

**FACTORS INFLUENCING MANAGEMENT OF RANGELANDS BY PASTORAL
COMMUNITIES IN GOTU, NGAREMARA WARD, ISIOLO COUNTY, KENYA**

BY

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**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT FOR
THE REQUIREMENTS OF THE DEGREE OF MASTER OF ARTS IN PROJECT
PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI**

2019

DECLARATION

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

Signed Date

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This research project report has been submitted for examination with our approval as the University Supervisors.

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DEDICATION

I would like to dedicate this report to my father the late Daniel Munene and my mother Margaret Wangari for their support and dedication to ensure that I complete my Master Degree.

ACKNOWLEDGEMENTS

I would like to express my special thanks and gratitude to all those who supported me through my studies and especially as I completed my project. Firstly, I offer my sincerest gratitude to my supervisor Prof. Harriet Kidombo of the University of Nairobi who has supported me throughout my project with her patience and knowledge for her guidance and encouragement while preparing this project. Secondly, without the great support of my family – my late father, mother and siblings, I would not have completed this project. I would like to make special mention of my colleagues at Food for the Hungry Kenya – Meru and Isiolo offices; and REGAL-IR Isiolo team for all their support and encouragement. In addition, I would like to appreciate my classmates for their encouragement to complete this project; especially Samuel, John, Halake and Gitonga.

TABLE OF CONTENTS

DECLARATION.....	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ACRONYMS AND ABBREVIATIONS	viii
LIST OF TABLES	ix
LIST OF FIGURES.....	x
ABSTRACT.....	xi
CHAPTER ONE: INTRODUCTION	1
1.1 Background to the Study	1
1.2 Statement of the Problem	2
1.3 Purpose of the Study.....	3
1.4 Research Objectives	3
1.5 Research Questions	3
1.6 Significance of the Study	4
1.7 Delimitation.....	4
1.8 Limitations of the Study	4
1.9 Assumptions of the Study.....	5
1.10 Definitions of Significant Terms	5
1.11 Organization of the study	6
CHAPTER TWO: LITERATURE REVIEW	7
2.1. Introduction	7
2.2. Rangelands Management	7
2.3 Size of Livestock Herd and Rangelands Management.....	7
2.4 Community Management Structures and Rangelands Management	9
2.5 Government Support and Rangelands Management	12
2.6 Socioeconomic Status and Rangelands Management	14
2.7 Theoretical Framework	16
2.8 Conceptual Framework	17
2.9 Literature Gap.....	18
CHAPTER THREE: RESEARCH METHODOLOGY	19
3.1 Introduction	19
3.2 Research Design	19
3.3 Target Population	20

3.4 Sampling Procedures	20
3.5 Methods of Data Collection	21
3.5.1 Questionnaire for the Residents	21
3.5.2 Interview Guide for the Isiolo County Governor	22
3.6 Validity and Reliability	22
3.6.1 Validity	22
3.6.2 Reliability	22
3.7 Methods Data Analysis	23
3.8 Operational Definition of Variables	23
3.9 Ethical Considerations.....	25
CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS	27
4.1 Introduction	27
4.2 Response Rate	27
4.3 Reliability Analysis	27
4.4 Demographic Information	28
4.4.1 Gender of the Respondent	28
4.4.2 Age of the Respondent	28
4.4.3 Education Background	29
4.4.4 Main Source of Income	29
4.5 Factors Influencing Management of Rangelands.....	29
4.5.1 Size of Livestock Herd	30
4.5.2 Community Management Structures.....	31
4.5.3 Government Support	32
4.5.4 Socioeconomic Status.....	33
4.5.5 Management of Rangelands	34
4.6 Regression Analysis	35
CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS	37
5.1 Introduction	37
5.2 Summary of the Findings	37
5.3 Discussion of the Findings	38
5.3.1 Size of Livestock Herd	38
5.3.2 Community Management Structures.....	39
5.3.3 Government Support	39

5.3.4 Socio-Economic Status.....	40
5.3 Conclusions	40
5.5 Recommendations	41
5.6 Recommendations for Further Studies	42
REFERENCES	43
APPENDICES	49
APPENDIX I: TRANSMITTAL LETTER.....	49
APPENDIX II: INTRODUCTION LETTER	50
APPENDIX III: QUESTIONNAIRE FOR RESIDENTS.....	51
APPENDIX IV: INTERVIEW SCHEDULE FOR THE ISIOLO COUNTY GOVERNOR	54

ACRONYMS AND ABBREVIATIONS

ASAL	Arid and Semi-Arid Areas
AU	African Union
CBNRM	Community-Based Natural Resource Management
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
ECOWAS	Economic Community of West Africa States
FAO	Food Aid Organization
GDP	Gross Domestic Product
GoK	Government of Kenya
ICARDA	International Center for Agricultural Research in Dry Areas
IIED	International Institute for Environment and Development
NGOs	Non-Governmental Organizations
SPSS	Statistical Package for Social Sciences

LIST OF TABLES

Table 4. 1: Response Rate	27
Table 4. 2: Reliability Analysis	27
Table 4. 3: Respondents Gender.....	28
Table 4. 4: Age of the Respondent	28
Table 4. 5: Education Background	29
Table 4. 6: Main Source of Income	29
Table 4. 7: Whether the Size of Livestock Motivate Conservation of the Grazing Land	30
Table 4. 8: Agreement with Statements on Livestock Size Influence on Conservation of Grazing Land.....	30
Table 4. 9: Community Management Structures.....	31
Table 4. 10: Some of the Conservation Activities.....	31
Table 4. 11: Measures by Government to Support Management of Local Grazing Land	32
Table 4. 12: Extent of Agreement with Some of the Measures for Managing Local Grazing Land	32
Table 4. 13: Agreement or Disagreement with a Statement.....	33
Table 4. 14: Reasons why Local Community's Occupation Prompts their Management of Grazing Land.....	33
Table 4. 15: Statements on management of rangelands	34
Table 4. 16: Model Summary	35
Table 4. 17: Analysis of Variance (ANOVA).....	35
Table 4. 18: Regression Coefficients	36

LIST OF FIGURES

Figure 1: Conceptual Framework.....	17
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ABSTRACT

Isiolo County, Kenya is made up of different communities that include Ameru, Borana, Gabra, Somali, Samburu and Turkana, who practice agropastoralism as a means of earning their livelihood. This form of livelihood is adequately supported by their physical environment which is categorized as rangeland. Rangelands are described as natural landscapes in the form of grasslands, shrublands, woodlands, wetlands, and deserts which are crucial sources of water, mineral resources, and wood products. This type of environment forms 85% of land surface in Kenya and is ideal for livestock production in the form of pastoralism. In recent times however, the Kenyan pastoralist has faced emerging challenges that include expansion of farming into rangelands through new agricultural practices; nationalization of land by governments; increased size of population increase; overgrazing; and indiscriminate water development. These problems have been compounded by a relentless series of droughts and conflicts. These external pressures have contributed to pasture shortages, land degradation, and socio-economic disintegration. Due to these challenges, pastoralists have been forced to diversify their forms of livelihood, although many still use yesteryear forms of livestock management. This study aimed to examine the factors that influence management of rangelands by Kenyan pastoral communities particularly in Gotu area in Ngare Mara Ward, Isiolo County. The study was guided by the following research objectives: To establish the influence of size of livestock herd on management of rangelands in Gotu area; to examine the influence of community management structures on management of rangelands in Gotu area; to determine the influence of government support on management of rangelands in Gotu area; to establish the influence of socioeconomic status of community on management of rangelands in Gotu area. The study targeted all the male and female inhabitants of Gotu area in Ngare Mara Ward. The researcher also interviewed the former governor of Isiolo County, Hon. Godana Doyo. Questionnaires and interview schedule were used to collect the data. The collected data was organized and prepared for analysis by coding and entry in the Statistical Package for Social Sciences (SPSS, Ver.19). The study found that size of livestock motivates conservation of the grazing land, that local communities frequently engage in any grazing land conservation activities, that government have put measures to support management of local grazing land and that local community's occupation prompts their management of grazing land. The study concluded that size of livestock herd had the greatest influence on management of rangelands in Gotu area followed by community management structures then socio economic status while had the government support then least effect on the management of rangelands in Gotu area. The study recommends that there is a need to strengthen the management capacity of rangelands through measures that enhance pastoralists' control over natural resources, that there is need to build capacity and skills of people to harvest and store rain water and surface run-off and to sensitize the communities on rangeland restoration techniques.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Colson (2008) defines rangelands as vast natural landscapes in the form of grasslands, shrublands, woodlands, wetlands, and deserts. Across the Europe, Asia, and United States, and South America rangelands are crucial sources of water, mineral resources, and wood products. The rangelands are also preferred destinations for wildland recreation, open space and natural beauty recesses (Spencer, 2006). African rangelands are symbolized by a diverse floristic mosaic. Adegboye (2005) observes that these rangelands are characterized by patches of grasslands and pure shrub thickets mixed with open canopy savannas and wooded Acacia steppes. On the fringes of ecosystems, the vegetation variety can be sharp or gradual, in both cases resulting in very special and diverse flora (Diop, 2007). African rangelands are predominantly used for livestock grazing. They are also crucial wildlife habitats.

According to Wario (2010), rangelands make up for 85% of the land surface area in Kenya. Types of rangelands in Kenya include short grass prairies, desert grasslands and shrublands, savannas, and chaparrals. Just like in other African countries, Kenyan rangelands are largely inhabited by nomadic pastoralists who are principally dependent on livestock. In adapting to a harsh and variable physical environment in the rangelands, the Kenyan pastoralist has developed principles and strategies for managing natural resources. Hamisi (2009) points out that coordination among herding units among pastoral communities in Kenya is ensured by a higher level of authority and occasionally by a set of formal rules. For example, according to Borana rules, large ceremonies are held only when and where there is enough pasture and water to support those attending (Godana, 2007). The Somali and the Masaai have similar rules (Sankale, 2005). Wario (2010) adds that the council of elders of the Il Chamus of Kenya enforces grazing controls through informal 'police' chosen from members of the 18-30-year-old age set. Again, three basic informal rules are common to all Kenyan pastoralists: avoid areas already in use, keep at an appropriate distance from others, and avoid areas just recently vacated by others (Njogu, 2008).

These social rangelands controls among Kenyan pastoralists, both formal and informal have successfully obviated the need for external natural resource management campaigns (Hamisi,

2009). This is mainly because these controls are enforceable through the traditional power of the leadership, the individual's need for conformity and acceptance, and the need for reciprocity and mutual help. The communities believe that sharing common property means that short term restraint and discipline has to be exerted in order to maintain the rangelands' long-term sustainability (Sankale, 2005).

The survey and synthesis of existing literature shows that Kenyan pastoral groups use a wide range of techniques in managing natural resources in the rangelands. Their systems are neither random nor irrational, but quite deliberate and adapted to the vagaries of their environment, meaning they are influenced by particular aspects that most current and previous studies have greatly overlooked. This study seeks to pay close attention to these aspects by examining the factors influencing management of rangelands by pastoral communities in Kenya with specific reference to Gotu area in Ngare Mara Ward, Isiolo County.

