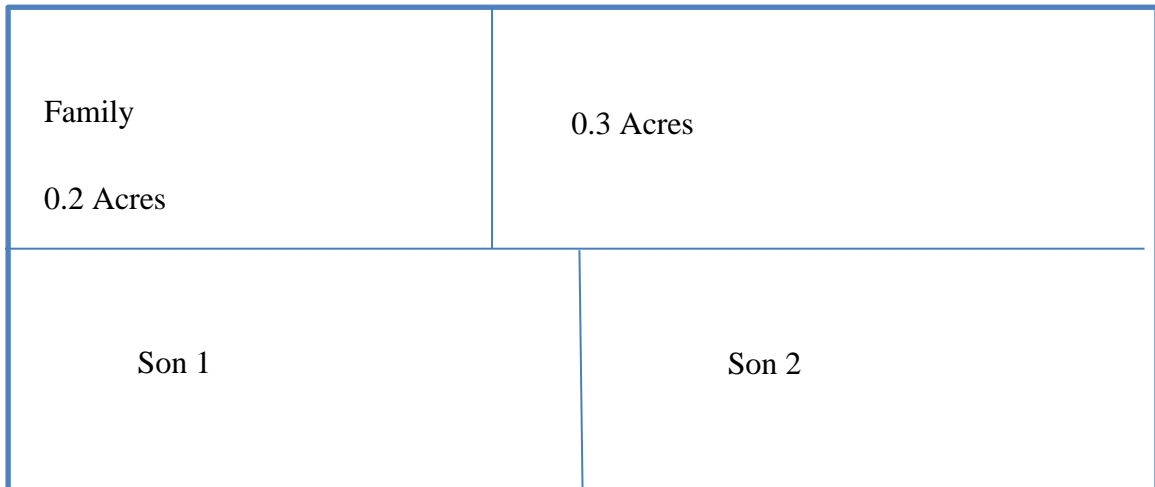
The fourth family had 1.2 Acres that they had bought from the sublocation after relocating back from Uganda. The family had 4 children that were all boys. Since the land could not be subdivided further due to the small size, they decided to buy land elsewhere and all the children moved out of the family land. The land owner confesses that the land is not sufficient to keep enough livestock and to grow crops to sustain the family needs and therefore the living standard cannot improve.

5.2.5 Case Study of Family V

In every community, there will always be an individual that beat the odds and the challenges and therefore make the difference in the society. The case of family V is that example. The family has got only 0.9 Acres of land, but the household head confesses that they are food secure. The family has got 4 children who are all boys. Each of the two boys who are married was each given 0.2 acres and the remainder was 0.5 acres. The 0.2 acres is where the family lives and they have 50 chicken, 6 goats and 4 cows that are under zero grazing within the compound. The remaining 0.3 acres is where the farm is tilled, and crops planted. In the family plan for planting, the maize is planted early in the season and harvested before the rest of the people, after which vegetables and other fast-growing crops are planted for commercial purpose before the next maize planting season. The family head gave an example of the previous season where he harvested maize for the family and

planted cabbages that were sold and was able to fetch money to pay school fees for the children. The sales from the milk and eggs also make the family to get enough income and be food secure for the whole year. He confesses that he has fallen in love with the land. The Figure 58 shows the farm arrangement for the 0.9 Acre piece of land.

Figure 58: Family V Arrangement



Source: Author, 2018

5.3 Hypothesis Testing

The following hypotheses were tested in the study: -

- a) There is no significant relationship between the household land size and food security in Leseru sub-location.
- b) The land usage has no effect the maize production hence food security in Leseru sub-location.

5.3.1 Hypothesis A

The relationship between the size of the household land size and the food security was investigated using Pearson Chi-square. The initial analyses were performed to ensure that no violation of the assumptions of linearity and normality. The variables used were the owned family land size in acres and the months in a year in which the specific household were able to have food without using other sources apart from the food harvested from their own farms.

The Tables 22 and 23 are the SPSS output using the two variables. Table 22 confirms that the chi-square included data from all the subjects.

Table 22: Case Processing Summary

| | Cases | | | | | |
|---|-------|---------|---------|---------|-------|---------|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| Owned Family Land Size in Acres * Months in a Year | 152 | 100.0% | 0 | .0% | 152 | 100.0% |

Table 23: Chi-Square Tests

| | Value | Degree of Freedom | Asymptotic Significance (2-sided) |
|------------------------------|---------------------|-------------------|-----------------------------------|
| Pearson Chi-Square | 66.936 ^a | 75 | 0.735 |
| Likelihood Ratio | 56.799 | 75 | 0.942 |
| Linear-by-Linear Association | 1.439 | 1 | 0.230 |
| N of Valid Cases | 152 | | |

a. 90 cells (93,8%) have expected count less than 5. The minimum expected count is ,01. The chi-square test results in Table 23 shows a p-value result of 0.735 which is greater than the significant value of 0.05. This value indicates that there is no significant relationship between the land sizes and the months in a year that were found to have food sufficiency in the sub-location.

$$\chi^2 (75, N 152) = 66.9 \quad P=74$$

This result means that the hypotheses of the study should be accepted. Null hypothesis is accepted and the alternative hypothesis rejected.

The literature reviewed had indicated two case scenarios on the household land sizes and its impacts on farming and food production. The first case scenario was the opinion of researchers that the smaller the land, the lower the food produced and hence there would be food insecurity. According to the researchers also, the reverse is also true whereby the larger the land size, the more the food produced that would be a result of technology use and economies of scale. The important finding from the literature review is that there are cases of inverse relationship between the land sizes and food security. In this case, the size of land that the households have does not give a guarantee as to how much farm yield was produced because of various reasons that this research has established. The first one is the land allocation to be discussed in the second hypothesis. The second factor is that food production in the study area and especially maize is a guarantee due to the areas' productive nature and therefore, even if a small portion of land it tilled, maize for family consumption for the whole year can be harvested.

5.3.2 Hypothesis B

Under scrutiny next is the second hypothesis that stated that land usage has no effect the maize production in Leseru sub-location. The relationship between the area of the maize farm and the maize yield obtained was investigated using Pearson Chi-square. The initial analyses were performed to ensure that no violation of the assumptions of linearity and normality. The Table 24 and Table 25 is the SPSS output using the two variables. Table 24 confirms that the chi- square included data from all the subjects.

Table 24: Case Processing Summary

| | Cases | | | | | |
|---|-------|---------|---------|---------|-------|---------|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| Area of Maize in Acres * Months in a Year | 152 | 100.0% | 0 | .0% | 152 | 100.0% |

Table 25: Chi-Square Tests

| | Value | Degree of Freedom | Asymptotic Significance (2-sided) |
|---------------------------------|---------------------|-------------------|--------------------------------------|
| Pearson Chi-Square | 74.936 ^a | 45 | 0.003 |
| Likelihood Ratio | 63.847 | 45 | 0.034 |
| Linear-by-Linear Association | 28.622 | 1 | 0.000 |
| N of Valid Cases | 152 | | |

A. 54 cells (90,0%) have expected count less than 5. The minimum expected count is ,01. The chi-square test results in Table 25 shows a p-value result of 0.003 which is less than the significant value of 0.05. This value indicates that there is a significant relationship between the land usage and the months in a year that were found to have food sufficiency in the sub-location.

$$\chi^2 (45, N 152) = 74.9 \quad P=0$$

This result also means that the first hypotheses of the study should be rejected. The null hypothesis is rejected and the alternative accepted.

