

**ASSESSMENT OF HOUSEHOLD LAND SIZE AND LAND USES FOR
SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN THE PASTORAL
FARMING SYSTEM OF BISSIL SUB LOCATION, KAJIADO COUNTY**

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DECLARATION

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

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This thesis research project has been submitted for examination with our approval as University supervisors.

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ABSTRACT

Growth and development of the agricultural sector in Kenya is crucial overall economic and social well-being. The sector ensures the country is food secure; generates incomes and provides employment both directly and indirectly for the population (Kenya, 2014). Land is the most important resource in agricultural production. It is critical to the economic, social and cultural development of the country.

Agricultural production is mainly constrained by limited availability of productive land. However, fragmentation of agricultural land is one of the main problems that limit production in Kenya. This problem has contributed to the declining agricultural productivity, farm efficiency and persistent food security problem in developing countries. The study aims to carry out an assessment of household land size and land uses for sustainable food and livelihood security in the pastoral farming system of Bissil Sub location, Kajiado Central constituency, Kajiado County.

The study adopted a survey design and purposively selected Bissil Sub location in Kajiado County which has a total population of 42,172. Data was collected through documents review, face to face interviews, focus group discussions, observations and photography. The research instruments used included a semi-structured questionnaire, an institutional and focus group discussion guide, an observation form and a camera. Respondents from 96 households and 5 key informants were interviewed. Two focus group discussions one for youths and another for women were held.

The findings show lack of significant of the land tenure system /arrangement on land fragmentation within the study area. The study also revealed a significant effect of the changing household land size and use on food and livelihood security in terms of livestock production and incomes. The study further indicated that there is a significant effect of pastoral household land allocation ratio on the Enterprise gross margins. Research recommends formulation of comprehensive policies and plans by the government in conjunction with development agencies to promote, protect and enhance pastoralism as a land use and a source of livelihoods. In addition, the pastoral community needs to embrace diversification of livelihoods and gender roles to enhance food security in Bissil sub location, Kajiado County, Kenya.

DEDICATION

I dedicate this project to my husband Mr. Paul Silali Wekesa, Sons Master AlphaMyles Wangusi Silali and Master JayPrince Musundi Silali, my uncle, Sir G.P.O. Onyango, and my mother Mrs. Silvia A. Kore for the moral and material support they have accorded me during not only the period of doing this thesis project report, but also during my entire academic journey.

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TABLE OF CONTENTS

DECLARATION	ii
ABSTRACT	iii
DEDICATION	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF MAPS	xiii
LIST OF APPENDICES	xiv
LIST OF ABBREVIATIONS	xv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Introduction	1
1.2 Statement of the Research Problem	3
1.3 Research Questions	4
1.4 Research Hypothesis	4
1.5 Research Objectives	5
1.5.1 Overall Objective.....	5
1.5.2 Specific Objectives	5
1.6 Geographical and Theoretical Scope.....	5
1.7 Justification of the Study.....	6
1.8 Limitations of the Study	6
1.9 Definition of Operative Terms	6
1.10 Organization of the Study	8
CHAPTER TWO	10
RESEARCH METHODOLOGY	10
2.0 Introduction	10
2.1 Research Design.....	10
2.2 Target Population	11
2.3 Sampling Plan	11
2.4 Methods of Data Collection	12
2.4.1 Document Reviews.....	12

2.4.2 Observation.....	13
2.4.3 Interviews	13
2.4.4 Photography.....	13
2.4.5 Instrument Administration.....	14
2.5 Data Analysis Methods	14
2.6 Data Presentation Plan	14
2.7 Ethical Considerations.....	14
2.8 Conclusion.....	15
CHAPTER THREE	16
LITERATURE REVIEW	16
3.0 Introduction	16
3.1 Agricultural Sector in Kenya.....	16
3.1.1 Importance of Agriculture in Kajiado County.....	17
3.1.2 Livestock Subsector.....	18
3.1.3 Livestock Production and Land Carrying Capacity	18
3.2 Food and Livelihood Security	20
3.3 Pastoralism	21
3.3.1 Forms of Pastoralism.....	22
3.3.2 Pastoralism Around the World	22
3.3.3 Pastoralism in Africa	23
3.3.4 Pastoralism in Kenya	24
3.4 Land Tenure Systems	25
3.4.1 Communal Group Ranches.....	26
3.4.2 Privatization of Land Tenure.....	26
3.5 Land Fragmentation	27
3.5.1 Land Fragmentation in Kajiado County	28
3.5.2 Impacts of Land Fragmentation on Food Security	29
3.6 Household Land Sizes.....	30
3.6.1 Impacts of Household Land Size on Food Security	31
3.7 Household Land Uses.....	33
3.7.1 Household Land Use in Kajiado County.....	33
3.7.2 Impacts of Household Land Use on Food Security.....	34
3.8 Factors that Influence the Size and Use of Household Land	36

3.9 Coping with Changes in Food Security	38
3.10 Possible Planning Interventions	39
3.10.1 Diversification	40
3.10.2 Development Control	41
3.10.3 Rural Urban Migration Control	41
3.11 National Strategies and Policies	42
3.11.1 Sustainable Development Goals	42
3.11.2 Vision 2030 on Agriculture Sector and Sustainable Development	42
3.11.3 Science, Technology and Innovation Strategy of Africa (STISA 2024) ...	43
3.11.4 Agriculture Sector Development Strategy (ASDS, 2010-2020)	43
3.11.5 Economic Recovery Strategy for Wealth and Employment Creation	44
3.11.6 Strategy for Revitalizing Agriculture	44
3.11.7 World Initiative for Sustainable Pastoralism (WISP).....	45
3.11.8 Livestock Projects Addressing Food Security.....	45
3.12 Theoretical Framework	45
3.12.1 The Tragedy of the Commons	45
3.12.2 Bid Rent Theory	46
3.12.3 Sustainable Livelihood Theory.....	47
3.12.4 The Basic Resources Theory	49
3.13 The Conceptual Framework.....	49
3.14 Conclusion.....	50
CHAPTER FOUR.....	52
THE STUDY AREA	52
4.0 Introduction	52
4.1 Location.....	52
4.2 Physiographic Conditions	58
4.2.1 Physical Features	58
4.2.2 Ecological Conditions.....	58
4.2.3 Climatic Conditions	59
4.3 Population Factors.....	59
4.3.1 Size of Population.....	60
4.3.2 Density of Population	61
4.4 Social Characteristics	61

4.5 Economic Characteristics	62
4.5 Cultural Characteristics	62
4.6 Land Use	62
4.6.1 Livestock Production	63
4.7 Physical Infrastructure.....	63
4.7.1 Transportation.....	63
4.7.2 Water and Sanitation	64
4.7.3 Energy.....	65
4.7.4 Posts and Telecommunications	65
4.8 Social Infrastructure	65
4.8.1 Educational Institutions	65
4.8.2 Health Facilities	66
4.9 Conclusion.....	66
CHAPTER FIVE	67
DATA ANALYSIS AND RESULTS	67
5.0 Introduction	67
5.1 Attributes of Respondents	67
5.1.1 Age.....	67
5.1.2 Gender	68
5.1.3 Size of Household.....	69
5.1.4 Level of Education.....	70
5.2 Land Size and Food and Livelihood Security	71
5.2.1 Land Ownership Characteristics.....	71
5.2.2 Tenure System	75
5.2.3 Ownership Documents	75
5.2.4 Household Land Size and Use and Food Security	76
5.3 Factors that Influence and the Size and Use of Household Land.....	84
5.3.1 Population Pressure	84
5.3.2 Household Size	84
5.3.3 Brothers at the Time of Inheritance and Number of Sons	85
5.3.4 Settlement Paterns	86
5.3.5 Urbanization Forces.....	86
5.4 Coping with Changes in Food Security	86

5.5 Optimal Household Land Size for Sustainable Food Security.....	87
5.6 Possible Policy Options for Sustainable Food Security	88
5.6.1 Adaptation of Modern Farming Methods	88
5.6.2 Establishment of Settlement Schemes	88
5.6.3 Reorganization of the Settlements	88
5.6.4 Discourage Individualization of Land Rights.....	89
5.6.5 Sensitize People on the Dangers of Land Subdivision	89
5.7 Hypothesis Testing	89
5.7.1 Land Tenure System and Fragmentation.....	89
5.7.2 Household Land Size and Food and Livelihood Security	90
5.7.3. Land Use Allocations and Enterprise Gross Margins	91
CHAPTER SIX	93
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS 93	
6.0 Introduction	93
6.1 Summary of Findings	93
6.1.1 Land Size and Food and Livelihood security	93
6.1.2 Land Use and Food and Livelihood Security	94
6.1.3 Factors Influencing Household Land Size and Use.....	94
6.1.4 Intergenerational Transmission of Land Rights and Use	94
6.1.5 Possible Policy Options for Sustainable Food and Livelihood Security	95
6.2 Conclusion.....	95
6.2.1 Land Size and Food and Livelihood security	95
6.2.2 Land use and Food and Livelihood Security	96
6.2.3 Factors Influencing Household Land Size and Use.....	96
6.2.4 Intergenerational Transmission of Land Rights and Use	96
6.2.5 Possible Policy Options for Sustainable Food and Livelihood Security	96
6.3 Recommendations	96
6.4 Areas of Further Research.....	97
REFERENCES.....	98
APPENDICES	105
Research Document	122
Extra Photos	123

LIST OF TABLES

Table 1: Target Population.....	11
Table 2: Kajiado County Population Projections by Age Cohort.....	60
Table 3: Population Distribution and Density by Constituency	61
Table 4: Number of Livestock in the County	63
Table 5: Level of Education.....	70
Table 6: Problems of Land Subdivision.....	76
Table 7: Area and Yields of Maize and Beans	77
Table 8: Frequency of Livestock Sale	81
Table 9: Value of Livestock.....	82
Table 10: Number of Portions.....	85
Table 11: Human Settlement Preference	88
Table 12: Land Tenure System and Fragmentation	90
Table 13: Household Land Size and Food and Livelihood Security	91
Table 14: Household Land Allocation and Enterprise Gross Margins	92

LIST OF FIGURES

Figure 1: Research Design Method.....	11
Figure 2: Sustainable Livelihood Framework.....	48
Figure 3: Conceptual Framework	50
Figure 4: Age of Respondent	68
Figure 5: Gender of Respondent	68
Figure 6: Size of Household	69
Figure 7: Pieces of Land Owned by Households.....	72
Figure 8: Size of Fathers Land before Inheritance.....	73
Figure 9: Current Household Land Size	73
Figure 10: Mode of Land Acquisition	74
Figure 11: Tenure System.....	75
Figure 12: Ownership Documents	75
Figure 13: Small Land Size Led to Reduced Production.....	78
Figure 14: Land Use Allocations	78
Figure 15: Size of Rented Land	79
Figure 16: Main Economic Activity	80
Figure 17: Annual Income from Livestock.....	81
Figure 18: Challenges in Livestock Keeping.....	82
Figure 19: Yields Comparison Before and Currently	83
Figure 20: Intensity of Food Security	84
Figure 21: Reasons for Further Land Subdivision.....	86
Figure 22: Enough Land Size	87
Figure 23: How Farms should be organized in Future	87

LIST OF MAPS

Map 1: National Context of the Study Area	53
Map 2: Study Area County Context.....	54
Map 3: Study Area in Local Context	55

LIST OF APPENDICES

Appendix 1: Kajiado Ranch Map	105
Appendix 2: National Livelihood Zone Map.....	106
Appendix 3: Seasonal Calendar: Livelihood Zone 15 - Southern Pastoral Zone ...	107
Appendix 4: Household Questionnaire	108
Appendix 5: Key Informant Interview Schedule	117
Appendix 6: Focus Group Discussion Guide.....	118
Appendix 7: Observation List	120
Appendix 8: Photography List	120
Appendix 9: Document Reviews	121
Appendix 10: Inter-generational Land Rights Changes Interview Schedule.....	121

LIST OF ABBREVIATIONS

ADB	African Development Bank
AgGDP	Agricultural Gross Domestic Product
AGRA	Africa Agriculture Status Report
ASALs	Arid and Semi-Arid Lands
ASDSP	Agricultural Sector Development Support Programme
ASDS	Agricultural Sector Development Strategy
CAADP	Comprehensive Africa Agriculture Development Program
CBD	Central Business District
CBS	Central Bureau of Statistics
DFID	Department for International Development
DTB	Diamond Trust Bank
ERS	Economic Recovery Strategy
FAO	Food and Agriculture Organization
FEWNET	Famine Early Warning Network
GDP	Gross Domestic Product
GIS	Geographic Information System
Ha	Hectare
IDRC	International Development Research Centre
KER	Kenya Economic Report
UNEP	United Nations Environment Program
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
SRA	Strategy for Revitalizing Agriculture
UN	United Nations
USAID	United States Agency for International Development
WHO	World Health Organization
WISP	World Initiative for Sustainable Pastoralism
WTO	World Trade Organization
STISA	Science, Technology and Innovation Strategy of Africa

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The growth and development of Kenya's agricultural sector is very critical to the country's overall socioeconomic development. The sector contributes in ensuring the country is food secure while generating income for the country's population for which it employs directly or indirectly (Kenya, 2014). The Economic Survey report of 2016 by Kenya National Bureau of Statistics indicated that the agricultural sector, through linkages with manufacturing, distribution and other service-related sectors, contributes about 27.0 percent to the Gross Domestic Product (GDP) of the country. Therefore, uplifting the standards of living for Kenyans calls for sustained growth and development of the agricultural sector in the country.

The Kenya Economic Report (2017) identifies agriculture as a major contributor to the GDP, employment and livelihood. Agriculture is identified as the backbone of Kenya's economy by this report since the sector remains the highest foreign exchange earner and that is one to drive growth towards the realization of Vision 2030 (Kenya Institute for Public Policy Research and Analysis, 2017). Kenya Vision 2030 was launched as the new long-term development blueprint for the country. The vision's goal is to transform Kenya to an industrialized middle-income economy that provides a clean and secure environment for all her citizens to live a high-quality life. Agriculture has since been identified among the leading sectors that will deliver an economic growth rate of 10 percent annually under the economic pillar (Kenya, 2008).

Sustainable Development Goals (SDGs), Goal 2 strives to promoting sustainable agriculture with the main goal of achieving food security, improving household nutrition and eradicate hunger completely. Majority of Kenyan household rely on purchasing food for their use. As a result, food prices and market integration become very critical influencers of household food security (Kenya, 2017). Households in rural areas buy around 76 percent of their food for consumption while pastoralist communities in the poorest areas of Kenya based in Arid and Semi-Arid Lands are forced to buy all their food supplies except those food products from livestock. Due to this, their diversity in terms of dietary provisions and access are extremely limited. Drought kills their livestock while making them less productive and as a result it

worsens pastoralists food security levels. Further, a slight increase or rise in prices of food worsens their food security status (ibid).

The World Health Organization (WHO) states that Food Security is achieved:

“When all people, at all times have physical and economic access to adequate/sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”.

The relationship between poverty and food security occurs when food security is considered as a result of or function of purchasing power and income as a food supply issue (Kenya, 2009). Wambua (2013) identifies the definition of food security as having three main dimensions which include availability, access and utilization of food. He indicates that lack of these three aspects results into food insecurity. A livelihood is the means by which a person or household makes a living over time (Concern Worldwide, 2004). One of the conditions necessary and often sufficient condition for food security is a secure livelihood (Maxwell, 1994).

Agricultural production is heavily reliant on land as its most vital resource and is critical to the economic, social and cultural development of Kenya. Agricultural production is majorly constraint by limited availability of productive land. Commercial agriculture dominates the potentially arable land with cropland accounting for 31 percent, grazing land 30 per cent, and forests 22 per cent of the available land area in Kenya. Urban centres, game parks, homesteads, markets and infrastructure take up the remainder of the land (Kenya, 2010). Approximately 84 percent of the Kenya land mass experiences very low erratic rainfall that limits cultivation of certain crops since its unsuitable for rain fed agriculture and is largely arid and semi-arid land (ASALS). Ranchers, agro-pastoralists and pastoralists use this ASALs areas as rangelands (ibid).

Smallholder famers dominate the Kenyan agriculture sector in rural areas, this makes the sector important in the reduction of food insecurity and poverty (KIPPRA, 2017). Land in Kajiado County is Arid and Semi-Arid with the predominant economic activity being livestock rearing. Just a small fraction of the population in Kajiado county practices subsistence farming since a greater proportion of the land is not arable (Kenya, 2014). However, fragmentation of agricultural land is one of the main problems afflicting Kenyan land sector today. This has contributed to the declining agricultural productivity, farm efficiency and persistent food security problem in developing

countries. In the recent past, the pastoralist lifestyle has changed as the formally communal land has been subdivided, and some of it has either been developed or fenced off pending urban development. Kenya has undergone a series of fairly quick changes in land tenure policies and regulations which have transformed former pastoral communal lands into various use types.

1.2 Statement of the Research Problem

The Kenya Government, in the effort to ensure that all land is put into productive and sustainable use, has struggled major challenges in matters dealing with land. Urban sprawl from Nairobi city has also led to a substantial pressure on agricultural land in Peri-urban areas including Kajiado, Machakos, Kiambu and Thika. The effect of this sprawl is most evident in land use changes leading to shifting from agricultural land use to commercial, residential or even industrial use. Over the years ASALs areas have experienced a shift in the pattern of household land-use. Mainly, the shift has been to either sedentary pastoralism, subsistence farming (pure cultivation) or to agro-pastoralism from nomadism. Unprecedented population growth, overgrazing and excessive cropping pressure has led to large areas of this lands undergoing some degree of land degradation. This adversely affects the productive capacity of these lands and livestock production in general.

Increased rangeland fragmentation, climate change and human population growth are major challenges that residents in Kajiado County are faced with. In many parts of this county tenure transformations plays a very critical role in aiding fragmentation. This is mainly due to the privatization of former communal lands to private individual land together with land use changes at times. In Kajiado, the household land sizes have undergone uncontrolled subdivision. Group ranches subdivision has resulted into smaller units which cannot support sustainable livestock farming. The population is increasing with no commensurate increase in the agricultural area. Farms may get smaller and when continuously subdivided they become economically unviable. Livestock numbers also decline as a result of subdivision, this is partially because households have to sell more livestock in order to generate the needed cash.

Studies have been carried out indicating how land use and sizes affect rural livelihood and food security in various countries around the world. There exists key information gaps at sub county level in the documentation of same information in Kenya that this

study wishes to fill by generating data on: implication of the current land sizes, uses on food and livelihood security in densely populated Bissil Sub Location, Kajiado County, estimate of the land holding that can sustain an average household in Bissil Sub location for livestock farming, and document how residence in Bissil Sub Location are coping with the impending changes in their livelihood and food security. The study shall recommend planning interventions that can create a sustainable household land size, food, and tenure and livelihood security in the study area. This will also aid in informed decision formulations and policy recommendations.

1.3 Research Questions

This study intended to address the following research questions:

1. How has household land sizes and uses changed over time?
2. What food and livelihood challenges face people in Bissil sub location?

1.4 Research Hypothesis

The study had three research hypotheses.

1. Relationship between land tenure system and land fragmentation

- a. Alternative Hypothesis

Ha: There is a significant effect of land tenure system on land fragmentation within the study area.

- b. Null Hypothesis

Ho: There is no significant effect of land tenure system on land fragmentation within the study area.

2. Relationship between household land size and use and food and livelihood security

- a. Alternative Hypothesis

Ha: There is a significant effect of the changing household land size and use on food and livelihood security in terms of livestock production and incomes.

- b. Null Hypothesis

Ho: There is no significant effect of the changing household land size and land use on food and livelihood security in terms of livestock production and incomes.

3. Relationship between land use allocation and enterprise gross margins

- a. Alternative Hypothesis

Ha: There is a significant effect of pastoral household land allocation ratio on the Enterprise gross margins.

a. Null Hypothesis

Ho: There is no significant effect of pastoral household land allocation ratio on the Enterprise gross margins.

1.5 Research Objectives

The study had overall and specific objectives.

1.5.1 Overall Objective

The overall objective of this study is to carry out an assessment of household land size and land use for sustainable food and livelihood security in the pastoral farming system of Bissil Sub location, Kajiado County.

1.5.2 Specific Objectives

The study has the following five specific objectives:

1. To assess how the changing household land size affect food and livelihood security;
2. To appraise effects of land uses on food and livelihood security;
3. To analyse factors that influence the size and use of household land;
4. To document intergenerational transmission of land rights and use and;
5. To recommend planning interventions for sustainable food and livelihood security in the sub location.

1.6 Geographical and Theoretical Scope

The study was carried out in Bissil Sub location, Kajiado Central constituency, Kajiado County. The choice for the study area was partly based on pastoral population in the area and also considering the population density of Bissil Sub location within Kajiado Central constituency. The Sub location is the most densely populated and strategic considering that it falls within the areas that were originally dominated by group ranches within Kajiado County. The study will focus on the relationship between land size, land fragmentation, land uses and land tenure on food and livelihood security of the households in the sub-location.

1.7 Justification of the Study

According to Mwamuye et al., (2012) agriculture contributes enormously to Kenya's economy is the backbone of the country's economy. It has been argued that land fragmentation has created uneconomic sizes of land that cannot even assure the relevant farmers adequate food for subsistence (Karangwa, 2007). He further argues that this kind of farm sizes has proved to be not economically sustainable to livestock farming and that lack of land use plan has left any person with title deed to use the land in whichever way they wish with little regard to how sustainable that use is. Sustained growth of the agricultural sector therefore will strongly influence the overall national economic performance and also contribute to food, nutrition and livelihood security.

This study will help both the county and national government to identify key areas that need to be worked on to ensure sustainability of food countrywide. The objectives of the research are significant in ensuring the right solutions and data are obtained that if implemented will aid in solving food insecurity challenges in the country. The study will equally help in the improvement of land management and administration to ensure prosperity and posterity. The findings of the study will influence the strategic decision process by land management agencies and the national government on policy formulations and implementations to ensure food and livelihood security and land management are checked and envisaged in law. This information that includes key Information on sound land planning livestock farming and food security in general will have a major impact on the future research activities in Kajiado County.

1.8 Limitations of the Study

The study was conducted against constraints of time and finances. Otherwise, with much time and sufficient financial resources, the study would have been carried out in the entire rural areas of Kajiado County and Kenya in general. This is because the problem of land sizes, fragmentation, food and livelihood security/insecurity is a national concern which is not only special to Bissil Sub Location, Kajiado County, but to the whole nation.

1.9 Definition of Operative Terms

Community: A group of people or animals in a shared geographical space, linked by social and/or economic ties, shared identity, collective action, and providing a means

for a common livelihood; notwithstanding the fact that they may have diverse characteristics and priorities.

Food Security: FAO (1996) defines food security as a state where all people, at all times, have both physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. According to Napoli et al., (2011) food security is a state in which all people at all times have physical and economic access to enough, safe and balanced diet food to cater for their dietary needs and food preferences for an active and healthy life.

Fragmentation: According to Oxford Dictionary, fragmentation refers to the process or state of breaking or being broken into fragments - portions. This practice involves a situation where a farmer farms multiple spatially detached parcels of land that they own or rent (Obonyo et al., 2016). Kavitha et al., (2015) defines land fragmentation as a method of land ownership where an individual owns several pieces of land which are scattered over a given geographical area.

Household: A family set up which includes a husband as household head, wives/wife, children and any other dependent family members living in the same compound either partially or permanently if any. While female headed household consists of mother as household head, children and dependent family members if any. Household is a basic unit of study and in this study, it is described based on consumption. The household unit in Kajiado is composed of an extended family whose members comprise the man as head of household, a wife or wives, their unmarried children and often one to two relatives. These members of the household herd their livestock as one unit and share the proceeds from their labour. Occasionally, sons who are married and living on the same compound with the parents as described above, are regarded as part of the household of the parents.

Land tenure: The way holding of land is determined/defined in a given society; whether legally or customarily, among people, as individuals or groups. It includes the rules, norms and institutions that govern land use. For example, freehold is a form of tenure by which land is held free of any fees for life and for descendants.

Land use pattern: Shows the spatial and temporal extent of human activities on land through occupation, which can be either economic or social in nature.

Livelihood security: it is a situation whereby people have access to income and other assets that enables them to meet their basic needs such as food, health facilities, nutrition, education, water and sanitation, shelter and participation in community and social activities (UNEP, 2011).

Productivity: This is production per unit of resource. The term is applied to crop / livestock production per unit of land or animal yield within a specified time; day, season or year in this study.

Rangeland: It is land suitable for grazing livestock; in which the natural vegetation is predominantly grasses and shrubs.

Sustainable food security: This is a situation whereby all people at all times have right to food and food production, physical and economic access to affordable, enough, safe and balanced diet food to cater for their dietary needs and food preferences for an active and healthy life while protecting the environment at the same time (Donkers, 2014).

1.10 Organization of the Study

The project report is chronologically structured and organized with the following sections preliminaries, introduction, research methodology, literature review, data analysis and results as well as summary of findings, recommendations and conclusions. The introduction provides a background of the study, the statement of the research problem detailing the information gap, the research questions, hypothesis and objectives, justification and significance of the study, the theoretical and geographical scope of the study as well as limitations of the study. The research methodology profiles the research design to be adopted, data collection methods and instruments, data analysis tools and methods and the data presentation techniques for the study findings. The literature review provides a detailed evaluation of previous research in the study area and elaborate on the knowledge gap that will be filled by carrying out the study.

The research findings provide an outline of the primary data collected from the field in relation to the research questions and hypothesis, often provided in figures, tables and graphs. The summary of findings details comments of the results, their meanings and interpretations while the recommendations are useful in answering the objectives of the study. The conclusions on the other hand emphasise on meeting the aims of the study

by elaborating the most significant achievement of the objectives and makes suggestions for further research.

CHAPTER TWO

RESEARCH METHODOLOGY

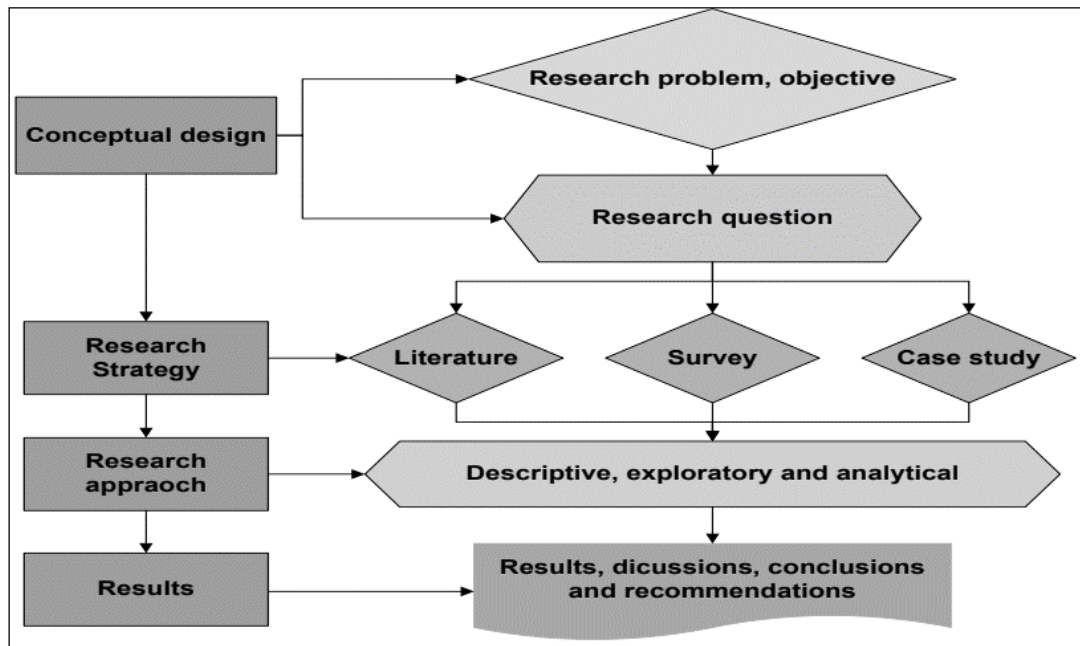
2.0 Introduction

The different stages and phases that were implemented in executing the study are discussed in chapter two. The chapter begins by discussing the research design that was adopted for the study followed by the methodology that was used to achieve the objectives of the study. It details the target population and the sampling plan that was used for the success of the study. A data needs matrix was formulated and well outlined on the actual data needed to make the study successful and ensure the right data is collected. The chapter has given a detailed explanation of the data collection methods used in the main study and the tools that were used to analyse the gathered data. Data presentation plan and ethical considerations for the actual research project will be explained in detail.

2.1 Research Design

The research assumed a descriptive and survey research design. The survey of the target population involved administration of data collection instruments to the households, key informants mainly professionals, administrators, political leaders, and focus groups of stratified groupings of eight to ten members. A correlational design was also adopted to aid in identification of the relationships of household land sizes and uses vis-à-vis food, nutritional and livelihood security in the rural areas of in Bissil sub location, Kajiado County. Figure 1 summarizes the study design used.

Figure 1: Research Design Method



Source: Verschuren, and Doorewaard, 2010. p.18

2.2 Target Population

The target population for the study consisted of the rural population of pastoral farming system of Kajiado County. In this case, the target population included households, community leaders, opinion leaders, religious leaders, political leaders, administrators and professionals residing in Bissil Sub Location, Kajiado County. A representative sample was picked from each category of the target population. The target population is structured as shown in Table 1.