1.2 Statement of the Problem

In the recent years, the Kenyan pastoralist has had to face new external pressures, such as crop expansion into high quality rangelands, nationalization of land by governments, population increase, overgrazing, and indiscriminate water development. These problems have been compounded by a relentless series of droughts and conflicts. These external pressures have contributed to pasture shortages, land degradation, and socio-economic disintegration. Although many pastoralists are changing their ways (for example diversifying into crop cultivation, sending relatives off for urban wages, or engaging in commerce and trade) many continue to manage their livestock in the old way. But in many areas their traditional system of management is no longer able to cope with the shortage of pasture or to manage the consequences of drought. At the same time, these systems have not been able to adequately balance community needs or sizes of herds owned by their members; hence frequent intercommunity conflicts for scarce rangelands and environmental degradation.

In addition, traditional management knowledge systems are gradually being lost as more of the younger generation of pastoralists is attracted to urban areas. Yet the local communities' system have over centuries developed an intimate knowledge of the environment and many successful techniques that are of great use in the rangelands today. This study therefore seeks to sensitize the

scholarly world as well as the next generation of pastoralists on the pivotal role played by communal rangelands management systems in Kenya; and how these systems, if mixed with certain modern methods, will improve environmental sustainability of pastoral physical environments and better sustain their socioeconomic system. The current study sought to accomplish this by exploring the factors influencing management of rangelands by pastoral communities in Kenya, with specific reference to Gotu area in Ngare Mara Ward, Isiolo County.

1.3 Purpose of the Study

This study aimed to closely examine the key factors that influence management of rangelands by pastoral communities particularly in Gotu area in Ngare Mara Ward, Isiolo County.

1.4 Research Objectives

The study was guided by the following research objectives:

- i. To establish the influence of size of livestock herd on management of rangelands in Gotu area
- ii. To examine the influence of community management structures on management of rangelands in Gotu area
- iii. To determine the influence of government support on management of rangelands in Gotu area
- iv. To establish the influence of socioeconomic status of community on management of rangelands in Gotu area

1.5 Research Questions

The study sought to answer the following research questions:

- i. How does the size of livestock herd influence management of rangelands in Ngare Mara?
- ii. In what ways does community management structures influence management of rangelands
- iii. How does government influence support on management of rangelands?
- iv. In what ways does socioeconomic status of community influence management of rangelands

1.6 Significance of the Study

The findings attained from this study would be beneficial to a number of stakeholders. Among the chief beneficiaries of the study include: The pastoral communities, Government and Non-governmental Organizations. The study would also add to the knowledge base of pastoral communities across Kenya and beyond through would benefit from the findings of the study in that they are going to get enlightened on various, and in fact, more significant factors that should influence management of rangelands in addition to their current systems. Government and Non-governmental Organizations would gain more insights on aspects that prompt pastoral communities' management of rangelands; areas that require capacity addition; and issues that need their support and endorsement. They'll then understand where to chip in and reinforce the rangelands conservation processes. Further, not much has been carried out on the factors that influence management of rangelands by Kenyan pastoral communities. This study would thus add to the knowledge base by looking closely at these factors with respect to Gotu area.

1.7 Delimitation

This study aimed at finding out the key factors that influence management of rangelands by Kenyan pastoral communities. The study covered Gotu area in Ngare Mara Ward, Isiolo County. Other areas of Isiolo County were not covered by the study because the study has a timeline of 1-2 months; meaning there may be no sufficient time to transverse the county. The timeline was also limited the study to 4 main variables (size of livestock, community management structures, government support, and socio-economic status). The study involved the residents of Gotu area, Ministries of Livestock and the Natural Resources Management of Isiolo County. This group of participants were involved since they are expected to provide reliable data to answer the main research objectives.

1.8 Limitations of the Study

The area to be covered is affected by poor transport and communication hence the researcher had to walk long distances to reach the respondents. There is also poor network, thus communication was hindered at times. The researcher was self-sponsored, meaning it may be difficult to meet all the expenses involved in carrying out the research like typing, printing, photocopying and binding the paper. The area to be covered is also vast and remote; the researcher may not reach all areas.

Again, the study has a time limit, so the researcher may not take more time since she is also involved in other activities.

1.9 Assumptions of the Study

The study postulates that the size of livestock herd influences management of rangelands in Ngare Mara because the local residents understand that destruction of rangelands means destruction of pasture for their livestock. Community management structures influence management of rangelands by instilling a sense of collective conservation responsibility on the community members. The government influence support on management of rangelands through their lack of support for cultural/ local management structures and community rangelands by-laws. Socioeconomic status of community influence management of rangelands because the rangelands provide pasture and water for their livestock, which are their main social economic activity.

1.10 Definitions of Significant Terms

For the purpose of this study, the following terms was taken to have the following meanings:

Community: For the purpose of this study this term was used to mean a group of people living in a particular local area, in this case, rangelands

Ecosystem: This term was used in this study to refer to the natural system formed by the interaction of pastoral communities with the physical environment of the rangelands

Livestock: In this study, the term was taken to mean any animals kept by communities living in rangelands for economic activity; these include cattle, sheep, goat, donkeys and camels.

Management: This term was used to refer to the ability of the community to tend rangelands reasonably well despite some difficulty to ensure that they are properly conserved, and are able to serve the community effectively

Pastoral: This term was used in this study to mean activities and lifestyles relating to herdsman devoted to raising livestock as their way of life

Rangeland: For the purpose of this study this term was used to refer to vast natural landscapes in the form of grasslands, shrublands, and deserts in the North Eastern region of Kenya

Socioeconomic: This term was used in this study to mean an activity that is both a way of life of pastoral communities as well as an income generating venture for them

1.11 Organization of the study

This study was organized into five chapters. Chapter one contains the introduction to the study. It presents background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the Study, delimitations of the study, limitations of the Study and the definition of significant terms. On the other hand, chapter two reviews the literature based on the objectives of the study. It further looks at the conceptual framework and finally the summary. Chapter three covers the research methodology of the study. The chapter describes the research design, target population, sampling procedure, tools and techniques of data collection, pre-testing, data analysis, ethical considerations and finally the operational definition of variables. Chapter four presents analysis and findings of the study as set out in the research methodology. The study closes with chapter five which presents the discussion, conclusion, and recommendations for action and further research

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The study investigates the factors that influence management of rangelands by Kenyan pastoral communities particularly in Gotu area in Ngare Mara Ward, Isiolo County. Basing on the purpose of this study, a summary of relevant literature will be used to conceptualize the key areas of the focus of the study. Relevant literature will be reviewed thematically in accordance to the research objectives. The first two sections give an insight into how size of livestock herd and community management structures influence management of rangelands. The third and fourth sections examine the influence of government support and socioeconomic status on management of rangelands. The fifth section reviews the theories pertinent to the current study; while the sixth section structures and clarifies the study's conceptual framework. This review thus locates the current study in the growing body of literature on the issues associated with influence of management of rangelands by pastoral communities.

2.2. Rangelands Management

Rangelands management involves the use of a practical decision-making process that effectively deals with complex rangeland environment from a holistic perspective. According to Spencer (2006) Using rangeland management, people dependent on rangeland areas begin to view their environmental management options in a whole new way, which in turn affects the way they make socioeconomic management decisions. This approach is innovative and yet elegantly simple. When one views the rangeland through a holistic lens and monitors all of the ecosystem processes (water cycle, mineral cycle, energy flow, and biological community dynamics) then rangeland management addresses the whole. The community can then manage animals to manage land, water, and biodiversity (Wario, 2010).

2.3 Size of Livestock Herd and Rangelands Management

Pastoralists always try to maintain a diverse portfolio of livestock designed to meet their needs and to fit the environment. Each type of animal fills a specific objective of the pastoral family. According to Grootaert and Bastelaer (2011), large animals (cattle and camels) are raised not so much for their meat as for their milk, but they are also the 'bank account' and 'security deposit' of

the pastoralist. Unlike Middle Eastern breeds, African sheep and goats are not kept primarily for their milk but for their meat, their 'liquidity', and to a lesser extent, their hair. Other animal products are certainly valued (such as manure and hides) but do not seem to factor in pastoral decisions on the composition of their herds (Jodha, 2009).

As observed in the preceding chapter, African rangelands are characterized by a diverse floristic mosaic. Patches of edaphic grasslands and pure shrub thickets can be mixed with open canopy savannas and wooded Acacia steppes. On the fringes of ecosystems, the ecotones can be sharp or gradual, in both cases resulting in very special and diverse flora (Diop, 2007). Modern ranchers in East Africa, raising solely cattle, have had to expend much capital and labour for bush clearing in order to maintain the rangelands. This is in marked contrast to the traditional African pastoralist who accepted and adapted to environmental diversity by having a herd of mixed species. Cattle and sheep rely in large part on grass (but also some forbs and browse especially in the dry season), while camels and goats rely mainly on browse (Mwangi and Dohrn, 2008).

In an effort to manage the rangelands, African pastoralists practice herd splitting. Herd splitting, the practice of dividing the livestock into separate herds depending on their age, sex, type and productivity, is widely practiced in Africa. Mwamfupe (2010) asserts that pastoralists frequently separate large ruminants from small ones, as among the Rendille of Kenya; herd camels together with sheep, and cattle with goats, as done by the Twareg of Niger; and separate livestock into a 'milk' herd (mostly milking and pregnant animals and their young), and a main or dry herd, as among the Fulani of northern Senegal and the Dinka of Sudan. Herd splitting results in increased niche specialization; reduced competition among livestock for the same vegetation; and a dispersion of grazing pressure as each type of livestock is taken to the pasture which suits it best. Those who do not split herds often do not have enough livestock or herders, or both. Herd diversity and splitting are techniques that can be used to maintain the long term productivity of the range; ensure sustainable production at a comparatively low cost; and in some cases improve degraded rangelands (Maganga, 2005). For example, the Maasai herd their flocks of goats in such a way as to reduce bush encroachment (Sankale, 2005).

Overgrazing has been faulted for degrading lands. Yet, perhaps what has not been recognized universally is what overgrazing really is. According to Lunde (2013), overgrazing is a function of

time, not animal numbers and occurs when an animal returns to a grass plant before it has had time to regenerate. When animals are allowed to roam at will, they will indeed revisit plants before the plants can recover. However, when animals are herded so as to ensure that they do not re-graze plants before they have recovered, then overgrazing is no longer an issue. Time governs the effects of trampling too. Animal hooves enhance soil health when they chip sealed soil surfaces, and knock down dead plants so they can decay more quickly. But they cause damage if animals remain in one place too long or return to it too soon (Kaswamila, 2010).

By combining small groups of animals into larger herds and planning their daily moves, herdsman maximize forage production and the benefits of animal impact – the hoof action of the animals as well as the dung and urine that fertilize the soil. To illustrate this, Butz (2009) explains that by mimicking the wild herds that roamed these lands in the past and keeping livestock moving, they minimize overgrazing of plants, which over time leads to increased ground cover. Livestock are, in effect, being used as a tool for improving soil aeration, water penetration, seed germination, and increasing species diversity and productivity. Rivers begin to flow again because water retention in soils is increased, leading also to more secure and lasting boreholes (Young and Cauldwell, 2007).

2.4 Community Management Structures and Rangelands Management

The main production objectives of pastoralists are not just increasing herd size, but also increasing milk yield, maintaining an appropriate herd structure for short and long term reproductive success, and ensuring disease resistance by selective breeding (Spalding and Jenkins, 2011). The priorities given to each goal will change depending on a pastoral community's ability to conserve their immediate environment- the rangeland by prudent herding. Herding is the art of guarding and conducting livestock. Not every pastoral community has the aptitude and skill in herding. For example, among the Samburu of Kenya, the more distant pastures are underutilized because they are only used by the more energetic and better managers (Hamisi, 2009). The art of herding may be fast disappearing as more and more young people leave the range, but the alternative to herding - fencing - is not feasible for the majority of pastoralists. This is because herders from the same social unit are usually free to use any part of their territory, but in practice confine themselves to the range they know best, and prefer to stay with the same group of people, especially relatives.

