

**ENVIRONMENTAL DEGRADATION AND ITS INFLUENCE ON THE
SECURITY OF PASTORALIST COMMUNITIES IN SAMBURU COUNTY,
KENYA**

PHILIP LTAPARWA GALWERSI

**A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree
of Master of Science in Governance, Peace and Security of the School of Humanities and
Social Sciences, Department of Governance, Peace and Security Studies of Africa Nazarene
University**

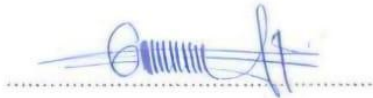
July 2026

DECLARATION

I declare that this thesis is my original work and that it has not been presented to any other university for academic work.

Name: PHILIP LTAPARWA GALWERSI

Reg. No. 110062348



01/07/2026

This thesis was conducted under our supervision and is submitted with our approval as university supervisors.

Supervisor name: PROF. REBECCA WAMBUA



University Supervisor signature

11/7/26

Date

Supervisor name: DR. DANIEL NAMENYA



University Supervisor signature

11/7/26

Date

Africa Nazarene University

Nairobi, Kenya

DEDICATION

This thesis is dedicated to my family members for their great support throughout my studies and in the course of writing this thesis.

ACKNOWLEDGEMENTS

First and foremost, I express my gratitude to Almighty God for granting me the grace and strength to reach this stage in my postgraduate studies. I firmly believe that with His support, anything is possible. Secondly, I extend my appreciation to my supervisor, Dr. Daniel Namanya and Prof. Rebecca Wambua, for their understanding, patience and most importantly, for dedicating their time to review my work, provide corrections and guide me on how to implement them. A special gratitude goes to HOD Dr Simon Muthomi for his immense out of schedule support to ensure this milestone is reached, I am honoured to have been mentored by a leader who is deeply invested in the growth and success of his students. Further, I am thankful to Africa Nazarene University for offering me the opportunity to pursue a Master of Science degree in Governance Peace and Security, which allowed me to meet and form new friendships.

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	x
LIST OF FIGURES	xi
ABSTRACT	xii
LIST OF ACRONYMS AND ABBREVIATIONS	xiii
OPERATIONAL DEFINITION TERMS	xiv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Introduction	1
1.2 Background to the Study	1
1.3 Statement of the Problem	6
1.4 Purpose of the Study	7
1.5 Objectives of the Study	7
1.6 Research Questions	8
1.7 Significance of the Study	8
1.8 Scope of the Study	9
1.9 Delimitations of the Study	11
1.10 Limitations of the Study	12
1.11 Assumptions of the Study	13
1.12 Theoretical Framework	14

1.12.1	Environmental Scarcity Theory.....	14
1.12.2	Ecological Systems Theory	15
1.13	Conceptual Framework.....	17
CHAPTER TWO		19
LITERATURE REVIEW		19
2.1	Introduction.....	19
2.2	Review of Literature Review	19
2.2.1	Loss of Vegetation Cover and the Security of Pastoralist Communities	19
2.2.2	Decline in Water Resources and the Security of Pastoralist Communities.....	23
2.2.3	Soil Erosion and the Security of Pastoralist Communities.....	27
2.2.4	Government intervention measures and Security of Pastoralist Communities	30
2.3	Summary and Gaps	31
CHAPTER THREE		33
RESEARCH METHODOLOGY		33
3.1	Introduction.....	33
3.2	Research Design.....	33
3.3	Research Site.....	34
3.4	Target Population.....	34
3.5	Study Sample	36
3.5.1	Study Sample Size	36
3.5.2	Sampling Procedure	37
3.6	Data Collection	38
3.6.1	Data Collection Instruments	38
3.6.2	Pilot Testing of Research Instruments.....	39
3.6.3	Instrument Reliability	39

3.6.4 Instrument Validity	40
3.6.5 Data Collection Procedures	41
3.7 Data Processing and analysis	41
3.8. Legal and Ethical Considerations	42
CHAPTER FOUR.....	43
DATA ANALYSIS, INTERPRETATION, AND DISCUSSIONS	43
4.1 Introduction.....	43
4.1.1 Response Rate	43
4.2 Demographic Characteristics	44
4.2.1 Gender Distribution of Respondents	44
4.2.2 Age Distribution of Respondents	45
4.2.3 Role or Affiliation of Respondents	46
4.2.4 Educational Background of Respondents.....	47
4.2.5 Duration in Operational Area	47
4.2.6 Primary Area of Focus or Work	48
4.3 Descriptive Statistics.....	49
4.3.1 Loss of Vegetation Cover and Its Influence on Security of Pastoralist Communities in Samburu County	50
4.3.2 Decline in Water Resources and Its Impact on Security of Pastoralist Communities in Samburu County	56
4.3.3 Soil Erosion and Its Influence on Security of Pastoralist Communities in Samburu County	60
4.3.4 Effectiveness of Government Interventions in Mitigating Environmental Degradation	65
4.3.5 Security of Pastoralist Communities in Samburu County.....	71
4.4 Inferential Analysis.....	75

4.4.1 Correlation between Loss of Vegetation Cover and Pastoralist Communities' Human Security in Samburu County	75
4.4.2 Correlation between Decline in Water Resources and Pastoralist Communities' Human Security	76
4.4.3 Correlation between Soil Erosion and Security of Pastoralist Communities	78
4.4.4 Correlation between Government Intervention Measures and Pastoralist Communities' Human Security in Samburu County	80
4.5 Regression Analysis Results	82
4.5.1 Model Summary	82
4.5.2 ANOVA Results	82
4.5.3 Regression Coefficients for Environmental Factors Predicting Security of Pastoralist Communities	83
CHAPTER FIVE	87
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS.....	87
5.1 Introduction.....	87
5.2 Discussion of the Study Findings	87
5.2.1 Loss of Vegetation Cover and Human Security	87
5.2.2 Decline in Water Resources and Human Security	88
5.2.3 Soil Erosion and Human Security	89
5.2.4 Government Intervention Measures and Human Security	89
5.3 Summary of the Findings.....	90
5.4 Conclusions.....	91
5.5 Recommendations.....	93
5.6 Suggestions for Further Studies	94
REFERENCES	96
APPENDICES	100

Appendix I: Research Questionnaire	100
Appendix II: Template for Analysis – Observation /Mapping	104
Appendix III: Key Informant Interview Guide: Exploring Environmental Degradation and Human Security in Samburu County	105
Appendix IV: Focused Group Discussion Guide.....	107
Appendix V: University Letter of Introduction	112
Appendix VI: NACOSTI Research License	113
.....	113
Appendix VII: Map of the Study Area	114

LIST OF TABLES

Table 3. 1: Target Population.....	35
Table 3. 2: Sample Distribution Matrix	36
Table 4. 1: Response Rate.....	43
Table 4. 2: Gender Distribution of Respondents	44
Table 4. 3: Age Distribution of Respondents.....	45
Table 4. 4: Role or Affiliation of Respondents.....	46
Table 4. 5: Educational Background of Respondents.....	47
Table 4. 6: Duration in Operational Area	48
Table 4. 7: Primary Area of Focus or Work	48
Table 4. 8: Loss of Vegetation Cover	50
Table 4. 9: Decline in Water Resources.....	56
Table 4. 10: Soil Erosion	61
Table 4. 11: Effectiveness of Government Interventions in Mitigating Environmental Degradation	66
Table 4. 12: Security of Pastoralist Communities	71
Table 4. 13: Correlation Between Loss of Vegetation Cover and Pastoralist Communities' Human Security	75
Table 4. 14: Correlation between Decline in Water Resources and Pastoralist Communities' Human Security in Samburu County	77
Table 4. 15: Correlation between Soil Erosion and Security Of Pastoralist Communities	79
Table 4. 16: Correlation between Government Intervention Measures and Pastoralist Communities' Human Security in Samburu County	80
Table 4. 17: Model Summary	82
Table 4. 18: ANOVA Results	82
Table 4. 19: Regression Coefficients for Environmental Factors Predicting Security of Pastoralist Communities	84

LIST OF FIGURES

Figure 1. 1: Conceptual Framework	17
Figure 4. 1: Histogram of Regression Standardized Residuals for Security of Pastoralist Communities.....	110

ABSTRACT

Environmental degradation in Samburu County, Kenya, severely impacted the livelihoods and security of pastoralist communities by reducing pasture, water resources, and arable land, leading to increased competition and conflicts. The study aimed to investigate how environmental degradation affects the security of pastoralist communities in Samburu County, Kenya. The study's specific objectives were to: analyze the impact of vegetation cover loss on the security of these communities from 2005 to 2025; evaluate how diminishing water resources affect their security; determine the influence of soil erosion on their security in Samburu County; and assess government intervention strategies. Theories of Environmental Scarcity and Ecological Systems offer a framework to explain how resource scarcity in Samburu has fueled competition, affected livelihoods and put pastoralists' security at risk in interwoven environmental and social impacts. A descriptive research design was used for the study. A total of 310,489 people were considered as the target population. A sample of 360 Community Members, 24 Local Leaders, 12 Government Representatives and 4 NGO Representatives were selected by stratified random sampling method. Data was obtained by descriptive statistics including frequencies, means and percentage and inferential statistics were Pearson correlations, hierarchical regression analysis, to explore the relationship and effect of study variables. The descriptive results from the study indicated that there was a significant vegetation cover decrease, plant density and biodiversity, in Samburu County due to increased insecurity. Rivers and boreholes were reported as drying, impacting human and livestock survival and thus socio-economic vulnerability. Less land available for crops, and food production and grazing disturbed by decreased soil fertility and erosion. There was an acknowledgement of government initiatives such as reforestation and peacebuilding, but there was a need for more sustained and localized support, to increase community security. The study observed that there was strong association and statistically significant correlation between the loss of vegetation cover and security of the pastoralists ($r = 0.813$; $p = 0.000$), and regression results showed that the degree of the association was significant for predicting the loss of vegetation cover and pastoralists' security. The negative trend in the water resources was closely correlated with the security ($r = 0.825$; $p = 0.000$) and regression analysis showed that it had a significant impact ($\beta = 0.196$; $p = 0.001$). Soil erosion was also significantly related to security ($r = 0.821$; $p = 0.000$), though its effect size was smaller ($\beta = 0.117$; $p = 0.012$). Finally, government intervention measures were found to correlate with security ($r = 0.827$; $p = 0.000$) the most, and also to have the most significant regression effect ($\beta = 0.354$; $p = 0.000$). For environmental degradation in Samburu County, the study recommends increased afforestation, water infrastructure enhancement and promotion of sustainable land use by relevant government agencies. It further requires more inclusive and community-led environmental programmes which integrate local knowledge and improve the effectiveness and sustainability of environmental actions. This research will provide insight into the local community, policy makers, NGOs, and academia. The results shape policies, shape guided interventions, and help with the understanding of the connection between environmental problems and security for pastoral populations.

LIST OF ACRONYMS AND ABBREVIATIONS

HOD	Head of Department
IPCC	Intergovernmental Panel on Climate Change
NACOSTI	National Commission for Science, Technology, and Innovation
NGO	Non-Governmental Organization
SIDP	Strategic Integrated Development Planning
SPSS	Statistical Package for the Social Sciences
UN	United Nations
WMO	World Meteorological Organization

OPERATIONAL DEFINITION TERMS

Loss of Water Resources: Decrease in the water quality and quantity of such resources as groundwater, lakes, rivers, and other water supplies. This declining trend poses a threat to the survival of the animals, limits drinking water, and exacerbates competition over scarce water availability for pastoralist communities.

Environmental Degradation: Loss or depletion of ecosystems and exhaustion of natural resources like soil, water, and air, which results in the degradation of the environment. Pastoralist communities, facing environmental loss which includes loss of plant cover and growth, scarcity of water, and erosion, are at risk to their traditional security and lifestyle.

Loss of Vegetation Cover – Reduction or decline in vegetation in a particular area, including grasses, trees, and bushes. This decline reduces the amount of pasture available for cattle in pastoralist communities, which increases competition for the few resources that remain and causes food insecurity.

Pastoralist Communities: Communities whose main source of income is the herding of animals; they usually migrate periodically in pursuit of pasture and water. The primary focus of the study is on pastoral communities in Samburu County, as they are more vulnerable to the effects of environmental deterioration than other communities.

Soil Erosion: The washing away of topsoil, the soil needed for the plants to grow, is caused by erosion, wind, and water. Soil erosion, within the scope of this study, causes

degradation of land, loss of productive land for grazing, and helps bring about environmental degradation, which in turn affects the livelihood of the pastoralist community.

Safety of Pastoralist Communities: Level of stability and security of pastoralist communities, especially in regard to access to resources like water and pasture. This study looks at the impact that environmental degradation – loss of vegetation cover, reduced water resources, and soil erosion – negatively impacts this security, intensifying competition for them and the likelihood of conflicts.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter introduces the study, providing context through the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, scope and delimitations of the study, limitations of the study, assumptions of the study, and operational definition of terms are presented and discussed.

1.2 Background to the Study

The management and herding of livestock in pursuit of pasture and water is known as pastoralism, and it is highly dependent on environmental factors such as climate, land quality, and water availability (Schilling & Werland, 2023). Pastoralists suffer dwindling resources as a result of the widespread effects of climate change, including changed rainfall patterns, protracted droughts, and habitat degradation. This intensifies competition and conflict over access to essential land and water supplies (Leal Filho et al., 2020). Developing effective policies and adaptable solutions that can protect these communities' livelihoods while addressing new security threats requires an understanding of how environmental degradation affects pastoralism (Ahmad & Afzal, 2022).

Historically, pastoralist civilizations have taken advantage of migration to be able to utilize as much of the available resources as possible to counterbalance the environmental changes (Mokku, 2023). The historic seasonal migrations which have been essential to the life and history of these groups have been interrupted by the effects of modern policies, land privatization and conflict, however (Schilling & Werland, 2023). Heralded by the late 20th century pastoralists' vulnerability

has been aggravated by encroaching industrialization and pastoralists' lands placed under farming, urban and land contradictions since then (Ide et al., 2014). In addition to this, pastoralist communities are now experiencing major environmental pressures and security threats, due to increased exacerbation of existing stresses triggered by climate change (van Baalen & Mobjörk, 2018).

An increasing number of world leaders are beginning to grasp the magnitude of the threat that the climate change poses to ecosystems and human culture. UN Secretary-General António Guterres (UN, 2018) warns that climate warming is a "direct existential threat" with "disastrous consequences for people and all the natural systems that sustain them. According to the IPCC's sixth assessment report, there is growing evidence that human-induced climate change is already making extreme weather events, including heatwaves, droughts, cyclones, and heavy rainfall, more severe globally (IPCC, 2021). Even those who are frequently thought of as robust are already suffering increased vulnerabilities as a result of environmental changes, and the effects of climate change are becoming more widely recognized as being immediate and widespread (WMO, 2021).

Pastoralism globally sustains around 500 million individuals who depend on livestock for their livelihoods, mainly in dry and semi-dry areas (World Bank, 2014). The pastoralists are also highly vulnerable to the impacts of climate change, land degradation and resource competition, particularly in Sub-Saharan Africa (SSA) (Xu et al., 2019). Climate change is increasing the climate variability and frequency of climatic events like droughts, floods, etc. that push traditional pastoralist coping mechanisms to their limits and risk food insecurity and socio-economic destabilisation (Postigo, 2021). The current context is worldwide and clearly shows the combined vulnerabilities pastoralists experience, particularly in zones where social, economic and environmental challenges converge. Kazakh herders also face land degradation and climate change

which is hindering their herding practices, while the herders in Kyrgyz have been experiencing water scarcity due to the retreat of glaciers (Kuznetsov et al., 2017; Bates et al., 2012). The problems of environmental consequences associated with overgrazing are growing in this well-known Mongolian Plateau, and the herders must be engaged in transition towards sustainability. Likewise, the Andean highlands in South America with primary communities engaged in the pastoral care of llamas and alpacas are under threat from climate change and the growing development of farmland on traditional grazing areas (Vanmoerkerke et al., 2022). The diversity example shows that pastoralism is not a single practice but is customized based on ecological and socio-economic circumstances. Environmental degradation and climate change can have significant impact on pastoral livelihoods, causing economic challenges and social fragmentation, and thereby requiring collective decisions by policy makers and pastoralist communities to build resilience and ensure pastoralists' livelihoods in the face of these challenges.

Pastoralism plays a critical role towards the livelihoods of more than 120 million people in a wide spectrum of ecosystems in Africa (Leal Filho et al., 2020). Climate variability is a growing threat for pastoralist populations in the region, with a number of the communities, particularly in the southern IHG, facing droughts of increasing severity that lead to shortfalls in pasture and necessitated migration to more productive areas (Schilling & Werland, 2023). There are also conflicts that have arisen not only because of environmental stress, but also as a result of land competition between pastoralists and agriculturalists which is worsened by the marginalisation experienced at the political level (Mburu et al., 2022). Ethiopia's Somali pastoralists experience greater food insecurity as a result of a worsening of climate shocks and resource conflicts (Schilling & Werland, 2023). Historical grievances and land-use issues can also trigger violence in pastoralist communities in East Africa today, deepening the insecurity in pastoralist

communities in these regions (Ide et al., 2014). So, the importance of grasping these regional dynamics in terms of addressing environmental degradation and security is key, as well as in understanding and building pastoralist community resilience in Africa.

Given the current drought situation in Kenya, communities such as the Maasai are experiencing economic difficulties, and there is also a disagreement between communities and farmers over land (Mokku, 2023). For pastoralist communities, Kenya is also a good example of the challenges they face in the context of environmental degradation and pastoralist populations of approximately 9 million in Kenya depend primarily on pastoralism in dry and semi-dry regions (Schilling & Werland, 2023). One of the worst droughts in recent history occurred between 2014 and 2022, causing livestock deaths and loss of food supply due to the worsening effects of climate change (Mokku, 2023). Kenyan pastoralists also face other challenges including the availability of traditional grazing lands due to relative scarcity of space, urban encroaching and the presence of large-scale energy projects as well as the availability of agricultural lands in the same territories that pastoralists inhabit, reducing their mobility and ability to access traditional grazing lands (Leal Filho et al., 2020). Such a combination of environmental and socio-political pressures leaves pastoralists with a fragile security stance, and it is important to undertake specific research that studies their adaptive strategies and resilience mechanisms (Næss, 2013).

In Samburu County, there are high linkages between the pastoralist people's security and living and the environmental health, and it has become a critical issue (Vundi & Koome, 2023). Due to overgrazing and deforestation, vegetation cover is reduced, thereby reducing the pasture available and causing conflicts and high level of competition between pastoralists and pastoralist groups in accessing pasture. The decreasing water sources are also due to poor water use and climate change

which threatens the survival of livestock which is the primary means of livelihood and food for the Samburu people.

Along with this major indicator of environmental degradation is soil erosion, which on top of already limited resources for the pastoralist communities has resulted in arable land being in a precarious state (Quinton & Fiener, 2024). This degradation means the land is less sustainable and makes people more vulnerable to food insecurity and economic instability. Given that these environmental constraints are increasing, it poses a very high insecurity risk to the pastoralist communities in Samburu County, and needs to be addressed and acted upon immediately to reduce the impact of these challenges and help support the pastoralist communities' resilience.

Pastoralist communities in Samburu County in Kenya face great vulnerability to risks of environmental degradation. Insects have been a major constraint in the pasture management system as the frequent drying out of pastures and long spells of dry weather have made pasture a less viable option for feeding pastoralists livestock than the traditional feeding pattern of their livestock and forced them to buy supplementary feeds and hay from outside (Lengurnet & Nalugala, 2022). This situation adds to the competition for limited resources, and can make the situation worse for the inter-communal conflicts that arise when pastoralists from different communities vie for available pastures and water. These dual environmental and social pressures not only risk threat to their food security but also their cultural lives inextricably bound to herding which make them more vulnerable and conflictual than others (Conflict Trends 2023).

It is essential to study the effect of degradation in pastoralist communities of Samburu County for several reasons. Firstly, it helps bring to focus the links between climate change, scarce resources, and conflict and the fragility of pastoral livelihood strategies. It is important to understand these dynamics when developing policy and planning adaptive strategies that are relevant to the

pastoralists' needs – Samburu pastoralists (Lengurnet & Nalugala, 2022). In addition, traditional knowledge in combination with scientific methods may create more comprehensive approaches to sustainable management of natural resources which contribute to boosting community security and stability. The research could ultimately inform targeted interventions that would tackle the environmental challenges and the socio-political issues in the region to ensure a comprehensive framework, which helps the pastoralist communities in Samburu County to achieve sustainable development.

