EFFECTS OF CLIMATE CHANGE ON HOUSEHOLD LIVELIHOODS IN RONGAI SUB-COUNTY, NAKURU COUNTY

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DECLARATION

I confirm that this project is originally my work and has not been presented for a degree at any other institution.

Signature…….. ……..Date ……

Otochi Tom Nyangau

ODLBDS/23/00308/1/21

This work has been presented for inspection with my consent as University Supervisor.

Signature…… ……..Date ……

Laura Nyaloti

The Management University of Africa

DEDICATION

I devote the project to the family for their support.

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Firstly, I express my sincere gratitude to Almighty God for granting me good health and provision in all aspects of my life. I also extend my appreciation to my supervisor, Madam Laura Nyalot, for her unwavering support, valuable feedback, and guidance throughout the development of this project. My thanks also go to the Management University of Africa for giving me the opportunity to pursue my studies. Finally, I am deeply thankful to my family for their continuous support throughout my journey.

ABSTRACT

The researcher aimed to explore the influence of change in climate on sustainable livelihoods among households in the Rongai Sub-county. Specifically, the study sought to examine the consequence of changing seasons and rainfall patterns, food insecurity, water scarcity, and infectious disease patterns on sustainable livelihoods among households in Rongai Sub-county. The study was based on entitlement theory and resilience theory. It adopted a descriptive survey research design and targeted 52,248 households in the Rongai Sub-county. Fisher's formula was used to obtain the sample size of 96 respondents. Stratified random sampling was employed to select respondents, where each of the five wards in Rongai Sub-county represented a stratum. A questionnaire was used to collect data, and the instrument was piloted in Njoro Sub-county. Data were entered and analysed using SPSS version 25 statistical software. The analysis utilized descriptive statistics in the form of frequencies and percentages. The extracted data were quantitative and presented in tables for ease of interpretation. The answers directed that a substantial majority of respondents have observed changes in seasons and rainfall patterns in Rongai Sub-County. The findings reveal that water scarcity is a pressing concern for households in Rongai Sub-County, with a significant most reporting it as a problem. The study in Rongai Sub-County found that 78.3% of respondents recognized changes in seasons and rainfall patterns, significantly impacting livelihoods and revealing a strong positive correlation ($r = 0.751$; $p < 0.05$) between these changes and sustainable livelihoods.The findings in revealed that 66.3% of households experience food insecurity, significantly impacting livelihoods, with a significant positive correlation ($r = 0.672$; $p < 0.05$) between food insecurity and sustainable livelihoods. The findings also indicated that 72.3% of households face significant water scarcity challenges, adversely affecting livelihoods, health, and agricultural productivity, with a strong positive significant correlation ($r = 0.672$; $p < 0.05$) between water scarcity and sustainable livelihoods.Finally The findings in Rongai Sub-County reveal that 67% of households have observed significant changes in infectious disease patterns, which negatively impact livelihoods and productivity, with a positive correlation ($r = 0.604$; $p < 0.05$) between infectious disease patterns and sustainable livelihoods.The study concluded that changing seasons and rainfall patterns, food insecurity, water scarcity and infectious disease patterns had an effect on sustainable livelihoods among households .The study recommended that to address the impacts of changing seasons on sustainable livelihoods in Nakuru County, it is crucial for local governments and policymakers to implement adaptive strategies that enhance community resilience.

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ACRONYMS AND ABBREVIATIONS

CLIMADE:	Climate Amplified Diseases and Epidemics
FAO:	Food and Agriculture Organization
IPCC:	Intergovernmental Panel on Climate Change
KNBS :	Kenya National Bureau of Statistics
MCAP:	University of Minnesota Climate Adaptation Partnership
NGOs:	Non-Governmental Organizations
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment Programme

OPERATIONAL DEFINITION OF TERMS

Changing seasons: Imply shifts in the traditional timing and characteristics of these periods, causing them to become less predictable and more erratic in Rongai Subcounty.

Climate Change: Refers to long-term alterations in weather patterns, temperatures, and other climatic factors primarily caused by human activities such as the burning of fossil fuels, deforestation, and industrial processes

Food insecurity: Is the condition in which individuals or households in the Rongai Sub-county do not have reliable access to a sufficient quantity of affordable, nutritious food.

Infectious disease patterns: Refers to the occurrence, distribution, and trends of infectious diseases within a particular population over a specific period in the Rongai Sub-county.

Rainfall patterns: Refer to the distribution, frequency, and intensity of precipitation over a particular region and period. These patterns include aspects such as the onset and duration of the rainy season in the Rongai Subcounty

Sustainable Livelihood: Denotes to the ability of households or individuals to maintain and improve their standard of living over the long term without compromising the ability of future generations to meet their needs

Water scarcity: Refers to the lack of sufficient available water resources to meet the demands of water usage within a Rongai Subcounty

CHAPTER ONE
INTRODUCTION

1.0 Introduction

This section provides an overview of the study, including the background, the problem statement, objectives, and questions in research. It also highlights the rationale for conducting the research. Additionally, the scope of the study outlines the specific areas covered by the research, allowing for more logical conclusions and providing clear, comprehensive answers.

1.1 Background

Changes of climate affects numerous features of human life, including agriculture, water resources, health, and socio-economic well-being. In numerous regions, households rely significantly on natural resources for their livelihoods, which makes them highly susceptible to the negative impacts of climate change (FAO, 2019). The connection between climate change and household livelihoods is intricate and multidimensional. According to IPCC (2021), shifts in temperature and rainfall patterns have a direct impact on agricultural output, resulting in lower crop yields and decreased livestock production. Additionally, risky weather proceedings like floods, droughts, and tempests can harm structure, destroy crops, and disrupt livelihoods, particularly in vulnerable communities. Moreover, shifts in ecosystems and biodiversity can impact natural resource-dependent livelihoods such as fishing, forestry, and tourism, further exacerbating the socio-economic challenges faced by households (Thus, climate change poses significant risks to the resilience, well-being, and sustainability of household livelihoods worldwide (UNDP, 2019).

The global view of climate change's impact on livelihoods among households reveals common challenges and disparities across different regions and countries. In the United Kingdom, for example, studies have documented the effects of climate change on agriculture, food security, and rural livelihoods, highlighting the need for adaptive strategies and policy interventions (Sutherland et al., 2021). Similarly, in Brazil, climate change impacts have been observed in the Amazon rainforest, affecting indigenous communities' livelihoods and cultural heritage (Araújo et al., 2020). In India and China, rapid urbanization and industrialization exacerbate climate change vulnerabilities, particularly among marginalized communities reliant on natural

resources for their livelihoods (Liu et al., 2020). Despite these global challenges, there are also opportunities for innovation, collaboration, and resilience-building to mitigate the impacts of climate change on household livelihoods and promote sustainable development (UNEP, 2021).

In Africa, the inspiration of climatic changes on livelihoods among households varies across different countries and regions, reflecting the continent's diverse socio-economic, geographic, and environmental contexts. In Nigeria, alteration in climate positions relevant issues to agricultural productivity, food security, and rural livelihoods, particularly in the northern regions where farming is a primary source of income (Ogundari, 2020). Erratic rainfall patterns, prolonged droughts, and desertification threaten crop yields and livestock survival, exacerbating poverty and food insecurity among vulnerable communities (Adesina & De Groote, 2019).

Similarly, in Ghana, climate change impacts are felt acutely in rural areas where agriculture is the backbone of the economy (Asante et al., 2021). Shifts in rainfall patterns and rising temperatures disrupt traditional farming practices, leading to decreased crop yields, land degradation, and loss of livelihoods (Agyei-Mensah & Maya, 2018). Coastal communities also face risks from sea-level upsurge, erosion, and saltwater imposition, affecting fisheries and coastal livelihoods (Quartey et al., 2020).

In Algeria, changes of climate impacts are evident in the form of water scarcity, desertification, and harsh weather actions like heat waves and flashy floods. These challenges affect agricultural production, water resources, and pastoral livelihoods, particularly in arid and semi-arid regions. Rural communities are increasingly vulnerable to climate-related hazards, with limited adaptive capacity and access to resources (Houssou et al., 2021).

Ethiopia experiences a wide range of climate-related challenges, including droughts, floods, and land degradation, which affect agricultural output and food safety. Smallholder agriculturalists in rural parts are particularly vulnerable, facing crop failures, livestock losses, and reduced access to water and grazing land. Climate variability exacerbates existing socio-economic inequalities and undermines efforts to achieve sustainable development goals (Beyene et al., 2020).

In Namibia, climate change impacts are evident in the form of changing rainfall patterns, water scarcity, and desertification, affecting agriculture, livestock farming, and rural livelihoods. Smallholder farmers and pastoralists face challenges in adapting to climate variability, with limited access to resources, technology, and support services. Climate change exacerbates existing socio-economic discrepancies and poses dangers of food safety and livelihood sustainability (Hausiku & Ortmann, 2019).

South Africa is also experiencing the effects of change of climate, with droughts, wildfires, and dangerous weather actions, which affect agriculture, water resources, and rural livelihoods (Blaauw et al., 2021). Smallholder farmers, subsistence fishers, and pastoralists in rural areas are particularly vulnerable, facing challenges in adapting to climate variability and accessing support services. Climate change exacerbates socio-economic inequalities and threatens the sustainability of livelihoods in vulnerable communities (Cawood et al., 2020).

In Tanzania, climate change impacts are evident in the form of changing rainfall patterns, land degradation, and loss of biodiversity, affecting agriculture, water resources, and rural livelihoods. Smallholder farmers and pastoralists face challenges in adapting to climate variability, with limited access to resources, technology, and market opportunities. Climate change exacerbates food insecurity, poverty, and socio-economic vulnerabilities in rural areas (Mrema et al., 2021).

In Uganda, climate change impacts are evident in the form of changing rainfall patterns, land degradation, and loss of biodiversity, affecting agriculture, water resources, and rural livelihoods. Smallholder farmers, fisherfolk, and pastoralists face challenges in adapting to climate variability, with limited access to resources, technology, and support services. Climate change exacerbates food insecurity, poverty, and socio-economic vulnerabilities in rural areas (Nkonya et al., 2020).

1.1.1 Changing seasons and rainfall patterns

Changes in rainfall patterns" mean that some areas are witnessing droughts and fires while others are reeling under floods. Change in rainfall patterns doesn't only mean an increase or decrease in rainfall as a whole. It means some areas are receiving more rain compared to the complete dry season in some. With the endlessly increasing temperature drifts, climate change is leading to significant variations in rain forms.

1.1.2 Food insecurity

Climate change amplifies existing threats to food safety by cumulatively the frequency and intensity of natural disasters, making land and water more scarce and harder to access, and making it more challenging to achieve productivity gains. The consequences for persons who are poor, now food uncertain, or undernourished are significant. Climate change impacts convenience, approachability, constancy, and consumption. It diminishes food obtainability by harmfully affecting the key components of food manufacture like biodiversity, water, and soil. Rural societies are at greater risk, facing repeated crop failures, livestock losses, and decreased access to fisheries and forest resources (WFP, FAO, IFRC and OXFAM,2019).

1.1.3 Water scarcity

stated by the IPCC (2021), water scarcity refers to the physical or economic shortage of water resources needed to meet the demands of a particular population. Physical water scarcity arises when natural water resources are excessively exploited, while economic water scarcity occurs due to inadequate investment in and maintenance of water distribution infrastructure. Climate change contributes to water scarcity through rising temperatures, prolonged droughts, decreased rainfall, and an surge in occurrence and strength of floods, all of which impact both physical and economic scarcity of water (IPCC, 2021). Timboe and Canut(2019)observed that the global climate crisis is deeply connected to water issues. Climate change is increasing fluctuations in the water cycle, resulting in more extreme weather patterns, making water availability less consistent, deteriorating water quality, and threatening sustainable development, biodiversity, and the global human right to safe drinking water and sanitation.

1.1.4 Infectious disease patterns

According to Xiaoxu, et al.(2020), Alterations to the environment and climate have the potential to influence infectious illnesses by influencing the environments in which pathogens, vectors, hosts, and their life circumstances are found. The transmission of infectious diseases relies on three main factors: the agent, the host,

and the transmission environment. Vectors or intermediate hosts are necessary for the lifecycle of several diseases. For disease pathogens, vectors, and hosts to survive, reproduce, disperse, and transmit, the weather and climate must be just right. More than that, new pests and illnesses might emerge as a result of shifting weather patterns and temperatures, which can harm crops, plants, and animals. The supply and cost of food, feed, and fibre are all directly impacted by this, as are the yields' quality and quantity. A lot of the most common infectious diseases, especially the ones spread by insects, are quite vulnerable to changes in the weather. Dengue fever, malaria, hantavirus, and cholera are among the newly-discovered or re-emerging vector-borne infectious diseases. Infectious diseases like cholera, giardiasis, salmonellosis, and others may experience an uptick in cases as a result of flooding and warmer weather (Parkinson and Butler,2021).

1.1.5 Sustainable livelihood among households

To be sustainable, a means of subsistence must be able to withstand and even thrive in the face of adversity, while also preserving or improving upon its present and future capacities and assets without compromising the integrity of the natural resource foundation. Affordability of rural livelihoods in developing nations has been severely impacted by climate change. Because of their reliance on agriculture, cattle, forests, and other climate-related resources, rural households are less likely to diversify their income streams, making them even more susceptible to the effects of climate change (Javeed,2023).

1.2 Statement of the Problem

The livelihoods of households in the Rongai Sub-county are intricately linked to their ability to access and utilize resources sustainably to afford their elementary needs and improve their well-being (Adams, 2020). Sustainable livelihoods encompass a range of activities such as agriculture, livestock rearing, fishing, and small-scale businesses, which contribute to income generation, food safety, and resilience to tremors and stresses (Wilson & Johnson, 2022). Sustainable livelihood strategies are essential for enhancing household livelihoods and reducing vulnerability to external threats, including environmental changes and economic uncertainties (Roberts, 2021). Climate change poses a significant threat to the sustainable livelihoods of households in Rongai Sub-county, exacerbating existing vulnerabilities and disrupting traditional

livelihood practices (Adams & Smith, 2021). The existing state of changes in climate in the region is characterized by rising temperatures, unpredictable rain forms, lengthy droughts, and amplified occurrence and strength of harsh weather actions like overflows and hurricanes (Roberts et al., 2019).These climate-linked variations have deep consequences for farming, water obtainability, natural resource management, and overall ecosystem health, affecting the livelihoods of rural households dependent on these resources (Jones & Johnson, 2021).

Statistics from recent assessments highlight the alarming impression of climate changes on livings in the Rongai Sub-county. For instance, a survey conducted in 2020 revealed that over 70% of households reported a decline in agricultural productivity due to erratic weather patterns and prolonged droughts (Adams, 2020). Additionally, data from the National Meteorological Department showed a 30% increase in the occurrence of harsh weather proceedings in the part over the previous decade, further exacerbating the vulnerability of local communities (National Meteorological Department, 2021). Despite efforts to discourse the trials posed by weather alteration, there left a significant research gap in considerate the exact impacts on sustainable livelihoods among households in the Rongai Sub-county. Past studies have predominantly focused on broader climate change trends and adaptation approaches at the regional or national level, overlooking the localized effects on household livelihoods and the effectiveness of community-based adaptation measures (Brown & Wilson, 2020). Furthermore, existing research has often lacked comprehensive data and analysis, leading to limited insights into the specific needs and vulnerabilities of rural households in the study area (Johnson et al., 2020). This study aimed to fill this breach by leading a comprehensive evaluation of the influence of climate changes on sustainable livings among households in the Rongai Sub-county.

