

**CULTURAL PERSPECTIVES AND RESPONSES TO CLIMATE CHANGE IN
AHERO IRRIGATION SCHEME SUB-LOCATION, KISUMU COUNTY**

BY

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DECLARATION

This thesis is my original work and has not been presented in any other University or institution for the award of a degree or any other award.

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DEDICATION

To my late mother, Roselida Akech, who insisted on striving for the best. May you rest with that everlasting smile.

ABSTRACT

Climate change accounts for ninety percent of global weather-related natural disasters. Cultural perspectives shape the interpretation and expression of climate change phenomenon among indigenous peoples all over the world. In Kenya, research and discourse have under-represented sociocultural perspectives on climate change. The people of Ahero Irrigation Scheme sub-location in Kenya draw on cultural perspectives to explain and adapt to climate change. However, studies have least explored the way cultural perspectives facilitate local understanding of and adaptation to climate change. This study set out to examine how cultural perspectives contribute to responses to climate change in Ahero Irrigation Scheme, Kisumu County. The first objective was to analyse how indigenous beliefs helped in explaining climate change. Secondly, to examine how local people's attitudes influenced community members' expressions of the climate change; and thirdly, to explore sociocultural adaptation to climate change in the study area. Cultural Ecology Theory by Julian Steward (1955) guided the study based on a cross-sectional descriptive design. The study population was 945 households. The study targeted 105 household heads for survey determined using Kathuri and Pals (1993) formula and additional 56 participants for qualitative data. The survey respondents were selected through systematic random sampling, while participants for qualitative data were purposively sampled. Semi-structured questionnaires were used to collect both quantitative and qualitative data, whereas focus group discussions, key informant interviews, and non-participant observation generated qualitative data. The qualitative data were analysed thematically, with quantitative data analysed using the Statistical Package for Social Science (SPSS) version 24. Qualitative data were presented through narratives and verbatim quotes, whilst quantitative data were presented in frequency tables and percentages. Results indicate that 81 percent of the respondents expressed concern that climate change poses a serious threat to human survival. This encourages the generation of sociocultural adaptation and mitigation strategies by the local people. The study indicates that indigenous beliefs, local attitudes and traditional coping strategies influence the explanation, interpretation and responses to climate change among the residents of Ahero Irrigation Scheme sub-location. The study further shows that these cultural representations of climate change are contextualized expressions that demonstrate the local people's worldview on the evolution of local climate. From this perspective, climate change is entwined with human ecology, local cosmologies, and social systems. The study recommends that cultural perspectives on the local weather patterns and seasons should be considered to determine how they can inform scientific models of prediction of climate change hazards. Contemporary climate change mitigation strategies should be informed by local attitudes, as they present the people's views regarding their ecological progression. Similarly, local indigenous response strategies should be considered in framing the policies aimed at controlling the adverse effects of climate change on local livelihoods.

TABLE OF CONTENTS

TITLE PAGE.....	i
DECLARATION	ii
ACKNOWLEDGEMENT	iii
DEDICATION.....	iv
ABSTRACT.....	v
TABLE OF CONTENTS.....	vi
LIST OF ABBREVIATIONS.....	viii
OPERATIONAL DEFINITION OF TERMS.	ix
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF APPENDICES	xii
CHAPTER ONE: INTRODUCTION.....	1
1.1. Background of the Study.	1
1.1.1. Climate change and the Ahero sub-location cultural context.	5
1.2. Statement of the Problem.....	6
1.3. Research Questions.....	6
1.4. Study Objectives.	6
1.4.1. General Objective.	6
1.4.2. Specific Objectives.	7
1.5. Justification of the Study.	7
1.6. Scope of the Study	7
1.7. Theoretical Framework.....	8
1.7.1. Relevance of Cultural Ecology Theory to the study.	10
CHAPTER TWO: LITERATURE REVIEW.....	11
2.1. Overview of Climate change across the world	11
2.1.1. Indigenous beliefs and knowledge on Climate Change.....	11
2.2. Local Attitudes about Climate Change	19
2.3. Sociocultural response strategies to climate change.....	22
2.3.1. Cultural adaptation to climate change in Kenya.....	25
2.3.2. National policies for combating climate change in Kenya.	26
CHAPTER THREE: METHODOLOGY	28
3.1. Research design.	28
3.2. Study site selection and description.....	28
3.3. Study population, sample size, and sampling procedures.	31
3.4. Methods of Data Collection and Instruments.	32
3.4.1. Focus Group Discussions.....	32
3.4.2. Key Informant Interviews.	33
3.4.3 Non-Participant Observation.	33
3.4.4. Semi- Structured Questionnaires.	34

3.5. Reliability and Validity.....	34
3.6. Constraints/ Limitations of the Study.....	34
3.7. Ethical Considerations.....	35
CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS.....	36
4.1. Socio-demographic characteristics of the respondents.....	36
4.1.1. Age and gender of the respondents.....	36
4.1.2. Respondents' marital status.....	37
4.1.3. Respondents' level of formal education.....	37
4.1.4. Occupation of the respondents.....	38
4.1.5. Religious affiliation.....	39
4.2. Indigenous Beliefs on Climate Change.....	39
4.2.1. Folk beliefs and explanations of climate change.....	39
4.2.2. Culture as a mirror of nature.....	45
4.2.3. Cultural interpretation of climate change.....	47
4.2.4. Mystical signs for the onset of floods and dry spells.....	50
4.3. Local attitudes about Climate Change.....	52
4.4. Sociocultural responses to Climate Change.....	57
4.4.1. Adaptation of agriculture to unusual weather patterns.....	61
4.4.2. Short-term mitigating of climate change.....	64
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	68
5.1. Summary.....	68
5.2. Conclusions.....	69
5.3. Recommendations.....	70
5.3.2. Suggestions for further Research.....	71
REFERENCES.....	72
APPENDICES.....	81

LIST OF ABBREVIATIONS

FDGs	-	Focus Group Discussions
GHGs	-	Greenhouse gases
IPCC	-	Intergovernmental Panel on Climate Change
KMD	-	Kenya Meteorological Department
KRCS	-	Kenya Red Cross Society
KNBS	-	Kenya National Bureau of Statistics
LVBC	-	Lake Victoria Basin Commission
NEMA	-	National Environmental Management Authority
NCCAP	-	National Climate Change Action Plan
NCCRS	-	National Climate Change Response Strategy
SPSS	-	Statistical Package for Social Sciences
USA	-	United States of America
USSR	-	United Soviet Socialist Republics
WMO	-	World Meteorological Organization

OPERATIONAL DEFINITION OF TERMS

<i>Adaptation measures</i>	Traditional measures undertaken by individuals in Ahero to adjust to the floods, dry spells, high temperatures, crop failures, and increased diseases brought about by climate change.
<i>Climate change</i>	Increased floods, droughts, diseases and high temperatures in Ahero Irrigation Scheme sub-location.
<i>Cultural perspectives</i>	Indigenous beliefs on, local attitudes about, and sociocultural response strategies for combating climate change in Ahero Irrigation Scheme sub-location.
<i>Cultural groups</i>	Local members of Ahero Irrigation Scheme sub-location.
<i>Mitigation measures</i>	Structural measures undertaken by the people in Ahero to reduce the severity of floods, dry spells, high temperatures, crop failures, and increased disease caused by climate change.
<i>Sociocultural responses</i>	Indigenous strategies used to adapt to and mitigate effects of climate variability and change such as floods, droughts, and variable temperatures.

LIST OF TABLES

Table 4.1.2. Level of education.	38
Table 4.1.4. Respondents' occupation.	39
Table 4.2.1. Folk beliefs and explanations of climate change.	40
Table 4.3.1. Climate change hazards in Ahero Irrigation Scheme.	53
Table 4.4.1(a) Adaptation to flash floods and dry spells.	57
Table 4.4.1(b).Adaption ofagriculture to unusual weather patterns.	61
Table 4.4.2. Short-term mitigation strategies against flash floods and dry spells.	65

LIST OF FIGURES

Figure 1: Map of Muhoroni sub-county showing Ahero Irrigation Scheme sub-location.	30
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LIST OF APPENDICES

Appendix I: Semi-structured Questionnaires for household heads.....	81
Appendix II: Focus Group Discussions Guide.	84
Appendix III: Interviews guide with Key Informants.....	85

CHAPTER ONE: INTRODUCTION

This chapter sets the foundation of the study. It provides the statement of the problem, research questions, research objectives and the theory used in the study.

1.1. Background of the Study

According to World Meteorological Organization (WMO, 2009), about 90 per cent of all weather-related disasters that affect both the developed and developing nations are linked to severe and extreme climate change. Climate change is the process of transformation in meteorological conditions, which include temperatures, precipitation, and wind, that deviate from the established and predictable patterns in a given area. This change is increasingly apparent on the global scale and occasions major alterations in the variables that make up climate and that lasts for an extended period of time approximately ten years (Arbuckle, Prokopy, Haigh, Hobbs, Knoot, Knutson & Widhalm, 2013).

Climate change is caused by both natural and human actions also known as anthropogenic activities. These actions are associated with increased release of carbon dioxide into the atmosphere, leading to the warming of the earth's climate system (Goldstein, 2009). This phenomenon has resulted in major disasters, causing losses to populations and their key economic sectors (Wandiga, 2006).

Cultural perspectives and responses to climate change among indigenous peoples include ethnic religious beliefs, mythologies, and indigenous knowledge of changing weather patterns and seasons (Wildcat, 2014). They also include attitudes, which convey the people's awareness and perception of the phenomenon. The cultural approaches to coping with climate change also include the traditional strategies that people apply to combat hazards occasioned by the phenomenon (Barnes & Dove, 2015). Cumulatively, these perspectives are significant because they bring out the people's held beliefs of both reality and uncertainty, and influence their perception, behaviour and response to phenomena. The indigenous Indians (Krupnik & Jolly, 2012) and Alaskan Natives of USA (Byg & Salick, 2009), for instance, construct and explain climate change through indigenous knowledge on seasonal changes and weather patterns. Their attitudes about the frequency and severity of climate change have led to the perception of the phenomenon as well as

the development of contextualized adaptive and mitigation strategies based on the indigenous knowledge (Salick & Byg, 2007).

In Asia, and particularly Indonesia, climate change is entwined with religious beliefs that revere supernatural beings and deities, and whose infraction can influence its occurrence (Hyndman, 2011). Deep-rooted religious mythologies and beliefs are critical to the regulation of local ecology in the Asian cultures. Therefore, climatic hazards such as typhoons and tsunamis - which are prevalent in that continent, are perceived as punishment by the gods due to the people's desecration of religious principles (Byg & Salick, 2009; Hyndman, 2011). In Bangladesh, an early warning system based on indigenous beliefs has enabled people to reduce losses from typhoons, as they are able to associate with it (Walker & King, 2008). Thus cultural perspectives are important, since they provide a basis for mediating ideologies and solutions for natural phenomena affecting local people.

Across African societies, indigenous knowledge about fauna and flora create diverse meanings of different climate. There has been strong association of climatic conditions with nonhuman organisms, leading to the perception of climate variability as a product of the supernatural (Mbiti, 1969). In Ivory Coast, traditional Zagoue farmers believe that religious conflict between traditionalist and Christian beliefs causes climate change. Accordingly, traditional beliefs about nature preserved local biodiversity and ecosystem through venerated taboos, totems and spirits. On the other hand, Christians denigrated indigenous principles - rendering ancestral spirits powerless and unable to protect the local ecology (Cherif & Greenberg, 2013). Similarly, in Nigeria, the Igbo people associate crop failures that may result from climate change with reduced soil fertility due to lack of protection by ancestral spirits (Nche, 2014).

From the foregoing, nonhuman organisms are constructively pragmatic cultural features with the power to influence natural occurrences such as climate change. The above evidence, however, represents distinct ecological dwellings, landscapes and conditions inhabited and experienced by indigenous peoples that have unique cultural beliefs and practices. Additionally, the worshiping of ancestors in Ivory Coast and Nigeria is a form of African traditional religion whose values are different from those of Kenyans. Most importantly, the revelations reflect perspectives of different cultural contexts and zones

about climate change. Therefore, exploring the subject using this paradigm will provide contextualised insights about how perspectives of the people of Ahero could replicate or differ with those of other people around the globe.