1.3 Statement of the Problem

Livelihoods and security of pastoralist communities are under threat from environmental degradation, as this phenomenon is becoming more of an issue over the globe, including in Samburu County, Kenya. The current situation is getting tougher for the Samburu people whose main livelihood is livestock herding who are being adversely affected by the loss of vegetation, availability of water and increased soil erosion (Lanyasunya & Mutisya, 2025). These environmental changes, exacerbated by climate variability and inadequate resource management, have resulted in less pastoral land, scarcity of water and degraded arable land and have worsened the fight for limited resources and conflicts between communities.

As the chances of livestock survival are reduced, the pastoralists' way of life is affected, which affects their food security and economic stability, according to Stavi et al. (2022). Despite the central role of environmental health in community security, and despite ongoing government and non-governmental interventions, resource-based competition and insecurity in Samburu County have persisted. The specific pathways through which vegetation loss, water resource decline and soil erosion translate into pastoralist insecurity in the county remain inadequately understood.

There is therefore a lack of comprehensive, locally grounded analysis of how environmental degradation affects the security of pastoralist communities in Samburu County. This study addresses that gap by examining the specific effects of vegetation loss, water resource decline and soil erosion on the security of pastoralist communities in the county, thereby providing essential insights for developing effective policies and adaptive strategies to enhance their resilience and sustainable development.

1.4 Purpose of the Study

The purpose of the study was to examine the influence of environmental degradation on security of pastoralist communities in Samburu County, Kenya

1.5 Objectives of the Study

The following were the specific objectives of the study.

- i. To assess the long-term influence of vegetation cover loss on the security of pastoralist communities in Samburu County, Kenya.
- ii. To determine the effect of the decline in water resources on the security of pastoralist communities in Samburu County, Kenya.
- iii. To examine the influence of soil erosion on the security of pastoralist communities in Samburu County, Kenya.
- iv. To evaluate the effectiveness of government interventions in mitigating environmental degradation and its effects on pastoralist communities.

1.6 Research Questions

The following research questions guided the study:

- i. What is the long-term influence of vegetation cover loss on the security of pastoralist communities in Samburu County, Kenya, over a 20-year period from 2005 to 2025?
- ii. How does the decline in water resources impact the security of pastoralist communities in Samburu County, Kenya?
- iii. How does erosion affect pastoralists' communities in Samburu County, Kenya?
- iv. What is the effectiveness of the intervention measures put in place by the government to counteract environmental degradation and its effects on pastoralist communities??

1.7 Significance of the Study

For pastoralist communities in Samburu County, Kenya, studies on the effects of environmental degradation on pastoralists' security bring a lot of benefits to various actors. The findings of this study will be relevant and valuable insights for local communities and pastoralists. This awareness of the direct link between environmental degradation and their security will enable these communities to become more active in calling for policies and practices that protect them from environmental degradation. This knowledge is essential to developing initiatives for sustainable response to the negative impacts of environmental degradation on their livelihoods and security, including loss of vegetation, depletion of water resources and erosion of the soils.

The study can also provide resources to help policy makers and/or Government agencies. The research can provide evidence-based recommendations to guide the creation of policies and programs aimed at tackling environmental challenges in Samburu County. The study can help in

the design of specific interventions for water and pasture shortage, soil erosion and pastoralist security that can help the adaptation and mitigation strategies of pastoralists. It focuses on the specific impacts of pastoralist security as a result of the process of vegetation loss, water scarcity and soil erosion to support the design of specific actions for adaptation and mitigation of pastoralist security as drivers of environmental sustainability.

The study may also be of interest for non-governmental organizations (NGOs) and development partners working in the fields of environmental protection and community development. The findings of the research can provide key information and insights which can support their efforts in Samburu County. These organizations can use the results to design their programmes to achieve better outcomes through addressing the underlying causes of insecurity among pastoralist communities.

The study can be useful in the academic sphere and to future researchers in solving the problem of relationship between environment and security of pastoral communities in Kenya. That it is a case study for the context of Samburu County and could be applied to studies conducted in other areas of the world with similar issues. This contribution to knowledge contributes to the work in progress in understanding and addressing some of the complexity of environmental degradation and community security issues in pastoralist regions.

1.8 Scope of the Study

Geographically, the study was conducted in Samburu County which is in the northern part of Kenya. The County of Samburu is mainly composed of arid and semi-arid land with pastoralism as the major activity of most communities. The study included different parts of the County, especially those parts affected most by environmental degradation, including loss of vegetation

cover, depletion of water resources and soil erosion. The study targeted Samburu County because, despite the arable grasslands in the whole Rift Valley system, the majority of pastoralist groups live in the county and so it was felt that the information collected would be vital specifically at that site.

The study mainly focused on the pastoralist communities of Samburu County which are directly affected from environmental degradation. Key informants were community leaders, elders, pastoralists and local government officials. Furthermore, non-governmental organizations (NGOs) involved with environmental conservation and community security and experts on environmental science and rural development were also represented in the study. The diversity of participants played a critical role in adding depth to the assessment of the situation of these communities' security and livelihoods in the face of environmental changes.

The focus of the study was on the impact of environmental degradation on pastoral groups' security. It concentrated particularly on three of the key above mentioned environmental problems which are soil erosion, diminishing water supply and vegetation cover. All these elements (including disputes over resource access, competition for grazing land, livelihood challenges and so on) were analysed in relation to their impact on the security experienced by pastoralist communities. In the study, the potential ways of counteracting these impacts and making the community more resilient were also explored.

A broader background to the study was environmental change and the impact of such change on pastoralist communities in the arid and semi-arid regions. It acknowledged the security and environmental degradation relationship among Samburu County's historical, socio-economic and cultural context. The study went beyond and covered the ongoing challenges associated with

population increase, land use change and climate change, which exacerbated environmental degradation from 2005 to 2025.

1.9 Delimitations of the Study

Only Samburu County in Kenya was included in the geographical study. An in-depth analysis of the security concerns and environmental deterioration of the pastoralist communities in the area was made possible by this concentration on a particular area. Because of the focused aspect of the study on only Samburu County, the issues raised around pastoralist security and environmental factors were context-specific issues that could have been different in other counties of Kenya or regions.

In addition, the study only considered three factors related to environment: soil erosion, decrease in water resources, and decrease in cover vegetation. The elements selected are relevant because of their impact on pastoralists' security and livelihoods. Notwithstanding their significance, other environmental issues, such as desertification and climate change were not included in the study to retain it as a manageable and focused study.

Further, other populations that reside in Samburu County, but are not pastoralist groups were excluded since the study was dedicated to pastoralist populations. This emphasis was warranted since pastoralist groups' livelihoods were largely dependent on access to natural resources like water and grazing land, making them especially sensitive to environmental changes. The idea of being able to keep the focus on the specific challenges that these communities face helped the study concentrate on these particular communities.

1.10 Limitations of the Study

One of the limitations of the study was the challenges to ensure that the data is accurate and reliable since it was obtained from self-report by the pastoralist groups. The respondents' answers may have been influenced by recall or social desirability biases, or failure to know exactly what was meant by the changes in the environment. To offset this, however, the researcher used result triangulation, so as to combine quantitative research methods (survey) and observational research in the field with qualitative research methods (interviews). This approach helped to increase the credibility and reliability of the results obtained from the study as data from the respondents could be checked against each other.

A further drawback was the difficulty of identifying the specific effect of environmental deterioration on community security as distinct from other socioeconomic and political challenges. Finding that security outcomes in pastoralist communities can only be explained by environmental degradation is challenging because there were many other factors that might have been at play such as ethnic tensions, governmental policies, and external conflicts for example, that may have caused security concerns. The researcher applied a combination of mixed methods approach to tackle this limitation and conducted both qualitative and quantitative analysis of the relationship between the environment and the security that arises from it. This encompassed accounting for the effect of other factors in the analysis, enabling a more specific examination of the effect of environmental degradation.

The third challenge was the logistics and difficulties of conducting research in the remote parts of Samburu County where access is difficult and sometimes dangerous. The geographical topography may have hindered the researcher's access to some communities, and/or may have influenced their ability to collect data throughout the area, due to the occasional security issues. The researcher

worked in partnership with local guides, community leaders and organizations that were already operating in the area to ensure access to sites for this research took place safely and effectively. Besides, the researcher prepared for flexibility in the data gathering periods, as unexpected delays and access restrictions may come up in the study and would have to be taken care of so that it would be comprehensive.

1.11 Assumptions of the Study

The study made the assumption that the respondents in pastoralist communities who reside in Samburu County would give true and accurate information while collecting the data. The assumption was significant in the validity and reliability of the study results; the responses created the basis of understanding the impacts of environmental degradation on their security.

The study was also based on the assumption that the environmental factors (Loss of Vegetation Cover, decline in water resources and soil erosion) that were selected played a role in the security situation of pastoralist communities. This assumption was instrumental in studying these factors, which it was assumed would affect pastoralist livelihoods directly and thus a range of community security dimensions.

Finally, it was believed that the research tools and methodologies (like surveys and interviews) could gather information regarding the environmental degradation and security issues to a satisfactory extent. The trustworthiness of the results relied on the capacity of these tools to measure properly the link between environmental elements and the pastoralist communities' security in the area.

1.12 Theoretical Framework

This study employed two theories as its theoretical basis: Environmental Scarcity Theory and Ecological Systems Theory. Theories were chosen to give a broad spectrum for analysing the newly identified dynamic interactions between environmental degradation and security for pastoralist communities in Samburu County, Kenya. Environmental Scarcity Theory is closely relevant which examines the link between the scarcity of resources and conflict, especially for pastoralists, where vegetation cover, water, and fertile land are the natural resources being depleted. Ecological Systems Theory gives a "big-picture" framework for analyzing how environmental factors and human communities work together.

1.12.1 Environmental Scarcity Theory

Enhanced by Thomas Homer-Dixon in the early 1990s, the Environmental Scarcity Theory argues that environmental degradation, depletion and population growth can cause serious shortages of basic resources such as water and arable land which eventually can increase social conflict and insecurity. Homer-Dixon (1994) suggested that environmental degradation due to resource scarcity is “a major stressor” on societies, particularly in developing countries around the world, where livelihoods are straightly linked to renewable resources. The theory indicates that when one of these becomes scarce, the competition for the resource escalates, causing conflict, social fragmentation and insecurities within communities infected by the resource scarcity.

This theory is very pertinent to the present study since it specifically explores the link between environmental factors (loss of vegetation cover, depletion of water resources and soil erosion) and security risks of pastoralist communities in Samburu County. The Environmental Scarcity Theory suggests that these environmental issues might contribute to conflict over resources that would further strain relations among pastoralist communities in common pursuit of limited water and

grass. The theory has been useful in the process of gaining insights into how environmental degradation may trigger increased tensions and insecurity between these communities, which is the aim of the study under consideration, environmental degradation and pastoralist insecurity in the Ethio-Somalia borderlands.

Furthermore, the theory's focus on the importance of resource scarcity in initiating conflicts underpins the study's analysis about the differential effects of vegetation loss, water limitations, and soil erosion on these pastoralist communities' security. By applying the Environmental Scarcity Theory, the study is able to examine systematically how each of these environmental problems contributes to insecurity and social instability. The theoretical framework not only improves the quality of the analysis made in this study, but can also provide ideas for possible interventions to reduce the threats pastoral areas face because of environmental deterioration. The theory further highlights its relevance to the study as it can be linked to the environment experienced by arid and semi-arid areas such as in Samburu County, which has already limited environmental resources and is susceptible to degradation (Homer-Dixon, 1994).

1.12.2 Ecological Systems Theory

Developed by Urie Bronfenbrenner in 1979, the Ecological Systems Theory offers a broad perspective on how a variety of environmental systems affects individual's growth and actions. The theory states that people are influenced by a variety of environmental systems that include, for example, the home context and community (microsystem) as well as broader/interactional systems (macrosystem). All of these systems are interconnected and affect one another which make it a dynamic system and therefore influence the individual's and collective's experience. An important principle of the theory is the interconnections within humanity and their environments, and how changes in one system may impact another.

Ecological Systems Theory is relevant in this study because it helps to understand how the environment and its associated problems are related and how pastoralist communities can remain secure. The theory emphasizes the various tiers of environmental systems and aims to shed light on the micro to macro and macro to micro repercussions of environmental change at an ecosystem and socio-economic level on pastoralists' security and wellbeing. Vegetation cover loss (macrosystem) may result in decreased grazing lands (mesosystem) that impacts the daily living and security of pastoralists (microsystem), for example. The multi-layered approach is particularly effective when considering the study's goals: to see how particular environmental challenges affect the security of communities.

Moreover, the research objective of gaining a view of the wider context of environmental degradation and its impact on security matches the premises of the Ecological Systems theory. When viewing the relationship between environmental systems, the negative impacts of soil erosion and water scarcity on security can be studied along with how other socio-economic and political factors can influence these in Samburu County. It is clear that the theory emphasises on the relationship between different systems, which gives it a solid framework for analysing findings of the study and for identifying potential interventions that tackle the environmental and social aspects of pastoralists' security (Bronfenbrenner, 1979).

These two theories collectively present a firm theory base for study and inquiry, in order to examine the environmental degradation in a comprehensive manner and its effect on security. Environmental Scarcity Theory focuses on the immediate causes of resource-based conflict, but Ecological Systems Theory adds depth to this discussion by taking into account the interconnectedness of the environment and human beings. This two-pronged theoretical approach helps to grasp the realities of pastoralist communities' problems in Samburu County from both angles.

Environmental Scarcity Theory and Ecological Systems Theory are very suitable as the basis for this study. These perspectives bring together the best of the scholarship to truly holistically tackle the important questions of environmental degradation and pastoralist community security. Beyond just the research paper overview, this theoretical understanding helps frame the problem and can inform effective strategies and interventions to address the challenges of these communities.

1.13 Conceptual Framework

In the present study, the independent and dependent variables are related to one another in the conceptual framework presented in Figure 1.1. The conceptual framework puts in place a solid framework to evaluate the impacts of environmental degradation on pastoralists' security in Samburu County, Kenya.

Independent Variables

Dependent Variable

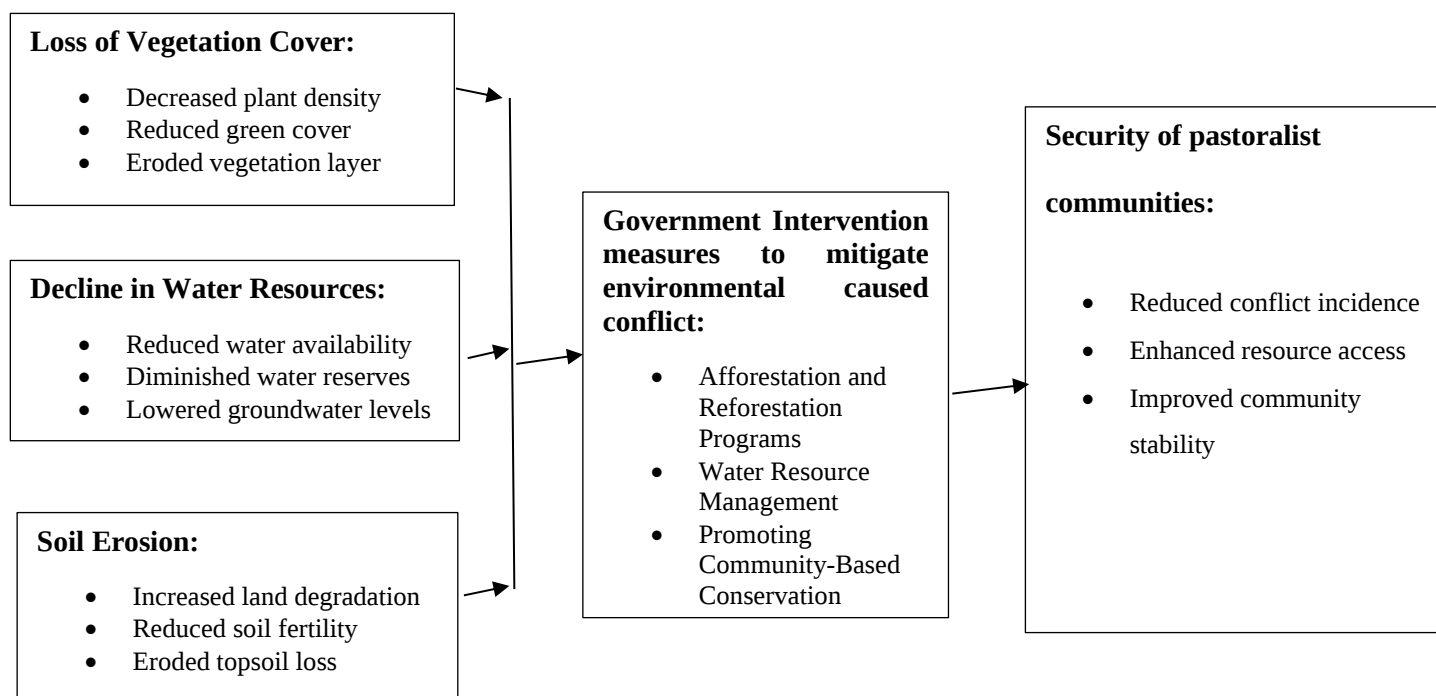


Figure 1. 1: Conceptual Framework

The conceptual framework presented in Figure 1.1 considers how different environmental factors (loss of forest cover, decreasing water availability, soil erosion and government intervention actions) affect pastoralist communities' security. Independent variables refer to the important environmental issues that have a direct impact on the pastoral ecosystem. Loss of Vegetation Cover includes a decrease in the numbers of plants, green coverage, and an eroded vegetation layer, all of which degrade the natural habitat that is needed for grazing. Decline in Water Resources includes water scarcity, lack of water reserves and lowering groundwater level and shows water's scarcity which is a huge requirement for the livestock and humans. Soil Erosion is expressed as land degradation, loss of soil fertility and soil loss, thereby further imposing environmental degradation and restricting soil productivity.

This framework is based upon a hypothesis that it is the dependent variable, Security of Pastoralist Communities, that is affected by these environmental stressors. The rise in the incidence of conflict could occur as vegetation cover becomes bare, water resources shrink and soil erosion grows more intense, leading pastoralist groups to compete for diminishing resources. Better management of these environmental concerns would otherwise lead to better resource access and more community stability. Hence, the idea is that the solution to these independent variables is important for pastoralist communities' security and resilience, and consequently to reduce pastoralist conflict, creating a more stable and secure living environment for them. Environmental degradation, such as soil erosion, water scarcity, and reduction of vegetation cover can threaten pastoralists' security. Therefore, government interventions, such as afforestation/reforestation, water resource management and promoting community-based conservation projects, can help to address these issues.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter emphasizes the review of existing studies and research of various variables of interest including loss of vegetation, reduction of water resources, soil erosion and government intervention measures. It seeks to provide the background to the present study by highlighting the gaps in the literature and draws on existing research to gain insight into the effect of environment degradation on the security of pastoralists. This analysis serves as a basis to discuss core themes of this study.

2.2 Review of Literature Review

The empirical review section examines the prevailing empirical studies and the findings of the research on the key variables under this study. In particular, this examines the effects of the loss of vegetation cover, diminishing water resources and the erosion of soils on pastoralist security. It reviews literature to put the current study in their context, highlighting gaps and extending existing research as a basis for understanding the link between environmental degradation and pastoralist's security issues.

2.2.1 Loss of Vegetation Cover and the Security of Pastoralist Communities

To investigate the link between reduced plant density and pastoralist security, González-Alonso and Kull (2022) carried out a study in Spain. Intensive land use also significantly reduced forage availability for livestock due to low densities, therefore threatening pastoralists food security, they

found. Loss of vegetation causes higher competition for the graziers with regards to the land, which in turn triggers conflicts between the pastoral and farming communities. This contest can easily be a conflict, threatening social cohesion in pastoralist societies. Based on the arguments presented by the authors, sustainable management of lands is recommended to improve vegetation cover and reduce conflicts. This study has helped uncover the effects of vegetation loss on pastoralist security in Spain, but it is important to conduct contextual research in Samburu County, Kenya, where the environmental and social context may differ.