This usually ensures a continuity and consistency in range use by the same managers (Jama and Zeila, 2005).

Nonetheless, most pastoral groups have several types of range management techniques including pasture rotation/deferment and grazing reserves. These techniques are frequently used to save forage for critical periods. For example, Nefzaoui, et al (2006) observe that the Zaghawa of Chad move their sheep and camels north to Sahara pastures in separate parallel paths, leaving a portion of the range ungrazed for their return journey to the south. Except during a drought, the Pokot defer using areas with termite-resistant grass during the wet season in order to preserve good fodder for the dry season (Njoka, 2008). The Maasai will widen their grazing radius and delay entering the dry season areas by using donkeys to transport water (Sankale, 2005), and in Amboseli National Park this strategy has been shown to increase the total carrying capacity by 50% (Kideghesho et al, 2008).

Apart from such large-scale rotations, herders also have formal and informal rules regulating the frequency of daily movements and camp locations. Khwaja (2006) reveals that the Wodaabe Fulani use lunar cycles to time their movements to new pastures, which in effect results in moving camp every 2-3 days and moving out of an area every week. This system is apparently common to all Fulani groups, but the Wodaabe observe it more strictly. The Fulani of northern Nigeria say that they must move camp at least four times each season (they recognize five seasons) to prevent over-use (Adegboye 1999).

Herders also closely monitor their livestock and environment for signs that indicate a need to move and the best direction to go. Khwaja (2006) points out that the Wodaabe monitor livestock faeces, milk yield, animal weight, and the number of cows in heat to evaluate the quantity of forage. The Fulani of Mauritania evaluate the quality of the range by taking the livestock to the same pasture on an experimental basis for seven consecutive days. During this time they examine the soil types, the presence or absence of key forage species, the behaviour of livestock (sleeping pattern, eating schedule and the quality of skin and hair, etc.), and presence or absence of wildlife. Good pastures, for example, support gazelles and wild boars, bad ones are inhabited by vividly coloured lizards, and pastures used by elephants and ostrich are good only in the dry season (Okayasu et al, 2011). There are also many indicators for monitoring pasture degradation. For example, the Samburu

observe grass and browse availability (Njoka, 2008), and the Fulani of Mauritania monitor specific plants and wildlife (Okayasu et al, 2011).

These traditional environmental indicators are still in use and have become more pertinent as resource shortages have increased. Up to now, these traditional rangeland monitoring systems have not been used in the development context, perhaps because they did not fit into the classical fenced ‘ranch’ model. Their effectiveness, enhanced by modern husbandry techniques and the relatively low cost of hiring herders as local range monitors, are advantages that can form an integral part of more effective range development programmes. Local herders and scouts should thus be considered as field implementers of environmental monitoring programs and early warning systems.

In some ecological zones, rotation strategies can also be used to increase rangeland capacity by deliberate overgrazing. According to O’Reagain and Schwartz (2007), the Fulani of northern Sierra Leone practice ‘shifting pasturage’; they overgraze one area for 2-3 years then move elsewhere and rest the first area for 15-20 years. The Sukuma (South of Lake Victoria) do the same but allow a rest period of 30-50 years (Mangora, 2005). However, not all ecological zones can withstand overgrazing. For example, in case of overcrowding, the Fulani of Nigeria send their surplus livestock to neighbouring territories where they have alliances (Adegboye 1999). The traditional range supervisors of the Tswana of Botswana were responsible for monitoring the range for overcrowding, and would suggest solutions to the community for allocating more rangeland or moving some herds out of heavily used areas (Tomoo, et al, 2011). Unfortunately, the information on traditional rotation strategies is very limited, perhaps because very few range managers have been interested in studying traditional systems.

Grazing reserves may be exceptions rather than the rule in Africa, but they have been found among more pastoral groups than previously thought. Vetter (2005) explains that some areas are formally declared as grazing preserves or livestock passages where no cultivation is allowed. These efforts to stop the encroachment of crops into rangelands have been documented among the Macina Fulani, the Tonga of southern Zambia, and the Luo of Kenya. Some reserves were set aside to save fodder for dry seasons, as among the Sukuma of Southern Lake Victoria, the Twareg of Ahaggar, the Il Chamus of Northern Kenya, and the Berbers of Morocco (Otsyina, et al, 2008). Groups such

as the Rendille of Kenya and the Tilemsi of Mali reserved certain areas for drought years. In the latter case it appears that the drought reserves were eventually abandoned because the pastures were invaded by toxic plants, possibly due to over-rest (Mwangi and Dohrn, 2008). Finally, some groups closed off degraded pastures for several years to allow regeneration, such as the Berbers of Morocco (Larbi, 2006) and the Chiefs of Northern Burkina Faso, who could order the closure of wells and other water points (De Jode, 2009).

2.5 Government Support and Rangelands Management

Sound environmental governance, which builds on equitable and sustainable management of natural resources, plays a key role in supporting sustainable livelihoods and building lasting peace. The Government of Kenya (2010) delineates that in order to safeguard long-term equitable and sustainable environmental management, a clear and transparent relationship to land – whether an individual's, a community's, a government's or a private investor's – is essential. As such, rangeland development policies and institutional set ups in Kenya and across Africa have evolved. Government institutions in African rangelands have existed and evolved over time. These institutions have been very instrumental in governing rights to water, land and rangeland resources, as well as in conflict resolution.

Pastoralism has been and continues to be the dominant land use system in Africa's rangelands. A key feature of the pastoral system is the strong social organization and customary institutions that have helped pastoralists to adapt to uncertainty and due to their flexibility have contributed to enhanced resilience in rangeland ecosystems (WISP, 2007a). Control of access and management of rangeland resources under traditional institutions has over time been weakened mainly by unsupportive policies and a tendency for state-centric natural resource management common in Africa (Tiedeman, 2005). However, the on-going process of democratization and devolution of power and resources is likely to have a positive impact on natural resource management in rangelands, but care must be taken to protect the vulnerable, voiceless and marginalized people and groups. The role played by the community in governance of natural resources has also gained more recognition and supportive policy is in place in some countries. For example, sectoral policies for forest and water in Kenya acknowledge and provide a framework for participation of communities and other stakeholders in resource management. This trend is also reflected through the emergence of community-based natural resource management (CBNRM) (Mureithi, 2011).

Nikola (2006) observes that over the years, rangeland development initiatives in Africa have advanced, with considerable differences across countries and the perceptions that pastoralism using communal rangelands was inefficient, had low productivity, and caused environmental degradation, led to pastoral policies that tended to favor sedenterization rather than promote pastoral mobility, resulting to widespread appropriation of pastoral rangelands, especially in Eastern and Southern Africa. However, due to better understanding of pastoral systems, this perception has changed and pastoralism is being viewed by African governments as a rational way (both economically and ecologically) of using the rangelands (Agade, 2010). The governments have thus developed policies and legal frameworks in support of pastoralism and in extension, rangelands management

At continental scale, the African Union is developing a Pan African pastoral policy framework which aims to secure, protect and improve the lives, livelihoods and rights of African pastoralists (African Union, 2010). Whilst the draft Framework Guidelines for Land Policy in Africa underscores the need to enhance access to land through tenure reform, particularly for vulnerable groups such as women, establishment of a process for resolution of cross boundary disputes which will help to protect grasslands and pastoral ecosystems (African Union, 2009).

Pastoral issues in Africa are also being captured within the bigger framework of climate change adaptation as rangelands are among the hardest hit by effects of droughts, floods and famine. Regionally, the Economic Community of West Africa States (ECOWAS) has set the pace by providing a legislative framework for cross border mobility, in the form of an International Transhumance Certificate to be used by pastoralists in fifteen-member states (IIED and SOS, 2010). For the COMESA region, there is a 2009 draft policy framework for food security in pastoral areas, which seeks to harmonize national policies to support pastoral movement and efficient use of transnational rangeland ecosystem, and promote livestock trade (African Union, 2010).

Closer home, the East African Community (EAC) recently developed the EAC Transboundary Ecosystems Management Bill, to provide for the management and regulation of Transboundary Ecosystems in the EAC (EAC, 2010), which is expected to enhance management of rangelands particularly with regard to wildlife, pastoralism and water resources.

In Kenya, Njoka (2008) asserts that, national and regional policies guiding rangelands management and development have established a balance between pastoralism and agriculture. However, more efforts are still needed today to incorporate pastoralism into the mainstream economy by undertaking reviews of a wide range policies and making relevant changes, informed by a better understanding of the Kenyan rangelands.

All in all, opportunities for enhancing pastoral lifestyle and rangelands management by African governments through policy and institutional frameworks continue to emerge, for example, the on-going progressive regional integration where recognition of the need for mobility of pastoralists across border has been given priority.

2.6 Socioeconomic Status and Rangelands Management

Rangelands, though generally perceived by many to be of low significance, have supported people's livelihoods for thousands of years. Rangelands support life for those living within them and also for those living outside them. Key economic activities supported by rangelands include livestock production, rangeland agriculture, wildlife conservation and related activities and to a lesser extent mining.

However, as previously noted, the rangelands are predominantly used for livestock production, mainly through pastoralism. Data from FAO (2009) reveal that in sub-Saharan Africa alone, 25 million pastoralists and 240 million agro-pastoralists depend on livestock as their primary source of income. The region holds a 12.5 per cent share of the world's meat production, a large part of which originates from rangelands. In sub-Saharan Africa about 16 per cent of the population relies on pastoralism which contributes significantly to the Gross Domestic Product (GDP) of many nations, for example, approximately 8.5 per cent in Uganda, 9 per cent in Ethiopia and 10 per cent in Mali (CBD, 2010). In the Sahel region in countries such as Burkina Faso, Chad,

In Mali, Mauritania and Niger, transhumance pastoralism (which is the dominant feature of pastoralism in the region) contributes an estimated 70 per cent to 90 per cent of cattle reared (Kamuanga *et al.*, 2008).

Land is the most fundamental among natural resources on which human existence and prosperity on the rangelands depends. Thus the importance of natural resources conservation in sustaining

productivity and rangelands protection among pastoral communities is now relatively more realized than in the past. The pastoral communities understand that livestock production, which is the backbone of their existence, is primarily dependent on a sound rangeland ecosystem.

It is important to note that, Sub-Saharan African pastoralism involves highly fluid production systems responding flexibly to variable and unpredictable arid and semi arid rangeland environments (Karrou and El Mourld, 2003). Consequently, a critical feature of the pastoral production system is access to extensive public land offering potential grazing and water resources that afford pastoralists the necessary flexibility to relocate their livestock when local rangelands fail (Wario, 2010). For this reason, driven by the will to preserve their sole socioeconomic activity, the pastoral communities have taken up the collective responsibility of conserving the rangelands. This conservation is mainly restricted to macro- and micro-economic rangeland elements that harbour biodiversity resources and support livestock production. These include:

Preservation of pastures: This mainly because, Scarcity of pasture associated with the temporal and spatial variability of rainfall and human interference in the rangelands continues to be a challenge for sustainable use of rangelands in Africa. According to FAO (2010), there has been a reduction in pasture with the total land area under pasture and fodder having decreased in Africa, partially due to the fact that large grassland areas have been destroyed or converted to agricultural land. Demand for livestock feed preservation in the rangelands has therefore increased.