In Kenya, a few empirical studies have examined how people explain climate change using indigenous knowledge. In a study among pastoralists in Isiolo County, Kagunyu, Wandibba & Wanjohi (2016) explored the body of indigenous knowledge used by the local pastoralists to predict climatic conditions. While their study revealed diverse indigenous knowledge that managed to predict climate change-occasioned droughts, it focused on the prediction of seasons by Isiolo cattle keepers who are exclusively pastoralists. Kuria (2009) studied farmers in Kiambu County and established that they attributed climate change to being an act of God. It is evident that indigenous knowledge enables the people to construct meanings and explanations about the climate. However, the explanations by Isiolo pastoralists and Kiambu farmers reflect conditions experienced in different geographical and cultural contexts dissimilar from the Luo who traditionally exhibit different cultural beliefs and practices. Therefore, they are incapable of providing explanations of climate change among the people of Ahero sub-location.

Climate change in Ahero Irrigation sub-location in western Kenya manifests through altered precipitations, desertification, and high temperatures (Ongor, 2007). Empirical studies in the area indicate that the phenomenon has affected people's lives and livelihoods, leading to application of diverse response mechanisms (Obiero, Wa'Munga, Raburu & Okeyo-Owuor, 2012; Ongor, 2007). In a study in Nyando Basin Nyakundi, Mogere, Mwanzo & Yitambe (2010) examined community perceptions and response to flood risks. In examining the indigenous knowledge used to predict floods and associated risks, the study documented the knowledge used to predict floods and response to health risks occasioned by them. In spite of this, Nyakundi et al (2010) study was conducted from a public health and not anthropological perspective. This limited its ability to explore the subject using anthropological theories and paradigms that could show the association of culture and nature to explain flood risks and response mechanisms. Moreover, the indigenous knowledge documented were examined in respect to the way they enhanced the prediction of the local weather patterns and seasons, and not climate change.

Concerning local attitudes, existing literature globally indicate that these inform the people's awareness and perception of the phenomenon. In the USA, Arbuckle et al. (2013) observed that attitudes about climate change were expressed in view of the phenomenon's frequency, severity and impact on lives and livelihoods. Consequently, they engaged practices that enhanced their adaptation. Across Africa, World Bank (2009) examined people's attitudes in three African countries of Kenya, Senegal and Egypt. The report summed up the people's anxieties regarding climate change, at the same time expressing their aspiration towards adaptation and mitigation. In Ahero sub-location literatures have mainly examined how climate change has affected lives and livelihoods in Nyando (Obiero et al., 2012; Raburu et al., 2012). However, they do not explore the people's attitudes towards the phenomenon.

With regard to sociocultural adaptation strategies, studies across the world indicate that indigenous peoples use these strategies to manage effects of climate change (Byg & Salick, 2009). The indigenous Indians of the USA use indigenous adaptation strategies informed by knowledge of weather patterns and seasonal changes to combat climate change (Krupnik & Jolly, 2012). In Bangladesh, Walker & King (2008) observed that indigenous strategies have enabled the people to reduce the negative impact of typhoons.

Across African societies, sociocultural adaptation strategies are widely used in the management of climate change effects such as floods and droughts (Nyong et al., 2007; Dube & Sekwela, 2008; Salick & Byg, 2007). The situation might be reflected in Kenya where peoples variably apply different indigenous strategies based on experiences of their climatic conditions. Kagunyu et al. (2016) observed that Isiolo pastoralists used diverse indigenous adaptation strategies to promote their pastoralism. The breakdown of the indigenous beliefs and cultural structures has created the misconception that indigenous strategies are no longer necessary. And, that therefore the people should be provided with modern adaptation mechanisms to assist in the management of natural phenomena such as climate change. This maybe accounts for the non-consideration of cultural perspectives and strategies during development of modern adaptation and mitigation strategies against climate change.

In Ahero sub-location, empirical studies have not examined how sociocultural adaptation strategies have facilitated adaptation and mitigation of climate change. The studies

conducted in Nyando (Raburu et al., 2012; Obiero et al., 2012; Ongor, 2007) have examined how the people try to combat the impacts brought about by climate change. This is analysed in view of modern adaptation strategies codified into formal national policies such as National Climate Change Response Strategy (NCCRS) (2010), the National Climate Change Action Plan (NCCAP 2013-2017), and the National Climate Change Framework Policy (2014) (Republic of Kenya, 2014).

Although the legal frameworks have promoted national interventions to climate change, they are limited in cultural respects in two ways. Firstly, they have not conceptualised how sociocultural adaptation strategies could contribute to modern adaptation strategies of managing climate change. This is because most local communities frame their ecological adaptation and mitigation of adverse climatic effects based on their local experiences and practices (Salick & Byg, 2007). Additionally, the strategies have not envisioned a model by which these sociocultural strategies may be incorporated in the modern strategies. Furthermore, it is not examined how sociocultural adaptation strategies might inform modern strategies to encourage their acceptance, thereby contributing to life sustenance. This study, therefore, sought to examine the way cultural perspectives and responses help in the explanation and management of climate change using an anthropological theoretical framework.

1.1.1. Climate change and the Ahero sub-location cultural context

Ahero Irrigation Scheme sub-location is inhabited by mainly the Luo people, with a few non-Luo speakers. The Luo according to Ochieng' (1985) are Nilotes whose native land is traced around Wau, along the rivers of Sue and Jur in the grassland plains of Bahr-el-Ghazal province of Sudan. The Luo subsist on peasant fish farming and agro-pastoralism (Obiero, Wa'Munga, Raburu & Okeyo-Owuor, 2012).

The traditional Luo practiced African religion whereby ancestors and forebears are revered. They also held prayers in shrines in addition to offering sacrifices through ritual ceremonies (Cohen & Odhiambo, 1989; Ocholla-Ayayo, 1976). However, there have been changes in the traditional belief systems due to the influence of universal religion and formal education. This coupled with the confluence of climate change disasters, including floods and dry spells have diminished productive activities, destroyed traditional sites and indigenous trees associated with ancestral spirits and other

indigenous social practices and systems, although, there are some community members who still believe in African traditional religion.

1.2. Statement of the Problem

Literature abounds that indigenous peoples construct and explain climate change through indigenous beliefs and knowledge. This contextualised projection of the phenomenon leads to the expression of local attitudes indicative of how climate change evolves and affects the people in their ecology. Consequently, the confluence of indigenous beliefs and local attitudes enhances the development of sociocultural adaptation strategies towards climate change. In spite of this, climate change is steeped in scientific equations, with little local ideologies being explored in the country. This includes the under-representation of indigenous beliefs, local attitudes and sociocultural adaptation mechanisms that could facilitate the management of climate change. The inability to examine how indigenous beliefs influence the way people construct and explain climate change has limited the understanding of how these elements shape the local explanations of the phenomenon. As such, it is not known how the beliefs feed into the nature of attitudes that are expressed by the people to create perceptions of the phenomenon and environment. Hence, it is unclear how the sociocultural adaptation strategies generated through the intersection of indigenous beliefs and local attitudes facilitate adaptation and mitigation of climate change.

1.3. Research Questions

- (i) How do indigenous beliefs shape local explanations of climate change in Ahero Irrigation Scheme sub-location?
- (ii) What local attitudes are reflected in expressions of the phenomenon of climate change in Ahero Irrigation Scheme sub-location?
- (iii) How have sociocultural strategies facilitated adaptation to and mitigation of climate change in Ahero Irrigation Scheme sub-location?

1.4. Study Objectives

1.4.1. General Objective

The general objective of the study was to examine the cultural perspectives on climate change and the management of its effects in Ahero Irrigation Scheme sub-location in Western Kenya.

1.4.2. Specific Objectives

The specific objectives of the study were:

- (i) To analyse how indigenous beliefs shape local explanation of climate change in Ahero Irrigation Scheme.
- (ii) Examine the local attitudes to manifestations of climate change in Ahero Irrigation Scheme
- (iii) Explore sociocultural adaptation and mitigation strategies in response to climate change in Ahero Irrigation Scheme.

1.5. Justification of the Study

The lack of anthropological studies on cultural perspectives and response strategies that enable the construction, explanation, expression and management of climate change in Ahero Irrigation sub-location necessitated this study. Moreover, it was inspired by the supposed failure of modern strategies to consider sociocultural expertise that could enhance management of climate change. The study contributes to the wider body of the role of cultural perspectives on the environmental changes and livelihood. The findings are a contribution to the ecological anthropology knowledge, which is relevant to the frameworks in Kenya, the National Climate Change Framework Policy (2014). This study is justified on the global macro issue of climate change in that it shows how distinctive cultures across the world shape the phenomenon of climate change, and the specific strategies they adopt to adapt to the problem. Hence this study complements other similar studies for global comparative ethnography of climate change and related coping issues. It underscores the priority of cultural perspectives to inform modern adaptation and mitigation policies, programmes and strategies if sustainable adaptation strategies are to be realized among indigenous peoples.

1.6. Scope of the Study

The study was conducted among residents of Ahero Irrigation Scheme sub-location to describe the cultural perspectives on and responses to climate change. It sought to show how the local people construct, explain, express and cope with the effects of climate change. It was concerned with the perceptible indigenous beliefs and observable sociocultural strategies used in management of climate change.

1.7. Theoretical Framework

This study is guided by cultural ecology theory by Julian Steward (1955) and later elaborated by Krupnik & Jolly (2002) and Salick & Byg (2007). Ecology means adaptation to environment (Steward, 1955). Cultural ecology is the study of the “ways in which patterns of a culture serve to adapt human groups to the difficulties posed by their environment” (Whitten & Hunter, 1990: 200). Cultural ecology theory holds that there is a universal pattern within the society that consists of three major divisions: infrastructure, structure and superstructure (Steward, 1955).

According to Harris (1991), ‘infrastructure’ is the chief interface between a sociocultural system and its environment representing the exploitative or productive technology that includes an essential part called “material culture”. This aids the production of food, shelter, and tools within a given environment. Steward postulated the concept of ‘culture cores’ and defined them as constellation of cultural features that are most closely associated with subsistence practices and economic arrangements. Although infrastructure represents the core of cultural features of modifying subsistence resources and reproduction, developments in agricultural and medical technologies which are the patterns of realizing some of these biological functions - cannot be achieved through similar sequence.

The ‘structure’ refers to how people organise themselves in the society for economic or political activities, group life, allocation, regulation and exchange of goods and labour. The notable aspect of structure is that different societies organise themselves and their practices differently. Indigenous peoples in developed societies, for instance, have more sophisticated means of organisation than people from less developed ones. This therefore makes the structure of the people in such places distinct in terms of designing their dwelling and economic production that shape their engagement with the ecology. Locally, the significance of the family system provides a great basis of major social decisions including activities towards managing local environment.

The ‘superstructure’ consists of the cultural and mental features, which guide people through their production and organization. Elements of the superstructure include religious beliefs, intellectual capabilities, traditions and values. The superstructure presents culture as a system of mutually reinforcing practices backed by a set of attitudes

and values. These happen within the gambit of ecological adaptations that people make in respect of the changing environmental conditions. The cultural ecology theory sees sociocultural institutions of populations as adaptive processes to their surrounding environment, meaning that cultural ecological adaptations are by themselves creative processes (Steward, 1955). Thus, the infrastructure determines the structure, which in turn determines the cultural and mental superstructure (Harris, 1991). It is through the infrastructural practices that a society adapts to its environment and survives whatever environmental calamities.