Tschakert et al. (2021) investigated the effects of loss of green cover on pastoralism in the Scottish Highlands. Their research has shown that as forage resources diminish, the health of the livestock suffers. Further, the research identified that during the reduction in the quality of pasture, pastoralists have to move around much of the time which aggravates resource conflicts with sedentary farmers. This research demonstrates the domino effect to the loss of vegetation which affects community resilience and food security. The authors call on policy makers to be extra-supportive of rewilding programs to restore vegetation and support pastoral livelihoods. The results of this study are useful but are only representative of the Scottish Highlands. Understanding of how similar processes could influence pastoralist community security in Samburu County, Kenya is limited.

Haggerty and Trent (2020) examined how eroded vegetational cover layers relate to the security of ranching communities in the Western United States. They discovered that the erosion damaged habitats and the survival of livestock depended on access to their needed forage. They indicated that the risk of market shocks has increased as a result of lack of resources among the ranchers, who depend upon good vegetation to sustain their operations. The study highlights the importance

of sustainable livestock utilization and rehabilitation efforts to help build resilience and stability within the community.

A study in Texas, by Boon (2019) and Meyer (2019) aimed to measure the effect of lower stocking density on the livelihoods of pastoralists in the study area. The study results show the overall health of livestock, and therefore pastoralists relying on them, has come to dramatically rely on the reduction of plant cover. The authors outlines the occurrence of this insecurity in the form of higher stress and possible violence within communities when pastoralists vie for limited resources. The research identifies an important need to invest in conservation practices that foster vegetation recovery, critical for increasing livelihoods and coolisolidation. Many circumstantial limitations exist in understanding the impact of vegetation loss on security of pastoralist communities in Samburu County, Kenya is a consequence of the study's focus on this area in the state of Texas, USA.

Muriithi and Wambua (2021) investigated how loss of green cover affects the pastoralists' food security in Ethiopia. They found they have left behind a vast amount of vegetation meaning there is an urgent need for forage for livestock with an associated income loss for pastoralist families. The study shows that these changes can have a negative impact on household security, and can also aggravate the situation in local conflicts as pastoralists move to different areas to find grazing land. The results clearly point to the necessity and importance of prioritizing the rehabilitation of the vegetation in the development process to safeguard pastoral livelihoods and peace in the region. The authors call for joint land-use planning which addresses pastoralist needs. However, the study offers important insights into the Ethiopian situation; the need for further research exists in Samburu County, Kenya to gain a deeper understanding of the particular vulnerability of pastoralist communities in this region stemming from land degradation caused by vegetation loss.

Ndung'u and Kihara looked at reduced plant density's impact on the resilience of the pastoralists in northern Kenya in their 2022 study. As they saw that the productivity of livestock declined as the vegetation cover decreased, they also realized the importance of not only securing food but also livelihoods for these people. Less grazing land has also caused greater competition for resources between communities leading to a higher prevalence of disputes over resources and increased tensions and violence. The report calls for improved management of plant life to help the recovery process and reduce conflict, including the development of tailored grazing practices that will allow modest recovery to occur in a sustainable way that meets the needs of pastoralist communities. The study is focused on northern Kenya but it is still necessary to explore the effects of land degradation on pastoralists' security in this distinctive cultural and environmental context, in Samburu County.

Oren and Ng'ang'a (2021) focused on the Maasai Mara region where they investigated how loss of green cover relates in pastoral security. Their results show that they lose ecologically rich vegetation, which affects the biodiversity of those plants and consequently impacts on the health of livestock and the ecological balance. The authors believe that it is necessary to blend traditional pastoralist coping strategies with new conservation approaches to achieve ecological balance particularly as the pastoralists' traditional coping strategies are not effective in non-structurally changing the environment and the environment becomes increasingly hostile and insecure. They note the need for sharing in management of pastoral resources, as a key element in maintaining community security and welfare. Conceptual understanding amongst them is lacking and it fails to shed light on the dynamics happening in Samburu County, where environmental aspects, as well as pastoral practices, can differ.

In their study, Wamatu and Gichuki (2023) focused on the disappearance of vegetation layers and identifying the impacts of this on pastoralist communities in Southern Kenya. Their analysis revealed that as vegetation is eroded, there's a decrease in livestock availability which becomes problematic for households in terms of food security. This economic burden has led to land and grazing disputes, escalating conflicts between pastoral communities

Karanja (2020) explored the resilience of pastoralists in dry regions in Kenya in relation to vegetation loss. They highlighted that loss of vegetation affects the lives of livestock, and livestock pastoralist communities as well as their social integration and adaptability. The study found communities with high vegetation loss who were affected by increased migration volatility and community fragmentation. The authors stress the importance of community-driven initiatives aimed at environmental restoration and securing resource access as crucial strategies to enhance pastoralist security.

2.2.2 Decline in Water Resources and the Security of Pastoralist Communities

The unimproved water supply compromises pastoralist security in its direct and indirect impacts. In northern Kenya, Bethancourt et al. (2023) determined that water insecurity among pastoralists was strongly related to food insecurity, suggesting that reduction of water access negatively impacts human security more than just water supply. More droughts and reduced access to water highlighted by Opiyo, Wasonga, Nyangito, Schilling and Munang (2015) have the effect of reducing the ewes of the livestock based livelihood and triggering distress migration by the household. Longer watering and grazing movements forced on the herders increase the potential for groups to interact, increasing the likelihood of conflicts over resources. These are clear indicators that lack or deterioration of water sources in northern Kenya, not necessarily in Samburu, is linked

to insecurity in arid and semi-arid lands countries, but mainly from neighbouring Counties compared to Samburu little study is carried out.

In their study on transhumance and management of natural resources in southern Mali, Umutoni and Ayantunde (2018) found that transhumance affects NRM through environmental damage and loss. The study showed that more than 75% of the respondents believed that forage and water decreased in numbers as the number of transhumant herders increased. This study helps to examine the impacts of transhumance on resource availability, but it fails to directly examine the impacts on pastoralist communities due to other factors related to water scarcity.

The scholars, Kirui et al (2022) looked at pastoral livelihood transition in northern Kenya, especially the effect of drought on pastoral communities. The study revealed that pastoralists have had to explore alternative lifestyles due to a series of large-scale droughts and climate, social and economic changes over time, which have often led to less income and a smaller herd size. The study did not, however, deal with the particular question of water resource depletion, being mainly about drought.

The researchers of M'Mbogori et al., (2022), analysed and summarised published studies on abandoned and current borewells in Marsabit County in Northern Kenya and looked at the relevance of IK to water governance. The study revealed positive and negative effects of external interventions on traditional water management practices. While this study reveals very useful information on the issue of water governance in Northern Kenya, it was not undertaken in a specific way that considers the impacts of declining water resources on pastoralists' security.

Cabeza et al. (2021) suggested that a transdisciplinary research framework for pastoralist transitions should embrace both the diverse social and economic and environmental dimensions,

presenting in different geographical settings. The study highlighted the need for a paradigm shift for pastoralism science and pastoralism policy. The research provides an overview of pastoralist transitions, but does not explain the particular effects of the reduction in water resources on pastoralist security.

Bencherif, et al. (2021) explored temporal variation of the vegetation cover in a single study area in Samburu County, Kenya and its effects on pastoralist livelihoods. The study indicates that the ineptitude of the vegetation cover is the result of environmental changes and it has led them to less forage and more competition for the little they have. The study is based on the effects of vegetation loss but it does not go in-depth into the direct effects of water scarcity on pastoralist security. This conceptual gap emphasizes the need for a study through pastoralist's water resource access and security implications as well as the pastoralist community in Samburu County, Kenya.

Through their analysis, Schilling and Werland (2023) shed light on the new risks confronting pastoral communities in Northern Kenya, specifically that of water, which is further constrained by the effects of climate change and policy choices, impacting the security of the pastoral communities. They report that certain historic weaknesses that cause dependency on water resources and have been exacerbated by recent pressures such as large-scale development projects. Decreased groundwater levels, is one such acidity, while others are also being withheld, create a compounding situation that lead to conflicts for water which is required and vital for livestock. However, the study does a good job of drawing an example that shows the link between changes in the environment and stability in socio-economic systems. It, however, points to the need to have a research project targeted at Samburu County which would directly inform strengthening the status and management of the water resources, in order to find water solutions for the community.

Manzano et al. (2021) called for a transdisciplinary perspective of pastoralism that takes into account impacts, including that of water resources. They noted that pastoralism's ecological aspects had been neglected, resulting in policy settings that fail to consider what's needed for water management in pastoralist areas. According to their research, reduced access to water negatively affects the resilience of pastoralist systems and the use of traditional adaptive strategies. The study findings do raise the question of the extent to which there is a link between scientific research and local knowledge in the development of a policy.

The literature reviewed collectively shows that pastoralist communities are closely associated with declining water resources and make pastoral water security their livelihood, but many publications are concentrated on other counties outside of Samburu or on other regions that have fairly stable water resources. In northern Kenya, beyond the arid and semi-arid regions, Opiyo, Wasonga, Nyangito, Schilling and Munang (2015) present evidence that repeated drought and lack of water reduce livelihoods through livestock, and that they force households into distress migration. Schilling and Werland (2023) also show how decreased access to water and pasture exacerbates more recent pressures like wildlife conservancies and big energy projects, which impact pastoralists' security in Turkana, Samburu and Marsabit. These are corroborated by Bethancourt et al. (2023), who note that water insecurity is significantly linked with food insecurity among pastoralists in the region, suggesting water declines impacts human security not only through food security but through other reinforcing pathways; and Asokan et al. (2025) who link increasing water insecurity due to prolonged droughts and poor water governance to declining access and livelihoods.

2.2.3 Soil Erosion and the Security of Pastoralist Communities

In order to investigate the variability of soil nutrient regeneration associated with erosion effects on microbial communities of soil, Zhang et al. (2022) chose to study soil nutrients in the Yunnan Plateau, China. They determined that the loss of top soil directly affects the diversity of microbes and soil nutrient cycles, thus reducing soil fertility. They identified the need to appreciate these microbial interactions for improved strategies in the ecological restoration. Considering the importance of soil quality on pastoralist's security and the importance of the microbial component in soil sciences, this can provide a different angle on soil erosion. This study however mainly investigated an agricultural setting as opposed to pastoralist situations. The key research gap here is to explore the effects of changing dynamics in the microbial communities that are affected by soil erosion on pastoralism and food security in Samburu County of Kenya.

Pozza and Field (2020) highlighted the critical link between food and soil security, and provided examples of the impacts of soil erosion on agricultural productivity in different parts of Nepal. They believe that degradation of farmland has a significant impact on food security and that this has a cascading effect which leads to poor community livelihoods. The Discussion, penned by the authors, calls for synergy in promoting Soil Health and sustainable land use. They reported that soil security is acknowledged in the international community but this has not been effectively incorporated within the context of local governance. More research is needed in the context of local settings because there is still a lack of conceptualization of how to connect soil health to strengthening community resilience. This indicates great need to investigate the application of these findings to pastoralist systems in the context of soil erosion in Nairobi's Samburu County in Kenya.

Boureima (2021) studied the effect of soil degradation on agriculture productivity and food security in Burkina Faso. The study concluded that economic and food security of the agricultural communities are severely affected due to the degradation of their land through the use of Computable General Equilibrium (CGE) model. The results indicate that improved rural infrastructure and infrastructure investment in irrigation systems may reduce the impacts of soil degradation. Nevertheless, the research is mainly centered on agricultural environment and does not provide answers to the specifics of soil degradation and pastoralist communities interactions.

The present study by Rabinovich et al. (2019) makes a thorough analysis of soil erosion in the Maasai land of Tanzania and its implications as a substantial social dilemma that impedes community resilience. The scientists found that the loss of the topsoil due to erosion affects woody productivity, one of the most important components of pastoralists' livelihoods. In addition, they said, in some cases low social cohesiveness and cultural norms regarding cattle ownership can aggravate the effects of soil erosion, thus boosting socio-economic vulnerability. The researchers found the need to overcome these aspects of culture and foster community cohesion in order to build resilience against soil erosion. The authors' interpretation of the concept of a commons dilemma brings attention to the lack of interventions which so often fail to account for cultural aspects and social systems

In an agro-pastoral system such as those in East Africa, which was affected by governance policies in the past, Wynants et al. (2019) analysed the factors that led to increased soil erosion. The research brought up a number of factors linked to soil degradation and soil fertility in the communities' soil erosion situation, including greater land degradation and loss of soil fertility. Coercive land-use policies with little consideration for indigenous knowledge systems was often linked to centralized governance models, exacerbating existing pressures on the economy and soil

erosion. It's an important study to consider how local management strategies can be integrated favorably with wider agricultural policy so as to reverse the deteriorating performance of the ecosystems, the authors note. This study illustrates that there is an urgent need for a contextualized approach, that connects the ecological management with the local practices.

Borrelli et al. (2017) presented a worldwide review of land-use alteration and the effects that the changes have on the erosion rates of the soil. What they reported noted that some of the high soil erosion rates that impact agricultural productivity exist in some of the lower developed economies, including those in Sub-Saharan Africa. The study applied cutting-edge modelling methods to measure changes, and found a comprehensive overview of soil erosion dynamics on a global scale. It does not have emphasis however on localized socio-economic impacts specific to pastoralist communities.

An interdisciplinary perspective on the issue of soil erosion in northern Tanzania was given by Blake et al. (2018) who were discussing on the interplay of environmental, social and governance mechanisms. The research revealed that high animal density and drought for long periods of time degrade the soil and causes erosion, affecting the agro-pastoral system. Their work showed key constraints like a high cultural need for cattle as a livelihood in the household that limit the sustainable use of land. They proposed that community engagement can be fostered within participatory decision-making structures, which can help environmental conservation. The research was however undertaken mainly in Northern Tanzania, thus leaving gaps with respect to contexts of pastoralism in other parts of the world.

Its findings also confirm the many aspects of the impacts of soil erosion on pastoralist communities, with greater pastoralist vulnerability to soil infertility and land degradation. Together, this demonstrates that there is much that remains to be done to address the distinctive

socio-cultural dynamics which may impact pastoralists' adaptive capacity. Thus, more studies are needed in these specific relationships, especially in the context of Samburu County, Kenya, to inform more specific policies that can address the continued problem of soil erosion in pastoral systems.

2.2.4 Government intervention measures and Security of Pastoralist Communities

Environmental degradation in the sense of a reduction in vegetation, water and soil has a significant impact on pastoral communities on livelihoods. Nyabuto (2016) studied the relationship between governance problems and environmental security among pastoralists in Northern Kenya. Low presence and history of neglect were found to negatively impact resource-based conflicts leading to insecurity, the study pointed out. Nyabuto underscored the importance of strong governance systems, and bringing traditional conflict resolution mechanisms into play to address these challenges.

Likewise, Kariuki (2020) took a look at adaptive coping mechanisms pastoralists use in such environments to adapt to hazards. The study mentions that such interventions by the government were limited in extent and effectiveness, for example, cash transfer programs and livelihood diversification programs. Kariuki asked for comprehensive policies aimed at improving resilience, and minimizing vulnerability to degradation. This resonates with Sabala 2013's study on the relationship between pastoralists-conflicts, governance and environmental security in Kenya. Sabala found that environmental insecurity and conflicts are aggravated by governance failures such as weak institutionalization systems, which require greater governmental efforts.

Additionally, the Security Research and Information Centre (SRIC) carried out a peace and conflict analysis in pastoralist areas of Kenya such as Samburu County, a County in Nechiangisa Division, and Turkana County. Programs by the government could be deemed partially effective,

including programs for disarmament and peacebuilding, the report pointed out. However, it pointed out that such measures typically lacked community involvement, which meant that they did not achieve the kind of lasting effects that were desired. This shows that citizen participation in development of and participation in government interventions is essential.

Nyabuto (2016) and Sabala (2013) highlight governance gaps, coverage and integration of traditional governance mechanisms while Kariuki (2020) and SRIC (2023) call for 'comprehensive' and 'community-inclusive' policies. Though they share these similarities there are some differences between the studies in terms of how they are geographically focused and what recommendations they have to offer, as pastoralist communities are diverse in their context.

2.3 Summary and Gaps

The study effectively places itself in the existing gaps in research in that it targeted the Samburu County of Kenya which is a region having different socio-environmental dynamics from the rest of Kenya. Previous research has examined the impacts that environmental degradation has had on pastoralist communities globally but this research is set in a particular context of environmental changes such as vegetation loss, water scarcity, soil erosion and security challenges that pastoralists in Samburu County face. This approach helps ensure the findings and policy recommendations are salient and not taken from elsewhere around the world.

As for methodological innovation, the study takes a multifaceted approach aiming to depict the complexities of pastoralist lives in Samburu. This is a form of research where the pastoralists are not excluded but are engaged in the process of data collection, primarily through participatory methods as opposed to the current research which tends to focus mainly on quantitative surveys or remote geospatial analyses. The study also involves community members using participatory

mapping, focus group discussions, and interviews, allowing for the incorporation of local perspectives and knowledge into the findings. This participatory aspect is a big contrast to the conventional 'downward' research approaches and makes the study more inclusive, reflecting on cultural and social aspects of pastoralism life.

Secondly, the study uses perceived longitudinal analysis of the impact of environmental stress on pastoralist security, something missing from existing literature but needed to capture the long-term effects of environmental stress. Studies that investigated the impact over the past half century come from other researchers and show short-term or geographically localized effects, as in the studies of González-Alonso and Kull (2022), Tschakert et al. (2021), and Haggerty and Trent (2020). The current study takes a temporal perspective, thus filling a critical gap by studying intervention and the sustainability and scalability over time.

An integration of modern scientific frameworks with traditional mechanisms of conflict resolution is also indicated as important in the study. Given the method's application to local practices, there is a possibility of cultural sensitivity and community-specific solutions to resource-based conflicts. For example, some recent studies, including those by Nyabuto (2016) and Sylvestre et al. (2020), call for the governance reforms and the consideration of integrated water management, but fail to consider the contribution of traditional practices to resilience. The study helps to fill this void and contributes to the understanding of addressing environmental degradation in Samburu County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The research methodology in this study is described in Chapter to explain the research design which was used, population, sampling frame, sampling techniques, procedures for data collection, pilot testing and the reliability and validity of the research instruments. It also includes the measurement of variables, presentation and analysis of data and ethical considerations that are followed throughout the research process. The methodology helps to carry out research systematically and rigorously and it produces reliable and valid results.

3.2 Research Design

This study took a descriptive research design approach that explored the impacts of degradation of the environment on the security of pastoralist communities in Samburu County, Kenya. The descriptive research design was the greatest need in this case, because it was found to be a kind of research design that makes it easier to get accurate data that fit the characteristics studied and the phenomenon studied (Trochim, 2021). This design enabled the researcher to observe, describe and document the different parts of the environmental problem and the implications of this problem for pastoralist security without affecting the variables (Creswell, 2014). In this way, the qualitative link between the independent variables loss of vegetation cover, decline of water resources, soil erosion and some measures taken by the Government and the dependent variable (the security of pastoralist communities) was obtained.

3.3 Research Site

The study was done in Samburu County in the northern part of Kenya. Samburu County (0030' – 2045'N and 36015' – 38010'E) is within the northern parts of Great Rift Valley in Kenya. The County lies within ASAL region covering an area of 21,090 square kilometers, and is bordered by the following Counties Turkana (Northwest), Baringo (Southwest), Marsabit (Northeast), Isiolo (East) and Laikipia (South). Eighty percent of it is population depend on pastoralists' economic livelihoods (County Government of Samburu, 2023). As a result of its semi-arid climatic conditions, the county was very prone to and vulnerable to environmental issues including drought, deforestation and soil erosion. The dry lands of Samburu had extensive plains, hills, and river beds which often became useless during the dry season, adding to environmental problems in the area.