Water management: water management and/or conservation of available groundwater reduces the pressure on grazing resources. Mengistu (2005) observes that a few pastoral groups have formal organisations for controlling and managing communal wells. For example, the northern Somali have an elected committee of 3-20 water managers who allocate water to the community and guests, guard the well, enforce and devise rules of use, charge fees, and maintain the well. The Borana of southern Ethiopia have a council of well users that appoints a ‘father of the watering order’. These organizational structures can be used to manage newly constructed boreholes, if the ownership of the well is officially transferred to the local people and if the users are trained in its maintenance (Jama & Zeila, 2005).

Fodder crop production and preservation: Fodder trees and shrubs constitute a major component of the diet of livestock in arid and semi-arid zones of Africa (Otsyina *et al.*, 2008). It has also been

noted that the integration of fodder shrubs into the production systems in the dry areas of North Africa and Central and West Asia could reduce rangeland degradation and mitigate desertification (Larbi et al., 2006). The loss of indigenous perennial plants and shrubs in North Africa rangelands due to increased population of people and livestock has therefore necessitated rehabilitation of denuded areas e.g. by reseeded the degraded areas with legumes (Kassahun et al, 2006).

In sum, pastoral communities have acquired a wide knowledge of the ecosystems in which they live and of ways of using natural resources to sustain their socioeconomic lifestyles

2.7 Theoretical Framework

This study will be based on the ecological succession theory developed by Henry Gleason in 1920. Gleason argued that species distributions responded individually to environmental factors, and communities were best regarded as artifacts of the juxtaposition of species distributions. According to the Gleasonian theory of ecological succession, disturbance becomes a part of the ecosystem and several stable communities have the potential to develop after disturbances are eliminated or reduced. The nature, frequency, and intensity of the disturbance differentially impact each plant species, therefore the community formed after a disturbance depends on the abilities of the species to survive the disturbance or to replace themselves through reproduction after the disturbance. The likelihood of a species surviving or replacing itself after a disturbance depends on the species germination characteristics, competitive ability, growth, phenology, and on its genetic variability and plasticity related to the myriad of environmental factors it may face. In short, forecasting the dynamics of a community following a disturbance requires the knowledge of the physiological and demographic responses of the individuals that constitute the interacting populations that form the community.

The Gleasonian-based successional theory as a model for vegetation conservation is in consistency with the current study's ecological thought regarding management of rangelands. The purpose of this paper is to examine the key factors that influence management of rangelands by Kenyan pastoral communities. Gleasonian successional theory, on the other hand, briefly describes current concepts of vegetation dynamics in relation to vegetation species interaction with populations that form the community. Thus, Gleason's theory of ecological succession is deemed utterly relevant for the current study.

2.8 Conceptual Framework

The conceptual framework shows the interrelation of variables in the study

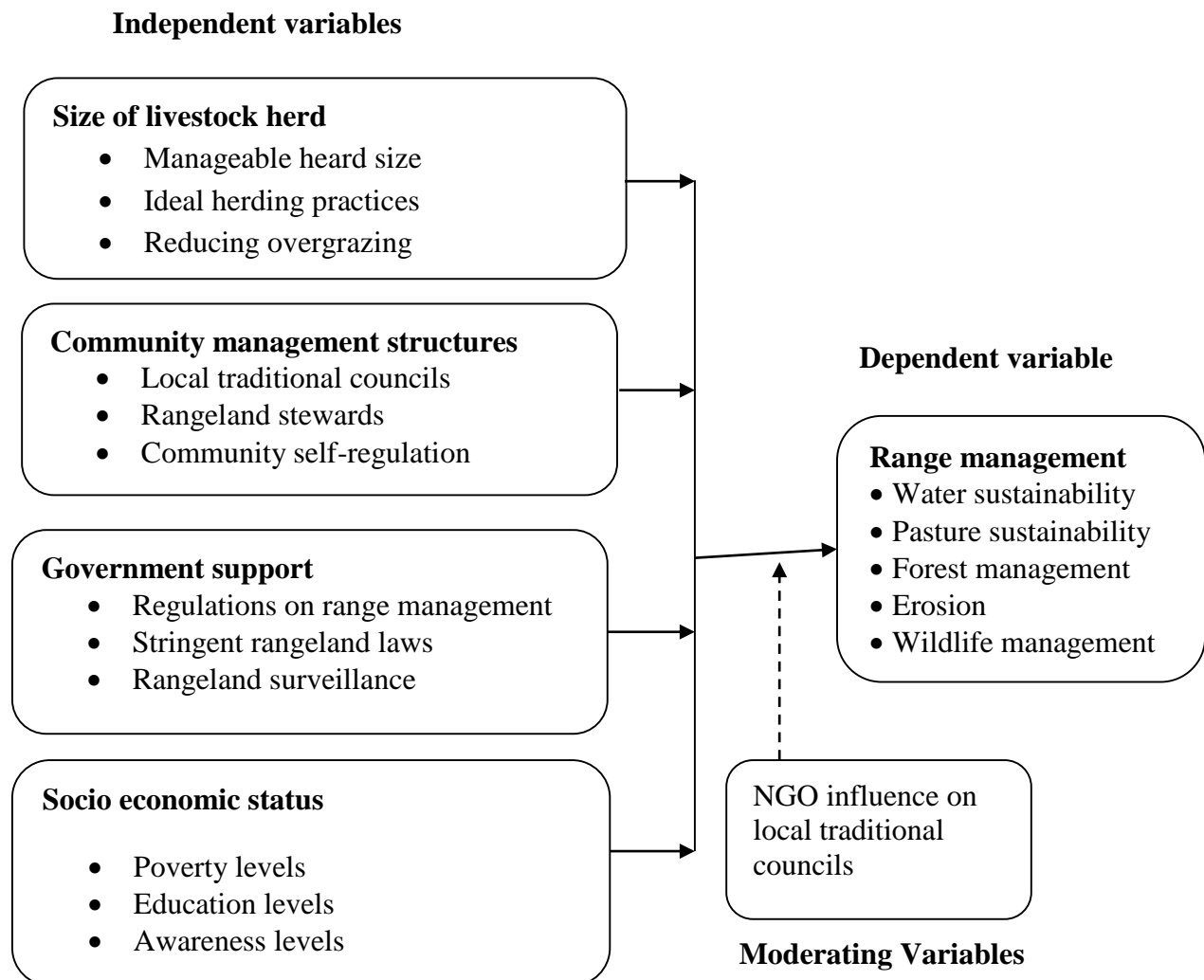


Figure 1: Conceptual Framework

Figure 1 shows that to achieve an optimum rangeland ecological balance, key community-specific factors must be put into consideration. These include: Size of livestock herd; Community management structures such as local traditional councils; government support for example regulations on range management; socio economic status that includes poverty levels, education levels among others (these are treated as the independent variables). An ideal interaction of these

factors ultimately leads to holistic range management that entails water and pasture sustainability, forest management, erosion control, and wildlife management.

2.9 Literature Gap

This study considered existing systems of rangeland management and found missing links between rangeland resources dynamics and community management structures. There was little existing literature on the traditional practices among Oromo ‘deedha’ and Maasai system for rangeland management. The study therefore considered accounts provided by interviewees to fill this gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the procedures and the methods the researcher employed to carry out the study. The section comprises the research design, target population, sampling procedure, data collecting instruments, reliability and validity of the instruments, data collection procedures and methods of data analysis, operational definition of variables, and ethical issues.

3.2 Research Design

Research design is a plan of action to be carried out in connection with the proposed research work. This study adopted a descriptive survey design. The choice of survey research as opposed to other research designs was motivated by the following factors. First, survey research provides a suitable instrument for collecting a large amount of data on similar data items over a short period of time. This facilitates gaining insights into the situation as it is, within a very short time without elaborate and often expensive preparations or long waiting. Secondly it provides a practical framework for collecting data on the factors that influence management of rangelands by Kenyan pastoral communities in Gotu area in Ngare Mara Ward, Isiolo County.

Thus, the survey study provided a suitable means of obtaining information that reflect the situation as it applies to all the stakeholders concerned with rangelands management among pastoral communities. Third, survey studies have strong data reliability. This provides information on the situation as it is at the time the study was conducted.

The qualitative research techniques allowed the researcher to understand the subjects and consequently provide a means of accessing unquantifiable facts about them. It also enabled the researcher to formulate open-ended questions through which a deeper range of responses was sought. In addition, this study employed quantitative techniques to determine the influence of size of livestock herd on management of rangelands in Gotu area; the influence of community management structures on management of rangelands in Gotu area; the influence of government support on management of rangelands in Gotu area; and the influence of socioeconomic status of community on management of rangelands in Gotu area

3.3 Target Population

Barton (2001) cites that any scientific research targets a given population through which interview and questionnaires are distributed so as to target the desired or the required data for analysis. Thus, in conducting a research study researcher ideally investigated all the individuals to whom they wish to generalize their findings. These individuals constitute a population, meaning that they make up the entire group of individuals having the characteristics that interest the researchers (Gall, 2003). In this study, the target population includes all the male and female inhabitants of Gotu area in Ngare Mara Ward. According to Gall, a target population provides a solid foundation and first step upon which to build population validity of the study. Thus, the researcher also considered population characteristics such as gender, age, education level and occupation, of the participants in the study. The researcher collected data from a representative sample composing of men and women residing in Gotu area. The researcher also interviewed the former governor of Isiolo County, Hon. Godana Doyo.

3.4 Sampling Procedures

According to Gall (2003), the general rule in quantitative research is to use the largest sample possible. The larger the sample, the more likely are its mean and standard deviation to be representative of that of target population (Ogula, 1998 p. 59). In this study, the researcher collected data from a representative sample composing of residents of Gotu area and the former Isiolo County governor as well.

3.4.1 Sample of Residents

During this study, cluster sampling was used. A mixture of stratified and simple random procedure was used to select a representative sample of residents, from a cluster, who participated in the study. First the researcher classified the residents into five (5) major stratas, that is, the five major regions of Gotu areas namely: Oldonyiro, Rahole, Merti, Kinna, and Garba Tula. In each of these five zones, the researcher randomly selected only one (1) development-oriented welfare group. In each of these welfare groups, the researcher randomly selected a representative sample of sixteen (16) group members. The researcher obtained the list of names of all the members of each welfare group from the group secretaries. These names was noted down on different slips of paper, which was placed in a container and mixed thoroughly. The researcher then picked 16 names from the container. This was done in every selected welfare group (5) to give a total of 80 members (N=80).

To ensure gender impartiality in the study, the researcher called for, and encourage the participation of balanced male to female ratio in each particular group. Table 3.1 shows the summary of the sample.

The Isiolo County governor was purposively sampled because he is only one (1).

Table 3.1: Sample of the Residents

Group	Population size	Sample size
Friends of Ewaso Nyiro River, Oldonyiro	36	16
Rahole Youth for Change	42	16
Kinna Herders Rescue Association	37	16
Merti Women Self-help Group	34	16
Mazingira ni Mali- Mado Gashi	39	16
TOTAL	188	80

Source: Registrar of Societies KE (2014)

3.5 Methods of Data Collection

In this study, questionnaires and interview schedule was used. The questionnaire was used since it facilitates data collection within short timeframe. On the other hand the interview method was used because it collects in-depth data and allows guided discussion among the participants with the researcher acting as the facilitator (Mwiria and Wamahu, 1995). The questionnaires was used with the residents of Gotu area whereas the interview guide (semi-structured) is intended for the former Isiolo County governor.