Land usage is defined by the literature review as the activities to which the land is subjected to. The hypothesis as to whether there was any relationship between the land usage and food security gave a positive result and therefore the land size allocated for maize farming affects the production and the months in which the household would have food in Leseru sub-location.

The results are also supported by the land subdivisions that have led to increased compounds and decreased utilization of agricultural land due to other land uses e.g. residential. The other land uses may not be contributing to food security in the study area.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

In this chapter, the first part gives a summary of the findings from the study that was undertaken and includes the issues that have been analysed in the research. The second part presents the models that have been extracted from the research discussions on how each works with its merits and demerits. This chapter also draws the conclusions of the study and the recommendations given by the researcher as per the preceding chapter's research findings, data analysis and discussions. The policy recommendations stated are based on the findings and the model that seems to work well for the benefit of the community, county and country.

6.1 Summary of Findings

The analysis in the study gave some findings as per the objectives at hand.

6.1.1 Household Land Sizes and Usage

The land owners have varying sizes of land ranging from hundreds of acres to less than an acre commonly referred to as a point by the local residents. The majority of individuals own a single piece of land that they had inherited from the parents who inherited from their grandparents with a freehold land tenure system. This mode of ownership meant that the respondents had liberty to transfer, sub-divide and use land without any external control or need to consult from other quarters. The size of land that one would want to maintain or own depended on personal decision and financial capabilities to accumulate more land through buying and on the other hand it depended on the unavoidable circumstance that requires one to transmit land to the children through inheritance. Through the study, it was clearly demonstrated that it is a fundamental right in the community for every boy child to inherit land from the parents, no matter the size. This has led to progressive subdivision over the years to very small and uneconomical land sizes.

During this study, the majority land holding for the respondents was 2-5 Acres thus averaging at 3.5 Acres per household, it is projected that in the next 3 decades, there would be no sensible size of land that will be available for subdivision and transmission to the growing population if the current trend is anything to go by.

The land usage in the area is majorly agricultural and specifically maize farming the happened in 90.8% of the respondent's land. Livestock rearing also featured in 78.9% of the homesteads that were interviewed.

6.1.2 Impacts of the Land Sizes on Food Production

From the study, the sizes of land have had a great impact on food production and livelihood security of the people living in Leseru sub-location. This was deduced from the study findings and the observations made on the ground. The individuals with larger sizes of land had better meals and better living conditions confirmed by the housing typology and the diet used. In the specific case of a family who had not subdivided their land opted to live at the peripheries of the land the do the farming together, there was a confession that they had food that was enough for the whole year and even surplus for sale.

The increasing population has led to increased housing need. This has encouraged more subdivision which has led to increased number of homestead compound that are not tilled and eventually leading to reduced food production.

Reduced sizes of land have made the families affected to maintain the traditional culture where the girl child and women were not allowed to inherit land. Due to the diminishing land sizes, the men prioritized the boys when it came to land transmission as opposed to women who came up in arms during the study to oppose the tradition. This traditional practice meant that the livelihood of the girls or young women is not guaranteed if they don't get married elsewhere. Women were found to play the major role in food production in the area and if they were to be denied the chance then food insecurity issues will be advanced.

Mechanization plays a pivotal role in food production, the 73.7% of the people applying the technologies larger quantities as opposed to those who do not. The small pieces of land that are now coming up will discourage mechanization and potential farmers are soon going

to revert to old techniques of farming that are not only cumbersome, but it reduces the total amount of production that has been the norm. Economies of scale will not be experienced due to fragmentation of land and production of small quantities.

6.1.3 Factors Influencing the Size and Use of the Household Land

The factors that have influenced the size and use of the household land has been identified from a broad analysis of all the research findings that are in tandem with the literature reviewed earlier. One of the dominant factors has been the population pressure, the population growth rate is at 3.8% according to the KNBS statistics explained in the earlier chapter. This has led to the inevitable subdivisions in the study area and has led to reduced land sizes. From the study, land use at some levels is determined by the size of land that is available for farming, for example wheat farming and commercial maize farming that was practiced when the land was extensive. This has gradually reduced over time and farmers have changed the type of crop they farm depending on the land sizes and the ability to use mechanization on the land. The location of the land in relation with the infrastructural availability e.g roads and railway and market proximity also influenced the sizes of land. This is explained by the fact that the closer the land is from the road, the sizes are reduced into plots and converted to commercial land use. Numerous subdivisions to plot sizes for commercial purpose happen in the prime areas along the highway and at the market centers around the study area. Market for the produce determined the land use by the land owners for example if the market for a specific farm product is available, then the land will be used to farm that crop e.g. maize, fruits, wheat etc. The issues of land use have got several other factors that affect it including prices of the produce, land degradation, climatic conditions, security of tenure and the agricultural technologies applied. Some maize farmers have recently changed land use due to frustrations by their main customer that is the government, the payment delays, high input prices and imports from other countries have discouraged maize farmers who have opted to change the use of the land.

6.1.4 Intergenerational Transmission of Land Rights

The study findings on the intergenerational transmission for both the land and its use have been illustrated in detail on the previous sections. However, to sum all these findings, it was clear that the sizes have drastically reduced and continue so, to date. The findings indicated a general decline since the days of white settlers where the land was in thousands of acres to date where the land is in less than a single acre and at most tens of acres. Variations on land use over time have been illustrated by the satellite imagery where the land use trends were established. In summary, the Agricultural land and vegetation cover has reduced by 12% and 1% respectively whereas the built-up area and the bare land area have increased by 7% and 6% respectively.