Samburu County was of particular interest for the study because environmental degradation is a direct issue affecting the livelihood security of the pastoralist communities. The reduced vegetation cover, reduction of water resources and erosion of the soil had not only impact on the pastoralists' ability to sustain their livestock, but also raised conflicts over the marginal resources. The issues faced by the affected environment also affected the security of the communities as competitions for scarce resources sometimes resulted in conflict between the clans, or between neighboring regions. Therefore, the region provided a relevant context to examine the impacts of environmental degradation on pastoralist communities' security.

3.4 Target Population

The study population included 310,327 community members in Samburu County (KNBS 2020), 108 community leaders, 39 government representatives and 15 NGO representatives for a total study population of 310,489. The choice was based on the fact that Samburu County was mainly

pastoralists who relied on natural resources for their livelihood thus making them highly vulnerable to environmental changes (Muriuki et al., 2019). The variety of community vulnerability within this population enabled a detailed and broad understanding of environmental fragility and effects on security, and a fuller understanding of the problem being analysed.

Table 3. 1: Target Population

Sub county	Male	Female	Intersex	Govt Rep	NGO	Local Leaders	Total
Samburu Central	83,633	81,307	2	13	6	46	165,007
Samburu North	34,930	32,457	4	12	4	29	67,436
Samburu East	38,211	39,782	1	14	5	33	78,046
Total	156,774	153,546	7	39	15	108	310,489

Source: KNBS (2020) as cited and extracted from the County Government of Samburu (2023).

The target population for the study on the impact of environmental degradation on pastoralist communities' security in Samburu County, Kenya, will be 310,327 community members, 108 community leaders, 39 Government members, and 15 members of Non-Governmental Organizations, totaling 310,489 persons. This option is supported because it is inclusive of a wide range of people affected by or in charge of activities related to the environment and security concerns. It is critical to take inputs from community people (310,327), as they are the most critical to quantify the effects of environmental change at the ground level on pastoralist security. Local leaders (108) offer perspectives on managing conflict and functioning at the community level. National and County Governments representatives and NGO representatives (39) share views and insights into policy and administrative responses, interventions, and support program

implementation(s). The diverse representation helps in the analysis of the study's goals and in the consideration of the multifaceted character of the problem of environmental degradation and environmental security.

3.5 Study Sample

3.5.1 Study Sample Size

Slovin's formula was used to determine the sample size for this study. A margin of error (e) of 0.05 was specified, and the total population (N) was 310,489. The formula to use for calculating a sample size (n) is:

$$n = N \div (1 + Ne^2)$$

$$n = 310,489 \div (1 + 310,489 \times 0.0025)$$

$$n \approx 399.5$$

The sample size of approximately 400 was based on the estimated size of each category and was proportional. The distribution was determined by allocating the sample across categories in proportion to each category's share of the total population:

Table 3. 2: Sample Distribution Matrix

Category	Target Population	Percentage (%)	Sample Size (N%400)
Community Members	310,327	90%	360
Local Leaders	108	6%	24
Government Representatives	39	3%	12

NGO representatives	15	1%	4
Total	310,489	100%	400

Source: Modified from County Government of Samburu (2023)

This table shows the size of each sample according to each category, in proportion to the number of people in each category in the target population. The number of Community Members (n=360), Local Leaders (n=24), Government Representatives (n=12), and NGO Representatives (n=4) in the sample was reflective of their proportions within the total population. A stratified random sampling technique was used to select the sample from the population. This technique fitted given that it allowed for adequate coverage of different groups of population within the population sample, including the community, local leaders, government, and NGO representatives (Etikan, Musa & Alkassim, 2016).

3.5.2 Sampling Procedure

The study was conducted using a stratified random sampling technique. The population was segmented by various factors, including geographic location, age, gender, and socio-economic status (Patton, 2015). A random sample was drawn to ensure good coverage of all subgroups in each stratum. This approach resolved sampling error in the results, as varied viewpoints and perspectives were offered, and sampling error was minimized (Cohen et al., 2018). The number of samples was computed employing Slovin's formula so as to have a statistically significant data with proper basis for meaningful Data analysis.

3.6 Data Collection

3.6.1 Data Collection Instruments

The tools used for data collection included a structured questionnaire, observations and mapping, key informant interviews, and focused group discussions, which were used to record quantitative and qualitative information for environmental factors and how they affect pastoralist community security. The research questionnaire is structured according to the independent variables and the dependent variables that are presented in the conceptual framework presented in Dillman et al (2014). It was comprised of closed-ended questions to which only quantitative analysis could be applied, and some open-ended questions for more in-depth response information. The questionnaire was based on the literature and was subject to an expert review to verify its relevance and completeness.

A Likert scale was used for the variables in the study, with the responses to the independent and dependent variables being partitioned into a range of statements about the extent to which the individual was willing to agree or disagree with said statements. This scale was designed from 1 (Strongly Disagree) to 5 (Strongly Agree), which reflects a quantitative measure for respondents' perception and experiences (Likert, 1932). The choice of using a Likert scale allowed measurement of the data in an ordinal scale and gave an indication of the order of importance of the factors that were being investigated.

Responses were categorized using data gathered in Section A, which included demographic information on role, age, education, gender, experience, and regional focus. For Section B, the parts of the vegetation cover that have been lost since 2005 were measured; this comprised plant density, green cover, and the vegetation layer. Some of the issues raised in Section C centered on the perceived sense of diminished water resources, water availability, water reserves, and reduction

in groundwater levels. Section D discussed the effects of soil erosion, including soil degradation, decrease in soil fertility, and loss of topsoil.

Section E looked at the effectiveness of these strategies to intervene in forest ecosystems, including the civic, community-based conservation efforts, water resource management, and/or afforestation and reforestation programs. Section F provided an analysis of the security situation of pastoralist communities by analyzing conflict incidence, access to resources, and community stability.

3.6.2 Pilot Testing of Research Instruments

To test the reliability and validity of the research instruments, a pilot test was carried out prior to the main data collection (Van Teijlingen & Hundley, 2001). The pilot study was done in Samburu East, Sub-County of Samburu County. This site was intentionally selected to be comparable to the main study areas, and adequate tests of the instruments were conducted under realistic situations. The number of individuals (10% of the total number of participants = 40) was chosen to be a small sample matching the population characteristics of the main study. It should be emphasized here that the respondents from this pilot area were not included in the main study, due to the risk of response bias and data contamination. The questionnaire was improved in light of feedback received from the pilot test to address clarity, question flow, and relevance. Use of a pilot test proved useful for identifying and fixing potential issues that would allow for the data to be collected effectively in the final test.

3.6.3 Instrument Reliability

Reliability refers to the consistency of the research instrument in measuring its intended constructs (Cortina, 1993). The internal consistency method, specifically Cronbach's alpha coefficient, was used to assess reliability. A Cronbach's alpha value of 0.7 or higher was considered acceptable,

indicating that the questionnaire items consistently measured the underlying constructs (Tavakol & Dennick, 2011).

Reliability tests were performed using SPSS Version 27 on the data collected from the pilot study. The results indicated high internal consistency for all constructs, with scores well above the acceptable threshold. Specifically, the Cronbach's alpha scores were as follows: Loss of Vegetation Cover ($\alpha = 0.82$), Decline in Water Resources ($\alpha = 0.85$), Soil Erosion ($\alpha = 0.79$), Government Intervention Measures ($\alpha = 0.81$), and Security of Pastoralist Communities ($\alpha = 0.84$). The overall reliability of the entire questionnaire was $\alpha = 0.86$. Items that weakened overall reliability were reviewed and rephrased for clarity. These results confirmed that the research instrument was highly reliable and suitable for the main data collection.

3.6.4 Instrument Validity

Validity refers to the degree to which the research instrument is valid in measuring what it was designed to measure (Messick, 1995). The Content Validity, test of Construct Validity, and Criterion Related Validity were used to determine the validity of the questionnaire. The items on the questionnaire were reviewed for content validity by experts. The construct validity was assessed by examining the item-theory congruence, and the criterion validity was approached by comparing the responses to the questions with the external criterion/standards. To validate tool accuracy, pilot tests and expert reviews were performed to guide observations and mapping. Triangulation was employed to confirm information, and knowledgeable informants were carefully selected for the interview. Moderated focus group discussions using trained moderators and systematic analysis were used to ensure credibility and depth of the discussion. It was crucial to validate instruments in order to obtain credible and meaningful results.

3.6.5 Data Collection Procedures

The researcher received an introduction letter from the University to help in obtaining approval from relevant authorities in the process, which included a research permit issued by the National Commission for Science, Technology, and Innovation (NACOSTI). The data collection took place in two steps: a pilot study was carried out, followed by the main data collection process (Yin, 2018). In Samburu County, selected respondents were personally interviewed using questionnaires. Face-to-face administration was preferred due to its favorable results of better response rate and interpretation of the ambiguities in the questions (Kumar, 2019). It was ensured that the data collection process would be monitored so that there would be uniformity and precision in data collection.

3.7 Data Processing and analysis

The data collected were both descriptive and inferential and had the same technique. The characteristics mean, standard deviations, frequencies, and percentage distributions of the sample were summarized and described using descriptive statistics . Focusing on the relationships among the two independent variables loss of vegetation cover, decline in water resources, and soil erosion) and one dependent variable pastoralist community security was made through the use of inferential statistics, namely correlation analyses and multiple regression analysis. For the present study, the regression model developed was:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\varepsilon$$

Where:

Y = Security of pastoralist communities (dependent variable)

β_0 = Intercept (constant)

X_1 = Loss of vegetation cover (independent variable)

X_2 = Decline in water resources (independent variable)

X_3 = Soil erosion (independent variable)

X_4 = Government Intervention Measure (independent variable)

$\beta_1, \beta_2, \beta_3$, and β_4 = Regression coefficients representing the effect of each independent variable on Y

ϵ = Error term

The findings are presented systematically in tables, graphs, and charts for clarity and ease of comparison. Statistical software like SPSS was used to analyze data to ensure accuracy and reliability.

3.8. Legal and Ethical Considerations

The importance of citing ethical standards was at the forefront of the study to ensure research was conducted with integrity and respect to participants' rights (Beauchamp & Childress, 2001). All respondents were fully briefed on the purpose of the study, their roles, and their right to withdraw at any time, and a signed informed consent was obtained from them. Where respondents were younger than 18 years, they gave informed assent, as well as written informed consent from their parents/legal guardians, in accordance with national ethical guidelines for research conducted with minors. Data was stored securely, and confidentiality and anonymity were ensured by not sharing identifying information with others. The study also ensured that there was no exploitation of the local culture and context in Samburu County.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION, AND DISCUSSIONS

4.1 Introduction

The data gathered from the questionnaires and interviews, were analyzed systematically in this chapter, both descriptively and statistically inferentially. The chapter is structured around the study's aims dealing with the situation of land cover change, pastoralist human security and the impact on approaches to conflict management. It also contains regression and correlation analyses to determine the relations between the important variables. In this chapter the findings are presented in an enhanced way with the use of tables, figures and narrative explanations so that there is efficiency and understanding.

4.1.1 Response Rate

A response rate analysis was undertaken to determine the effectiveness of the data collection. The questionnaires were distributed to 360 individuals who participated in the activities and 258 questionnaires were completed and returned in Samburu County. The rate in which everyone responds to the study is very important for the results to be reliable and generalizable or representative.

Table 4. 1: Response Rate

Item	Frequency	Percentage (%)
Questionnaires Issued	360	100.0
Questionnaires Returned	258	71.7
Questionnaires Not Returned	102	28.3

An excellent response rate of 71.7% was obtained for the study, which is exceptional for survey-based studies. If the response is over 70% it is considered very good, as this boosts the research findings thus the findings to be trusted, according to Mugenda and Mugenda (2003).

4.2 Demographic Characteristics

The socio-demographic profile of the sample which participated in the study is presented in this section. In contextualising the findings, an understanding of these characteristics is crucial, as the data should illustrate a variety of views among the pastoralist groups in Samburu County. Demographic information variables studied are gender, age, role or affiliation, highest education level, time in the current operational area, and major operational area of work or focus. These attributes will give information of the kind of social and working population represented in the sample, and will be useful in determining whether or not the conclusions draw on a representative sample and whether or not the conclusions can be generalized to that population.

4.2.1 Gender Distribution of Respondents

The gender distribution of the respondents involved in the study is given in table 4.2. Knowing the gender representation is crucial in attaining inclusivity and generalized results.

Table 4. 2: Gender Distribution of Respondents

Response	Frequency	Percentage
Male	141	54.7
Female	117	45.3
Total	258	100

The results indicate that 54.7% of them were males and 45.3% females. This means there is relatively even (males just outnumber females) gender balance. This representation aims to reduce the gender bias and to provide an analysis that references multiple and varied viewpoints when considering land cover change impacts on pastoral communities. The ‘meshed’ proportions further add to the credibility of conclusions made from both genders, and also ensure that the conclusions derived are relevant to both men and women and thus intervene effectively on the basis of findings.

4.2.2 Age Distribution of Respondents

Table 4.3 gives information about the age group of the audience. This distribution is useful to understand the differences in experiences and perceptions of changes in land cover by age group.

Table 4. 3: Age Distribution of Respondents

Response	Frequency	Percentage
Under 20 years	39	15.1
20-29 years	21	8.1
30-39 years	174	67.4
40-49 years	24	9.3
Total	258	100

A majority of the respondents (67.4%) were aged between 30–39 years, followed by 15.1% under 20 years, 9.3% aged 40–49 years, and 8.1% aged 20–29 years. The population of 30-39 year olds were dominant in this study, as these are the main members of a household's operational team, involved in everyday livestock care and resource-collection, however the study recognises that the number of elders (those aged 50+ years) is small. This reflects logistical and difficult access to the

manyattas in remote areas as well as the fact that younger people are now experiencing a significant share of the growing workload – as they spend more time carrying water or firewood – hence, they are key in understanding current security dynamics. The age-profile is consequently not interpreted as a sign of complete multi-generational coverage but as a limitation to the knowledge that has been captured, both the traditional and inter-generational types.

4.2.3 Role or Affiliation of Respondents

Table 4.4 segments respondents according to their community roles and/or the group they belong to. Especially important for gaining a diverse perspective based on influence and engagement in land management.

Table 4. 4: Role or Affiliation of Respondents

Response	Frequency	Percentage
Community Member	244	94.6
Local Leader	14	5.4
Total	258	100

Table 4.4 shows that overwhelmingly (94.6%) all participants were community members, while only 5.4% were local leaders. This means that it shows mainly grassroots views of facts, but has also included minimal input from leaders, giving some institutional perspective to the analysis. This balance supports the credibility of the study by including the lived experience aspects and governance for interpretation of land cover change impacts and minimizes study role related bias in interpreting impacts of land cover change.

4.2.4 Educational Background of Respondents

The highest education that the respondents have attained is shown in table 4.5. The level of education impacts on how a person perceives and reacts to changes in their environment/society.

Table 4. 5: Educational Background of Respondents

Education Level	Frequency	Percentage
Primary Education	159	61.6
Secondary education	24	9.3
No formal Education	75	29.1
Total	258	100

The results shown in Table 4.5 shows that 61.6% of the respondents had attained only Primary Education, 29.1% could not attain any education and 9.3% had been educated at Secondary school. This educational profile indicates the majority of the respondents are doing a survey and have competent literacy to do so. To be sure, results reflect the reality of communities where there is a low level of access to advanced education, as the majority of the respondents had limited formal education. It is essential to include this group in any effort to remove the bias in education and to develop recommendations that are feasible and available to the user population.

4.2.5 Duration in Operational Area

Table 4.6 shows the duration of time that the people who conducted the interviews lived or had been working in the area. The depth of knowledge/experience of land cover changes can be evaluated by and while considering duration of stay.

Table 4. 6: Duration in Operational Area

Response	Frequency	Percentage
Less than 1 year	36	14
Between 1 year and 3 years	51	19.8
Between 3 years and 6 years	102	39.5
Between 7 years and 10 years	69	26.7
Total	258	100

The results in Table 4.6, most respondents (39.5%) had been in their area for 3–6 years, followed by 26.7% for 7–10 years, 19.8% for 1–3 years, and 14.0% for less than one year. The overwhelming presence of long-term residents gives some authenticity to the answers as people are more likely to have seen major long-term changes in their environment. This longevity helps minimise temporal bias and let the data be from long time observations and less transient.

4.2.6 Primary Area of Focus or Work

The responses of main areas of work/interest are presented in Table 4.7. Professional emphasis helps the student to understand the perceptions of land cover changes that they are experiencing.

Table 4. 7: Primary Area of Focus or Work

Response	Frequency	Percentage
Environmental conservation	68	26.4
Community development	79	30.6
Policy making	15	5.8

Education	47	18.2
Health	49	19
Total	258	100

The top priorities were for community development (30.6% of responses) and environmental conservation (26.4% of responses), followed by health (19.0%), education (18.2%) and policy making (5.8%). The diversity stems from various areas of expertise and concerns, thus providing a richness of the analysis in the study. The high percentage of fields that are directly related to land and social welfare provides insights into an informed data set, and reduced occupational bias minimizes that bias to the extent that the findings are applicable across various sectors affected by land cover dynamics.

4.3 Descriptive Statistics

Descriptive statistics associated with the responses to the key study variables were presented, based on the study objectives outlined in this section. Descriptive statistics can be useful to summarise the central tendencies and distribution of the data; it could assist them to understand general patterns, trends and perceptions among respondents, as well as the distribution of the data. Key variables considered are: status of changes in land cover, effects of changes in land cover on pastoralist human security, impact on pastoralist human security on conflict management strategies, and overall implications on pastoralist communities' human security. The frequencies, percents, means and standard deviations are used to show the number and dispersal of opinions for each variable, to emphasize the intensity and dispersion of opinion among the participants.

4.3.1 Loss of Vegetation Cover and Its Influence on Security of Pastoralist Communities in Samburu County

The findings presented and explained the long-term effects of loss of vegetation that impacted on the security of communities that till pasture in Samburu County. The findings are based on the perception of the respondents about plant density, green cover, different vegetation layers and biodiversity in the region. The results of these are very vital in any allegation of how degradation is occurring and its implications for resource-based livelihoods in pastoralism areas.

Table 4. 8: Loss of Vegetation Cover

Statement	SD F (%)	D F (%)	N F (%)	A F (%)	SA F (%)	Mean	Std Dev.
1. Plant density in the area has decreased over time.	18 (7.0%)	39 (15.1%)	63 (24.4%)	84 (32.6%)	54 (20.9%)	3.45	1.18
2. Green cover in the region has significantly reduced.	9 (3.5%)	33 (12.8%)	93 (36.0%)	63 (24.4%)	60 (23.3%)	3.51	1.09
3. The layer of vegetation in the area has been eroded.	6 (2.3%)	36 (14.0%)	81 (31.4%)	69 (26.7%)	66 (25.6%)	3.59	1.08
4. There is less plant diversity compared to previous years.	15 (5.8%)	39 (15.1%)	81 (31.4%)	57 (22.1%)	66 (25.6%)	3.47	1.19
5. The area now has fewer trees and shrubs than before.	21 (8.1%)	18 (7.0%)	72 (27.9%)	84 (32.6%)	63 (24.4%)	3.58	1.17

6.	Vegetation loss	15	24	81	81	57	3.55	1.11
	has impacted local biodiversity negatively	(5.8%)	(9.3%)	(31.4%)	(31.4%)	(22.1%)		

The results were as follows.

Specifics of plant density in the area have declined over time with 84% (32.6%) affirming that this has been true and 54% (20.9%) strongly agreeing. However, 63 (24.4%) were neutral, while 39 (15.1%) disagreed and 18 (7.0%) strongly disagreed, yielding a mean of 3.45 (SD = 1.18). This was a moderate level of agreement, which suggests that there was a large amount of people who agreed that plant density was reduced but were also unsure or skeptical about an extreme level of reduction. The reduction in plant density has been interpreted as a reduction in forage for the livestock, which is a threat to pastoral livelihoods. The implication is that when vegetation stops growing pastoral livelihoods are set on a course to become more vulnerable to conflict and insecurity.