3.5.1 Questionnaire for the Residents

The Questionnaires for residents had a number of sub-sections that are sub-divided based on the research objectives except the first sub-section (Section A) that is meant to capture the demographic characteristics of the participants. Section A: Demographic characteristics of residents (sex, age, educational background, occupation); Section B: Influence of size of livestock herd on management of rangelands; Section C: Influence of community management structures on

management of rangelands; Section D: Influence of government support on management of rangelands; Section E: Influence of socioeconomic status of community on management of rangelands and Section F: Management of Rangelands

3.5.2 Interview Guide for the Isiolo County Governor

A semi-structured interview guide was used to collect data from the former Isiolo County governor. The interview guide consisted of two main sections. Section A covers the demographic characteristics of the participant. Such characteristics include age and administration experience. Section B addresses the main research questions on the factors that influence management of rangelands by Kenyan pastoral communities in Gotu area.

3.6 Validity and Reliability

Validity is the degree to which a research instrument measures what it purports to measure and consequently permits appropriate interpretation of the outcomes (Nachmias and Nachmias, 1996). On the other hand, Reliability is the ability of an instrument to produce consistent results (Sarantakos, 1996). The researcher used test-retest to ascertain the coefficient of internal consistency or reliability.

3.6.1 Validity

To check the content validity of the instruments, the instruments were given to two (2) independent experts from the School of Continuing and Distance Education in Nairobi University. The views from the supervisors were also welcomed.

3.6.2 Reliability

Before the actual study, a pilot test of the instrument was conducted in three welfare groups in an area in Isiolo County which enjoys similar characteristics as Gotu area, in this case, Garba Tula Area. The three welfare groups include: Sericho Greenzone Club, Garba Tula Pastoralists' Union; and Meloye Livestock Farmers Association. This was done in order to test whether: There is vagueness in any item; if the instrument can elicit the type of data anticipated and to indicate whether the research objectives are being appropriately addressed

Fifteen (15) residents drawn from the three groups were requested to complete the questionnaires. The residents were randomly sampled. The instrument was administered twice to the same group of subjects at an interval of two weeks. The scores of the first and the second was correlated using Pearson product moment correlation coefficient formula. The responses obtained were analyzed

and compared. Where the responses relationship was between 0.5 and above then the instrument was deemed reliable. Where the relationship was between 0.5 and below, the instrument was deemed of low reliability. In the event the score is low, the researcher sought the counsel of the supervisors on how to improve the instrument. Recommended changes in the instruments were made accordingly.

3.7 Methods Data Analysis

The collected data was organized and prepared for analysis by coding and entry in the Statistical Package for Social Sciences (SPSS, Ver.19). The researcher used both descriptive statistics such as frequencies and percentages. The number of responses (response rate) against the questionnaires sent to participants were determined. Subsequently, coding, classification and grouping of the data according to the predetermined criteria of the received data was done. Quantitative data was presented in the form of tables and graphs with accompanying descriptive details. Quantitative data, which formed the bulk of the study, was analyzed using quantitative methods in order to establish findings and conclusions based on the research questions of the study.

3.8 Operational Definition of Variables

The operationalization of variables is shown in Table 3.2

Table 3.1: Operationalization of variables

Objective	Variables	Indicators	Measurement scale	Tools of analysis	Type of data analysis
To establish the influence of size of livestock herd on management of rangelands in Gotu area	Independent Size of herd of livestock	Herd size Ideal herding practices Reducing overgrazing	Ratio	Mean and percentage	Descriptive statistics

To examine the influence of community management structures on management of rangelands in Gotu area	Community based natural resources management structures	Local traditional councils Rangeland stewards Community self-regulation	Ratio	Mean and percentage	Descriptive statistics
To determine the influence of government support on management of rangelands in Gotu area	Government support to community based natural resources management structures	Range management regulations Rangeland laws Rangeland surveillance	Ratio	Mean and percentage	Descriptive statistics
To establish the influence of socioeconomic status of community on management of rangelands in Gotu area	Community socioeconomic status	Poverty levels Education levels Awareness levels	Ratio	Mean and percentage	Descriptive statistics
To determine availability of rangeland	Dependent Management systems	Water sustainability	Ratio	Mean and percentage	Descriptive statistics

management systems in Gotu area		Pasture sustainability Forest management Erosion Wildlife management			
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3.9 Ethical Considerations

Several official processes took place to ensure that the research can begin collection of data. Prior to data collection, a research permit was first obtained from The University Nairobi. After obtaining permit, the researcher contacted the chairpersons of each selected welfare group so as to explain the purpose of the study, to obtain their consent and request for their assistance. Before responding to the questionnaires, the participants were given instructions on what to do, what is required of them and why. Guided interview schedule with the former Isiolo County governor was carried out with respect to the respondent’s convenience. This research took into consideration the following three areas; consent, confidentiality and deception.

Consent

This involves the participants choosing whether to participate or not to participate in the study. According to Cohen (2000), at all times, the welfare of subjects should be kept in mind by the researcher. In this study the researcher asked for the consent of the participants and was not force anybody to take part in the research. The researcher also endeavored to explain to the participants the purpose of the study and their role in this study.

Confidentiality

Information obtained from the respondents form the basis for a research. In order for the information to be reliable, the respondents should be assured the by confidentiality of the

information they provide (Cohen 2000). In this study, confidentiality was taken care of by advising the participants not write their names in the questionnaire.

Deception

According to Cohen (2000), deception lies in not telling the whole truth. In research, deception involves misrepresentation of facts concerning the purpose, nature or consequences of the study. In this study, the researcher explained the purpose of the study to the respondents. The researcher acknowledged all materials received from secondary sources.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter discusses the findings obtained from the primary instrument used in the study. It interprets the characteristics of the respondents as well the collective opinions on the factors influencing management of rangelands by pastoral communities in Gotu, Ngaremara Ward, Isiolo County. The researcher provided tables that summarized the collective reactions of the respondents.

4.2 Response Rate

The questionnaires that the researcher administered were 80 out of which only 68 fully filled questionnaires were returned. This gave a response rate of 85% which was within what Sekaran (2003) prescribed as a significant response rate for statistical analysis and established at a minimal value of 50%. Response rate analysis for the study are presented in Table 4.1.

Table 4. 1: Response Rate

		Response Rate
Response	68	85%
Non-response	12	15%
Total	80	100

4.3 Reliability Analysis

Reliability analysis was subsequently done using Cronbach's Alpha which measures the internal consistency by establishing if certain items within a scale measure the same construct. Malhotra (2015) established the Alpha value threshold at 0.7, thus forming the study's benchmark. Reliability analysis for the study are presented in Table 4.2.

Table 4. 2: Reliability Analysis

	Alpha value	Comments
Size of livestock herd	0.789	Reliable
Community management structures	0.811	Reliable
Government support	0.987	Reliable
Socio economic status	0.702	Reliable

The Cronbach Alpha was established for every objective which formed a scale. The findings in Table 4.2 illustrates that all the five variables were reliable as their reliability values exceeded the

prescribed threshold of 0.7, Malhotra (2015). This, therefore, depicts that the research instrument was reliable and therefore required no amendments.

4.4 Demographic Information

This section required the respondents to indicate their general information including gender, age bracket, education background and the main source of income. This general information is presented in form tables.

4.4.1 Gender of the Respondent

The respondents were requested to indicate their gender. Their responses are shown in Table 4.3.

Table 4. 3: Respondents Gender

	Frequency	Percent
Male	41	60.3
Female	27	39.7
Total	68	100

From the findings, majority of the respondents were male as shown by 60.3% while female respondents were 39.7%. This implies that the researcher was not gender biased in data collection since all the respondents were considered irrespective of their gender.

4.4.2 Age of the Respondent

The respondents were further asked to indicate the age bracket to which they belong. Their responses are shown in Table 4.4.

Table 4. 4: Age of the Respondent

	Frequency	Percent
20-30 years	9	13.2
31-40 years	15	22.1
41-50 years	32	47.1
51-60 years	12	17.6
Total	68	100

The study results show that majority of the respondents were aged between 41 and 50 years as shown by 47.1%. Others were aged between 31 and 40 years as shown by 22.1%, age of 51 to 60 years as shown by 17.6% and 20 to 30 years as shown by 13.2%. This shows that majority of the respondents were mature enough which made them to have diverse information on the subject under study and also cooperative in giving it.

4.4.3 Education Background

The respondents were asked to indicate their education background. Their responses are presented in Table 4.5.

Table 4. 5: Education Background

	Frequency	Percent
None	19	27.9
Primary	30	44.1
Secondary	12	17.6
College	7	10.3
Total	68	100

From the findings the study found that 44.1% of the respondents had primary education. The other respondents had no education at 27.9%, secondary education at 17.6% and college education at 10.3%. This represents a pool of respondents with some knowledge on the subject under study and could comprehend and give reliable information.

4.4.4 Main Source of Income

The respondents were asked to indicate the main source of their income. Their responses are shown in Table 4.6.

Table 4. 6: Main Source of Income

	Frequency	Percent
Pastoralist	5	7.4
Agro-pastoralist	30	44.1
Agriculture	21	30.9
Fishery	12	17.6
Total	68	100

From the findings, the respondents indicated that their main source of their income was agro-pastoralist as shown by 44.1%, agriculture as shown by 30.9%, fishery as shown by 17.6% and pastoralist as shown by 7.4%. This implies that main source of their income was agro-pastoralism.

4.5 Factors Influencing Management of Rangelands

This section gives findings for size of livestock herd, community management structures, government support and socio-economic status and how they affect management of rangelands.

4.5.1 Size of Livestock Herd

The respondents were asked to indicate whether the size of livestock motivate conservation of the grazing land in Gotu. Their responses are presented in Table 4.7.

Table 4. 7: Whether the Size of Livestock Motivate Conservation of the Grazing Land

	Frequency	Percent
Yes	62	91.2
No	6	8.8
Total	68	100

From the findings, the respondents indicated that size of livestock motivate conservation of the grazing land in Gotu as shown by 91.2% and others indicated that size of livestock don't motivate conservation of the grazing land in Gotu as shown by 8.8%. This is an implication that size of livestock motivates conservation of the grazing land in Gotu.

Further the respondents who indicated size of livestock motivate conservation of the grazing land in Gotu were asked to indicate their level of agreement with various statements about the influence of livestock size on conservation of grazing land. Their responses are as shown in Table 4.8.

Table 4.8: Agreement with Statements on Livestock Size Influence on Conservation of Grazing Land

	Mean	Std. Dev.
Conservation of grazing land ensures its long-term productivity for the increasing herds of livestock	3.887	0.603
Animal hooves enhance soil health when they tramp on solid soil surfaces thus enhancing pasture growth	2.436	1.236
Improvement of degraded grazing land means more pasture for more livestock	4.097	0.844
Large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil end ensure healthy grazing lands	4.323	0.672
Sustainable production of the large herds of livestock is maintained by well-preserved grazing lands	3.129	1.063

The respondents agreed that large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil end ensure healthy grazing lands as shown by a mean of 4.323, Improvement of degraded grazing land means more pasture for more livestock as illustrated by a mean 4.097 and conservation of grazing land ensures its long-term productivity for the increasing herds of livestock as shown by a mean of 3.887. Further, the respondents were neutral that

sustainable production of the large herds of livestock is maintained by well-preserved grazing lands as illustrated by a mean of 3.129 but disagreed that animal hooves enhance soil health when they tramp on solid soil surfaces thus enhancing pasture growth as shown by a mean of 2.436.