6.2 Settlement Models

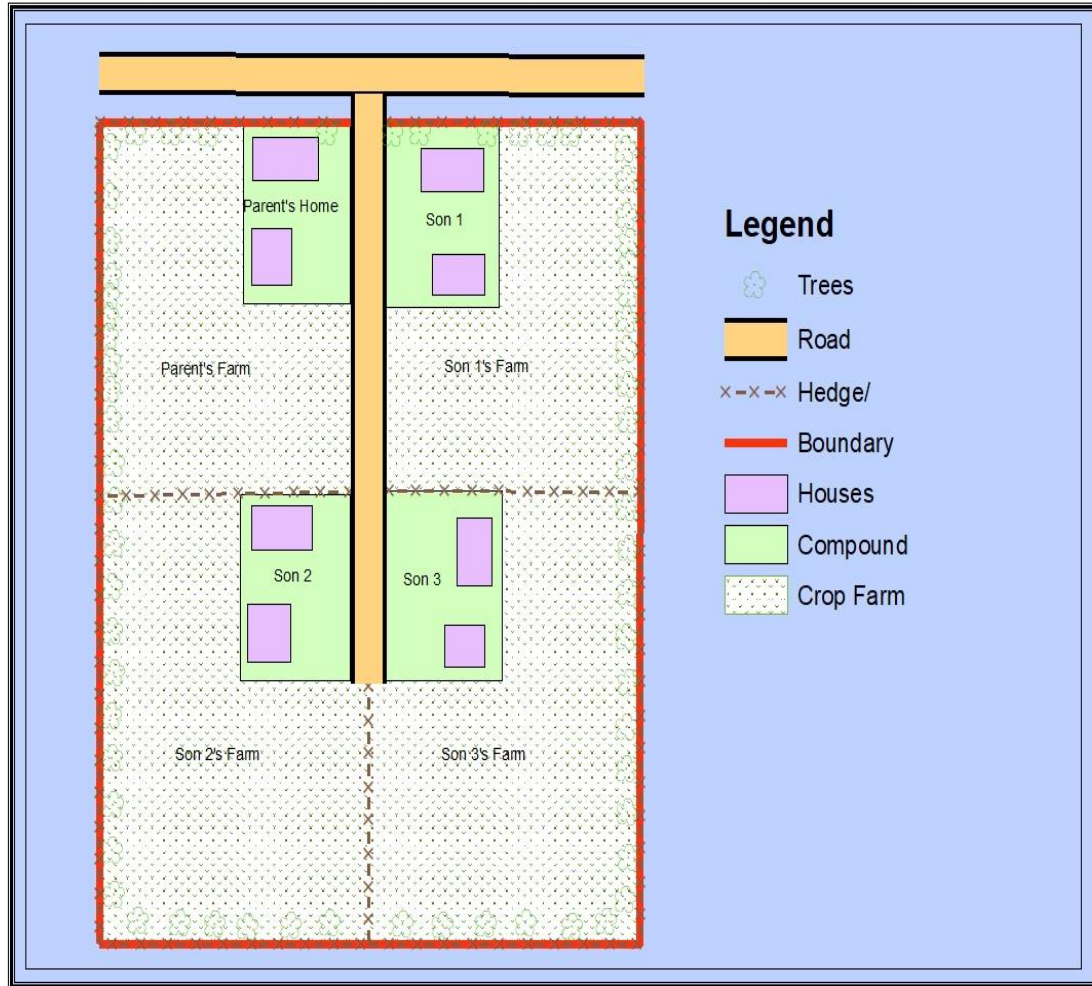
The field study, case studies and the findings from this research has generated about four settlement models that are described, discussed and illustrated in the subsections below. The various models have their merits and demerits that could form a basis of the decisions on the way forward on the issues that should be addressed to ensure food security in Leseru sub-location and in Uasin Gishu county and ensure that the maize production is not affected by the land sizes that have been reduced due to sub-division that is so rampant.

6.2.1 Scattered Settlement Model

The scattered settlement model is the model where the families reside separately and farm separately. This is the most commonly practiced settlement pattern and mode of managing land in the study. As the families grow, the land parcels and settlements keep increasing due to sub-divisions that are being done, needless to say that the land sizes are also reduced at the same rate. In the community under the study which is dominantly Kalenjin, the sons are the land heirs after their fathers and this practice is taken as a basic right for these sons to get land from the parents at some age and stage in their life. In the process, land sizes are reduced significantly due to the new access roads introduced to enable each 'Inheritor' to access their farms as illustrated in Figure 59. Since the new homes with compounds are

created, the space taken up by the compound and the fence or hedges add up to be a significant land not utilized well for food production.

Figure 59: Scattered Settlement Model



Source: Author, 2018

The advantages of scattered settlement model are that:

- There are less interfamily social conflicts in this model.
- Individual efforts are rewarded by hard work.

The disadvantages include:

- Reduced space for farming due to the access roads, compounds, fence, hedges etc.

- Uneconomical land sizes – Economies of scale may not be realized.
- Mechanization is will be difficult at some level.
- Lazy individuals will face food shortages.

6.2.2 Linear Settlement Model

Linear settlement model is where the families live separately but they do the farming together. In the study area, one of the families was practicing this model which was found to be quite successful. If well managed, the production on the farms can be maximized because of the resources that can be mobilized and put together for the inputs like seeds and fertilizers to maximize on the production. Some families that may not be able to buy the inputs can be assisted to ensure that the land is used to capacity and this can also be possible and easy because of the economies of scale in production. Production cost and management cost will be lower. In this arrangement, each family has their livestock which are also grazed together. This is a common practice in some states in the USA where families have got family ranches that they inherit from their great grandparents. The ranch remains a family property but they live in different places outside the ranch.

One of the major benefits of settling along a public road is that, there is full utilization of the existing road stretch as shown in in the Figure 60 and no more land will be needed to create accesses to each compound.

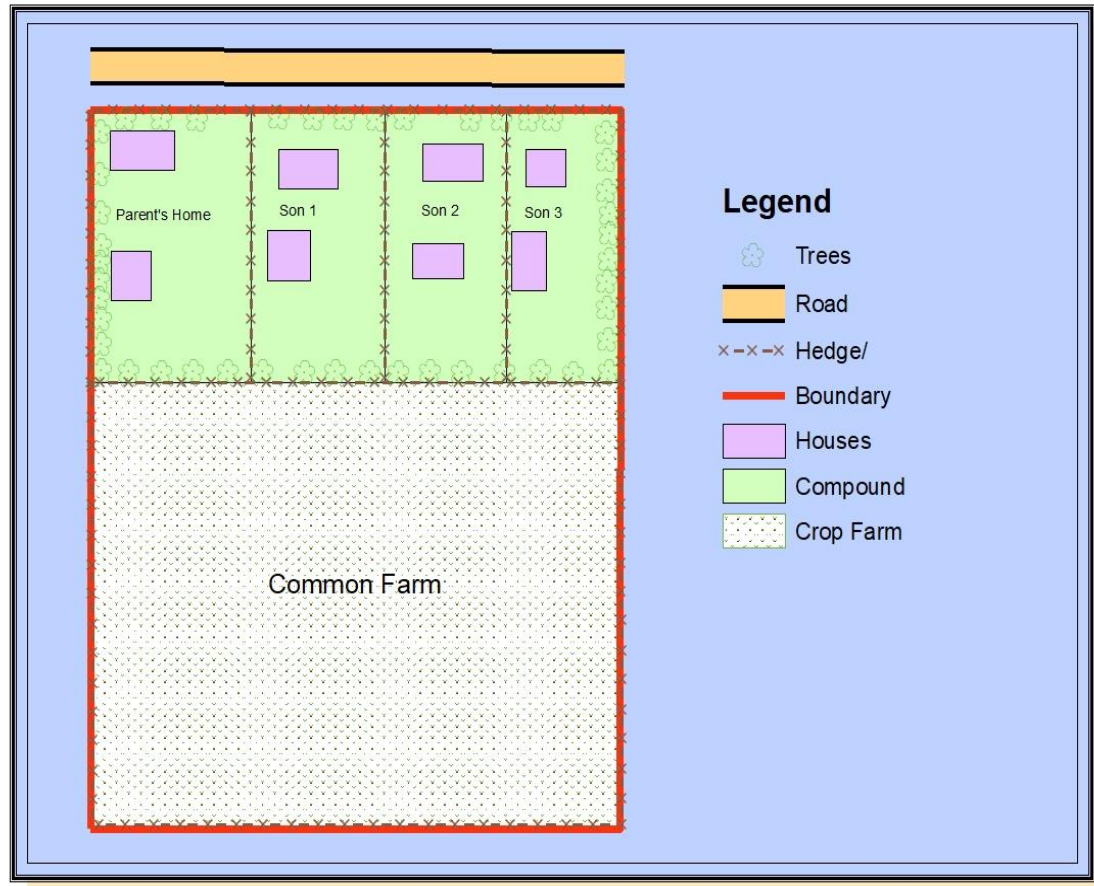
Advantages of the linear settlement model include:

- There are less interfamily social conflicts in this model.
- Economies of scale can be realized.
- Mechanization can easily be used.
- No access road space needed.