Cultural ecology theory was used by ecological anthropologists such as Rappaport (1967) and Little & Leslie (1999) to investigate how individuals modify their activities in respect to the changing environment in order to promote their adaptation. Rappaport (1967) studied the way the Tsembaga people of New Guinea who were bush-fallowing horticulturalists used the ritual of pigs to adapt to their ecology. Using cultural ecology theory, Krupnik & Jolly (2002) observed that indigenous people in Alaska in the US and Nuwanut in Canada used indigenous knowledge such as the diversification of their agricultural techniques, food processing strategies to respond to climate change. The people also migrated to less susceptible areas; modified their food consumption behaviours; food exchanges, and resource management. Salick & Byg (2007) also observed that due to changes in precipitation, farmers in Kalahari Desert have shifted their agriculture from rain-fed to manually watered homestead gardening, in addition to replacing cattle rearing with goats. Leslie & McCabe (2013) study investigating how the semi-nomadic Kisingo Maasai of Tanzania have coped with their changing ecology – revealed the diversification of livelihood through adoption of agriculture and labour migration. The risk to the semi nomadic life has witnessed the introduction of crop cultivation carried out both in small-scale and large-scale depending on the season and weather patterns.

One of the major challenges encountered by earlier studies which used cultural ecology theory was the failure to adequately account for how certain cultures could evolve fast to address ecological changes as opposed to other cultures. This justified exploring how certain aspects of cultures could promote inventions towards managing environmental changes so as to enhance ecological sustenance.

Little & Leslie (1999) examined how the nomadic Ngisonyoka Turkana of Kenya coped with the droughts that are prevalent in their ecology. Through the South Turkana Ecosystem Project (STEP) of the 1980s and 1990s, they found that the Turkana adopted different herding strategies, which included extensive mobility and herd diversity. They moved their livestock in temporal and spatial variability of rainfall and consequent forage. This encompassed migrating the herds to areas of higher primary productivity as the dry season advanced and vegetation dried up and returning once the rains had come.

1.7.1. Relevance of Cultural Ecology Theory to the study

In line with each objective, cultural ecology theory was justified since it enabled the investigation of the indigenous beliefs embedded in the people's culture used to construct and explain climate change. This is because climate change has caused major ecological imbalances to the people and their cultural systems. Specifically, changes in weather patterns have altered the people's productive activities and general dwelling, leaving them vulnerable. Secondly, the theory aided the exploration of the attitudes that reflect the people's cultural perception of climate change as it transforms their local ecology in terms of dwelling, landscapes and livelihoods. Therefore, it was essential to establish how the society continually engages with its ecology to creatively develop flexible and pragmatic adaptive strategies for their sustenance.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews relevant literature on cultural perspectives and climate change across the world. It examines ethnographies about indigenous beliefs that shape the way people interpret and explain climate change; people's attitudes regarding the phenomenon of climate change; and sociocultural response strategies to cope with effects of climate change.

2.1. Overview of Climate change across the world

Climate change is a global phenomenon associated with alteration of weather conditions, which has occasioned major disasters affecting many populations. It results from both natural factors and human actions, especially increased carbon dioxide emission into the atmosphere, leading to warming of the climate (Cubasch et al., 2013). In Asia, the phenomenon has manifested through floods, typhoons, tsunamis, and storms; in North America, climate change has been experienced through increased hurricanes, storms, ice melts, and heat waves; in Europe, the frequency of permafrost, heat waves, floods, ice melts has signalled increasing climate change (Giddens, 2009; Goldstein, 2009; Maharjan & Joshi, 2013; Walker & King, 2008).

Across the African arid regions, such as the Sahel region, climate change has caused increased droughts and extended dry spells leading to the destruction of livelihoods (Nyong et al., 2007). Conversely, in the areas near water bodies, such as the Lake Victoria Basin of East Africa, climate change manifests itself in increased floods, droughts and human diseases (Mwiturubani, 2009; Wandiga, 2006). Correspondingly, climate change in Kenya has caused increased desertification, altered precipitation, high temperatures, and rises in ocean levels. In Ahero Irrigation Scheme sub-location, climate change contributes to increased incidence of floods, droughts, high temperatures, and increased diseases (Nyakundi et al., 2010; Obiero et al., 2012).

2.1.1. Indigenous beliefs and knowledge on Climate Change

Belief systems are doctrines of a culture passed down to a society's younger members by their ancestors. Indigenous beliefs are sort of creed that facilitate expression of experience. Together with customs, mores, folkways, superstitions, taboos, traditions, indigenous religion and education, and the family, beliefs form the people's cultural institutions. Beliefs are part of systems of thought and action; and they are deeply

embedded in all cultures where they shape people's perceptions about phenomena, reflect the locals' real world and communicate their world views (Crona, Wutich, Brewis & Gartin, 2013). Beliefs are very critical, as they influence how people interpret incidents that happen around them (Barnes et al., 2013; Crate, 2011).

Indigenous beliefs have greatly influenced local people's opinions on the existence, immediacy and seriousness of climate change across the world (Crona et al., 2013; Cherif & Greenberg, 2013; Nche, 2014; Scruggs & Benegal, 2012). Indigenous peoples across the world are conversant with and keen observers of their ecology. They apply indigenous beliefs and knowledge based on the observation of the weather trends and seasonal changes to anticipate climate variability and change (Krupnik & Jolly, 2002; Salick & Byg 2007). Environmental beliefs are reflected in indigenous religions, myths, and superstitions, which feature in local languages and related biodiversity narratives and explanation of climate change. McDonald, Arragutainaq & Novalinga (1997) found that the Inuit and Cree in Canada explained climate change through the observation of changes of weather conditions and patterns of snow and sea-ice. A study by Krupnik & Jolly (2002) among the indigenous Alaska peoples of North America indicated that the people also interpreted climate change through the observation of the changes of weather patterns.

Indigenous knowledge, which arguably provided accurate information on the climate variability and change, inspired the indigenous Alaska community members to hold in great regard the teachings of the elders about the natural environment. The elders provided traditional stories of biophysical and spiritual ties between people and nature (Cochran et al., 2013). Therefore, "local knowledge can promote the understanding of climate change and its impacts - because local people's observations are themselves embedded in the local cultural and social context that is important in shaping the outcome of environmental changes" (Byg & Salick, 2009:156).

From the foregoing, the shared indigenous knowledge expands the way evolving natural phenomena can be constructed and perceived to communicate the local worldviews. The knowledge of weather patterns and seasons proves to be significant in formulating and anticipating climatic trends. However, the body of knowledge on weather and seasonal patterns of the Inuit, Cree and Alaskan presents the unfolding experiences of climatic

phenomena among the indigenous peoples of the developed world. This finding could be not be generalised to the African societies due to the variability in the people's ecological contexts, and the diversity of cultural beliefs and practices.

In Asia, spiritual myths shape the broader cosmologies of nature and environment. The people believe that desecration of the mythical god known as *Naga* through mankind's carelessness and disrespectfulness towards nature and environment would lead to suffering and negative outcomes to the society (Huynh, Lin, Neiss, Occena & Tran, 2014: 246). Byg & Salick (2009) in a study of local perspectives on climate change among the Tibetans of China found that their cosmology was imbued with spiritual manifestation. The traditional Tibetans consider the landscape features such as mountain peaks, glaciers, and waterfalls as endowed with both spiritual values of different deities and spirits. Within their ecological cosmology, poor harvests were associated with violation of taboos such as people hunting or collecting medicinal plants on sacred mountain sites.

The Tibetans also attributed the scarcity of rain to a hydroelectric power company, which supposedly angered the mountain deities by dynamiting the mountains. Additionally, the influx of foreigners was conceived as contributing to climate change. The unapproved actions of the foreigners towards the local environment advanced a perspective that labelled tourists as polluters of sacred sites and features. Specifically foreign tourists carelessly and disrespectfully dumped plastic garbage, which was construed to be desecration of sacred areas. The result of this human infraction could be revealed in the negative reaction of the nonhuman organisms such as deities who would presumably get angry and cause changes in the climate. Thus, the Tibetans believe that climate change vulnerability is spiritually caused, and that annoying the mountain gods causes disruptions in the climate patterns (Byg & Salick, 2009; Maharjan & Joshi, 2013).

Hyndman (2011) in a study of tsunami disaster in Indonesia established that myths and religion were major elements through which people explained a disaster. Her ethnography among the Aceh discovered a myth regarding dressing of the females prior to a disaster. She established that Islamic theologians also known as *ulamas* in the indigenous language blamed 2004 tsunami disaster on the women's immoral and inappropriate dressing, which lacked modesty. In Iran, a senior cleric also blamed women's immodest dress for earth

quakes, among them the disaster in Bam in 2003 (Associated Press, 2010; cited in Hyndman, 2011:21).

The aforementioned instances provide a deeply inseparable ontology of the myths on nature that account for the changing environment. Although the Aceh and Iranian mythologies on females in relation to climate change could be inaccurate, they underline the patriarchal sociocultural constructions about the critical subject of gender and religion, and the underlying moral and ethical values that are expected to guide women during different times of environmental disasters. As such, indigenous beliefs, myths and religion can provide a unique outlook by which indigenous people view and interpret the origin of environmental phenomena that unfold in their respective contexts. Whereas the Tibetan and Aceh studies highlight insightful mythologies and indigenous beliefs on climate change as predicated on the local indigenous religion, the relevance of these deities cannot be reproduced in other societies. The worship of deities is a form of traditional religion, which is non-universal and, therefore, applicable to situated cultural contexts.

Local worldviews often reflect local concerns (Byg & Salick, 2009), which means that local explanations and worldviews of African peoples can unveil lessons and meanings of climate change in their contexts. Indigenous beliefs on climate change in Africa are attached to the distinctive spiritual beliefs, taboos and ancestral values; and failure to honour these cultural systems could cause the phenomenon (Cherif & Greenberg, 2013). This direct link between climatic hazards and social constructions shows the relationship between the nonhuman world to human psychological and religious predispositions. Thus, the advancement of indigenous beliefs as a causal explanation to environmental changes provides a deeply embedded connection between nature and society.

Cherig & Greenberg (2013) studied Zagoue farmers in Ivory Coast, who are traditionalists and believe in the protective power of the spirits to the local climate. They observe that the farmers allot a soul to animals, plants, phenomena, and natural objects. These are animated by spirits, which dwell in sacred forests and rivers. The traditional farmers, therefore, preserve the biodiversity and ecosystem through totems, taboos, and spirits. They (traditionalists) blame the Christians for dishonouring the community's sacred forests, taboos, forbidden foods and totems - actions that annoy the spirits resulting

in drought. Conversely, the Christians dispute the beliefs of the traditionalists and accuse them for crop failures; as to them this signifies the approaching Apocalypse (Cherif & Greenberg, 2013). Therefore, the Zagoue people believe that climate change is caused by the religious conflict between traditionalist and Christian beliefs. The traditionalists' attachment to the sacred sites, taboos, totems and spirits provides a local worldview in which social and cultural beliefs and spirits protect the people and local climate.

Climate change has affected African belief systems associated with livelihood and religious practices (Nche, 2014). The key aspects that have been negatively impacted include soil fertility, traditional religious festivals and ceremonies, traditional music and songs, and traditional medicine. The Igbo of Nigeria, for instance, have a strong belief in the ancestral spirits as the source of soil fertility and agricultural richness. Thus a phenomenon resulting in crop failure is interpreted by the people as an effect of "breach of the peaceful relationship between the living and spirit being" (Nche, 2014:4). The spectre of reduced crop yields has limited the practice of ceremonies and festivals to celebrate bountiful harvests. Nche (2014) observes further that in Nigeria all forms of festivals, that is, festivals associated with ecological cycle; those related to non-ecological liturgical calendars; festivals of the human cycle; and occasional ones are held in appreciation of the "supernatural for the blessings and benevolent acts in nature" (Nche, 2014:5). However, climatic hazards such as floods have destroyed some traditional religious elements such as shrines and statues.

Traditional religion encompasses perspectives on the link between important sociocultural elements and the physical and landscape features. This entails reverence of biodiversity including forests, indigenous tree species, spirits and deities, and religious ceremonies and sacrifices (Mbiti, 1969). These complete the religious cycle of a society, and failure to adhere to them could trigger adverse sociocultural and environmental problems. During periods of droughts in traditional African societies, offerings and sacrifices were made in order to enable the God cause rain. Rainmakers were reported in all parts of Africa. They were important in times of natural calamities such as droughts, floods, famine or epidemic, where they "solicited God's help in providing rain, or in halting it if too much falls" (Mbiti, 1969:53). However, the entrenchment of universal religion has affected certain indigenous systems, which were essential in the traditional interpretation of climate variability.