4.5.2 Community Management Structures

The respondents were asked to indicate how frequent the local communities engage in any grazing land conservation activities. The findings are presented in Table 4.9.

Table 4. 9: Community Management Structures

	Frequency	Percent
Frequently	51	75
Sometimes	15	22.1
Rarely	2	2.9
Total	68	100

From the findings, the respondents indicated that local communities engage in any grazing land conservation activities frequently at 75%, sometimes at 22.1% and rarely at 2.9%. This is indication that local communities frequently engage in any grazing land conservation activities.

The respondents were asked to indicate some of the conservation activities. The findings are as shown in Table 4.10.

Table 4. 10: Some of the Conservation Activities

	Frequency	Percent
Maintaining an appropriate herd structure for an suitable time	9	13.2
Regulating the frequency of daily livestock movements	15	22.1
Monitoring livestock physical characteristics to evaluate the quantity of pasture	23	33.8
Rotation grazing to avoid overgrazing	11	16.2
Closing off degraded pastures for several years to allow regeneration	10	14.7
Total	68	100

From the findings, the respondents indicated that some of the conservation activities include monitoring livestock physical characteristics to evaluate the quantity of pasture as shown by 33.8%, regulating the frequency of daily livestock movements as shown by 22.1%, rotation grazing to avoid overgrazing as shown by 16.2%, closing off degraded pastures for several years to allow regeneration as shown by 14.7% and maintaining an appropriate herd structure for a suitable time as shown by 13.2%.

4.5.3 Government Support

The respondents were asked to indicate whether the government put any measures to support management of local grazing land. The findings are presented in Table 4.11.

Table 4. 11: Measures by Government to Support Management of Local Grazing Land

	Frequency	Percent
Yes	60	88.2
No	8	11.8
Total	68	100

The respondents indicated that government have put measures to support management of local grazing land as shown by 88.2% and others declined. This implies that government have put measures to support management of local grazing land

Further the respondents were requested to indicate to what extent they agree with some of the measures. The responses are illustrated in Table 4.12.

Table 4. 12: Extent of Agreement with Some of the Measures for Managing Local Grazing Land

	Mean	Std. Dev.
Establishment of grazing land development policies	2.550	0.594
Control of access of grazing land resources	2.617	0.585
Democratization and devolution of power and natural resources	2.267	0.660
Providing a framework for participation of communities and other stakeholders in grazing land management	1.817	0.833
Development of legal frameworks in support of grazing land management	2.667	0.475

The respondents agreed to greater extent that development of legal frameworks in support of grazing land management as shown by a mean of 2.667 that control of access of grazing land resources as illustrated by a mean score of 2.617 and that establishment of grazing land development policies as expressed by a mean of 2.550. However, the respondents agreed to some extent that democratization and devolution of power and natural resources as shown by a mean of 2.267 and that providing a framework for participation of communities and other stakeholders in grazing land management as indicated by a mean of 1.817.

4.5.4 Socioeconomic Status

The researcher asked the respondents to indicate their agreement or disagreement with the statement that the local community's occupation prompts their management of grazing land. The findings are as illustrated in Table 4.13.

Table 4. 13: Agreement or Disagreement with a Statement

	Frequency	Percent
Agree	58	85.3
Disagree	10	14.7
Total	68	100

Most of the respondents agreed that local community's occupation prompts their management of grazing land at 85.3% while others disagreed at 14.7%. This is an indication that local community's occupation prompts their management of grazing land.

Further the researcher asked the respondents who agreed with the statement to indicate whether the some of the reasons why local community's occupation prompts their management of grazing land. The results are presented in Table 4.14.

Table 4. 14: Reasons why Local Community's Occupation Prompts their Management of Grazing Land

	Agree		Disagree	
	f	%	f	%
Grazing land supports local people's livestock, which is their livelihood	47	81	11	19
By supporting livestock, grazing lands supply food to those living within and around them	42	72.4	16	27.6
Local communities manage available grazing lands to avoid traveling for the same	50	86.2	8	13.8
Proper management of grazing lands ensures ideal water conservation	48	82.8	10	17.2
Grazing land preservation prevents conflicts by curbing inter-community competition for pasture	40	69	18	31

From the findings, most of the respondents agreed that some of the reasons why local community's occupation prompts their management of grazing land were local communities manage available grazing lands to avoid traveling for the same as shown by 86.2% and proper management of grazing lands ensures ideal water conservation as shown by 82.8%. They also indicated that grazing land supports local people's livestock, which is their livelihood as shown by 81%, that by

supporting livestock, grazing lands supply food to those living within and around them as illustrated by 72.4% and grazing land preservation prevents conflicts by curbing inter-community competition for pasture as shown by 69%.

4.5.5 Management of Rangelands

The respondents were also asked to indicate their response on various question about management of rangelands. The results are presented in Table 4.15.

Table 4. 15: Statements on management of rangelands

	Yes		No	
	f	%	f	%
Are there any water management systems currently being used by your community that helps to preserve water for the dry seasons?	57	83.8	11	16.2
Are households in Gotu practicing any pasture preservation methods that support their livestock during drought seasons?	59	86.8	9	13.2
Are there forest management systems and methods that are currently practiced by your community to preserve current forest resources?	29	42.6	39	57.4
Are there any soil erosion prevention measures that your community uses to protect soil resource?	49	72.1	19	27.9
Does wildlife management support preservation of rangelands in your community?	50	73.5	18	26.5

From the findings, the respondents indicated that the households in Gotu are practicing any pasture preservation methods that support their livestock during drought seasons as shown by 86.8%, that there are water management systems currently being used by your community that helps to preserve water for the dry seasons as indicated by 83.8% and that wildlife management supports preservation of rangelands in your community as illustrated by 73.5%. Further, the respondents indicated that there are soil erosion prevention measures that the community uses to protect soil resource as expressed by 72.1% and that there are forest management systems and methods that are currently practiced by your community to preserve current forest resources as shown by 57.4%.

4.6 Regression Analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS V 21.0) to code, enter and compute the measurements of the multiple regressions. The model summary was presented in the Table 4.16.

Table 4. 16: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.818	0.670	0.649	1.911

The study used coefficient of determination to evaluate the model fit. The adjusted R^2 , also called the coefficient of multiple determinations, is the percent of the variance in the dependent explained uniquely or jointly by the independent variables. The model had an average adjusted coefficient of determination (R^2) of 0.649 and which implied that 64.9% of the variations in management of rangelands in Gotu area are explained by changes in size of livestock herd, community management structures, government support and socio-economic status.

The study further tested the significance of the model by use of ANOVA technique. The findings are tabulated in Table 4.17.

Table 4. 17: Analysis of Variance (ANOVA)

Model	Sum of Squares	Df	Mean Square	F	Sign.
Regression	488.713	4	122.178	31.923	.000
1 Residual	241.121	63	3.827		
Total	729.834	67			

From the ANOVA statics, the study established the regression model had a significance level of 0.00% which is an indication that the data was ideal for making a conclusion on the population parameters as the value of significance (p-value) was less than 5%. The calculated value was greater than the critical value ($31.923 > 2.5087$) an indication that size of livestock herd, community management structures, government support and socio-economic status all have a significant effect on management of rangelands in Gotu area. The significance value was less than 0.05 indicating that the model was significant.

In addition, the study used the coefficient table to determine the study model. The findings are presented in the Table 4.18.

Table 4. 18: Regression Coefficients

	Un standardized		Standardized	t	Sig
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	0.986	0.123		8.016	.000
Size of livestock herd	0.813	0.387	0.717	2.101	.037
Community management structures	0.767	0.236	0.681	3.250	.001
Government support	0.598	0.219	0.503	2.731	.007
Socio economic status	0.789	0.198	0.702	3.985	.000

The regression equation obtained from this outcome was: -

$$Y = 0.986 + 0.813X_1 + 0.767X_2 + 0.598X_3 + 0.789X_4$$

As per the study results, it was revealed that if all independent variables were held constant at zero, then the management of rangelands in Gotu area will be 0.986. From the findings the study revealed that if Size of livestock herd increases by one unit, then management of rangelands in Gotu area would increase by 0.813. This variable was significant since $p=0.037$ is less than 0.05.

The study further revealed that if community management structures changes it would lead to 0.767 change in management of rangelands in Gotu area. The variable was significant since $p\text{-value}=0.001 < 0.05$. Moreover, the study showed that if all other variables are held constant, variation in government support variates management of rangelands in Gotu area by 0.598. This variable was significant since $p=0.007$ was less than 0.05. Finally, the study revealed that variation in socio-economic status would change the management of rangelands in Gotu area by 0.789. This variable was significant since $p\text{-value}=0.000$ was less than 0.05.

Generally, size of livestock herd had the greatest influence on management of rangelands in Gotu area followed by community management structures then socio economic status while had the government support then least effect on the management of rangelands in Gotu area. All the variables were significant since $p\text{-values}$ were less than 0.05.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, discussion of the data findings, conclusions drawn from the findings highlighted and recommendations made. The conclusions and recommendations drawn are focused on addressing the objective of the study.

5.2 Summary of the Findings

The study sought to establish the influence of size of livestock herd on management of rangelands in Gotu area. The study found that size of livestock motivates conservation of the grazing land in Gotu. The study also revealed that large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil and ensure healthy grazing lands, improvement of degraded grazing land means more pasture for more livestock and that conservation of grazing land ensures its long-term productivity for the increasing herds of livestock. Further, the study found that sustainable production of the large herds of livestock is maintained by well-preserved grazing lands and that animal hooves enhance soil health when they tramp on solid soil surfaces thus enhancing pasture growth.

The study further sought to examine the influence of community management structures on management of rangelands in Gotu area. The study found that local communities frequently engage in any grazing land conservation activities. The study revealed that some of the conservation activities include monitoring livestock physical characteristics to evaluate the quantity of pasture, that regulating the frequency of daily livestock movements, rotation grazing to avoid overgrazing, closing off degraded pastures for several years to allow regeneration and maintaining an appropriate herd structure for a suitable time.

The study also sought to determine the influence of government support on management of rangelands in Gotu area. The study found that government has put measures to support management of local grazing land. It was revealed that these measures include development of legal frameworks in support of grazing land management, that control of access of grazing land resources and that establishment of grazing land development policies. The study found that democratization and devolution of power and natural resources and that providing a framework

for participation of communities and other stakeholders in grazing land management has also been beneficial in management of grazing land.

Further the study sought to establish the influence of socioeconomic status of community on management of rangelands in Gotu area. The study revealed that local community's occupation prompts their management of grazing land. The study also established that some of the reasons why local community's occupation prompts their management of grazing land were local communities manage available grazing lands to avoid traveling for the same; proper management of grazing lands ensures ideal water conservation; grazing land supports local people's livestock, which is their livelihood; and by supporting livestock, grazing lands supply food to those living within and around them; and grazing land preservation prevents conflicts by curbing inter-community competition for pasture.