The disadvantages are:

- Reduced space for farming due to the compounds, fence, hedges etc.
- Lazy individual families will take advantage of the hardworking families.

Figure 60: Linear Settlement Model



Source: Author, 2018

6.2.3 Clustered Settlement Model

Clustered settlement model is whereby families decide to live together in the same compound but do farming separately. The farming land is subdivided to each individual family in the homestead. This model is as illustrated in the Figure 61. This settlement model has the following advantages and disadvantage;

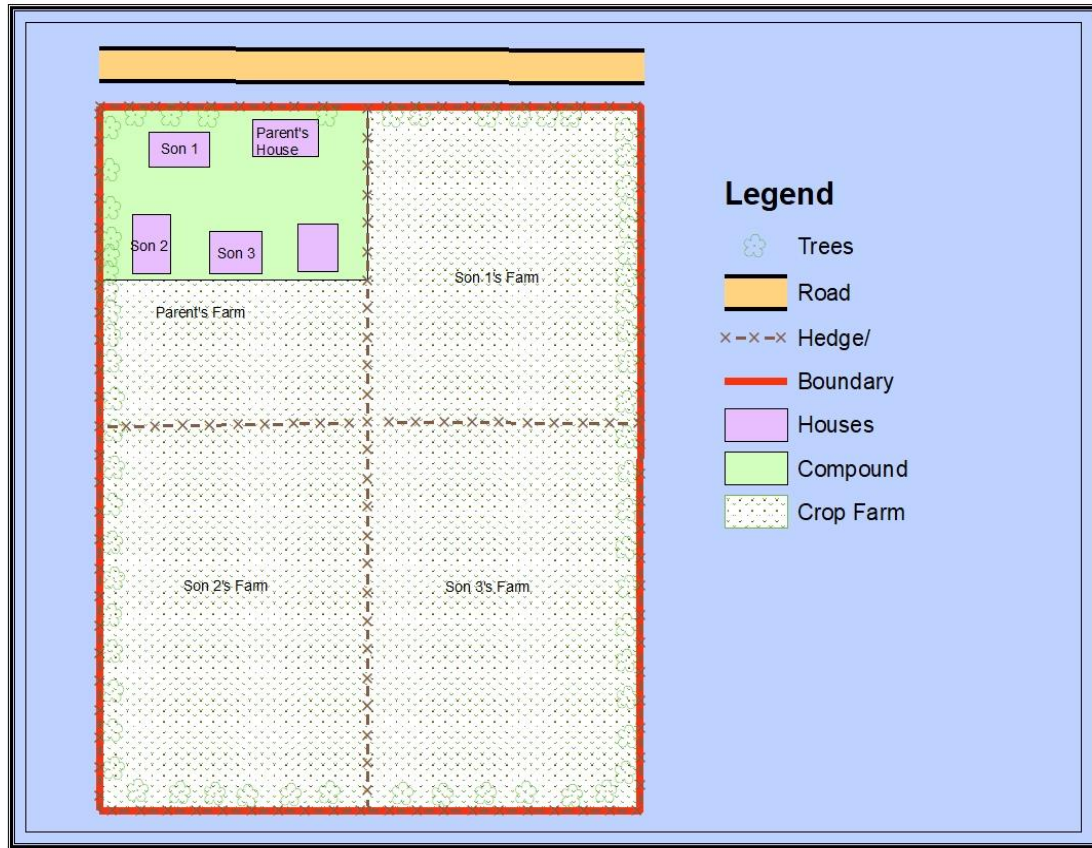
The advantages are:

- Mechanization can easily be used.
- There is no reduced space for farming due to the compounds, fence, hedges etc.
- Lazy individual families will not take advantage of the hardworking families.

Whereas the disadvantages include:

- There are interfamily social conflicts experienced in this model because of living in the same compound.
- Economies of scale may not be realized because each family till their own land.

Figure 61: Clustered Settlement Model



Source: Author, 2018

6.2.4 Communal Settlement Model

The communal settlement model is where families reside together in a common compound do farming together communally. In this set up, in case the family grows further, a small portion is extended in the compound and a new house built. The upcoming families may also be encouraged to buy and settle elsewhere but become beneficiaries of the food produced in the family farms. This practice is common in Israel and the communities stay in arrangements called 'Kibbutz' which in Hebrew means gathering or clustering. This was a collective community in Israel that was traditionally based on agriculture. In this

arrangement, the community stayed together in one location, they eat together in a common point, go to school in a centralized place and nothing belongs to an individual. The rehabilitated land in Israel that is useful for agriculture is reserved for mass production of food i.e. crop farming and livestock rearing. Israel is one of the most advanced countries in the world especially in agriculture yet the country was mostly desert and they only practice irrigation farming. It is known to be a food secure country that exports the surplus to other parts of the world with many countries visiting it for benchmarking.

This model can be applied by families that keep on growing year by year by choosing to live in the same compound and till the rest of the land communally. The typical arrangement illustrated in Figure 62 and Figure 63.

Figure 62: Communal Farming



Source: Earthporm.com

The advantages are numerous and they include:

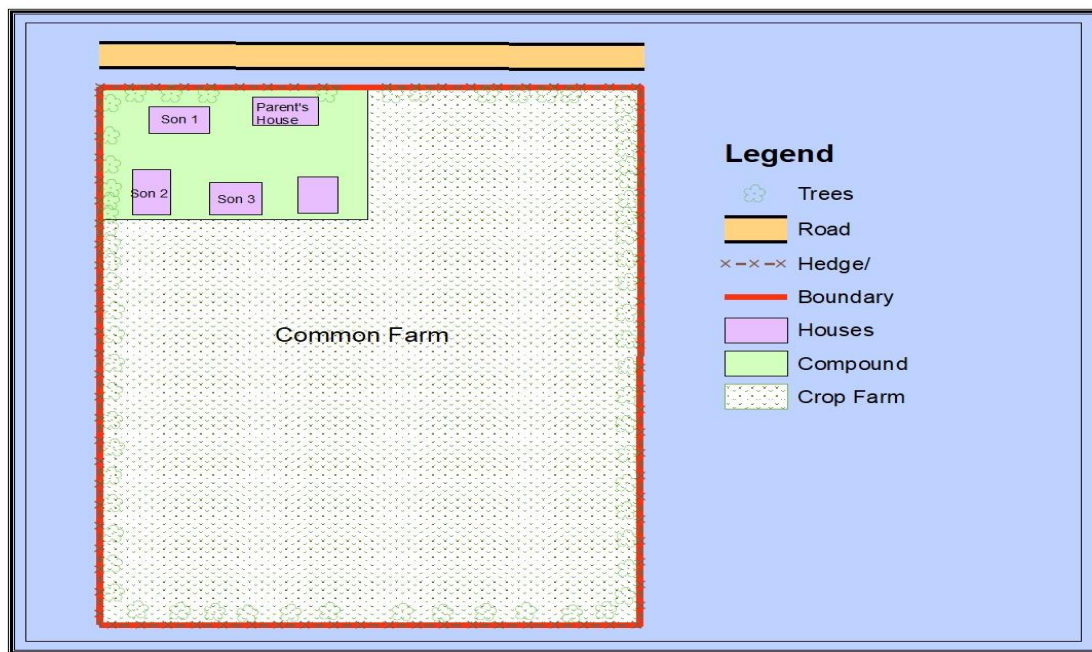
- Mechanization can easily be used.
- Good quality farm inputs e.g. seeds and fertilizers can be easily acquired since the collective capital is higher. This leads to better production.
- There is no reduced space for farming due to the compounds, fence, hedges etc.
- An economy of scale is achievable.
- Proper monitoring and controls in farming can be put in place easily.