Table 1: Target Population

Administrative Unit	Male	Female	Total	Households	Area in Sq. Km	Density
Bissil Sub Location,	4647	4995	9642	2363	250.2	38.54

Source: KNBS, 2010

2.3 Sampling Plan

The sub-location to be studied will be the rural Bissil Sub Location, Kajiado County with the highest population density. The choice of the highest population density is to examine how high population density is interacting with land size, food and livelihood security. For households, the study adopted a stratified multistage random sampling method, where households were stratified based on household headship i.e. male

headed, female headed – widows and singles. This was followed by proportionate simple random sampling of the households. For the households sampled the father, mother, an adult son and an adult daughter was interviewed. For all the other categories, a sampling frame consisting of a list of all members of the category in the sub-location was generated and simple random sampling method used to select the sample.

A 10-30 percent of the population that is accessible to the researcher is considered adequate sample size for a survey study (Mulusa, 1990). In this study, the formula $n = \frac{NCv^2}{(Cv^2 + (N-1)e^2)}$ proposed by Nassiuma (2000) was used to establish the sample size. In

the formula: -

n = sample size

N = population

Cv = coefficient of variation (take 0.5) and

e = tolerance of the desired confidence level of 0.05% taken at 95%.

Bissil Sub-location has a total population of 2363 households as per the Kenya National Housing and Population census of 2009, the sample size is computed as follows:

$$n = \frac{2363 (0.5)^2}{0.5^2 + (2363) \times 0.05^2}$$

Computing the formula and figures give 96 respondents as the sample size.

2.4 Methods of Data Collection

Both quantitative and qualitative data was collected from the outlined sources in the data matrix. Multiple sources and method by multiple investigators were used to allow triangulation hence improve validity of the findings. The sources of data were primary and secondary while the methods included document examination, photography, case study reviews, individual and group interviews, round table discussions, observations, oral history and instrument administration.

2.4.1 Document Reviews

The researcher reviewed existing literature on the relationships between household land sizes, fragmentation, tenure and land uses with food and livelihood security. Also, population census reports and maps on rainfall, temperature, soil types, and dominant crop cover as well as population structure maps of the study area were reviewed. The study examined case studies of food and livelihood security levels of other countries

with similar challenges of excessive rural land fragmentation, high population densities in the rural areas so as to draw lessons on how these problems were addressed.

2.4.2 Observation

Observation was used as a tool to purposefully and selectively watch and listen to verify the respondents' information and the information from the secondary sources and have a feel of the impacts of land use and size on food and livelihood security. In this study, observation was used to examine land use trends, patterns and land sizes. The researcher formulated an observation checklist (Appendix 7) on all data needs so as to ensure all essential data that can be gathered by observation is obtained. The checklist encompassed relevant key features of the study such as forests, crop cover, farmlands, house types and the materials used for construction, farm boundary markers, household compound sizes and layout amongst others.

2.4.3 Interviews

With the aid of a well-formulated questionnaire of both open ended and closed questions, data on land sizes, subdivision, fragmentation and use allocation, from members of households, religious leaders, administrators, professionals and possibly political leaders was gathered. This was done through face to face interviews of the stratified randomly selected respondents. Key informant interviews, focus group and round table discussions was also conducted with the aid of open-ended customized interview guides. This aided to get respondent's original ideas and thoughts. The round table discussions with administrators, mainly the chief, his assistants and the village elders assisted in supporting the gathering of data on food and livelihood trends of the study area as well as any institutional memories on land issues, land related conflicts and possible solutions.

2.4.4 Photography

The still images were captured with the aid of a photography checklist that will validate data obtained via observation. Digital cameras were used to take pictures of the current status of land uses, sizes, physical infrastructure status. This acted as evidence of the actual situation on the ground and provided a basis for comparisons with existing photography on the area. This helped to visualize the levels of land subdivision in the study area and the changes over time and their implications on food security and livelihoods.

2.4.5 Instrument Administration

With the use of the appropriate tools and instruments, the actual measurements of the household land size and land allocations for different land uses was being undertaken using a surveying tape and hand held GPS. This acted as validation of data gathered via the interview method.

2.5 Data Analysis Methods

The study adopted various methods to analyse the collected data. Frequency distributions and measures of central tendency were generated by use of Statistical Package for Social Sciences (SPSS). Correlations was undertaken with the right data sets to aid in measuring the associations and relationships between household land sizes and uses on the one hand and food and livelihood security on the other. Additionally, statistical tests such as T-tests and Chi-Square was carried out where necessary to test the stated hypotheses. Additionally, a detailed analysis of documents, maps and photographs was carried out to assess the relationships of different variables. Analysis of qualitative data involved both case and cross-case analysis subject to the variables identified.

2.6 Data Presentation Plan

All the data collected was analysed using both qualitative and quantitative analyses techniques. The findings were reported both descriptively and graphically using tables, pie- charts, graphs and polygons as determined by the team. Descriptive data was presented through text narratives to provide interpretations of the findings. Descriptive statistics using SPSS aided in the computation of means, frequencies, distributions and percentages from the edited and coded data collected from the field through the questionnaires. The analysed findings were presented inform of charts, graphs, maps, tables and figures. Qualitative data from in-depth interviews, questionnaires and observation was edited, organized descriptively into themes which was presented in discussions, narrative forms and citations through transcription.

2.7 Ethical Considerations

The study was scientifically conducted and observed key ethical considerations. All internationally accepted standards for what is right and wrong in conducting the research was strictly be adhered to. By conducting the study, the researcher was bound to confidentiality and secrecy of collected data and information. Findings were for the purpose of the study and any publications will adhere to consent regulations that guide

research world over. The research was based on honesty, objectivity, and respect for intellectual property, social responsibility, confidentiality, and non-discrimination. The study realized the intended goals and objectives by adoption of voluntary participation of all participants. Respondents gave their informed consent to participate in the research where they acted independently without being coerced to give their views on the subject of study and without due influence or pressure from anyone. This was so for purposes of the study to be as objective as possible. Before the respondents gave their consent, the study objectives and purpose were explicitly and clearly explained to them and assured confidentiality of their information. A research approval was also sought. Research questionnaires were administered to the respondents by the researcher herself. Information collected from the respondents was accessible to the researcher and the supervisor only. After completion of the study the data collection tools will be destroyed.

2.8 Conclusion

The target population for the study included the sub location households; community, opinion, religious and political leaders; administrators and professionals in Bissil sub location. In total, 172 households and 5 key informants were interviewed and two focus group discussions; one for the youths and the other one for the women were held. The households selected for the study were sampled using a stratified random sampling method, where households were stratified based on household headship. From each stratum, proportionate simple random sampling was used. In addition, purposive sampling was done to identify the key informants for the study. The methods of data collection employed included document reviews, observation, interviews, photography and instrument administration. The collected data was analyzed and presented in appropriate formats.

CHAPTER THREE

LITERATURE REVIEW

3.0 Introduction

This chapter presents an overview of the literature on agricultural sector in Kenya with a focus on livestock subsector. This section also describes importance of agriculture in Kajiado County and outlines a general overview on pastoralism. It further reviews literature on the impacts of land size and land use on food and livelihood security, and factors that determine household land size and use. The coping strategies embraced by the community as a result of the impending changes in their livelihood and food security in the study area have also been explored. The chapter concludes by highlighting the possible planning interventions that can ensure sustainable food and livelihood security in the sub location.

3.1 Agricultural Sector in Kenya

The Africa Agriculture Status Report (AGRA) (2017) indicated that over the period 2005–2015, the economies in African countries have experienced rapid urbanization as well as unprecedented rates of economic growth. The report further indicated that there is a change in the food systems of Africa and a growing strong demand for food. A strong national shift of diets from staple foods such as grains to more of horticulture, livestock products, processed and pre-cooked foods is gradually evolving. The Agricultural Sector Development Strategy (ASDS) policy document indicated that agriculture sector contributes 26 per cent of the GDP of the country annually, accounting for 65 per cent of the total exports in the country. The sector provides more than 70 per cent of informal employment in the rural areas (Kenya, 2010). The agricultural sector is both a driver of Kenya's economy and a source livelihood for the largest portion of the citizens. The agricultural sector is not only the driver of the Kenyan economy but also the means of livelihood for the majority of the citizens. Livestock, crop, fisheries, water, land, regionals development, environment and forestry are the main subsectors of the agricultural sector in the country (ibid).

Agricultural productivity plays an increasingly important role in improving food supplies and food security. According to Vision 2030, Productivity is still a cardinal challenge in the agricultural sector. The production level of most crops over the last five years has almost stagnated or has been declining. Fish and livestock products

output levels are below potential. Population growth has been steadily increasing while the area covered by the forest has been sharply reducing (Kenya, 2007). Productivity is a core element of the agricultural sector. It is imperative to note that enhanced productivity fosters food security, increases foreign exchange inflow and contributes to alleviation of poverty particularly in the rural areas.

Land is a very critical component of agricultural development in emerging economies. Land has a direct effect on the livelihoods of farmers especially in alleviation of poverty cases in rural economies and it aids in income generation (Vixathep, et al. 2013). Agricultural land, commonly known as farmland can be defined as any parcel of land that is used for solely for the purposes of livestock keeping and crops growing. It therefore encompasses that land used as pasture or farm. Land used for crops commonly known as cropland refers to the sum total of all arable land mainly used for either permanent or temporary crops. The third category of land comprises of cultivated or naturally growing grass land, pasture and land having permanent meadows (Maletta, 2014). While land is a core aspect in agricultural production, its use is another challenge in the agricultural sector. The land available for crop production is overexploited especially the small-scale farmers in Kenya. Arid and semi-arid lands (ASALs) and land in high and medium potential areas remain underexploited for agricultural production in Kenya (Muraya, 2017).

3.1.1 Importance of Agriculture in Kajiado County

The Agricultural Sector Development Support Programme (ASDSP) household baseline survey in Kajiado indicated that the predominant economic activity in the county is livestock rearing with largest portions of the land in the county being arid and semi-arid (ASAL). The report shows that only a few residents of the county practice subsistence farming owing to the fact that majority of land in the county is not arable. The report further points out that the average farm size for small scale and large sale farms are 9 Ha and 70 Ha respectively. Onions, tomatoes and cotton are some of the major crops grown at commercial level in some parts of the county especially near Mt. Kilimanjaro and Chulu hills though some farmers grow these crops in small amounts at subsistence level (Kenya, 2014). The household baseline survey report identifies pastoralism as the main source of living for majority of residents in the rural areas of the county. Goats, sheep pigs, donkeys, dairy cattle, beef cattle, indigenous chicken, camel and donkeys are the main livestock types in the county. Hides and skins, milk

and beef are the main livestock products in the county. Major land subdivisions and sale of land have taken a major hit on the group ranches whose numbers are dwindling at an accelerating pace. Bee keeping has been embraced and is taking root in some parts of the county as an option to keeping of livestock while promotion of fish farming is rapidly happening with 650 fish ponds in various parts as well in bid to sustain livelihoods and reduce overdependence to livestock production (Kenya, 2014).

3.1.2 Livestock Subsector

The livestock subsector plays a very vital role in the country's economic and sociocultural growth and it contributes seven percent to the GDP. It is a source of income and food for the farmers especially the pastoralists who exchange their livestock for cash and as a result it contributes 17 percent to the AgGDP. Further, the sector creates employment for approximately 10 million Kenyans and it provides half of the total agricultural labour (Kenya, 2010). Beef cattle, sheep, goats, dairy cattle, camel, poultry, piggery and emerging livestock form the subsector's core livestock. According to this report, the subsector is a significant consumer of other products such as vaccines, animal feeds and equipment. Additionally, it is also a source of key raw materials for industries and as such a high level of vertical linkages for both down-stream and upstream industries. The demand for food of animal origin has been boosted by an increase in population growth (ibid).

3.1.3 Livestock Production and Land Carrying Capacity

Grandon (1991) reports that saturation of grazing lands in parts of eastern Kajiado has resulted to a decline and a plateau in growth of livestock populations measured in live weight since late 1960s. immigrations, subdivision of land and loss of land to subsistence farming, national parks, forest and game reserves have contributed to rise in land fragmentation and constrained mobility of pastoralists. This shift increases risks of drought among pastoral communities in multiple ways such as disruption of established livestock migration pathways, flexibilities in evading outbreaks of diseases, accessibility to drought reserves, reduction of grazing area and mobility (Western and Nightingale, 2003). In addition, this loss of grazing land badly disturbs the mobility patterns for wildlife and livestock and so compounding drought risks in arid areas. This depicts the sorry state of food and livelihood security driven by land fragmentation and subdivision of rangelands for agriculture.

The survey carried out by Thorton et al. (2007) in four case studies of Ngorongoro Conservancy Area – Tanzania, Kajiado – Kenya, Northwest Province – Republic of South Africa and in Vihiga – Western Kenya pointed out a decrease per household in grazing land, numbers of simulated cattle and general total livestock population overtime. Reporting on research findings commissioned by International Development Research Centre (IDRC) and the UK based Department for International development (DFID), the newspaper goes on to point out that until 1970s, when pastureland was demarcated into communal ranches, and later into shareholding ranches in the 1990s, land in Kajiado supported pastoralists because they had enough space for grazing but not anymore. The land has been subdivided into smaller plots, most of them sold to individuals who have already and are still investing in real estate following increased demand for land due to expanding towns and population pressure

Western and Nightingale (2003) argue that livestock population has stagnated and not increased owing to shortage of pasture since 1960s among the Maasai of Kajiado underscoring the importance of land as a key factor to food and livelihood sustenance. In their study on Environmental Change and the Vulnerability of Pastoralists to Drought: A Case Study of the Maasai in Amboseli, Kenya, point out to an exaggeration of pastoral areas drought related stresses largely due to effects of increased fragmentation of land, degradation of range lands and loss of livestock mobility on the one side compared to the difficulties of competitively penetrating the other sectors of the economy on the other (ibid).

Kimiti et al. (2018) note that frequent drought recurrent, decrease in grazing lands owing to growth in human population that has increased settlements and expansion of subsistence crop farming have all contributed to land subdivision and fragmentation and subsequent decline in size of household herds. Flintan et al. (2011) observes that prospects for sustainable pastoral production have been profoundly hindered by fragmentation of rangelands and insecurity of resources. While studying pastoralism and land fragmentation among the Borana, Oromia and Harshin in Somalia, they point out that fragmentation of rangelands has resulted to limitations on animal mobility and loss of grazing areas and thus a shift of the pastoral communities to cultivation, which, they argue is unviable and hence conclude that a crisis is imminent as food and livelihood security of the pastoral communities in the said areas is threatened.

3.2 Food and Livelihood Security

The World Health Organization (WHO) observes that food security is achieved

When all people, at all times have physical and economic access to adequate/sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Food security has a relationship to poverty if it is viewed as a function of income and purchasing power not only as a supply issue (Kenya, 2009). According to the 2010 State of Food Insecurity Report, Food and Agriculture Organization (FAO) of the United Nations, 98 percent of close to a billion undernourished people in the world live in developing countries (FAO 2010). A report by the Ministry of Agriculture on food security in Kenya postulates that the rate of a community's vulnerability to hunger can be determined by use of four perspectives of utilization/nutrition, stability, food accessibility and finally food availability (Kenya, 2009). Nyariki and Wiggins (1997) in their study states that food security is attained through adequate growth of livestock and food crops which also maintains output per individual and reduces deficits in food calories and imports.

A Post-Modern Perspective report on food security by Maxwell, (1994) indicated that food security is dependent among other things on a secure livelihood. A report on Sustainable Rural Livelihoods by Chambers and Conway, (1992) indicates that a livelihood is made up of people's means of living such as income, food and assets together with their other capabilities. Kauti, (2009) carried out an assessment for rural livelihood security for smallholders undergoing economic changes and agro-climatic events in Central Kenya. He postulates that a combination of both tangible and intangible assets aid in achieving sustainable livelihoods. the tangible assets comprise of land, capital, labour and stocks while education status, social capital and health are more familiar intangible assets that are mostly related with anthropological and sociological inquiries.

According to Livelihoods zoning 'plus' activity in Kenya report by USAID & FEWNET, (2011) categorises Kajiado County livelihood zone 5, southern pastoral zone. The report identifies the Maasai as the majority inhabitants of zone at 95 percent with most residents being semi-nomadic – 80 percent, fully settled and nomadic at 5 percent each while internally displaced and outmigrants laborers make up 10 percent.

The main source of household income in this zone five is livestock rearing. The report further approximates a typical household in the zone to have 10-20 cattle, goats and sheep at 10 to 30 and 20-40 respectively with chicken and donkeys kept by a few households as well. The livestock kept in this zone are mainly for purposes of milk, meat, skins, hides, income and sometimes blood production. In this zone, households keep local breed of livestock due to its tenacity to withstand tough conditions that are the very basic features of the region. Households food requirements and cash needs are heavily dependent on cattle and sheep. Food purchase from the market makes above 80 percent of the food consumed in this zone. Over 80 percent of food is purchased from the market comprising of pulses, maize, rice, beans and vegetables. Households produces almost all their requirements for livestock products of milk, meat, ghee and other livestock products (USAID & FEWNET, 2011).

3.3 Pastoralism

The World Initiative for Sustainable Pastoralism (WISP) defines pastoralism as any principal mode of livestock-oriented production system that is naturally extensive and uses some type of livestock mobility (Hatfield and Davies, 2006). Pastoralist as a term defines a cultural identity or a system of production or livelihood (Krätli and Swift, 2014). It encompasses all those individuals who engage in pastoralism related activities including those who share backgrounds in pastoralism. Semi-arid areas are characterised as areas that are unsuitable for cultivation and often experience relatively lower economic growth, high levels of poverty and increasing climate change impacts (FAO, 1987). Arid and Semi-Arid (ASAL) areas with grasslands, have no sustainable crop alternative due to climate, altitude or terrain, therefore livestock production in pastoral systems is not in competition with crop production for human nutrition. Pastoralists in their normal state depend on kinship ties for defence and mutual herding of livestock in their inhabited land that is shared communally. They often keep large herds of cattle that are that are almost always in a poor condition and surprisingly hardy enough to survive frequent recurrent droughts and very sparse vegetation.

Livestock are not only economic assets but also are spiritual, cultural, and social assets. Water and forage are often scarce and temporal in the arid and semi-arid lands that are typically remote and sparsely inhabited by pastoralists forcing them to adopt varying degrees of mobility as remedy to these challenges. Majority of populations mostly pastoralists in these sparsely populated arid and semi-arid lands are often economically,

socially and politically marginalised and are mostly neglected or segregated out of the nation state as minority ethnic groups (Galaty and Bonte 1991).

3.3.1 Forms of Pastoralism

The degree of mobility is the basic method used to classify pastoralists. FAO identifies agro-pastoralism, nomadism, pastoralism/ranching and transhumance as the four main broad categories of pastoralism. Nomads form the basic components of nomadism. Nomads migrate according to seasonal patterns strictly determined by search for water and pasture for their livestock. Nomads live in temporary structures and shelters that they carry along as they move and they don't establish or live in permanent homes/settlements. Transhumance is the occasional migration of part of a community to far away pasture while leaving the bulk of the community in permanent settlements. The transhumant pastoralists exploit the good grazing grounds of the arid and semi-arid lands (ASAL) in the rainy season, but are forced to move to the savannahs due to lack of water. Not only is the quality of pasture low in savannahs, but also the risk of diseases is much higher. The main feature of transhumance is their seasonal based movement of their herds to specific fixed points with the main aim of exploiting seasonal availability of water and pastures before moving to the next point.

FAO describes those communities that have settled on land and cultivate enough areas with production of crops for feeding their families as agro-pastoralists. These communities hold land rights and keep smaller herds of livestock. Ranching or enclosed livestock production is the other category that entails extensive production of livestock on individually owned and typically fenced land. Finally, sedentarisation is the last category and it entails keeping of livestock all year round within or next or near the farm (Weber and Horst, 2011).

3.3.2 Pastoralism Around the World

Grasslands occupy almost a quarter of the earth surface and make the main areas under which pastoralism is practiced (Follet & Reed 2010) pastoralism is the major subsistence strategy for over 20 million households globally and it dominates land use in approximately 25 percent of the world's landscape (Galaty and Johnson 1990). Pastoralism is very diverse: it can be found in all continents, from the drylands of Africa and the Arabian Peninsula, to the highlands of Asia and Latin America, or the tundra in the circumpolar zones, and in particular where crop cultivation is physically limited (FAO 2001). Regardless of the variations, the various forms of pastoralism have certain

common features: communal land ownership and use, mobile herds, and locally adapted livestock breeds. Across Africa, Asia, and Latin America more than 50 percent of the local breeds of sheep, goats, and cattle have been developed in, and are adapted to, the specific conditions and disease prevalence of the respective dry lands (Hoffmann 2014).

Pastoralism supports several hundred million households worldwide (Pastoralist Knowledge Hub 2016). It manages one billion animals, including camelids, cattle, sheep and goats, in addition to yaks, horses and reindeer, contributing about 10 percent of the meat production in the world. It produces food and ecological services, and is often the only significant economic contribution in the world's poorest regions. It is the cultural backbone of longstanding civilizations (Nori and Davies 2007). With its mobility and collective resource management, it is now recognized as a rational and sustainable livelihood strategy in marginal lands (Morton et al. 2007).

3.3.3 Pastoralism in Africa

Livestock forms a substantial share of food and income for African pastoralists (Swift 1988), despite the fact that most pastoralists engage in other income generating activities and even practice cultivation of crops. Extensive pastoralism and wildlife conservation are practiced mainly on the African rangelands that cover almost half of the continent's total land surface (Nyariki et al. 2009; Kaimba et al. 2011; Nkedianye et al. 2011; Bekele and Kabede 2014). Galaty & Johnson 1990 and Jahnke 1982 postulate that half of the world's pastoral people are found in Africa consisting of nine million agro-pastoralists who practice agriculture together with rearing of huge herds of cattle and another thirteen million predominantly pastoral Africans. The *Tuareg*, *Somali*, *Fulani (Fulbe, Peul)*, *Nuer*, *Bedouin* and *Maasai* are the predominant African pastoral communities that occupy the arid deserts, semi-arid areas and the savanna grasslands where rain-fed agriculture is completely untenable, unreliable and risky hence their undertaking in pastoralism.

Pastoral societies and/or activities in East Africa occupy 70, 50, and 40 percent of the total land mass in Kenya, Tanzania and Uganda respectively (Reda, 2012). Pastoral herds play essential core functions to the pastoral communities comprising regular food provisions of blood, milk and meat, a sign of wealth and prosperity, a medium of exchange especially in settlement of dowry, a source of cash income, buffer against drought and famine, outbreak of diseases and other calamities of rangelands, and a

mode for compensating individuals injured during raids (Nyariki et al. 2009; Kaimba et al. 2011; Opiyo et al. 2011; and Schilling et al. 2012). In East Africa, the pastoralist groups comprise the Southern Kenya and Northern Tanzania Maasai who keep cattle, the Turkana, Samburu, Orma and Boran of Kenya, the Dodoth, Karamajog, Teso and Jie of Uganda. These pastoral groups are found in the drier areas of North Eastern Kenya, Somali and Southern Ethiopia. They also comprise of the Rendille, Afro-Asiatic Gabra and the Somali. Further, in East Africa, many other agro-pastoralists keep large herds of cattle and include the Kalenjin speakers of Kipsigis, Pokot and Nandi in the Rift Valley of Kenya; the Tutsi of Rwanda and Burundi and the Bantus of Western Uganda being the Bankole.

The new land tenure rules that permit subdivision of communally held land and dissolution of group ranches together with exigencies of an unchanged ecology of dry land systems are the major challenges faced by pastoral producers in East Africa. There are generally high levels of poverty among the pastoral households of East Africa (Thornton et al., 2003) with research showing per capita decline in units of tropical livestock over the last three decades (Bekure et al. 1991, Rutten 1992).

3.3.4 Pastoralism in Kenya

The semi-arid lands covering over 80 percent of Kenya's land mass makes up part of the country's massive rangelands (Mwang'ombe, et al., 2011); and is home to millions of pastoralists and agro-pastoralists. The primary mode of agricultural production and major consumer of these semi-arid rangelands is pastoralism (Nyangito, et al., 2009). FAO observes that the subsector contributes an estimated 12 percent to the country's GDP (FAO 2005). Further, livestock production is source of income to over 95 percent of ASAL's households and creates 90 percent of all opportunities for employment (Kaimba et al. 2011). Pastoralism remains the dominant strategy for millions of people's livelihoods in the ASALs ecosystems with mobility of herds in search of pasture and water in time and space being the main feature of pastoralism in these areas (Nkedianye et al. 2011; Tefera 2014; Berhanu & Beyene 2015).

According to Kiuluku, (2008) religion, type of pastoral production system and culture distinguishes the diversity of pastoral communities hence each community is deemed unique and identified based on these factors. Hatfield & Davies, (2006) opine that some of these communities specialize in their system of farming by keeping just single cattle

or camel's species especially in Northern Kenya while others engage in more than a single species comprising a combination of sheep, goats, cattle and crops particularly in Southern Kenya. The land tenure changes have contributed to the rise of sedentarization and fragmentation of rangelands. This has in turn resulted to limited mobility of livestock and as such contributing to undue pressure in some patches of grazing affected by the adopted all year round grazing hence an increase in degradation of ranges. The shrinking of grazing areas, declining productivity of land, limited livestock mobility and regular droughts have occasioned the loss of livestock, a rise in household poverty and vulnerability levels of pastoralists and a further destruction of a pastoral household's resilience future shocks (Fratkin 2008; Groom and Western 2013; Kirwa et al. 2012; Moyo et al. 2013).

3.4 Land Tenure Systems

The social relations and institutions that govern access to and ownership of land and natural resources are the major components of a land tenure system. Land tenure is generally defined as a "bundle of rights" in which case are specific rights for doing certain things with land or property (Bruce 1993). According to Lastarria-Cornhiel (1995) land tenure rights dictate what land can be used by who and how the land would be used. There exist three main land tenure systems in East Africa comprising of the group ranch, pure and quasi customary models according to (Mulaku, 2000). Further, Mulaku, 2000 postulated that land tenure systems must be given due and long-term attention if any community in marginal areas is to attain food security and particularly the agropastoral and transhumant communities that have for the longest while received little or no attention from government being accused of restricted potential for food production. Unfortunately, in his study, Mulaku, 2000 did not show the relationship between land tenure and land use on one hand and food security on the other even though he showed how these elements relate to each other. This thus raises the need to study and get an understanding of the land tenure on use of land effects to household food security. Zhoali et al. 2005; Lesorogol, 2008; Galvin, 2009 & Mwangi 2009 observes a trend in privatization of grasslands to individual land is going on steadily despite majority of rangelands been formally or informally governed as communal lands.

Land tenure in Kenya is categorised into government trust land, communal land and private owned land. Government held trust land refers to the land held in trust by

government entities, departments and state corporations including ministries and other public institutions for public use mainly as land for forests, buildings, national parks and for research purposes. Communal land system refers to the land held based on traditional customary rights where all individuals born in a community have unquestioned and unlimited rights to use the land except selling it. The privately-owned individual land is that land registered in an individual's name who have total jurisdiction over their land which they hold leasehold or freehold title over. The owner of private land has right to obtain credit with its title as collateral. The private ownership of land in Kenya has motivated investment and long-term developments on farms hence creating secure land market (Kenya, 2010).

3.4.1 Communal Group Ranches

In the 1980s, the government established group ranches in Kajiado district. However, only a handful of the 52 group ranches established there have not been subdivided (Flyntan, 2012). Olkiramatian Group Ranch fed by permanent rivers, for example has zoned the ranch into grazing, conservation and agricultural areas and has sub-divided the latter into individual plots though the rest remains communal use. The Land (Group Representative) Act of 1968 established group ranches. All groups representatives established under the Land Adjudication Act were incorporated under this act of parliament so as to attain collective management and use of pastoral resources. The group ranch was initially conceptualised due to its popularity among the Maasai since it gave them assurance of safe and secure land rights against alienation by non-Maasai. The ongoing dissolution and ensuing subdivision of group ranches was a result of the failure of the group ranches to achieve their intended objectives mainly of ensuring security of land tenure and improving the livelihoods of the Maasai pastoralists.

3.4.2 Privatization of Land Tenure

The government's failure to respond to calls for disbandment of group ranches in the early 1980s was occasioned by doubts in the administration itself and disputes among government departments against each other. The fear for severe land erosion in areas set aside for cultivation, fear of alienation of the Maasai by non-Maasai people on land, loss of Maasai culture and limitations on wildlife and livestock mobility formed the basis for those who argued against the disbandment and eventual subdivision of the group ranches. They argued that the subdivisions would affect meat production and functions for attracting tourists amongst the Maasai. Archambault et al. 2016 argued

that private land holdings were beneficial in that they offered households alternatives for livelihoods and more certainly an assurance of a modern sedentary lifestyle. They further report that private land holdings were viewed as a way of preventing neighbouring ethnic groups from encroaching to their fertile rangelands and further annexation of huge chunks of land by the state for agriculture, conservation or even for industrial purposes (Ibid).

Mwangi, 2007a observes that continued land tenure experiments by international donor agencies, pre and post-colonial governments have been aimed at acquiring more exclusive land rights for developing pastoralism amongst the Maasai. The group ranch system was viewed as the bridge between communal land ownership and the transition to individual private land ownership (Archambault et al. 2016). Most of the land in Kajiado County's rural areas does not have title deeds as opposed to the urban and peri-urban areas. This situation is attributed to little knowledge of absence of awareness on the value of the title deed to a land holder. The situation is worsened by communal and group ranch land ownership models in the county together with limited number of land registration offices across the county (Kenya, 2014). The erection of fences around privately owned parcel is most common in those communities that have privatized land. The fence is ideally used to define, mark, defend and enclose privately owned land. This is eventually a source for dramatic effects on mobility of livestock and restrictions for access to grazing land as well as other natural resources requiring new arrangements to be put in place (Archambault, 2016).