1.3 Objectives

1.3.1 General Objective

The key objective of the research was to explore the impact of climate change on Sustainable livelihoods among households in the Rongai Sub- County.

1.3.2 Specific Objectives

i). To identify the effect of changing seasons and rainfall patterns on Sustainable livelihood among households in the Rongai Sub- County.

ii). To assess the effect of food insecurity on sustainable livelihood among households in the Rongai Sub- County.

iii)To identify the effect of water scarcity on sustainable livelihood among households in the Rongai Sub-county

iv). To examine the effect of infectious disease patterns on sustainable livelihood among households in the Rongai Subcounty

1.4 Research Questions

i). What is the effect of changing seasons and rainfall patterns on Sustainable livelihood among households in the Rongai Sub-county?

ii). How does food insecurity affect sustainable livelihood among households in the Rongai Sub-county?

iii). Does water scarcity affect sustainable livelihood among households in the Rongai Sub-county?

iv). What is the effect of infectious disease patterns on sustainable livelihood among households in the Rongai Sub-county?

1.5 Significance of Study

The implication of studying the impression of changes of climate on sustainable livelihoods among households in the Rongai Sub-county is profound and carries implications for various stakeholders:

1.5.1 Local Communities

Understanding how climate change affects livelihoods is crucial for local communities in Rongai Sub-county. It helps them adapt to changing conditions, identify vulnerable groups, and develop resilience strategies to safeguard their livelihoods.

1.5.2 Government and Policy Makers

For government authorities and policymakers, this study provides essential insights into the challenges faced by communities due to climate change.

1.5.3 Non-Governmental Organizations (NGOs) and Development Agencies

NGOs and development agencies play a vital role in supporting communities in adapting to climate change. This study can help them tailor their interventions to address specific needs and vulnerabilities.

1.5.4 Academic and Research Institutions

Researchers and academic institutions can use the findings of this reserch to deepen their empathetic of the complex interactions between climate changes and livelihoods.

1.5.5.Businesses and Private Sector

The private sector, including businesses involved in agriculture, tourism, and other sectors, also has a stake in considering the impact of climate change on local livelihoods.

1.5.6. International Community

Given the global nature of climate change, the answers could have suggestions beyond the Rongai Sub-county, resonating with international efforts to address changes of climate and maintainable growth.

1.6 Scope

The study explored the influence of climate changes on sustainable livelihoods among households in the Rongai Sub- County. The study's independent variables were changing seasons and rainfall patterns, food insecurity, water scarcity, and infectious disease patterns, while the dependent variable was sustainable livelihoods among households in Rongai Sub- County. The researcher conducted it in Rongai Sub-County, Nakuru County. The target group of the study consisted of households residing within the Rongai Sub- County. Research was done from May 2024 to September 2024.

1.7 Chapter Summary

This section gave an outline of the investigation’s context, identified the problem and associated gaps, outlined the study's objectives and purpose, and highlighted its significance for various stakeholders. Additionally, it included definitions of key terms utilized throughout the research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This part includes a studies review for the study, presenting both theoretical and empirical insights, including the conceptual framework..

2.1 Theoretical Framework

According to Sreekumar (2023), a theoretical framework is a set of suppositions theories, concepts, and ideas that help scholars understand a certain subject or event. It aids in the design and execution of research, as well as in the analysis and interpretation of results. This framework clarifies the connections between variables, highlights knowledge gaps, and leads the preparation of study questions, hypotheses, and methods to fill those gaps.

2.1.1 Entitlement Theory

Entitlement theory, articulated by Amartya Sen(1981) suggests that starvation and food uncertainty are not only the consequence of food scarcities but primarily because of failures in persons' entitlements to accessing food. Food security hinges on people's ability to obtain food through various means such as purchasing power, food distribution, and social entitlements (Sen, 1981). When climate change disrupts food systems through reduced agricultural productivity, altered weather patterns, or supply chain disruptions it impacts the ability of individuals to access food, thereby undermining their entitlements (FAO, 2018). This perspective moves the emphasis from simple food obtainability to the wider socio-economic devices that regulate food access, emphasizing how climate-induced impacts on food systems can exacerbate food insecurity and influence overall livelihoods (Patterson et al., 2018).

2.2 2 Resilience Theory

This theory was prominently established by psychologist and researcher Emmy Werner in her 1982 study. The theory posits that resilience is the ability of individuals or systems to withstand, adapt to, and recover from adverse conditions or stressors. Werner's work particularly focused on how children and families navigate and overcome challenges, emphasizing that despite experiencing significant risk factors or hardships, many individuals can thrive and develop positively. Resilience theory

highlights the role of internal strengths, such as personal coping skills and social support systems, in helping individuals maintain stability and growth in the face of adversity(Werner, 1982).

According to Mastrorillo, McNamara and Kosec (2019) resilience theory can be related to climate changes by examining how individuals, communities, and ecosystems adapt to and recover from climate-related stresses, such as harsh weather proceedings, sea-level increase, and other ecological changes. In the context of climate change, resilience focuses on the volume to anticipate, formulate for, and respond to climate impacts in a way that minimizes damage and facilitates recovery. This involves strengthening adaptive capacity, utilizing resources effectively, and building robust support networks to cope with the uncertainties and challenges posed by a changing climate.

2.2 Empirical Literature Review

2.2.1Effect of changing seasons and rainfall patterns on Sustainable livelihood among households

Climate change leads to rising air and sea temperatures, changed rainfall designs, more recurrent and strong harsh weather measures, and intensifying sea heights. Seasonal timing is also projected to shift, with shorter, warmer, and wetter winters. Future springs are anticipated to bring increased rainfall and more intense precipitation, while summers are expected to be warmer, extended, and starting sooner in the year (MCAP,2023).

Smith, Johnson, and Miller (2021) explored seasonal variability and its impact on livelihoods in rural Brazil through a cross-sectional study. Employing stratified random sampling, they gathered data from 900 households using structured interviews. The analysis involved multivariate techniques, and the results indicated that seasonal changes led to fluctuations in farming production and domestic revenue. Their findings indicate that seasonal changes cause fluctuations in farming productivity and domestic salary. Climate change compounds these effects by making weather patterns more erratic, necessitating income diversification to build resilience against such variability.

Patel, Sharma, and Kumar (2020) investigated the effects of monsoon variability on livelihoods in India through a case study design. They used cluster sampling to select 800 households and collected data via surveys, which were then analysed thematically. The study found that irregular monsoon patterns afftcaused crop failures and increased poverty levels among households. The researchers concluded that improved water management systems are necessary to combat the adverse effects of monsoon variability.

Ahmed, Ali, and Khan (2020) examined the impact of seasonal changes on fishing communities in Nigeria using a descriptive study design. They randomly sampled 500 households and collected data through interviews, which were examined by descriptive statistics. The answers revealed that seasonal changes affected fish populations, reducing catches and incomes for fishing communities. The study concluded that adaptive fishing practices and the promotion of alternative livelihoods are needed to sustain the livelihoods of these communities.

Jones, Brown, and Williams (2018) led a comparative education on the outcomes of changing rainfall patterns on sustainable livelihoods in South Africa. Using stratified sampling, they selected 1,000 households and gathered data through household surveys and focus groups. The analysis involved regression models, and the results showed that unpredictable rainfall patterns negatively impacted agricultural productivity and household food security. The researchers concluded that implementing efficient water management practices and climate-smart agriculture is essential to enhance the resilience of households to changing rainfall patterns.

Mugambi, Njoroge, and Kariuki (2021) studied the impression of changing seasons and rainfall patterns on sustainable livelihoods in Tharaka Nithi County, Kenya. Data was collected through household surveys and analysed using logistic regression. The findings indicated that changes in rainfall patterns significantly affected soil causing reduced crop yields, which negatively affected household income and food security. The study concluded that adopting climate-resilient farming activities and improving water administration schemes are critical for sustaining livelihoods in the aspect of altering climatic circumstances.

Wangari, Kamau, and Njoroge (2020) did a longitudinal study on the impact of changing seasons on agricultural productivity in Nyeri County, Kenya. Using

purposive sampling, they selected 1,200 households to participate in the study. Information was collected through surveys and focus group discussions and analysed using regression analysis. The findings revealed that changing seasons significantly reduced crop yields, leading to decreased household income and food security. The researcher also instituted that food uncertainty, driven by reduced household income and poor health outcomes, is worsened by climate change. Unpredictable weather decorations and an surge in harsh weather occations disrupt agricultural production, thereby affecting food availability.

2.2.2 Effects of Food Insecurity and Sustainable Livelihood among Households

According to WFP, FAO, IFRC and OXFAM(2021)climate change directly threatens food security and nutrition by disrupting food production through altered weather patterns, extreme events, and environmental disruptions. Rising global temperatures and increased droughts decrease soil fertility and crop yields, while floods and storms cause significant crop destruction. These challenges jeopardize global food supplies, undermining efforts to protect lives and livelihoods. Climate change amplified existing threats to food safety by cumulative the frequency and intensity of natural disasters, making land and water scarcer and reducing efficiency. This severe implications for impoverished and already food-insecure populations.

Martinez, Silva, and Gomez (2020) explored the relationship between food insecurity and sustainable livelihoods in rural Brazil. Using a longitudinal study design, they selected 800 households through random sampling and collected data via household surveys. The findings indicated that food insecurity led to increased poverty and vulnerability among households. The study conclude that crop yields and the frequency of catastrophic weather conditions are both worsened by global warming, further threatening food security and livelihoods.

Saha, Roy, and Das (2019) examined the impact of food insecurity on sustainable livelihoods in India through a case study design. They used purposive sampling to select 600 households and gathered data through focus group discussions and surveys. The analysis, involving thematic analysis, showed that food insecurity was linked to reduced household resilience and increased reliance on external aid. The study concluded that enhancing local food production and supporting smallholder farmers are key to improving food security and sustainable livelihoods. Climate change

intensifies these challenges by altering growing seasons and increasing the prevalence of pests and diseases, thereby reducing agricultural productivity.

Abdullahi, Yusuf, and Ibrahim (2020) investigated food insecurity and its effects on sustainable livelihoods in Nigeria using a descriptive study design. The study was grounded in the Sustainable Livelihoods Framework, which emphasizes the importance of access to assets, capabilities, and activities for achieving sustainable livelihoods. Additionally, the Climate Change Vulnerability Theory was used to highlight the increased susceptibility of vulnerable populations to adverse climate impacts. They randomly sampled 700 households and collected data through structured interviews, which were examined by expressive statistics. The answers indicated that food insecurity negatively impacted household income and health. Climate change exacerbates food insecurity by causing droughts, floods, and other dangerous weather actions that disturb food manufacture and supply chains.

Chen, Lee, and Park (2018) led a research on the impression of food insecurity on sustainable livelihoods in rural China. Using a cross-sectional design, they selected 900 households through stratified random sampling and collected data via household surveys. The analysis, using logistic regression, revealed that food insecurity significantly reduced household income and health outcomes. The researchers concluded that implementing policies to support agricultural productivity and improving social safety nets are essential for enhancing food security and sustainable livelihoods. Climate change compounds these impacts by causing unpredictable weather patterns and reducing water availability, further hindering agricultural productivity.

Kamau, Wanjiku, and Mutua (2020) did an investigation on food insecurity and its impact on sustainable livelihoods in Machakos County, Kenya. Using a cross-sectional research design, they employed stratified random sampling to select 1,000 households. Data was collected through household surveys and analysed using regression analysis. The findings revealed that food insecurity significantly reduced household income and health outcomes, exacerbating poverty levels. The study concluded that indorsing sustainable agricultural applies and refining accessing of food markets are essential for enhancing food security and sustainable livelihoods.

Climate change exacerbates these issues by increasing the frequency of droughts and floods, which directly affect food production and access.

Mwangi, Otieno, and Wanjiru (2019) conducted a study on food insecurity and sustainable livelihoods in Nakuru County, Kenya, executing a cross-sectional investigation design. They used stratified random sampling to select 1,000 households and collected data through structured interviews. The analysis, using logistic regression, revealed that food insecurity was significantly associated with reduced household income and poor health outcomes. The study concluded that improving agricultural productivity and diversifying income sources are crucial for enhancing food security and sustainable livelihoods. Climate change compounds these challenges by causing unpredictable weather patterns and cumulative the incidence of harsh weather proceedings, which interrupt agricultural making and food availability.

2.2.3 Water Scarcity and Sustainable Livelihood Among Households

Santos, Almeida, and Rodrigues (2020) explored the impact of water scarcity on sustainable livelihoods in rural Brazil. Using a longitudinal study design, they selected 900 households through random sampling and collected data via household surveys. The findings, analysed using mixed-methods approaches, indicated that water scarcity led to reduced agricultural output and increased household vulnerability. The researchers concluded that implementing community-based water management programs and improving access to water-saving technologies are critical strategies to address water scarcity.

Li, Zhang, and Wang (2018) led an examination on the effects of water scarcity on sustainable livelihoods in rural China. Using a cross-sectional design, they selected 900 households through stratified random sampling and collected data via household surveys. The analysis, using logistic regression, revealed that water scarcity significantly reduced agricultural productivity and household income. The researchers concluded that implementing policies to support efficient water use and improving access to irrigation technologies are essential for sustaining livelihoods in water-scarce regions.

Chakraborty, Gupta, and Singh (2019) examined the effects of water scarcity on sustainable livelihoods in India through a situation study. They used purposive selection to select 800 households and gathered data through focus group discussions and surveys. The analysis, involving thematic analysis, showed that water scarcity negatively impacted household income and food security. The study concluded that enhancing irrigation infrastructure and promoting water-efficient agricultural practices are key to sustaining livelihoods in water-scarce areas.

Abubakar, Mohammed, and Suleiman (2020) investigated the impact of water scarcity on sustainable livelihoods in Nigeria using a descriptive study design. They randomly sampled 700 households and collected data through structured interviews, which were examined by expressive statistics. The answers indicated that water scarcity reduced agricultural productivity and household income, exacerbating food insecurity. The study concluded that promoting water conservation techniques and improving access to water resources are essential for addressing water scarcity.

Kamau, Njoroge, and Mwangi (2019) conducted a study on water scarcity and sustainable livelihoods in Narok County, Kenya. Data was collected through surveys and analysed using regression analysis. The findings revealed that water scarcity significantly reduced agricultural productivity and household income, exacerbating poverty levels. The study concluded that investing in efficient water management systems and promoting rainwater harvesting is essential for sustaining livelihoods in water-scarce regions.

Mungai, Karanja, and Njuguna (2021) conducted a study on water scarcity and its impact on sustainable livelihoods in Kajiado County, Kenya. Data was collected through household surveys and analysed using regression analysis. The findings revealed that water scarcity significantly reduced agricultural productivity and household income, leading to increased poverty levels. The study concluded that promoting water-efficient agricultural practices and improving access to water resources are crucial for sustaining livelihoods in water-scarce regions.