Concerning the effect of green cover in the region, 93 (36.0%) respondents were neutral, 63 (24.4%) agreed and 60 (23.3%) were strongly agree. A smaller proportion, 33 (12.8%) disagreed and 9 (3.5%) strongly disagreed, with a resulting mean of 3.51 (SD = 1.09). There was a large number of neutral responses, meaning that there may be some uncertainty about what had happened or a lack of direct observation by those responding, overall, there is an acknowledged reduction in green vegetation. A decrease in green cover usually indicates land degradation of the pastures, which means food shortages and forced pastoralists migration. This aligns with the results of Tschakert et al. (2021) who associated the decrease in the proportion of green cover with poorer animal health and more livestock movement, leading to increased competition and inter-

community disputes. Hence, the loss of green areas reflects increasing stresses on the environment, which could threaten pastoralist security.

Sixty-nine (26.7%) and 66 (25.6%) agreed and strongly agreed respectively that the layer of vegetation in the area has been eroded, while 81 (31.4%) were neutral. A smaller proportion, 36 (14.0%) disagreed and 6 (2.3%) strongly disagreed, generating a mean of 3.59 (SD = 1.08). These responses confirm the perception of a general degradation of vegetation cover and potentially of soils, which results in higher erosion risk. Such land degradation and the degradation of the pasture quality have a negative impact on the sustainable development of livelihoods. A similar study by Haggerty and Trent (2020) in the Western United States found that erosion of vegetation reduced the forage available to livestock, increased livestock stress and had a negative impact on the economic resilience. It is suggested that gully vegetation eroded contribute directly to the deterioration of the ecosystem and indirectly to pastoralists' social problems.

There was less diversity of plants than in previous years, with 57 agreeing and 66 strongly agreeing and 81 neutral. Meanwhile, 39 (15.1%) disagreed and 15 (5.8%) strongly disagreed, resulting in a mean of 3.47 (SD = 1.19). Moderate agreement suggests that the diversity of plant species has been perceived to be reduced, an important indicator of good ecological conditions. Depression of biodiversity limits feeding diversity for animal production and curtails the ability to withstand environmental impacts. These results corroborate those from Muriithi and Wambua (2021) which revealed acceleration of intergroup competition for limited resources due to the decrease of plant diversity in Ethiopia, resulting livestock malnutrition. This can imply that biodiversity loss has implication on security and ecological threat on the pastoralist communities in Samburu.

In response to "Is there a reduced quantity of trees and shrubs compared to pre-development in this area?": 84 (32.6%) responded yes, 63 (24.4%) responded strongly yes and 72 (27.9%) were

neutral, while 49 (18.9%) responded no, and 7 (2.7%) responded strongly no. A minority—18 (7.0%) disagreed and 21 (8.1%) strongly disagreed—brought the mean to 3.58 (SD = 1.17). This distribution is a clear sign of lower perception of woody vegetation with very direct implications on forage, fuelwood and regulation of the micro climates. Stands of trees and shrubs are important to maintain pasture and to prevent erosion of the soil. The results corroborate with those of Wamatu and Gichuki (2023) that reduction in woody vegetation leads to food insecurity and land disputes in southern Kenya. This may continue to exacerbate further instability in Samburu as a result of increased competition among pastoralists existing on the few environmental resources at their disposal.

Lastly, with respect to the negative impact of vegetation loss on local biodiversity, 81 (31.4%) agreed, and 57 (22.1%) strongly agreed. Additionally, 81 (31.4%) were neutral, 24 (9.3%) disagreed, and 15 (5.8%) strongly disagreed, producing a mean of 3.55 (SD = 1.11). That is suggested by the recognition of the agreement levels that the loss of vegetation extends beyond the pasture level to the broader ecosystem, wildlife and native plant species. Loss of biodiversity causes the ecological web to become more fragile, reduces natural resilience and increases environmental stress.

Of the 40 Key Informants interviewed, majority (35) stated that the vegetation cover in Samburu County had undergone a significant reduction in the last 20 years. This was blamed on overgrazing, extended periods of drought and deforestation. Some of the most frequently reported impacts were loss of pasture, movement of livestock, and the impact on livelihood. There were three major theme groups of responses: (1) reduction in grazing land, (2) the interference and/or alteration of natural seasonality in migrations, and (3) existing territorial disputes over access to grazing land.

Similarly, Government Representative 4 and NGO Representative 2 echoed this by stating that *“Loss of indigenous grasslands has triggered frequent disputes among clans and tribes over grazing routes.”*

Of the 24 local leaders, 20 reported very significant pasture vegetation loss, with reports of migration and a rise of intra-community tensions. The most commonly cited causes of most of the lost vegetation were overgrazing, wood burning and lengthy droughts.

For instance, Community Leader 1 noted, *“Our animals now walk for days in search of pasture where it used to take a few hours twenty years ago.”*

Unpredictable vegetation patterns in relation to the cessation of the traditional elders' grazing days was reiterated by several leaders.

Ten government officials acknowledged vegetation degradation and its contribution of undermining traditional livestock routes. They observed that there was an increasing need for planning of rotational grazing and for enforcement of environmental bylaws.

Government Representative 4 observed, *“Loss of indigenous grasslands has triggered frequent disputes among clans over grazing routes.”*

The lack of engagement with the communities and climatic stress were raised as concerns about the failure to address reforestation issues by three NGO officials. Not enough technical follow-up after tree-planting projects was another area they expressed a concern about.

NGO Representative 2 stated, *“We plant trees, yes, but without water and fencing, they rarely survive beyond the first season.”*

Finally, the key informant interviews showed that the majority of stakeholders including local leaders, government officials and NGOs in Samburu County are generally cognizant that the vegetation cover in the county has drastically reduced over the last 20 years with the major causes of this being over grazing, deforestation and the recurring droughts. As a result, the quality of the grazing land has decreased, stocking movements are affected, and tensions have risen around access to already scarce grazing land. Increased migration, social instability were the most often cited issues from the side of most local leaders, whereas the lack of traditional systems for the use of livestock pastures was reported from the side of the government representatives, who also stressed the necessity for proper resource management.

Observations on Environmental Degradation (2005, 2015, 2025): Participants had perceptions that during the 3 periods, “a decrease and persistently low vegetation cover”, “increase in soil erosion” and “drying of the usual water sources”, were consistently reported in the FGDs. The male participants remembered that there was a lot of vegetation and water in pre-2005 but there was a significant reduction by 2025. Women mentioned the additional time load of fetching wood and water.

"Before 2005, we had rivers flowing year-round. Now, we only see water during the rains."

– Elder Male

"Our children now walk twice the distance to fetch firewood compared to 10 years ago." –

Female Youth

Changes in Land Use: Male and female participants in the FGDs noticed that once they were vegetated land is being barren or less vegetated. Excessive grazing, deforestation and durable settlement expansion were highlighted as the major factors.

"This place had thick shrubs; now it's just dust and thorns." – Middle-aged Male Pastoralist

4.3.2 Decline in Water Resources and Its Impact on Security of Pastoralist Communities in Samburu County

This section outlines the results of the reduction in water resources and how this impacts pastoralists' security in Samburu County. Water poverty is a major issue in arid and semi-arid areas with significant impact on pastoral wellbeing and social cohesion. The below analysis provides the perspectives of respondents on the changes in water supply, water reservoirs and groundwater resource, and their role relating to the security and environmental dynamics of the region.

Table 4. 9: Decline in Water Resources

Statement	SD F (%)	D F (%)	N F (%)	A F (%)	SA F (%)	Mean	Std Dev.
1. Water availability in the area has decreased.	15 (5.8%)	18 (7.0%)	63 (24.4%)	90 (34.9%)	72 (27.9%)	3.72	1.12
2. The reserves of water in local sources are lower.	9 (3.5%)	33 (12.8%)	69 (26.7%)	93 (36.0%)	54 (20.9%)	3.58	1.06
3. Groundwater levels have dropped significantly.	6 (2.3%)	24 (9.3%)	99 (38.4%)	60 (23.3%)	69 (26.7%)	3.63	1.05
4. There is less water in rivers and streams compared to before.	9 (3.5%)	39 (15.1%)	75 (29.1%)	81 (31.4%)	54 (20.9%)	3.51	1.09
5. The local water table has shown a noticeable decline.	12 (4.7%)	33 (12.8%)	87 (33.7%)	63 (24.4%)	63 (24.4%)	3.51	1.13

6. Water scarcity has	9	33	81	66	69	3.59	1.12
become a pressing	(3.5%)	(12.8%)	(31.4%)	(25.6%)	(26.7%)		
issue in the area.							

90 respondents (34.9%) strongly agreed to the statement “Water availability in the area has decreased” and 72 of these (27.9%) agreed. Meanwhile, 63 (24.4%) were neutral, 18 (7.0%) disagreed, and 15 (5.8%) strongly disagreed, producing a mean of 3.72 (SD = 1.12). The following mentions the widespread view of declining water supply over time. This is a worrisome as reduced access to water degrades the well-being of livestock and humans on which pastoralist systems depend. The results also corroborate with Schilling and Werland (2023) who reported that climate change and neglect of water resources policies in Northern Kenya have led to increased water scarcity and consequently high-water tension. The inference is that a lack of water could be one of the primary factors for resource conflicts and insecurity in Samburu County.

Whether “the reserves of water in local sources have decreased”, 69 were neutral, 93 agreed (36.0%) and 54 Strongly Agreed (20.9%). A smaller proportion—33 (12.8%) disagreed and 9 (3.5%) strongly disagreed—brought the mean to 3.58 (SD = 1.06). The overall trend is a general awareness of decreasing wells, pans, and reservoirs that have stored or are available for use. Lower reserves indicate poorer confidence in traditional water sources would necessitate longer travel and result in higher vulnerability to risks like theft, violence and inter-community conflict. Similarly, for both cases, the results align with what Umutoni and Ayantunde (2018) found – yet more availability issues and rising water shortfalls because of the increase in transhumance became a source of conflicts. The revealed vulnerability is similar in Samburu where reserves of water are shrinking, augmenting the competition and insecurity.

Respondents demonstrated moderate agreement that “groundwater levels have dropped significantly” with 60 (23.3%) and 69 (26.7%) respectively indicating moderate and strong agreement. A notable 99 (38.4%) were neutral, while 24 (9.3%) disagreed and 6 (2.3%) strongly disagreed, yielding a mean of 3.63 (SD = 1.05). It was a neutral response from a large number, and perhaps because they did not have firsthand information about groundwater; a combined 50% confirmed the decline. This implies a potential for loss of viability of boreholes, and reliability of water table, particularly during dry seasons. The results align with M'Mbogori et al. (2022) who reported falling water levels in Marsabit County and the negative impacts of declining water levels on the socio-economic well-being of communities. Groundwater depletion raises the threat of environmental stress, affecting water sharing among Samburu, which leads to insecurity.

The findings indicate that 81 (31.4%) respondents agreed and 54 (20.9%) strongly agreed that there "is less water in rivers and streams than there used to be. Another 75 (29.1%) were neutral, while 39 (15.1%) disagreed and 9 (3.5%) strongly disagreed, giving a mean of 3.51 (SD = 1.09). The results indicate that surface evidence of drying within streams and rivers exists which is a very important result in an area where stream and river runoff is a prominent feature in the wet seasons. When surface water is limited, it impacts on livestock moving around as well as the number of livestock pooling in a limited area which could lead to conflict. These findings are corroborative of Kirui et al. (2022) who observed that reduction in rainfall was responsible for significant pastoral livelihood disruption in northern Kenya, while reduced river flow disruptive pastoral livelihoods in these areas.

Sixty-three (24.4%) percent of respondents said there has been a noticeable decline in the local water table and an equal number (24.4%) strongly agreed with that statement. However, 87 (33.7%) were neutral, and the rest, 33 (12.8%) disagreed and 12 (4.7%) strongly disagreed resulted

in a mean of 3.51 (SD = 1.13). Again, there is some uncertainty reflected in these responses, probably because there is not a great deal of scientific measurement of underground water and thus reliability is low, but a good percentage believed that there had been a decrease. This indicates that shallow wells and boreholes are becoming more severe among the ones who are relying on it. This is consistent with Manzano et al. (2021) who highlighted those shrinking aquifers were threatening the resilience of pastoralist systems.

Lastly, 66 (25.6%) agreed and 69 (26.7%) strongly agreed that water scarcity is an emerging problem in the region. An additional 81 (31.4%) were neutral, while 33 (12.8%) disagreed and 9 (3.5%) strongly disagreed, leading to a mean of 3.59 (SD = 1.12). With this consensus, it was again reinforced that water scarcity is no longer a seasonal issue but one that is chronic. A persistent lack of feed reduces the sustainability of pastoralism, creates resource-based disagreements and stress amongst communities and decreases pastoral welfare. These findings corroborate Cabeza et al. (2021) who maintained that water scarcity negatively affected pastoral systems, and raised the risk of conflict and displacement. Therefore, water scarcity in Samburu is an environmental and security problem that requires critical targeted and timely interventions.

Interview results: effects of water sources depletion on human security. Local Leaders (n = 24). Twenty-two out of the 36 local leaders mentioned the significant decrease in water points. Seasonal water bodies such as rivers and pans have dried up or reduced in size. This has caused disruption in livestock watering routine, and domestic running of water.

Community Leader 7 mentioned, *“We now fight over water. People camp at boreholes overnight.”*

All 12 out of the 12 government respondents admitted that water shortage was worsened. The following noted delays of borehole drilling and maintenance are considered to be a contributing factor. Other's ones referenced impoverished groundwater replenishment caused by deforestation and over-extraction.

Government Representative 8 stated, *“The scarcity of water is turning peaceful areas into hotspots of conflict.”*

All four NGO representatives reported increased social burden due to decreased water availability especially borne by women and girls. They noticed that approach to water works and the planning and sustainability of the water project in the community was not included generally.

NGO Representative 3 noted, *“We’ve seen more mothers abandon other chores just to queue at the only functioning borehole.”*

4.3.3 Soil Erosion and Its Influence on Security of Pastoralist Communities in Samburu County

This section elicits and contextualises the findings on the impact and thinning of pastoralists' security and sustainability linked to soil erosion in Samburu County. Erosion is one of the most serious problems associated with arid and semi-arid lands – land productivity loss, soil fertility declines and desertification. The following analysis presents the results of respondents' perceptions around: land degradation, topsoil erosion, falling birth rates, and how these negative effects are affecting their livelihoods and their national dynamics of conflict.

Table 4. 10: Soil Erosion

Statement	SD F (%)	D F (%)	N F (%)	A F (%)	SA F (%)	Mean	Std Dev.
1. Land degradation has increased in the area.	6 (2.3%)	30 (11.6%)	78 (30.2%)	75 (29.1%)	69 (26.7%)	3.66	1.07
2. Soil fertility has declined over time.	18 (7.0%)	21 (8.1%)	96 (37.2%)	66 (25.6%)	57 (22.1%)	3.48	1.13
3. There has been significant loss of topsoil.	15 (5.8%)	30 (11.6%)	72 (27.9%)	60 (23.3%)	81 (31.4%)	3.63	1.20
4. Erosion has caused noticeable changes in land productivity.	9 (3.5%)	42 (16.3%)	63 (24.4%)	84 (32.6%)	60 (23.3%)	3.56	1.12
5. Soil erosion is affecting agricultural output negatively.	12 (4.7%)	21 (8.1%)	78 (30.2%)	72 (27.9%)	75 (29.1%)	3.69	1.12
6. The area has seen an increase in soil erosion events.	21 (8.1%)	30 (11.6%)	81 (31.4%)	81 (31.4%)	45 (17.4%)	3.38	1.15

Land degradation has also been suggested to have increased in the area, 75 respondents (29.1%) agreed while 69 respondents (26.7%) strongly agreed. Additionally, 78 (30.2%) were neutral, while only 30 (11.6%) disagreed and 6 (2.3%) strongly disagreed, producing a mean of 3.66 (SD = 1.07). A popular belief that reinforces the fact that degradation is a significant environmental problem in Samburu. Land degradation reduces the productive rangeland and endangers pastoral way of life. These results corroborate the results of Wynants et al. (2019), which we found that misinformed historical governance policies in East Africa have resulted in land degradation and

reduction of traditional agro-pastoral systems. The message here is that as land becomes less productive, risks of resource competition and displacement may increase, affecting security in the region.

Sixty-six (25.6%) agreed and 57 (22.1%) strongly agreed with the statement 'soil fertility has declined over time' - 96 (37.2%) were neutral. Meanwhile, 21 (8.1%) disagreed and 18 (7.0%) strongly disagreed, yielding a mean of 3.48 (SD = 1.13). While a considerable proportion of respondents are unsure, there is still significant agreement on declining fertility. Loss of soil fertility can negatively impact pasture and crop yields, making pastoralists' rearing livestock and "topping up" rations difficult. The results are consistent with those of Pozza and Field (2020) that related soil erosion with the decrease in food security and land productivity in agro-pastoral regions. Fertility rates at their lowest in Samburu increase pressure on pastoralists to move or encroach on conflicted areas working to heighten security tensions.

As to whether there has been "significant loss of topsoil": 81 (31.4%) strongly agreed; 60 (23.3%) agreed; 72 (27.9%) were undecided. Fewer respondents disagreed, 30 (11.6%) and 15 (5.8%) strongly disagreed, leading to a mean of 3.63 (SD = 1.20). The results show considerable agreement that topsoil erosion is an obvious and a destructive phenomenon in the region. Withholding the topsoil is crucial for the regrowth of the vegetation, and will have a severe impact on grazing cycles and the natural regeneration of the ecosystem. In this context, Zhang et al. (2022) have correlated soil erosion with reduced soil nutrient levels and decreased resilience of the ecological systems. Topsoil erosion is not only thought of as a degradation of the land, but also a displacement of pastoral activities that puts pressure on other land areas and may result in conflict in Samburu.

Respondents responded to the statement “erosion has caused noticeable changes in land productivity” with 84 (32.6%) agreeing, and 60 (23.3%) strongly agreeing. Additionally, 63 (24.4%) were neutral, while 42 (16.3%) disagreed and 9 (3.5%) strongly disagreed, with a resulting mean of 3.56 (SD = 1.12). The results indicated that most respondents feel that there is a strong relationship between soil degradation and low productivity and soil degradation has become a threat to their daily living. Environmental deterioration and socio-economic hardship play a close relationship in articulating pastoralists' insecurity. The poor social cohesion and the associated economic and security risks were found to aggravate erosion-related productivity decline in pastoral lands in Tanzania (Rabinovich et al., 2019). The findings highlight the imperative to develop interventions that are both productive and have community-level impacts.

The responses for the statement “soil erosion has a negative influence on agricultural production” were: strongly agree (75, 29.1%), agree (72, 27.9%) and neutral (78, 30.2%). A smaller group, 21 (8.1%) disagreed and 12 (4.7%) strongly disagreed gave a mean of 3.69 (SD = 1.12). This high consensus highlights the observed clear negative trends in food production by respondents as a result of soil erosion. Soil erosion affects food availability and increases dependency on aid or migration in times of conflict for pastoralists who feed their animals by keeping small gardens, and it can lead to increased food insecurity and tensions between communities sharing the same resources.

Last, 81 (31.4%) and 45 (17.4%) respondents said that “the area has experienced more soil erosion events” and “the area has experienced a great deal of soil erosion events” respectively. However, a notable portion, 81 (31.4%) were neutral, and 30 (11.6%) disagreed and 21 (8.1%) strongly disagreed, resulting in a mean of 3.38 (SD = 1.15). It's not that there's as much disagreement as there is agreement, but the very high neutral response could be due to seasonal effect or may simply

indicate limited awareness of this issue among some respondents. However, more erosion events in general have consequences for sustainable land use and heightened vulnerability to a sudden environmental shock. In northern Tanzania conditions were found that the erosion events made agro-pastoral systems vulnerable in particular periods, especially in cases where cultural beliefs would not allow access to land management processes to be altered from the usual practices (Blake et al. 2018). The suggestion is that if erosion is not managed proactively in Samburu there will be a long way for stability in the environment and security of the community and this will happen if erosion is a regular occurrence.

The research found that 18 local leaders reported some soil erosion, particularly in lowland grazing areas. They correlated erosion with overstocking, deteriorated land use and rainfall runoff. Leaders reported decreased yield of lands and reported some migration resulted from barren lands.

Community Leader 9 commented, *“We used to grow maize in some parts; now it’s just sand and rock.”*

It was found that Eleven government officials reported widespread topsoil loss and shrinking rangelands. They emphasized the lack of land restoration programs and weak enforcement of soil conservation policies.