Lesogorol, 2008 supports the arguments that land tenure changes have impacts on land use changes and decisions. She notes that the shift to private land from communal tenure system among the Samburu resulted to new land uses including leasing or even selling of land which provided food and income for the short while though it eventually threatened the community's welfare especially in cases where an entire private land was sold.

3.5 Land Fragmentation

According to Hobbs et al., 2008 there is a very rampant fragmentation of rangelands globally. The growth in human population, changes in climate and intensified fragmentation of rangelands is such a major challenge faced globally by pastoralist today (Archambault, 2016). Galvin et al., (2008) pointed out that multiple factors of

humans and dynamic natural process such as fires, landslides, floods amongst others that can establish barriers to dissection of natural ecosystems are to blame for environmental fragmentation. However, their study on causes of rangelands fragmentation, pointed out that use of land by humans together with land tenure systems, household decision making bodies, history of the pastoral group, pressures from human population, protected and settlement area policy, their nearness to markets, multiple heir for inheritance and sales of land, urbanization – especially the growth of industrial and settlement activities, livelihoods commoditization especially to meet market demands, high market access and use, access to goods and utilization of opportunities brought about by education, human population growth, increased cultivation and fragmentation of land that is carried out with the aim of promoting the move away from nomadic/subsistence farming to sedentary/commercial production of livestock as the major root causes of fragmentation.

Flintan et al. 2011 posits that both endogenous factors such as social changes and exogenous factors of losing dry season grazing land to large -scale investors as the main drivers of rangeland fragmentation. They point out to issues of privatization of communal land, sedentarization, the conversion of land to agriculture, conflicts, water schemes and population pressures as playing key roles in rangeland fragmentation. Their arguments suggest that land use changes are driven by fragmentation of pastoral rangelands in need to sustain their livelihoods. They note that due to the adoption of sedentary kind of settlements, households have had to establish houses for settlements, and due to small sizes of land, they have had to shift to agricultural activities though unviable among other emerging land use decisions. They note that communal decisions have somewhat diminished being replaced by individual household decisions all as a result of rangeland fragmentation.

3.5.1 Land Fragmentation in Kajiado County

Demands for food requirements such as grain and products from livestock increases with increase in the number of people or rather with growth of population especially at the household level. The need to supplement household food needs with other alternatives increases when livestock production is on the decline or stagnating as it results to decrease in per capita units of livestock and so contributing to reduced supply of livestock products of meat, milk and blood. The Maasai lifestyle experiences devastating effects emanating from any decrease or decline in the productivity or

production of livestock. The renewed concern is as due to the declining livestock productivity, farm efficiency and persistent food security problem in Kajiado County. This community still relies on livestock for their livelihood. This indicates that productivity and production of livestock must be increased if the community's food security and standards of living are to be improved.

3.5.2 Impacts of Land Fragmentation on Food Security

According to Thornton et al. (2007) livelihoods that are livestock-based options are threatened by subdivisions of groups ranches that increases the rate of fragmentation of land. According to them, group ranch subdivisions contributes to notable decrease in numbers of livestock partly due to the fact that households are forced to sell their animals to raise the needed cash and eventually experiences detrimental effects on food security and herd size. Boone, et al., (2005) on the other hand opined that subdivisions of the Maasai communally held group ranches to individual private owned land holdings in Kajiado District were ongoing. They observed that large herds of livestock owners knew that it was totally impractical to keep such large herds on small minute land parcels. Land fragmentation is as such considered a factor that contributes to under productivity of pastoralism and a threat to food and livelihood security.

Sere et al. (2008) attribute fragmentation to increased cropping and sedentarization that leads to decreased rangelands for grazing, restricted pastoral mobility and reduced dry season grazing reserves buffer. This has the effect on sustaining livestock for food and livelihoods security in the pastoral communities. Kimani and Pickard (1998) findings showed that ranch subdivision was consistently on the rise among pastoralists especially in Kajiado who sold the subdivided plots to non-pastoralists who fenced off their plots; adopted cultivation rather than pastoralism and cropping became common even among the Maasai of Kajiado. They report their findings that the subdivision and fragmentation of decreasing livestock productivity which is a threat to food and livelihood security. They concluded that the resultant small plots from subdivision and fragmentation that the Maasai are ending up with, cannot currently provide an adequate source of subsistence from sedentary livestock production. Climate change, intensified fragmentation of rangeland and growth of human population pose a major challenge to current residents of Kajiado County. Most parts of the county are experiencing land fragmentations especially due to either transformations of land tenure or as a result of

subdivisions of former communal lands into individual privately-owned land and use changes.

3.6 Household Land Sizes

Land subdivision reduces the land holding sizes (Lusenaka, 1996). Production of livestock in Kenya is mainly by pastoralism in which case societies keep livestock as a source of livelihood especially in the ASALs (Ewoi, 2014). Pastoralism according to Ewoi, 2014 is fully dependent on labor, pasture and water availability with water being the major factor that limits the sector from thriving. In this context, the essential role of land as a factor of production and its vital role in livestock production with the inverse value in enhancing food and livelihood security. He postulates that the shrinking land base and the changing climatic conditions further worsen availability of pasture in the already dry pastoral regions (ibid). Land subdivision is also a key factor influencing the size and use of household land. Gicheru et al. (2010), noted that smaller land units resulting from land subdivision are not capable of sustaining the rural peoples' life which is depended on agricultural activities as there means of livelihood, hence resulting to food insecurity and diversion to other means of livelihoods either in the smaller or larger urban areas.

The farm sizes have been declining as a result of land subdivision for inheritance (Kenya, 2013). In Kajiado, the household land sizes have undergone uncontrolled subdivision. Group ranches subdivision has resulted into smaller units which cannot support sustainable livestock farming. The population is increasing with no commensurate increase in the agricultural area. Farms may get smaller and when continuously subdivided they become economically unviable (Skienicka, 2016). Land subdivisions leads to significant reductions in number of livestock kept partly due to the fact that most of the households are forced to sell most of their animals to raise cash for household needs eventually causing serious lasting effects on size of herd and household food security.

The size of arable land in Kajiado county covers 3468.4Km² and equals to 15.8 percent of the county's total land area of 21,900.9Km². household land holding sizes in the county averages 9 and 70 ha for small scale and large-scale farmers respectively (Kenya, 2014).

3.6.1 Impacts of Household Land Size on Food Security

Various studies carried out by different scholars have pointed out how land uses and sizes affect rural livelihood and food security. FAO (2011) highlighted how land fragmentation in rural parts of Africa leads to constraints food productions increasing risks for food security. The renewed concern is as a result of the declining livestock productivity, farm efficiency and persistent food security problem in Kajiado County. The productivity and production of livestock in Kajiado county has to be improved if the household food security and people's standards of living are to be increased in this community which still relies on livestock for their livelihoods. Studies like Conelly and Chaiken, (2000) have showed how livelihood and food security in rural Kenya is jeopardized due to land subdivision and small landholdings. Ravallion, 1997 in Jayne et al (2003) supports the argument that household land size is a key determinant to food security since poverty is associated with the inability to service basic needs comfortably. Khan and Gill (2009) found that food availability requires the increased production of crops and livestock products. They reported that marginalization of land contributes negatively to food accessibility which is a determinant factor of food security.

Galvin et al. 2008 note that fragmented landscapes can only maintain smaller animal and human densities as compared to intact landscapes that have similar resources within the same area that can sustain high human and animal densities. They further argue that fragmentation has significant consequences on livelihoods and biodiversity conservation. They support their arguments by accepting Kimani and Pickard, 1998 who observed that that subdivision of land within the pastoral communities, especially in Kajiado County, have resulted to selling the small plots to non-Maasai who in turn fence them off hindering animal mobility, access to resources as water, change of land use such as for housing, increased cultivation, and as such decrease in animal productivity. This affects food and livelihood security of a household amongst the region's pastoral communities, case which is replicable in other pastoral communities in Africa.

The greatest tragedy of all according to Kibugi (2009) is the subdivision of the ranch since it comprises the division of group's land parcel into small land parcels that are individually owned. FOLA, 2011 in USAID, (2013) argues that subdivision of the group ranches resulted to smaller land sizes, increased crop production and cultivation

and land sales increased. In addition, the subdivision resulted to higher intensity in agricultural production over smaller fragile lands. It also led to higher intensity growing on smaller more fragile lands. Agricultural activities on such parcels are largely unsustainable and households can't farm enough to support their families. Campbell et al. (2005) reiterates that, as a result of subdivision of group ranches and subsequent subdivisions of the land allocated to households due to land tenure changes will result to majority of the Maasai holding very minute parcels that are not viable for agricultural production and therefore unable to sustain livestock based livelihoods which would most likely force the community to sell their livestock and even the land allocated to them.

A study by Tittonell, (2007) showed that farmers who had relatively larger farm sizes had longer periods of food security as compared to them that had smaller farm sizes. They pointed out that households which had achieved 12 months' food self-sufficiency owned almost twice the area of land owned by the food insecure households. Arable land that is available in east Africa is extremely subdivided into very small and minute units that are not economical to any form of production and they eventually result to highly fragmented systems of production and low productivity which is a recipe for food and livelihood insecurity (Salami et al. 2010). Obonyo et al. (2016) study findings concluded that small land acreages arising from fragmentation, leads to low yields in terms of food and livestock productivity and hence household food insecurity as the produce could not sustain households throughout until the next harvest.

Ntiati, 2002 observes that pastoral land subdivision has the negative effects of declining livestock productivity associated with fencing off of subdivided plots, privatization of individual land and new settlement for pastoral communities and in migration due to land fragmentation which has a huge impact on land use as there is no more available room for animal mobility across landscapes. Gurung, et al (2016) noted that a farmer's landholding size was the most important indicator of well-being in a contemporary rural livelihood. Dixon et al. (2001) posited that increasing the area under herd or farm by way of consolidating the current land holdings or extending farming to new agriculture rich land would be a very reliable option contributing to household food and livelihood security and poverty eradication.

A study conducted by Amwata. et al. (2016) found a positive significant relationship on the influence of household land size to its food security in the pastoral and agro pastoral drylands of Kajiado and Makueni counties. They posit that those households with larger land sizes had higher possibilities of being food secure since they produced more from their farms with all other factors holding constant. Alemu et al. (2017) on Effects of Land Fragmentation on Productivity in Northwestern Ethiopia asserts that land fragmentation overall effects, of reducing farm land sizes, on productivity and net farm income undermines livelihood prospects of small holder farmers insinuating that livelihoods are largely dependent on land productivity and farm net incomes for which their increase or decrease affects the overall household's food and livelihood security.

3.7 Household Land Uses

Africa is the only continent with the largest share of its total population committed to pastoralism and has the largest percentage of its total land surface of 40 percent dedicated for pastoral use (Behnke and Freudenberger, 2013). Land use refers to the utilisation of the available land resources at the disposal of an individual for the satisfaction and fulfilment of human wants (Wandera, 1997). The major land uses in the arid and semi-arid areas have been nomadism in the arid regions, transhumance in the semi-arid regions and agro-pastoralism in sub-humid regions. Land use is characterized by the organization, actions and inputs people undertake in a particular land cover type to produce, which can change or sustain it (FAO, 1999).

Socio-economic factors are the main drivers of changes in land use though restricted by physical conditions. Changes in construction and cultivated land which are strongly inter-related with production activities of humans are the main features of these land use changes (Long, et al., 2007). The current trend on changes in the use of pastoral land occasioned by land subdivisions comprises of intensive and long-term grazing of livestock on privately owned land parcels with households having limited alternatives for mobility. This replaces the original case where pastoral land was mainly a system composed of extensive seasonal mobility and short-term grazing of succeeding pastoral rangelands.

3.7.1 Household Land Use in Kajiado County

Growing of crops and keeping of livestock are the main land uses in Kajiado County. Livestock production is mainly by nomadism which is predominant in the entire

Kajiado county. The emergence and growth of commercial, industrial and residential land uses in the urban areas of the county form some significant changes on how land is used in the county. Just a small share of the county residents undertake subsistence crop production since land in the county is not arable in most places making crop production untenable. Vegetables, beans, maize, cassava and potatoes are the main crops produced for food in the county. Further, horticulture done in irrigation schemes is gaining acceptance in the county particularly in Kajiado North and Isinya sub counties (Kenya, 2014).

Kenya, (2014) Agricultural Sector Development Support Programme (ASDSP) report on household baseline survey in Kajiado report an average farm sizes of 9ha and 70 ha for small- and large-scale farmers correspondingly. According to this report, food crops occupy 1055ha while cash crops occupy an estimated 60ha. Rainfed agriculture is dominantly practiced for the large farms exceeding 50 ha though poor rainfall patterns is discouraging the agricultural method. Keeping of bees is slowly gaining momentum as an alternative to livestock rearing in some parts of the county while in other parts fish farming is highly promoted with 650 fish ponds already erected in these various places of the county (Kenya, 2014). Majority of the households in Kajiado's rural areas depend on livestock as the major source of their livelihoods. Goats, sheep, cattle for beef and dairy, camel, pigs, and donkeys, chicken both indigenous and exotic for commercial and subsistence are the main livestock types reared by households in the county. The livestock types are a source of hides and skins, milk and meat for household, commercial and industrial use. Land subdivisions and land sales have greatly influenced the number of group ranches that have greatly dwindled (Ibid).

3.7.2 Impacts of Household Land Use on Food Security

The alienation of highly productive land to other uses is most common in Asia and Africa making it difficult to be accessed by pastoralists who have to do without it (Behnke and Freudenberger, 2013). The allocation of rural land uses in third world countries is phenomenal in the alleviation of poverty, attaining food security and controlling changes in the environment (Duc et al., 2014). Tefera et al., (2016) note that pastoralism is one of the most valuable, if not the most valuable, land use system found in dry land areas.

Payne (Undated) points out that developments of land for residential purposes in the rural areas impacts on land-based resources as these developments occupy the most productive areas that interact with forestry and farm lands. This implies that household land allocation has the ability to determine food and livelihood security. Githui (2015) reports that land use has an impact on food security of a household. In his findings, he pointed out that a unit change in use of land allocated for varied crops had a significant correlation with food security of the household while agreeing that governance and climate changes as other factors that impacted household food security. Maengwe (2017) observes that demographic factors and economic changes are key determinants of land use and have huge impacts on household food security. A study conducted by Lusena (1996) indicates that land's ecological potential and household resource allocations have significant on the household's socioeconomic performance while disputing the argument that land size has influence on resource allocation. This argument suggests that a pastoral based household's sustainability is largely reliant on the land's ecological potential as well as resource allocation.

Both land size and use has many positive and negative impacts on food and livelihood security worldwide (Donkers, 2014). Expansion of agricultural lands leads to increased food production which in turn may lead to realization of food security while reduction of agricultural lands leads to reduced agricultural production thereby resulting to food insecurity (Wanjiku, 2015). A draft policy on food security issues in Kenya indicated that competing uses for land have tended to reduce the land area dedicated to food farming. This is attributed to need to use land for multiple crops for production which in the end affects the productivity of the entire farm, however big or small it is, and hence a resulting household food insecurity.

Findings by Walangitan, et al (2012) on optimization of land use and allocation to ensure sustainable agriculture in the catchment Area of Lake Tondano showed that households that allocated a large farming area to a single crop, especially rice, corn or forest stood better yields to support decent lives as compared to them that practiced mixed crop farming at equal plots sizes. Pichon, (1997) observed that farmers with bigger herds of cattle spared largest portions of their farms for pasture purposes while decreasing allocations of their farms under food crops. He further noted intensive cultivation and use of land by farmers with smaller farm sizes who even cleared most parts of the forest for perennial and annual crops. The study findings showed that use

of land for ranching contributed to less clearing of forests for pasture purposes for those households that held larger farms as opposed to those with smaller ones.

3.8 Factors that Influence the Size and Use of Household Land

Land size and use among the pastoral communities in Kenya has been influenced by a number of factors. It is imperative to note that perhaps the transformations of land tenure that privatizes formerly held communal land to individual holdings and/or land use changes that forces pastoralists to devise new diversifications for their livelihoods such as conservation of subsistence cultivation results to ongoing fragmentation of pastoral rangelands in most pastoral settings globally (Archambault, 2016). According to Pichon, (1997), the farmland's topographical location, fertility of its soil, household resource endowments and settlement duration especially the age of the farm have considerable impacts on land use decisions. Ogechi and Hunja (2012), observed that agricultural land fragmentation, increase in population and urbanization results to a decrease in agricultural land and food production leaving the rural livelihoods food insecure. Walker et al., (2002) argue that the economic ability of a household, availability of labor, house holding farm size, need for survival, existing socio-political and economic environment determines household land use decisions.

Olson et al., (2004) note that the forces behind land use changes are complex and linked to each other as they evolve over time. FAO (Undated) notes that agricultural activities, mining and allocation of land by the government for national parks and conservation areas have resulted to declines in grazing areas. Fear of land expropriations, according to Western and Nightingale (2003), is the primary driver of rangelands subdivision. Kipainoi (2016) further reiterates that Maasai pastoralists in Narok and Kajiado suffered encroachment by small-scale farmers from the highlands pushed by population pressure. This further saw continuous loss of pasture land.

Increase in population density in the rural areas is also a key factor affecting the size and use of household land (Menberu, 2014). An increase in the number of people calls for a proportionate increase in food demands especially grain and livestock food products. A need for supplementing household food requirements occurs when production of livestock decreases. This is occasioned by the fact that per capita decrease in livestock numbers results to shortage in supply of livestock products of meat and milk. Essentially, the decline in livestock numbers have far reaching implications to the

lifestyle of the Maasai people and to pastoralists in general. Campbell et al. (2005) pointed out that policy changes; immigration; population growth; demarcation of park; weather and rainfall patterns like drought, rainfall levels, among others; economic viability of agriculture like commercial opportunities; infrastructure development mainly roads and urban centers; subdivision of land; changes in land tenure systems; interactions of social and environmental processes over time; education and relief features such as mountains and slopes; swamps and rivers as being the main driving forces for land use decisions and changes among the Maasai community of Loitokitok Division.

Increase in population density exerts more pressure on the agricultural land which results to smaller land sizes, lower incomes and higher off-farm enterprises (Agbo et al., 2014). Population increase increases the proportion of land used for settlement purposes. Consequently, the size of land allocated for agricultural purposes reduces resulting to food and livelihood insecurity (Muyanga and Jayne, 2014). Population increase also leads to increased vegetation clearance which comes as people clear land to settle on it and as a result increased soil erosion which reduces agricultural production is observed (Menberu, 2014). Leonard et al. (2011) findings show the size of a household, age of the farmer and household structures concurrently relate to both the land use intensity and extent of operations on the farm in consideration of environmental conditions. A study conducted by Kodiwo, (2012) reveals that socio-economic factors, including and not limited to demographic characteristics, education, income differentials, farm inputs, and distance and land tenure were the majority contributors to the spatial variations in land use intensity between farmsteads.

Sakimba, (2016) reported that decrease in grazing land and increase in bare land among the pastoral Maasai of Kajiado County was as a result of deforestation, expansion of cultivation and settlements, human population growth, land use changes, rising grazing pressure due to restricted herd movements (sedentarization), reduced rainfall. He points out that these factors have largely influenced land use and size among the nomadic, sedentary and non-nomadic pastoralists of Kajiado County. Sakimba, (2016) further noted that land use was affected by increased droughts, growth in population, and loss of livestock productivity which resulted to increased cultivation, land subdivision and restricted movements especially in sedentary pastoralists.

Rapsomanikis, (2015) observes that policy measures such as regulations restricting rural-urban migration, subsidies, and taxes together with population growth in the rural areas and urbanization against a fixed agricultural land affects farm sizes. These policy implications on land distribution and allocation are a driver to land fragmentation and hence small uneconomical land sizes, Shuhao, (2005). Sere et al. (2008), point out that increased population is a driver to land use changes among the pastoral communities. The population increase in turn results to land fragmentation. They additionally argue that climate change is another major influence on the use of land as a rise in temperatures, expansion of dry lands and a reduction in primary productivity incomes and food security come in handy, these forces changes in the use of land to sustain livelihoods.

Jayne et al., (2014) further supports Headey and Jayne, (2014) by noting that population growth puts pressures on land resulting to diminishing farm sizes in arable rich African countries. Headey and Jayne, (2014) note that small farms are getting smaller and will continue to shrink as the population continues to grow. This implies that population growth is a determinant of farm sizes and particularly it encourages land subdivision for settlement and food production purposes. Bremner, (2012) reports that farms in Africa will likely get smaller as a result of subdivision of agricultural land by farmers among their children attributing this to continued growth in rural population.

3.9 Coping with Changes in Food Security

Archambault (2016) in his study in Elangata Wuas, southern district of Kajiado titled '*Re-creating the commons and re-configuring Maasai women's roles on the rangelands in the face of fragmentation*' noted that residents adopted new pastoral mechanisms that aided in livelihood diversification in response to privatization of previously held communal lands and rampant land fragmentation. Land fragmentation is reported to have profound effects on mobility of livestock which is core to thriving of pastoralism in extreme climatic environment that doesn't favour pastoralism in rangelands across East Africa.

Pastoralists have developed and adopted different strategies to maintain their pastoral economy. The maximisation of herds, dispersion of herds, stock mobility and diversification of herds have been the core alternatives that the pastoral communities have adopted in efforts to reduce risks associated to their livelihoods in a harsh and

volatile environment. Stock mobility was adopted purposely to ensure livestock get access to sufficient minerals, fresh water and pastures and eradicated competition, overgrazing and disease outbreaks. Maximisation of herds was so essential in maintaining as many female animals as possible basically for increased milk and its by-products production and ensure adequate supply of these products to the household. Further, this aided in the building of a large size of the herd for purposes of reducing risks, survival, and recovery after the recurrent droughts.

3.10 Possible Planning Interventions

Different authorities have provided literature on necessary interventions to solve the challenges of land size and use within the pastoral rangelands especially in Kenya. A study by Kibaara et al., (2009) suggest that policy changes to control declining landholding are needed. Kibugi, (2009) suggests that the state should enact and implement an integrated rangelands administration policy; the disbandment of group representatives' system; territorial definition and general governance as portions of the policy. Besides a legal and policy framework, he further recommends that adaptive measures such as preempting the subdivision of group ranches, arrangements for post group-ranch subdivision and the legal options should be flexible as they provide opportunities for maintaining large tracts of land that can enhance livestock productivity as well as ensure food and livelihood security for the pastoral communities.

Bruce et al (2013) observes that protection of pastoralists access to and use of land by policy makers solely depends on the efficiency and productivity of the land in view of the policy makers. Basupi et al. (2007) supports these arguments by noting the need for policy makers to focus on sustainable goals for land management including flexible and negotiated tenure frameworks that enhance the participation of pastoralists in making of decisions and to overcome anti-pastoral prejudice. Ewoi, (2014) recommends that, besides legal and policy change adoption, pastoral communities should diversify their livelihoods. Galvin et al. (2008) suggest that pastoralists diversification to agricultural activities to support their livelihoods, social bonding/capital and networking /connectivity amongst them is a major step to handle land tenure fragments and provide the much-needed land size and use for sustainable livestock productivity.

Kimani and Pickard, 1998 suggest the group ranches should be kept intact and identification of ways of improving their management would be a sure way of ensuring

consistent livestock productivity. On their part, Kimiti et al. (2018), they note maintenance of grazing lands are critical strategies for achieving sustainable pastoral livelihoods. This to ensure livestock productivity is maintained year in out. Ntiati, (2002) presupposes that land reconsolidation may be inevitable to provide sufficient grazing area for livestock which allows mobility of animals to access season based grazing areas and other vital resources like water. Mulianga, (2009) suggests that seasonal land sharing model through seasonal land rights for pastoral communities should be encouraged which would aid access to vital resources especially during the dry spells. This suggestion is upheld by Western and Nightingale (2003) who suggest that configuration to seasonality and aridity together with adjustments to land holding sizes are possible interventions to land size and use challenges among the pastoral communities. They further propose that closed-membership land owners associations should practice reciprocal grazing arrangements amongst themselves to aid in livestock mobility and open up access to pastures and diversifications on and off the land to enhance sustained pastoralism and support food and livelihood security together with minimizing the effects of consistent droughts among the pastoral communities especially in Kajiado County.

3.10.1 Diversification

The pursuit of any activities that are income generating in a non-pastoral way whether in rural or urban areas is pastoral diversification. Pastoral diversification may involve multiple retail and wholesale trade mechanisms such as selling of livestock or livestock products of milk, meat, skins and hides and other non-livestock products like honey, goods from artisan works, letting property for rental income, property sales, employment for salaries or wages whether local or non-local comprising of working as a hired herder, a farm labourer, migrant worker, engaging in commercial or subsistence crop farming, hunting and gathering and selling of products from the wild like resins and Arabic gum, plants that are medicinal or even firewood (Little, 2001). Notably, pastoral diversification does not include selling of livestock and/or their products at the farm or herd gate together with the strategies that comprise of a mixture various species of animals to cope with effects of drought among others (Ibid). A recent development founded on the arrival of an exclusively livestock-based livelihood strategy overarch the billing that only the Maasai are primarily pure pastoralists (Marshall 1990).

Marshall convincingly postulates that the bi-modal rainfall patterns that are common in most parts of the world today was a result of climatic changes that occurred about 2000 to 3000 years ago. The effect of this bi-modal patterns of rainfall was a favourable condition of the environment that saw an all year-round dependence on milk for food by East Africans (Ibid). Livestock keeping combined with hunting and gathering, subsistence cultivation in a small scale and fishing were the main livelihood means for East Africa pastoral communities before the climatic shift. Interestingly, even in the immediate past some pastoral communities such as the Maasai divided into sections such as the Arusha and Parakuyu that in addition to keeping of livestock practiced cultivation while others like the Kisongo practiced pure pastoralism. Additionally, pastoral livelihood diversification is themed by restricted mobility that is corelated to high levels of impoverishment. Nevertheless, Fratkin and others show that pastoralists have embraced cultivation such as the Ariaal and the Rendille of Northern Kenya and even a more complex system of pastoral sedentarization (Fratkin and Roth 2005).

3.10.2 Development Control

The act of regulating or even managing the undertaking of any activities (works) on land or even making any changes on use of any structures on land and ensuring adherence to the physical development plan is known as development control (Physical Planning Act, 1996). The main function of development control is to manage and regulate development of properties and ensure all developments on land occur in the right place and time and in a way that completely agrees with the pre-determined set standards and policies. Aluned and Dinye (2011) notes that development control is either pre, during or post project development stages sited in a location that is unapproved. Maengwe, 2017 recommends controlled subdivision of land and stricter policies that discourage holding of land for speculation purposes. His recommendations are based on the findings that land subdivision has negative impacts on livestock productivity with notable decrease in production of cattle for beef in Kaputiei North, Kajiado County.

3.10.3 Rural Urban Migration Control

The rural – urban migration basically refers to the movement of people from the rural hinterland to urban areas or towns. Kenya is currently facing a major shift in rural – urban migration with the preference to move to urban areas increasing the growth of urban population and the country increasingly becoming urbanized. The need to get

employment and improve the standards of living are considered the main reasons behind the unprecedented growth in rural-urban migration with employment being considered the core factor that pushes people from the rural areas to the urban centers. The hope to get employment opportunities largely considered available and more in urban areas than are in the rural areas stirs desire for people to migrate to the urban areas.

3.11 National Strategies and Policies

Some of the national strategies and policies relevant to the study include: sustainable development goals; vision 2030 on agriculture sector on sustainable development; Science, Technology and Innovation Strategy of Africa; Agriculture Sector Development Strategy among others as discussed below:

3.11.1 Sustainable Development Goals

Sustainable Development Goal number two aims to end hunger, achieve food security, improve nutrition and promote sustainable agriculture (United Nation, 2018). According to the SDG review report of 2017, efforts to combat hunger and malnutrition have advanced significantly since 2000. According to the report, focused and endless efforts are required particularly in Africa and Asia if food insecurity, hunger and malnutrition for all are to be fully eradicated. Agricultural productivity must be increased through increased agricultural investments by aid and government spending.

The SDG goal two has several targets and indicators to measure the success of the world population towards zero hunger. The aim of target 2.3 is to double the incomes for small scale producers of food and the productivity from agriculture. This target also includes equal and secure access to land, financial services like credit, value addition opportunities, knowledge, other inputs and resources that are productive, markets and even off-farm employment particularly for women, family farmers, fisher men, indigenous people and pastoralists by 2030. Clearly the SDGs has provided the framework and the need to improve on food production towards realising global food security as well as improving livelihood through income levels.

3.11.2 Vision 2030 on Agriculture Sector and Sustainable Development

Kenya adopted the Kenya Vision 2030 economic development blueprint in June 2008. The main aim of the blueprint is to make Kenya a middle income industrialized nation by the year 2030 with her citizens having access to higher quality life in a secure and cleaner environment. The social, economic, and political pillars are the core

foundations under which the blueprint is established. The vision identifies agriculture as a core sector that would play a critical role in maintaining the envisioned annual growth rate of the country's economy. The adoption of modern, innovative and commercially based agriculture is deemed to replace the smallholder subsistence agriculture to aid in achieving the intended objective. The agricultural transformation would be attained by changing core agricultural institutions on wildlife, livestock and forestry and promoting the sector's growth by raising the country's tree cover, livestock and crop productivity, enacting and adopting new policies on use of land for better exploitation of high and medium potential land, improve access to markets especially for smallholder farmers by enhanced management of the supply chain and value addition to forestry, livestock and farm products before they get to local, regional and even international markets.