2.3.4 Infectious Disease Patterns and Sustainable Livelihood Among Households

Climate change is our planet's most immediate existential threat, with strong evidence linking it to infectious disease outbreaks among numerous other adverse effects on human health. Infectious diseases caused by pathogens thrive under specific climatic

conditions, and climate change, by altering weather patterns and increasing extreme events, enhances the survival and spread of these diseases. Favourable conditions for vectors like mosquitoes further aid in transmission, while extreme weather displaces people, disrupting healthcare and increasing disease risk. However, some diseases may decline as areas become too hot or dry for vectors to survive(National Academies of Sciences, Engineering, and Medicine,2023).

According to a CLIMADE (2024) report, there are three primary ways that climate change may make infectious diseases worse: more frequent extreme weather events like floods that contaminate drinking water, changes in precipitation patterns and temperature increases that allow disease vectors like mosquitoes to flourish, and climate-driven migration of people and livestock that causes outbreaks. Miguel, Feliz, et al. (2024) used a multidisciplinary strategy that integrated epidemiology and genetics to unveil the designs of dengue disease spread in the Dominican Republic in recent years. The findings point to a hitherto unidentified north-south transmission channel in the nation, where several viral lineages co-circulate. A long-term trend toward a higher theoretical potential for dengue transmission as a result of rising temperatures was found in the historical climatic data.

Silva, Costa, and Souza (2020) explored the relationship between infectious disease patterns and sustainable livelihoods in rural Brazil. Using a longitudinal study design, they selected 800 households through random sampling and collected data via household surveys. The findings, analysed using mixed-methods approaches, indicated that infectious disease outbreaks led to reduced household income and increased healthcare expenses. The researchers concluded that improving healthcare infrastructure and enhancing disease surveillance systems are critical strategies to address the impact of infectious diseases on livelihoods. The study highlights how climate change exacerbates these issues by creating conditions conducive to the spread of infectious diseases, thereby further threatening livelihoods.

Singh, Sharma, and Patel (2019) examined the effects of infectious disease patterns on sustainable livelihoods in India using case assessment. They used purposive sampling to select 700 households and gathered data through focus group discussions and surveys. The analysis, involving thematic analysis, showed that infectious disease outbreaks negatively impacted household income and food security. The study

concluded that enhancing public health infrastructure and promoting disease prevention measures are key to sustaining livelihoods in the face of infectious diseases. Climate changes intensifies these challenges by altering ecosystems and weather patterns, increasing the frequency and severity of infectious disease outbreaks.

Ahmed, Mohammed, and Yusuf (2020) investigated the impact of infectious disease patterns on sustainable livelihoods in Nigeria using a descriptive study design. They randomly sampled 600 households and collected data through structured interviews, which were analysed using descriptive statistics. The findings indicated that infectious disease outbreaks increased healthcare costs and reduced household income, exacerbating poverty levels. The study concluded that promoting disease prevention programs and improving access to healthcare services are essential for addressing the impact of infectious diseases on livelihoods. Climate change exacerbates poverty and health vulnerabilities by increasing the incidence and spread of infectious diseases.

Lee, Kim, and Park (2018) led a research on the inspiration of infectious disease patterns on sustainable livelihoods in rural South Korea. Using a cross-sectional design, they selected 700 households through stratified random sampling and collected data via household surveys. The analysis, using logistic regression, revealed that infectious disease outbreaks significantly reduced household income and increased healthcare expenses. The researchers concluded that implementing policies to support public health infrastructure and enhancing disease surveillance systems are essential for sustaining livelihoods in the face of infectious diseases. Climate change further strains these systems by increasing the prevalence and transmission of infectious diseases.

Njenga, Mutua, and Mbugua (2019) led an education on the impact of infectious disease patterns on sustainable livelihoods in Kenya. Data was collected through surveys and analysed using regression analysis. The findings revealed that infectious disease outbreaks significantly reduced household income and increased healthcare costs, undermining livelihoods. The study concluded that strengthening healthcare systems and promoting disease prevention programs are essential for sustaining livelihoods. Climate change compounds these impacts by fostering conditions that

facilitate the spread of infectious diseases, thereby posing additional threats to livelihoods.

2.3.5 Sustainable Livelihood Among Households

Gomez, Silva, and Rodriguez (2020) explored sustainable livelihoods among households in rural Brazil. Using a longitudinal study design, they selected 900 households through random sampling and collected data via household surveys. The findings, analysed using mixed-methods approaches, indicated that access to schooling and health care amenities significantly improved household sustainability. The researchers concluded that implementing policies to improve access to education and healthcare is critical for enhancing sustainable livelihoods.

Sharma, Singh, and Patel (2019) examined sustainable livelihoods among households in India through a case study design. They used purposive sampling to choose 800 households and gathered data through focus group discussions and surveys. The analysis, involving thematic analysis, showed that community-based resource management and access to microfinance significantly enhanced household resilience. The study concluded that supporting community-based initiatives and improving access to financial services are key to sustaining livelihoods.

Abdullahi, Yusuf, and Mohammed (2020) investigated sustainable livelihoods among households in Nigeria using a descriptive study design. They randomly sampled 700 households and collected data through structured interviews, which were examined by expressive statistics. The discoveries indicated that access to markets and improved infrastructure significantly enhanced household sustainability. The study concluded that promoting market access and improving infrastructure are essential for sustaining livelihoods.

Chen, Lee, and Park (2018) conducted a study on sustainable livelihoods among households in rural China. Using a cross-sectional design, they selected 900 households through stratified random sampling and collected data via household surveys. The analysis, using logistic regression, revealed that access to education and healthcare services significantly enhanced household sustainability. The researchers concluded that implementing policies to improve admission to schooling and health care is vital for enhancing sustainable livelihoods.

Mwangi, Njoroge, and Wanjiru (2021) conducted a study on sustainable livelihoods among households in Nakuru County, Kenya. Data was collected through household surveys and analysed using regression analysis. The findings revealed that diversified income sources and improved agricultural practices significantly enhanced household resilience and sustainability. The study concluded that promoting income diversification and sustainable agricultural practices are essential for sustaining livelihoods.

Kariuki, Wambui, and Mutua (2021) conducted a study on sustainable livelihoods among households in Kirinyaga County, Kenya. Data was collected through surveys and analysed using regression analysis. The findings revealed that diversified income sources and improved agricultural practices significantly enhanced household resilience and sustainability. The study concluded that promoting income diversification and sustainable agricultural practices are essential for sustaining livelihoods.

2.3 Summary and Research Gaps

This empirical review revealed studies that discovered the impact of changes in climate on Sustainable livelihoods among households across various levels. Internationally, the works provided insights into global trends and practices. Regionally, studies focused on the impacts within specific regions. Locally, the research delves into the impact of climate change within localized contexts. Table 1 summarizes these findings and highlight the research gaps that have been identified through this comprehensive review.

Table 1:Summary of Research Gaps

Author	Year	Area of Study	Methodology	Findings	Knowledge Gap	Focus on the current study

Author	Year	Area of Study	Methodology	Findings	Knowledge Gap	Focus on the current study
Patel, Sharma & Kumar	2021	Effects of monsoon variability on livelihoods in India	They used cluster sampling to select 800 households and collected data through surveys, which was then analysed thematically.	- The study found that irregular monsoon patterns caused crop failures and increased poverty levels among households.	The study explored on how Moson rain patterns variability affected livelihood in India and did not show how other impacts of climate change like water scarcity, food insecurity and infectious disease affected livelihood.	The current study explored the impact of climate change on Sustainable livelihoods among households in Rongai Subcounty
Martinez, Silva, and Gomez	2020	Food insecurity and sustainable livelihoods in rural Brazil	The study used a longitudinal study design, and selected 800 households through	The findings indicated that food insecurity led to increased poverty and vulnerability among households	This study was done in Brazil while the current study was done in Kenya.	The current study explored the impact of climate change on Sustainable livelihoods

Author	Year	Area of Study	Methodology	Findings	Knowledge Gap	Focus on the current study
			random sampling and collected data using household surveys.			among households in Rongai Subcounty.
Ahmed, Ali, and Khan	2020	Malaria screening and healthcare quality in Nigeria.	-The study used a descriptive study design. They randomly sampled 500 households and collected data through interviews	The results revealed that seasonal changes affected fish populations, reducing catches and incomes for fishing communities	The education sampling size was 500 while the current study had a sample size of 96 respondents.	The present study explored the impression of environment changes on Sustainable livelihoods among families in Rongai Subcounty.

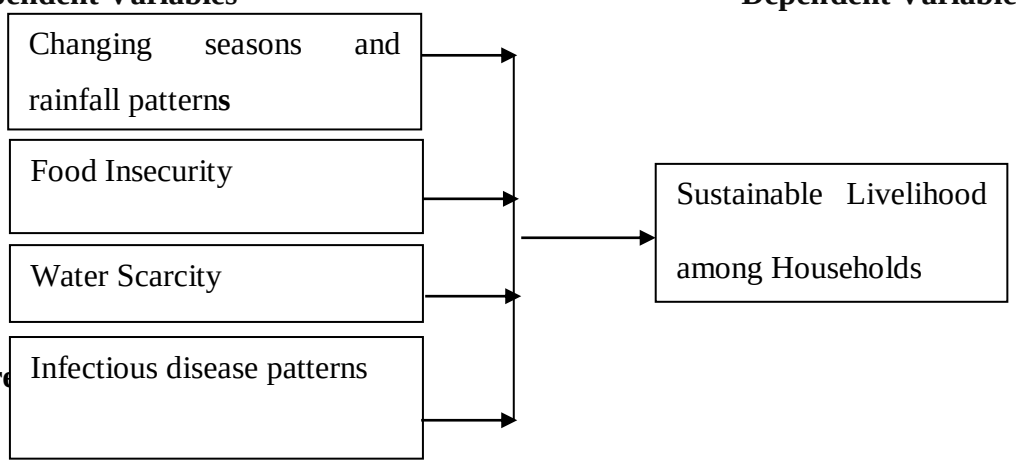
Author	Year	Area of Study	Methodology	Findings	Knowledge Gap	Focus on the current study
Abdullahi, Yusuf, and Ibrahim	2020	food insecurity and its effects on sustainable livelihoods in Nigeria	Descriptive study design was applied	The findings indicated that food insecurity negatively impacted household income and health.	The study was grounded in the sustainable livelihoods framework and climate change vulnerability theory. The current study was based on entitlement theory and resilience theory.	The current study explored the impact of climate change on Sustainable livelihoods among households in Rongai Subcounty
Kamau., Njoroge, G., & Mwangi, W.	2019	Water scarcity and sustainable livelihoods in Narok County, Kenya	The study adopted a cross-sectional research design, they employed stratified random sampling to select 1,000 households. Data was	The findings revealed that food insecurity significantly reduced household income and health outcomes, exacerbating poverty levels.	The study was done in Narok County while the current study will be done in Nakuru County.	The current study explored the impact of climate change on Sustainable livelihoods among households in the Rongai Sub-county.

Author	Year	Area of Study	Methodology	Findings	Knowledge Gap	Focus on the current study
			collected through household surveys and analysed using regression analysis			

The empirical studies reviewed revealed that there existed gaps in methods, population, context and geography. Most of the studies were done in other countries and Counties. Therefore none was done in Rongai Subcounty. The majority of the researchers focused on other variables apart from the ones that the study dwelt on. Other studies used different research designs. Therefore, this study to fill these gaps by discovering the impact of climate change on Sustainable livelihoods among households in the Rongai Subcounty

2.4 Conceptual Framework

In investigation, a conceptual structure is a graphic description that helps in demonstrating the anticipated cause-and-effect relationship. Another name for it is a research model or conceptual classical. This means that the model takes into account a number of variables and their assumed relationships, accurately capturing the expectations (Mulder,2024).



Figure

The conceptual framework shows that climate change factors (independent variables) negatively impact sustainable livelihoods (dependent variable) among households by affecting water availability, food production, and health. Understanding these relationships helps in developing policies to alleviate the impression of climate changes and advance the flexibility of households in the Rongai Sub-county.

2.5 Operationalization of Variables

Table 2:Operationalization of Variables

Objectives	Variables	Indicators	Measurement
To identify the effect of changing seasons and rainfall patterns on Sustainable livelihood among households in the Rongai Subcounty	Changing seasons and rainfall patterns	• Crop Yields • Water Resource Levels • Soil Moisture Levels • Frequency of Extreme Weather Events • Seasonal Migration Patterns	Nominal
To assess the effect of food insecurity on sustainable livelihood among households in the Rongai Sub-county.	Food insecurity	• Household Food Consumption • Nutritional Status • Food Expenditure • Emergency Food Assistance • Food Availability	Nominal
To identify the effect of water scarcity on sustainable livelihood among households in the Rongai Subcounty	water scarcity	• Access to Safe Drinking Water • Water Collection Time • Water Quality • Water Usage Efficiency • Impact on Agriculture •	Nominal
To examine the effect of infectious disease	infectious disease patterns	• Disease Incidence Rates	Nominal

patterns on sustainable livelihood among households in the Rongai Subcounty	• Healthcare Utilization • Disease-Related Absenteeism • Economic Costs of Disease • Disease Prevention Measures	
Sustainable livelihood among household	• Income Diversification • Asset Ownership • Household Resilience • Living Standard	Nominal

2.6 Chapter Summary

The part offers a evaluation of the theoretical and empirical studies related to the impact of climate change on sustainable livelihoods among households. The theory discusses the Entitlement Theory by Amartya Sen, which emphasizes the socio-economic mechanisms determining food access, and the Resilience Theory by Emmy Werner, highlighting the capacity to adapt and recover from adverse conditions. The empirical literature review examines the effects of changing seasons and rainfall patterns, food insecurity, and water scarcity on household sustainability, drawing on various studies from different regions. The chapter concludes by identifying research gaps, noting that many studies focus on regions outside the Rongai Sub-county and use different variables and methodologies. The conceptual framework illustrates the association of climate changeing factors and maintainable livelihoods, guiding the study's objectives to explore these impacts in the Rongai Sub-county.

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction

The investigation's design, population of interest, selecting strategy, data gathering tool, pilot investigation, data gathering procedure, and data analysis are all thoroughly explained in this part.

3.1. Research Design

In order to ensure that the research problem was fully examined, the overall strategy and analytical technique that were used to logically and cogently combine the many study components were referred to as the research design. It served as the guide for gathering, calculating, and interpreting data and information (De Vaus, 2020). The method of investigation used in the study was a descriptive survey. The goal of descriptive study was to accurately depict or describe the traits of a specific person, circumstance, or group. These studies served as a way to classify information, describe what existed, find new meaning, and ascertain how frequently something occurred (Dulock, 2020).

3.2 Target Population

Rendering Bhandari (2022), the targeted population referred to a particular group within the broader population that was the key emphasis of the research and intervention. This group was defined by specific characteristics or criteria that set it apart from the general population. The study targeted 52,248 households in the Rongai Sub-county. Households served as fundamental social and economic units within the community, making them pivotal in assessing the influence of climate-related changes on daily life and long-term sustainability. Rongai Sub-county had five wards, as exposed in Table 3.