Government Representative 6 stated, *“Soil erosion has eaten away pasturelands and even displaced some families.”*

All four NGOs acknowledged soil degradation as a critical issue but noted a gap in integrated land rehabilitation approaches. They emphasized participatory land-use mapping and grassroots capacity building.

NGO Representative 1 shared, *“The problem is not just erosion, it is that nothing is done to stop it.”*

These findings indicate erosion as a major and growing challenge to human security in Samburu County, impacting land productivity and food systems, as well as impacting community stability beyond. 18 local leaders noted the serious degradation of lowland grazing land, with reasons being overstocking, non-sustainable grazing and lack of water management for rainwater. These conditions have left once-fruitful land unsuitable for farming, forcing families to move onto others seeking land suitable for harvest. These findings corroborate Nyabuto (2016) who noted that lack of good environmental governance exacerbates the impacts of soil degradation in pastoral areas. In sum, the findings indicate that unrestricted soil erosion has a negative impact on pastoral livelihoods, boosts urban migration and raises the likelihood of environmental-induced conflicts and poverty.

Mentioned by both gender male and female were the Soil Cover Changes that is severe soil erosion and the loss of arable land. There was a connection between this and overgrazing, deforestation and absence of conservation practices.

“When it rains, it washes away everything—even our crops and homes.” – Youth Male

4.3.4 Effectiveness of Government Interventions in Mitigating Environmental Degradation

This section examines the effectiveness of government interventions to reduce environmental degradation and improve pastoralist communities' security in Samburu County. Responses indicate the degree of implementation of programmes like afforestation, water resource development, community-based programmes and so on, by national and county governments. The analysis

provides fresh perspectives on government presence, governance and environmental and livelihood problems pastors experience.

Table 4. 11: Effectiveness of Government Interventions in Mitigating Environmental Degradation

Statement	SD F (%)	D F (%)	N F (%)	A F (%)	SA F (%)	Mean	Std Dev.
1. Government have conducted afforestation and reforestation.	12 (4.7%)	10 (3.9%)	51 (19.8%)	86 (33.3%)	99 (38.4%)	3.97	1.08
2. Government has enhanced water resource access for pastoralist communities.	4 (1.6%)	18 (7.0%)	68 (26.4%)	90 (34.9%)	78 (30.2%)	3.85	0.98
3. Government intervention has enhanced Community stability in pastoralist regions.	8 (3.1%)	10 (3.9%)	71 (27.5%)	81 (31.4%)	88 (34.1%)	3.90	1.02
4. Governance is major issue for pastoralist communities.	14 (5.4%)	4 (1.6%)	62 (24.0%)	109 (42.2%)	69 (26.7%)	3.83	1.02
5. Community based intervention strategies are given chance.	6 (2.3%)	16 (6.2%)	89 (34.5%)	74 (28.7%)	73 (28.3%)	3.74	1.01
6. County and national government presence is not felt by the pastoralist communities.	8 (3.1%)	18 (7.0%)	73 (28.3%)	72 (27.9%)	87 (33.7%)	3.82	1.07

Most of the respondents (86, 33.3%) agreed that afforestation and reforestation is done by the government while 99 (38.4%) strongly agreed. Meanwhile, 51 (19.8%) were neutral, and a

minority, 10 (3.9%) disagreed and 12 (4.7%) strongly disagreed, resulted in a high mean of 3.97 (SD = 1.08). This point indicates the general awareness for environmental rehabilitation processes, especially with regard to vegetation removal. Revegetation projects are an effective solution that can improve grazing lands, help manage the climate and/or limit erosion. The findings are congruent with the recommendations made by Wamatu & Gichuki (2023) to promote the restoration of vegetation for food security and environmental stress reduction within the communities. Such initiatives seem to be visible and valued in Samburu, bringing relief to the demands for natural resources and minimizing environmental conflicts.

Concerning the government having improved water resource access for pastoralists, 90 (34.9%) agreed and 78 (30.2%) strongly agreed whilst 68 (26.4%) were neutral. Only 18 (7.0%) disagreed and 4 (1.6%) strongly disagreed, yielding a mean of 3.85 (SD = 0.98). It was found that there had been a noticeable positive effect with regard to water infrastructure provided by the Government, such as boreholes and pans in the area. Water availability can have a positive impact on herders' stress levels, regularity of migratory journeys and decrease water-related conflicts. This found is aligned with Schilling and Werland (2023) who highlighted the state-led water management as a successful method of improving pastoralist resilience. Thus, water infrastructure seems to be one of the government interventions that is being felt more strongly in Samburu County.

Approximately 81 (31.4%) agreed and 88 (34.1%) strongly agreed with the statement "government interventions have contributed to stability in pastoralist areas," with 71 (27.5%) were neutral. Only 10 (3.9%) disagreed and 8 (3.1%) strongly disagreed, producing a mean of 3.90 (SD = 1.02). That's a sign of hope that the government, in its peace efforts, or provision of resources or through law enforcement has helped to tame instability in the area. A stable environment is necessary to promote trust, minimize the risk of displacement and promote sustainable land use. The results are

consistent with the Security Research and Information Centre (2023) which concluded that while there are limitations to interventions, they have an important role to play in conflict management. While not always 'the ideal world', it would seem that the Government has not been a bad influence in Samburu in creating a sense of social order.

When asked if governance is a big issue for pastoralist communities, 109 (42.2%) agreed, 69 (26.7%) strongly agreed and 62 (24.0%) were neutral. Only 4 (1.6%) disagreed and 14 (5.4%) strongly disagreed, resulting in a mean of 3.83 (SD = 1.02). But the answers from these responses seem to suggest continued issues in governance, which may be related to poor policy implementation, poor representation, or corruption. Governance holes may impact the effectiveness/availability of interventions. The issues expressed here have echoes in Nyabuto (2016) whose attention was drawn on the need for better governance as a key constraint to environmental security in northern Kenya. Even with available interventions, however, governance continues to be a structural vulnerability to the impact of interventions on community security.

About 74 (28.7%) agreed, 73 (28.3%) strongly agreed, and 89 (34.5%) was neutral, for the statement 'community-based intervention strategies are given a chance'. A small minority—16 (6.2%) disagreed and 6 (2.3%) strongly disagreed—yielded a mean of 3.74 (SD = 1.01). The number of transitions to community solutions in the data demonstrates a moderate belief that these kinds of solutions are being recognized and supported within the community. However, the involvement of local people strengthens the chances of ownership, relevance and sustainability of environmental programs. The findings corroborate Kariuki (2020) who noted that participatory governance and empowerment of pastoral communities are essential for resilience building in

pastoral communities. As such, fostering inclusive strategies may increase the legitimacy and sustainability of government interventions in Samburu.

Lastly, “county and national government presence is not felt by the pastoralist communities” indicated 87 (33.7%) strongly agreed while 72 (27.9%) agreed. Meanwhile, 73 (28.3%) were neutral, with 18 (7.0%) disagreeing and 8 (3.1%) strongly disagreeing, generating a mean of 3.82 (SD = 1.07). The combination of these statements is paradoxical: "There are interventions, but the governments are not felt as strong. The two statements above indicate that there are some deficiencies in visibility, communication, consistency etc. This corroborates with Sabala (2013) who determined that where there is a program, limited local integration and top-down approaches reduce governments' impact. Effective presence might take longer to gain traction and effectiveness for Samburu pastoralists, including more sustained presence, capacity building, and ongoing, visible, leadership on environmental governance and peace-building.

A total of 21 local leaders knew about environmental projects like tree plantation and dam making. They did criticize poor follow-up and lack of community involvement and a lack of visibility of interventions in the short term.

Community Leader 3 said, “*We hear about tree planting, but we don’t see trees surviving.*”

Around Eight government officials cited budget constraints and logistical difficulties in sustaining interventions. They highlighted the challenge of scaling programs across the vast county.

Government Representative 2 stated, “*Yes, projects exist, but we are stretched thin across the county.*”

Three NGO representatives stressed that interventions work best when communities are part of the planning and monitoring process. They highlighted the need for long-term funding and local ownership.

NGO Representative 4 commented, *“Communities need to be involved in planning, not just receiving orders.”*

Such views concur with those of Kariuki (2020) who noted that designing intervention successfully and effectively should be inclusive and participatory.

The findings suggest that environmental projects are known and occur at some level, although the results also indicate that there are several significant issues that impede the effectiveness of environmental projects. Second, there is a significant difference between the project implementation and the achievement of a sustainable result - high tree mortality and little lasting impact indicating a lack of follow-up and monitoring. Second, if the community is not included in the process, local ownership and accountabilities suffer, impacting sustainability and relevance of interventions. Third, government officials have limited resources, both funds and manpower, to carry out and operate programs on the vast county. Finally, NGO representatives emphasize the need for community participation from the planning phase and on an ongoing basis as well as ongoing funding for successful interventions.

Some interventions encompass dam construction, tree planting etc by Government and NGOs were mentioned by the participants, but they were not impressed by their sustainability.

"They dig a dam and leave, after two years it's just dry land again." – Woman

FGD results on Governance Structures (2005–2025): There was limited awareness of formal environmental policies among community members. Instead, traditional governance systems were often relied upon for decision-making on resource use.

"Our elders used to guide us on grazing patterns, now we wait for NGOs." – Elder Male

4.3.5 Security of Pastoralist Communities in Samburu County

This section has presented respondents' views on the perceived current security environment among the pastoralists in Samburu County. Those statements describe influences like conflict that occurred, resources that were available, community stability and security measures. These will help provide a sense of the underlying implications on safety, cohesion and resilience within impacted communities going forward and how environment impacts and government responses relate to this.

Table 4. 12: Security of Pastoralist Communities

Statement	SD F (%)	D F (%)	N F (%)	A F (%)	SA F (%)	Mean	Std Dev.
1. Conflict incidence has increased in pastoralist communities.	12 (4.7%)	18 (7.0%)	93 (36.0%)	57 (22.1%)	78 (30.2%)	3.66	1.12
2. Resource access for pastoralist communities has improved.	15 (5.8%)	33 (12.8%)	72 (27.9%)	87 (33.7%)	51 (19.8%)	3.49	1.12
3. Community stability has enhanced in pastoralist regions.	6 (2.3%)	39 (15.1%)	90 (34.9%)	60 (23.3%)	63 (24.4%)	3.52	1.09

4. Security concerns are a major issue for pastoralist communities.	9 (3.5%)	42 (16.3%)	72 (27.9%)	75 (29.1%)	60 (23.3%)	3.52	1.12
5. The presence of security measures has strengthened community safety.	12 (4.7%)	30 (11.6%)	75 (29.1%)	78 (30.2%)	63 (24.4%)	3.58	1.12
6. The level of conflict in pastoralist communities has diminished.	6 (2.3%)	39 (15.1%)	78 (30.2%)	66 (25.6%)	69 (26.7%)	3.59	1.11

Approximately 78 (30.2%) respondents strongly agreed to "There has been more conflict in pastoralist communities than before", and 57 (22.1%) agreed, with 93 (36.0%) neutral. Only a small portion—18 (7.0%) disagreed, and 12 (4.7%) strongly disagreed—resulted in a mean of 3.66 (SD = 1.12). The results document that such concerns have been broad and the signals point to further conflict if this first were to persist or intensify, probably stemming from limited resources such as water and pasture. The same applies to Schilling and Werland (2023), who noted that environmental scarcity, specifically water and pasture, further increases tensions and the risk of conflict in pastoralist areas, particularly in Northern Kenya. However, the implication is that, even in the face of some mitigation efforts, a lot of communities continue to live in insecure conditions.

The statement "Access to resources (including pastoralists) has improved" got slightly more mixed results, with 87 (33.7%) saying yes and 51 (19.8%) strongly agreeing, and 72 (27.9%) who were neutral. Still, 33 (12.8%) disagreed, and 15 (5.8%) strongly disagreed, with a mean of 3.49 (SD = 1.12). Responses indicate moderate optimism in accessing essential resources, possibly related to

government interventions in accessing water infrastructure and/or grazing corridors. Lesser significant neutral responses and more significant disagreement responses, however, indicate some degree of inequality in distribution and/or benefits across the regions. These observations are consistent with those made by Kariuki (2020), who found that though some interventions are effective at building resilience, some face implementation and governance obstacles. However, progress has been made, and many pastoralists are still facing challenges around access.

Sixty-three (24.4%) strongly agreed, and 60 (23.3%) agreed that the security of the community had improved in pastoralist areas. A large segment 90 (34.9%) remained neutral, while 39 (15.1%) disagreed and 6 (2.3%) strongly disagreed, producing a mean of 3.52 (SD = 1.09). The numbers indicate the lack of apprehension about any step taken in the direction of peace and community cohesion, possibly a result of better governance or peace-making efforts. But the high neutrality indicates some fragility or regional imbalance of stability. The trend is in line with the results of the Security Research and Information Center (2023), noting that certain regions can be victims of peacebuilding efforts, while others continue to be susceptible to conflict because of lingering grievances.

Sixty out of the 75 pastoralist communities (23.3%) agreed, and 60 (27.9%) strongly agreed that the security challenges are a key concern for pastoralists, with 72 (27.9%) feeling neutral. Another 42 (16.3%) disagreed, and 9 (3.5%) strongly disagreed, giving a mean of 3.52 (SD = 1.12). The findings confirm the persistent challenges of insecurity, despite the interventions in recovery efforts to date. Disputes over diminishing community resources can result in security issues. The perceptions concur with the results presented by Nyabuto (2016) that weak governance structures and environmental stress have historically led to insecurity in pastoralist areas. The data reveals

that some enhancements are possible, but there are basic security issues that continue to pose a challenge to daily life in Samburu.

On the issue of the additional security to enhance community safety, 78 (30.2%) and 63 (24.4%) respectively agreed and strongly agreed that this was the case. Meanwhile, 75 (29.1%) were neutral, and a minority of 30 (11.6%) disagreed, and 12 (4.7%) strongly disagreed, leading to a mean of 3.58 (SD = 1.12). As demonstrated here, security interventions like the use of police and/or disarmament, as well as the deployment of peacekeepers, are valued by many respondents. Some of these measures, however, may only be implemented in certain hotspots or might not always be effective due to a high level of neutrality. Results are consistent with the findings of SRIC (2023), which mentions the limited effectiveness of security operations due to their comparatively smaller scale and insufficient community participation. So, such actions to enhance safety can call for more comprehensive and ongoing efforts.

Finally, on attitude, “The level of the conflict in pastoralist communities has reduced”, 69 (26.7%) strongly agreed, 66 (25.6%) agreed. However, 78 (30.2%) remained neutral, while 39 (15.1%) disagreed and 6 (2.3%) strongly disagreed, yielding a mean of 3.59 (SD = 1.11). The relatively high consensus rates suggest that there is a sense of improved peace in the communities, possibly because of good conflict resolution approaches, better environmental conditions, or engagement of the community. Yet, neutrality indicates caution, perhaps due to the unevenness of peace or its lack of solid institutionalization. This nuanced finding aligns with Sabala (2013), who warned of the need for long-term governance and community-based peacebuilding structures for the underlying sustainable security of pastoralist regions. Finally, it is good to report that positive

changes are happening, but that's not the end of the process towards full peace and security in Samburu.

4.4 Inferential Analysis

4.4.1 Correlation between Loss of Vegetation Cover and Pastoralist Communities' Human Security in Samburu County

A Pearson correlation was performed, and the results are presented in Table 4.13 to establish the correlation between loss of vegetation cover and human security of pastoralist communities in Samburu County. The purpose was to determine if a significant association exists between environmental degradation (in this case, vegetation loss) and changes in community security. The findings substantiate the previous descriptive analyses and offer statistical evidence to quantify the strength of the connection between ecological and human security indicators.

Table 4. 13: Correlation Between Loss of Vegetation Cover and Pastoralist Communities' Human Security

		Loss of Vegetation Cover	Security of Pastoralist Communities
Loss of	Pearson Correlation	1	.813**
Vegetation Cover	Sig. (2-tailed)		.000
	N	258	258
Security of	Pearson Correlation	.813**	1
Pastoralist	Sig. (2-tailed)	.000	
Communities	N	258	258

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

There were very significant and positive correlation trends between loss of vegetation cover and security of the pastoralist community, with a Pearson's correlation coefficient (r) of 0.813 and a P-value of 0.000 at the 0.01 level of significance. Such factors, if indicative of a reduction in vegetation cover, can significantly increase insecurity amongst pastoralist communities. The correlation is strong, indicating that environmental conditions, particularly a reduction in green cover and biodiversity, have direct impacts on livelihood stability, stress for migration, and conflict potential. These findings corroborate Schilling and Werland (2023), who concluded that the loss of vegetation was one of the major factors contributing to insecurity in Northern Kenya. The message here is that reversing or mitigating vegetation loss would have a potentially important role to play in improving human security of pastoralist communities, by helping to make resources more secure and ease mindsets.

4.4.2 Correlation between Decline in Water Resources and Pastoralist Communities' Human Security

Table 4.14 gives Pearson correlation tests for assessing the correlation between pastoralists' perceived decline in water resources and pastoralists' human security in Samburu County. The analysis was used to test the hypothesis that access to water, one of the most vital resources in arid pastoral areas, can be shown to have an effect on community security and wellbeing. The results provide important information on the environmental conditions that contribute to both social and economic vulnerability among pastoralists.

Table 4. 14: Correlation between Decline in Water Resources and Pastoralist Communities' Human Security in Samburu County

		Decline In Water Resources	Security of Pastoralist Communities
Decline In Water Resources	Pearson Correlation	1	.825**
	Sig. (2-tailed)		.000
	N	258	258
Security Of Pastoralist Communities	Pearson Correlation	.825**	1
	Sig. (2-tailed)	.000	
	N	258	258

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

A very strong ($r=0.825$) and statistically significant (p value = .000) positive correlation at the 0.01 level is found between the drop of water resources and pastoralist communities' security. These findings suggest a direct reduction in pastoralist communities' security and stability when water resources become limited. Water scarcity fosters higher influx, conflicts over resources, and lower livestock production, further aggravating community stress and anxiety. The results give similar conclusions to Schilling et al (2020), who reported that in arid areas of Kenya, water insecurity has often been a source of conflict over access and undermined pastoralist systems' capacity to withstand shocks. The notion that access to water is a livelihood concern is one that is extended to claiming that access to water is not just the function of a policy or development imperative but a security condition that must be addressed.

Moreover, the high correlation is a confirmation that environmental degradation, especially the lack of water, is an important element to consider in pastoralist human security planning. Changes in water resources and traditional coping mechanisms like dwelling on it and sharing it among the community are becoming increasingly unrealistic and difficult to sustain, leading to competition and conflicts. Similarly, water scarcity in West Africa, reported in the study by Umutoni and Ayantunde (2018), aggravated conflicts between pastoralist communities as well as conflicts between pastoralists and farmers. The strong correlation found in this study in Samburu North indicates that sustainable water resource management and equitable distribution are critically important in order not to cause further destabilization. Supporting water security through sustainable infrastructure, participative governance, and resilient approaches can substantially increase security and people's capability for long-term resilience.

4.4.3 Correlation between Soil Erosion and Security of Pastoralist Communities

Table 4.15 shows the Pearson correlation results that were used to assess the relationship between pastoralist communities' human security and soil erosion in Samburu County. The purpose of this analysis was to check if the degradation of soil condition, including reduction in fertility, increased topsoil erosion, and diminished agricultural productivity, statistically affects, negatively, the social stability and security of the affected community. The findings provide empirical evidence linking ecological degradation to the health and resilience of pastoralist communities.

Table 4. 15: Correlation between Soil Erosion and Security of Pastoralist Communities

		Soil Erosion	Security Of Pastoralist Communities
Soil Erosion	Pearson Correlation	1	.821**
	Sig. (2-tailed)		.000
	N	258	258
Security Of Pastoralist Communities	Pearson Correlation	.821**	1
	Sig. (2-tailed)	.000	
	N	258	258

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

The results show that soil erosion is highly positively related to the security of pastoralist communities ($r = .821$) at a statistically significant level ($p\text{-value} < .000$, $S < 1\%$). An increase in insecurity in the pastoralist community is a result of an increase in soil erosion. Erosion undermines the productivity of land, decreases grazing land, can drive people out of their home region, further agitates inter-communal conflicts, and increases financial hardships, all of which may result in migration. The results found in this study corroborate the findings of Pozza and Field 2020, which illustrate the linkage between livelihood fragility and higher conflict in Arid regions that are at the same time experiencing land degradation. For a community such as the Samburu, this correlation is very strong and suggests a need for integrated land management policies, which should tackle environmental degradation and improve land security.