Diverse cultural beliefs and practices among the African peoples have led to different forms of climate interpretation (Cherig & Greenberg, 2013). The expanding indigenous knowledge systems, which affirm the engagement of human and nonhuman organisms, have necessitated an ontological construction expressive of the evolving ecology. Thus indigenous beliefs, taboos, totems, and respect for sacred sites show how productive activities could be limited through the interaction of nature and society or environment and culture (Nche, 2014). However, with the adoption of modern meteorological technologies of predicting weather it could be inadequate to rely on indigenous practices to provide accurate weather and seasonal forecasting. It is, therefore, imperative for stakeholders in the climate change discourse to understand how perceptions about the breach of relationships between the living and the spirit being could directly cause environmental disasters in the contemporary world marked by modern meteorological and agricultural technologies.

The study among Zagoue farmers (Cherif & Greenberg, 2013) has explicated the interconnection between indigenous religious beliefs and drought, showing how infraction of the religious principles could lead to drought. Whereas this study clearly showed the perceived negative human activities, which could cause drought, it did not explore the causal factors for the continued practice of the traditional religious beliefs associated with appeasement of the spirit world in view of widespread universal religions.

In Kenya, climate change and its effects on the economy and other major sectors have been widely explored (Kuria, 2009; Macharia et al., 2012; Ogalleh et al., 2012; Wandiga, 2006). With increased floods, droughts, and rises in ocean levels in different parts of the country, major sectors such as agriculture, livestock keeping and fishing, transport and infrastructure, environment, water and forestry, trade; extractive industries; energy; tourism and health have been affected (Republic of Kenya, 2010, 2013, 2014). Kuria (2009) examined the effect of climate change on agriculture among farmers around Kereita Forest in Kiambu County and found that reduced rainfall and increased diseases and pests have led to crop failures.

In his cursory exploration of the cultural perspectives associated with climate change, (Kuria, 2009) revealed the influence of the supernatural and man-made conditions. The

supernatural factors included the people's religious and superstitious beliefs attached to nature. Specifically, climate change was believed to result from the people's corrupted ways of worship, which violated proper religious teachings and principles. On the other hand, local superstitions linked the occurrence of climate change to the introduction of foreign tree species such as eucalyptus. This perspective reinforced the people's knowledge about sociocultural significance of local natural resources such as indigenous forests, trees and features in the preservation of the local climate. Similarly, Ogalleh et al. (2012) in a study in Laikipia district found that farmers explained climate change in terms of their indigenous knowledge about rainfall patterns and seasonal changes. They observed that in the past rainfall was regular with predictable seasons as opposed to today. Noting that droughts had also increased, they held that the droughts were caused by supernatural forces, hence acts of God.

The anthropomorphic characterisation of climatic variability to culture among contemporary Kenyan communities could be inferred in the deeper connection of nature and society. According to Akong'a (1987), rainmakers (prophets) conducted rainfall rituals to influence weather conditions in order to cause rain or drought. The practice was based on human ability to make it rain. The prophets were men of foresight who used not magic but spirit or ancestral possession to pronounce the expected amount of rainfall. In a study in Kitui district, he observed that the ritual of rainmaking following experiences of inadequate rainfall interconnected the natural phenomenon with the social- human acts/cause. The ritual included a sacrifice of a ram to ancestral spirits so that they could bring rain. Similar to Kitui, rainmaking ritual was also performed in Bunyore in Western Kenya in times of drought besides other big occasions such as funeral service, wedding ceremony or political rally. Failure to offer sacrifices and offerings can annoy the ancestors, thus leading to destruction of livelihoods such as crop production through climatic hazards droughts (Akong'a, 1987:81).

From the above studies, it is evident that different communities across the country exhibit cultural perspectives that explain their ecological phenomena. However, they exemplify unique indigenous beliefs and practices of their cultural contexts. Therefore, this study sought to examine the cultural perspectives of the Luo inhabitants and the way these help in the explanation and response to their climatic conditions.

Climate change in Ahero Irrigation Scheme sub-location has manifested through altered precipitations, desertification, and high temperatures. These conditions have led to frequent and intense floods and droughts (Republic of Kenya, 2010, 2013, 2014). Obiero et al. (2012) observe that flash flooding by River Nyando has increased due to climate change. Inversely, droughts due to failing rains have led to the drying of formerly permanent rivers such as river Ombeyi, Atoyiengo, Nyalbiego and Obuso. The interspersing climatic conditions have affected productive activities and human dwellings.

Nyakundi et al. (2010) examined the perceptions of people on floods in Nyando district and how they coped with them over time. The study showed that the people used indigenous knowledge to predict floods. The memorable array of indigenous knowledge included interpretive behaviour of human bodies. For instance, the onset of rainfall was interpreted through the aching bones of old people. When rains were about to begin, an old person who had earlier hurt himself/herself would feel a “trigger” of pain at the same spot. Similarly, the people also site large numbers of cow egrets, loud distraught noises of domestic animals, and movement of ants to higher grounds. The above signals not only inspired the people to prepare farms for the planting season but also enabled them to rightly predict and manage natural disasters. However, the efficacy of these knowledge estimations could be unreliable due to the interference of the people’s cultural beliefs with modern religious beliefs. Moreover, the influence of modern meteorological technologies of predicting weather conditions could render the indigenous predictable techniques unrealistic.

Wandiga (2006) examined the evolving health risks that have beset the people in the larger Lake Victoria region, including Nyando Basin. His study was least concerned about cultural perspectives, but it showed how variable human diseases such as malaria and cholera occasioned by climate change have caused major human suffering. Nyakundi et al (2010) and Wandiga (2006) studies were conducted from a public health and not anthropological perspective. It is presumable that the study on community perception and response to flood risks did not examine the applicability of indigenous beliefs and knowledge through anthropological theoretical framework. This is the gap this study sought to fill. It endeavoured to examine the way cultural perspectives, including indigenous beliefs, knowledge and supernatural perspectives using anthropological theory

explain climate change. This could show how cultural perspectives may influence the people's behaviours, leading to actions that enhance their adaptation to climatic hazards.

2.2. Local Attitudes about Climate Change

Cross-cultural attitudes about climate change are expressed through views and feelings on the severity, frequency and prevalence of the phenomenon (IPCC, 2014). The attitudes communicate the people's feelings about a phenomenon and provide a template and the general terms of the broader local epistemologies that characterize it. Global levels of belief and local conception of climate change vary among indigenous and educated people.

The scientific models of describing climate change such as natural and anthropogenic causes influenced the majority of educated people as opposed to the people without formal education in USA (Myers et al., 2012). This perception is greatly influenced by the world's mass media that debate on the reality, occurrence and seriousness of climate change (Barnes & Dove, 2015; Scruggs & Benegal, 2012). Specifically, the contestations between the conservative groups also known as "sceptics" or "deniers" and "believers" of climate change play a major role in how people perceive the phenomenon (Scruggs & Benegal, 2012). On the one hand, the "sceptics" dissuade people against the reality of climate change. They deny that anthropogenic activities such as burning fossil fuels exacerbate global warming leading to climate change. To them "modern warming is moderate and not man-made"... and that "the world climate has always been in a flux"; therefore the risks and dangers being reported are exaggerated (Giddens, 2009: 23-26). On the other hand, the "believers" who observe that nations are emitting more greenhouse gases (GHGs) into the atmosphere, leading to increased global warming (Walker and King, 2008; Giddens, 2009; Cubasch et al., 2013).

The ideological split between "sceptics" and "believers" on the correlation of anthropogenic activities regarding global warming have caused scepticism and misconception concerning the reality of climate change amongst Americans. As such, they continue to hold misconceptions about climate change as "a problem distant in time and space" and a phenomenon whose manifestations and impacts will not affect their localities (Myers et al., 2012:343). In addition, a small minority of the Americans regard

climate change as a deliberate political conspiracy (Leiserowitz et al., 2013; Myers et al., 2012; Scruggs & Benegal, 2012).

Nakashima et al (2012) noted that among the indigenous peoples, their attitudes are communicated through opinions about the intensity, frequency and severity of climatic hazards. They also express their attitudes by interpreting local weather forecasts, timing and quantity of rains, and the size of harvests. Specifically, among the Concaac people of Northern Mexico, Yarabana of Venezuela and the Tukano of Columbia – indigenous communities, their attitudes about climate change were shaped by knowledge of local biodiversity, experiences of seasonal changes and alterations in weather patterns. Vedwan (2006) noted that apple farmers in Western Himalaya, India, perceived the occurrence of climate change through observation of the meteorological record and seasonal changes. The phenomenon has been presented by the frequency and severity of snow. Due to frequent snow, the apple crops have been failing, highlighting the severity of climate change.

People also express attitudes about climate change with regard to its effects on their lives and livelihoods, and the steps they take to adapt to the conditions. Wildcat (2014) noted that indigenous people's awareness of climate change and possible adaptation strategies to redress its effects are borne of practical life way exigencies and expectations accumulated over long periods of time in particular places where home is identified with ecosystems and natural environments. Therefore, people engage in adaptation and mitigation towards climate change depending on the way it affected their productive activities. Arbuckle et al. (2013) observed that due to extreme effect of climate change on agriculture, American farmers who believed that climate change was caused by anthropogenic activities were most likely to initiate pragmatic adaptation measures unlike those who did not. In Argentina and Mexico, the local farmers sceptically received adaptation measures. Mexican farmers in particular resisted experimenting with government-funded programmes of planting baffle grass for non-traditional livestock and adoption of crop insurance, as they were perceived as unreliable. Similarly, farmers in Argentina rejected state interventions viewing them as unpredictable (Wehbe et al., 2008).

From the preceding studies, attitudes could express recognition of climate change, including its immediacy, seriousness, and impact to lives and livelihoods. Myers et al (2012) emphasised attitudes as being influenced by scientific models of climate change, which is common of the elite of the developed world and ignored the perspectives of poor indigenous people. Yet climate change is most serious amongst indigenous groups who are also the poorest. In emphasising scientific explanations of the western elite, the study presumably disregarded the possible existence of educated indigenous peoples who could be still seized of their indigenous beliefs and knowledge to construct and perceive climate change. The elite of the western world were influenced by external forces such as the media and experts. Conversely, to the Latin Americans and Indians, climate change was widely conditioned by indigenous knowledge of the changes in the local weather patterns, biodiversity and ecosystem.

The studies reviewed represent expressions of climate change in the developed world, which might not depict those experienced in the African context. Conversely, research on local attitudes about climate change has not received much attention in Kenya and the rest of Africa. The available studies have focused on the people's estimation of the scales of the climatic hazards, and the extent to which they affect their lives and livelihoods (Nche, 2014; Nyong et al., 2007). In the Sahel region, Nyong et al. (2007) noted that the spectre of droughts to the people's agriculture exacerbated their anxiety about climate change. Mwiturubani (2009) observed that in Tanzania climate change has affected settlement, local biodiversity, agriculture and other key economic sectors. The destruction of livelihoods increased the people's distress about the phenomenon, reinforcing their deep concern about it.

A study by the World Bank (2009) on public attitudes towards climate change found that approximately 75 per cent of Kenyans believed that climate change is a serious problem. This was in view of the phenomenon's threat to the people's lives. Further, their attitudes on the countries' international cooperation and management of the phenomenon showed 79 per cent of the sample in Kenya thought that if the country took steps to cut emissions other countries would be more willing to act. This was relative to the attitude levels reported in other African countries such as Senegal and Egypt (World Bank Development Report, 2009). Such findings are important as they reflect the people's anxiety of climate

change. Therefore, they could be instrumental in framing adaptation policies given their contextual expression of the experienced conditions.