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

According to the African Union (2014), a total 239 million Africans are directly affected by food insecurity challenges. Further, 30 to 40 percent of children under five years are constantly exposed and suffer chronic mal/under nutrition at this critical stage of their lives when they have to survive and their physical and cognitive development. The African Union stresses on agricultural and rural economy development by programs and tools such as Comprehensive Africa Agriculture Development Programme (CAADP) that would aid in poverty alleviation and accelerate socio-economic developments in the continent. A declaration to end hunger in the continent by the year 2025 was adopted unanimously by heads of state and governments of African Union member states, international organizations representatives, cooperatives, private sector, youths, farmers, academia and other 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. The first priority is to eradicate hunger and attain food security. This is associated with research and innovation in areas such as agronomy, agriculture, in terms of farming techniques, soil, seeds and climate (African Union, 2014).

3.11.4 Agriculture Sector Development Strategy (ASDS, 2010-2020)

The Agriculture Sector Development Strategy (ASDS 2010 – 2020) came about as a result of the subsequent revision of Vision 2030 to devise the Strategy for Revitalizing Agriculture (SRA, 2004 – 2014). The aim of ASDS 2010 -2020 is to ensure the country

is prosperous and attains a food security status by the year 2020 with a shift from subsistence agriculture to agri-business or commercial oriented agriculture.

3.11.5 Economic Recovery Strategy for Wealth and Employment Creation

This entails the policies and strategies that focused on economic recovery-oriented policies and completely disregarded and any policy on reduction and alleviation of poverty. The main objective of the ERS that was launched in 2003 was to create wealth for the citizens of the country and steer it back to the path of economic growth and prosperity. The ERS blueprint stressed on the growth of the economy, employment and wealth creation as the major tools towards poverty alleviation and ending food insecurity. This marked a remarkable shift from focus reduction of poverty. Agriculture was determined as the main productive driver towards recovery of the economy. Investment in research, extension and development in agriculture and revival of agriculture-based institutions was considered as a way to harnessing the sectors growth and productivity and so enhance sustainable economic growth. As a result, ERS became the launching pad in the revitalization of the agricultural sector (Kenya, 2010).

3.11.6 Strategy for Revitalizing Agriculture

In response to ERS, the Kenyan Government in March 2004 devised and launched the Strategy for Revitalizing Agriculture (SRA). The core vision of SRA as set out in government was to transform the country's agricultural sector into a commercially based, regionally and internationally competitive and profitable economic activity that is a core source of income generating employment and high quality of life for the citizens. The government aimed at achieving this within the context of increased incomes from the farms and harnessed agricultural productivity in tandem with environmental and land conservation. This SRA strategy indicated the governments vision of a paradigm shift in the agricultural sector basically to a commercially and profitable agribusiness and away from subsistence agricultural production. SRA therefore assigned specific activities, tasks to be undertaken and guidance on achieving the set vision (Kenya, 2010). The target for a real agricultural output to steer its average annual growth rate of 3.1 percent in 2003 to 5 percent by the year 2007. The growth and development of agricultural sector was considered top notch priority due to its core role in reducing poverty and a livelihood means especially in the rural areas.

3.11.7 World Initiative for Sustainable Pastoralism (WISP)

The World Initiative for Sustainable Pastoralism (WISP) concerns itself as the foundation for capacity and advocacy building. Its main objective is to advocate for increased attention to the value attached to development of sustainable pastoralism as contributing to the management of the environment and reduction of poverty. WISP is globally interconnected with the main focus of empowering pastoralists with knowledge and skills that enables them to show their effective and efficient system of production and use of land and to manage the dry lands sustainably as a tool for harnessing dry lands resources globally.

3.11.8 Livestock Projects Addressing Food Security

ASAL Based Livestock and Rural Livelihoods Support Project was devised to run for a period of six years in 22 arid and semi-arid districts of Kenya. The projects core objective of ensuring rural based livelihoods and food security conditions increased sustainably was to be achieved through improved productivity of livestock, support and marketing strategies for management of droughts and initiatives for food security. Healthy animals, sustainable improvement of livestock, food security and drought management initiatives and marketing of livestock were the four core elements of this project. Beneficiaries, the republic of Kenya and the African Development Bank (AfDB) were the project financiers. The expected outcomes of the project include decreased food insecurity as a result of increased employment in the rural areas, increased incomes, an empowered community in the rural areas by participatory approach, decreased mortality rates for livestock and improved supply of water and improved sustainable rural livestock livelihoods (Kenya, 2009).

3.12 Theoretical Framework

From global literature, several theories exist that have been used to back the study. Some of these theories include tragedy of the commons, bid rent theory and sustainable livelihood theory as discussed below:

3.12.1 The Tragedy of the Commons

Garret Hardin published the Tragedy of the Commons in 1968. The core of the theory is that an individual acting independently and rationally rendering their own egocentricity depletes common resources even if its against the best interest of the group. The folktale that is tragedy of the commons exerts itself to elaborate why common resources are depleted faster than is expected in contrast to the position of the

entire whole society. Many attribute overgrazing as the main contributor to the tragedy of the commons especially amongst the pastoral communities of the world. This occurs due to the high numbers of cattle that actually devour too much grass rendering the commons unsustainable. This grass devouring in the dry seasons triggers the tragedy in the pastoral commons. Further, the case is different for the Maasai pastoralists since the grass was for instance devoured by farming rather than by cattle. The analogy of a farmer's decisions to devour more grass by cultivating more or expanding his farm more into the grazing areas compare to the devouring of grass by more and more cattle numbers. One can only account to others very little incentives on the grass benefits in these two instances.

The fate of a common pasture is described by Garrett, 1968. He denotes that this pasture is not owned by any specific person and it is available for use by all. Each herder therefore has self-interest to the other to maximally exploit use of this common resource at the community's expense. Here egocentrism overrules common interest as one uses the grass for their selfish interest without caring for the interest of the entire society. To capture this self-interest, a farmer adds more heads of cattle to his already large herd for maximum use of the available common grass. In this context, unfortunately, the overgrazing cost is equally spread amongst each user of the pasture. Incidentally, overgrazing of the pasture occurs as all herders respond to the incentives and so the tragedy strikes. Here, farmers individually act independently and rationally in deciding to bring in more animals to feed on the common grass on the shared pastures since it is to their benefit if they free the grazing area. Unfortunately, the whole group/community suffers because each individual acted individually in this manner causing a depletion of the common shared resource.

3.12.2 Bid Rent Theory

Bid rent is the value of land for different purposes. The theory states that land values are highest at the city centre due to land scarcity that calls for high-rise buildings at the central business district and ease and better access by public transport. Due to this, the values of land decrease the further away the land is from the central business district/city centre with exception to some specific desirable areas such as the main road intersection points where the values peak. According to bid rent theory, the bid for land differs for different uses/functions of land in various areas of the city with the easily and highly accessible areas having higher values. The theory suggests that land values

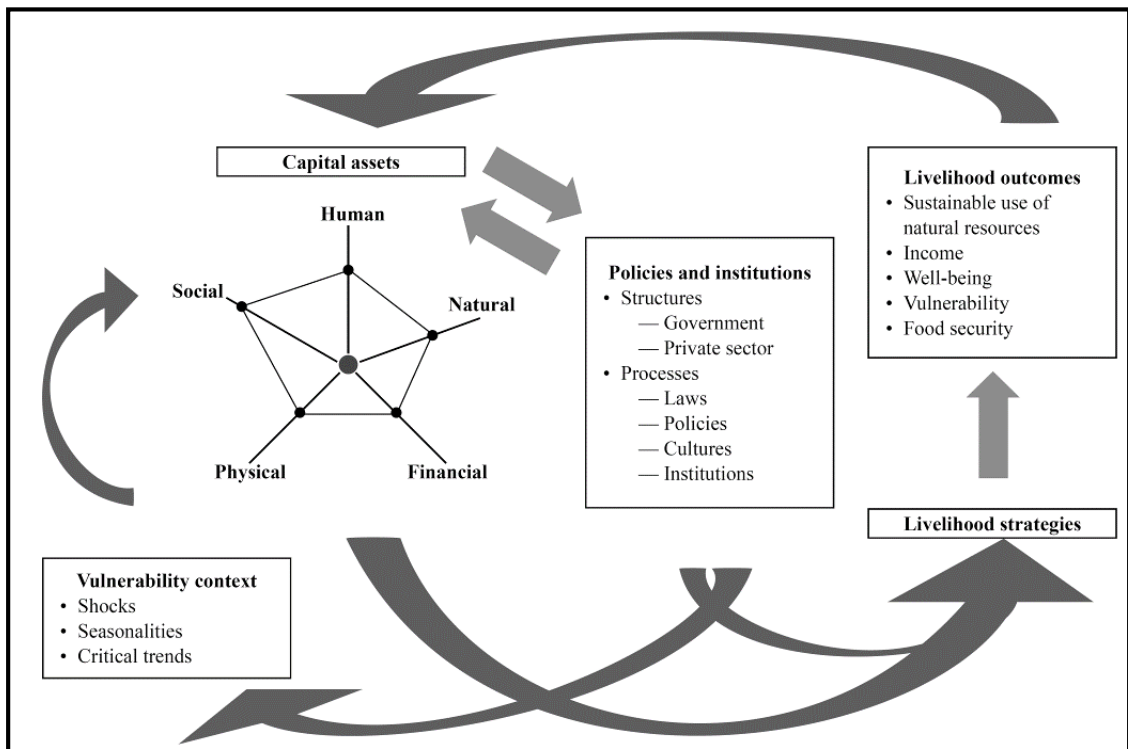
are influenced by government policies, nearness to secondary shopping sites, security, and local site features.

3.12.3 Sustainable Livelihood Theory

A livelihood is a means through which people utilize their abilities and the resources they have to make their living while a sustainable livelihood is the one resilient and able to recover from stress and unexpected disturbances, retain or improve its assets and properties and provide a sustainable means of livelihood for the next generations while supporting other sources of livelihood at the local and worldwide extent in the short and long term (Carney, 2016). A livelihood has many components but the most important one is the capital assets out of which people make a living (Haan, 2012). This resource includes both tangible properties and resources and intangible ones such as claims (Su and Shang, 2012). In most cases households combine different capital assets readily available to them in different ways in order to undertake a livelihood activity which enables them to earn a living (Knutsson, 2006).

Carney (2016) explains five capital assets in a household, they include; natural capital that are assets that occur naturally on the earth's surface. They include; land (soil), water and air and environmental services such as pollution sinks and hydrological cycle from which resources are transmitted and services to make a living are derived. Financial or economic capital that includes the capital base and economic assets required by the rural poor to carry out various livelihood activities. Capital base for a livelihood includes money, savings and credits and debits from financial institutions. Physical capital that includes basic infrastructure such as roads and buildings, equipment's used for production purposes and various technologies involved in carrying out a livelihood activity. Human capital that involves being physically fit, able to work, being healthy and having the skills and knowledge required to execute different livelihood activities. Finally, social capital that are social networks, affiliations, social networks, and associations that people create when carrying out different livelihood activities that require coordinated efforts. Figure 1 shows the five capital assets as explained by Carney (2016).

Figure 2: Sustainable Livelihood Framework



Source: Carney, 2016

Sustainable livelihood approach provides variety of activities that the poor carry out in combination in order to make a living (Lisocka, 2015). This is very important for the poor people who carry a number of different economic activities as their means of livelihood (United Nations, 2009). Also, by creating awareness of the different assets that the poor use to make a living, the approach provides a holistic view on what resources are important for eradicating poverty among the poor. In addition the sustainable livelihood approach gives poor people the insight to the underlying causes of poverty among them (Krantz, 2001).

Although the sustainable livelihood approach gives a comprehensive and integrated approach to poverty eradication among the poor, it is faced by a number of weaknesses. They include; the approach does not clearly define who the poor people are and what constitutes poverty. Poverty is a multi-dimensional issue and cannot be eradicated by only addressing the economic perspective of the poor people (UN, 2009). This factor has to be put in place if this theory is considered to be applied. Also the sustainable livelihood approach is faced by biases during program planning and implementation (Krantz, 2001)

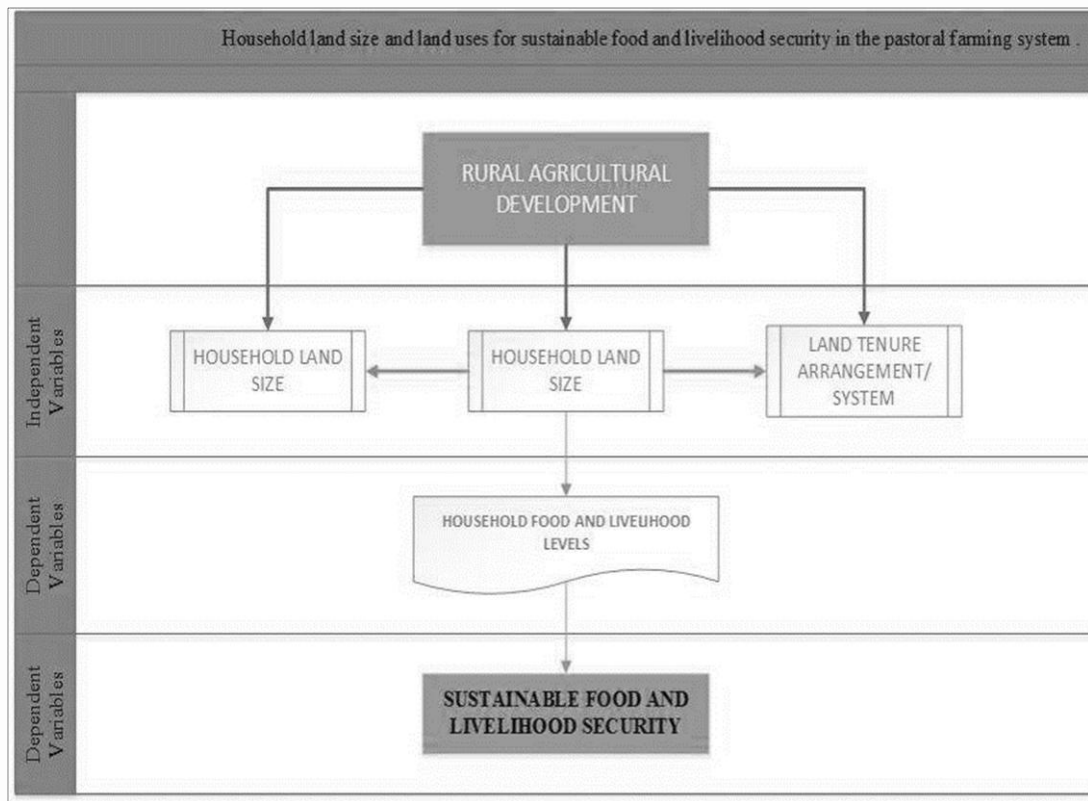
3.12.4 The Basic Resources Theory

The theory of basic resources is amongst the original and most preferred theories which have been adopted widely in the third world countries to promote households development particularly in the rural areas (Davis and Cobb, 2009). According to the theory, the economic development occurring in a specific place and/or community is depended on the presence, quality and extent of the natural resources in that locality (Umebau, Onwe, & Oruku, 2008). This theory of basic resources theory also acknowledges the fact that the availability of natural resources in any particular area would attract both local and international investors and as a result more income to the local people and employment would be realised (WTO, 2010). Notably, there must be skilled and qualified manpower to tap an areas potential for the existing high quality and sufficient naturals resources if its economic potential is to be exploited, developed and of value to the community of the particular area (Umebau et al., 2008). (Davis and Cobb, 2009) observes that assuming economic development will obviously occur in any particular economic area due to mere presence of high quality and sufficient natural resources in that particular region is totally incorrect.

3.13 The Conceptual Framework

The model for sustainable livelihoods forms the basis for this study's conceptual framework as this model provides a way of assessing how land use affect land size and its influence on land transfer and how these three factors contribute to livelihood security (Solesbury, 2003). Food and livelihood security and socioeconomic characteristics are influenced by land size, use and land ownership rights; hence the need for constant review of these factors and integration of the beneficial land management practices in the study area.

Figure 3: Conceptual Framework



Source: Author, 2018

3.14 Conclusion

Over the years, ASALs have experienced a shift in the pattern of household land-use mainly from nomadic pastoralism to sedentary pastoral and agro-pastoral production, or to pure cultivation. Unprecedented population growth, overgrazing and excessive cropping pressure has led to large areas of this lands undergoing some degree of land degradation. This adversely affects the productive capacity of these lands and livestock production in general. Increased rangeland fragmentation, climate change and human population growth are major challenges that residents in Kajiado County are faced with. In many parts of the county, tenure transformations play a major role in the process of fragmentation as previously communal lands are privatized into individual holdings, and/or changes in land use. In Kajiado, household land sizes have undergone uncontrolled subdivision. Group ranches subdivision has resulted into smaller units which cannot support sustainable livestock farming. The population is increasing with no commensurate increase in the agricultural area. Farms may get smaller and when continuously subdivided they become economically unviable. Livestock numbers also

decline as a result of subdivision; this is partially because households have to sell more livestock in order to generate the needed cash.

CHAPTER FOUR

THE STUDY AREA

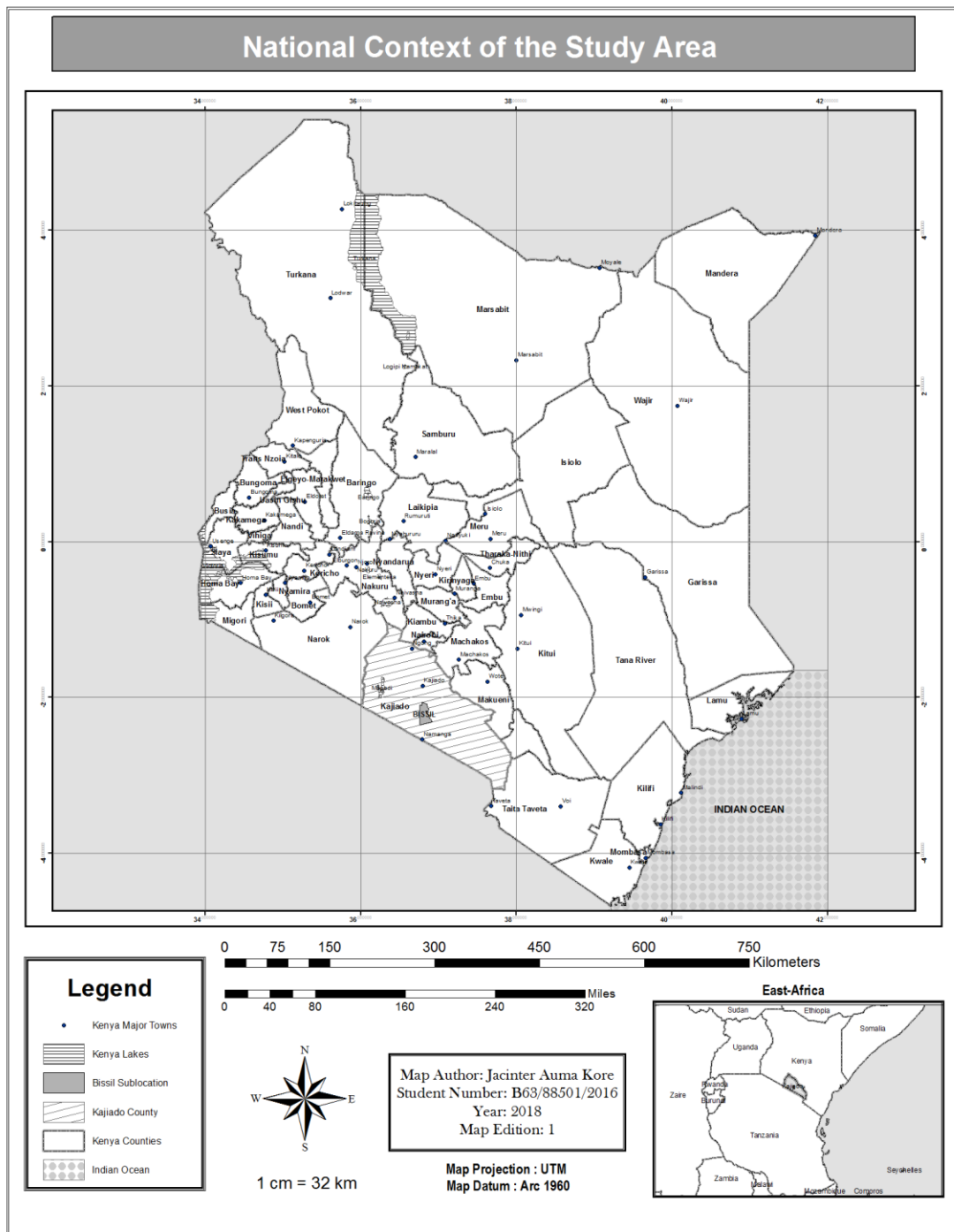
4.0 Introduction

This chapter outlines the geographical coverage of the study area in terms of its spatial placement in the national and local context; physiographic features which include Physical, topographical and climatic conditions; demographic dynamics in terms of population size and composition as well as population density and distribution. The chapter also outlines the socio-economic characteristics, land and land use as well as social and physical infrastructure of the study area.

4.1 Location

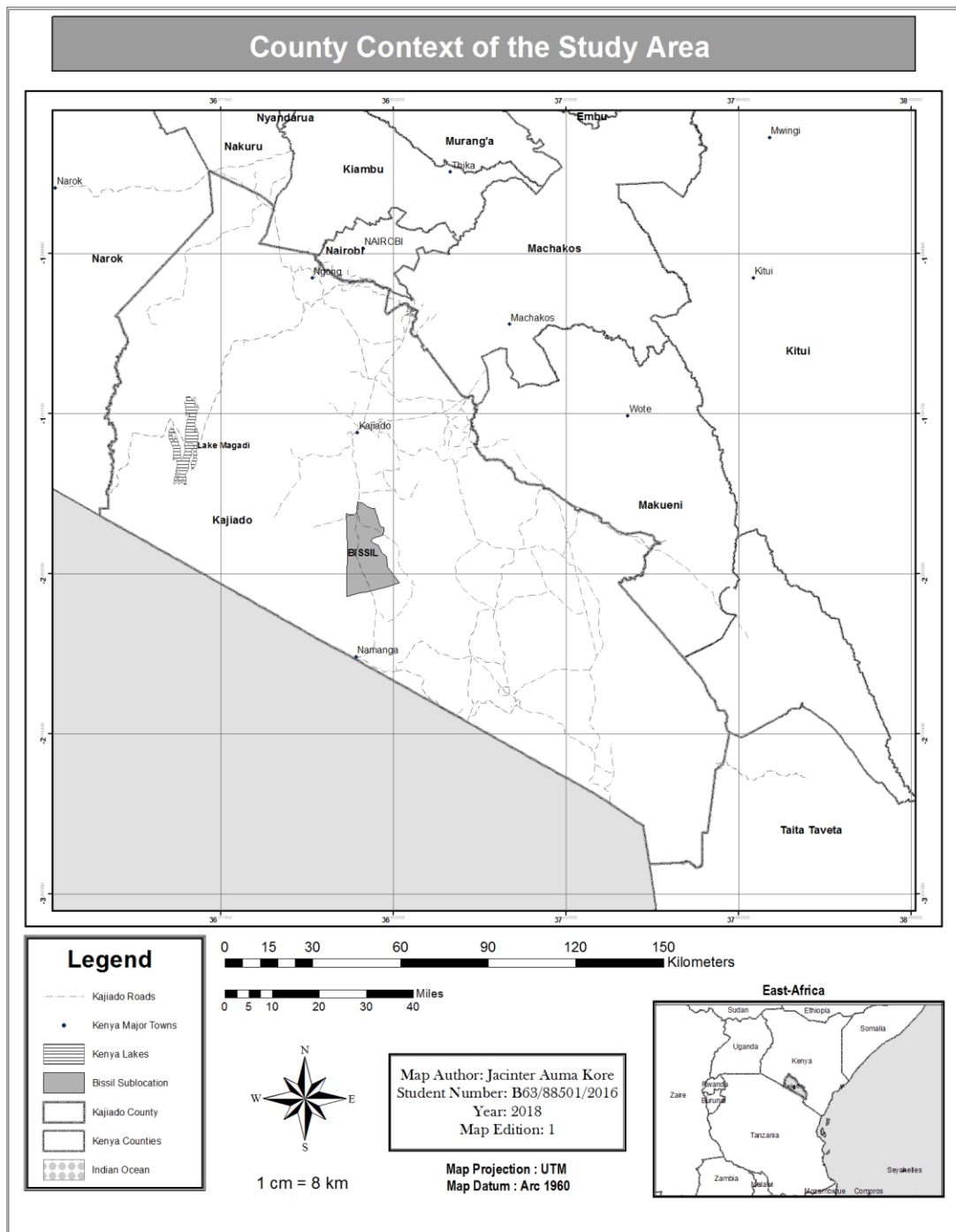
Kajiado County is situated on Kenya's southern area with a total coverage area of 21,900km². The county borders Machakos and Makueni counties to the East while Nairobi and Kiambu counties are on its North East and North respectively. The county shares its West and South West boundaries with Narok County and the United Republic of Tanzania with Taita Taveta County lying on its South East. Bissil sub location is located approximately 30 km from Kajiado town. The geographical location of Bissil sub-location at the ward, sub-county and national context is shown in the following maps 1 to 3.