- A common market with good crop prices can be sought. No need for brokers since the produce is at large scale.
- Land degradation can easily be controlled.

Some of the disadvantages include:

- There are interfamily social conflicts experienced in this model.
- Growing population may lead to congestion.

Figure 63: Communal Settlement Model



Source: Author, 2018

6.3 Conclusion

In conclusion, the study has revealed dwindling land sizes over time and the variations on usage of the land is slowly leading to low production of the main food crop in the area. Based on the study findings, it was evident that the reasons as to why people subdivided land were the traditions and customs that required fathers to give an inheritance to their sons. Land fragmentation was found to be having more demerits than its merits especially when it comes to its effects on crop and livestock production, given that it decreases amount of crop yield, livestock rearing capacity and leads to food insecurity. At the rate at which

the land is being sub-divided, there would be no land remaining for the grandchildren of the current parents, a span of only 3 decades.

The study has shown that that the study area has immense maize production potential due to the fertile soils and the general climatic conditions in the area. However, due to the reducing farm sizes, there is also reduced usage of modern technology in crop production and livestock production that would have ensured that there is enough food produced for domestic and commercial usage. Most of the land is now used to settle the growing population signifying different land usage over time.

On the factors that influence the size and use of the household land, the study has attributed this to the location of the land in relation with the increased infrastructural development. This has encouraged subdivision of the agricultural land to smaller plots that are sold to people who would want to develop it for commercial purposes and cater for the demand of the growing population. The people that don't own any land may want to rent houses for residence and some would put up businesses e.g. shops, hardware, hotels, lodgings etc.

Based on these findings, the government should put up measures into place and ensure that the agricultural land that is meant to produce enough food for the country is not slowly being turned into other uses. This is possible through zoning and establishment of proper national land use policies. Importation of maize from other countries is uncalled for and not sustainable as compared to the locally produced crop that can benefit the individual farmers and the consumers. The relevant government agencies should also ensure that the maize farmers are safeguarded from the exploitation of the middlemen commonly referred to as brokers who import cheap maize from other countries or buy maize from the desperate farmers at very cheap prices that gives no meaningful returns to the farmers.

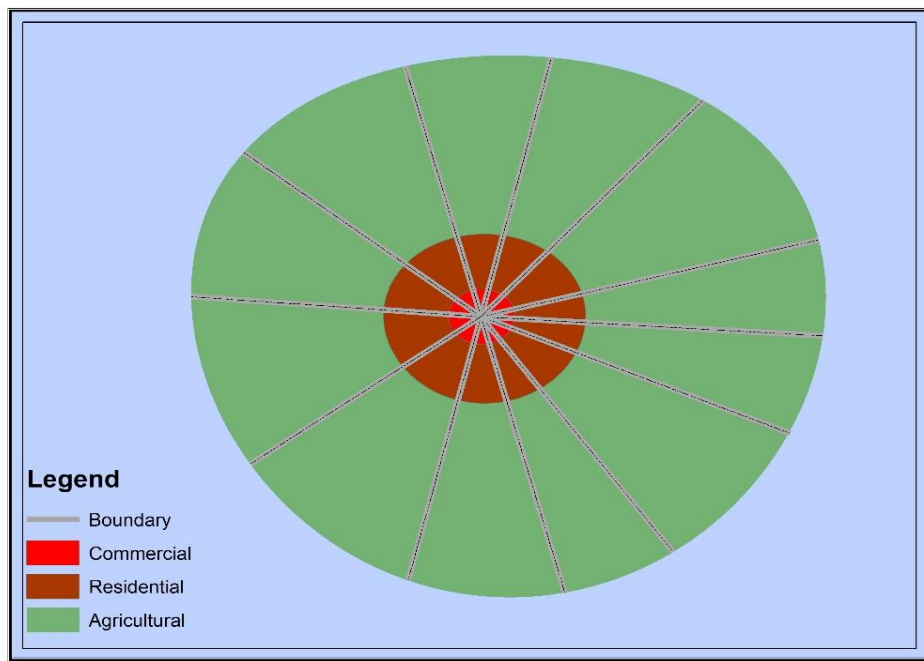
6.4 Recommendations

Below are recommendations that have been made based on the study findings and the case studies done on how to ensure that there is sustainable food security.

6.4.1 Implementation of the Communal Settlement Model

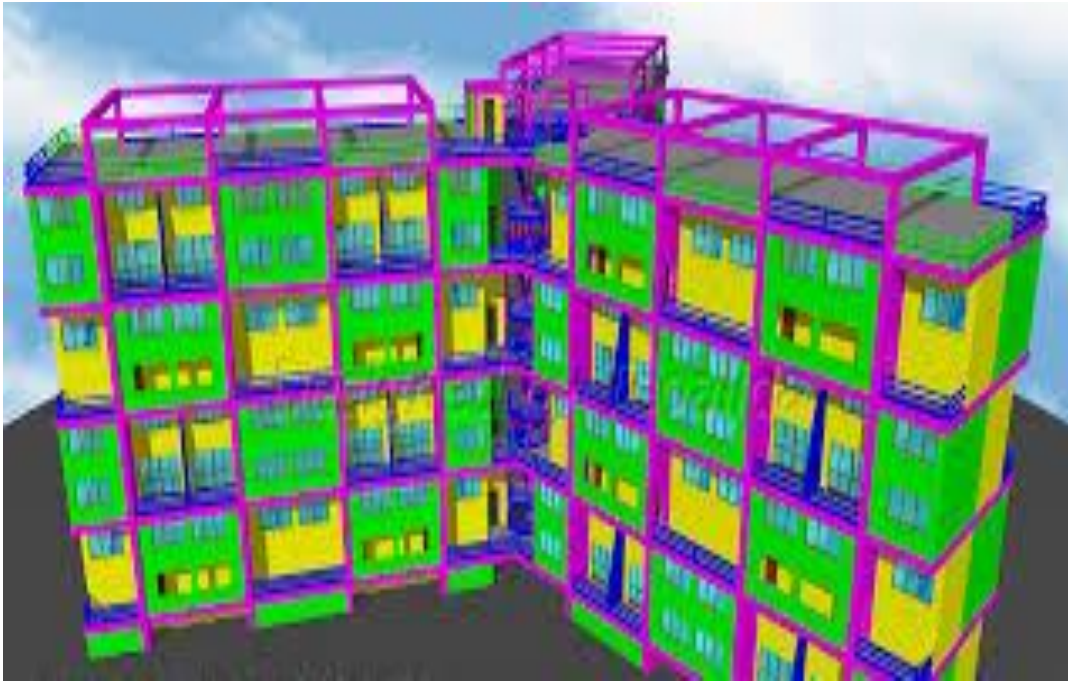
The study recommends the implementation of the communal settlement model where people ought to reside together in one place or compound and use the remaining parcel of land for communal farming. Common benefits under this policy as a long-term objective include economies of scale, greater cohesion of the people and improved agricultural farm outputs with better utilization of the land without petty subdivisions around homesteads. There will be greater productivity, to the benefit of the population. The Figure 64 shows how this model works where people reside at a common central point and farming production activities radiate outwards, the commercial areas being at the central node. In this arrangement, the commercial area is located at the common point then the residential area surrounds it and the rest of the land is left for agriculture. To maximize on the land space for commercial and residential land uses, high density buildings are constructed as shown in Figure 65.