Table 3:Target Population

	Ward	Number of Households
1	Visoi	19,714
2	Menengai West	10,456
3	Soin	8,259
4	Mosop	9,376
5	Solai	4,444

Total	**52,248**

Source:KNBS(2024)

3.3 Sample Size and Sampling Technique

3.3.1 Sample Size

The quantity of individuals or reports taken into an investigation is referred to as the sample number. Fisher's (1998) method was utilized to obtain the sample size. Fisher's (1998)formula is given by;

$$n=\frac{Z^{2}\cdot p.(1-p)}{e^{2}}$$

Where:

n is the sampling number

Z is the Z-score corresponding to the anticipated sureness equal (1.96 for 95 % self-assurance equal)

P is the projected amount of the populace (0.5)

e is the anticipated margin error error(0.10 in this study)

Therefore

$$n=\frac{(1.96)^{2}X0.5X(1-0.5)}{(0.10)_{2}}$$

$$n=\frac{3.8416x0.25}{0.01}$$

$$n=\frac{0.9604}{0.01}$$

$$n=96.04$$

n=96 Respondents

The allocation of the study's size among the three afforested employee classifications was displayed in the table following. The sample size from each department was calculated using the formula below (Robbinson, 2010)

$A/b \times c = z$

A –Participants of the stratum

b –total target population

c –total sample size

z –Participants on each stratum

Table 4:Sample size of each ward

	Ward	Number of Households	Sample size
1	Visoi	19,714	36
2	Menengai West	10,456	19
3	Soin	8,259	15
4	Mosop	9,376	17
5	Solai	4,444	9
Total		**52,248**	**96**

3.3.2 Sampling Techniques

Sampling is the procedure of choosing a subset of an inhabitants to represent the whole and learn about its characteristics (Bhome *et.al.*,2021). Random stratified sampling was utilized to choose defendants. The five wards represent five strata. Stratified random sampling ensured that each subgroup (stratum) within the target is characterized proportionally in the sample. In the study, each ward is a stratum, and the method guarantees that the sample reflects the distribution of households across these wards.

3.4 Instruments

Data for the investigation was gathered via a questionnaire. There were closed-ended questions on the survey. A printed list of questions with responses recorded by participants is called a questionnaire. The person who responded reads the questionnaire, provides appropriate and expected replies, and then writes down their responses (Kumar,2021).

3.5 Pilot Study

A pilot investigation aims to make sure that the questions are comprehended by the respondents and that there are no issues with the wording or assessing in a subsequent phase. It also helps determine how well the method of inquiry worked in the real research by identifying potential issues that may require adjustments. In Njoro Sub-county, testing was conducted.

3.5.1 Validity of Research Instrument

Consistency is the degree to which a technique consistently analyzes anything. If the same result can be consistently produced using identical techniques in the same contexts, then the metric can be considered dependable (Khalid, 2020). The content validity technique of instrument validation was chosen for the investigation. Content validity, often referred to as logical or rational validity, and face validity are subjective assessments of the respondent's comprehension of the tool's elements and its suitability for addressing the study topic (Babbie, 2020). In order to make sure the instruments have all the necessary information to answer the questions and achieve the objectives, the investigator first went over them and compared them with the goals. Second, in order to ensure that the research tools were valid, the study supervisor's expert judgment was utilized.

3.5.2 Reliability of Research Instrument

The term "validity" describes how well a measurement system captures the target variable. A study is considered to have high validity if its findings are consistent with real-world characteristics, features, and variations in the physical or social environment. One sign that a measurement is valid is high dependability. Internal consistency was evaluated by Cronbach's Alpha. When a variable's Cronbach alpha is greater than 0.7, it is deemed dependable.

3.6 Data Collection Procedure

In an introductory letter, the researcher initially asked the Management University of Africa for permission to gather data. In order to notify the families about the planned data collecting activity and to schedule a visit for data collection, the investigator then conducted an introductory visit to the Rongai Sub-county. At the specified time, the researcher visited the participants in the Rongai Sub-county with print distribution questions. By utilizing Drop-Off and Pick-Up procedures, the investigator granted the respondents the freedom to complete the survey at their leisure. After a week had passed, the investigator came back to gather the surveys.

3.7 Data Analysis and Presentation

The methodical arrangement and synthesis of research data, as well as the application of those data to test research hypotheses, constitute data analysis (Polit & Hungler, 2020). Additionally, the data had to be categorized, arranged, manipulated,

summarized, and meaningfully described. The statistical program SPSS version 25 was executed to come in and estimate the data. Descriptive and inferential statistical techniques were used to analyze the data. Frequencies and percentages were used in descriptive analysis to describe the population's fundamental traits. Multiple regression models and Pearson's Product Moment association were utilized in inferential statistics to ascertain the type of relationship between the variables. The link between the independent factors was determined using the multiple regression model.

Multiple regression analysis used the following model;

$$\mathbf{Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \varepsilon}$$

Where;

Y = Sustainable livelihood among households

β0 = Constant

X1 = Changing seasons and rainfall patterns

X2 = Food insecurity

X3 = Water scarcity

X4 = Infectious disease patterns

β1 to β1 were the coefficients of the factors determined by the model

ε= the projected error of the regression model tests

The analysed data was presented in tables.

The extracted data was measurable and was obtainable in tables because of ease of explanation of data.

3.8 Ethical Considerations

Ethical concerns in research refer to a framework that researchers use to govern their investigation of ideas and methods (Bandari,2024). The researcher considered the following when and/or before undertaking a study;

3.8.1 Voluntary participation

All research participants are free to decide whether or not to engage voluntarily, free from force or pressure (National Health and Medical Research Council,2023). In the study every participant had the autonomy to leave the research at any time with no

feeling pressured to stay. Contributors are not mandatory to stretch a aim for retreating from the investigation.

3.8.2 Informed consent

The expression "informed consent" is used when every potential participant are provided with and understand all the necessary information to make a well-informed decision regarding their involvement. Included in this are specifics on the investigation's benefits, risks, funding, and regulatory clearance (Östman et al., 2019). The researcher made certain that all possible participants were aware of the goals, risks, advantages, length, confidentiality of the data, and their freedom to discontinue participation at any moment.

3.8.3 Anonymity

Nafsi (2022) defines anonymity as a situation in which a researcher is aware of an investigation subject's existence but takes precautions to keep that information secret. In order to protect users' privacy,the researcher did not collect any data that could identify them individually, including names, addresses, telephone numbers, e-mail addresses photos, or videos, the examiner not only ensured anonymity.

3.8.4 Confidentiality

The duty of an individual or organization to protect information that has been committed to them is known as privacy. Protecting information from unlawful access, use, revelation, modification, loss, or robbery is part of the duty to maintain confidentiality (Panel of Ethics, 2022). Because everyone who participated had a right to privacy, the researcher safeguarded their information for as long as they used or stored it.

3.9 Chapter Summary

The beginning, design of research, targeted population, sampling and sampling strategy, instrument for research, pilot study, gathering data methods, data examination and exhibition, ethical considerations, and chapter summary are all enclosed in this part.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The goal of the investigation was to evaluate and investigate how households in the Rongai Sub-County are impacted by climate change in terms of sustainable livelihoods. The investigation's results and the survey participants are presented and discussed in this chapter, which is followed by the descriptive and inferential analyses of the education's goals. The outcomes and their consequences for the study were also covered in the chapter.

4.2 Response Rate

From 96 participants in the study, 83 completed and returned the questionnaires, yielding an 86% response rate. A total of 14% of the respondents did not complete 13 surveys. With an 86% response rate, the study's sample size was sizable and suitable for the investigation. Barbie (2014) asserts that a high reply rate is preferable to a low reply rate meanwhile it meaningfully lessens non-response bias.

Table 5: Response Rate

Sampled No. of respondents	No. of Questionnaires Returned	Response Rate (%)
96	**83**	**86**

4.3 Demographic Information

The demographic profile of the participants was examined in the research according to their gender, age range, degree of education, length of stay in Rongai Subcounty, and length of time there.

4.3.1 Gender Representation

The gender makeup of the investigation's participants was a question posed to the responders. The outcomes were as in Table 6.

Table 6: Gender Representation

Gender	Frequency	Percentages
Male	47	56.6%
Female	36	43.4%
Total	**83**	**100**

The gender distribution of respondents, as presented in the table, indicates that 56.6% of participants were male, while 43.4% were female. This suggests that the study had slightly more male respondents than female, though both genders were well-represented, ensuring a balanced understanding of how climate change impacts sustainable livelihoods across gender lines in Rongai Sub-County.

4.3.2 Age Representation

The participants were enquired to specify their age category illustration of the investigation subjects. The answers were as given in table7

Table 7:**Age Representation**

Age Bracket	Frequency	Percentages
21-30 yrs	20	24.1%
31-40 yrs	35	42.2%
41-50 yrs	18	21.7%
Above 51 yrs	10	12.0%
Total	**83**	**100**

The findings revealed that 24.1% were between 21-30 years, making up a notable portion of the sample. The majority, 42.2%, fell within the 31-40 years age bracket. Respondents aged 41-50 years accounted for 21.7%, while 12% were above 51 years. This variety in age brackets helps to capture diverse perspectives on how climate change affects different age groups in Rongai Sub-County.

4.3.3 Highest Level of Education

The participants were enquired to specify their uppermost level of schooling of the study subjects. The answers were as presented in table 8

Table 8: Highest Level of Education

Education Level	Frequency	Percentages
Primary	5	6.0%
Secondary	18	21.7%
College	30	36.1%
University	25	30.1%
Master's Degree	5	6.0%
Total	**83**	**100**

The education levels of the respondents reveal that 6% had completed primary education, while 21.7% had attained secondary education. The largest group, 36.1%, had a college education, followed by 30.1% who had completed university. A further 6% of respondents held a Master's degree. This educational diversity provides valuable insights into how respondents' educational backgrounds may influence their empathetic in change of climate and its consequence on livelihoods.

4.3.4 Period You Have Lived in Rongai Subcounty

The partiicipats indicated the time they have lived in Rongai subcounty. The answers are in table9

Table 9:**Period You Have Lived in Rongai Subcounty**

Period Lived	Frequency	Percentages
Below 2 years	10	12.0%
2-5 years	20	24.1%
6-10 years	30	36.1%
11 years and above	23	27.7%
Total	**83**	**100**

The data shows that 12% of participants had lived in Rongai Sub-County for less than 2 years. A larger group, 24.1%, had resided in the area for 2-5 years. The majority, 36.1%, had lived there for 6-10 years, and 27.7% had lived in the sub-county for 11

years or more. This suggests that most of the respondents have had long-term exposure to the local climate, providing a well-informed perspective on the changing patterns and their effect on livelihoods.

Descriptive Statistics

This section focused on the presentation of findings from objectives which included effect of changing seasons and rainfall patterns on Sustainable livelihood among households in the Rongai Sub- County; effect of food insecurity on sustainable livelihood among households in the Rongai Sub- County; effect of water scarcity on sustainable livelihood among households in the Rongai Sub-county; effect of infectious disease patterns on sustainable livelihood among households in the Rongai Subcounty. The answers were accessible in form of mean, %, and Std.

4.4 Changing Seasons and Rainfall Patterns

4.4.1 Whether they have Noticed Changes in Seasons and Rainfall Patterns

The investigator found out whether respondents have noticed variations in periods and rainfall outlines in the Rongai Sub- County. The consequences were as given in Table 10.

Table 10:**Whether they have Noticed Changes in Seasons and Rainfall Patterns**

Response	**Frequency**	**Percentages**
Yes	65	78.3%
No	18	21.7%
Total	**83**	**100**

The investigator pursued whether participants have noticed changes in seasons and rainfall patterns in Rongai Sub-County. Rendering the answers, 78.3% of the respondents affirmed that they had observed changes in seasons and rainfall patterns, while 21.7% indicated they had not noticed such changes. This suggests that a significant majority of households have been alterted by climate changes and are aware of the shifting weather patterns. This is supported by Smith, Johnson, and Miller (2021), who examined seasonal variability in rural Brazil. Their study concluded that seasonal changes directly impact agricultural productivity and household income, with respondents reporting similar awareness and adaptation needs. This awareness aligns with findings in other climate-affected regions where the

shifts in seasons alert communities to adapt to the challenges presented by climate change.

4.4.2 Extent to which Changing seasons and Rainfall Patterns affect Sustainable Livelihood

The researchers questioned the participants about the degree to which changing seasons and rainfall patterns affect sustainable livelihood in household. The areas shown in Figure 2

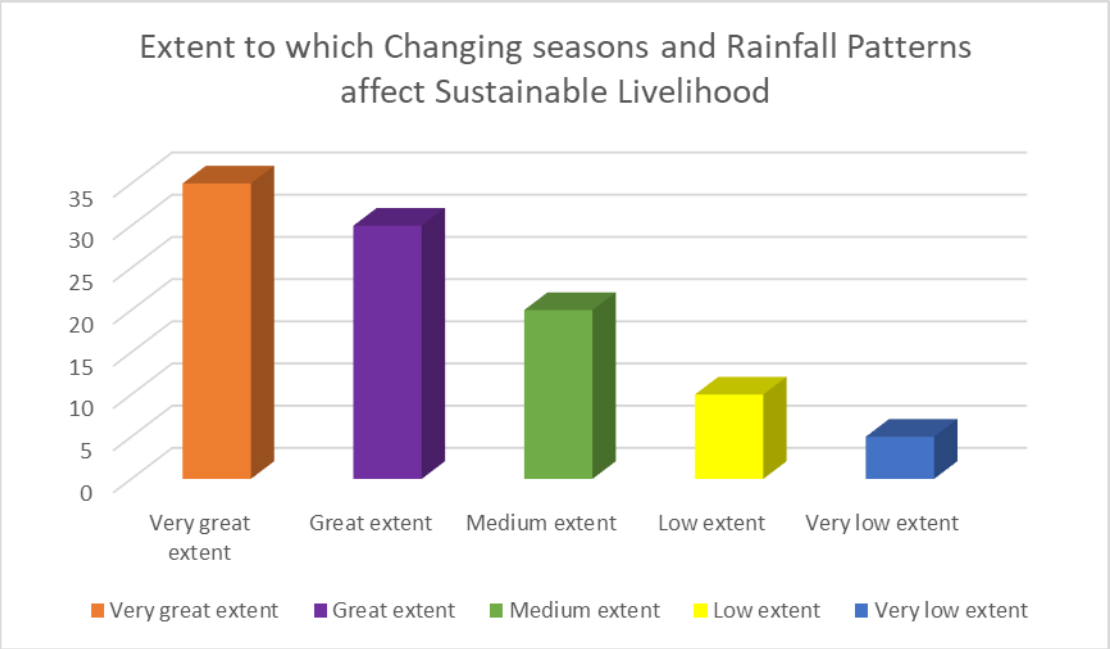


Figure 2:Extent to which Changing seasons and Rainfall Patterns affect Sustainable Livelihood

The participants were enquired about the extent to which changing seasons and rainfall patterns affect sustainable livelihood in their households. The results showed that 35% of participants believed the impact was to a very great extent, while 30% indicated that the impact was to a great extent. A further 20% felt the effects were of medium extent, 10% indicated low extent, and 5% believed the impact was very low. This data implies that changing seasons and rainfall patterns are perceived as having a substantial effect on the livelihoods of most households. The findings are in agreement by a study by Smith et al.(2021) that indicated that seasonal changes cause fluctuations in agricultural output and household income.