Map 1: National Context of the Study Area



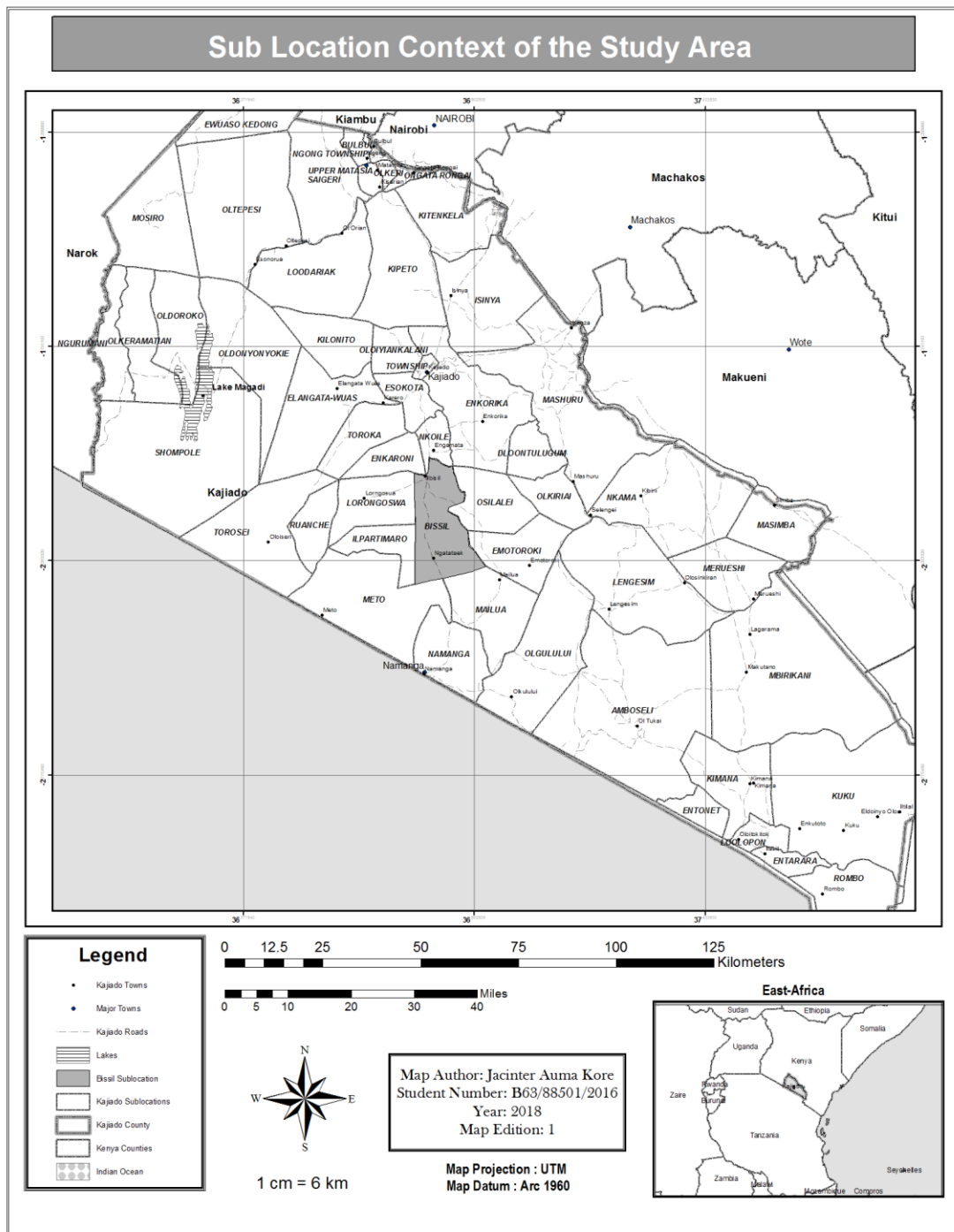
Source: Author, 2018

Map 2: Study Area County Context



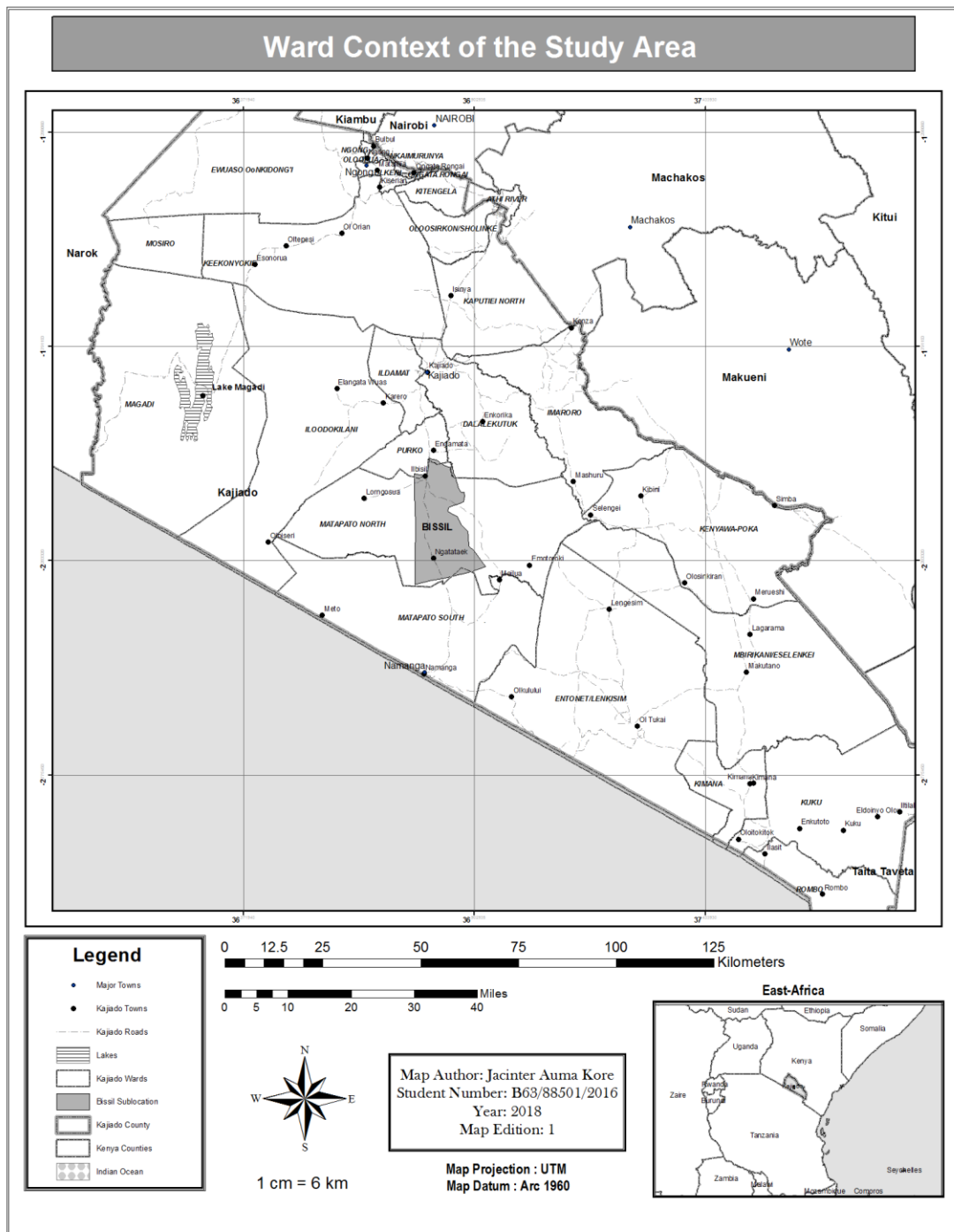
Source: Author, 2018

Map 3: Study Area in Local Context



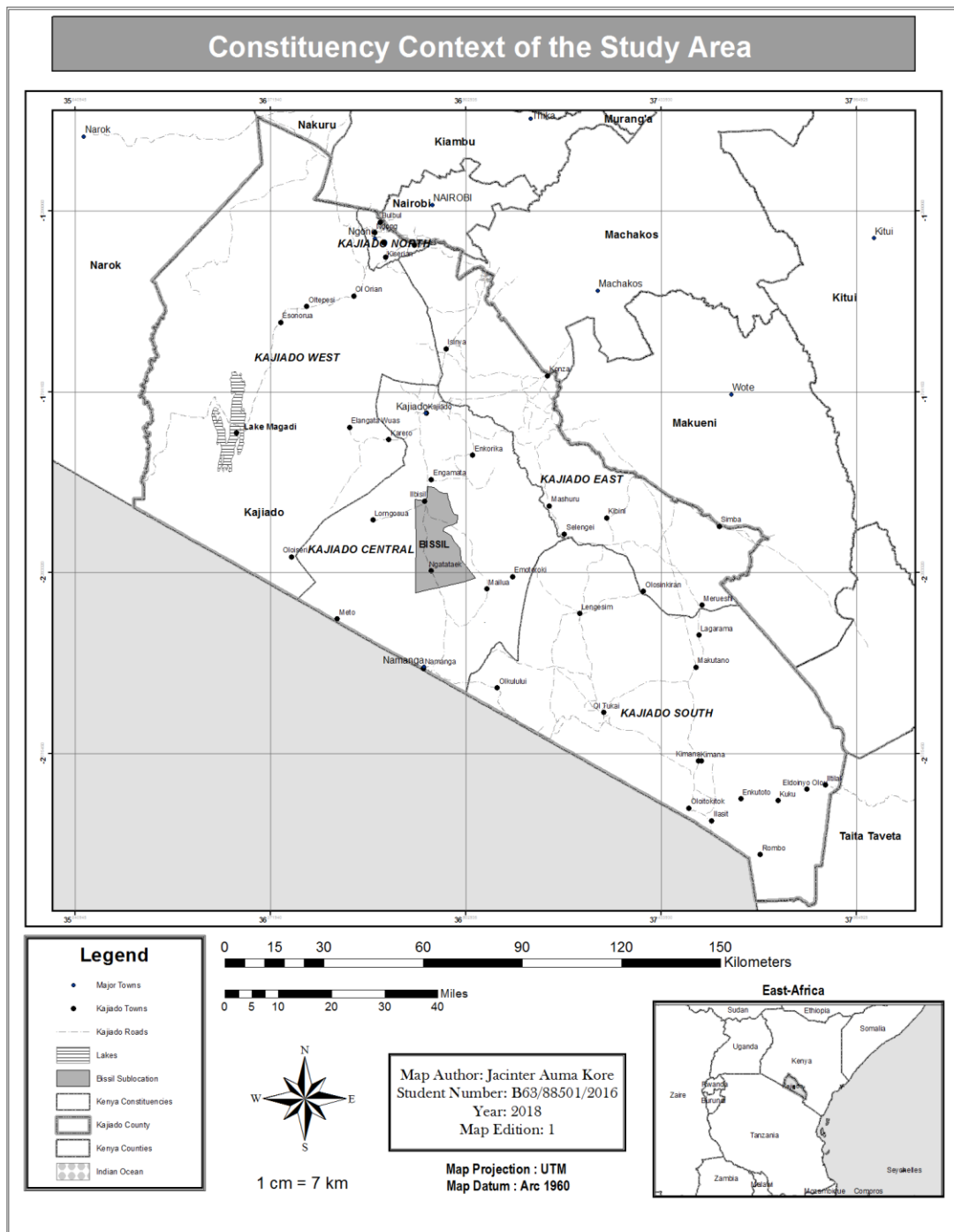
Source: Author, 2018

Map 4: Study Area in Ward Context



Source: Author, 2018

Map 5: Study Area in Constituency Context



Source: Author, 2018

4.2 Physiographic Conditions

This section outlines the physical and topographical features as well as the ecological and climatic conditions of Kajiado County.

4.2.1 Physical Features

Valleys, plains and irregular volcanic hills are the major physical features found within Kajiado county. The altitude varies from 500m to 2500m above sea level at L. Magadi and Ngong Hills respectively. The Athi Kapiti plains, the rift valley and the central broken ground are the major topographic features of the county. The rift valley runs from north to south forming a truncated depression on the west of the county where Mt. Suswa and L. Magadi are found. Its steep faults form the more common scarps, plateau and structural plains in the county. Considerable soda ash mineral deposits are found and exploited from the lake. The gently undulating slopes that roll and turn hilly near Ngong Hills are the main characteristics of Kapiti plains with an altitude range of 1580 to 2460 meters above sea level. Kiserian and Mbagathi tributaries feed Athi River which has its catchment on the hills. The central broke ground stretches 20 to 70Km wide across the county from its northeastern border to its southwest with an altitude variance of between 1220 and 2073 meters above sea level.

4.2.2 Ecological Conditions

The Pleistocene, the quaternary and basement rock soils are the major geological areas found in Kajiado county with Alluvial soils as well in some parts. The rift valley is home to the quaternary volcanic soils while basement rock soils are found majorly along the river banks and the valleys with composts of cists, crystalline limestone, quartzite, and gneiss. The region within L. Amboseli is where Pleistocene soils are found especially due to its inland drainage system. Several quarries for construction materials are also available in the county. Lake Magadi is found at a region in the county where most of the rivers drain at the floor of the rift valley without major outlets and so are limited to shallow lakes and depressions.

The topography of the area, its climate and source of the underlying rock are key determinant of underground water. Within the county, the yields from ground water vary from 0.01 to 35.77 cubic meters an hour. The underground water is mainly used for irrigation, livestock and domestic purposes since its on average of good quality. Further, on the slopes of Mt. Kilimanjaro are very high yielding springs that yield on average 20 to 50m³ per hour. Domestic and livestock can as well obtain sub surface

water from dams, pans and shallow dams found in various parts of the county. Rainfall, type of soil and altitude determine the type of vegetation in the county though its often modified by human and wildlife activities. The main activities of browsing, grazing, cultivation, burning of charcoal and harvesting of firewood greatly reduce the vegetation cover especially in the lower parts of Mt. Kilimanjaro where clearing of indigenous vegetation is rampant mainly to pave way for agricultural production. Further, in the low altitude areas are scarce vegetation that increases with increase in the altitude. Grazing and rainfall intensity influence the ground cover that is seasonally oriented all over the county. The cover with canopy varies from heavily settled areas at 1 percent to the steep hills at approximately 30 percent.

The county is hugely endowed with broad ranges of flora and fauna. The gazelles, hyenas, wild beasts, zebras, elephants, leopards, warthogs, lions and elands and a rich diversity in birds' species. The Chyulu hills conservation area of 445km² and the Amboseli national park covering 392km² are the major game reserves that fall within the rangelands in the county.

4.2.3 Climatic Conditions

Two rain seasons – bi-modal pattern of rainfall – are experienced in the county. The long rains fall within March and May while the short rains commonly known as the second season of rainfall occurs between October and December. The rainfall in the county follows a general gradient pattern as it increases with altitude. The rainfall pattern varies within the county with a more pronounced long rains in the western parts and heavy short rains on the eastern parts of the county. The quantity of rainfall varies across the county. The Amboseli basin receives the minimum rainfall of 300mm and it peaks within the slopes of Mt. Kilimanjaro and Ngong hills where it hits 1250mm. season and altitude define the temperatures of the county which range between 10°C and 34°C at the eastern slopes of Mt. Kilimanjaro in Loitoktok and within L. Magadi respectively. July and August are the coldest months of the year while its hottest between November and April.

4.3 Population Factors

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

4.3.1 Size of Population

The 2009 national housing and population census shows the total population of Kajiado county stood at 687,312 persons of which males were the majority at 345,146 against 342,166 females. The county population was projected to grow at 5.5 percent to stand at 807,069 in 2012 comprising of males at 405, 285 and females at 401,784. This population was expected to stand at 898,291 persons made up of 451,093 males and 447,198 females in 2015 and to 999,819 comprising of 502,077 males and 497,742 females by 2017. This population growth demands increased investments in socio-economic facilities, health, agriculture and education together with creation of income generating opportunities of employment for the citizens. The 2009 census report detailed that a total 40,299 residents being 21,042 and 19,257 males and females respectively were in search for employment. This was equivalent to 10.45 percent of the county's productive population. The county has very limited openings of employment for her residents with a dire need for intensified mechanisms to be adopted that can aid in generation of off farm incomes especially through livestock diversification and growth of small-scale medium enterprises (Kenya, 2014).

Table 2: Kajiado County Population Projections by Age Cohort

Age cohort	2009 Census			2012 Projections			2015 Projections			2017 Projections		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	56172	54591	110763	65959	64103	130062	73415	71348	144763	81712	79412	161124
5-9	48440	47402	95842	56880	55661	112541	63309	61953	125262	70465	68955	139420
10-14	40160	39366	79526	47158	46225	93383	52488	51450	103938	58420	57265	115685
15-19	32318	34114	66432	37949	40058	78007	42238	44586	86824	47012	49625	96637
20-24	33929	43374	77303	39841	50932	90773	44344	56688	101032	49356	63095	112451
25-29	35722	36250	71972	41946	42566	84512	46687	47377	94064	51964	52732	104696
30-34	26909	24084	50993	31598	28280	59878	35169	31477	66646	39144	35034	74178
35-39	21693	18752	40445	25473	22019	47492	28352	24508	52860	31556	27278	58834
40-44	15178	12571	27749	17823	14761	32584	19837	16430	36267	22079	18287	40366
45-49	10912	9402	20314	12813	11040	23853	14262	12288	26550	15873	13677	29550
50-54	7460	6382	13842	8760	7494	16254	9750	8341	18091	10852	9284	20136
55-59	5161	4079	9240	6060	4790	10850	6745	5331	12076	7508	5934	13442
60-64	3716	3508	7224	4363	4119	8482	4857	4585	9442	5406	5103	10509
65-69	2305	2255	4560	2707	2648	5355	3013	2947	5960	3353	3280	6633
70-74	1885	2003	3888	2213	2352	4565	2464	2618	5082	2742	2914	5656
75-79	1083	1159	2242	1272	1361	2633	1415	1515	2930	1575	1686	3261
80+	1939	2718	4657	2277	3192	5469	2534	3552	6086	2821	3954	6775
N/S	164	156	320	193	183	376	214	204	418	239	227	466
Total	345146	342166	687312	405285	401785	807070	451092	447197	898289	502077	497742	999819

Source: KNBS, 2009.

The county has a very young population with 0-4 years at 16.1 percent forming the dominant age cohort compared to 0.67 percent over 80-year olds that are the smallest age cohort in the county as per Table 2. Notably, the population decreases across all age cohorts except a slight increase in age cohorts 20-24 and 25-29. The sex ratio is 1:1 for males is to females accordingly.

4.3.2 Density of Population

As of 2009, according to the census report, the population density of the county was 31 persons per square kilometre and it was projected to grow to 46 persons per kilometre square by 2017 marking an almost 50 percent growth over the eight-year period with an almost 8 percent annual growth rate. High densities are common in the urban areas as opposed to the scarcely populated rural areas of Kajiado county as shown in Table 3.

Table 3: Population Distribution and Density by Constituency

Constituency	2009 Census		2012 Projection		2015 Projection		2017 Projection	
	Population	Density	Population	Density	Population	Density	Population	Density
Kajiado North	202651	1369	237912	1603	264865	1879	294857	2087
Kajiado Central	102978	24	120896	29	134592	34	149833	37
Kajiado East	137254	53	161135	62	179390	72	199703	80
Kajiado West	106933	14	125492	16	139709	19	155529	21
Kajiado South	137496	21	161420	25	179707	29	200057	33
Total	687312	31	806856	37	898263	41	999979	46

Source: KNBS, 2013

Kajiado North constituency is the most densely populated constituency with a population density of 1,369 persons per square kilometre while the lowest population density of 14 persons per square kilometre are in Kajiado West constituency. Kajiado West low sparsely distributed population density is attributed to its vast land mass and unfavourable climatic conditions that hinder agricultural production and human settlement.

4.4 Social Characteristics

The Maasai community are the main inhabitants of the sub location. The Maasai practice social activities that revolve around their cattle. Cattle rustling is currently being eliminated by the law but a common practice centered on belief that all cattle were given to the Maasai by God and so they own all cattle on earth. They live together in villages called Kraals comprising of the Inkajjik (Manyatta houses). Cattle and their byproducts of milk, blood and skin are very core in the Maasai life as source of food,

clothing and shelter. The Maasai are semi-nomadic in nature and mostly lived under communal land management system. Their livestock mobility is seasonal based and most frequently on a rotational basis.

4.5 Economic Characteristics

The Maasai community are the main inhabitants of the sub location. The dominant economic activity they are engaged in is livestock rearing. They mainly keep sheep, goats and cattle as their primary source of income. Livestock serves as a social utility and plays an important role in the Maasai economy. Trade involves livestock for another livestock, cash or even livestock products. The economy is largely depended on the market economy with livestock being traded for cash in market. The cash is used for acquiring beads that form a very important part of their life, clothing mainly shuka particularly the red one and grains for food. However, with the diminishing household land sizes as a result of privatization of land tenure and sale of family land to outsiders, crop farming and business are slowly emerging as economic activities.

4.5 Cultural Characteristics

The Maasai practice cultural and religious beliefs that are based on their live as pastoralists. They practice female circumcision in a society where education has not completely taken form. The Maasai women are responsible for putting up the Inkajjik mostly from hides and locally available materials with the dung of cattle smeared on the wall of the manyatta. Young boys are trained to be responsible warriors at tender age especially after circumcision where they learn roles of raiding cattle, chasing young girls, and game hunting. After graduating from a Moran and turning to a warrior, one becomes responsible for their home by settling in marriage, acquiring cattle and becoming a responsible elder.

4.6 Land Use

Agriculture is the dominant land use in the county. Particularly the growing of crops and rearing of livestock are the core uses of land in Kajiado county. Significantly, nomadism is the predominant land use across the entire county. Notables changes in land uses are more significant in the urban areas where commercial and industrial land uses are gaining momentum. Only 15.8 percent of the entire land mass in Kajiado county is arable. This makes up a total arable land size of 3,468.4Km² of the total county land mass of 21,900.9km². The household land holding sizes average 9 and 70 Ha for

both small scale and large-scale farmers respectively. A total 1,067.58 Ha are under food crops in the county with only 50.59 Ha under cash crops. Majority of residents in the highly productive areas of Isinya, Loitoktok and Nguruman have smaller farms that are put under irrigation. Majority of the large-scale farms that exceed 50 acres are rain fed even though they are losing traction due to poor and irregular unreliable rainfall patterns.

4.6.1 Livestock Production

Most of the rural households in Kajiado county depend on pastoralism as the major source of their livelihood. Goats, sheep, indigenous and exotic chicken, donkeys, dairy cattle, pigs, beef cattle and camels are the main breeds of livestock kept in the county. These livestock breeds are source of milk, beef, hides and skins in the county. There is however very few value additions ventures in the county. Table 3 outlines the number of the livestock breeds in the county.

Table 4: Number of Livestock in the County

No.	Breed	Number
1.	Sheep	718,950
2.	Goats	699,658
3.	Beef and dairy cattle	411,840
4.	Commercial chicken	276,291
5.	Indigenous chicken	267,913
6.	Donkeys	63,980
7.	Pigs	6,127
8.	Camel	1,597

Source: Kajiado, 2013: pp 18

Major subdivisions of group ranches, land sales and human settlement have all contributed to huge decrease in ranch numbers despite a relatively high livestock population that appears to remain steady over the years. A total of 38 adjudicated group ranches remain in the county compared to 16 others that haven't been adjudicated.

4.7 Physical Infrastructure

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

4.7.1 Transportation

Kajiado county is served by road, railway and air transport. The county has a cumulative total road length of 2,344.3 km of which 300km are tarmacked roads. The Emali – Loitoktok, Isinya – Kiserian, Namanga – Athi River, Kiserian – Ngong – Karen and Magadi – Mbagathi are the five major tarmac roads in Kajiado county. Earth roads cover a total of 1,111.9km while a total 932.3km are gravel roads. Further, a total railway line of 147km connect Tata Chemicals Limited (previously known as Magadi Soda Company) to the meter gauge Nairobi – Mombasa railway line. The railway line plays a pivotal role in aiding the exploitation of Soda Ash which it transports to Mombasa together with its by-products. Kajiado county has a total of seven airstrips with one airstrip found in each of its seven sub-counties. There are found in major economic areas being Kajiado, Oololoitikosh, Loitoktok, Magadi, Ngong, Daraja towns and Amboseli National Park.

4.7.2 Water and Sanitation

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

4.7.2.1 Water Resources and Quality

Water in the county is obtained from both natural and man-made sources. Various sources of water in the county include rivers, lakes, shallow wells, water pans, dams, protected and unprotected springs and boreholes. Water is used for livestock, domestic and commercial purposes. The county rivers are mostly seasonal with just a few permanent rivers while the underground water has high levels of salt in some parts of the county. Water resources development, management and maintenance of water infrastructure is done by Tana Athi Water Services Board. The provision of water and sewerage services is done by water service providers who also undertake to ensure efficient and economical provision of water and sewerage services in the entire county. Water access is mainly by water taps and wells in various parts of the county. Household members travel an average 10 km in search for water for their homesteads. Water connectivity and access is poorer in the rural areas with the urban areas having better access attributed to high numbers and connectivity of water networks by the service providers in urban areas than the rural areas.

4.7.2.2 Sanitation

Kajiado county boasts of adequate sanitation conditions. Despite this, a paltry 2,407 of the total 87,120 households in urban areas are connected to a main sewer system. A

total of 17,157 households rely and are connected to either septic tanks or cesspools. An approximated 50 percent of total rural households practice open defecation being 44,203 of the total 86,344 households.

4.7.3 Energy

Charcoal, firewood, solar, electricity and petroleum products are the main sources of energy in Kajiado county. A total of 39.8 percent of households are connected to the main grid. This consists of 69,098 households out of the total 173,464 households in the entire county. Majority of the 39.8 percent of household connected to electricity are found in the urban areas. Solar, wind and geothermal energy sources remain underexploited despite their huge potential.

4.7.4 Posts and Telecommunications

Kajiado county is served by six postal offices spread in different parts of the county and mainly in major towns of Kitengela, Kajiado, Rongai, Loitoktok, Namanga and Ngong while only one sub-county doesn't have a postal office – Mashuuru sub-county – that utilizes the Kajiado post office. Further, three private courier services have presence in the county together with 20 licensed stamp vendors spread across the county. The county has a 60 percent mobile network coverage with all urban areas having a 100 percent coverage. Mobile network service providers include Safaricom, Airtel and Telkom with most parts of the rural Kajiado county having little or no mobile network coverage at all. As per the census of 2009, Kajiado North had the highest landline connectivity at 10.6 percent while Kajiado Central and Loitoktok had a coverage of 0.9 and 0.6 percent respectively.

4.8 Social Infrastructure

This section outlines the educational and health facilities in Kajiado County.

4.8.1 Educational Institutions

A total 76.7 percent of ECDE potential population has been enrolled for pre-primary education being 42,565 pupils of the total 52,091 total potential ECDE population for both boys and girls in the county. This calls for increased sensitization if 100 percent enrollment to pre-primary education is to be achieved in the county. A total 925 ECDE centers served by 2211 basic education and early learning tutors with a teacher to pupil ratio of 1:19. As of 2013, a total 155,955 pupils were enrolled in 514 public and private primary schools throughout the county. The number of boys enrolled was 52 percent than that of girls at 48 percent and a net enrolment rate of 86.19. The teacher to pupil

ratio stands at 1:60. Further, a total 20,122 students were enrolled in 104 public or private secondary schools in the county as of 2013. A total 2,614 teachers were instructing these students with a teacher to student ratio of 1:21. The primary to secondary school transition rate was at 54 percent majority of whom were boys. A total secondary school enrolment stood at 32 percent meaning majority of eligible students didn't enroll for secondary school education or perhaps a very high dropout rate if compared to the primary to secondary school transition rate. The Maasai Mara University is the only public university with a campus in the county while several private universities exist in Kajiado county. Numerous public and private middle level colleges have operations in the county.

4.8.2 Health Facilities

The Kajiado County Government runs a total 60, 16 and 4 dispensaries, health centers and sub-county hospitals respectively within the county. Further, private individuals, faith and community-based organizations and non-governmental organizations run multiple other health facilities being 101 clinic, 27 dispensaries, 7 health centers, 6 hospitals and 13 nursing homes. Further, a total 62 community health units have been initiated by the county government with 37 being active currently while the rest are out of operations. The nurse to population ratio stands at 1:1,068 while that of a doctor to population is at 1:26,094. On average, a household covers 14.3 km to access a health facility with just 9.9 percent of the entire county population having access to a health facility under a kilometer from their household mainly in the urban areas.

4.9 Conclusion

The high population growth rate in the county which stands at 5.5 percent per annum, higher than the national average of 2.9 percent has led to tremendous pressure on the natural resources particularly land where sub-division is now a common phenomenon in the sub-location. Areas close to Bissil town are gradually being converted to commercial and residential areas. The desire for a better lifestyle has lured the community to sale of their lands for big cars, houses or money. This practice has rendered some households landless despite the fact that they had over 100 acres to their name. With no grazing fields, livestock rearing is no longer feasible in the sub location and some households are being forced to look into alternative sources of livelihoods.

CHAPTER FIVE

DATA ANALYSIS AND RESULTS

5.0 Introduction

This study assessed how changing household land size and use affected food security in Bissil sub-location. The information was obtained after administering household questionnaires to the residents of Bissil sub-location, interviewing of key informants including County Lands Officer, County Physical Planner and County Agricultural Officer, conducting of Focus Group Discussions and use of photography. This chapter is therefore a compilation of the research findings of the primary data collected from the household questionnaires, interview schedules, observation checklist among other methods of primary data collection. This section analyses the field work data and interprets the information with regard to respondents demographics, land tenure arrangement/systems, effect of household land size and use on food and livelihood security, factors influencing the size and use of household land, coping mechanisms to address food insecurity and optimal household land size for sustainable food and livelihood security. The chapter concludes with the testing of the hypothesis adopted for the study.

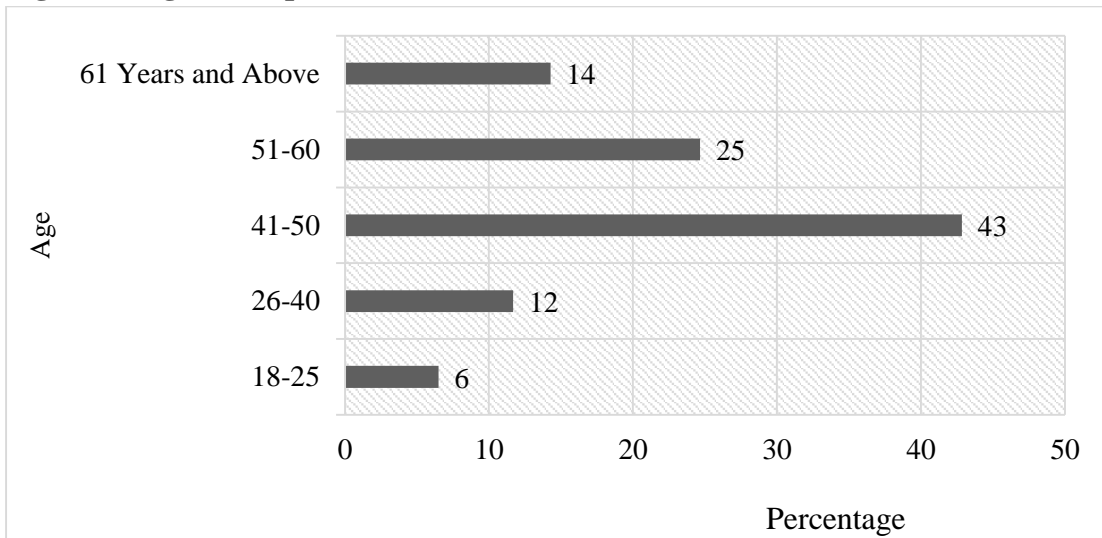
5.1 Attributes of Respondents

This section discusses the age and gender of the respondent, household size and education level and their implication on land and food security in the sub-location.

5.1.1 Age

About 83 percent of the respondents are aged 41 years and above with majority aged between 41-50 years as represented by 43 percent of the respondents (Figure 4). This implies that the sample consisted of mature adults who had lived in the area for a significantly a long period of time and were key in making land and land use decisions. Only about 6 percent of the respondents were aged between 18-25 years. This segment of the respondents represents the young families in the sub-location sampled for the study.

Figure 4: Age of Respondent

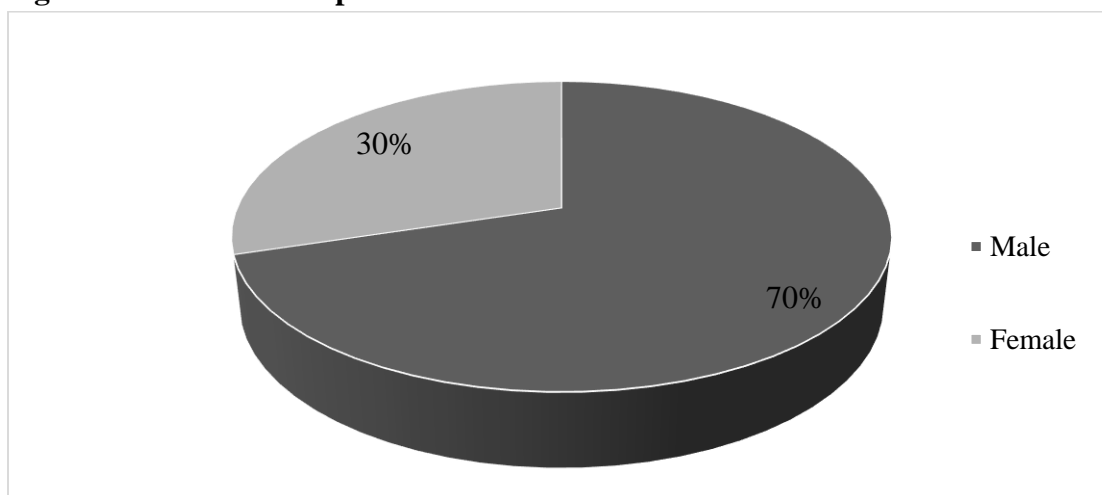


Source: Field Data, 2018

5.1.2 Gender

Majority, about 70 percent of the respondents were males as compared to 30 percent female respondents (Figure 5). The high dominance of male respondents corresponds to their dominance in making land and land use related decisions. However, the side-lining of women in land related matters may not have a significant negative implication in food security in this pastoralism farming system as men, *morans* are the main actors in livestock rearing. The women are basically left at home to look after the home and young livestock.