Figure 64: Communal Settlement Model



Source: Author, 2018

Figure 65: High Density Residential



Source: Author, 2018

6.4.2 Zoning

The study noted the need for zoning to stop further subdivisions that are not economically viable. Zoning is the legal regulation of the use of land. It involves segregation of parcels of land or acres of towns in a physical development plan and ascribes to them broad classifications of appropriate use for example, residential, industrial, educational, commercial, etc. (Physical Planning Handbook)

This land use regulation is aimed at protecting public health, welfare and safety and it includes provisions for the use of property and limitations upon shape and bulk of the building that occupy the land. A zoning plan serves as a guide for urban and rural development and is adopted and rendered effective as a legal ordinance. In the zoning plan, the planning area is divided into different zones in which land is restricted to certain classified uses. The size, shape and location of these zones reflect the major uses indicated by the structure plan of the area under observation. Most zoning regulations/ordinances provide for different densities of population in different zones. The zoning plan proposed by the study aims at achieving the following in different sectors:

6.4.2.1 Clustered Land Use in the Sub-location:

- Minimize development within areas of the best agricultural lands to preserve critical masses of farmland.
- Locate higher-density development near commercial and employment centers.
- Locate commercial and industrial centers in clusters rather than in isolated scattered locations.
- Locate major commercial and industrial areas where there is direct access to existing or planned major transportation facilities.

6.4.2.2 Economic Development

- Encourage the development of sufficient commercial, office, and industrial space to meet the needs of the existing and projected population.
- Locate industrial and commercial development in clusters, rather than in isolated, scattered locations, emphasizing appropriate landscaping and buffering.

6.4.2.3 Housing

- Provide incentives for the construction of clustered units away from the commercial centers to reduce the concentration of developments in the centres.
- Provide incentives for increasing the use of the existing mixed-use & mixed density regulations to promote more efficient, compact nodes of development.
- Promote the provision of recreational opportunities within walking distance of all housing developments or existing neighborhoods.

6.4.2.4 Agricultural

- Encourage the development and implementation of an aggressive program to preserve agricultural uses in those areas identified for permanent agricultural zones.
- Discourage subdivision of land and maintain the minimum of 2.5 acres in rural area and minimum of 0.045 ha in urban area.

6.4.2.5 Open Spaces and recreational facilities

- Conservation of areas with scenic interest, wetlands etc so that they are considered in the development of parks and open space areas.

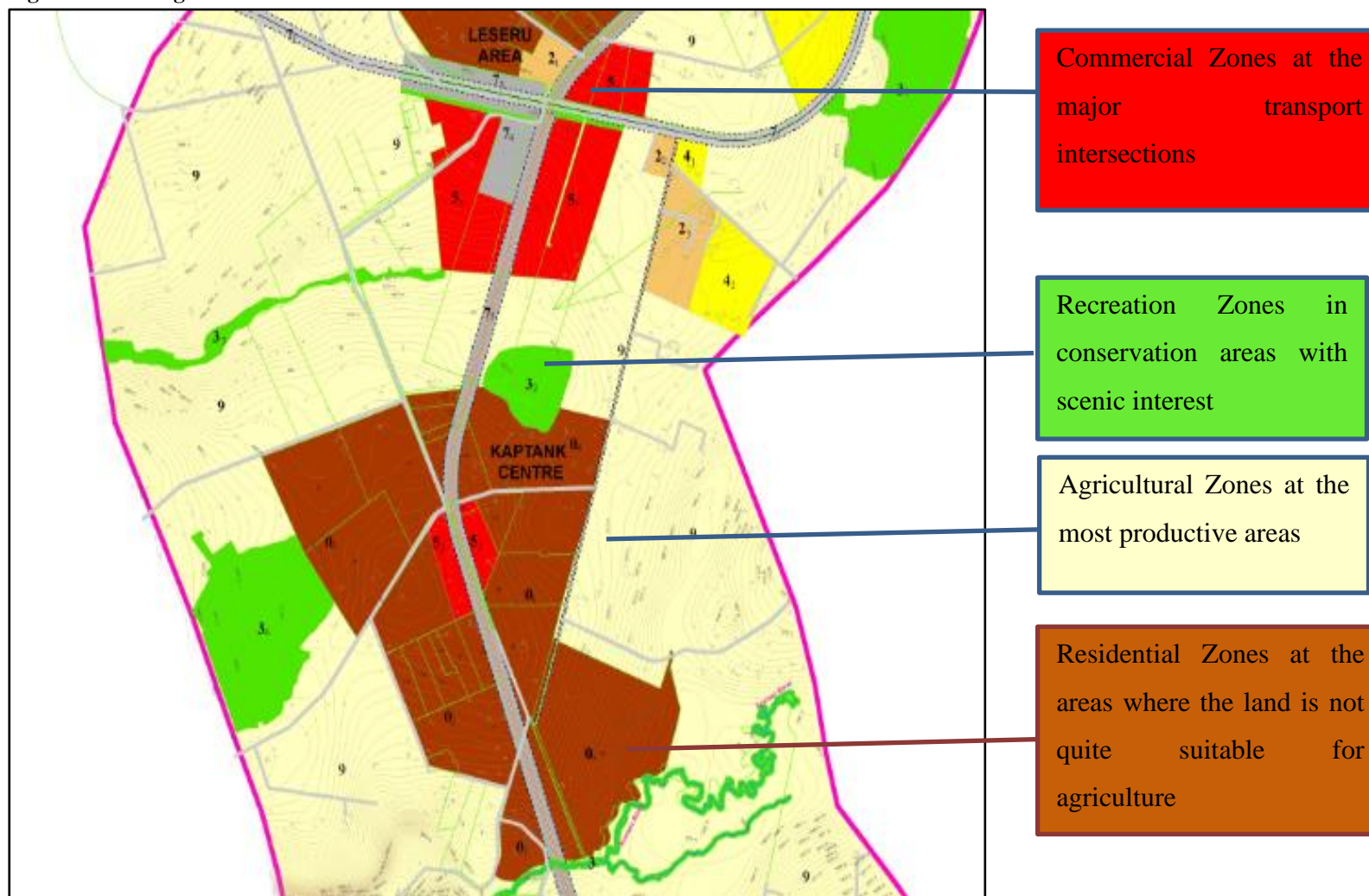
- To promote open space connectivity, establish standards for the provision of recreational amenities servicing commercial, industrial, and office projects.

6.4.3 Implementation of National Land Use Policy

This study found out that there were land use practices that reflected uncoordinated legal and policy framework that has brought about poor land use management leading to haphazard land subdivisions that are not regulated. The study area was found to possess some great potential in farming and specifically maize farming that can be fully utilized for the common good of the county and the country at large. It is against this backdrop that there is need to sort the problems of rapid urbanization; inadequate land use planning; unsustainable agricultural and industrial production methods; poor environmental management; poor cultural practices; inappropriate ecosystem protection; and management are commonplace and require appropriate policy responses. The Constitution of Kenya 2010, Kenya Vision 2030 and the Sessional Paper No. 3 of 2009 on National Land Policy all call for a clear framework for effectively addressing the challenges related to land use. The Sessional Paper, No. 1 of 2017 on National Land Use Policy (NLUP) that was launched on 12th June 2018 will also be key to the realization of food security in the country. The main objective of the NLUP being to provide legal, administrative and technological framework for optimal utilization and productivity of land and land related resources in a sustainable and desirable manner at national and county level. Other objectives of the policy include:

- Enhancing land use planning, resource allocation and management for sustainable development.
- Promote equitable utilization of land resource to meet governance, social-economic and cultural obligations of the people of Kenya.
- Establish appropriate, independent, accountable and democratic instruction for land use conflict resolution; and
- Mitigate problems associated with poor land use.