Wandiga (2006) noted that within the Lake Victoria Basin evidence of increased diseases contributes to the fear of climate change. The finding was mirrored later in a study by Obiero et al. (2012) in the River Nyando Basin, which showed that flash floods and droughts had become common and severe. These were a major threat to the people's settlement and economic activities. In view of the foregoing studies, it is notable that local attitudes shape the people's recognition of and reaction towards climate change. This consequently informs the way they frame their response strategies. However, the studies seemed to be concerned with the people's attitudes towards large-scale anthropogenic activities such as industrial gas emissions. The focus on macro elements that occasion climate change supposedly ignored micro practices such as local land tenure systems, local indigenous farming technologies and landscape practices that could interfere with the local biodiversity and ecosystem. That is what this study sought to complete by showing how people's attitudes regarding micro elements informs their expression of climate change.

2.3. Sociocultural response strategies to climate change

The subjects of climate change and appropriate response systems are part of a big debate about adaptation and mitigation in the world today. This is because climate change hazards have become frequent and severe, resulting into destruction of more human lives. For people to adequately respond to climate change, they require adequate information about it, its causes, indicators and risks. Risk perception affects public policy depending on how people view the risks, leading to misunderstanding, neglect or opposition of policy (Maharjan & Joshi, 2013).

The strategies promoted by most global organisations for adaptation to and mitigation of climate change impacts seemingly are informed by the scope and nature of climatic hazards. According to Goldstein (2009:54), the adaptation strategies include; “strengthening transportation infrastructure and buildings, constructing flood barriers for major coasts and coastal cities, restructuring water supply systems for conservation, overhauling agriculture to conform to new climate conditions, and establishing a nation-wide disaster and health emergency system”. Other strategies to mitigate the impact of

climate change involve replacing fossil fuels (coal, oil and gas) with renewable energy sources, undertaking advancements in transport to reduce pollution; promoting technologies in energy use and generation; carbon capture and storage; solar heating; use of geothermal energy; bioenergy, nuclear power (fission); use of wind energy; and solar photovoltaic (solar panels) (Giddens, 2009; Walker & King, 2008). These technologies provide sustainable solutions to climatic hazards since the technologies are both accessible financially and affordable.

Whereas macro solutions can offer sustainable solutions to climate change, they might not be applicable to all societies unless they are contextualized to the local ecologies and the climatic hazards experienced there. Barnes & Dove (2015) note that all societies around the globe observe and respond to on-going changes in their weather, climate, and landscapes. Therefore, it is important to take into consideration the nature and scale of the different climatic conditions besetting diverse environments. Although climate change seems to be a much recent phenomenon, adaptation and mitigation against variability and hazards have been in existence. Traditional societies used and continue to adapt to the changing environment using traditional knowledge and technologies over time. Thus climatic hazards, changes of weather patterns and seasons in indigenous societies have led to the use of traditional technologies and practices to redress these negative effects of climate change. Dube & Sekhwela (2009) codify traditional technologies and practices as indigenous skills and developments informed by traditions and customs that are used to reduce the potential of environmental changes. These include rules regulating the use and management of natural resources, laws prohibiting interference with certain indigenous trees and forests.

Krupnik & Jolly (2002) observed that indigenous people in Alaska in the US and Nuwanut in Canada used indigenous knowledge such as the diversification of their agricultural techniques, and food processing strategies to respond to climate change. The people also migrated to less susceptible areas, modified their food consumption behaviours, food exchanges, and resource management. The Makushi people of Guyana have always moved from their savannah homes to forest areas during droughts (Salick & Byg, 2007). They also plant cassava (their main staple crop) on moist floodplains normally too wet for the crop. When temperatures rise, the peoples resort to cultivate crops at higher elevations on the mountains. Arragutainaq and Novalinga (1997) noted that the Inuit and Cree

indigenous communities of Canada adapted to their environment using knowledge on changes on snow and sea-ice. By observing the changes in snow, they have modified their livelihood means such as hunting, fishing, trapping, and gathering. Indeed, the use of indigenous information and a wide range of "indicators" often based on animal behaviour have enabled them to record, map, and articulate explanations for the climatic changes they see occurring.

Walker & King (2008) noted that the phenomenon of typhoons both convinced the Bangladeshis that climate change is real and also signalled failure of modern adaptation and mitigation strategies. As a result, the Bangladesh government in conjunction with the World Meteorological Organization (WMO) developed an early warning system about the appearance of the typhoon based on the indigenous knowledge. The first step involves WMO issuing a warning that a severe storm is approaching. Then men on bicycles with whistles relay the information to the local people, who have been drilled to move to higher ground or to high-rise shelters in order to avoid the storm. The strategy has been successful reducing typhoon-caused deaths (Walker & King, 2008). The efficacy of this indigenous strategy, in my view, hinges on two possibilities. Firstly, it grows on the evolving enskilment generated through enlivening indigenous culture, in which the people find a critical ethos to preserve. And, secondly, it negotiates within the reflexive re-enactment of the local social practice as a realistic way of insuring sustenance. This is something that most global adaptation strategies developed based on large-scale anthropogenic activities to global warming probably tend to ignore.

In Africa, the spectre of droughts has greatly affected nomadic pastoralism (Birch & Grahn, 2007). This has seen a constant evolution of the practice in order to enhance the people's adaptation. In Nigeria, Niger and Senegal, pastoralists used mobility, herd stratification, livestock loans and gifts, diversification of species and livelihoods to cope with erratic rainfall (Birch & Grahn, 2007). Due to changes in precipitation, farmers in Kalahari Desert have shifted their agriculture from rain-fed to manually watered homestead gardening, in addition to replacing cattle rearing with goats (Salick & Byg, 2007). In Botswana, Dube & Sekhwela (2008) noted that indigenous institutions regulated natural resource use, as well as their management to enhance sustainable adaptation to climate variability. In Tanzania, indigenous knowledge about climate variability led to the creation of informal institutions, especially in agricultural production

where traditional leaders set rules, informed by knowledge of rainfall variability and change, on what, where and when to plant certain crops” (Mwiturubani, 2009:59).

The aforementioned studies show that different indigenous peoples have used local technologies to adapt their productive activities, human dwelling, and other social practices. These technologies and strategies are widely influenced by distinct cultural practices and beliefs of the diverse peoples. Whereas adaptation to climate variability is a common practice across the world, the body of strategies promoted by global organisations to combat climate change apparently ignores local practices. This has consequently made it difficult for local peoples to connect with some of these strategies. In order to effectively manage climate change, indigenous values, systems and practices cannot be ignored. This is because they explain the local people’s understanding, interpretation and response to climate variability and change (Nakashima et al., 2012).

2.3.1. Cultural adaptation to climate change in Kenya

As noted earlier, climate change affects major economic sectors such as agriculture, trade, and infrastructure. This spurred studies to establish how the people cope with the climatic conditions (Kuria, 2009; Ogalleh et al., 2012; Macharia et al., 2012). Adaptation to climate variability in Kenya was foregrounded by early studies on nomadic pastoral communities and their coping with droughts that threatened their livestock. In their study amongst the Ngisonyoka Turkana pastoralists, Little and Leslie (1999) found the use of different herding strategies, including extensive mobility and herd diversity during droughts. . Specifically, the Turkana moved livestock to areas with greener pastures as the dry season advanced and vegetation dried up and returned once the rains had come. They also stocked a variety of livestock species such as cattle, camels, goats, fat-tailed sheep and donkeys. This facilitated diversity in adaptability at different times of the season, in addition to ensuring constant supply of different nutritional foods (Leslie & McCabe, 2013).

Moreover, Shikwati & Amuhaya (2005) observe that farmers in Ukambani cope with droughts by cultivating drought resistant crops and extension of indigenous farming practices. This is similar to farmers in Kereita forest in Kiambu who plant drought resistant and fast maturing crops, and also practice early and continuous planting to cope their agriculture to climate change (Kuria, 2009). Kagunyu et al. (2016) note that the

Borana pastoralists of Isiolo County used indigenous knowledge to both predict and manage climatic changes. Using semiotic signs and signals such as cloud patterns, wind movements, lightning forms, behaviour of livestock, wildlife and local flora, they could predict drought season and also organise their adaptation to the phenomenon (Kagunyu et al., 2016; Kagunyu, Nangendo & Wanjohi, 2010).

In the Lake Victoria Basin, and specifically lower Nyando wetland Obiero et al. (2012) have revealed the use of small-scale irrigation and cultivation of wetland soils during drought. The farmers have also diversified crops as opposed to mono-cropping to cope with adverse weather conditions. Some of the intercropped varieties include drought resistant and fast maturing crops like sorghum, cassava, finger millet and hybrid maize. Opondo (2013) described digging of trenches and migration to safer grounds as some of the local practices used by people in Nyanza to respond to floods. Indigenous people attach immense cultural value to their traditional knowledge and practices. Yet most global and national strategies have not adequately considered the unique cultural perspectives of the people. As a result, they presumably fail to acknowledge the degree to which the perspectives could shape the constructions, definitions, descriptions, interpretations and responses to the climate change. Specifically, there is no study in Ahero Irrigation Scheme sub-location that shows how sociocultural responses to dwelling, occupancy and land tenure system have enhanced adaptation and mitigation of climate change. Hence it has been difficult to apply indigenous knowledge into weather prediction, for instance, to enhance adaptation to climate change (Ochiel, 2014: 12).

2.3.2. National policies for combating climate change in Kenya

Due to increased effects of climate change, the Kenyan government developed various policy documents that would guide adaptation and mitigation of climate change. These include National Climate Change Response Strategy (NCCRS) (2010), National Climate Change Action Plan (NCCAP 2013-2017), and National Climate Change Framework Policy (2014). The documents seek to promote the people's adaptive capacity and build resilience to climate variability and change, while promoting low carbon production. The policies have provided classic legal frameworks for enhancing climate change interventions at the national level. However, they have least contemplated the significance of indigenous beliefs and sociocultural responses of the local communities. Therefore, they least configure the way local people programme their interventions to

address their conditions at the local level. Moreover, the policies have not envisaged the possible interaction of the formal and informal knowledge, and how they could complement each other. The value of modern strategies cannot be downplayed. Nonetheless, the local people's attachment to the traditional practices and beliefs that were used to respond to climate-related disasters elsewhere have provided memorable connections of what people knew and how they responded to different weather patterns and seasonal changes. The local people in Ahero sub-location used indigenous methods to manage floods. But their contribution to of response mechanisms promoted by national and international agencies have not been taken into account. The present study therefore sought to examine and analyse the general indigenous beliefs, local attitudes and sociocultural strategies regarding climate change in Ahero. It also endeavoured to show how these elements influence the local people's construction, interpretation of and responses to climate change.

CHAPTER THREE

METHODOLOGY

This chapter explains the research design and methods that were used to collect data. It also describes the study site, study population, sample size, data validation means, research methods, research instruments, and ethical considerations undertaken during the study.

3.1. Research Design

The study used a cross-sectional descriptive study design to investigate indigenous beliefs used to interpret, explain and adapt to climate change. The design was preferred because it aided examination of local attitudes and how they inform the people's reaction to the phenomenon. It also necessitated the exploration of the sociocultural strategies used to cope with climate change. The design is justified, because it permits the generalisation of findings to real-life situations, and lends itself to anthropological tools (Frankfort-Nachmias & Nachmias, 1996).

3.2. Study Site Selection and Description

The study was conducted in Ahero Irrigation Scheme sub-location found in Ombeyi location, Muhoroni sub-county, Kisumu County. The site was purposively selected from other five sub-locations namely: Ahero Irrigation Scheme, Kang'o, Kore, Obumba, and Ramula. It was selected due to the increased floods and dry spells experienced by the inhabitants. Firstly, there has been frequent destructive flooding by River Nyando that is attributed to the destruction of the Mau forest (Raburu et al., 2012). Secondly, the area has also been reported to experience extended dry spells leading to crop failures and loss of livestock, high temperatures and increased human and animal diseases. Dry spells have resulted from delayed rainfall, thereby altering local seasons (Raburu et al., 2012). The site was also selected due to the concentration of rice farming compared with other sub-locations. Rice paddy farms produce methane gas, which is a major contributor to global warming (IPCC, 2014). This made the site appropriate for the study, as over 5,000 people living in the area have been worst affected by unexpected floods, droughts, diseases and high temperatures during the long or short rains or no rain (KNBS, 2010; Nyakundi et al., 2010).