5.3 Discussion of the Findings

5.3.1 Size of Livestock Herd

The size of livestock was found to motivate conservation of the grazing land in Gotu. The study also revealed that large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil and ensure healthy grazing lands, improvement of degraded grazing land means more pasture for more livestock and that conservation of grazing land ensures its long-term productivity for the increasing herds of livestock. Further, the study found that sustainable production of the large herds of livestock is maintained by well-preserved grazing lands and that animal hooves don't enhance soil health when they tramp on solid soil surfaces thus enhancing pasture growth. These findings are in line with Lunde (2013) who noted that overgrazing is a function of time, not animal numbers and occurs when an animal returns to a grass plant before it has had time to regenerate. When animals are allowed to roam at will, they will indeed revisit plants before the plants can recover. However, when animals are herded so as to ensure that they do not re-graze plants before they have recovered, then overgrazing is no longer an issue. Time governs the effects of trampling too. Animal hooves enhance soil health when they chip sealed soil surfaces, and knock down dead plants so they can decay more quickly. But they cause damage if animals remain in one place too long or return to it too soon.

5.3.2 Community Management Structures

The study found that local communities frequently engage in any grazing land conservation activities. The study revealed that some of the conservation activities include monitoring livestock physical characteristics to evaluate the quantity of pasture, that regulating the frequency of daily livestock movements, rotation grazing to avoid overgrazing, closing off degraded pastures for several years to allow regeneration and maintaining an appropriate herd structure for a suitable time. These results agreed with Njoka (2008) who noted that traditional environmental indicators are still in use and have become more pertinent as resource shortages have increased. Up to now, these traditional rangeland monitoring systems have not been used in the development context, perhaps because they did not fit into the classical fenced 'ranch' model. Their effectiveness, enhanced by modern husbandry techniques and the relatively low cost of hiring herders as local range monitors, are advantages that can form an integral part of more effective range development programs. Local herders and scouts should thus be considered as field implementers of environmental monitoring programs and early warning systems.

5.3.3 Government Support

The study found that government has put measures to support management of local grazing land. It was revealed that development of legal frameworks in support of grazing land management, that control of access of grazing land resources and that establishment of grazing land development policies. The study found that democratization and devolution of power and natural resources and that providing a framework for participation of communities and other stakeholders in grazing land management. These findings correlate with Nikola (2006) who observes that over the years, rangeland development initiatives in Africa have advanced, with considerable differences across countries and the perceptions that pastoralism using communal rangelands was inefficient, had low productivity, and caused environmental degradation, led to pastoral policies that tended to favor sedenterization rather than promote pastoral mobility, resulting to widespread appropriation of pastoral rangelands, especially in Eastern and Southern Africa. However, due to better understanding of pastoral systems, this perception has changed and pastoralism is being viewed by African governments as a rational way (both economically and ecologically) of using the rangelands.

5.3.4 Socio-Economic Status

The study revealed that local community's occupation prompts their management of grazing land. The study also established that some of the reasons why local community's occupation prompts their management of grazing land were local communities manage available grazing lands to avoid traveling for the same, proper management of grazing lands ensures ideal water conservation, grazing land supports local people's livestock, which is their livelihood, by supporting livestock, grazing lands supply food to those living within and around them and grazing land preservation prevents conflicts by curbing inter-community competition for pasture. These findings conform to Mengistu (2005) who observes that a few pastoral groups have formal organizations for controlling and managing communal wells. For example, the northern Somali have an elected committee of 3-20 water managers who allocate water to the community and guests, guard the well, enforce and devise rules of use, charge fees, and maintain the well. The Borana of southern Ethiopia have a council of well users that appoints a 'father of the watering order'. These organizational structures can be used to manage newly constructed boreholes, if the ownership of the well is officially transferred to the local people and if the users are trained in its maintenance.

5.3 Conclusions

The management of rangelands in Gotu area is significantly affected by study sought to establish size of livestock herd. The size of livestock has been indicated to motivate conservation of the grazing land. This is because large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil end ensure healthy grazing lands. The improvement of degraded grazing land means more pasture for more livestock where long-term productivity for the increasing herds of livestock is guaranteed.

The community management structures were concluded to significantly affect management of rangelands in Gotu area. In this case, the local communities frequently engage in any grazing land conservation activities. These conservation activities include monitoring livestock physical characteristics to evaluate the quantity of pasture, regulating the frequency of daily livestock movements, rotation grazing to avoid overgrazing and closing off degraded pastures for several years to allow regeneration and maintaining an appropriate herd structure for a suitable time.

The study concluded government support influence management of rangelands in Gotu area positively. In Gotu area, the government has put measures to support management of local grazing

land. These measures include development of legal frameworks in support of grazing land management, control of access of grazing land resources and establishment of grazing land development policies and democratization and devolution of power and natural resources.

The socioeconomic status of community was concluded to significantly influence the management of rangelands in Gotu area. The local community's occupation prompts their management of grazing land. This is because as a result of local communities manage available grazing lands to avoid traveling for the same, proper management of grazing lands ensures ideal water conservation, grazing land supports local people's livestock, which is their livelihood and grazing land preservation prevents conflicts by curbing inter-community competition for pasture.

5.5 Recommendations

The study recommends use of local land classification systems to identify key land resources and assign appropriate use in addition to incorporation of "traditional" authorities into formal management committees. In the light of pastoral institutional problems, a participatory approach involving local communities is recommended in determining the best opportunities and options available for the management of rangelands.

There is a need to strengthen the management capacity of rangelands through measures that enhance pastoralists' control over natural resources. Water development for production (surface water harvesting for small scale crop irrigation and livestock) and domestic use and diversion of some water would not only avail water for Gotu area but also save downstream communities from floods.

There is need to build capacity and skills of people to harvest and store rain water and surface runoff. In addition a watershed management policy in rangelands is urgently needed to save green belts. There is need to increasing access to agricultural inputs especially those used in land opening and range pasture quality improvement (seeds) and livestock restocking. Build the capacity to restore soil fertility and also improve grazing lands and overall ecosystem productivity.

There is need to sensitize the communities on rangeland restoration techniques. Government through development pattern in the region needs to establish rangeland demonstration farms that are accessible by the pastoralists. Diversification in sources of livelihoods to reduce the negative impacts of total rangeland/livestock dependence would also reduce on environmental impact

To improve rangeland management for sustainable development and improve welfare of the local communities, there is a need to increase production and productivity of rangeland through increased off-take of livestock and livestock products and increase the income of pastoralists. This would entail research and programs that enhance the understanding of the present situation with regard to the utilization of rangelands resources.

The need for land use plans is very strong in the light of multiple uses of rangelands. The rights of pastoralists over rangeland resources should be legally recognized, thus ensuring security of tenure and protection of property. There is a need that stakeholders, pastoralists in particular, take advantage of the existing state administrative machinery to become involved in the decision-making process on matters affecting rangeland resources. NGOs, government and pastoralists working together can have a positive impact on sustainable use of rangeland resources

The study recommends a practical extension approach where rangelands are utilized according to land potential such as specific enterprises based on rainfall amount, soils, minerals and vegetation types would not only provide the community decent livelihoods but also, protect rangelands from extreme impacts of climate change events. However, this should follow a detailed study of the available resources and determine the range ecosystem resilience to guide enterprise location or appropriate range use.

5.6 Recommendations for Further Studies

This study only focused on factors influencing management of rangelands by pastoral communities in Gotu, Ngaremara Ward, Isiolo County. The study recommends the same study to be done in other areas in Isiolo County. Further a similar study can be done in other counties in Kenya.

The study also recommends another study to be done on rangeland resource dynamics and their implications for pastoral livelihoods.

REFERENCES

- Adegboye, R O (1999) *A socio-economic study of Fulani nomads in Kwara State* Federal Livestock Department (Kadunda), Ibadan
- African Union (2009) *Framework and Guidelines on Land Policy in Africa*. Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia
- African Union (2010) *Policy Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities*. Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia.
- Agade, KM. (2010). Complexities of livestock raiding in Karamoja. *Nomadic Peoples* 14: 87–105
- Butz R.J (2009) Traditional fire management: historical fire regimes and land use change in pastoral East Africa. *International Journal of Wildland Fire* 18: 442–450. doi: 10.1071/WF07067
- Colson, N. T (2008) Agro-pastoral production strategies and development in the Bay Region. Labahn, T (ed) *Proceedings of 2nd International Congress of Somali Studies* vol 3. University of Hamburg, Verlag, Hamburg. 159-186
- De Jode, H. (2009). *Modern and mobile. The future of livestock production in Africa's drylands*. IIED and SOS Sahel UK. ISBN 978-1-84369-752-7
- FAO (2010) *Guidelines on sustainable forest management in drylands of sub-Saharan Africa*. Arid Zone Forests and Forestry Working Paper No. 1. Rome.
- Godana A. (2007) Post-Drought Recovery Strategies Among the Pastoral Households in Northern Kenya. *Environment Quarterly* 5 (13)

- Grootaert, C. and Bastelaer, T. (2011). “*The Role of Social Capital in Development: An Empirical Assessment*”, Cambridge: Cambridge University Press.
- Hamisi, B. (2009) Empowering Pastoralists in Kenya: A Strategy for Relief and Rehabilitation. Nairobi: Longhorn
- IIED (International Institute for Environment and Development) and SOS Sahel International UK. (2010). Modern and mobile: The future of livestock production in Africa’s drylands. ISBN 978-1-84369-752-7
- Jama, B. and Zeila, A. (2005). Agroforestry in the drylands of eastern Africa: a call to action. ICRAF Working Paper – No. 1. Nairobi: World Agroforestry Centre.
- Jodha, N.S., (2009). “Natural Resource Management and Poverty Alleviation in Mountain Areas: Approaches and Efforts, Conference Paper Series No. 11, International Conference on Natural Assets at Tagaytay City, Philippines, 8-11 January 2010
- Kamuanga, M. J. B., Somda, J, Sanon, Y. and Kagone, H. (2008). Livestock and regional Market in the Sahel and West Africa Potentials and challenges. SWAC-OECD/ECOWAS
- Karrou, M. and El Mourld, M. (2003). Drought management and planning strategies in semi-arid and arid agro-pastoral systems of West Asia and North Africa: A review. International Center for Agricultural Research in Dry Areas (ICARDA). Tunis, Tunisia
- Kassahun, A., Snyman, H.A. and Smit, G.N. (2006). Impact of rangeland degradation on the pastoral production systems, livelihoods and perceptions of the Somali pastoralists in Eastern Ethiopia. *Journal of Arid Environments* 72, 1265–1281.

- Kaswamila A (2010) Human-wildlife conflicts in Monduli District, Tanzania. *International Journal of Biodiversity Science and Management* 5(4): 199–207. doi: 10.1080/17451590903557526
- Khwaja, A.I., (2006). “Measuring Empowerment at the Community Level: An Economist’s Perspective”, Chapter 12 in Narayan, Deepa (ed.) 2006. “*Measuring Empowerment: Cross- Disciplinary Perspectives*”, Washington DC: World Bank
- Kideghesho JR, Røskoft E, Kaltenborn BP, Mokiti TCM (2008) Serengeti shall not die’: Can the ambition be sustained? *International Journal of Biodiversity Science and Management* 3(1): 150–166. doi: 10.1080/17451590509618089
- Larbi, A., Khatib, A., Bolus, P., Tiedeman, J. and Iniguez, L. (2006). Forage potential of non-leguminous and leguminous fodder shrubs in the dry areas of Central and West Asia and North Africa. *Human and Nature: Working Together for Sustainable Development in Dry Lands. Proceedings of the 8th International Conference on Development of Drylands. Beijing, China 25-28 Feb 2006*
- Lunde E.V (2013) Assessing the effect of roads on impala (*Aepyceros melampus*) stress levels using faecal glucocorticoid metabolites. MSc thesis, Norwegian University of Science and Technology, NTNU, Trondheim
- Maganga L.S (2003) Threats to biodiversity in Africa’s protected areas and implication on the environment. In: *Proceedings of the SUA Convocation 1st Workshop 26–27 July*
- Mangora M.M (2005) Ecological impact of tobacco farming in miombo woodlands of Urambo District, Tanzania. *African Journal of Ecology* 43: 385–391. doi: 10.1111/j.1365- 2028.2005.00603.