Figure 5: Gender of Respondent



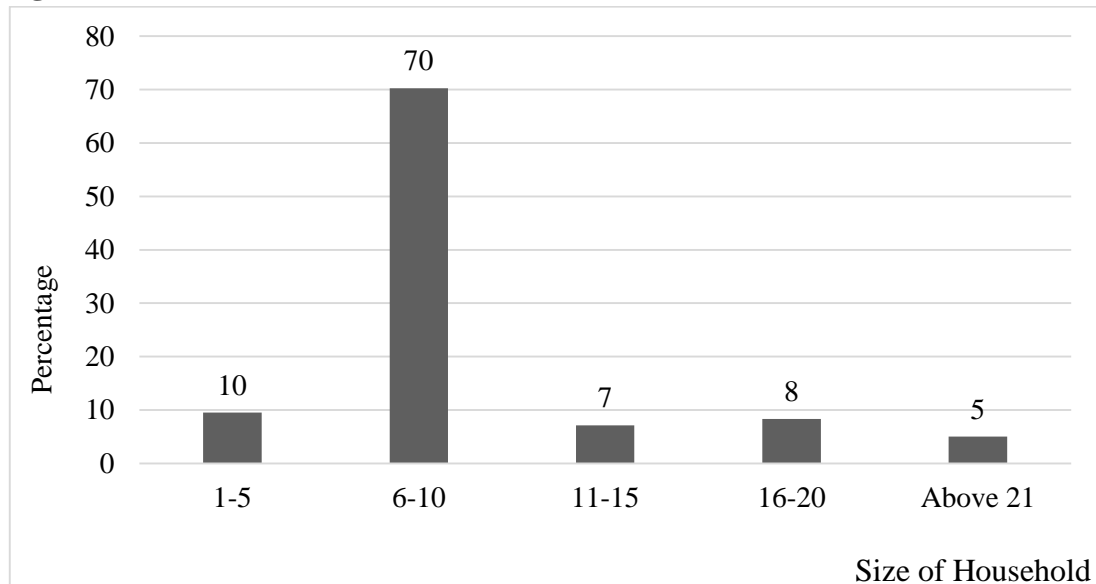
Source: Field Data, 2018

The dominance of male respondents could also be explained by the fact that, in the Masaai Community, women are not expected to give family or community information on behalf of the family as this responsibility is dedicated to the male members. In this regard, only the male household heads are allowed to give the information, and in circumstances that they are not available, the elder son is called upon to speak on behalf of the family.

5.1.3 Size of Household

Approximately 70 percent of the households have a household size of 6-10 members with about 5 percent having over 21 members (Figure 6). The big household sizes could be attributed to the polygamous culture of the Maasai community where the study is based. Most of the families have more than two wives, thus bearing relatively more children. In addition, a few households have other males in their compounds who mainly help them with the livestock at the fields. The big household sizes translates into many mouths to feed hence impacting on food security. In addition to the polygamous nature of the Masaai community, the relatively big household sizes can also be attributed to the high fertility rates in the sub-location and the county in general. The big household sizes have an implication on the size of subsequent land sizes as traditions dictate that the land should be subdivided to the heirs, in this case the sons.

Figure 6: Size of Household



Source: Field Data, 2018

5.1.4 Level of Education

The level of education in the sub-location is quite low as about 49 percent of the household heads have no form of education with only 9 percent having attained tertiary level of education. Education is a key determinant of the available off-farm employment activities, thus with low education level, majority of the household heads are forced to remain herders as they lack the prerequisite skills for any formal employment. The low level of education witnessed in the household heads is also translated to the wives and children. About 100 percent of the first wives had not attained any form of education. Analysing the level of education for the second wives reveals that only three wives had attained secondary level of education out of the total sample of 96 respondents and only one wife had attained tertiary level of education.

However, the analysis of education level for women shows a significant improvement with the number of wives married. The first wives had relatively lower levels of education as compared to the last wives. The level of education for the children also increased over time with families with many children taking a few to school especially the near lastborn children. This phenomenon has resulted from the view of education as an alternative investment besides livestock keeping. In this regard, the older children have low education level as compared to the young generation who have had the preference of being taken to school (Table 5).

Table 5: Level of Education

Category	Educational Level in Percentage (%)				
	None	Pre-primary school	Primary school	Secondary school	Tertiary education
Father	49	0	29	13	9
Mother 2	80.7	0	15.8	2.7	0.9
Mother 3	33.6	0	4.2	45.5	16.8
Child 2	24.8	10.9	17.0	37.6	9.7
Child 4	12.5	4.4	60.5	17.5	5.0
Child 8	8.1	52.4	21.8	16.1	1.6

Source: Field Data, 2018

The level of education has a direct impact on the occupation opportunities available for the populace as well as their livelihoods. Those who have attained tertiary level of

education tend to have a variety of job offers within their areas of specialty as compared to those with none, pre-primary and primary level of education who have to be contented with livestock rearing or any casual jobs available. Thus, with respect to food and livelihood security, households whose members have higher education levels are more food and livelihood secure as compared to those whose members have low levels of education.

5.2 Land Size and Food and Livelihood Security

This section outlines the land ownership status with respect to pieces of land owned by the households, size of household land and mode of land acquisition. The prevailing tenure system and available land ownership documents in the study area has also been discussed.

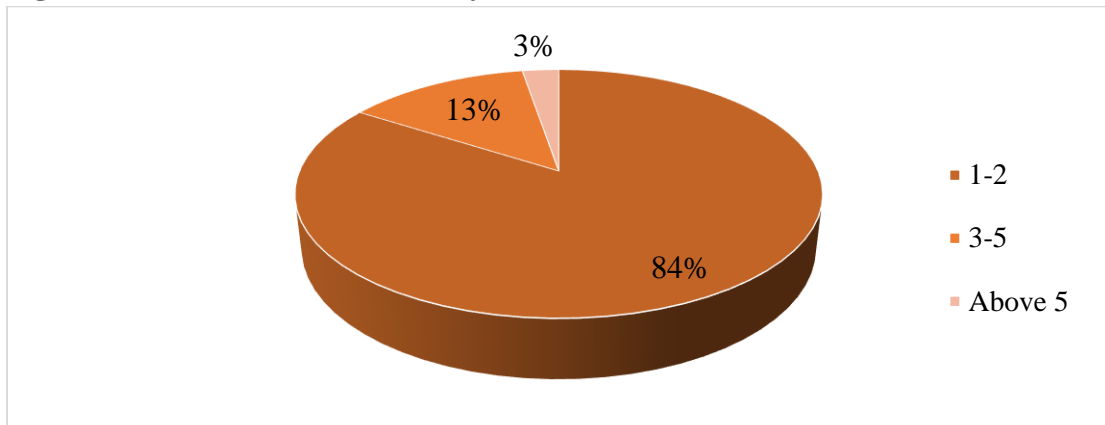
5.2.1 Land Ownership Characteristics

The Masai people are the main inhabitants of the study area and own majority of the land parcels. Land ownership is quite high as 77 percent of the respondents owned land compared to 23 percent who didn't own land. The percentage of the population with no land parcels to their names comprise of the young households whose parents are yet to formally transmit land rights to them. In this scenario, these households communally use the family land together.

5.2.1.1 Pieces of Land Owned by Households

About 84 percent of the respondents own 1-2 parcels of land, 13 percent own 3-5 parcels while 3 percent own above five pieces as shown in Figure 7. Thus, land fragmentation with respect to the number of land parcels owned is not quite pronounced in the sub location as majority own either 1 or pieces of land. However, the 16 percent of households with more than 2 parcels should not be ignored as this form of land fragmentation negatively implicates on livestock production. There were also a few individuals who had a challenge in identifying the number of parcels they owned since traditionally, the Maasai community never practiced individual land ownership and use.

Figure 7: Pieces of Land Owned by Households



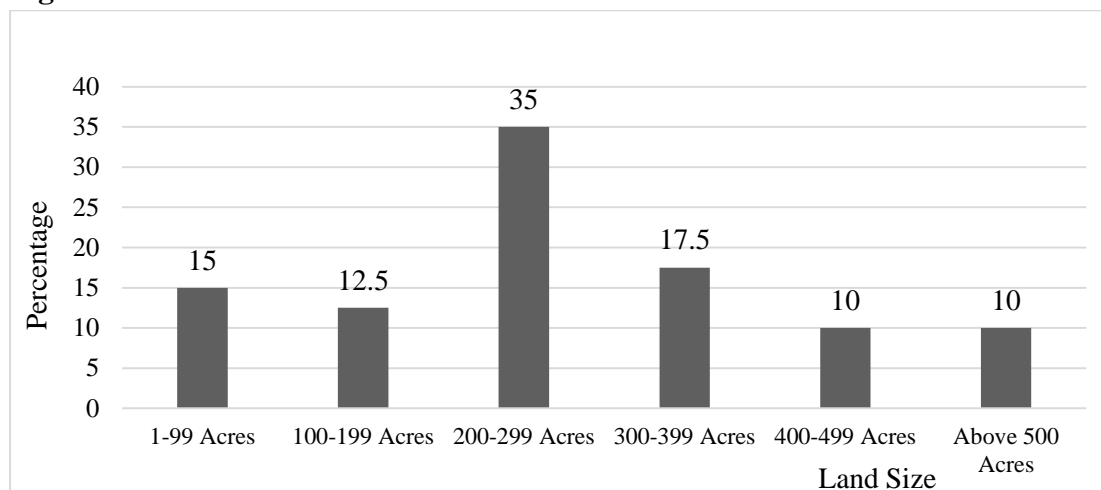
Source: Field Data, 2018

Spatially, majority of the parcels are located in Bissil sub-location especially for the respondents with 1-2 land pieces. For those with more than 2 parcels, some of the parcels are located in neighbouring sub-locations of Oloika, Meidanyi, Enkutoto, and Namanga. There were an interesting scenario of the residents residing on neighbouring sub-locations especially those near the roads and using the land parcel in Bissil sub-location as a grazing field. For instance, though Namanga is located approximately 35km from Bissil sub-location, it attracted a significant number of the community members as a residence and commercial centre. However, Bissil is also another upcoming urban centre of interest as it attracts a significant proportion of the community who engage in farming and business activities.

5.2.1.2 Size of the Household Land

There has been a significant decrease of household land size over time as the current household land holdings are quite small as compared to the size of the fathers' land before subdivision for inheritance. Before inheritance, about 85 percent of the households owned 100 – over 500 acres of land with majority owning between 200-299 acres as seen in Figure 8.

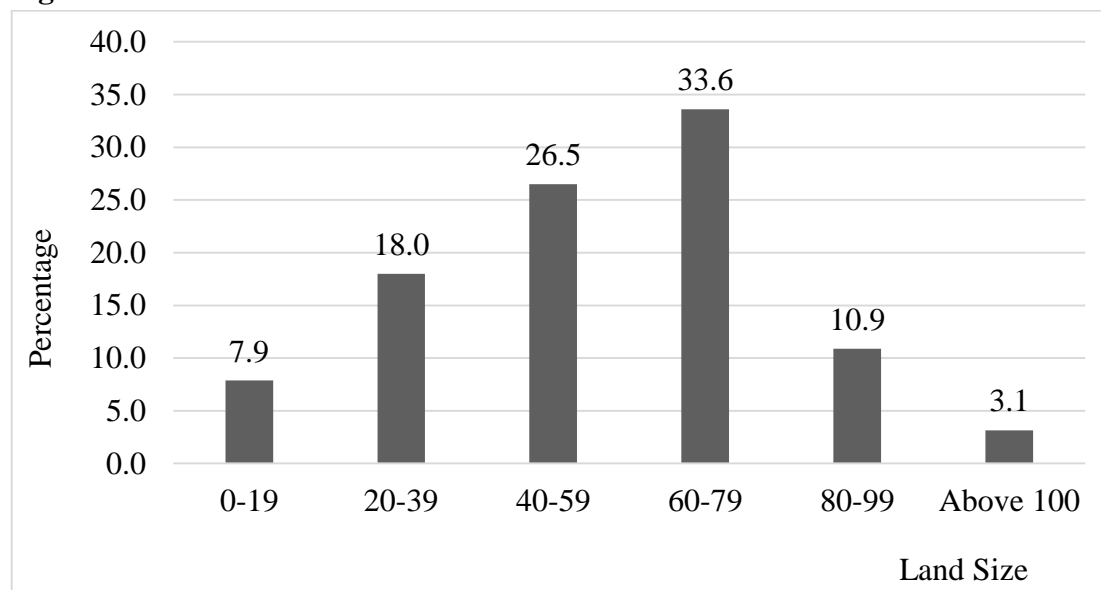
Figure 8: Size of Fathers Land before Inheritance



Source: Field Data, 2018

The current household land holdings range from 0 – over 100 acres with majority owning between 60-79 acres as seen in Figure 9. This is a quite a reduction from the original size of fathers' lands before inheritance.

Figure 9: Current Household Land Size



Source: Field Data, 2018

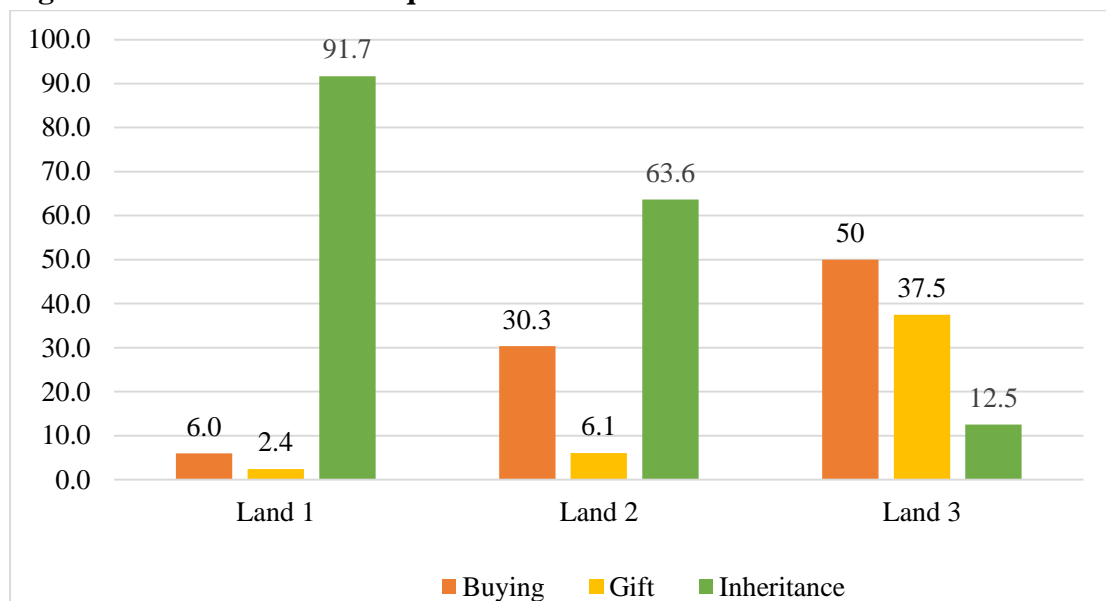
This reduction in household land size could be attributed to the inheritance practices as fathers are supposed to share their properties including land to the sons. Thus, the gradual subdivision of land among the male members of the family has resulted to this decrease in household land holdings. The availability of relatively large land sizes under freehold presents an opportunity for the introduction of other interventions to improve

the economy of the people. Some of these interventions include mixed farming and use of modern farm technologies to increase farm yields and pasture for animals.

5.2.1.3 Mode of Land Acquisition

Inheritance is the main form of land acquisition for the first and second land parcels as represented by 91.7 and 63.6 percent of the respondents respectively. Land purchase begins to take precedence with the second and third land parcel owned as seen in Figure 10. The sale of land could affect this pastoral community in the long run since it has significantly disrupted the communal land ownership which characterized the Masaai community. The dominance of inheritance as the main mode of land acquisition could explain the high land subdivision rates in families. It is indeed a common practice in the sub-location to subdivide land amongst sons in equal proportions to avoid conflicts and encourage equity.

Figure 10: Mode of Land Acquisition



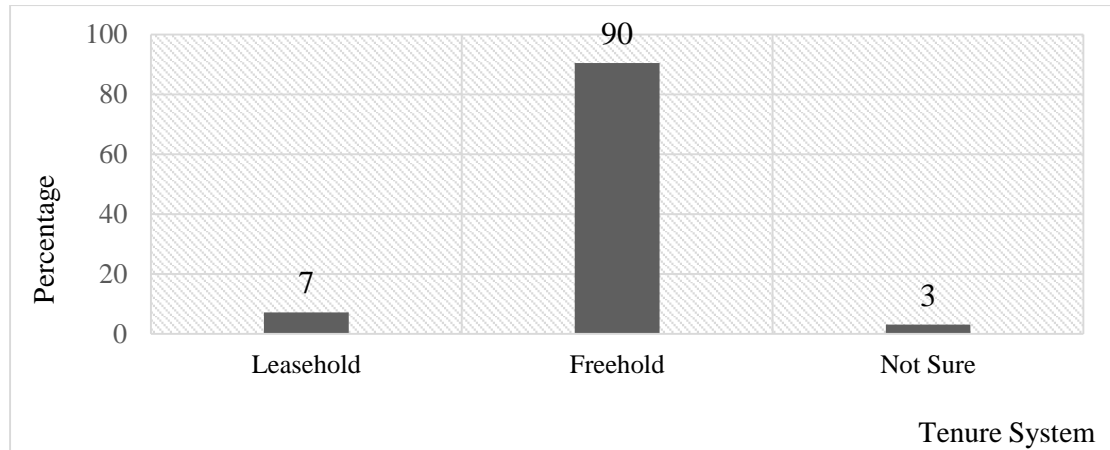
Source: Field Data, 2018

Historically, land in Maasai Community was communally owned. With time, the locals were influenced by the elite group of the community through some programs conducted in the area. These programs promoted land subdivision for individual ownership, a practice that began to be adopted in the sub-location. Gradually, most families began subdividing their land parcels amongst their sons, making inheritance the main mode of land acquisition.

5.2.2 Tenure System

Freehold is the main land tenure system in the sub-location as represented by 90 percent of respondents. About 7 percent had a leasehold tenure system while 3 percent were not sure of the type of tenure system for the lands they occupied as seen in Figure 11.

Figure 11: Tenure System

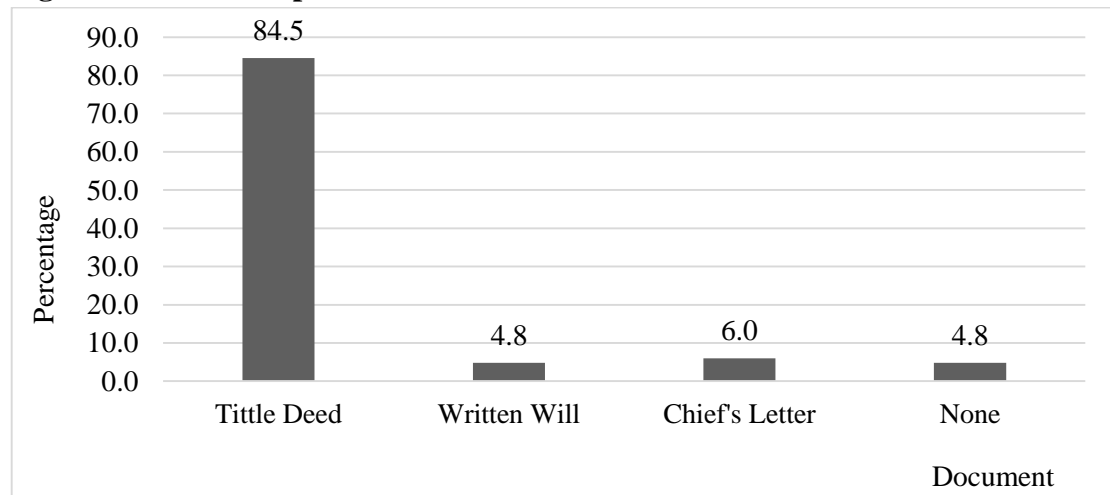


Source: Field Data, 2018

5.2.3 Ownership Documents

Majority of the respondents in the study area had title deeds as the registration documents for the land parcels they own as represented by 84.5 percent of the respondents. About 4.8 percent had a written will of their parents, relatives or friends, 6 percent had a letter from the chief while 4.8 percent had no ownership documents to the land parcels they occupied as shown in Figure 12. The proportion of the population with no ownership documents are in the process of acquiring them. The high percentage of respondents with ownership documents is a clear indication of a shift from communal land ownership to individualization of land tenure in the sub-location.

Figure 12: Ownership Documents



Source: Field Data, 2018

5.2.4 Household Land Size and Use and Food Security

As outlined above, there has been a significant decline in land size with the current land size ranging from 0 – 100 acres, with only a few households owning more than 100 acres of land. This decline of household land size is as a result of unregulated land subdivision. From the household interviews, some of the problems associated with land subdivision include: small unproductive land portions, loss of grazing lands, lower farm yields among others as shown in Table 6.

Table 6: Problems of Land Subdivision

No.	Problem of Land Subdivision	Percentage (%)
1.	Small unproductive land parcels	22.5
2.	Loss of grazing land	13.75
3.	Lower farm yields	22.5
4.	Family conflicts	26.25
5.	Communal land disputes	15

Source: Field Data, 2018

The problems of land subdivision outlined above have an impact on food security. For instance, small unproductive land parcels and loss of grazing land results to rearing of few livestock. This realizes lower farm yields hence food insecurity. Family and communal land disputes on the other hand disrupt grazing activities and some lead to loss of livestock, impacting negatively on livestock production. Ceteris paribus, encouraging further land subdivision, would worsen these challenges in the future and disrupt this pastoralism community in totality. If the status quo is left to continue, chances are, the community will be rendered landless by the many investors, developers and immigrants looking for in the area. With no land, the locals will be subjected to abject poverty since they depend on land for the rearing of livestock and crop growing.

5.2.4.1 Land Size and Crop Production

About 89 percent of the respondents attributed the reduction of crop production to small land sizes. This was in comparison to the crop production they had when they had large parcels before the inheritance and individualized land ownership practices were embraced. About 12 percent did not agree that small land sizes led to reduced crop production while 2 percent were not sure of the effect of small land sizes on crop production. Maize and beans are the main types of crops grown by the households

practicing crop farming. The proportion of farm land under maize and beans, area and yield of the crop and the percentages consumed by the households as well as the surplus sold to the market are as outlined in Table 7.

Table 7: Area and Yields of Maize and Beans

Crops	Area of crop		Yield of crop			Consumed	Sold
				Season 1	Season 2		
Maize- 52% of land cultivated	0-1 acres	10%				-	-
	1-3 acres	45%	0-99kgs	16%	7%	16%	11%
	4-6 acres	8%	100- 199kgs	17%	5%	23%	20%
	7-10 acres	8%	200- 299kgs	23%	1%	50%	6%
	10+ acres	29%	Above 300kgs	34%	1%	10%	20%
Beans- 48% of land cultivated	0-1 acres	11%				-	-
	1-3 acres	47%	0-99kgs	21%	10%	20%	7%
	4-6 acres	5 %	100- 199kgs	10%	3%	17%	7%
	7-10 acres	4 %	200- 299kgs	11%	2%	10%	1%
	10+	33%	Above 300kgs	7%	2%	5%	1%

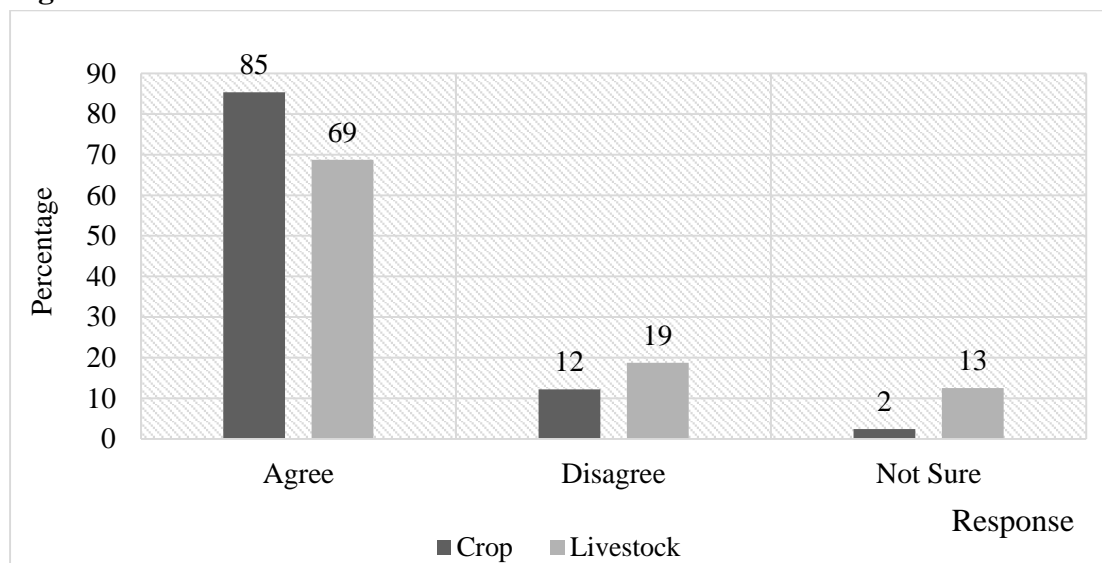
Source: Field Data, 2018

Based on the big household sizes, most of the produce is reserved for household consumption as there are relatively more mouths to feed. Thus, the residents have to be contented with the little earnings realized from the sale of the little surplus left after an adequate amount is set aside to sustain the families throughout the year.

5.2.4.2 Land Size and Livestock Production

The effect of small land sizes on livestock production is not as pronounced as in crop production. This could be attributed to the fact that, being nomads, the inhabitants migrate their livestock to areas with pasture and water, thus the size of land one has may not directly impact on the number of cattle kept. However, about 69 percent of the respondents attributed reduction of livestock to small land sizes, 19 percent didn't agree while 13 percent were not sure of a possible relationship between land size and livestock production as shown in Figure 13.

Figure 13: Small Land Size Led to Reduced Production

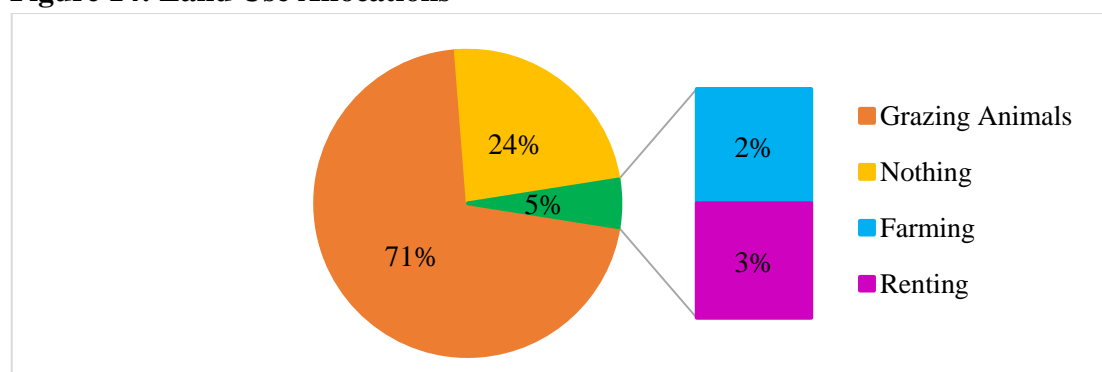


Source: Field Data, 2018

5.2.4.3 Land Use and Food Security

From the Focus Group Discussions, it emerged that, originally, livestock keeping was the only economic activity for all the households in the sub-location. With time, crop farming has emerged though still in very small scale. Due to the climatic conditions of the sub-location and the fact that it is located in the ASAL region, the yields are relatively very low and the fact that farming is done only in a single season compounds the food insecurity problem. Majority of the residents have allocated a significant amount of their land for grazing of animals as represented by 71 percent of the respondents with 2 and 3 percent allocating land for crop farming and renting respectively. In addition, about 24 percent have left their land idle as shown in Figure 14. In certain instances, land is left bare as a pasture reserve and is used when other areas have been exhausted.

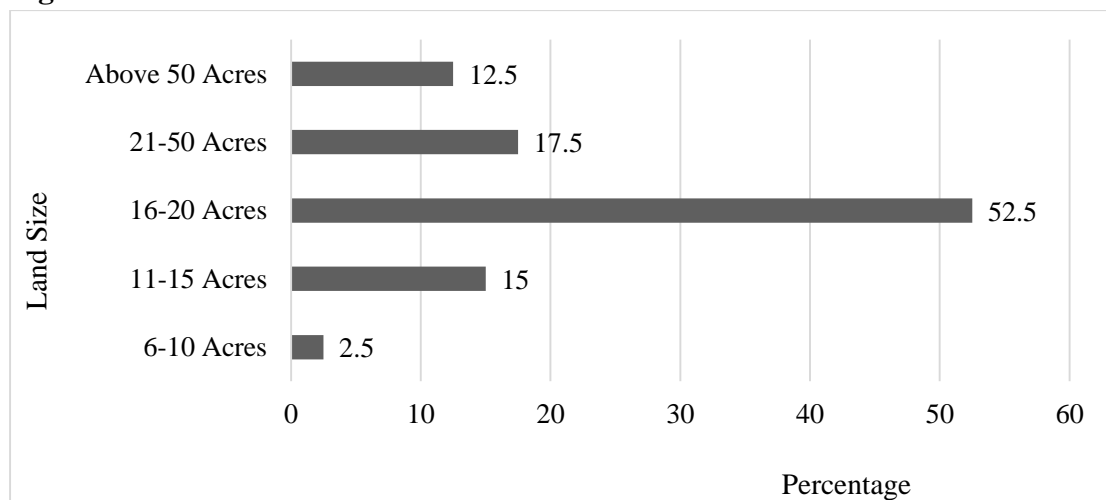
Figure 14: Land Use Allocations



Source: Field Data, 2018

Renting of land can be seen as a vibrant business in the sub-location, though it is practiced in small scale. Areas with majority of rented land parcels are Namanga and Bissil centers as they act as magnets to several activities due to their urban characteristics. These centers offer business comparative advantage due to their strategic location and the existing character of development. They provide a ready market for the farm produce and Maasai cultural artifacts produced. The size of rented land ranges from 6 to over 50 acres as seen in Figure 15.