Figure 66: Zoning Plan



Source: Simuplan and Author

Some of the most important general policy statements in the NLUP include:

a) Land Tenure

All Kenyans have a right to access and use land, either through lease or freehold title, as individuals, corporations or collective trusts. However, the availability of land, particularly arable/cultivable land, is in increasingly short supply, and consequently some prudence is required in the issuing of Public Land. To address the issue of unsustainable form of land distribution, the policy recommends among others, the following guidelines, principles and strategies for addressing land issues;

- Allocation of lands and issuance of titles should be done based on approved physical development plans.
- Undertaking an audit and mapping out the number and location of informal settlement and provide legal security of tenure.
- Holding of land under a collective basis will be subject to conditions of lease and will require an approved and binding management plan for the leased land.
- All lands should be managed according to their actual suitability and local land use plans will be required to implement proper management.
- Areas protected for specific use by any law shall not be de-gazetted except in circumstances prescribed in the laws governing such areas.

b) Sustainable Land Management/Administration

This research noted that there were poor land management techniques employed in the sublocation by the land owners. A lot of land/cadastral information was found missing and this contributed to poor land administration by the government leading to haphazard subdivisions and unsustainable farming practices. This research therefore strongly recommends that the issue of land administration, registration and dissemination of information in relation to land transactions should be addressed with the level of seriousness it deserves. The NLUP addresses the issue of land administration with the following guidelines, principles and strategies;

- Establishment and operationalization of a national GIS based land information system.

- Identification, mapping and documentation of all land uses in the country to be put in an inventory that is updated every 5 years for the urban and 10 years for the rural.
- All leases of Public Land will be issued with binding conditions stating clearly the intended use of the land and which shall comply with the relevant local land use plans and the National Spatial Plan.
- The national cadastre shall be linked to the national land tax and rent database to ensure that all users of land make their annual contributions for the use of the land.
- The national cadastre shall be open to the general public to guarantee the transparency of land tenure, land issuing and land transactions and the contribution of land tax
- Protected areas and areas of high intrinsic value such as habitat for endangered biodiversity and genetic resources, ecologically sensitive sites, national heritage, water towers, marine waters and exclusive economic zones, wetlands forests and sites with fossils fuels and energy resources among others will not be allocated for private use or degazetted.
- Land reserved for public utilities and infrastructure such as roads, railways, airports, seaports, housing, offices, land banks for investments among others shall not be allocated and shall remain public lands.
- Reserved areas on public land shall be determined through the National Spatial Plan, local plan or upon the recommendation of the office in charge of Physical Planning.

c) Productive and Sustainable Use of the Land

The study unmasked a lot of unproductive land that were not being utilized and were left as bare land. The success of land policy is on the other hand is determined by the extent to which it facilitates the productive and sustainable use of land. The study area has good soils and good climatic conditions that are suitable for agriculture, these merit by themselves warranted policies to address the problems that include: Underutilization of land especially in the large farm sector, land deterioration due to population pressure, massive soil erosion arising from bad land use practices and variability in climatic

patterns, Abandonment of agricultural activities due to poor infrastructure for agricultural produce such as rural access roads, marketing, facilities, financing and extension services and incompatible land uses have resulted in land use conflicts.

To address issues of proactive and sustainable use of land through the NLUP, the government shall develop a framework to facilitate: -

- The attainment of orderly, productive and sustainable land use through sound land use practices;
- The conservation and enhancement of the quality of land and land-based resources;
- The improvement of the condition and productivity of degraded lands in rural and urban areas;
- The development by the State, of a set of guidelines for adoption by planning authorities throughout the country in order to ensure uniformity in the exercise of the State's regulatory power.
- Appreciation of the essential linkages between the environment and development and the promotion of individual and community participation in environmental action.
- The proper management of demographic and health parameters in the country and in the rural areas.
- The provision of social, economic and other incentives to induce the sustainable use and management of land.
- Integrated land use planning through information based and participatory processes.
- The provision and maintenance of adequate infrastructure in the promotion of approved land use development.

In order to implement the recommendation of the policy, there is a proposal to establish various institutions that will be mandated in ensuring that there will be enhanced land use planning across the country that is likely to result in efficient, productive and sustainable use of land and land-based resources according to the sessional paper no. 1 of 2017. The institutions include;

- ⇒ The National Council for Land Use Policy which shall be steering body for overseeing the implementation of the policy.

- ⇒ The National Technical and Implementation Committee and the County Technical Implementation Committees to spearhead the implementation at national and county levels respectively.
- ⇒ The policy proposes restructuring the national department of physical planning to give impetus for effective performance of its enhanced function.

6.4.4 Government Subsidies and Incentives

The study revealed that the maize production levels are trending downwards because of the governments' laxity in addressing the issues affecting the agricultural sector. The major issues being expensive farm inputs and farm machinery, poor market for the maize produced and the cartels or middlemen who take advantage of the vulnerable farmers to buy the maize at a very low price. These factors discourage farmers from farming and thus think of other ways of using their land or worst still sub-divide and sell to raise income for other activities. The government should give priority to maize farmers and purchase their crop immediately it is harvested and at a good price. The importation of maize should not happen if the maize is available from within the country.

The study finally recommends that the best farmers that produce more should be given bonuses just like the coffee and the tea farmers. This will encourage them to work hard and maximize their land for maize production with an expectation of better live and improved living standards due to the incentives received.

6.5 Areas of Further Research

Land size and land uses have become a major source of food insecurity not only in Kenya but in the world over. The ever-increasing population and the inelastic land make the land question a very emotive issue. A wider research should therefore be undertaken with the following issues forming the basis for further study. First, there is need of assessing the role of the government agencies in regulation of the land uses and land sizes for the common interest of the Kenyan people. Secondly, researchers should analyze the over reliance of maize crop as a major food source that bring about food and livelihood security in the country and explore the possible substitutes that don't require a lot of land space. Thirdly, there is need to examine the reasons of paradigm

shift by the maize farmers who have started to practice other economic activities or farming different produce that has led to periodic shortage in production.