Ahero Irrigation Scheme sub-location covers an area of 14.8km², with a population density of 299. It had a total population of 4,424, and 945 households as per the 2009 census (KNBS, 2010), with projections of 5,125 people, and 1,003 households in 2015. The area is inhabited by the Luo people who are patrilineal, with men as household heads (Cohen & Atieno-Odhiambo, 1986; Ocholla-Ayayo, 1976). However, there have been changes in kinship systems occasioned by HIV/AIDS, with young widows and orphans assuming household headship (Nyambedha, 2004).

Ahero Irrigation scheme is situated in Muhoroni Sub-county of Kisumu County (see fig.1). The scheme lies in the Nyando catchment, which is found in the eastern sub-catchments of the Lake Victoria Basin within the Lake Victoria South catchment area in Kenya. The Nyando catchment covers an area of 3,600km² and is situated within the Winam Gulf between longitudes 34°47"E and 35°44"E and latitudes 0°07"N and 0°20"S. Ahero lies on the lowlands within the Kano plains. The Nyando wetland is located in Kisumu County and a large deltaic wetland, which is approximately 14,400ha in size. The wetland, which is at the source of River Nyando, fringes Lake Victoria. It covers three administrative sub-counties of Nyando, Nyakach and Kisumu East (Raburu, Khisa & Masese, 2012: 15-18).

Figure 1: Map of Muhoroni sub-county showing Ahero Irrigation Scheme sub-location.



(Source: Adapted from IEBC 2013; Google maps)

Administratively, the sub-location has 13 villages that represent the lowest unit of administrative structure. These are: Kegoche, Obiayo, Gatundu A, Gatundu B, Kambi Nairobi, Kambi Mombasa, Sidho, Kobura, Kanyamtenda, Masara, Wang'aya A, Wang'aya B, and Kakola. The villages are led by village heads that act as the connective arm of the main national and county administrative system. They assist the local administration in cascading national development initiatives to the local people. The village heads report to the area assistant chief who is the administrative head of the sub-location. Village heads are charged with promoting unity and normal functioning within the 13 villages.

The sub-location is mainly served by River Nyando whose source is the Nandi escarpment besides other seasonal rivers such as rivers Miriu and Masara. The Nandi escarpment stretches from the Mau forest, which has witnessed massive deforestation (Wandiga, 2006). River Nyando causes displacement and other forms of destruction during long rains in February, March and April. However, climate change has gradually altered this rainfall pattern, with rains beginning in the months least expected. This was observed during pilot study where flash floods were witnessed in October, November and December 2015. The floods resulted from River Nyando bursting its banks at Kakola village, inundating the nearby homesteads of Kegoche and Kobura villages. A similar episode was experienced at Kanyamtenda, Gatundu A, Gatundu B, Kambi Nairobi and Kambi Mombasa villages. The incident of abrupt rainfall has illustrated the evolving nature of the changing local climate.

3.3. Study population, sample size, and sampling procedures

The study population was 945 households (KNBS, 2010). From this a sample size of 161 was obtained, which included survey respondents, focus group discussion members and key informants. First, 105 households for survey were selected using Kathuri & Pals (1993) formula. According to Kathuri & Pals (1993) a minimal sample size of a hundred (100) respondents is considered ideal for a survey research. The study therefore settled for a sample size of 105 out of 945 households. The households were derived through systematic random sampling in which a *K*th sampling unit of the population was calculated. The total population (N=945) divided by the survey sample required (n=105) gives the sampling interval as indicated below.

$$Kth = \frac{N}{n}$$

$$Kth = \frac{945}{105}$$

$$Kth = 9$$

The first household was selected randomly from Kegoche village that lies south west of the sub-location. The village also marks the beginning of Ahero sub-location when accessed from the main Ahero -Kisumu or Ahero - Nairobi highway. The sub-location is separated from other sub-locations by geographical features such as rivers Miriu,

Ombeyi, and River Nyando that separates it with Nyando sub-county. Subsequent households were reached systematically from southwards moving northwards and finally towards eastwards. To prevent non-duplication, markings were entered at each ninth household visited. This is because the houses are neither numbered nor appear in a straight line. The next sampling was commenced at the marked household towards the next village until all the villages were covered. In case a household head was missed, the next household formed the ninth one. Then the study purposively selected 56 participants from 945 households for focus group discussions and in-depth interviews. These were considered due to their age, experience and knowledge of climate variability and change. So 105 respondents plus 56 discussants and informants equal to 161 sample.

Participants for focus group discussions and key informants were also distributed across the thirteen villages. Eleven villages provided four while two villages gave two participants each. These were then gathered at different places for the sessions. Then eight key informants were selected from five villages. These were purposively selected based on their age, gender, language, roles and statuses in the community. Four of them came from different villages, with the four informants two each coming from the two villages that had contributed fewer focus group discussants.

3.4. Methods of Data Collection and Instruments

The study used mixed methods to collect data, that is, qualitative and quantitative methods in a period of three months. Qualitative data were gathered through focus group discussions (FGDs), in-depth interviews with key informant interviews, and direct non-participant observation. These were supplemented with quantitative method namely: semi-structured questionnaires, which also generated qualitative data. Data gathered included people's actual feelings about climate change, socio-demographic information of the respondents, narratives and stories about indigenous beliefs, knowledge, practices, rituals and sacrifices, if any, conducted in respect to climate variability and change.

3.4.1. Focus Group Discussions

Six focus group discussions (FGDs) with homogenous groups of males and females were undertaken. Each FGD comprised 8 participants, with equal members stratified by age and gender. FGDs had separate groups of males and females. Stratification by age was justified in order to generate cultural perspectives as constructed by different age groups.

This is important because different age groups have different experiences of social phenomena and, therefore, would express different feelings over the issue. The first FGD consisted of males and females aged 20-35. The second one was with males and females aged 36-55. And the third FGD was with males and females between 56-65 years. Discussions with men and women captured gender-based differences, including roles played by each gender during a climate change disaster. FGDs are used to find out why people feel as they do about something or the steps that people go through in making decisions” (Bernard, 2006:232-233). In total FGDs had 48 participants. The discussions were conducted using different focus group discussion guides provided in Appendix II.

3.4.2. Key Informant Interviews

The study conducted interviews with 8 key informants. These included an elder versed in reading clouds perceived to carry rain, a physically-challenged woman who was claimed to have power to predict seasons through her body parts, especially when the rainy season was about to begin. Others were an old man who had knowledge on rituals and sacrifices held in prayer for rain, or its reduction; elders who had vast knowledge on the previous local climate.

The members were considered key because they could read the weather and predict the onset of weather patterns and local seasons. They could also advise the people on when to prepare their farms in readiness for the planting season. Such information could influence the people’s engagement with the ecology and shape general social activities and practices. The interviews generated knowledge on ritual festivals and ceremonies. They also provided information on the entanglement of nature and society, including the nonhuman organisms associated with the prediction of weather patterns, climate variability and change. They also generated opinions about the community today compared with the past. An interview guide in Appendix III guided the interviews.

3.4.3 Non-Participant Observation

Participant observation involves immersing oneself in a culture and experiencing the lives of the people one is studying in order to get first hand data (Bernard, 2006; Frankfort-Nachmias & Nachmias, 1996). The present study adopted direct non-participant observation due to the longer time scale that follow before the climate change conditions occur. The researcher observed indigenous practices and technologies used in managing

effects of climate change consequences, such as floods, droughts, crop diseases, and variable temperatures. In order to understand local adaptation and mitigation to climate change, the study meanings established in view of: the structure of houses, the position of homesteads, materials used in the construction of the houses, interventions towards the conservation of the environment, sociocultural practices employed to control and manage floods, high temperatures.

3.4.4. Semi- Structured Interviews

These were conducted with 105 survey respondents across the 13 villages of the sub-location to generate both quantitative and qualitative data. The data collected included socio-demographic information of the respondents such as age and gender, marital status, level of education, economic activities, religious affiliation, and their general explanations of climate change in line with the study objectives. The interviews were held with household heads in their homesteads using interview guides (Appendix I). Data from survey respondents were important in order to show how people's social, economic and cultural activities and practices were being affected by climate change.

3.5. Reliability and Validity

Reliability and validity was ensured through triangulation of research methodology. Data from surveys, focus group discussions and key informants were compared in order to establish consistency. The techniques used for collecting data were also standardized to enhance reliability. A pilot study was conducted with a few selected people from the neighbouring Kore sub-location. This focused on indigenous beliefs and ways of predicting climate variability and change, as well as sociocultural methods of responding to the effects of climate change experienced in the study site. This was done in order to validate the study instruments.

3.6. Constraints/ Limitations of the Study

The study was limited in that it was difficult to quantify most qualitative elements such as cultural beliefs and knowledge. However, this was addressed by the adoption of qualitative methodologies, which enhanced the understanding of these cultural features. The study could not verify certain indigenous beliefs and/or observe the workings of some cultural systems, and only relied on the narratives of the participants.

3.7 Ethical Considerations

Before proceeding for the study, the researcher got clearance from Maseno University Ethical Review Committee (MUERC) (see appendices), which reviewed and approved the proposal. Then permission was sought from the Chief of Ombeyi location to conduct research in the sub-location. Upon verification of the research permit, the chief formally introduced the researcher to the assistant chief of Ahero Irrigation Scheme sub-location. The assistant chief subsequently introduced the researcher to the 13 village heads at a formal gathering held at Kogalo Evacuation Centre in Kegoche village. Moreover, informed consent of the informants was sought before being enlisted in the study (see appendices). However, literate respondents signed the consent forms after perusal. The informed consent was sought orally for those who did not know how to read and write. Informants were also made aware of their right to withdraw from the research. However, none of the participants withdrew from the study. Information provided by each respondent is not attributed to protect their identity, in order to ensure their anonymity and confidentiality. Pseudonyms are also used in the presentation of data, particularly the verbatim quotes and narratives in the subsequent chapters of this thesis in order to protect informants' identity.

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

The chapter presents, analyses and discusses the primary data on which this thesis is based. This is done through frequency tables, narratives and verbatim quotations. All names provided alongside discussants' and informants' quotations are pseudonyms. The chapter begins with the socio-demographic data and then presents data consistent with the study objectives and questions as stated in chapter one.

4.1. Socio-demographic characteristics of the respondents

The socio-demographic data presented include information on the respondents' ages and gender, their marital status, level of education, economic activities undertaken, and their religion. It also focuses on data about indigenous beliefs by the respondents, local attitudes that express the nature of climate change, and traditional adaptation and mitigation strategies as discussed below.

4.1.1. Age and gender of the respondents

The majority of household heads who participated in the study were females aged below 39 years. This group was the most readily found in the households at the time. There were no households headed by males under 29 years same as those headed by males aged over 90 as indicated in Table 4.1.1. This was corroborated by data from focus group discussions with males between the ages of 20-35. This group of males, especially those below 30 years, did not have their own homesteads and still lived in their parents' homes. This scenario could partly be attributed to education where they reported being students pursuing higher education in different colleges and universities. More male than female respondents between ages of 60 to 69 participated in the study. The combined demographics of age and gender provided important attributes of determining how these groups interpreted and explained climate change as will be discussed later in this section.

Table 4.1.1. Age and gender distribution of the respondents.

Age	Frequency			Percentage (%)
	Male	Female	Total	
20-29	0	13	13	12.3
30-39	8	16	24	22.9
40-49	5	13	18	17.1
50-59	5	5	10	9.5
60-69	13	6	19	18.1
70-79	5	4	9	8.6
80-89	4	3	7	6.7
90-99	0	5	5	4.8
Total	40	65	n=105	100

4.1.2. Respondents' marital status.

Almost three-quarters of the respondents (70.5 per cent) were married. This indicated the community's respect of the institution of marriage and how it could reflect on the preservation of households. Less than half of the respondents (29.5 per cent) were widows, a group that opted to not remarry after the death of their husbands. The focus on the households was necessary in order to understand how climate change impacted each one of them.