Figure 15: Size of Rented Land



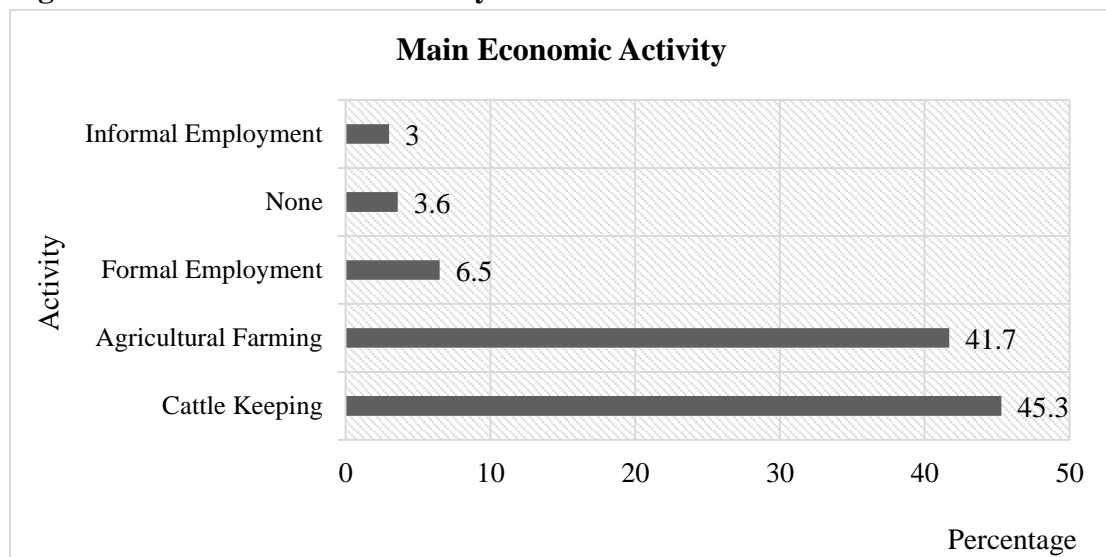
Source: Field Data, 2018

Renting out of land has two side effects. One, the more pieces of land one rents out, the more the actual land size owned by a family reduces. Secondly, renting of land comes with rental income earned from the rented pieces of land. In most scenarios, this type of income is quite tempting as one does not have to toil to earn it, all one has to do is place a piece of land on offer for rent. This “free” income would further tempt individuals to sell off their lands for higher incomes. This brings forth the need to properly guide the community in undertaking these land transactions lest they lose their land to the developers and investors. The rent duration ranges from 6 months to over 5 years. Majority of the residents rent lands for a period of above 5 years as represented by 55 percent of the population, 33 percent rent for 2-5 years, 7 percent for 1-2 years while 5 percent rent for 6 months to 1 year. The annual land renting cost ranges from Kshs. 1000 to over Kshs15000 with majority of the residents rent land parcels for an annual cost of between Kshs. 10,000-14,999. The tenants of rented land parcels tend to take poor care of them, thus impacting negatively on livestock production.

5.2.4.4 Economic Activities

Contrary to the past when Maasai practiced pastoralism as the only economic activity, other activities are gradually forming part of the economy. For instance, crop farming is slowly becoming a rival to cattle keeping. Other economic activities that are slowly being introduced include formal and non- formal employment. As seen in Figure 16, cattle keeping is the main economic activity as represented by 45.3 percent of the population followed closely by crop farming at 41.7 percent.

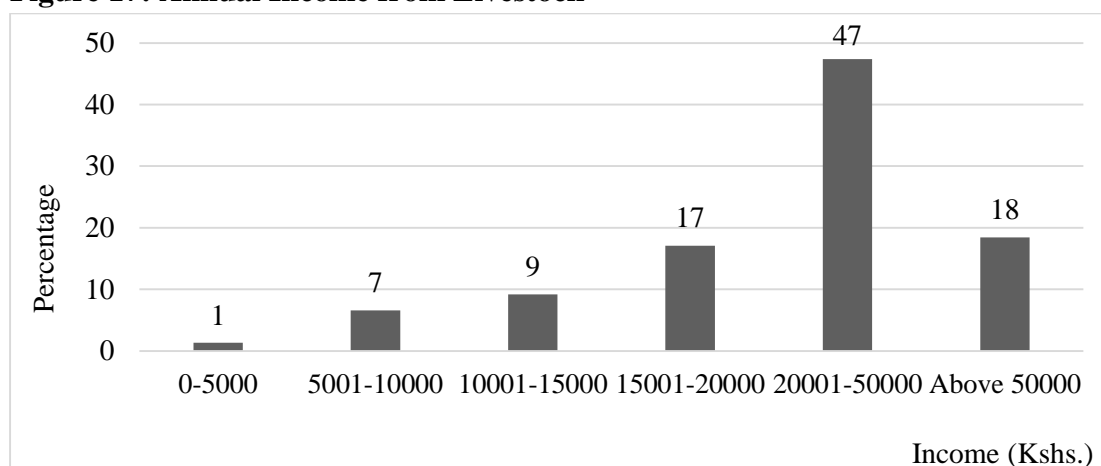
Figure 16: Main Economic Activity



Source: Field Data, 2018

Despite the introduction of other economic activities in the sub-location, cattle keeping is still the most dominant economic activity. Being plain Nilotes, the Masai community derives their pleasure in livestock rearing hence the dominance of the activity. About 47 percent of the respondents earn between Kshs. 20,001 – 50,000 from the sale of livestock per annum as seen in Figure 17.

Figure 17: Annual Income from Livestock



Source: Field Data, 2018

The low average annual income was due to the fact that the community discourages selling of livestock as the more livestock one has, the richer he is considered. In this regard, households are encouraged to either maintain or increase their current stock. Thus, selling of livestock is only done as the last option available. Table 8 outlines how often the residents of Bissil sell their livestock.

Table 8: Frequency of Livestock Sale

Frequency	Weekly (%)	Monthly (%)	After 3 months (%)	After 6 months (%)	Annually (%)
Cows	1	35	10	20	34
Goats	32	40	21	2	4
Sheep	18	19	19	24	20
Chicken	21	36	14	14	14
Donkeys	50	0	50	0	0

Source: Field Data, 2018

Most residents in Bissil sell cows on a monthly or annually basis as represented by 35 percent and 33 percent of the respondents respectively. Since the residents keep more numbers of goats and sheep than cows, and the sentimental value attached to goats and sheep is relatively very low as compared to the value attached to cattle, they tend to sell goats and sheep more often. Very few households keep chicken or rare donkeys, thus the selling of chicken and donkey is quite insignificant. Table 9 illustrates the value at which the five categories of livestock are sold. Cows are the most valued of the reared livestock with about 85 percent of the household fetching between Kshs. 10,000 – 40,000 from their sale. Chicken are the least valued as depending on the number of

chickens sold, about 69 percent of the respondents earn at most Kshs. 5000 as one chicken is sold averagely at Kshs. 400.

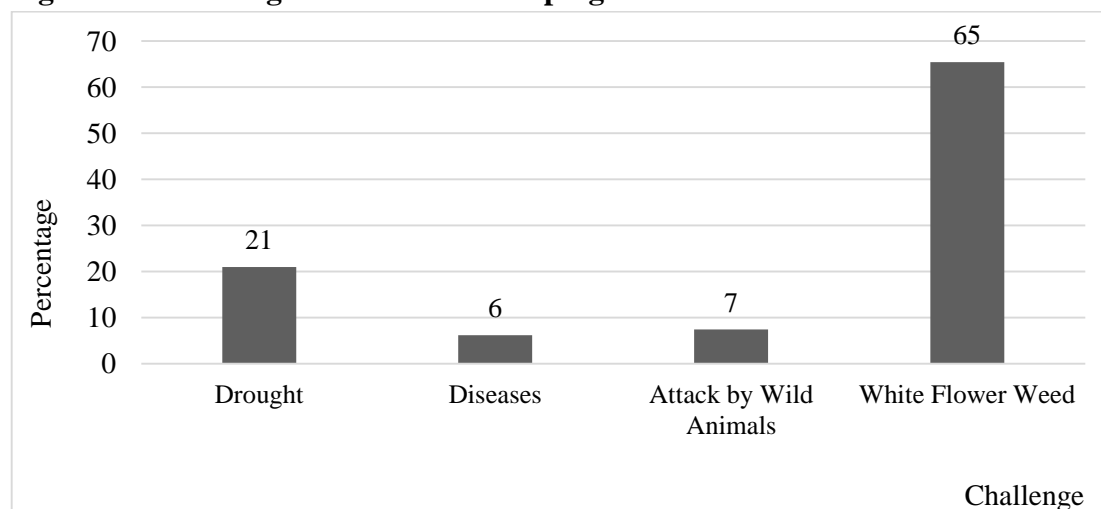
Table 9: Value of Livestock

Value	KES 0-5000	KES 5000-10000	KES 10000-40000
Cows	0	15	85
Goats	21	79	0
Sheep	15	85	0
Chicken	69	23	8
Donkeys	25	50	25

Source: Field Data, 2018

The number of livestock is also influenced by the areas climatic condition. The location of the sub-location in the ASALs makes it prone to a series of droughts which claim a significant number of livestock. During this period, the livestock prices also reduces as most of them are either too sick or skinny to be sold. The main challenge facing livestock production in the sub-location is drought and effects of the white weed (Figure 15). This is because, drought dries all the vegetation that the cattle grazes on and the white weed has colonized most of the pasture lands, leaving cattle with nothing to feed on. Other challenges include diseases and attack by wild animals.

Figure 18: Challenges in Livestock Keeping

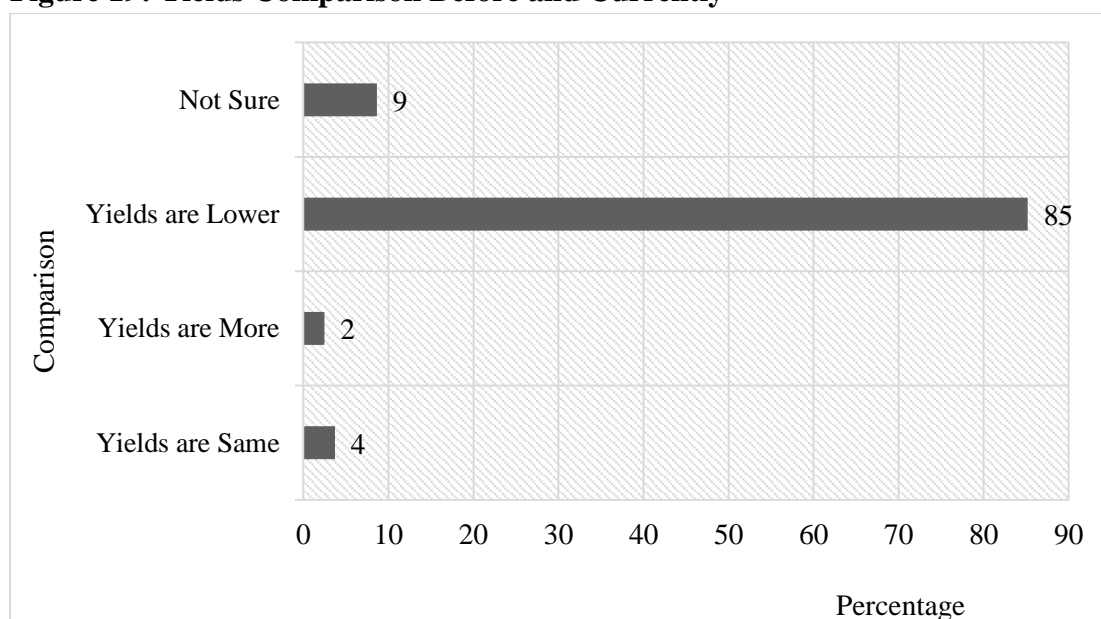


Source: Field Data, 2018

5.2.4.5 Food Stability

When asked to compare the current yields with the previous ones before land subdivision, 85 percent of the respondents indicated that, the yields are currently lower by a quarter - 37 percent, half - 45 percent or three quarters - 18 percent. Only about 2 percent specified that the yields are more, a phenomenon that they attributed to use of modern farming methods like certified seeds, fertilizers and adopting of irrigation fed agriculture as opposed to overreliance on rain-fed agriculture. A few of the respondents, 4 percent indicated that the yields are the same, an occurrence that was attributed to the use of the same farming methods while 9 percent were not sure about the changes in the yields as shown in Figure 19. About 54 percent attributed the reduction in production to the diminishing land sizes while 46 percent attributed it to the climate change. This implies that, land size has a greater effect on food production than climate change and other factors bringing forth the reduction.

Figure 19: Yields Comparison Before and Currently

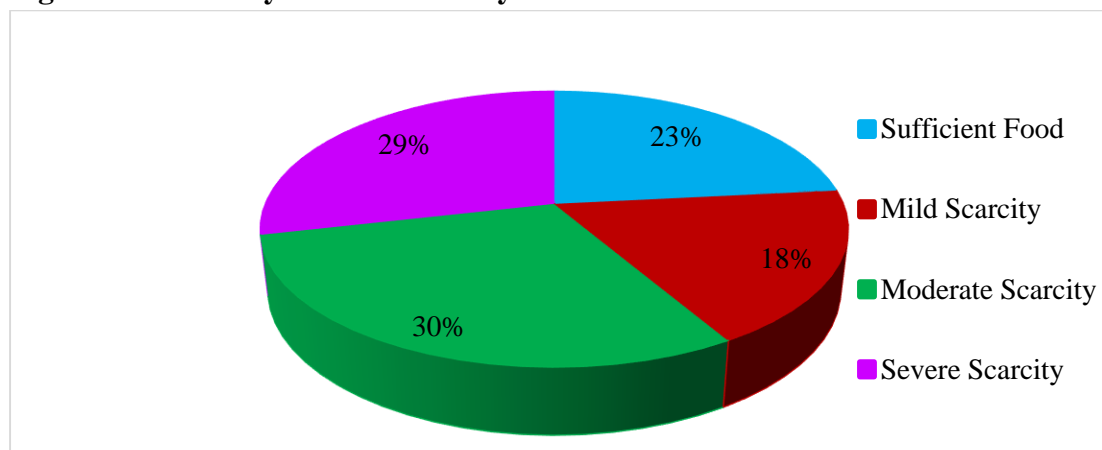


Source: Field Data, 2018

5.2.4.6 Food Accessibility and Availability

The current yields are only sufficient to about 23 percent of the households since they last for 12 months or more after the harvest. However, a significant proportion of the households, 29 percent struggle with severe food scarcity as the harvested farm yields last up to 3 months or less. About 30 percent encounter moderate food scarcity as the farm produce lasts for at most 6 months while 18 percent have mild food scarcity with farm yields lasting up to 9 months (Figure 20).

Figure 20: Intensity of Food Security



Source: Field Data, 2018

Households that are food insecure are forced to buy food commodities to supplement the deficit, thus eating up on the finances that could be budgeted for other productive household expenditures. Food scarcity is really a big problem in the sub-location as about 71 percent of the respondents confirmed that they had skipped a meal in the last three months due to food shortage.

5.3 Factors that Influence and the Size and Use of Household Land

There are several factors that influence household land size and use in the sub-location. These include: population pressure, household size, number of sons, education level, income which mainly results from off-farm income generating activities, traditions and customs among other factors as explained below:

5.3.1 Population Pressure

The increase in population within the sub-location coupled with individualization of land tenure has resulted to numerous land subdivision as new families settle. From the household surveys, it emerged that land fragmentation existed due to population pressure as echoed by 81 percent of the respondent. About 12 percent did not agree that land fragmentation exists due to population pressure while 7 percent were not sure.

5.3.2 Household Size

Big household sizes which translates to high population densities in the sub-location have led to reduced land sizes as parents subdivide the lands to their sons. The size of the household also influences various land use allocations. With more mouths to feed, households with big household sizes tend to allocate bigger portions of their land for

food production. Those with small household sizes on the other hand rent out significant proportions of their lands thus reducing the actual land size in their possession.

5.3.3 Brothers at the Time of Inheritance and Number of Sons

Traditionally, parents are required to subdivide their lands to their sons. As a result, the number of sons a household has implicates on the size of subsequent parcels as all sons are entitled to land inheritance. In addition, the number of brothers the household head had at the time of inheritance influenced the possible land sizes available for inheritance. About 96 percent of the respondents postulated that all the brothers they had at the time of inheritance got an equal share of the family land with on 4 percent inheriting unequal shares. Majority of the parents have done further subdivision of their land parcels as represented by 86 percent of the respondents to give an inheritance to their sons. These subdivisions have been mainly into 2-3 portions as seen in the Table 10:

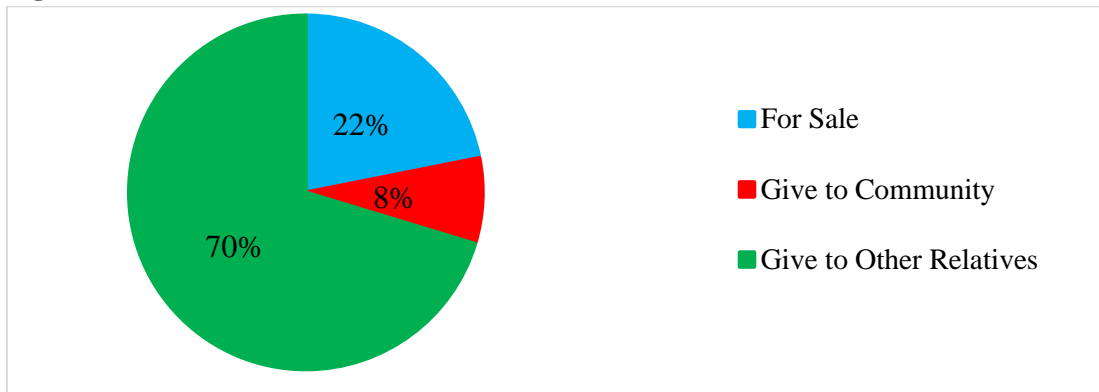
Table 10: Number of Portions

Portions	Percentage (%)
2-3 portions	78
4-5 portions	16
6-10 portions	5
Over 10 portions	1

Source: Field Data, 2018

Giving land to other relatives especially heirs was among the main reason for further land subdivision as represented by 70 percent of the population. Other reasons postulated included subdivision for sale so as to meet certain family needs and giving land for community projects as seen in Figure 21.

Figure 21: Reasons for Further Land Subdivision



Source: Field Data, 2018

5.3.4 Settlement Paterns

The total area of homesteads was not equal among the households as households with bigger land parcels allocated bigger proportions of land for settlements as opposed to those with smaller land parcels. Since semi-permanent and temporary structures inform of iron sheet structures and manyattas and very few brick houses characterize most of the homesteads, most of main houses measured between 15-25 square metres. Majority of the houses were one-roomed with a few 2-3 roomed houses. In addition, scattered settlements are the most common pattern of human settlement in the area as sons, once given their share of the family land, tends to erect structures away from the compounds of their parents. The scattering of settlements limits the amount of space available for grazing of livestock.

5.3.5 Urbanization Forces

Areas close to Bissil market centre are experiencing very high land subdivision rates as the forces of demand and supply try to locate additional land uses like commercial and residential. This has resulted to un-serviced plots within the centre and the periphery areas with speculators holding on to the plots as they wait for their prices to shoot.

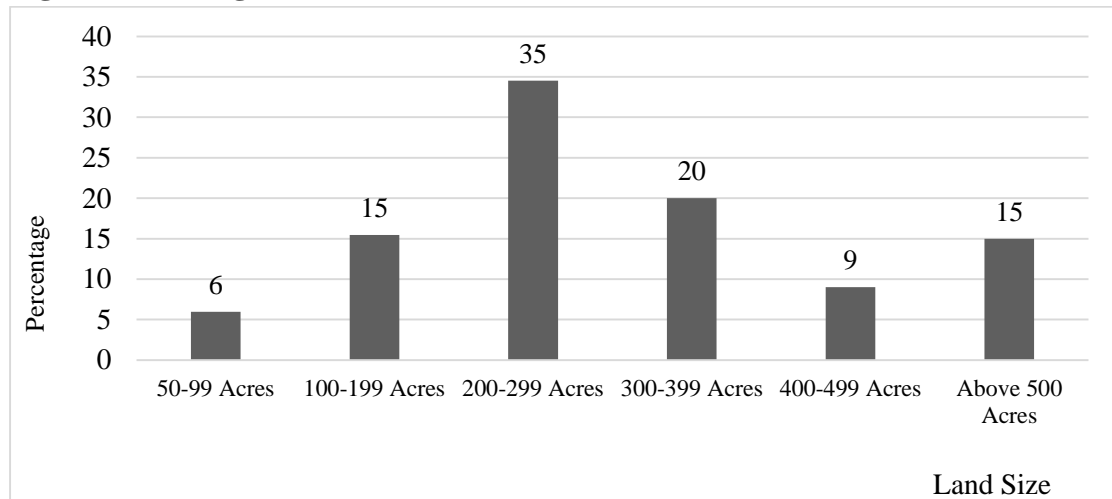
5.4 Coping with Changes in Food Security

The residents of the sub-location have opted to sell their livestock every week or month to buy food commodities hence suppressing the food shortage as represented by 76 percent of the population. The food commodities are purchased from the farmers with surplus or from the neighbouring market centres. In a few instances, residents are forced to borrow food from relatives and friends to augment their food supply as represented by 24 percent of the respondent.

5.5 Optimal Household Land Size for Sustainable Food Security

As per the respondents, a land sizes ranging from 50 to over 500 acres was optimal for sustainable food security in the sub-location. Majority recommended an optimal land size of between 200-299 acres for sustainable food security as represented by 35 percent of the population as seen in figure 19.

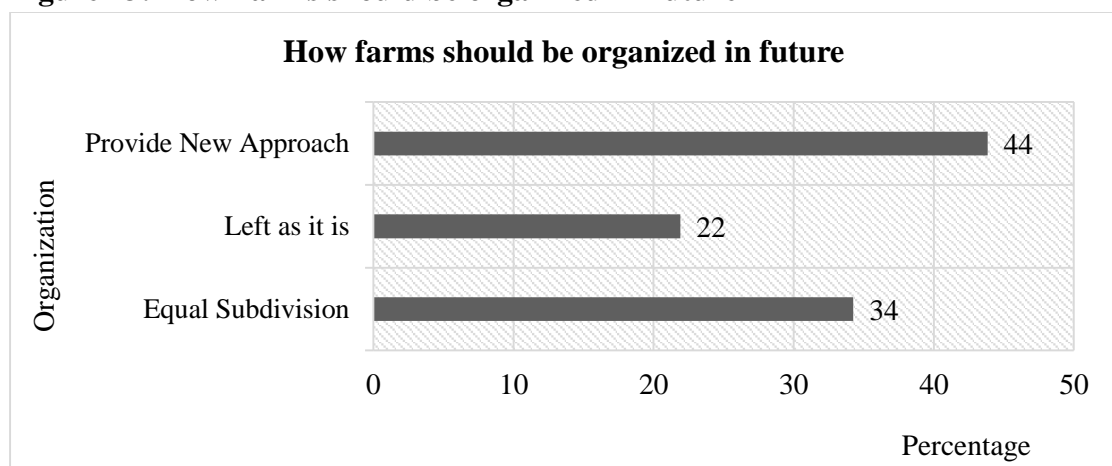
Figure 22: Enough Land Size



Source: Field Data, 2018

The optimal land sizes proposed by the respondents are still very high and probably unattainable. Ways of ensuring efficiency in livestock rearing should therefore be explored and incorporated in Bissil sub-location so as to ensure sustainable food security. Asked how farms should be organized in the future, about 44 percent recommended for provision of new approaches in livestock rearing (Figure 23).

Figure 23: How Farms should be organized in Future



Source: Field Data, 2018

Asked to rank possible patterns of human settlement in order of their preference, about 45 percent of the respondents ranked linear pattern of settlement as the most preferred as compared to 27 percent who ranked clustered settlements as the most preferred as shown in Table 11.

Table 11: Human Settlement Preference

	Preference in Percentage (%)		
	Scattered	Linear	Clustered
Most Preferred	14	45	27
More Preferred	25	21	32
Preferred	22	25	19
Least Preferred	39	5	22

Source: Field Data, 2018

The linear type of settlement was preferred since the residents want to settle along the transport routes and leave the rural hinterland as grazing fields for their animals.

5.6 Possible Policy Options for Sustainable Food Security

Some of the possible policy options to ensure sustainable food and livelihood security in the sub location are:

5.6.1 Adaptation of Modern Farming Methods

With the decreasing household sizes and increasing population densities, modern farming methods would come in handy so as to ensure attainment of food security. Some of these modern farming methods could include zero grazing, paddocking and adoption of green houses for crop production.

5.6.2 Establishment of Settlement Schemes

With proper planning, viable areas of settlements could be identified which would act as residence areas as the rest of the land parcels are used as grazing fields and for farming activities. This would in a way help to solve the food insecurity problem.

5.6.3 Reorganization of the Settlements

The current scattered settlement patterns in the sub-location are unsustainable as settlements in the long run as if left unchecked, they will eat up on the available grazing areas. Reorganization of the settlements is thus necessary. Possibilities of constructing clustered settlements probably high-rise buildings for residence in specific areas leaving the other areas for livestock grazing, common water and other forms of

agricultural activities should be promoted. This will reduce the buildings foot print and create more space for graze land

5.6.4 Discourage Individualization of Land Rights

The emergence of individualization of land rights in an area that entirely was comprised of communal land ownership has really transformed the area for the worst. Household land holdings have become very small to the extent of not supporting pastoralism activities in the long-run. Discouraging individual land ownership and encourage farmers to go back to the communal land ownership system will help to protect the livelihoods of this pastoralism community.

5.6.5 Sensitize People on the Dangers of Land Subdivision

Some of the problems of land subdivision identified included: small unproductive land parcels, loss of grazing lands, lower farm yields, family conflicts where some of the family members are not comfortable with the land parcels allocated to them and communal land disputes in case of communal lands like watering points located in private properties. Sensitizing the residents on those challenges and the possibility of future generations being left landless, would help them make informed decisions on the utilization of land resources. This could be done through formulation of scenarios on how further land subdivision would affect their nomadic way of life and general welfare as well. Some of the proposals on future organization of farms include; provision of a new approach in livestock production, land should be left as it is and there should be equal land subdivision to avoid family conflicts as seen in Figure 20.

5.7 Hypothesis Testing

This section presents the empirical results from the assessment of land size and use on food and livelihood security. Chi-square test was employed to evaluate the relationship between various variables.

5.7.1 Land Tenure System and Fragmentation

Null Hypothesis (H₀): There is no significant relationship between land tenure system /arrangement and land fragmentation.

Alternative (H_a): There is significant relationship between land tenure system /arrangement and land fragmentation.

Table 12: Land Tenure System and Fragmentation

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.337 ^a	9	.998
Likelihood Ratio	2.312	9	.986
N of Valid Cases	84		
a. 13 cells (81.3%) have expected count less than 5. The minimum expected count is .02.			

Source: *Field Data Analysis, 2018*

A chi-square test of association was conducted to establish the relationship between land tenure system and fragmentation. The value of the chi-square statistic is 1.337, 9 degrees of freedom and a p of 0.998 (Table 12). The results may not however be meaningful as one of the assumptions of chi-square has been violated since 81.3 percent of the cells have an expected count of less than 5. Thus, the p value was used determine the significance of the relationship between tenure system and fragmentation.

Decision: Accept the null hypothesis (**H₀**) as there is no significant relationship between land tenure system and fragmentation, $p = 0.998$ is more than $\alpha = 0.05$.

Conclusion: The null hypothesis (**H₀**) is adopted. Thus, there is no significant relationship between the land tenure system /arrangement and land fragmentation within the study area.

5.7.2 Household Land Size and Food and Livelihood Security

Null Hypothesis [H₀]: there is no significant effect of the changing household land size and land use on food and livelihood security in terms of livestock production and incomes.

Alternative Hypothesis [H_a]: There is a significant effect of the changing household land size and use on food and livelihood security in terms of livestock production and incomes.

A chi-square test of association was conducted to establish the relationship between household land size and food and livelihood security. The value of the chi-square statistic is 52.123 and 42 degrees of freedom with a p of 0.136 (Table 13). The results may not however be meaningful as one of the assumptions of chi-square has been

violated since 94.6 percent of the cells have an expected count of less than 5. Thus, the p value was used determine the significance of the relationship between household land size and food and livelihood security.

Decision: Accept the null hypothesis (**H₀**) as there is no significant relationship between changing household land size and food and livelihood security, $p = 0.136$ is more than $\alpha = 0.05$.

Conclusion: The null hypothesis (**H₀**) is adopted. Thus, there is no significant effect of the changing household land size and land use on food and livelihood security in terms of livestock production and incomes.