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APPENDIX 1: STUDY WORK PLAN

| Activity | March 2018 | | | | April, 2018 | | | | May, 2018 | | | | June, 2018 | | | |
|--|------------|---|---|---|-------------|---|---|---|-----------|----|----|----|------------|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Literature Review | | | | | | | | | | | | | | | | |
| Preparation of Project Proposal | | | | | | | | | | | | | | | | |
| Planning Research Design | | | | | | | | | | | | | | | | |
| Submission of proposal for checking | | | | | | | | | | | | | | | | |
| Data Collection | | | | | | | | | | | | | | | | |
| Data Analysis | | | | | | | | | | | | | | | | |
| Write Journal Paper | | | | | | | | | | | | | | | | |
| Review and Edit Draft Chapters | | | | | | | | | | | | | | | | |
| Submission of the Proposal for checking | | | | | | | | | | | | | | | | |
| Finalize Thesis and Present the Final report | | | | | | | | | | | | | | | | |

APPENDIX 2: BUDGET

| Budget Items | Quantity | Cost/Unit | Amount (KES) |
|---|--------------------|----------------------|-------------------|
| Printing of research | 20 pages | 10 per page | 200.00 |
| Photocopy of research | 1120 pages | 3 per page | 3,360.00 |
| Mileage claims for reconnaissance | 700 km | 20 per km | 14,000.00 |
| Accommodation during | 1.5 days | 4,000 per day | 6,000.00 |
| Payments to Research assistants | 6 days | 1000 per person per | 18,000.00 |
| Focus group discussions | 4 Groups | 5,000 per group | 20,000.00 |
| Data input | 150 Questionnaires | 50 per questionnaire | 7,500.00 |
| Data analysis | 5 days | 1,500 per day | 7,500.00 |
| Mileage claim for all researchers | 400 km. per sub- | 20 per km | 8,000.00 |
| Other facilitators at field level (e.g. Chief, Asst. Chief, | 4 days | 1000 per person | 4,000.00 |
| Accommodation and meals for | 6 days | 4,000 per day | 24,000.00 |
| Institutional administrative costs 5% | | | 5,628.00 |
| Total | | | 118,188.00 |

APPENDIX 3
HOUSEHOLD QUESTIONNAIRE

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

Sub-location Questionnaire
No.....
Name of Interviewer..... Date of
Interview.....
Telephone No. of
Interviewer.....

1.0 Respondent Profile

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

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

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

1.3 Marital status

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

1.4 Gender 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 | | | | | | |
| | Total | | | | | |

3.5 Do you rent any land? Yes ()

No ()

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

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

3.9 Off-farm income generating activities

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

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

3.11 Have they done any sub-division?.....

| Activity | Area (Acres or Sq. Metres) | Yield (kgs) (other) in Seasons | | Use (Kgs) (Other) | | Price per unit weight (Min- Maximum) | | Averag e income to the family (Kshs.) |
|--------------------|---|-----------------------------------|-------------|----------------------|----------|--|---------|--|
| | | Season 1 | Season 2 | Consume d | Sol d | Mi n | Ma x | |
| CROPS | | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| LIVESTOC K TYPE | No. Animal s | Yield/Animal/Ye ar | | Use (Kgs) (Other) | | Value (Ksh) | | Averag e income to the Family |
| | | | | Consume d | Sol d | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

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

.....

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

3.14 If yes to 3.13 why do you think so?.....

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

3.16 State one major problem of land subdivision to a farmer.....

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

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

4.0 Land uses, Food and Livelihood Security

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

4.2 Do you practise any agriculture?

Yes () No ()

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

Food and Nutrition Security

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

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

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

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

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

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

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

| Intensity of scarcity | | Duration of farm yield availability (months) | Coping Strategies Employed |
|-----------------------|-------------------|--|----------------------------|
| a | Sufficient food | At least 12 Months | |
| | | | |
| b | Mild Scarcity | 9 Months | |
| | | | |
| c | Moderate Scarcity | 6 Months | |
| | | | |
| d | Severe Scarcity | 3 Months | |
| | | | |

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

Yes () No ()

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

| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---------|--------|---------|-----------|----------|--------|----------|--------|
| Morning | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Lunch | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Supper | | | | | | | |
| | | | | | | | |
| | | | | | | | |

4.11 How often do you take the following meals?

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

Views on Land Subdivision

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

4.12 Land fragmentations exists due to population pressure

Agree () Disagree () Not sure ()

4.13 Small sub-divided parcels lead to low crop yield

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

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

Agree () Disagree () Not sure ()

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

Agree () Disagree () Not sure ()

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

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

Agree () Disagree () Not sure ()

5.0 Human Settlement

5.1 Sketch the current arrangement of the homestead?

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

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

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

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

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

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 discussion, 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.

Record of FGD participants

| Name | Age (Years) | Gender | Marital status | Land owned acres (if any) |
|------|-------------|--------|----------------|---------------------------|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |

Discussion Guiding 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 these changes?
- c) What were the main land uses then? What are the current land uses?
- d) Has farm productivity been changing over time? Why is it so?
- e) Is productivity dependent on ownership of land?
- f) Is the farm produce sufficient? How long does it last?
- g) And how come we settled to plant the crops we plant 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 up, does this affect land size and use?

APPENDIX 5

KEY INFORMANT SCHEDULE

KEY INFORMANTS SCHEDULE 1 (INFORMANTS FROM LESERU)

NAME: _____

DESIGNATION: _____

1. What do you know about Leseru sub-location?
.....
2. What is the estimate number of household in Leseru sub-location?
.....
3. What are the main cash and food crops cultivated in the sub-location?
a) b) c) d)
.....
4. What do you think about the land size and food production in the area?
.....
5. What farming techniques are used in the sub-location?
.....
6. What do you think about the land subdivision issues in the sub-location?
.....
7. Do you have any challenges with the land inheritance in the area?
.....
8. What do you think is the cause of the above challenges and what can be done to solve this?.....
.....
9. What do you think is the ideal size of land that an individual can own in order to provide sufficient food for the family? Assume an average family of 7 members..... Acres.

APPENDIX 6

OBSERVATION LIST

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

- Land sizes
- Settlement patterns
- Housing structures
- Field crops and farm sizes allocated to each crop
- Type of livestock and numbers (Many verses Few)
- Demarcation of farm sizes

Observation checklist

| NO | Activity Observed | Observation (tick) | Status | Comments |
|----|--|-----------------------|--------|----------|
| 1 | Land Sizes | YES/NO | | |
| 2 | Settlement patterns | YES/NO | | |
| 3 | Housing structures | YES/NO | | |
| 4 | Field crops and farm sizes allocated to each crop | YES/NO | | |
| 5 | Type of livestock and numbers | YES/NO | | |
| 6 | Demarcation of farm sizes | YES/NO | | |

APPENDIX 7

PHOTOGRAPHY LIST

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

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

Photography checklist

| No. | Description of the Photograph | Photo taken (tick) | Photo Number |
|-----|--|--------------------|--------------|
| 1 | Housing Structures | YES/NO | |
| 2 | Cropped farms | YES/NO | |
| 3 | Non-cropped farms | YES/NO | |
| 4 | Agricultural machinery, tractors | YES/NO | |
| 5 | Demarcation of boundaries | YES/NO | |
| 6 | The people in their natural state | YES/NO | |
| 7 | Household activities | YES/NO | |
| 11 | The interview with the household | YES/NO | |
| 12 | The interview with the focus group 1 | YES/NO | |
| 13 | The interview with the focus group 2 | YES/NO | |
| 14 | The interview with the focus group 3 | YES/NO | |
| 15 | The interview with the key informant 1 | YES/NO | |
| 16 | The interview with the key informant 2 | YES/NO | |
| 17 | The interview with the key informant 3 | YES/NO | |
| 18 | The interview with the key informant 4 | YES/NO | |

APPENDIX 8

DOCUMENTS REVIEWS

The following documents shall be reviewed

- Maps in time intervals of 7 years beginning 1988

- Photographs indicating historical changes in the land size and use in the study area since 1988

- Hospital/dispensary/clinic record sheets on dietary related diseases such as marasmus, kwashiorkor and malnourishment