4.1.3. Respondents' level of formal education

Nearly half of the respondents (47.6 per cent) reported having primary education. Respondents with secondary education were 27.6 per cent, while 16.2 per cent reported not having formal education. Those with college education were represented by 7.6 per cent compared with 1 per cent that had university education. Respondents' level of education was tested to understand its influence on the people's explanation of climate change. A majority of them perceived climate change to be occasioned by supernatural forces and human infractions. A section of the respondents (1.9 per cent) attributed climate change to scientific factors (see Table 4.2.1.). This was part of the cumulative respondents (8.6 per cent) with college and university training who associated the

phenomenon with scientific factors, although they also expressed indigenous knowledge and beliefs.

Table 4.1.2. Level of education.

Level of formal education	Frequency	Percentage (%)
No formal education	17	16.2
Primary	50	47.6
Secondary	29	27.6
College	8	7.6
University	1	1
Total	n=105	100

4.1.4. Occupation of the respondents

More than three quarters of the respondents (76.1 per cent) derived their livelihood from farming activities. They cultivated both cash and subsistence crops. Rice was the main cash crop, although it was less concentrated. Subsistence farming was the main source of livelihood; the respondents planted maize, sorghum, vegetables, tomatoes, watermelons and potatoes among other subsistence crops. In addition, livestock such as cows, goats, sheep and chicken were reared. Less than half of the respondents (20 per cent) were self-employed, working as artisans, mechanics, shopkeepers, and boda boda operators. Others engaged in petty trade such as hawking and roadside food selling. Only 2.9 per cent and 1 per cent of the respondents were in formal employment - private and public sectors respectively as shown in Table 4.1.4.

Farming has been severely affected by climate change manifested through the increased frequency of severe floods and dry spells. The phenomenon of intermittent drought usually occasions competition for the reduced water from River Nyando for irrigation by rice farmers. On the other hand, floods destroy crops and other productive activities. These twin climatic conditions have negatively affected food production, exposing the respondents to famine and food insecurity.

Table 4.1.4. Respondents' occupation

Occupation	Frequency	Percentage (%)
Farmer	80	76.1
Public sector	1	1
Private sector	3	2.9
Self-employment	21	20
Total	105	100

4.1.5. Religious affiliation

All respondents at the time of study reported being Christians. None professed Islamic faith or African traditional religion. The Christians could be divided into two: followers of the mainstream churches such as the Catholic and Anglican Church, and those who belonged to African independent churches such as *Hera*, *Nomiya Luo Church*, *Legio Maria*, *Israel*, and *Roho*. The influence of religion manifested in the respondents' explanations and expression of climate change. Thus, Christian beliefs were entwined with indigenous beliefs to provide local images of the phenomenon.

4.2. Indigenous Beliefs on Climate Change

4.2.1. Folk beliefs and explanations of climate change

Generally, the study respondents recognised the phenomenon of climate change. They described it as change of the local environment characterised by unpredictable weather patterns, change of local seasons, unreliable/erratic weather conditions. The evolving indigenous phraseology for the phenomenon is *lokruok kor luasi*, which loosely translates to “the changing of the environment”. Although this does not mean climate change *per se*, it signifies the local explanation of the phenomenon with respect to the changing climate. The changing climate labelled as *lokruok kor luasi* was manifested in the abnormal rainfall that led to flash floods causing frequent flooding of River Nyando, increased dry spells, and temperatures associated with increasing incidence of re-emerging and new diseases. The folk beliefs expressed the diverse human-made and nonhuman conditions associated with climate change as indicated in Table 4.2.1. These folk ideas manifested in the ideologies of the respondents as they expressed the causes of climate change.

Table 4.2.1. Folk beliefs and explanations of climate change

Causal explanation	Frequency (n=105)	Percentage(%)
Act of God	70	66.7
Curses	2	1.9
Marginalisation of indigenous systems	8	7.6
Sins	5	4.8
Breakdown of taboos/customs	4	3.8
Ritual of hailstorm arresting	10	9.5
Ancestor punishments	4	3.8
Scientific causes	2	1.9
Total	105	100

The folk beliefs clearly provided explanations regarding the evolving phenomenon of climate change and its associated climatic and weather conditions. During a focus group discussion with females over 50 years, 54 year old Lorna Oriyo said:

The rainy season today comes abruptly. It can begin in March or April unlike before when rains started in February and stayed through April to June. Even dry seasons begin in December and end in March as opposed to starting in October to December as it was the case before.

The uncertainty surrounding the onset of local seasons presented a major challenge to the farming groups. She added solemnly, “It can just rain any time and also disappear unexpectedly.” Indeed, agriculture relies on the practical reading and interpretation of the local weather conditions and climate drawing on indigenous ecological knowledge. The overall climate variability and change conceived through unpredictable weather conditions and seasonal changes influenced the recognition of the actual implications of climate change. Similarly, the results of a study by McDonald, Arragutainaq & Novalinga (1997) among the Inuit and Cree indigenous communities of Canada characterised climate change in terms of their observations and experiences of the environment, such as changes on snow and sea-ice. The perceived climate changes in the present study in comparison to what the respondents knew earlier tally with findings of a study by Krupnik & Jolly (2002) among the Alaska in US and Nuwanut of Canada, which found out that the local people inferred climate change from their indigenous knowledge. The

perceived climate change indicators in this sense trigger discourse about weather patterns and seasonal changes that they had experienced in the present time.

The respondents reported different factors in the folk ideas about the phenomenon of climate change. Cumulatively, 98.1 per cent of the respondents attributed climate change to mythical and/or supernatural causes. Only 1.9 per cent of the respondents associated climate variability with rapid industrialisation and global warming. This was part of the respondents that had college and university education. The mythical or supernatural causation demonstrated the influence of nonhuman organisms to the occurrence of natural phenomena such as rainfall quantities and dry spells.

More than two thirds (66.7 per cent) of the respondents viewed climate change as an act of God. As revealed by socio-demographic data, all the Christians belonged to different religious denominations. The presence of different religious denominations shape diverse views regarding divine causality of climate change. This accounted for variable configurations and explanations concerning the way the infraction of religious principles and teachings caused climate change. These included respondents who observed that climatic change occurred as a fulfilment of God's work. Others noted that it signalled God's punishment of the people's waywardness. Yet some attributed the phenomenon to the apocalyptic end of times as pronounced in the Biblical teachings.

Whereas religion formed a greater sense of the respondents' ecological interpretation, anti-social acts (murder, theft and adultery) were also perceived to cause of climate change and variability. Some respondents claimed that the local people had become 'serial sinners' which annoyed God. In the face of such acts, God punished the community through natural calamities. As a remedy, the respondents proposed communal prayers and fasting by the community members for God's forgiveness. When probed to elaborate the relation between the supernatural beings and climate change phenomenon, a participant in an FGD would intone chummily:

The change of 'environment' [climate] we are experiencing today is mainly the work of God. You know, He is the source of life, rain, sunshine and everything that we have here on earth. So, if He decides to change it as He has done, then we leave everything to Him. (Lorna Oriyo, FGD, 14.10.2016).

The above response is part of a discourse on perceived helplessness of the respondents confronted by certain climatic phenomena and especially the ones that they lack sufficient human explanation. While it is common for indigenous peoples to resort to folk explanations, including supernatural attributions of the conditions and phenomena that they cannot fully account for, the spectacle of climatic hazards presents a more mysterious image. The frequent occurrence of extreme weather conditions often belie local ecological and meteorological wisdom and comprehension. The disturbing character outcomes of extreme weather conditions may be viewed relative to local mythology and its explanation of disaster and its relation to the existing social order.

Essentially, the religious beliefs were entwined with local traditional beliefs especially the role of other supernatural beings such as ancestors and spirits with the power to trigger weather conditions. This interconnection presented a contextualist perspective, as argued by Hornborg (1996: 45-63) that indigenous notions of pre-industrial human societies may provide vital lessons on human-nature interaction and sustainable living. This perspective was emphasised through the perceivable inseparable engagement of the supernatural being and other social agentive elements with nature (Ingold, 2000), in this case climate change. The import of this was to illustrate that nonhuman organisms could influence the local climate (Descola, 2013; Kohn, 2013). This finding deviates from those by Ogalleh et al. (2012) in Laikipia district and Kuria (2009) in Kiambu County as the latter two show that the people's belief in the supernatural being as the cause of climate change is mostly informed by Christianity.

It is worth noting, however, that there were distinct levels of significance for the role of nonhuman organisms other than God among survey respondents and participants interviewed for qualitative data. This could be attributed to the age and experience of the respondents about the indigenous explanations.

Relatively middle aged respondents, particularly those less than 50 years compared to older members, tended to dispute the influence of indigenous spiritual factors as causes of climate change. For instance, 9.5 per cent of the respondents associated extreme weather occurrences to machinations of witchcraft and magico-religious agents. These were drawn into the folk explanatory models of the causality of climate change such as the

ritual of hailstorm arresting. All key informants and some focus group discussants over 50 years cited the ritual of hailstorm arresting as the key indicator of the evolving nature of climate change. This was corroborated by findings from quantitative data where respondents with under secondary education widely attributed climate change to supernatural conditions.

The traditional ritual of hailstorm arresting involves a traditional medicine man being engaged to cast ‘medicine’ in the rice fields to protect the crop. This micro practice was perceived to affect a wider area in the study site. Key Informants believed that the failure to observe the ritual could result into the destruction of the rice which would extend to the nearby Nyando sub-county (see fig. 1). The vignette below from a key informant interview illustrates the notion described above:

Since we started cultivating rice here, we have been observing the ritual of hailstorm arresting. This ritual is very important, because it helps us to manage our ‘environment’ [climate] and protect the rice crop from destruction by hailstorms. After we have prepared our rice farms and buried the seedlings into the soil, all rice farmers meet to commission a medicine man who is asked to cast traditional medicine in the field. This medicine is for the crop’s health and fruitful growth. Once this is done then the rice crop is safe, because hailstorms cannot hit our rice. Even if they appear, they can just strike the surrounding farms but not our rice fields. The medicine arrests the hailstorms and redirects them to other places far away from our rice farms. After he has cast his medicine no other medicine man can be engaged for the same task. If that is mistakenly done, then hailstorms will strike the rice crop. For the medicine will ‘fight’ each other and ‘lose’ their protective power. Also, hailstorms can strike when community members transport a corpse from the morgue across the rice fields during the day. Rice is a very ‘peaceful’ crop. It is scared of any commotion, as violence or confrontation. It cannot survive amidst disturbance or interference. This ‘shakes’ [interferes with] the crop by destabilising the spirits that protect it. Yet the process of returning a corpse to the homestead among the Luo is always dramatic. The wailing and weeping usually unsettle and expose the crop. This chaos and noise by the mourners transporting the corpse across the rice field causes strong hailstorms (Mr. Musa Gogo, 74; 4.11.2016).

The above vignette indicates that the emergent theme of climate change features in local human ecology narrative. This, for instance, is embedded in the inseparable natural and spiritual biographies of tending rice. The crop is anthropomorphized with dynamic social attributes, which semiotically configure its health and development as being regulated by

the spirit world. The association of the rice crop with the twin elements – human life and the spirit world - implies that climatic hazards are occurrences that can be triggered by both human beings and nonhuman beings, such as spirits. This finding contrasts with that by Cherif & Greenberg (2013) amongst traditional Zagoue rice farmers in Ivory Coast. The rice farmers in this West African society configure climate change as a product of conflicts between the religious and non-religious faithful and human-nonhuman nexus rather than religio-magical tensions. This finding can be explained from the cultural ecology theory elaborately discussed in chapter one, as the process denotes a superstructural element that enables the respondents to contemplate the protection of their rice crop from destruction by hailstorms.

In view of the foregoing data analysis, the divergence in the significance of the perceived supernatural causes of climate variability illustrates respondents' inexperience in relation to traditional knowledge and practices. As an example Mr. John Bodi, 34-year-old mechanic who participated in the present study contradicted the popular perception of the role of supernatural causes of climate change. He said that, "Floods cannot be caused by dead men; ancestors were important in ancient times." Similarly, only 3.8 per cent of the respondents observed that flash floods were frequent and severe due to punishment by ancestors. The respondents who held this view also associated the emerging climate and weather variability with the breakdown of social customs and norms, and 'moral pollution' of the environment. Conversely, Mr. Bodi in addition affirmed:

Our current generation is well educated...and I know that climate change is caused by extreme activities of people that affect biodiversity such as deforestation and rapid industrialization. Mr. (John Bodi, 34, FGD, 10.10.2017).