Table 13: Household Land Size and Food and Livelihood Security

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.123 ^a	42	.136
Likelihood Ratio	47.720	42	.251
N of Valid Cases	84		
a. 53 cells (94.6%) have expected count less than 5. The minimum expected count is .05.			

Source: *Field Data Analysis, 2018*

5.7.3. Land Use Allocations and Enterprise Gross Margins

Null Hypothesis [H₀]: There is no significant effect of pastoral household land allocation ratio on the enterprise gross margins.

Alternative Hypothesis [H_a]: There is a significant effect of pastoral household land allocation ratio on the enterprise gross margins

A chi-square test of association was conducted to establish the relationship between pastoral household land allocation ration and enterprise gross margins. The value of the chi-square statistic is 32.646 and 30 degrees of freedom with a p of 0.338 (Table 14). The results may not however be meaningful as one of the assumptions of chi-square has been violated since 94.6 percent of the cells have an expected count of less than 5. Thus, the p value was used determine the significance of the relationship between pastoral household land allocation ratio and the enterprise gross margins.

Decision: Accept the null hypothesis (**H₀**) as there is no significant relationship between pastoral household land allocation ratio and the enterprise gross margins, $p = 0.338$ is more than $\alpha = 0.05$.

Conclusion: The null hypothesis (**H₀**) is adopted. Thus, there is no significant effect of pastoral household land allocation ratio on the enterprise gross margins.

Table 14: Household Land Allocation and Enterprise Gross Margins

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.646 ^a	30	.338
Likelihood Ratio	33.129	30	.317
N of Valid Cases	84		
a. 38 cells (90.5%) have expected count less than 5. The minimum expected count is .06.			

Source: *Field Data Analysis, 2018*

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

Livestock rearing is the main economic activity in Bissil sub-location though the areas within the market centre boundaries are gradually transforming into commercial and residential precincts. This economic activity and source of livelihood for the many households of the sub-location is being threatened by land subdivision for inheritance and sale. This practice is postulated to render the households landless in the long run as their land will be lost to speculating land buyers, developers and investors.

6.1 Summary of Findings

This section has been discussed with regard to the study objectives.

6.1.1 Land Size and Food and Livelihood security

This objective examined the land ownership status, land tenure system, household land sizes and the food and livelihood situation. Land ownership in the sub location is relatively high as about 77 percent of the respondents' own land. The 23 percent who do not own land comprise of the young households whose parents are yet to formally transmit land rights to them. About 84 percent of the respondents owned 1 or 2 parcels of land, 13 percent owned 3 -5 parcels while 3 percent owned over 5 parcels. There has been a significant decrease of household land size over time as the current household land holdings are relatively small as compared to the size of the fathers' land before subdivision. Before embracing the inheritance practices, about 85 percent of the households owned 100 – 500 acres of land with majority having between 200 – 299 acres. However, the current land sizes ranges from 0 – over 100 acres with majority owning between 60-79 acres.

Inheritance is the main form of land acquisition for the first and second land parcels as represented by 91.7 and 63.6 percent of the respondents respectively. The dominance of inheritance as the main mode of land acquisition explains the high land subdivision rates in families. Freehold is the main land tenure system accounting for about 90 percent of the land parcels owned by the households. A significant proportion of the households have title deeds for the lands they occupy as represented by 84.5 percent of the respondents. About 89 percent of the respondents attributed the reduction of crop production to small land sizes. This was in comparison to the crop production they had

when they had large parcels before the inheritance and individualized land ownership practices were embraced. The effect of small land sizes on livestock production is not as pronounced as in crop production. This could be attributed to the fact that, being nomads, the inhabitants migrate their livestock to areas with pasture and water, thus the size of land one has may not directly impact on the number of cattle kept. However, about 69 percent of the respondents attributed reduction of livestock to small land sizes.

6.1.2 Land Use and Food and Livelihood Security

This objective assessed how the current land use allocations impacted on food and livelihood security. The study established a change in economic activities. Originally, livestock rearing was the only economic activity for all the households in the sub location. Gradually, residents started to practice crop farming though in small scale. However, the harsh climatic conditions of the area make crop farming uneconomical since very low yields are harvested. Majority of the residents have allocated a significant amount of their land for grazing of animals as represented by 71 percent of the respondents with 2 and 3 percent allocating land for crop farming and renting respectively. Despite the introduction of other economic activities in the sub-location, cattle keeping is still the most dominant economic activity. Being plain Nilotes, the Maasai community derives their pleasure in livestock rearing hence the dominance of the activity. About 47 percent of the respondents earn between Kshs. 20,001 – 50,000 from the sale of livestock per annum. The low average annual income was due to the fact that the community discourages selling of livestock as the more livestock one has, the richer he is considered.

6.1.3 Factors Influencing Household Land Size and Use

The study established several factors that influenced household land size and use in the sub location. Among these factors are; population pressure, household size, brothers at the time of inheritance, number of sons, settlement patterns and urbanization forces. Most of these factors were articulated in the literature review as influencing household land size and land use allocation decisions.

6.1.4 Intergenerational Transmission of Land Rights and Use

Intergenerational transmission of land rights is evident in Bissil sub location. This could be explained by the fact that inheritance is the main mode of land acquisition. Indeed, inheritance was the main reason for land subdivision as people subdivided their lands to share with their relatives. From literature, inheritance especially in Africa is a key

component of tenure system. African customs dictate that fathers should subdivide their properties including land to the sons. This practice results to intergenerational transmission of land rights. The results from the study confirmed the existence of similar customs and traditions. This intergenerational transmission of land rights has significantly led to the decline of household land size over-time. With time, this practice is projected to render some of the households landless. In addition, land uses have also been transmitted over the generations with livestock rearing still being the most dominant land use.

6.1.5 Possible Policy Options for Sustainable Food and Livelihood Security

The study aimed at recommending possible policy options for sustainable food and livelihood security in the pastoral farming system of Bissil sub location, Kajiado County. Some of the options recommended by the households interviewed include; adoption of modern farming methods in livestock and crop production, establishment of settlement schemes, reorganization of the settlements, discourage individualization of land rights and sensitize people on the dangers of land subdivision. From review of literature, some of the possible policy options include; policy stages to control declining land holding, development of an integrated policy for rangeland administration, land reconsolidation, reciprocal grazing arrangements among others.

6.2 Conclusion

This study assessed household land size and use for sustainable food and livelihood security in a pastoral farming system of Bissil sub location, Kajiado County. It sought to establish the relationship between land size and use on food and livelihood security as well as the factors that influence household land size and use. The conclusions of the study have been discussed as per the objectives.

6.2.1 Land Size and Food and Livelihood security

Household land size does not have a direct impact on food and livelihood security. Being a nomadic community, they migrated with their livestock to areas with pastures and water. Thus, despite the declining land sizes, a household could still maintain relatively the same herds of cattle. However, with time, these alternative grazing areas might not be available. This would then force some of the households with small grazing fields and large herds to destock their livestock. Since, livestock rearing is the main source of livelihood for the community, destocking would negatively impact on their food security.

6.2.2 Land use and Food and Livelihood Security

Livestock rearing has the highest land allocation in the sub location. However, there is no significant difference in the size of land allocated to livestock rearing for the households that were food and livelihood secure and those who were insecure. This could be explained by the fact that, the community is a nomadic community and migrate with their animals to areas with pasture and water. Thus, the land allocated to grazing may not have a direct impact on the number of livestock reared. In addition, as the community discourages the sale of livestock, the proceedings from the sale of livestock are relatively low thus no major impact on livelihood security.

6.2.3 Factors Influencing Household Land Size and Use

The factors that influence household land size and use in the sub-location include; population pressure, household size, brothers at the time of inheritance, number of sons, settlement patterns and urbanization forces.

6.2.4 Intergenerational Transmission of Land Rights and Use

Land rights and use have been transmitted over the generations since the inception of the sub location. Inheritance is the main means of land acquisition as fathers are required to subdivide and share their land amongst their sons. This practice has led to gradual decline in land size. Coupled with the location of the sub location along Namanga – Nairobi road, and the speculative nature of the land buyers in the area, these herders may be left landless in the long run.

6.2.5 Possible Policy Options for Sustainable Food and Livelihood Security

To ensure sustainable food and livelihood security in the sub location, some of the policy options postulated include adoption of modern farming methods in livestock and crop production, establishment of settlement schemes, reorganization of the settlements, discourage individualization of land rights and sensitize people on the dangers of land subdivision.

6.3 Recommendations

With the diminishing household land sizes, livestock rearing may not be feasible in the future. In this regard, alternative livelihoods strategies need to be explored. Provision of education to the children will empower them in the future and enable them have alternative livelihood sources with regard to the prerequisite skills acquired. Awareness and sensitization programs with regard to the number of children per household need to be held as the relatively large household sizes will result into significant reduction

of the subsequent land sizes. In addition, the polygamous nature of the community needs to be discouraged as it results to high household sizes. To ensure sustainable food and livelihood security, mixed farming need to be encouraged. In this regard, other farming activities like crop farming, horticulture, bee keeping among others need to be embraced. Development control with specific emphasis on limiting urban growth within Bissil town boundaries need to be upheld as a way of protecting the rural hinterland for livestock production. This will help in addressing the problems of urban sprawl being experienced in the county as a result of the pressure for developable land in the neighbouring Nairobi city. This has led to conversion of agricultural land to residential or commercial uses.

To address the challenges facing livestock rearing, several policy interventions need to be done. These include; reviewing policy, legal and institutional frameworks with regard to livestock production, improving livestock productivity, integrating development and management of rangeland, improving animal health and quality assurance services, improving access to markets, establishing a centrally coordinated livestock database and implementing the flagship disease-free zones project. In addition, poverty-reducing opportunities for livestock development need to be tapped into.

6.4 Areas of Further Research

Some of the probable areas for further research would include; impact of reciprocal grazing arrangements, range management and maintenance on sustainable food and livelihood security. From the literature review, livelihood diversification was one of the coping strategies adopted to ensure food and livelihood security amidst the diminishing land sizes which cannot support pastoralism activities. This research could thus be extended to examine the effect of livelihood diversification for sustainable food and livelihood security in a pastoral farming system. In addition, another research could be done to establish the specific livelihood sources and their appropriate combinations so as to ensure optimal productivity.

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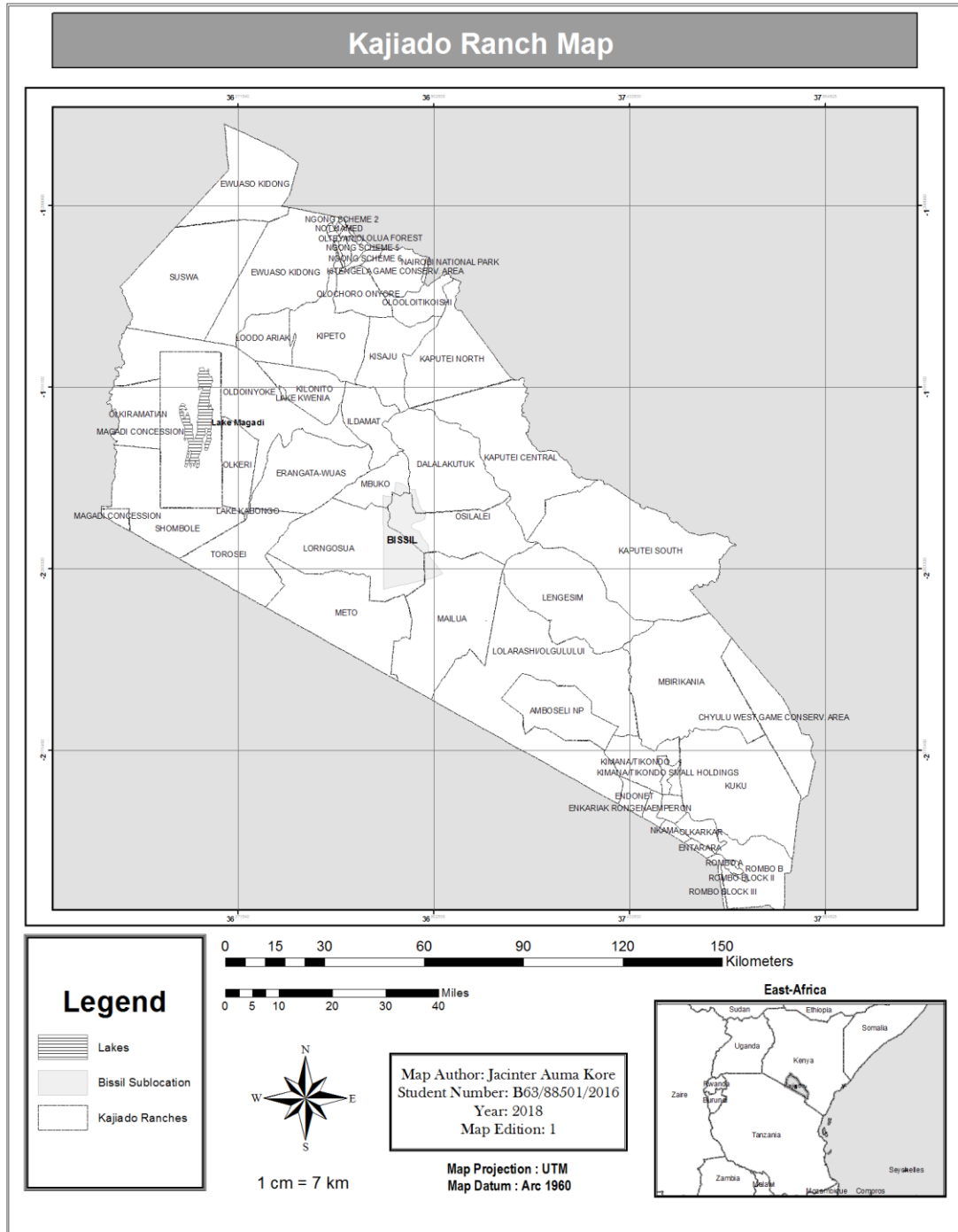
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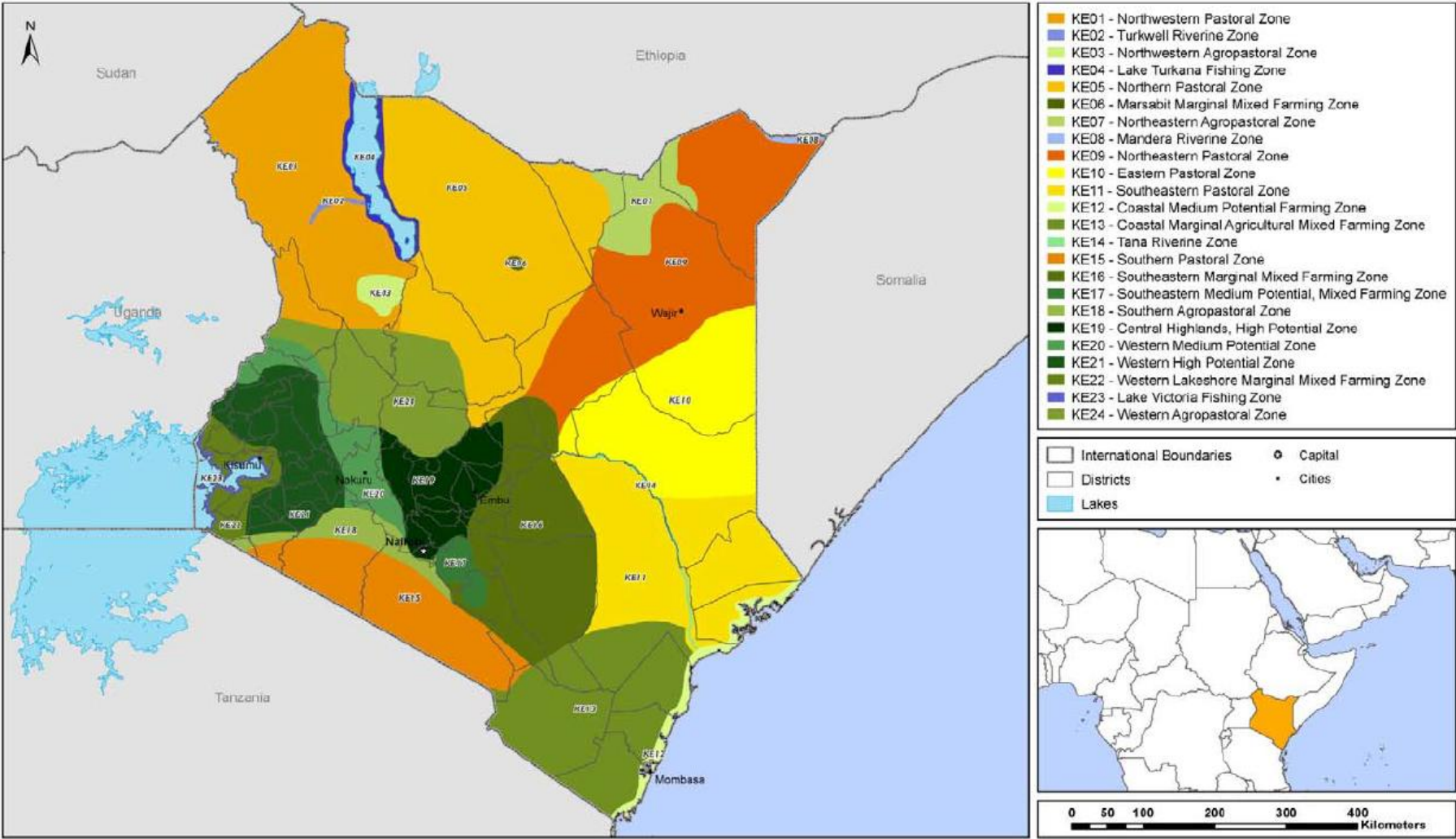
APPENDICES

Appendix 1: Kajiado Ranch Map



Source: Kajiado District Survey Office

Appendix 2: National Livelihood Zone Map



Appendix 3: Seasonal Calendar: Livelihood Zone 15 - Southern Pastoral Zone

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Seasons	Dry		Long rains			Dry					Short rains			
Livestock production														
Calving											Peak			
Kidding/lambing				Peak							Peak			
Diseases (peak)														
Prices					Peak								Peak	
Milk availability	Shoats					Shoats							Cattle/	
Migration							Dry						Wet	
Others														
Livestock sales														
Conflict risks														
Lean season														
Malnutrition											High			
Labor (peak)														
Water stress														
Cross border inflows						Peak								
Food price					High							High		
FS Assessments														

Appendix 4: Household Questionnaire
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 the respondent
Male () Female ()

2.0 Household Data

2.1 How many people are you in your household (Household size)?
2.2 How many Sons do you have?
2.3 How many Daughters do you have?
2.4 Apart from your Sons, do you have any other male member living in your household? *(Tick (√) in the bracket provided the appropriate answer).*
Yes () No (). If Yes, how many are they
2.5 Apart from your Daughters, do you have any other female member living in your household? *(Tick (√) in the bracket provided the appropriate answer).*
Yes () No (). If Yes, how many are they
2.6 What is the highest education level attained by the household members?
(Tick (√) where appropriate answer).

Household members	Age	Education levels					Occupation
		None	Pre-primary	Primary	Secondary	Tertiary	
Father							
Mother 1							
Mother 2							
Mother 3							
Mother 4							
Mother 5							
Mother 6							
Mother 7							
Mother 8							
Son/Daughter							
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

3.0 Land holding arrangements

3.1 Do you own land? (Tick (√) in the bracket provided the appropriate answer).

Yes ()

No ()

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

(If more than one pieces of land are owned, fill in the table below).

3.3 Owned land characteristics

No.	Spatial Location and distance (Km)	Size in Acres	Mode of Acquisition (Buying , Gift or Inheritance)	Main use	Tenure System (leasehold or freehold)	Ownership document
1						
2						
3						
4						
5						
	Total					

3.4 Did you inherit land from your parents? (Tick (√) in the bracket provided, the appropriate answer). Yes () No ()

3.5 What was the size of your father's land before you inherited?.....

3.6 How many **Brothers** did you have at the time of land inheritance?.....

3.7 Did all of them inherit equal share of your parents' land?.....

3.8 How many **Sisters** did you have at the time of inheriting land?.....

3.9 Did any (sisters) of them inherit land from your parents?.....

3.10 If yes to 3.9 above, **how many acres** did each inherit?.....

3.11 Have your parents done any further sub-division apart from the portions they gave you and your siblings? (Tick (√) in the bracket provided the appropriate answer).

Yes () No ()

3.12 If yes to 3.11 above, to how many portions and for what reasons?

a) Portions.....

b)Reasons.....

3.13 Do you think as a country we should continue sub-dividing land among heirs? (Tick (√) in the bracket provided the appropriate answer).

Yes () No ()

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 In your opinion, what is the 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.....

3.19 Are there any **cultural practices** around the inheritance of land in your community? *(List if any)*

3.20 Do you rent any land? *(Tick (✓) in the bracket provided, the appropriate answer).*

Yes () No ()

3.21 If yes to 3.20 above, 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				

4.0 Land uses, Food and Livelihood Security

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

4.2 What other Economic activities do your household engage in ?

No.	Other Source of Income	Frequency	Estimated amount per year (Ksh)
1			
2			
3			
4			
5			

4.3 If agriculture is one of the above economic activities, then complete the table in the following page;

Table of crop and livestock keeping within the farm

No.	Activity	Area (Acres or Sq. Meters)	Yield (kgs) (other) in Seasons		Use (Kgs) (Other)		Price per unit weight. (Min-Maximum)		Average income to the family (Kshs.)
			Season 1	Season 2	Consumed	Sold	Min	Max	
	<u>CROPS</u>								
1									
2									
3									
4									
5									
	<u>LIVESTOCK TYPE</u>	No. Animals	Yield/Animal/Year	Use (Kgs) (Other)		Value (Ksh)		Average income to the Family	
				Consumed	Sold				
1									
2									
3									
4									
5									
6									

4.4 How often do you sell your Livestock ? complete the table below

	LIVESTOCK TYPE	PERIOD (Yearly / monthly)	Value (Kshs)
1	Cows		
2	Goats / Sheep		
3	Chicken		
	Others		
4			
5			
6			
7			
8			
9			
10			

4.5 What are the main challenges you currently encounter in Livestock Keeping?

- (1).....

 (2).....

 (3).....

 (4).....

 (5).....

 (6).....

5.0 Food and nutrition security

5.1 Compare the yield you get currently in your farm and the yields that used to come from your father's farm before sub-division. *(Tick (√) in the bracket provided the appropriate answer).*

Yields are the same ()

Currently yields are lower ()

Yields are more ()

I'm not sure ()

5.2 By how much has the yield change? A *Quarter* () *Half* () *Three Quarters* ()
N/A ()

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

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

5.5 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	

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

Yes ()

No ()

5.7 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							

5.8 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	

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

- 6.1 Land fragmentations exists due to population pressure
 Agree () Disagree () Not sure ()
- 6.2 Small sub-divided parcels lead to low crop yield
 Agree () Disagree () Not sure ()
- 6.3 Modern farming techniques can easily be applied on small land sizes
 Agree () Disagree () Not sure ()
- 6.4 With small land sizes, number of cattle kept has gone down
 Agree () Disagree () Not sure ()
- 6.5 If you agree in 6.4 above, the change was from how many to how many?

- 6.6 Land fragmentation has made people adopt new farming techniques and skills
 Agree () Disagree () Not sure ()

7.0 Human Settlement

7.1 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.			

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

7.3 Given the following possible patterns of human settlement – rank them in your order of preference. *(Interviewer’s observations) Rank from 1 to 4 (1 being most preferred)*

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

7.4 Do you have any question for us?

.....

.....

.....

.....

.....

Appendix 5: Key Informant Interview Schedule

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

Name of respondent.....

Position of respondent.....

Gender of respondent.....

Name of Interviewer.....

Schedule Number.....

Interview Guide Questions

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

Appendix 6: 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

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

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

This is to confirm that I give my consent to voluntarily participate in the group discussions as long as the stated above consent details are strictly adhered to

and that I was not coerced to participate in the discussions but voluntarily decided to partake in its deliberations.

Introduction

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

Questions

- a) Let's start the discussion by talking about our history of origins and when we settled here, what brought us here and what size were our farms
- b) Have the land/farm sizes changed overtime, what brought about these changes?
- c) How have the livestock productivity change over time? What do you think is the cause of change?
- d) Is productivity dependent on ownership or Tenure of land?
- e) Are the livestock productivity sufficient? How long does it last?
- f) How have the residents coped with the changing productivity?
- g) Is there emergence of other practices to take part of livestock production? Which ones are they
- h) What settlement patterns have come up since we settled, are the same houses enough or many others have come, does this affect land size and use?

Appendix 7: Observation List

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

ITEM	CHECK
1. Land sizes	
2. Settlement patterns	
3. Housing structures	
4. Field crops and sizes allocated to each	
5. Demarcations of farm sizes	
6. Types of livestock and number	
7. Any business ventures available	
8. Rangelands	
9. Grazing lands	

Appendix 8: Photography List

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

ITEM	CHECK
1. Housing structures	
2. Cropped farms	
3. Non-cropped farms	
4. Demarcations of boundaries	
5. If possible, aerial photographs showing the land sizes and well delineated boundaries	
6. The people at their natural state as much as possible (with their consent)	
7. Types of livestock and number	
8. Any business ventures available	
9. Rangelands	
10. Grazing lands	

Appendix 9: Document Reviews

The following documents shall be reviewed

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

Appendix 10: Inter-generational Land Rights Changes Interview Schedule

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

Name of respondent.....

Occupation of respondent.....

Gender of respondent.....

Name of Interviewer.....

Schedule Number.....

Interview Guide Questions

a) When did you first settle in Bissil sub-location

.....
.....

b) How many acres of land did you settle on

.....
.....

c) Do you still own the same size of land/farm?

Yes () No ()

Research Document

Extra Photos

Photo A: Focus Group Discussion Sitting 1- Women



Photo B: Women Focus Group Discussion – Female Youths



Photo C: Administering Household Questionnaire



Photo D: White Flower weed in the grazing fields.

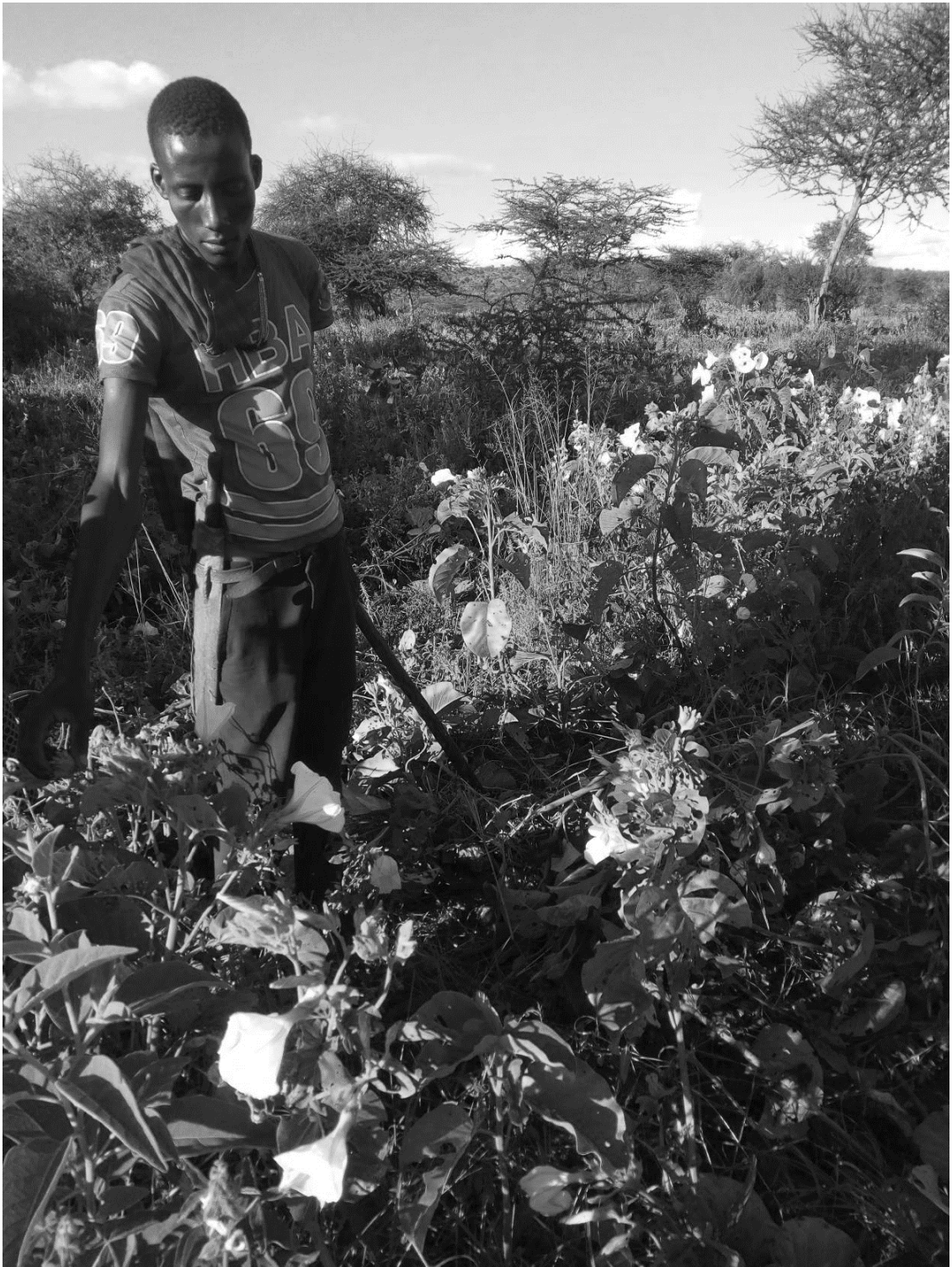


Photo C: Earth Road