Furthermore, the correlation brings out the relationship between the environmental and social systems in pastoralist areas. Damage to soil resources damages not only agricultural output, but also the traditional sharing of soil resources, adding to precarious community relations. As noted by Rabinovich et al. (2019), soil erosion in drylands in East Africa comes with a cost of food

insecurity, population displacement, and conflicts over decreasing resources. The results from the study site in Samburu County show not only that there is a need to address soil erosion in the area it covers, but that conservation of the land as a habitat for restocking is a security strategy. A resilient pastoralist livelihood depends on healthy soil, and a lasting peace needs to be realized among pastoralist communities.

4.4.4 Correlation between Government Intervention Measures and Pastoralist Communities' Human Security in Samburu County

The correlation values for government intervention measures and pastoralist communities' human security in Samburu County are presented in Table 4.16. The purpose of this analysis was to identify the degree to which the government's efforts of afforestation, provisioning on water and land, conflict intervention, and the utilization of community-based security have affected the security outcomes of communities that have been greatly affected by environmental degradation. The outcomes give essential inputs on the effectiveness of state responses in supporting the promotion of peace, stability, and livelihood resilience.

Table 4. 16: Correlation between Government Intervention Measures and Pastoralist Communities' Human Security in Samburu County

		Government Intervention Measures	Security Of Pastoralist Communities
Government Intervention Measures	Pearson Correlation	1	.827**
	Sig. (2-tailed)		.000
	N	258	258
Security Of Pastoralist Communities	Pearson Correlation	.827**	1
	Sig. (2-tailed)	.000	
	N	258	258

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

The correlation coefficient (r) of government intervention measure and security of pastoralist community was .827 with the p -value being .000, which means that there is a statistically significant positive correlation at the 0.01 level. This means that the human security of pastoralist communities is, in turn, greatly improved as the government takes action or improves its action. Improved access to water, reforestation efforts, and community stabilization projects clearly contribute to a more secure environment and are effective government programs. The findings support those of Wamatu and Gichuki (2023), who emphasized the importance of co-designed environmental and governance approaches in mitigating conflict and building resilience in the arid areas in Kenya. Hence, from the achievement, it can be concluded that the proactive and continued efforts of the government are vital in reducing the risk factors that cause environmental stress in pastoralist areas.

Moreover, the key link highlights the importance of governance to environmental and social stability. Government intervention and good policy provisions are increasingly recognized as a means of ecological rehabilitation, and as key ways to increase security and mitigate vulnerability of marginalized communities. The Security Research and Information Center (2023) cited successful peacebuilding and environmental management in pastoralist regions as being hugely reliant on coordinated, inclusive, and well-resourced government interventions. The finding is significant in Samburu County as it emphasizes that governance strengthening and community-level interventions are critical pillars towards attaining long-term peace and development in the county. Hence, government intervention policy can serve as a cushioning mechanism to mitigate the impact of environmental shocks and provide for socio-economic security.

4.5 Regression Analysis Results

4.5.1 Model Summary

Table 4.17 shows the combined effect of the important environmental variables, namely, government intervention measures, soil erosion, loss of vegetation cover, and decrease of the water resources, on human security of pastoralists in Samburu County, using multiple regression analysis.

Table 4. 17: Model Summary

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate
1	.933 ^a	.870	.868	.32029

a. Predictors: (Constant), Government Intervention Measures, Soil Erosion, Loss of Vegetation Cover, Decline in Water Resources

The result of the model summary yielded a very high correlation coefficient ($R = .933$), pointing to a strong coefficient of determination ($R^2 = .870$), which means that 87.0% of the variance in the security of pastoralist communities can be explained by the four predictor variables. Finally, the adjusted R^2 of .868 indicates the strength of the model since it takes into account the number of predictors in it.

4.5.2 ANOVA Results

Table 4.18 presents the results of an ANOVA test to determine if the regression model used to explore implications of human security of pastoralist communities to land cover change is significant.

Table 4. 18: ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	<u>Regression</u>	173.357	<u>4</u>	43.339	<u>422.476</u>	.000 ^b

Residual	25.954	253	.103
Total	199.311	257	

a. Dependent Variable: Security of Pastoralist Communities
b. Predictors: (Constant), Government Intervention Measures, Soil Erosion, Loss of Vegetation Cover, Decline in Water Resources

The results of ANOVA also support the significance of the model, and an F value of 422.476 at $p = .000$ shows that the regression model is statistically significant. These findings suggest that indicators of environmental degradation and environmental intervention are important and dependable assessments of community security. The results uphold the conclusions put forward by Schilling and Werland (2023), who deemed environmental stressors as having a direct impact on pastoral populations, which influence their security and resilience in fragile environments when paired with responsive governance.

4.5.3 Regression Coefficients for Environmental Factors Predicting Security of Pastoralist Communities

The regression coefficients when environmental factors were determinants of pastoralist communities' security.

The regression model results for four independent variables: loss of vegetative cover, loss of water resources, soil erosion, and government interventions indicated consistent results across the four factors considered in the estimation of the contribution made by each of these variables to pastoralist communities' security in Samburu County (Table 4.18). A linear multiple regression model was tested for each variable to determine the predictive power and significance of the variables in explaining variations in community security. The human security status of pastoralist communities was the dependent variable. These findings suggest that all four predictors had statistically significant effects and thus had differing influences.

Table 4. 19: Regression Coefficients for Environmental Factors Predicting Security of Pastoralist Communities

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.102	.101		-1.010	.313
	Loss of Vegetation Cover	.334	.054	.352	6.142	.000
	Decline in Water Resources	.190	.057	.196	3.324	.001
	Soil Erosion	.109	.043	.117	2.534	.012
	Government Intervention Measures	.394	.038	.354	10.470	.000

a. Dependent Variable: Security of Pastoralist Communities

The regression results revealed that loss of vegetation cover was a highly significant factor that relates to pastoralist community security with a standardized beta coefficient of $\beta = 0.352$ ($p = .000$). The unstandardized coefficient ($B = 0.334$) suggests that if there is a one-unit rise in perceived vegetation loss, there is a corresponding 0.334-unit decrease in community security, everything else being equal. That means the vegetation cover is vital for pastoralism sustainability as it affects pastoral utilization of settlement and access to food and pasture. The ability of communities to sustain livestock and decrease migration pressures will diminish as vegetation declines. This study corroborates the findings of Schilling & Werland (2023), which showed that loss of vegetation is associated with an increase in environmental stressors and insecurity in the pastoralist areas of northern Kenya. So the conservation of vegetation would not only be an environmental affair, but also an important human security issue as well.

A significant but relatively weak effect on water resources, as shown by the model, is a standardized beta value of $\beta = 0.196$ and a p-value of 0.001, in relation to the decline of water resources. A one-unit drop in water scarcity is associated with a 0.190-unit drop in perceived community security, an unstandardized coefficient (B). While not so extreme as vegetation denudation, this is proof that water is an important factor for security in arid pastoral areas. Low water availability introduces a greater tension at the water points, impacts the regular movement of people, and increases the risk of conflict. The findings confirm the work of Umutoni and Ayantunde (2018) in West Africa, who noted that pastoralist communities grew more tense due to water shortages. Meeting the water needs of pastoralist communities in Samburu is therefore critical, and combating water scarcity through investments in infrastructure, water resources conservation, and equitable sharing systems is necessary to decrease vulnerability and maintain social cohesion.

Soil erosion was also statistically significant with the smallest effect size, a $\beta = 0.117$ ($p = 0.012$). A one-unit increase in the unstandardized coefficient of B is expected to lead to a 0.109-unit decrease in human security. The findings suggest that soil erosion happens in the context of insecurity, but may also have other indirect consequences – decreasing land productivity, worsening food insecurity over time. It also emphasizes that the effects of land degradation on resilience are most significant where there is suboptimal use of the land by livestock and humans, often in the poorest communities. Pozza and Field (2020) also determined that soil degradation undermines agricultural productivity and increases the motivation for migration and land conflicts. For this reason, even though the impact of soil erosion is not so great, the contribution of sustainable land use for environmental security in Samburu is very important.

Lastly, measures taken by the government were shown to most strongly affect the level of security in the community, as evidenced by a standardized beta of one ($\beta = 0.354$) and a p value of 0.000. Unstandardized statistics show that each additional unit in the effectiveness or amount of government interventions leads to an increase of 0.394 units in the perceived security of the area.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

Chapter Five gives a detailed summary and interpretation of the results of the research conducted under the report theme of Effects of Environmental degradation on security of pastoralist communities in Samburu County, Kenya. These cover a discussion of the results in the context of the study's aims and theory, including the production of key information on vegetation loss, water resources, soil erosion, and government intervention. A set of conclusions from the analysis, recommendations for policy and practice, and suggestions for future study are also included in the chapter. In doing so, Chapter Five brings together the empirical evidence presented in the preceding chapters and its implications for pastoralist governance, security, and sustainable development.

5.2 Discussion of the Study Findings

Shortage of resources such as water and pastures lead to competitions amongst pastoralist communities which results to conflicts. The research findings are discussed here under.

5.2.1 Loss of Vegetation Cover and Human Security

The study found that the majority of the respondents noticed that there was a significant loss of vegetation cover in Samburu County. All key indicators, namely plant density, green cover, vegetation layers, and biodiversity, were reported to have decreased over the years. For example, most respondents said "yes, plant densities have decreased" (32.6%) and "yes, very much" (20.9%). This also applied to the decline in green cover, erosion of vegetation layers, and the

decrease in plant diversity. The overall pattern indicates an extensive degradation of the environment, with potential impacts on the livelihoods of pastoral communities in the areas with high reliance on natural vegetation for grazing and ecological functions. Loss of vegetation cover and human security were highly correlated and significant ($r = .813$; $p < .001$), making it clear that loss of vegetation directly diminishes the livelihood stability and hammers the vulnerabilities of communities. The results from regression analysis revealed that loss of vegetation significantly explained insecurity with a standardized beta (β) value of .352 ($p < .001$) and an unstandardized coefficient B value of .334. This means that for every unit of perceived vegetation loss, there is an expected loss of one-third of a unit of security, and that vegetation is one of the primary drivers of human security.

5.2.2 Decline in Water Resources and Human Security

The descriptive results were not elaborated upon, but the inferential results played a crucial role. All but a handful of those who responded confirmed that water resources had substantially reduced in their areas. Results showed good consensus for statements that referred to the shrinkage of rivers, seasonal water points, and distance from water supplies. Water availability was cited by many participants as becoming more difficult, impacting human and livestock survival. The decrease in water availability represents the increased environmental burden in the region and is indicative of increased difficulty in providing for basic life needs, increasing socioeconomic stress for affected communities. The correlation between water resources decline and security was $r = .825$ ($p < .001$) and quite strong and positive. Water scarcity increases insecurity considerably, forcing livestock to migrate, fight over water points, and have limited productivity. Water resource decline was affected significantly, but moderately, in the regression model ($\beta = .196$, $p = .001$, B

= .190). Such values suggest water scarcity is not as detrimental to community security as is vegetation loss.

5.2.3 Soil Erosion and Human Security

Regarding soil erosion, descriptive statistics depicted a pervasive feeling of high concerns on the increased soil erosion in Samburu County. Indicators that soil fertility was waning, topsoil loss was becoming more common and productive land loss was resulting from too much erosion. The agreement was high on statements concerning decreased agricultural productivity and disturbed grazing behaviour. The results in this study indicate that soil degradation impairs farming and pastoralism, increases food insecurity and adds to the pressures that are driving pastoralist households to displacement. Erosion was correlated with community security at $r = .821$ ($p < .001$) meaning that as the erosion increased so did the community's insecurity. Using the regression analysis, a statistically significant but lesser effect was found ($\beta = .117$, $p = .012$, $B = .109$), indicating that over time, land loss, degradation of land productivity and land systems, are indirect factors that drive insecurity.

5.2.4 Government Intervention Measures and Human Security

The overall theme of government actions (reforestation, water infrastructure, peace building) on the security level was positive and came with a moderate degree of support from respondents, with descriptive statistics confirming this. The majority of participants accepted that there were government interventions to alleviate environmental problems and improve community security. These encompassed the afforestation programs, water infrastructure development, peace building, and support for sustainable livelihoods. For some participants, they were neither better nor worse; however, a significant percentage felt these interventions had made some positive changes, including reduced conflict and improved use of resources. The results indicate that while some

positive impact has been achieved, there is a need to upscale, sustain, and localize the actions and interventions of the government to scale the security and development needs of the community. The relationship of state-led measures with security was the highest amongst all variables ($r = .827$, $p < .001$), indicating a strong link between government action and security. The result was confirmed with regression analysis, where government intervention proved to be the most important predictor ($\beta = .354$, $p < .001$; $B = .394$). This signals the importance of concerted and sustained policy interventions to enhance pastoralist livelihoods and mitigate conflict.

5.3 Summary of the Findings

This result confirms the literature findings by Wamatu and Gichuki (2023) which showed there was a direct link of loss of vegetation to food systems, increasing pastoralists' vulnerability to food insecurity. The findings also resonate with the findings of Schilling and Werland (2023) which reported that reducing the availability of water fuels conflicts and is associated with gender inequities in the north of Kenya. The data therefore do support the fact that environmental water considerations are not only an environmental issue but also a major determinant of insecurity, inequity and livelihood disruption in Samburu. The results corroborate the results by González-Alonso and Kull (2022) who concluded that lower plant densities in pastoral areas lead to lower food provision for animals as well as increasing tensions regarding animal resources.

The result highlights the importance of governance to environmental stress management and stability. By taking proactive government action on afforestation, water development, or conflict resolution, pastoralist communities can be better protected against external shocks and stressors. This result was corroborated by Wamatu and Gichuki (2023), who found that through an inclusive, consistent, and community-based approach, government-led initiatives can be effective in

environmental peace and development. In Samburu County, government action is a driver of environmental degradation as well as a determinant of community security.

5.4 Conclusions

The study findings indicate that the continuous diminishing of the vegetation cover has greatly affected pastoralists' security in Samburu County. However, responses were uniform across all the areas, with the respondents consistently citing a decrease in both the number of plants and green cover, as well as washed away layers of vegetation—a factor that directly affects livestock availability for pasture. This degradation has compromised pastoral livelihoods, reduced the mobility of the herds, and increased competition by other communities and residents of the affected area for the available resources. Therefore, the depletion of vegetation is not only a problem of the environment but an actual threat to the economic and potential area of conflict as well.

It is also confirmed that the reduction of water resources is one of the most important factors that reduces human security in pastoralist communities. The respondents indicated that water points, rivers, and boreholes were drying out, and the distance to water points was extended. This has increased the time constraint, particularly for women and children, and decreased the resilience of people and livestock. Likewise, this shortage of water has become an issue of conflict between communities, highlighting the need to work on water resources management in arid and semi-arid dependencies such as the Samburu region.

The conclusions support the data that soil erosion is a common problem that is causing loss in land productivity and food security for households. Pastoralists realize that valuable topsoil is being wasted at a very rapid pace, compromising rangelands and farmland. Limited fertility in soils not only affects grazing but also crop production and reduces the ability to be self-sufficient within

affected communities. The authors conclude that soil erosion without control increases vulnerability and can bring about forced migration and land related conflict if prevented by adopting sustainable land management practices.

Finally, the effects of the various measures of government intervention and their significance have been recorded and appreciated but are not significant enough or sufficiently scalable. Some relief has come through afforestation, water infrastructure and conflict resolution programmes, but they are not widely implemented and are not very participative, resulting in less impact in the longer term. It underscores the importance of strengthening more comprehensive and community-based approaches that are sensitive to pastoralist's way of life and environmental challenges. These interventions will need to be better sustained and impactful by strengthening institutional components and improving the engagement of citizens.

This study is a unique methodological and empirical contribution because simultaneous use of grassroots participatory mapping with inferential statistics in Samburu County, whereas others conducted only one, quantitative measures derived from top-down approaches or using the aggregate data from the whole of the region. Interestingly, the regression analysis showed that environmental stressors (vegetation loss, water decline, soil erosion) are significant predictors of insecurity, while government measures for improving security ($\beta = 0.354$, $p < 0.001$) are the strongest predictor of improved security, a counterintuitive but important result. This signifies that proactively, inclusively governing is not a reactive measure to defy environmental degradation but rather a very crucial factor that contributes to pastoralist resiliency. The discovery redirects the academic debate on pastoralists from a climate band of victims to an explicit acceptance of the critical role of local governance in the reduction of conflict caused by resource issues in the community.

5.5 Recommendations

Based on the findings, it is recommended that the Ministry of Environment and Forestry initiate strong actions on afforestation and reforestation programmes in Samburu County, as vegetation cover in general has considerably decreased through reduced vegetation layers and plant density. The programs should provide community-managed grazing reserves, as well as reseedling of indigenous grass species. These will assist in rehabilitating degraded rangelands and mitigate the use of pastures for competing with pastoralists, which will improve the security of pastoralists and the ecosystem.

Lack of water and very long distances to fetch water points due to the dried-up boreholes is evidence of the acute water shortage, and therefore, emphasis is placed on the need to build and rehabilitate water infrastructure, including solar-powered boreholes, rainwater harvesting, and sand dams is recommended in the water resources policy at both central and county levels. They need to be evenly spread around grazing routes to facilitate access and minimise potential conflicts over water.

The study revealed that soil erosion is causing soil resources to become degraded for plant production and loss of productivity of flora and animal resources. In turn, the National Land Commission should encourage sustainable use of land by preparing training programmes in the use of contour farming, rotational grazing, and soil bund constructions with County agricultural officers. If these techniques are incorporated into the practices of the pastoralists, through training and incentives, soil deterioration and erosion can be considerably mitigated, thus increasing household food security and ability to deal with adverse climatic changes and shocks.

The fact that governments' interventions are accepted, yet not broadly reachable or community-engaged, indicates that there is a need for greater inclusiveness. Policymakers and Development Partners should jointly design environmental programs with local communities, in keeping with both indigenous knowledge and scientific methods, in a participative process. Operating community environmental committees will enhance their ownership, sustainability, and enable them to operate to address their own needs in Samburu.

5.6 Suggestions for Further Studies

- i. The study of the extent to which vegetation cover has been reduced to cause competition for grazing lands has shown that a follow-up study is needed to assess the longer-term social and political implications of the loss of vegetation cover on the frequency and nature of resource-based conflicts. This would enable researchers to determine whether loss of vegetation is followed by chronic insecurity or adaptation by the communities. The dynamics over time can be important to sustainable land management and peacebuilding strategies for pastoralist areas.
- ii. Study showed that water scarcity today is further compelling members of the community to walk longer stretch to fetch water, thereby burdening the households. In-depth research on the implications this has on the welfare of women and children (who are frequently responsible for water collection) would be helpful. Looking at gender and water can help inform the development of interventions that help promote vulnerability reduction and equity in resource-constrained environments.
- iii. Soil erosion was determined to have lowered the fertility of the land and affected pastoral productivity, so more detailed studies of soil erosion and its effects on household income, food security, and migration are needed. This research finding can help to calculate the cost of degradation to land use and provide climate evidence to support land conservation in development plans. This would also enable the policy makers to gain insight into the climate change-poverty nexus in situations of livelihoods' destabilisation in dryland communities.

- iv. The study revealed that although there were examples of the government intervening, there was low awareness and reach of such interventions. It will be worth investigating in future research the efficacy of decentralized and community-led environmental efforts vs. bottom-up governmental environmental programs in furthering human security. This would help in understanding which models work the best, and have cultural resonance, in pastoralist settings, and provide a blueprint for the expansion of those which are working well to other locations of similar pastoralist character.