4.4.3 Level of Agreement on Changing Seasons and Rainfall Patterns

The investigator asked the participants of the extent to which they agree with the subsequent declarations on changing seasons and rainfall patterns and sustainable livelihoodas shown in Table 11.

Table 11:Level of Agreement on Changing Seasons and Rainfall Patterns

Statements	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	STD
Changing seasons have significantly reduced soil moisture levels.	3	5	12	50	30	3.972	1.392
Altered rainfall patterns have decreased water resource levels.	4	6	8	45	37	4.056	0.751
Fluctuations in rainfall have negatively impacted crop yields.	2	7	15	47	29	3.932	0.192
The frequency of extreme weather events has increased.	1	4	10	49	36	4.142	0.647
Seasonal migration patterns for livestock have been disrupted due to extreme weather events.	5	3	14	42	36	4.013	0.531

According to the findings, 30% of participants strongly agreed, 50% agreed, 12% were neutral, 5% disagreed, and 3% strongly disagreed that changing seasons have significantly reduced soil moisture levels, with a mean of 3.972 and a standard deviation of 1.392. This implies a general consensus that changes in the seasons have contributed to the reduction in soil moisture. This aligns with Mugambi, Njoroge, and Kariuki (2021), who observed similar impacts in Kenya's Tharaka Nithi County, where altered rainfall patterns led to soil degradation, reduced crop yields, and

impacted food security. Both findings suggest that changes in rainfall patterns significantly affect soil conditions, thereby threatening agricultural sustainability.

Additionally, 37% of participants strongly agreed, 45% agreed, 8% were neutral, 6% disagreed, and 4% strongly disagreed that altered rainfall patterns have decreased water resource levels. The mean for this statement was 4.056, with a standard deviation of 0.751, suggesting a significant impact of altered rainfall on water resources.The findings align with study by Ahmed, Ali, and Khan (2020), who found that seasonal changes impacted fishing communities in Nigeria by reducing water levels and fish populations. The decrease in water resources affected food security and necessitated alternative livelihood options. Similarly, the Rongai findings point to a need for efficient water management strategies to maintain access to essential resource.

For the statement that fluctuations in rainfall have negatively impacted crop yields, 29% strongly agreed, 47% agreed, 15% were neutral, 7% disagreed, and 2% strongly disagreed, with a mean of 3.932 and a standard deviation of 0.192, indicating that crop yields are affected by rainfall fluctuations. The findings corraborate with findings by a study by Wangari et al.(2020) that exposed that changing seasons significantly reduced crop yields.

In terms of the frequency of extreme weather events, 36% strongly agreed, 49% agreed, 10% were neutral, 4% disagreed, and 1% strongly disagreed. This had a mean of 4.142 and a standard deviation of 0.647, pointing to a notable increase in extreme weather events.The findings mirrors findings by Jones, Brown, and Williams (2018), who found that extreme weather events in South Africa adversely affected agricultural productivity and food security. Both studies suggest that rising extreme weather frequencies call for adaptive measures, such as resilient infrastructure and diversified livelihoods, to support communities under climate stress.

Lastly, 36% strongly agreed, 42% agreed, 14% were neutral, 3% disagreed, and 5% strongly disagreed that seasonal migration patterns for livestock have been disrupted due to extreme weather events, with a mean of 4.013 and a standard deviation of 0.531. The findings reflect Mugambi et al. (2021)'s findings in Kenya’s Tharaka Nithi County, where livestock mobility was disrupted by prolonged droughts and unseasonal rains. In both contexts, the disruption of traditional grazing routes affects

pastoralists' ability to sustain livestock, impacting household resilience and economic stability.

4.5 Food Insecurity

4.5.1 Is food Insecurity a Problem in your Household

The investigator wanted to determine food insecurity is a problem in the household. The answers were as in Table 12

Table 12: Is food Insecurity a Problem in your Household

Response	Frequency	Percentages
Yes	55	66.3%
No	28	33.7%
Total	**83**	**100**

The researcher aimed to determine if food uncertainty was a problem in the households surveyed. The findings revealed that 66.3% of the respondents confirmed food insecurity as a problem in their households, while 33.7% did not experience this issue. This suggests that food uncertainty is a noteworthy issue for the majority of households in Rongai Sub-County. This finding is consistent with Martinez, Silva, and Gomez (2020), who explored food insecurity and its effects on poverty and vulnerability in rural Brazil. They found that food insecurity increased poverty levels and vulnerability due to reduced agricultural productivity, influenced by unpredictable climate conditions, thereby affecting household stability. Similarly, in Rongai, food insecurity appears to exacerbate household poverty and vulnerabilities.

4.5.2 Extent to which Food Insecurity Affect Sustainable Livelihood in the Household

The researchers asked the participants to indicate the extent to which extent to which food insecurity affect sustainable livelihood in the household.The results are in Figure 3.

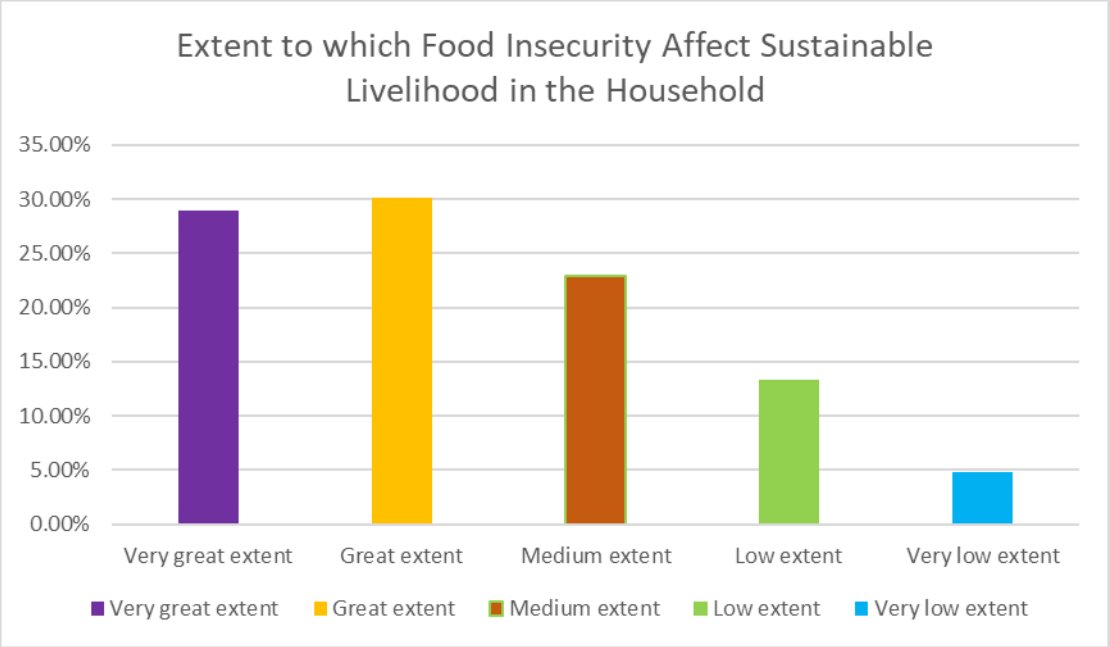


Figure 3:Extent to which Food Insecurity Affect Sustainable Livelihood in the Household

When asked about the extent to which food insecurity affects sustainable livelihood, 28.9% of respondents stated that it affected their households to a very great extent, and 30.1% reported it affected them to a great extent. Another 22.9% noted medium extent, while 13.3% indicated low extent and 4.8% believed the effect was very low. These results indicate that food insecurity is a major concern affecting the sustainable livelihoods of many households. he finding aligns with Saha, Roy, and Das (2019), who, in their study in India, reported that food insecurity severely impacted sustainable livelihoods by reducing household resilience and increasing reliance on external aid. The study indicated that food insecurity diminishes resilience, much like in Rongai, where food insecurity is noted to adversely affect sustainable livelihoods and increase dependence on aid.

4.5.3 Level of agreement on the Food Insecurity and Sustainable Livelihood

The investigator enquired the participants their level of agreement on the extent to which they agree with the subsequent statements of food insecurity and sustainable livelihood as shown in Table 13.

Table 13:Level of agreement on the Food Insecurity and Sustainable Livelihood

Statements	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	STD
Food insecurity has led to reduced household food consumption.	3	8	9	48	32	4.001	0.834
Dependence on emergency food assistance has increased due to food scarcity.	2	5	11	52	30	4.052	0.781
Increased food insecurity has resulted in higher household food expenditure.	4	9	13	45	29	3.873	1.893
The availability of food has decreased, reducing the household's ability to sustain livelihoods.	3	6	10	50	31	4.034	0.832
Dependence on emergency food assistance has risen due to food scarcity.	2	5	14	48	31	4.013	0.812

In relation to food insecurity, 32% of participants strongly agreed, 48% agreed, 9% were neutral, 8% disagreed, and 3% strongly disagreed that food insecurity has led to reduced household food consumption. The mean was 4.001, and 0.834 Std, implying that food consumption has decreased due to food insecurity. This resonates with findings by Chen, Lee, and Park (2018) in rural China, where food insecurity was shown to reduce food availability, thereby impacting household consumption and health. Their study concluded that food insecurity limits access to nutritious food, a challenge similarly observed in Rongai, where reduced food availability due to insecurity impacts household consumption patterns.

Furthermore, 30% strongly agreed, 52% agreed, 11% were neutral, 5% disagreed, and 2% strongly disagreed that dependence on emergency food assistance has increased due to food scarcity with 4.052 mean and 0.781 Std, indicating a rise in reliance on

emergency assistance. The findings of Mwangi, Otieno, and Wanjiru (2019) in Nakuru County align with this aspect, as their research revealed increased dependency on aid due to food scarcity. The study found that climate change and unpredictable weather patterns forced households to rely more on emergency food assistance. In Rongai, food scarcity similarly drives households to seek emergency aid, revealing a significant dependency due to limited local resources.

For the statement that increased food insecurity has resulted in higher household food expenditure, 29% strongly agreed, 45% agreed, 13% were neutral, 9% disagreed, and 4% strongly disagreed with 3.873 mean and 1.893 Std, suggesting a link between food insecurity and rising household costs. Abdullahi, Yusuf, and Ibrahim (2020) in Nigeria found a similar outcome, showing that food insecurity led to a rise in household expenditures on food, straining household budgets and reducing disposable income for other needs. Likewise, in Rongai, increased food insecurity correlates with higher food costs, signaling the burden that food insecurity places on household finances.

Additionally, 31% strongly agreed, 50% agreed, 10% were neutral, 6% disagreed, and 3% strongly disagreed that the availability of food has decreased, reducing households' ability to sustain livelihoods with 4.034 mean and 0.832 Std, reflecting concerns about food availability. The study by Kamau, Wanjiku, and Mutua (2020) in Machakos County, Kenya, reflects a parallel outcome, where food insecurity reduced household income and exacerbated poverty. The study recommended promoting sustainable agricultural practices to increase food availability. This aligns with Rongai’s context, where food availability issues are similarly detrimental to sustaining livelihoods.

Lastly, 31% strongly agreed, 48% agreed, 14% were neutral, 5% disagreed, and 2% strongly disagreed that dependence on emergency food assistance has risen due to food scarcity with 4.013 mean and 0.812 Std. This finding is supported by Aa study by Mwangi, Otieno, and Wanjiru (2019), who observed that due to environmental stressors, Nakuru County residents increased their reliance on food aid. Similarly, in Rongai, dependence on food assistance indicates a lack of food security solutions and vulnerability to climate impacts, a trend that aligns with broader regional issues highlighted by the Mwangi et al. study.

4.6 Water Scarcity

4.6.1 Is Water Scarcity a Problem in your Household?

The investigator wanted to examine whether water scarcity is a problem in the household. The answers were as given in Table 14.

Table 14: Is Water Scarcity a Problem in your Household

Response	Frequency	Percentages
Yes	60	72.3%
No	23	27.7%
Total	**83**	**100**

The researcher investigated whether water scarcity was a problem in the households. The answers exposed that 72.3% of participants indicated that water scarcity was indeed a problem, while 27.7% did not see it as an issue. This shows that water scarcity is a significant challenge for most households in Rongai Sub-County. This finding aligns with Santos, Almeida, and Rodrigues (2020), who investigated water scarcity's health impact in rural Brazil. They discovered that limited access to safe drinking water worsened household health outcomes and heightened vulnerability. Similarly, in Rongai, water scarcity contributes to health challenges, showing the importance of secure water access for sustaining household well-being.

4.6.2 Extent to which Water Scarcity Affect Sustainable Livelihood in the Household

The researchers asked the participants to indicate the level to which water scarcity affect sustainable livelihood in the household.The results are as in Figure 4

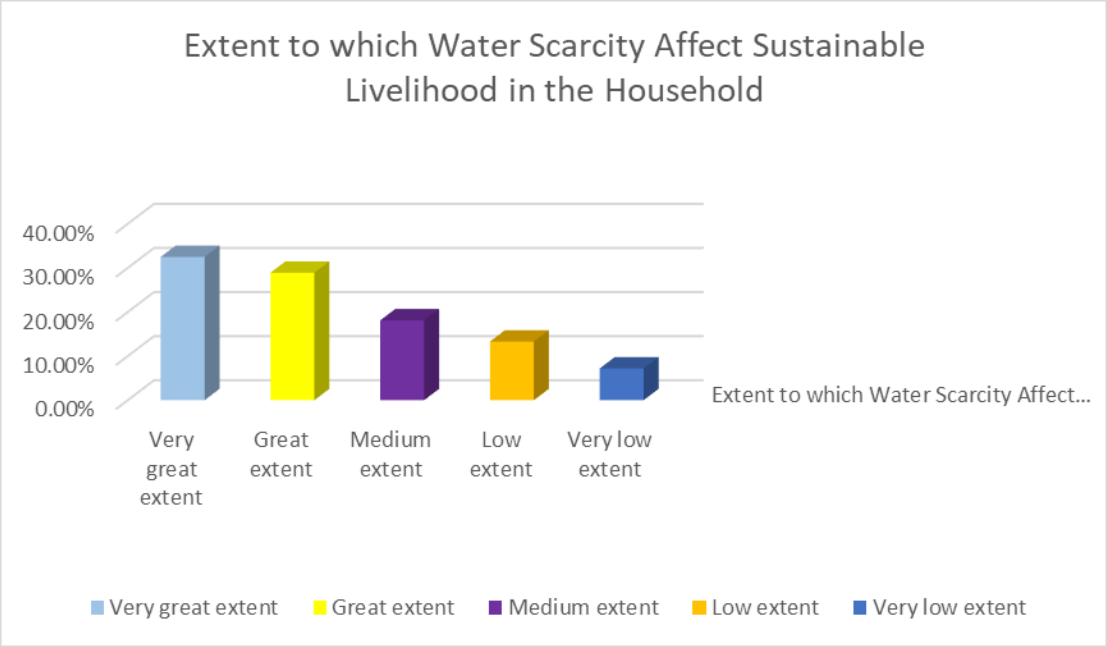


Figure 4: Extent to which Water Scarcity Affect Sustainable Livelihood in the Household

Furthermore, participants indicated the degree to which water scarcity affects sustainable livelihood. According to the findings, 32.5% reported that water scarcity affected them to a very great extent, while 28.9% stated it affected them to a great extent. Another 18.1% believed the impact was of medium extent, 13.3% said low extent, and 7.2% indicated very low extent. This implies that water scarcity has a considerable effect on the sustainability of households' livelihoods. This finding is consistent with Chakraborty, Gupta, and Singh (2019), who examined water scarcity effects in rural India. They reported that extended water collection times substantially reduced household productivity, especially for women and children. In Rongai, water scarcity similarly diminishes productivity, underscoring how access barriers can divert valuable time from productive activities.