- Mengistu, T., Teketay, D., Håkan, H. and Yonas, Y. (2005). The Role of Communities in Closed Area Management in Ethiopia. *Mountain Research and Development*, 25(1):44- 50.
- Mureithi, S. M. (2011). Final evaluation of scaling up range rehabilitation project in community areas in Laikipia-Kenya: Biophysical and socio-economic impacts of range rehabilitation in Tiamamut-Kijabe-Nkiloriti Group Ranches. African Wildlife Foundation Report. 40 pp. 17th May 2011
- Mwamfupe D (2010) Demographic impacts on protected areas in Tanzania and option for action. *Parks* 11: 42–56.
- Mwangi, E. and Dohrn, S. (2008). Securing access to drylands resources for multiple users in Africa: A review of recent research. *Land Use Policy* 25, 240–248.)
- Nefzaoui, A., El Mourid, M., Saadani, Y., Jallouli, H., Raggad, N. and Lararev, G.(2006). A Field Manual for the Preparation of a Participatory Community Development Plan. ICARDA Aleppo, Syria, 116 pp.
- Nikola, R. (2006). Policies and strategies to address the vulnerability of pastoralists in sub-Saharan Africa. PPLPI working paper no. 37
- Njogu, G. (2008) Livestock and the environment: How grazing benefits grassland ecosystems. Nairobi: Oxford
- Njoka, J. T. (2008). Dryland Livestock Wildlife Environment Interface Project (DLWEIP). DLWEIP Mid-Term Review Report, March 2008. AU-IBAR (African Union-InterAfrican Bureau for Animal Resources), Nairobi, Kenya

- Okayasu, T., Okuro, T., Jamsran, U., and Takeuchi, K. (2011). Threshold Distinctions Between Equilibrium and Non-equilibrium Pastoral Systems along a Continuous Climatic Gradient. *Rangeland Ecology and Management*, 64(1):10-17.
- O'Reagain, P.J. and Schwartz, J. (2007). Dietary selection and foraging strategies of animals on rangeland. Coping with spatial and temporal variability
- Otsyina, R.M., Norton, B.W. and Djimde, M. (2008). Fodder Trees and Shrubs in Arid and Semi-Arid Livestock Production Systems. Session 23-Grasslands in Arid and Semi Arid Regions
- Sankale, D. (2005) Asset Building through Community Participation: Re-stocking Pastoralists Following Drought in Kenya. Unpublished thesis. Kenyatta University
- Spalding M, and Jenkins M (2011) The World's Protected Areas: Status, Values and Prospects in the Twenty-first century. University of California Press, Berkeley
- Spencer, E.H (2006) Global Desertification and Population. *Development and Change* 52(1):74-112
- Tiedeman, J. (2005). The Challenge of Rangeland Degradation in WANA: Going Beyond Restoration ICARDA Caravan, Issue No. 22
- Tomoo, O., Toshiya, O., Undarmaa, J. and Kazuhiko, T. (2011). Threshold Distinctions between Equilibrium and Nonequilibrium Pastoral Systems along a Continuous Climate Gradient. *Rangelands Ecology and Management*: January 2011. Vol 64. No. 1, pp 10-17
- Vetter, S. (2005). Rangelands at equilibrium and non-equilibrium: recent developments in the debate. *Journal of Arid Environments* 62, 321–341

- Wario, M.A (2010) *Savannah Nomads: A Study of the Borana Pastoral Community of North Eastern Kenya*. London: Oxford University Press
- WISP (2007a). Squandered wealth: a global economic review of pastoralism. WISP Policy Issues Paper 2
- Young C.R, and Cauldwell R.D (2007) Animal breeding systems and big game hunting: Models and application. *Biological Conservation* 142: 909–929. doi: 10.1016/j.biocon.2008.12.018
- Barton, K. (2001) *Introduction to Scientific Research Method*. New York: Griaef Publishers
- Cohen, L. (2000). *Research Methods in Education*. 5th Edition Routle Falmer, New York.
- Gall, M. D. (2003). *Educational research: An introduction*. (7th Edition). White Plains, New York: Longman
- Mwiria, K. and Wamahiu, S. P. (eds) (1995). *Issues in educational research in Africa*. East Africa Educational Publishers; Nairobi.
- Nachmias D. and Nachmias, C. (1996) *Research methods in the social sciences (5th ed.)*, St. Martins Press; New York.
- Ogula, P. A. (1998). *A handbook on educational research*. Longman; Nairobi.
- Sarantakos, S. (1996). *Social Research*. Sydney: Macmillan Education Australia PTY Ltd.

APPENDICES

APPENDIX I: TRANSMITTAL LETTER

Mary Wanjiku Munene

P.O BOX 68964, 0062

NAIROBI, KENYA.

Dear Sir/ Madam,

RE: ACADEMIC RESEARCH PROJECT

I am a Master of Arts in Project Planning and Management student at University Of Nairobi. I wish to conduct a research entitled Factors Influencing Management of Rangelands by Pastoral Communities in Gotu, Ngaremara Ward, Isiolo County, Kenya. A questionnaire has been designed and will be used to gather relevant information to address the research objective of the study. The purpose of writing to you is to kindly request you to grant me permission to collect information on this important subject from your organization.

Please note that the study will be conducted as an academic research and the information provided will be treated in strict confidence. Strict ethical principles will be observed to ensure confidentiality and the study outcomes and reports will not include reference to any individuals.

Your acceptance will be highly appreciated.

Yours faithfully,

Mary Wanjiku Munene

L50/73238/2012

APPENDIX II: INTRODUCTION LETTER

Mary Wanjiku Munene

P.O BOX 68964, 0062

NAIROBI, KENYA.

TO WHOM IT MAY CONCERN

Dear Sir/ Madam,

RE: REQUEST FOR PARTICIPATION IN A RESEARCH STUDY

I am a final year Master of Arts student at the University of Nairobi, specializing in project planning and management. I am currently undertaking a research on “FACTORS INFLUENCING MANAGEMENT OF RANGELANDS BY PASTORAL COMMUNITIES IN GOTU, NGAREMARA WARD, ISIOLO COUNTY, KENYA”.

I will be grateful if you could spare sometime from your busy schedule and fill in the questionnaire. All the information provided will be purely used for academic purposes and your identity will be treated with utmost confidentiality.

Thank you for your cooperation.

Yours faithfully,

MARY WANJIKU MUNENE

L50/73238/2012

APPENDIX III: QUESTIONNAIRE FOR RESIDENTS

Section A: Background Information

Please respond to each item by putting the appropriate code in the corresponding box.

A1 Please indicate your gender

Female Male

A2 Indicate your age bracket Age

20 - 30 years 31 - 40 years 41 - 50 years Above 50 years

A3 State your highest education level

None Primary level Secondary College

A4 State your main sources of income

Pastoralist Agro-pastoralist Agriculture Fishery Petty Trade Casual labor
 Charcoal burning Other (if other, Specify – question A5)

A5 Other (Specify)

Section B: Influence of size of Livestock Herd on Management of Rangelands

B1 Does the size of livestock motivate conservation of the grazing land in Gotu?

Yes No

If YES, please indicate whether you Strongly agree; Agree; Undecided; Disagree; Sstrongly disagree with the following statements about the influence of livestock size on conservation of grazing land

B2 Conservation of grazing land ensures its long term productivity for the increasing herds of livestock

Strongly agree Agree Undecided Disagree Strongly disagree

B3 Animal hooves enhance soil health when they tramp on solid soil surfaces thus enhancing pasture growth

Strongly agree Agree Undecided Disagree Strongly disagree

B4 Improvement of degraded grazing land means more pasture for more livestock

Strongly agree Agree Undecided Disagree Strongly disagree

B5 Large herds of livestock knock down dead plants making them decay more quickly and fertilize the soil end ensure healthy grazing lands

Strongly agree Agree Undecided Disagree Strongly disagree

B6 Sustainable production of the large herds of livestock is maintained by well-preserved grazing lands

Strongly agree Agree Undecided Disagree Strongly disagree

Section C: Influence of Community Management Structures on Management of Rangelands

C1 How frequent does the local communities engage in any grazing land conservation activities?

Frequently Sometimes Rarely

C2 Please indicate whether the following are some of the conservation activities

Maintaining an appropriate herd structure for an suitable time

Regulating the frequency of daily livestock movements

Monitoring livestock physical characteristics to evaluate the quantity of pasture

Rotation grazing to avoid overgrazing

Closing off degraded pastures for several years to allow regeneration

Section D: Influence of Government Support on Management of Rangelands

D1 Has the government put any measures to support management of local grazing land

Yes No

If YES, indicate by ticking to what extent you agree with the following as some of the measures

Not at all To some extent To a greater extent

D2 Establishment of grazing land development policies

Not at all To some extent To a greater extent

D3 Control of access of grazing land resources

Not at all To some extent To a greater extent

D4 Democratization and devolution of power and natural resources

Not at all To some extent To a greater extent

D5 Providing a framework for participation of communities and other stakeholders in grazing land management

Not at all To some extent To a greater extent

D6 Development of legal frameworks in support of grazing land management

Not at all To some extent To a greater extent

Section E: Influence of Socioeconomic Status of Community on Management of Rangelands

E1 The local community's occupation prompts their management of grazing land

Agree Disagree

If you AGREE, please indicate by ticking whether the following are some of the reasons why local community's occupation prompts their management of grazing land

Agree Disagree

E2 Grazing land supports local people's livestock, which is their livelihood

Agree Disagree

E3 By supporting livestock, grazing lands supply food to those living within and around them

Agree Disagree

E4 Local communities manage available grazing lands to avoid traveling for the same

Agree Disagree

E5 Proper management of grazing lands ensures ideal water conservation

Agree Disagree

E6 Grazing land preservation prevents conflicts by curbing inter-community competition for pasture

Agree Disagree

Section F: Management of Rangelands

F1 Are there any water management systems currently being used by your community that helps to preserve water for the dry seasons?

Yes No

F2 Are households in Gotu practicing any pasture preservation methods that support their livestock during drought seasons?

Yes No

F3 Are there forest management systems and methods that are currently practiced by your community to preserve current forest resources?

Yes No

F4 Are there any soil erosion prevention measures that your community uses to protect soil resource?

Yes No

F5 Does wildlife management support preservation of rangelands in your community?

Yes No

Date

Thank you for your cooperation

APPENDIX IV: INTERVIEW SCHEDULE FOR THE ISIOLO COUNTY GOVERNOR

Section A: Demographic Information

A1 Please indicate your age bracket

41-45 years 46 - 50 years 51 - 55 years 56 - 60 years Above 61 years

A2 State number of years of administrative experience

1 - 4 years 5 - 10 years 11 - 15 years 16 - 20 years Above 21 years

Section B: Factors That Influence Management of Rangelands by Kenyan Pastoral Communities in Gotu Area

B1 In what ways does the size of livestock herd influence management of rangelands in Gotu area?

B2 What are some of ways in which community management structures influence management of rangelands?

B3 How does both the county and national government influence support on management of rangelands?

B4 In what ways does socioeconomic status of community influence management of rangelands?

Thank you for your time