REFERENCES

- Ahmad, S., & Afzal, M. (2022). Environmental degradation and resource management in pastoral communities: Implications for livelihoods and security. *International Journal of Environmental Science and Conservation*, 9(1), 1-12.
- Ahlborn, G., Von Wehrden, H., Lang, C., Römermann, C., Oyunbileg, M., Oyuntsetseg, D., & Wesche, K. (2020). Effects of land use and climate change on pastoral systems in Mongolia. *Global Change Biology*, 26(5), 3013-3027.
- Alemayehu, M., & Oda, D. (2022). Land degradation and its implications on pastoralist communities in Somalia. *African Journal of Environmental Science and Technology*, 16(9), 273-282.
- Asokan, S. M., Kweyu, R. M., Kalibbala, M. M., & Obando, J. A. (2025). Prolonged drought and governance challenges in Turkana County, Kenya: Access to water and livelihood changes. *Environmental Development*, 55, 101193.
- Bencherif, Y., Dain, A., & Ramires, R. (2021). Changes in vegetation cover and its impacts on pastoralist livelihoods: A case study in Samburu County, Kenya. *Sustainable Development*, 29(4), 751-761.
- Bethancourt, H. J., Swanson, Z. S., Nzunza, R., Young, S. L., Lomeiku, L., Douglass, M. J., Braun, D. R., Ndiema, E. K., Pontzer, H., & Rosinger, A. Y. (2023). The co-occurrence of water insecurity and food insecurity among Daasanach pastoralists in northern Kenya. *Public Health Nutrition*, 26(3). <https://doi.org/10.1017/S1368980022001689>
- Blake, H., Roberts, M., & Naughton, C. (2018). Interactions between soil management practices and pastoral resilience in northern Tanzania. *Environmental Science & Policy*, 82, 93-104.
- Boon, P., & Meyer, J. (2019). The ecological impacts of vegetation loss on livestock: Evidence from Texas. *Journal of Ecology and Environmental Science*, 4(3), 265-275.
- Borrelli, P., Paudel, N. S., & Morari, F. (2017). Soil erosion in Sub-Saharan Africa: A global assessment of land-use changes and their impact. *Earth-Science Reviews*, 174, 581-596.
- Boureima, M. (2021). The role of soil degradation in food security in Burkina Faso: Implications for pastoral communities. *Sustainability*, 13(24), 14047. <https://doi.org/10.3390/su132414047>
- Conflict Trends. (2023). The dynamics of resource conflicts among pastoralist communities in Kenya. *Conflict Trends*, 1(1), 45-50.
- Cooper, D. R., & Schindler, P. S. (2014). *Business research methods* (12th ed.). McGraw-Hill/Irwin.

- County Government of Samburu. (2023). *Samburu County Integrated Development Plan 2023-2027*. Retrieved from <https://repository.kippra.or.ke/handle/123456789/45>
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications.
- González-Alonso, A., & Kull, C. A. (2022). Pastoralist security and biodiversity: Evidence from Spain. *Global Ecology and Conservation*, 31, e01887. <https://doi.org/10.1016/j.gecco.2021.e01887>
- Haggerty, J. H., & Trent, M. (2020). Habitat degradation and their impacts on ranching communities in the U.S.: An ecological perspective. *Environmental Management*, 65(1), 101-114.
- Homer-Dixon, T. (1994). *Environmental scarcities and violent conflict: Evidence from cases*. *International Security*, 19(1), 5-40.
- Ide, S., Haines, A., & Hess, J. (2014). Climate change and health in East Africa. *Environmental Research Letters*, 9(7), 074012.
- Kariuki, R. (2020). *Counter Measures Used by Pastoralists in Arid Areas on Environmental Hazards: A Critical Literature Review*. Kenyatta University.
- Kenya National Bureau of Statistics (KNBS). (2020). 2019 Kenya Population and Housing Census: Volume I Population by County and Sub County. Nairobi: Kenya National Bureau of Statistics.
- Kuznetsov, A., Galkina, N., & Rybakov, V. (2017). Climate change and the sustainability of pastoralism in Central Asia: Factors and adaptive strategies. *Rural Studies*, 55, 27-37.
- Lanyasunya, A. R., Mutisya, M., & Wairiuko, J. W. (2025). Examination of Livelihoods Vulnerability among the Samburu Nomadic Pastoralist Community in Samburu County, Kenya. *Editon Consortium Journal of Economics and Development Studies*, 7(1), 1-7. <https://doi.org/10.51317/ecjeds.v7i1.604>.
- Lengurnet, J., & Nalugala, I. (2022). Drought dynamics and food security in Samburu County: Implications for pastoralist communities. *Kenyan Journal of Geography and Environmental Resource Management*, 12(1), 1-16.

- Leal Filho, W., et al. (2020). Pastoralism under threat: Climate change and social security in sub-Saharan Africa. *Rural Sociology*, 85(4), 743-762.
- Mburu, J., & Wangui, E. (2022). Resource-based conflicts among pastoralists in Kenya: An analysis of social and environmental challenges. *African Journal of Conflict Resolution*, 22(4), 51-74.
- Mugenda, O. M. & Mugenda, A. G. (2003). Research methods: Quantitative and qualitative approaches. ACT Press, Nairobi.
- Muriithi, J. & Wambua, G. (2021). Environmental degradation and its effects on food security in Ethiopia. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, 122(2), 125-133.
- Næss, L. (2013). Climate change adaptation and resource conflict in Africa: Implications for health. *Environmental Research Letters*, 8(4), 041001.
- Nyabuto, B. K. (2016). *Conflict and Environmental Security Among the Pastoral Communities in Northern Kenya: The Case Study of Turkana*. United States International University-Africa.
- Opiyo, F., Wasonga, O. V., Nyangito, M. M., Schilling, J., & Munang, R. (2015). Drought adaptation and coping strategies among the Turkana pastoralists of northern Kenya. *International Journal of Disaster Risk Science*, 6(3), 295–309. <https://doi.org/10.1007/s13753-015-0063-4>
- Quinton, J. N., & Fiener, P. (2024). Soil erosion and food security challenges for pastoralist communities. *Global Environmental Change*, 77, 102500.
- Rabinovich, A., Schaeffer, F., & Cormier, M. (2019). Erosion and social structures: How soil degradation affects Maasai land use and resilience in Tanzania. *Journal of Environmental Sociology*, 15(3), 165-183.
- Risvoll, C., Vadla, H., & Dhanjal, P. (2022). Changing land use and its impact on pastoralism in Sub-Saharan Africa. *Pastoralism*, 12(1), 18.
- Sabala, K. M. S. (2013). *Conflict, Environmental Security, and Governance Among Pastoralists in Kenya*. University of Nairobi.
- Schilling, J., & Werland, E. (2023). Emerging risks for pastoralist communities in Northern Kenya: Water scarcity and conflict. *Climate Change and Sustainability*, 24(3), 354-372.
- Security Research and Information Center (SRIC). (2023). *Assessment of Peace and Conflict Dynamics in Pastoralist Regions of Kenya*.

- Stavi, I., Roque de Pinho, J., Paschalidou, A. K., Adamo, S. B., Galvin, K., de Sherbinin, A., ... & van der Geest, K. (2022). Food security among dryland pastoralists and agropastoralists: The climate, land-use change, and population dynamics nexus. *The Anthropocene Review*, 9(3), 299-323.
- Sylvestre, P., Ayantunde, A., & Umutoni, C. (2020). *Water resource challenges in transhumant communities in Southern Mali*. *International Journal of Arid Regions*, 19(4), 87-102.
- Tschakert, P., et al. (2021). Linking land use change, health, and security: A case study in Scotland. *Building Resilience in Rural Communities*, 1(1), 1-17.
- UN. (2018). UN Secretary-General calls climate change a “direct existential threat”. *United Nations Press Release*.
- van Baalen, J., & Mobjörk, M. (2018). Bridging the gap: Climate change, pastoral livelihoods and resource conflicts. *Global Environmental Politics*, 18(4), 1-28.
- Vundi, W., & Koome, K. (2023). Environmental challenges in Samburu County: Implications for pastoralist security. *International Journal of Environmental Studies*, 80(1), 51-68.
- Wamatu, B. K., & Gichuki, H. (2023). The impact of vegetation loss on pastoralists: A case study of southern Kenya. *African Journal of Environmental Science*, 17(1), 31-45.
- World Bank. (2014). *Climate Change and Non-Timber Forest Products in East Africa: Climate change impacts on pastoralism*. Washington, DC: World Bank.
- Wynants, M., et al. (2019). Historical governance policies and their role in soil erosion in East Africa: Implications for pastoralists. *Land Use Policy*, 86, 290-298.
- Xu, J., et al. (2019). Climate change and the future of pastoralisms in Sub-Saharan Africa: An assessment of impacts and adaptive strategies. *Agriculture & Food Security*, 8(1), 1-14.

APPENDICES

Appendix I: Research Questionnaire

Section A: Demographic Section

1. What is your gender?
Male [] Female []
2. What is your age group?
Under 20 years []
20-29 years []
30-39 years []
40-49 years []
50-59 years []
60 years and above []
3. What is your role or affiliation?
Community Member []
Local Leader []
Government Representative []
NGO Representative []
4. What is your highest level of education?
No formal education []
Primary education []
Secondary education []
Certificate/Diploma []
Bachelor's degree []
Master's degree []
Doctorate/PhD []
5. How long have you been in your current role or position?
Less than 1 year []
1-3 years []
4-6 years []
7-10 years []
More than 10 years []
7. What is your primary area of focus or work?
Environmental conservation []
Community development []
Policy making []

Education []

Health []

Other (please specify): _____

This demographic section will help categorize responses based on the role, age, education, gender, experience, and regional focus of the respondents, providing a comprehensive understanding of the sample's background.

Section B: Loss of Vegetation Cover

1. How much do you agree with each of the following claims Loss of Vegetation Cover? Make use of the scale below: (2) = Disagree, (2) = Neutral, (3) = Agree, (4) = Agree, and (1) = Strongly Disagree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Plant density in the area has decreased over time.					
2. Green cover in the region has significantly reduced.					
3. The layer of vegetation in the area has been eroded.					
4. There is less plant diversity compared to previous years.					
5. The area now has fewer trees and shrubs than before.					
6. Vegetation loss has impacted local biodiversity negatively.					

Section C: Decline in Water Resources

2. To what extent do you concur with the following assertions regarding the depletion of water resources? Use the following scale: (3) = Agree, (4) = Agree, (2) = Disagree, (1) = Strongly Disagree, and (2) = Neutral

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Water availability in the area has decreased.					
2. The reserves of water in local sources are lower.					

3. Groundwater levels have dropped significantly.					
4. There is less water in rivers and streams compared to before.					
5. The local water table has shown a noticeable decline.					
6. Water scarcity has become a pressing issue in the area.					

Section D: Soil Erosion

2. How much do you agree with each of the following claims about soil erosion? Make use of the scale below: (2) = Disagree, (2) = Neutral, (3) = Agree, (4) = Agree, and (1) = Strongly Disagree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Land degradation has increased in the area.					
2. Soil fertility has declined over time.					
3. There has been significant loss of topsoil.					
4. Erosion has caused noticeable changes in land productivity.					
5. Soil erosion is affecting agricultural output negatively.					
6. The area has seen an increase in soil erosion events.					

Section E: Government Intervention Measures

3. How much do you agree with each of the following claims on government intervention measures on influence of environmental degradation on Security of Pastoralist Communities? Make use of the scale below: (2) = Disagree, (2) = Neutral, (3) = Agree, (4) = Agree, and (1) = Strongly Disagree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Government have conducted afforestation and reforestation.					

2. Government has enhanced water resource access for pastoralist communities.					
3. Government intervention has enhanced Community stability in pastoralist regions.					
4. Governance is major issue for pastoralist communities.					
5. Community based intervention strategies are given chance.					
6. County and national government presence is not felt by the pastoralist communities.					

Section F: Security of Pastoralist Communities

4. How much do you agree with each of the following claims Security of Pastoralist Communities? Make use of the scale below: (2) = Disagree, (2) = Neutral, (3) = Agree, (4) = Agree, and (1) = Strongly Disagree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Conflict incidence has increased in pastoralist communities.					
2. Resource access for pastoralist communities has improved.					
3. Community stability has enhanced in pastoralist regions.					
4. Security concerns are a major issue for pastoralist communities.					
5. The presence of security measures has strengthened community safety.					
6. The level of conflict in pastoralist communities has diminished.					

Appendix II: Template for Analysis – Observation /Mapping

STUDY TITLE: Environmental Degradation and its Influence on Security of Pastoralist Communities in Samburu County, Kenya

Mapping issues	Detailed information
<i>Natural resources</i>	
Water resources	
Soil cover changes	
Pasture/Rangelands	
Forests/ vegetation cover	
Hilltops	
Wetland	
Others (specify)	
Infrastructure	
Roads/bridges	
Settlements	
Livestock markets	
Stock feed sources	
Others (specify)	
Social services	
Health	
Security Agencies	
Church	
Local administration	
Traditional authorities	
Extension offices	
Government/NGO/CBO offices	
Others (specify)	
Environmental resource use system	
Croplands and use of crop residues	
Communal rangelands	
Grazing reserves	
Water use	
Agro forestry practices	
Brick making	
Charcoal burning	
Quarrying	
Sand harvesting	

Appendix III: Key Informant Interview Guide: Exploring Environmental Degradation and Human Security in Samburu County

The questions below focus on key areas such as vegetation cover loss, water resource decline, soil erosion, and the role of government interventions. Your responses will contribute valuable knowledge to inform policies and interventions aimed at improving environmental sustainability and community security. Please respond to each question based on your knowledge, experience, and observations within the community or region you serve. There are no right or wrong answers—your honest and detailed insights are most valuable for this study.

Section A: Influence of Vegetation Cover Loss on Human Security

Indicators: Decreased plant density, reduced green cover, eroded vegetation layer

1. From your experience, how has the density and availability of pasture vegetation changed in your area over the past 20 years?
2. What observable effects has reduced green cover had on community livelihoods and livestock movement?
3. In what ways has the erosion of vegetation layers contributed to resource conflicts or tensions within or between communities?

Section B: Impact of Decline in Water Resources on Human Security

Indicators: Reduced water availability, diminished water reserves, lowered groundwater levels

4. How has the availability and accessibility of water sources (such as rivers, boreholes, and wells) changed over the past decade?
5. What are the main consequences of reduced water reserves on household and livestock survival in the community?
6. Can you describe any community-level challenges or conflicts that have emerged due to the depletion of groundwater sources?

Section C: Effects of Soil Erosion on Human Security

Indicators: Increased land degradation, reduced soil fertility, eroded topsoil loss

7. What signs of soil erosion and land degradation have you observed in your area, and how have they affected land use?
8. How has the loss of soil fertility impacted food production or grazing land availability in your community?
9. In your opinion, what role does topsoil loss play in contributing to economic stress or migration among pastoralist families?

Section D: Role of Government Intervention Measures on Human Security

Indicators: Afforestation/reforestation programs, water resource management, community-based conservation initiatives

10. What government or NGO-led afforestation and reforestation efforts have been implemented locally, and how effective have they been?
11. How would you assess the effectiveness of water management programs (e.g., borehole drilling, dam construction) in addressing water scarcity?
12. Are there any community-based conservation initiatives in your area? If so, how have they influenced environmental sustainability and community cooperation?

Thank you for participating in the study

Appendix IV: Focused Group Discussion Guide

STUDY TITLE: Environmental degradation and its influence on security of pastoralist communities in Samburu County, Kenya

FGD No:		Name of Facilitator:	
Name of the County:		Sub county:	
Ward:		Village:	
No of Males:		No of Female:	
Other information:			

1. What Environmental degradation (vegetation cover, soil cover change, soil erosion, decline of water sources) have you observed in this county in the following periods 2005, 2015, 2025? How have you responded to these changes?

Men	
Women	
General	

2. What vegetation cover changes (forest land, closed shrub-land, open shrub-land, crop land, wetland, water body, built up areas and bare-land) have you observed in this county in the following periods 2005,2015,2025? How have you responded to these changes?

Men	
Women	
General	

3. What changes in (water quality, water availability) have you observed in this county in the following periods 2005,2015,2025? How have you responded to these changes?

Men	
Women	
General	

4. What changes in soil cover changes have you observed in this county in the following periods 2005,2015,2025? How have you responded to these changes?

Men	
Women	

General	
---------	--

5. What are the causes for changes listed in (1,2,3 and 4 above)?

Men	
Women	
General	

7. What did the governments and non-governmental organizations do to help you adjust to the listed changes above in the following periods 2005,2015,2025?

Men	
Women	
General	

8. What governance structures (policies, plans, law and regulations) existed in the following timelines to address above changes 2005,2015,2025?

Men	
Women	
General	

9. Does environmental resources management structures contribute to security of pastoralists in this county?

Men	
Women	
General	

10. What are the drivers for environmental degradation in Samburu Are they the same drivers for insecurity among the pastoralist communities?

Men	
Women	
General	

11. How are you involved in the mitigation of insecurity of pastoralist in this county?

Men	
-----	--

Women	
General	

12. What environmental knowledge and resources do you possess that complement the efforts of other actors in environmental resources management in Samburu County?

Men	
Women	
General	

13. Do you and local political leadership support other actors' programmes in pasture/rangeland management in Samburu?

Men	
Women	
General	

14. Which departments or agency has been created that coordinates and enhances environmental resources management and pastoralist security activities in Samburu County?

Men	
Women	
General	

16. Are there conflicts in the environmental resources management systems in Samburu County that may hinder pastoralist security goals? What are the causes of conflicts among actors and what mechanisms have been put in place to address such conflicts?

Men	
Women	
General	

18. Describe the working relationship between this community with the following institutions: ***NEMA, WRA, WRUA, National government departments, Environmental departments, Faith Based organizations, CBOs, NGOs.***

Men	
Women	
General	

19. Are there any gaps you observed that was left by changes from national to National-County governance system in environmental degradation and pastoralist security? Give examples

Men	
Women	
General	

20. Do you have by-laws and plans that contribute to environmental activities in Samburu County? Give examples.

Men	
Women	
General	

21. Are these by-laws and plans consistent with the grassroots, vegetation cover changes, national and international laws and plans? Give examples.

Men	
Women	
General	

22. How has the current environmental resources management structures impacted on pastoralist security in Samburu County? i.e. availability of pastures, access to water, pastoralist conflict incidences and pastoralist stability.

Men	
Women	
General	

23. What are the environmental degradation challenges in Samburu County?

Men	
Women	
General	

24. What are the pastoralist security challenges in Samburu County?

Men	
Women	

General	
---------	--

25. Are you satisfied with environmental resources management and pastoralist security governance process in this county? What changes do you propose that will enhance environmental resources management for pastoralist security in Samburu County?

Men	
Women	
General	

Thank you for participating in the study

Appendix V: University Letter of Introduction



AFRICA NAZARENE
UNIVERSITY

P.O.Box: 53067 – 00200
Nairobi, Kenya.
Tel: 020 252 7170/1 – 5
Email: vc@anu.ac.ke
www.anu.ac.ke

15th April 2025

TO WHOM IT MAY CONCERN

RE: RESEARCH PERMIT: PHILIP LTAPARWA GALWERSI

Philip Ltaparwa Galwersi Reg. No. (110062348) is a Bonafide postgraduate student at Africa Nazarene University, pursuing a master's degree in governance, Peace and Security Studies. This program entails Coursework and Thesis. He has successfully completed coursework and defended his thesis proposal entitled:

"Effects of Environmental Degradation on Pastoralist Communities' Security in Samburu County, Kenya".

Any assistance accorded to him to facilitate data collection and complete his thesis will be highly appreciated.

Sincerely,

Prof. Orpha K. Ongiti
Dean, Postgraduate Studies & Director, Institute of Research

Appendix VI: NACOSTI Research License

 REPUBLIC OF KENYA National Commission for Science, Technology and Innovation	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 746603	Date of Issue: 10/May/2025
RESEARCH LICENSE	
	
This is to Certify that Mr.. Philip Ltaparwa Galwersi of Africa Nazarene University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Samburu on the topic: ENVIRONMENTAL DEGRADATION AND ITS INFLUENCE ON THE SECURITY OF PASTORALIST COMMUNITIES IN SAMBURU COUNTY, KENYA for the period ending : 10/May/2026.	
License No: NACOSTI/P/25/4173108	
Applicant Identification Number 746603	<i>Galwersi</i>
	Deputy Director
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION	
	Verification QR Code
	
NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.	
See overleaf for conditions	

Appendix VII: Map of the Study Area