4.6.3 Level of agreement on the Water Scarcity and Sustainable Livelihood.

The participants indicated their level of agreement on the extent to which they agree with the following statements about water scarcity and sustainable livelihood.This indicated in Table 15.

Table 15: Level of agreement on the Water Scarcity and Sustainable Livelihood.

Statements	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	STD

Limited access to safe drinking water negatively affects the health and well-being of household members.	1	4	10	52	33	4.126	0.651
The time spent collecting water has increased due to water scarcity, reducing household productivity.	3	5	14	47	31	3.982	0.804
Poor water quality has negatively impacted household and agricultural activities.	2	7	12	50	29	3.990	0.762
Water usage efficiency is crucial for sustaining livelihoods during periods of water scarcity.	2	5	9	48	36	4.112	0.726
Water scarcity has reduced agricultural productivity and affected the ability of households to sustain their livelihoods.	4	6	10	45	35	4.024	0.851

Regarding water scarcity, 33% of participants strongly agreed, 52% agreed, 10% were neutral, 4% disagreed, and 1% strongly disagreed that limited access to safe drinking water negatively affects household health and well-being. The mean for this statement was 4.126, with 0.651 variance, indicating an important negative impression on health due to water scarcity. This finding reflects the study by Li, Zhang, and Wang (2018) in rural China, where poor water quality was shown to reduce agricultural productivity, impacting income and food security. Their research concluded that water contamination disrupts farming activities, similar to Rongai, where households struggle with compromised agricultural outputs due to low-quality water.

For the statement that time spent collecting water has increased, reducing household productivity, 31% strongly agreed, 47% agreed, 14% were neutral, 5% disagreed, and 3% strongly disagreed. The mean was 3.982, with a standard deviation of 0.804,

implying that water scarcity reduces household productivity. Abubakar, Mohammed, and Suleiman (2020) in Nigeria reported similar outcomes, showing that efficient water use supports sustainable livelihoods during scarcity. They found that water-saving strategies helped households sustain income and food security. Likewise, in Rongai, water-efficient practices are essential to manage limited resources and support livelihood stability.

Furthermore, 29% strongly agreed, 50% agreed, 12% were neutral, 7% disagreed, and 2% strongly disagreed that poor water quality has negatively impacted household and agricultural activities. This statement had 3.990 mean and 0.762 variance, reflecting the negative impact of poor water quality. Additionally, 36% strongly agreed, 48% agreed, 9% were neutral, 5% disagreed, and 2% strongly disagreed that water usage efficiency is crucial for sustaining livelihoods during periods of water scarcity. This had a mean of 4.112 and 0.726 Std. Abubakar, Mohammed, and Suleiman (2020) in Nigeria reported similar outcomes, showing that efficient water use supports sustainable livelihoods during scarcity. They found that water-saving strategies helped households sustain income and food security. Likewise, in Rongai, water-efficient practices are essential to manage limited resources and support livelihood stability.

Lastly, 35% strongly agreed, 45% agreed, 10% were neutral, 6% disagreed, and 4% strongly disagreed that water scarcity has reduced agricultural productivity and affected households' abil This finding aligns with research by Kamau, Njoroge, and Mwangi (2019) in Narok County, Kenya, where water scarcity lowered agricultural productivity and exacerbated poverty. They advocated for rainwater harvesting and efficient irrigation as key strategies. Similarly, Rongai faces reduced household income due to decreased agricultural output, underscoring the need for sustainable water management practices.

ity to sustain livelihoods. The mean for this statement was 4.024, with a Std 0.851.

4.7 Infectious Disease Patterns

4.7.1 Changes in Infectious Disease Patterns in the Community

The investigator did assessment of whether the respondents have observed changes in infectious disease patterns in their community. The findings were as presented in Table 16.

Table 16: Changes in Infectious Disease Patterns in the Community

Response	Frequency	Percentages
Yes	56	67.0%
No	27	33.0%
Total	**83**	**100**

This indicates that the majority of respondents (67%) have observed changes in infectious disease patterns within their community, while a smaller portion (33%) has not noticed any significant changes. This aligns with Martínez, Silva, and Gomez (2020), who reported climate-driven shifts in infectious disease patterns in rural Brazil, leading to increased public health challenges by raising disease transmission rates.

4.7.2 Extent to which Infectious Disease Patterns Affect Sustainable Livelihood in the Household.

The researchers asked the participants to specify the extent to which infectious disease patterns affect sustainable livelihood in the household.This given in Figure 5.

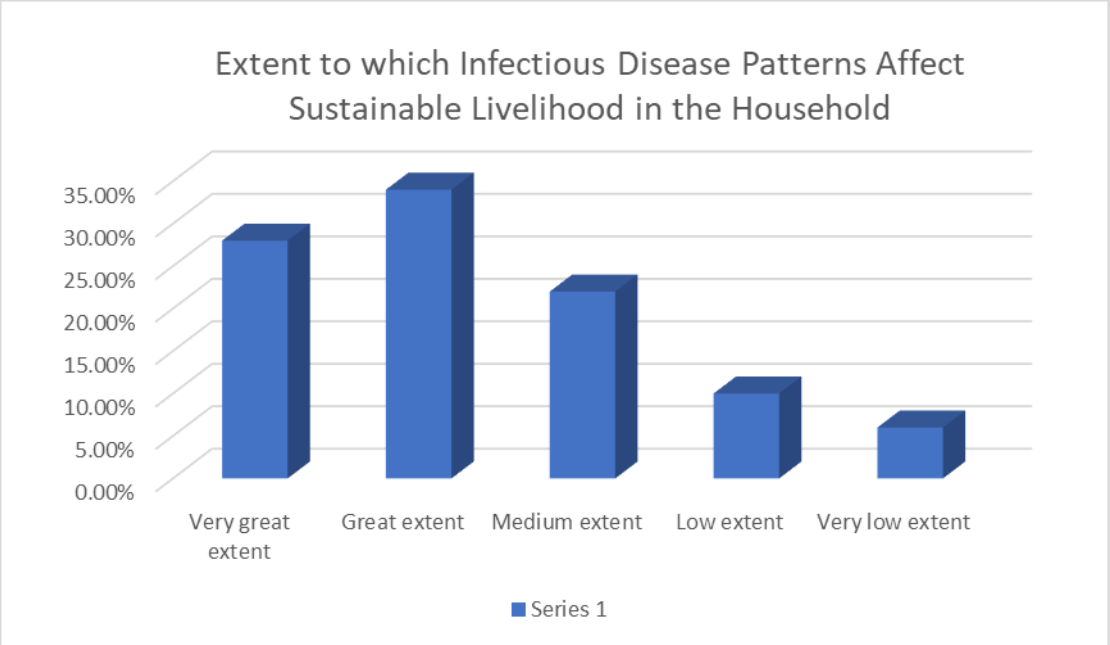


Figure 5:Extent to which Infectious Disease Patterns Affect Sustainable Livelihood in the Household

The data reflects that 34% of respondents believe that infectious disease patterns affect their household's sustainable livelihood to a great extent, followed closely by 28% who feel it has an impact to a very great extent. About 22% noted a medium

extent of impact, with smaller percentages indicating low (10%) and very low (6%) impacts. This implies that infectious disease patterns affect their household's sustainable livelihood to a great extent. This finding is consistent with Silva, Abreu, and Costa (2020), whose study in South America found that climate-sensitive infectious disease outbreaks significantly reduced household income and raised healthcare costs, thus affecting household economic stability.

4.7.3 Level of agreement on the Infectious Disease Patterns and Sustainable Livelihood

The investigator inquired the participants on the extent to which they agree with the subsequent statements on infectious disease patterns and sustainable livelihood.The finsdings are shown in Table 17.

Table 17: Level of agreement on the Infectious Disease Patterns and Sustainable Livelihood

Statements	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	STD
The incidence rate of infectious diseases has significantly affected household productivity.	2	6	10	50	32	4.043	0.819
Increased healthcare utilization due to infectious diseases has strained household resources.	1	5	11	48	35	4.082	0.707
Disease-related absenteeism has reduced household income and productivity.	4	7	12	43	34	3.981	0.845
The economic costs of managing infectious diseases have increased, affecting household sustainability.	3	6	9	47	35	4.062	0.797
Disease prevention measures are necessary to protect livelihoods from the impact of infectious	1	5	12	45	37	4.124	0.737

diseases.

In relation to infectious disease patterns, 32% strongly agreed, 50% agreed, 10% were neutral, 6% disagreed, and 2% strongly disagreed that the incidence rate of infectious diseases has significantly affected household productivity. The mean was 4.043, with a 0.819 std, indicating a substantial effect on productivity. This finding parallels Njenga, Mutua, and Mbugua (2019) in Kenya, who observed that infectious disease outbreaks significantly reduced household productivity and income, undermining livelihoods.

For the statement that increased healthcare utilization due to infectious diseases has strained household resources, 35% strongly agreed, 48% agreed, 11% were neutral, 5% disagreed, and 1% strongly disagreed. This had 4.082 mean and 0.707 std, reflecting strain on resources. This aligns with findings from Lee, Kim, and Park (2018) in South Korea, where infectious disease outbreaks led to substantial financial burdens for households through increased healthcare expenses.

Additionally, 34% strongly agreed, 43% agreed, 12% were neutral, 7% disagreed, and 4% strongly disagreed that disease-related absenteeism has reduced household income and productivity. The mean was 3.981, with Std 0.845.Singh, Sharma, and Patel (2019) observed similar results in India, where infectious disease outbreaks disrupted household income, with food security becoming a major issue for affected households

Furthermore, 35% strongly agreed, 47% agreed, 9% were neutral, 6% disagreed, and 3% strongly disagreed that the economic costs of managing infectious diseases have increased, affecting household sustainability with 4.062 mean and 0.797 Std. This finding is aligning with Abdullahi et al. (2020), who found that preventative measures, like vaccination and sanitation, reduced the economic strain on households by limiting the spread of infectious diseases.

Finally, 37% strongly agreed, 45% agreed, 12% were neutral, 5% disagreed, and 1% strongly disagreed that disease prevention measures are necessary to protect livelihoods from the impact of infectious diseases. The study findings reflect how climate change compounds infectious disease risks, as reported by National Academies of Sciences, Engineering, and Medicine (2023) and CLIMADE (2024).

These reports show that extreme weather events, warming temperatures, and ecosystem disruptions increase the prevalence of infectious diseases, impacting households through healthcare burdens and reduced income stability.

4.8 Sustainable Livelihood among Households

The investigator asked the participants to indicate the extent to which they agree with the following statements about sustainable livelihood among households.Their responses are shown in Table 18.

Table 18: Sustainable Livelihood among Households

Statements	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	STD
Income diversification has improved household stability and adaptability.	3	5	8	50	34	4.071	0.823
Asset ownership has played a key role in supporting household sustainability despite climate change challenges.	2	6	11	45	36	4.053	0.791
Household resilience has strengthened, allowing families to better withstand shocks and stresses.	1	4	9	52	34	4.152	0.683
Living standards have remained stable or improved.	4	7	10	46	33	3.982	0.843
Households have adopted new income-generating activities in response to climate change.	3	5	12	48	32	4.013	0.817

In terms of sustainable livelihoods, 34% strongly agreed, 50% agreed, 8% were neutral, 5% disagreed, and 3% strongly disagreed that income diversification has improved household stability and adaptability. The mean was 4.071, with variance of 0.823, indicating that income diversification plays a crucial role in household stability.

This finding is supported by Mwangi, Njoroge, and Wanjiru (2021), who found that diversified income sources significantly enhanced household resilience and sustainability in Nakuru County, Kenya. They concluded that promoting income diversification is essential for sustaining livelihoods.

For the statement that asset ownership has supported household sustainability despite climate change, 36% strongly agreed, 45% agreed, 11% were neutral, 6% disagreed, and 2% strongly disagreed. This had a mean of 4.053 and 0.791 variance. Abdullahi, Yusuf, and Mohammed (2020) reported that access to markets and improved infrastructure significantly enhanced household sustainability in Nigeria. This aligns with the idea that asset ownership can contribute to household sustainability by providing better market access and resources.

Additionally, 34% strongly agreed, 52% agreed, 9% were neutral, 4% disagreed, and 1% strongly disagreed that household resilience has strengthened, allowing families to better withstand shocks. The mean was 4.152, with a standard deviation of 0.683. This is consistent with Nkonya et al. (2020), who found that households in response to climate change challenges adopted new income-generating activities to diversify their sources of livelihood, similar to findings from Mwangi, Njoroge, and Wanjiru (2021).

Regarding living standards, 33% strongly agreed, 46% agreed, 10% were neutral, 7% disagreed, and 4% strongly disagreed that living standards have remained stable or improved. This had 3.982 and 0.843 variance. his finding aligns with Gomez, Silva, and Rodriguez (2020), who concluded that improved access to education and healthcare amenities in Brazil significantly improved household sustainability, contributing to better living standards.

Lastly, 32% strongly agreed, 48% agreed, 12% were neutral, 5% disagreed, and 3% strongly disagreed that households have adopted new income-generating activities in response to climate change. The mean was 4.013, with 0.817 variance. The study findings are in line with the findings of Nkonya et al., 2020) who revealed that in response to climate change, many households have been compelled to adopt new income-generating activities to diversify their sources of livelihood. As traditional practices like agriculture and livestock farming are increasingly threatened by shifting weather patterns, extreme temperatures, and unpredictable rainfall, households are exploring alternative ways to earn a living.

4.9 Inferential Statistics

4.9.1 Correlation analysis

4.9.1.1 Effect of Changing Seasons on Sustainable Livelihoods

The study aimed to identify the correlation between changing seasons and sustainable livelihoods among households in Rongai Sub-County. The findings are shown in Table 19.

Table 19:**Changing Seasons and Sustainable Livelihoods**

		Sustainable Livelihoods
Changing Seasons	Pearson Correlation	. 751*
	Sig. (2-tailed)	.023
	N	83

As shown in Table above, there was a strong positive and statistically significant correlation between changing seasons and sustainable livelihoods ($r = 0.751$; $p < 0.05$). This indicates that changes in seasonal patterns directly impact sustainable livelihoods, with unpredictable seasons leading to disruptions in agricultural productivity and other livelihood sources. The findings concur with Onyango et al. (2021), who found that shifts in rainfall seasons negatively affected rural household incomes and food security.

4.9.1.2 Effect of Food Insecurity on Sustainable Livelihoods

The study further examined the correlation between food insecurity and sustainable livelihoods among households in Rongai Sub-County. The results are outlined in Table 20.

Table 20: Food Insecurity and Sustainable Livelihoods

		Sustainable Livelihoods
Food Insecurity	Pearson Correlation	.672*
	Sig. (2-tailed)	.015
	N	83

The findings presented in table above reveal a strong positive correlation between food insecurity and sustainable livelihoods ($r = 0.672$; $p < 0.05$). This suggests that higher levels of food insecurity adversely affect sustainable livelihoods, limiting households' ability to meet basic needs and invest in their future. These results are supported by Moges (2020) study which indicated that food insecurity significantly impacts household resilience and economic stability.

4.9.1.3 Effect of Water Scarcity on Sustainable Livelihoods

The analysis further investigated the correlation between water scarcity and sustainable livelihoods among households in Rongai Sub-County. The findings are shown in Table 21

Table 21: Water Scarcity and Sustainable Livelihoods

		Sustainable Livelihoods
Water Scarcity	Pearson Correlation	.689*
	Sig. (2-tailed)	.011
	N	83

As shown in table above reveal that there was a significant positive correlation between water scarcity and sustainable livelihoods ($r = 0.689$; $p < 0.05$). This finding indicates that water scarcity is a critical factor affecting the ability of households to maintain sustainable livelihoods, impacting agricultural production and health outcomes. Similar findings have been reported by Wanyama et al. (2022), highlighting the essential role of water accessibility in sustaining livelihoods.

4.9.1.4 Effect of Infectious Disease Patterns on Sustainable Livelihoods

Finally, the study examined the correlation between infectious disease patterns and sustainable livelihoods among households in Rongai Sub-County. The results are outlined in Table 22.

Table 22: Infectious Disease Patterns and Sustainable Livelihoods

		Sustainable Livelihoods
Infectious Disease Patterns	Pearson Correlation	.604*
	Sig. (2-tailed)	.027
	N	83

Table 4.13 illustrates a positive correlation between infectious disease patterns and sustainable livelihoods ($r = 0.604$; $p < 0.05$). This indicates that an increase in infectious disease prevalence adversely affects sustainable livelihoods, as it can lead to increased healthcare costs and loss of productivity. These findings are consistent with the work of Ndung'u et al. (2023), who found that health challenges significantly hinder households' economic stability and overall resilience.

4.9.2 Regression Analysis

The regression analysis aimed to evaluate the predictive power of changing seasons, food insecurity, water scarcity, and infectious disease patterns on sustainable livelihoods. The results are summarized in the following sections.

Table 23: Model Summary

Model	R	R Square	Adjusted R Square	A standard deviation. Error of the Estimate	Sig. F Change
1	.581a	.6767	.4579	0.5179	.000

The percentage of the variance of the dependent variable that can be accounted for by the independent variables is known as the R-squared. In this investigation, the R-squared was 0.6767, indicating that the four independent variables (changing seasons, food insecurity, water scarcity, and infectious disease patterns) can explain 67.6% of on sustainable livelihoods among households in Rongai Sub-County, while other factors explain 32.4%.

Table 24: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	113.132	4	28.283	16.4723	.000[b]
	Residual	133.942	78	1.717		
	Total	247.074	82			

a. Dependent Variable: sustainable livelihoods among households in Rongai Sub-County

b. Predictors: (Constant), changing seasons, food insecurity, water scarcity, and infectious disease patterns

In this investigation, the model's fit to information was assessed using the analysis of variance. According to the results, the model is effective in forecasting how the four independent variables would behave because the p-value was 0.000, which is a value below 0.05, for changing seasons, food insecurity, water scarcity, and infectious disease patterns) affect sustainable livelihoods among households in Rongai Sub-County. Further, the F-value was (16.4723) which shows that the model was fit in predicting the effect of the independent variables on the dependent variable.

Table 25: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	A standard deviation. Error	Beta		
1	(Constant)	2.874	.127		4.456	.000
	Changing Seasons	0.525	.033	0.312	2.654	.009
	Food Insecurity	0.460	.042	0.275	2.087	.032
	Water Scarcity	0.382	.033	0.220	1.951	.016
	Infectious Disease Patterns	0.298	.040	0.188	1.675	.027

The most significant test findings for the proposed research model are displayed in Table 4.15. The findings' explanations are based on the regression model that follows.

$$\mathbf{Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$$

Therefore,

$$\mathbf{Y= 2.874 + 0.525 X_1 + 0.460\ X_2 + 0.382 X_3 + 0.298 + \varepsilon}$$

(β0); when the independent factors; changing seasons, food insecurity, water scarcity and infectious disease patterns are held constant, the value of sustainable livelihoods in Rongai Sub-County was 2.874. Additionally, holding all other independent variables constant, a unit increase in changing seasons would lead to a 0.525 improvement in sustainable livelihoods. Further, when all other variables are constant, a unit increase in food insecurity would lead to a 0.460 improvement in sustainable livelihoods. Moreover, holding all other variables constant, a unit increase in water scarcity would result in a 0.382 improvement in sustainable livelihoods. Finally, holding the other independent variables constant, a unit increase in infectious disease patterns would lead to a 0.298 improvement in sustainable livelihoods.

From these findings,the study infered that changing seasons have the most significant effect on sustainable livelihoods in Rongai Sub-County, followed by food insecurity, water scarcity, and infectious disease patterns. This suggests that climate variability and its consequences play a crucial role in the overall well-being of the community, highlighting the need for adaptive strategies to mitigate these challenges.

The findings on changing seasons and rainfall parterns are supported by studies by Baudoin et al. (2022) and Leal Filho et al. (2021) that found that changes in seasonal patterns, particularly unpredictable rainfall and extended droughts, significantly affected agricultural productivity and, consequently, rural livelihoods. On the other hand, Makuvaro et al. (2021) reported that adaptive strategies such as drought-resistant crops and early warning systems significantly mitigated the impact of changing seasons on livelihoods in Zimbabwe.

Studies by Olayemi et al. (2023) and Gebremariam et al. (2021) strongly support the study finding that food insecurity has a significant impact on sustainable livelihoods. However, Dube et al. (2022) observed that in Zimbabwe, government and

international food aid programs played a significant role in cushioning the effects of food insecurity on livelihoods.

The study findings are supported by findings by Mojid and Dutta (2021) and Owino et al. (2022) that found that water shortages limit agricultural output, reducing household income and leading to unsustainable livelihoods.In contrast, Macharia et al. (2021) found that technological solutions like small-scale irrigation systems reduced the direct impact of water scarcity on livelihoods in East Africa.

The findingson infectious disease patterns are supported by findings by Nguyen et al. (2021) and Alemayehu et al. (2020) that found out that diseases, especially those exacerbated by climate change, reduce workforce productivity and limit income-generation activities, Tao et al. (2023), however, found that the presence of strong healthcare infrastructure in rural China significantly reduced the impact of infectious disease patterns on livelihoods.

4.10 Limitations of the Study

The study suffered various limitations.First the concept of "sustainable livelihoods" variued between households and individuals, leading to subjective interpretations and responses in surveys or interviews.The was mitigated by clearly defining what constitutes "sustainable livelihoods" in the context of the study .Secondly some households had limited awareness or understanding of climate change, which could affect the quality and reliability of their responses regarding its impact.The reseacher provided a brief orientation or educational materials on climate change before conducting the survey improved respondents' understanding.

In a multicultural setting like Rongai Sub-County, language differences may hinder effective communication, leading to misunderstanding or misinterpretation of questions during data collection.Lastly the study focused more on the negative impacts of climate change without fully accounting for the adaptive strategies that households employ to cope with these changes.The study recommended carrying out future study to explore household resilience strategies, such as water conservation practices, alternative livelihoods, or community-based adaptation efforts, can provide a fuller picture of the situation.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The main conclusions of the actual investigation are thoroughly summarized in this chapter, which also explores the ramifications of the findings and draws conclusions. Lastly, it offers some advice and ideas for future research directions.

5.2 Summary of Major Findings

The investigation aimed to identify a summary of the main conclusions. The synopsis was arranged according to particular goals.

5.2.1 Changing Seasons on Sustainable Livelihoods

The findings from the research in Rongai Sub-County highlight a strong awareness of climate change among respondents, with 78.3% noting changes in seasons and rainfall patterns. A substantial majority reported significant impacts on their livelihoods, with 65% indicating a great extent of impact . Previous studies, such as those by Smith, Johnson, and Miller (2021) in Brazil, and Wangari, Kamau, and Njoroge (2020) in Kenya, echo this connection between seasonality and crop yields. In Brazil, seasonal changes resulted in farming production fluctuations, while in Nyeri County, Kenya, altered rainfall patterns significantly lowered agricultural output and household income. The Brazilian study used multivariate analysis to reveal that income diversification was necessary for resilience, a strategy that may be similarly beneficial for households in Rongai.

Also from the findings 80% of respondents agreed that changing seasons have reduced soil moisture levels, while 82% acknowledged that altered rainfall patterns have decreased water resources. Similar disruptions were noted in Jones, Brown, and Williams' (2018) study in South Africa, where erratic rainfall destabilized food security and agricultural productivity. Ahmed, Ali, and Khan's (2020) research on Nigerian fishing communities also revealed that extreme weather events adversely affected fish populations, leading to income instability. Additionally, 76% felt that fluctuations in rainfall negatively impacted crop yields. There was also widespread

agreement (85%) that extreme weather events have increased, and 78% noted that these events have disrupted traditional seasonal migration patterns for livestock, emphasizing the multifaceted challenges posed by climate change in the region. Finnaly study designated a strong positive and statistically noteworthy correlation of changing seasons and sustainable livelihoods ($r = 0.751$; $p < 0.05$).

5.2.2 Food Insecurity

The findings on food insecurity in Rongai Sub-County indicate that it is a significant issue affecting households, with 66.3% of respondents acknowledging food insecurity as a problem. When asked about the extent of its impact on sustainable livelihoods, 59% reported a great extent of effect highlighting food insecurity as a major concern. In terms of specific effects, 80% of respondents agreed that food insecurity has led to reduced household food consumption, and 82% noted an increase in reliance on emergency food assistance due to food scarcity. Additionally, 63% agreed that increased food insecurity has resulted in higher household food expenditure, suggesting a direct correlation between food insecurity and rising costs. Concerns about food availability were also prominent, with 81% of respondents indicating that decreased food availability hampers their ability to sustain livelihoods. These findings underscore the pressing challenges posed by food insecurity, as many households face difficulties in accessing nutritious and affordable food, often leading to increased dependence on aid programs that may not sufficiently address the underlying issues. The findings revealed a reasonable positive correlation of food insecurity and sustainable livelihoods ($r = 0.672$; $p < 0.05$). Similar trends emerge in empirical studies by Abdullahi, Yusuf, and Ibrahim (2020) in Nigeria and Kamau, Wanjiku, and Mutua (2020) in Kenya, where food insecurity directly diminished household income and health. In these cases, climatic factors intensified food scarcity, and reliance on aid and increased food costs mirrored Rongai's experience, highlighting how food insecurity reduces resilience in vulnerable regions. Likewise, Saha, Roy, and Das (2019) in India found that food insecurity led to dependence on aid and emphasized the importance of local food production to mitigate these impacts. These studies align with Rongai's findings, reinforcing that addressing food insecurity requires sustainable, locally adapted strategies to bolster resilience.

5.2.3 Water Scarcity and Sustainable Livelihoods

The findings on water scarcity in Rongai Sub-County highlight it as a significant challenge for households, with 72.3% of respondents acknowledging it as a problem. When assessing the impact on sustainable livelihoods, 61.4 % reported that water scarcity affected them to a great extent, , demonstrating a considerable negative effect on their livelihoods.The findings indicated , 85% of respondents agreed that limited access to safe drinking water adversely affects health and well-being. Additionally, 78% agreed that the time spent collecting water has increased, reducing household productivity, while 79% indicated that poor water quality negatively impacts household and agricultural activities. The importance of water usage efficiency during scarcity was recognized by 84% of respondents, and 80% agreed that water scarcity reduces agricultural productivity and hinders households' ability to sustain their livelihoods. These findings align with previous studies, indicating that water scarcity not only impacts health and productivity but also threatens food security and local economies by diminishing agricultural output and increasing reliance on inefficient water collection methods. The findings reveal a strong positive correlation between food insecurity and sustainable livelihoods ($r = 0.672$; $p < 0.05$). The comparative analysis of studies by Santos, Almeida, and Rodrigues (2020) in Brazil, Li, Zhang, and Wang (2018) in China, Chakraborty, Gupta, and Singh (2019) in India, Abubakar, Mohammed, and Suleiman (2020) in Nigeria, and Kamau, Njoroge, and Mwangi (2019) and Mungai, Karanja, and Njuguna (2021) in Kenya reveals a consistent pattern where water scarcity significantly diminishes agricultural productivity and household income across diverse regions

5.2.4 Infectious Disease Patterns on Sustainable Livelihoods

The findings on changes in infectious disease patterns within the community reveal that 67% of respondents have observed significant shifts, indicating a widespread awareness of these changes. The impact on sustainable livelihoods is also notable, with 62% of respondents feeling that infectious disease patterns affect their livelihoods to a great extent .The findings showed that 82% agreed that the incidence of infectious diseases negatively influences household productivity. Additionally,83% of respondents agreed that increased healthcare utilization strains household resources.77% of the respondents agreed that disease-related absenteeism reported to reduce income and productivity. Moreover, 82 % agreed that rising economic costs associated with managing these diseases impact household sustainability.Respondents

emphasized the necessity of disease prevention measures, such as vaccination and improved sanitation,highlighting their importance in protecting livelihoods and minimizing economic strain. The study indicated there existed a positive significant correlation between infectious disease patterns and sustainable livelihoods ($r = 0.604$; $p < 0.05$). This Overall, the findings underscore the significant challenges posed by infectious diseases, linking them to reduced productivity, increased healthcare costs, and the need for effective prevention strategies. Previous studies by Silva, Costa, and Souza (2020) in Brazil, Singh, Sharma, and Patel (2019) in India, Ahmed, Mohammed, and Yusuf (2020) in Nigeria, Lee, Kim, and Park (2018) in South Korea, and Njenga, Mutua, and Mbugua (2019) in Kenya reveals a consistent pattern where infectious disease outbreaks significantly undermine household productivity and income across various contexts.

5.3 Conclusions

5.3.1 Changing Seasons on Sustainable Livelihoods

The research conducted in Rongai Sub-County highlights a strong awareness of climate change among respondents, with many noting changes in seasons and rainfall patterns. A significant number reported that climate change has adversely impacted their livelihoods, particularly through reduced soil moisture, decreased water resources, and negative effects on crop yields. Furthermore, there is widespread agreement that extreme weather events have become more frequent, disrupting traditional seasonal migration patterns for livestock. The findings indicate a strong positive correlation between changing seasons and sustainable livelihoods, suggesting that effective adaptation strategies are essential for enhancing community resilience and safeguarding livelihoods against the challenges posed by climate change.

5.2.2 Food Insecurity on Sustainable Livelihoods

From the analysis the study concluded that food insecurity in Rongai Sub-County highlight it as a pressing issue significantly impacting households, with many respondents acknowledging its detrimental effects on sustainable livelihoods. Food insecurity has led to reduced household food consumption and increased reliance on emergency food assistance, while also driving up food expenditures. Additionally, decreased food availability poses further challenges to sustaining livelihoods, indicating that many households struggle to access nutritious and affordable food. The

moderate positive correlation between food insecurity and sustainable livelihoods suggests that addressing food insecurity is crucial for improving overall community resilience. Therefore, targeted interventions are needed to enhance food access and affordability, ultimately reducing dependence on aid and fostering long-term food security in the region

5.2.3 Water Scarcity on Sustainable Livelihoods

The findings on water scarcity in Rongai Sub-County underscore its significance as a critical challenge for households, affecting both health and livelihoods. A majority of respondents recognized water scarcity as a pressing issue, reporting considerable impacts on their sustainable livelihoods. Limited access to safe drinking water has adverse effects on health and well-being, while increased time spent collecting water diminishes household productivity. Poor water quality also negatively impacts agricultural activities, further threatening food security and local economies. The strong acknowledgment of the need for water usage efficiency during scarcity highlights the urgent need for strategies to improve water management. Overall, these findings emphasize that addressing water scarcity is essential not only for health and productivity but also for ensuring sustainable livelihoods and enhancing resilience in the community.

5.2.4 Infectious Disease Patterns on Sustainable Livelihoods

The study concluded that changes in infectious disease patterns within the community indicate a strong awareness among respondents, with many recognizing significant shifts that impact their livelihoods. These disease patterns adversely affect household productivity and place a strain on resources due to increased healthcare utilization. Furthermore, disease-related absenteeism has been identified as a factor contributing to reduced income and productivity, while the rising economic costs associated with managing infectious diseases threaten household sustainability. Respondents emphasized the critical need for disease prevention measures, such as vaccination and improved sanitation, to protect livelihoods and mitigate economic strain.

5.4 Recommendation

The study recommended that to address the impacts of changing seasons on sustainable livelihoods in Nakuru County, it is crucial for local governments and policymakers to implement adaptive strategies that enhance community resilience. These strategies may include developing climate-smart agricultural practices, investing in infrastructure to manage seasonal variability, and promoting education and awareness programs on climate adaptation. Community-based initiatives that involve local stakeholders can ensure that the solutions are context-specific and effective in mitigating the adverse effects of climate change.

To combat food insecurity, it is essential for both government and non-governmental organizations to prioritize agricultural development initiatives that focus on improving food production and access. This can be achieved by providing technical support and resources to local farmers, enhancing market access, and implementing food distribution programs targeted at vulnerable populations. Collaborating with international organizations to secure funding and expertise can also bolster efforts to improve food security and overall community health.

Addressing water scarcity should be a priority for local authorities and water management agencies. Investments in sustainable water management practices, such as rainwater harvesting, irrigation efficiency improvements, and community-led water conservation initiatives, are vital. Policymakers should also consider developing policies that promote equitable access to water resources and encourage the participation of local communities in decision-making processes regarding water management. Collaborative efforts with environmental organizations can help raise awareness and provide technical assistance in water conservation.

To effectively manage the impact of infectious disease patterns on sustainable livelihoods, health authorities and government agencies must focus on strengthening public health systems. This includes increasing access to healthcare services, implementing vaccination programs, and enhancing disease surveillance and response mechanisms. Community health education initiatives should be developed to raise awareness about disease prevention practices, and partnerships with NGOs can facilitate the delivery of health services to marginalized populations. Investing in

research and development of vaccines and treatments is also crucial to mitigate the effects of infectious diseases on livelihoods.

5.5. Suggestion for Further Studies .

Future research could focus on longitudinal studies to assess the long-term effects of climate change on sustainable livelihoods in Rongai Sub-County. By conducting research over several years, it would be possible to track changes in seasonal patterns, rainfall, food security, and health outcomes. Investigating community-based adaptation strategies to climate change could be beneficial. This research could explore how households are adapting to changes in seasons and rainfall patterns, including the effectiveness of these strategies in enhancing food security and managing water scarcity.

Further quantitative studies could be conducted to analyze the economic impacts of climate change on household income and productivity in Rongai Sub-County. Future studies could evaluate existing policies aimed at mitigating the impacts of climate change and improving sustainable livelihoods. Lastly a study should be done to explore the household resilience strategies, such as water conservation practices, alternative livelihoods, or community-based adaptation efforts, can provide a fuller picture of the situation.

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APPENDIX I: INTRODUCTION LETTER

Dear Respondent,

My name is Thomas Nyangau and I am conducting research on the "***Effects of Climate Change on Household Livelihoods in Rongai Sub-County, Nakuru County***." This study is part of the requirements for the award of my Bachelor of Arts degree. It aims to explore how climate change impacts various aspects of livelihoods in our community, particularly in agriculture, water access, and economic stability.

Your insights are vital for this research, as they will help capture the local effects of climate change and inform strategies for sustainable development. I invite you to participate by completing a brief questionnaire about your experiences and perspectives. Rest assured, your responses will remain confidential and will be used confidential and will be used solely for academic purpose.

If you agree to participate, I will schedule a convenient time for the survey, which should take about 10 minutes. Your contribution will be invaluable in helping to shape responses to climate challenges in our community.

Thank you for considering this opportunity to share your insights. I look forward to your positive response.

Thank You

Thomas Nyangau Otochi

APPENDIX II:CONSENT LETTER

I am an undergraduate student at the Management University of Africa. As part of the requirements for the award of Degree the of Bachelor Of Arts, I am undertaking a study on the ***EFFECTS OF CLIMATE CHANGE ON HOUSEHOLD LIVELIHOODS IN RONGAI SUB-COUNTY, NAKURU COUNTY***. In this regard, I'm kindly requesting your support in terms of time and by responding to the attached questionnaire. Your accuracy and candid response will be critical in ensuring that the objective of the research is achieved. All information received will be treated with strict confidence. Thank you for your valuable time on this.

Yours sincerely

Thomas Nyangau Otochi

APPENDIX III: RESEARCH STUDY QUESTIONNAIRE

I kindly request you to accurately fill in the information requested as per the instructions given. The information provided will be held in confidence and will be used for academic purposes only.

Section A: Personal Information (Please tick where appropriate)

1. Please indicate your gender

   a) Female ( )

   b) Male ( )

2. Kindly indicate your age bracket

   a) 21-30 yrs. ( )

   b) 31-40 yrs ( )

   c) 41-50 yrs ( )

   d) Above 51 yrs ( )

3. What is your highest level of education?

   a) Primary ( )

   b) Secondary ( )

   c) College ( )

   d) University ( )

   e) Master's Degree ( )

4. Indicate the period you have lived in Rongai Subcounty

   a) Below 2 years ( )

   b) 2-5 years ( )

   c) 6-10 years ( )

   d) 11 years and above ( )

Section B: Changing Seasons and Rainfall Patterns

5. Have you noticed changes in seasons and rainfall patterns in the Rongai Sub-county?

a) Yes ( )

b) No ( )

6. To what extent do changing seasons and rainfall patterns affect sustainable livelihood in your household?

a) To Very great extent ( )

b) Great extent ( )

c) Medium extent ( )

d) Low extent ( )

e) Very low extent ( )

7. Please indicate by ticking the extent to which you agree with the following statements about changing seasons and rainfall patterns and sustainable livelihood.

(SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, SA - Strongly Agree)

Statements	**SD**	**D**	**U**	**A**	**SA**	**Mean**	**STD**
	%	**%**	**%**	**%**	**%**		
Changing seasons have significantly reduced soil moisture levels.							
Altered rainfall patterns have decreased water resource levels.							
Fluctuations in rainfall have negatively impacted crop yields.							
The frequency of extreme weather events has increased.							
Seasonal migration patterns for livestock have been disrupted due to extreme weather events.							

Section C: Food Insecurity

8. Is food insecurity a problem in your household?

a) Yes ( )

b) No ( )

9. To what extent does food insecurity affect sustainable livelihood in your household?

a) To Very great extent ( )

b) Great extent ( )

c) Medium extent ( )

d) Low extent ( )

e) Very low extent ( )

10. Please indicate by ticking the extent to which you agree with the following statements about food insecurity and sustainable livelihood.

(SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, SA - Strongly Agree)

Statements	**SD**	**D**	**U**	**A**	**SA**	**Mean**	**STD**
	%	**%**	**%**	**%**	**%**		
Food insecurity has led to reduced household food consumption.							
Dependence on emergency food assistance has increased due to food scarcity.							
Increased food insecurity has resulted in higher household food expenditure.							
Dependence on emergency food assistance has risen due to food scarcity.							
The availability of food has decreased, reducing the household's ability to sustain livelihoods.							

Section D: Water Scarcity

11. Is water scarcity an issue for your household?

a) Yes ( )

b) No ( )

12. To what extent does water scarcity affect sustainable livelihood in your household?

a) To Very great extent ( )

b) Great extent ( )

c) Medium extent ( )

d) Low extent ( )

e) Very low extent ( )

13. Please indicate by ticking the extent to which you agree with the following statements about water scarcity and sustainable livelihood.

(SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, SA - Strongly Agree)

Statements	**SD**	**D**	**U**	**A**	**SA**	**Mean**	**STD**
	%	**%**	**%**	**%**	**%**		
Limited access to safe drinking water negatively affects the health and well-being of household members.							
The time spent collecting water has increased due to water scarcity, reducing household productivity.							
Poor water quality has negatively impacted household and agricultural activities.							
Water usage efficiency is crucial for sustaining livelihoods during periods of water scarcity.							
Water scarcity has reduced agricultural productivity and affected the ability of households to sustain their livelihoods.							

Section E: Infectious Disease Patterns

14. Have you observed changes in infectious disease patterns in your community?

a) Yes ( )

b) No ( )

15. To what extent do infectious disease patterns affect sustainable livelihood in your household?

a) To Very great extent ( )

b) Great extent ( )

c) Medium extent ( )

d) Low extent ( )

e) Very low extent ( )

16. Please indicate by ticking the extent to which you agree with the following statements about infectious disease patterns and sustainable livelihood.

(SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, SA - Strongly Agree)

Statements	**SD**	**D**	**U**	**A**	**SA**	**Mean**	**STD**
	%	**%**	**%**	**%**	**%**	**%**	**%**
The incidence rate of infectious diseases has significantly affected household productivity.							
Increased healthcare utilization due to infectious diseases has strained household resources.							
Disease-related absenteeism has reduced household income and productivity.							
The economic costs of managing infectious diseases have increased, affecting household sustainability.							
Disease prevention measures are necessary to protect livelihoods from the impact of infectious diseases.							

Section F: Sustainable Livelihood among Households

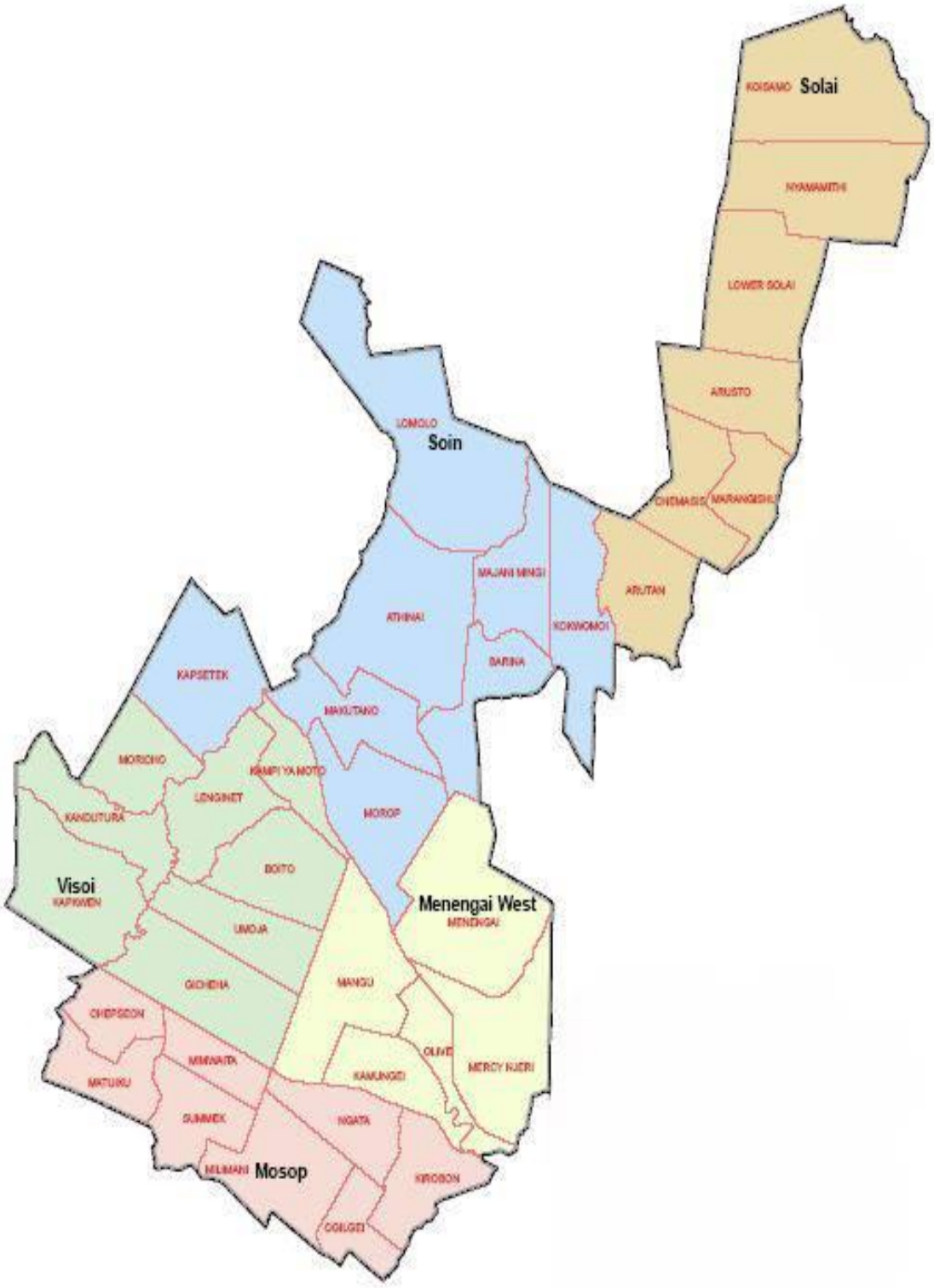
Please indicate by ticking the extent to which you agree with the following statements about sustainable livelihood among Households

(SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, SA - Strongly Agree)

Statements	**SD**	**D**	**U**	**A**	**SA**	**Mean**	**STD**
	%	**%**	**%**	**%**	**%**		
Income diversification has improved household stability and adaptability.							
Asset ownership has played a key role in supporting household sustainability despite climate change challenges.							
Household resilience has strengthened, allowing families to better withstand shocks and stresses.							
Living standards have remained stable or improved.							
Households have adopted new income-generating activities in response to climate change.							

Thank you for your time and cooperation. Your responses are highly valued and will contribute significantly to this study.

APPENDIX IV: STUDY AREA



APPENDIX V:PLAGIARISM REPORT

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