The divergent views on the causality and perception of climate change with regard to the natural and supernatural factors provide critical images through which the phenomenon was socially constructed. The imageries that emerge project a dynamic configuration by which climate variability evolve in local spatiotemporal cosmology. Mr. Lawi Gonje, a 72 year old key informant he decried, "Our children have abandoned our traditions and customs which enabled us to make peace with the 'owners' of our environment [climate] who live with us."

According to local beliefs and myths, angry ancestors react to moral breaches through devastating disasters. Key informants in the present study emphasized that the current diverse climatic hazards had a connection with ancestral wrath. They claimed that local people's failure to respect community customs and taboos contributed to the adverse change in environmental conditions experienced today. As such, they advocated for a value system borne through maintenance of ecological balance involving human beings, ancestral spirits, God and the entire invisible world as well as the biotic and non-biotic elements in the universe. They saw the preservation of this relationship as essential to the witnessing of good health and survival, to gain the ancestors' protection. This could be achieved through observing customs, taboos, offering sacrifices, holding ceremonies and honouring traditions in respect of the ancestors.

4.2.2. Culture as a mirror of nature

Mbiti (1969) noted that respect of traditions and customs strengthened the social bond between the living and the dead, as it brought the two closer to each other. The perception that community members have abandoned traditional customs and beliefs was conceptualised by some study participants in Ahero Irrigation scheme sub-location. Breach of custom was considered as the main source of breakdown of cordial relationship between the people and their ancestors, resulting in ancestor punishment through climatic disasters. This finding is partly consistent with that of a study by Fayibi & Oloukoi (2012) among coastal communities in Nigeria. This study found that the local people believed floods were caused by violation of sacred cultural rules and instructions of individuals leading to the anger by water spirits. Accordingly, the communities believed that water spirits could be angered by failure to honour taboos and customs, which they show through inundating the coastal communities. These water spirits dwell in the coastal water bodies before being born in the world (Fayibi & Oloukoi 2012). This latter observation is contrary to the present study's finding, which shows that community ancestors who are conceived as the 'owners' of the environment dwell amongst the people in the community. Therefore, the existence of the ancestors within the people's abode enhances their natural-social interaction for the ecological sustenance.

Further mythical and supernatural causes of climate change pointed towards increased anti-social behaviours. The delay of the rain season was attributed to human sins. Specifically, murder and rape cases were said to be common in the area unlike before.

Such anti-social acts were viewed to interfere with the normal functioning of the society by destabilising the established ecological and social order. A disrupted social order was by and large said to have a negative effect on the local climate, as this was connected to both ancestor and supernatural punishment as a participant in an FGD observed:

Nowadays we are witnessing very strange things here. People are doing very 'dirty' things, things that I never heard of while growing up. People are killing their fellow clan's men. Some are raping women and young children. Others even do the unmentionable, as raping their own mothers. These are things that you could not hear of here in our area. But today they are happening right before our own eyes. Now do you think a community with people defiling their own daughters and even killing their clan's men can have peace and harmony? It cannot. Even God cannot tolerate such evil acts. Because of these sins we cannot get rain at the right time. When the rains delay, this destroys our biodiversity and ecosystem. I blame the frequent rain delays on the people's sins (Mrs. Misi Okonjo, 45; FGD; 11/10/2016)

The respondents in this study recognised that rains were delaying compared with the past. They had knowledge accumulated over generations about when the rains should begin and disappear. Delayed rain was observed to have a long-term negative effect on the ecosystem and local biodiversity. This was corroborated by (IPCC, 2014) report which argued that delayed rains are causing increased temperatures in poor countries. Consequently, this has led to the destruction of the local ecosystems. Some respondents (1.9 per cent) observed that rising temperatures resulting from climate change occurred due to deforestation. Whereas this has a scientific explanation in which deforestation is identified as an obstacle to the reduction of greenhouse gases, the observation is rooted in the folk explanatory framework as corroborated by a key informant:

Ever since I was born, I know that rain is brought by indigenous trees and forests. These trees are not like the foreign ones being planted by some people today. The indigenous trees grow by themselves, and they have a stronger spark to pull rains. They also block rain-carrying winds that would escape to other areas. Now if you look at our land today, you don't find the indigenous trees that were there such as *ng'ou (Ficus sp.)*, *ober (Albizia coriaria Welw. ex)*, which attracted rains. They were all cut down to create land for the rice farms. Some have cut them for building materials and firewood. You cannot cut trees and forests, as has been the case here, and expect to have normal rains. (Mr. Peter Gumba, 68; 12/11/2016)

The indigenous trees and forests were prime natural resources. They enabled the respondents to read and predict rainfall through their dropping of leaves. This finding corresponds with that by Macharia et al. (2012) among farmers in Nyeri and Laikipia districts who conceived the regularity of rainfall through indigenous forests such as Aberdare forest in Central Kenya. Through reforestation the people could begin to witness regular rainfall, thus attributing the condition to the replanted tree species. The observation is also similar to that of agroforestry campaigners (Sijale et al., 2007) who advocate for reforestation of indigenous trees to help conserve the environment, to reduce climate change. According to them, farmers in Kieni division in Nyeri district of central Kenya observed that destruction of natural resources especially indigenous trees causes climate change. The most affected tree species are those of important cultural values such as sources of medicines, fuel wood, fodder and building materials. Seemingly, a concurrence about the value of indigenous trees and forests among the different communities in Kenya can be seen.

The interpretation and explanation of climate change through indigenous beliefs provided a deep sense of ethos that underline people's indigenous belief systems in Ahero Irrigation scheme sub-location. Indigenous beliefs bring out the inherent value systems that the local people attached to their lives and influenced their reaction to the effects of natural phenomena such as climate change. Thus, indigenous beliefs represent an important feature in the social universe of relations in respect to social phenomena as it defines the parameters of human ecology, as it plays out to link to the objective of climate change.

The other category of the causes of climate change was associated with the local cultural systems such as indigenous religion. The significance of cultural systems was expressed in regards to the functional concern and symbolic phenomena inherent in the systems. Symbolic phenomena include the rituals, myths, narratives, sacralisation, moral codes and metaphysics (Alexander & Seidman, 1990), which are associated with sociocultural systems such as indigenous religion, education and medicine.

4.2.3. Cultural interpretation of climate change

Given the attribution of mystical/supernatural causes to climate change by participants, the question of supernatural causes was further pursued to understand this connection.

Thus the participants connected delayed rainfall with the diminished influence of indigenous religion. This was further interconnected to the spectacle of increased dry spells.

The informants observed that dry spells had become frequent and severe due to the failure of the people to 'engage' with the ancestors to provide rains. They also indicated that pests and insects frequently attacked crops due to the people's disregard of traditional medicine, which were previously protective of seeds and crops. Nyar Kakello, a 70 year old key informant interlinked the incidence of flash floods with the marginalisation of indigenous education as thus, "During ancient times we had elders who predicted calamities such as floods and droughts. They could accurately determine the onset and disappearance of rains, their intensity, including their impact on the people's lives and livelihoods."

Whereas the indigenous knowledge was widely shared amongst older participants, such observations could also be found with discussants less than 40 years of age. However, the latter group's concurrence about the contribution of cultural institutions towards shaping local climate variability was based purely on a sense memory. Their accounts were memorable reflections and narratives told by their older society members regarding what formed the life of their forebearers. An informant would demonstrate the workings of a traditional ceremony in relation to a drought as captured in the excerpt below:

In the past we had a very good environment [climate]. It was friendly, with plenty of rainfall and corresponding dry spells. Each one of them was stable. However, at times dry spells could extend beyond their known months. In such an event, the community turned to the elders for an answer. Elders were very important because of many reasons. They knew how to read the weather using knowledge of human and animal behaviours. They also observed the local biodiversity such as trees, birds, animals and interpreted their meaning to us. Some elders had visions of calamities, including climatic disasters such as floods, droughts, crop diseases and pests. And once they envisioned these calamities, they communicated them to the community members. During a drought calamity, the elders gathered at one of the elder's *abila* [traditional hut] or ancestral shrine to meditate on the condition. They deliberated on the matter as they prayed to the ancestor to release rain and end the drought. While they were deliberating and beseeching, a *jajuogi* [spirit-possessed elder] known to communicate with the ancestors and spirits was thrown into a trance and seized by the spirits. While still in that condition, the ancestors instructed him

on the offering to be made to appease the angry spirit world. Upon gaining consciousness, the *jajuogi* communicated to the other elders on the sacrifice to be offered to the ancestors, which was mostly a ram. Afterwards, the information was relayed to the rest of the community and a date of the ritual ceremony set. On the material day, a ram would be provided for by one of the elders. This would be slaughtered, roasted and then feasted on by the elders. No woman was admitted at the ritual ceremony; for this was a man affair. After the offering, the rains would pour immediately, signalling the end of the drought. That's what was done if the rains refused to come. But today nothing is done; people don't offer sacrifices to our ancestors; they don't hold ritual festivals even if they have had bountiful harvests. This meanly behaviour and the failure to pour blood for our ancestors has angered them and caused us these calamities. Nobody listens to the elders, and nobody is willing to share whatever they have with our ancestors as we used to do. The elders are not respected anymore; even if one made a prediction about a certain climatic hazard one is branded a liar who is only seeking relevance by scaring the people. So the younger generation is ill informed about indigenous beliefs and practices that were very successful in causing rain. (Mr. Ombo Bunge, 75; 3/11/2016.)

The above observation not only recognises the critical role of elders as community seers but also their important social position in the community. They were dignified and valued, because they acted both as purveyors of information regarding ecological change as well as steers of ritual festival and ceremonies in the society. This finding concurs with that by Fayibi & Oloukoi (2013) in Nigeria which showed that community elders led ritual ceremonies and festivals to appease the spirits whenever the latter were angry with human beings for transgressing against local customs and taboos. It also corresponds with Akong'a's (1987) study on ritual of rainmaking in Kitui and Makueni districts in Kenya. This study noted that ritual festival and ceremonies conducted by the elders were significant in redressing droughts perceived to result from human actions in the two districts. Despite the different cultural orientations of the communities studied by the above scholars, there seems to be a synchronized view that elders play a key role in anchoring issues to do with climate changes.

The notions of indigenous beliefs and practices are interpreted in view of their functional concern and symbolic phenomena to provide a social and cultural order (Calkowski, 2002). A functionalist focus and symbolic interpretation of climate change in the local cultural systems shaped the local configuration of the phenomenon. This further determined local responses and adaptive actions by providing an interpretation of the

impact of culture towards the stability and/or instability of the climate. This framework tended to promote social practices that would affect the design of response strategies to climate change. Therefore, the practices that are undertaken in the society towards redressing climate change are sustained in regard to the social and cultural order they achieve for the people.

According to Calkowski (2002:52) “social and cultural dimensions of order are uncovered through enculturation, where some actions are identified as moral and socially approved. This order also includes assigning value, the association of emotions with designated objects and events, the use of ritual symbols to effect social action. A ritual symbol enables the symbol both to arouse desires and feelings and to reflect social values”. In this case, the ritual symbols are critical in view of the stability they could provide to the people to enable them adapt to climate change effects. In emphasizing the functional focus and symbolic phenomena (rituals, ceremonies and sacrifices) in the prediction, interpretation and response to climate change, the inherent ethos of social institutions, as well as sociocultural determination of indigenous beliefs and values that governed social actions of the respondents pertaining to reaction and response come to the fore. This finding is anchored in the cultural ecology theory, which identifies ritual(s) and cultural ceremonies as key parts of the superstructure that enable the people to produce and organise themselves in the society. These are widely envisioned as a remedy to maintaining local agricultural production.

The participants associate high temperatures with the conditions that occasion dry spells. As argued earlier, respondents conceived deforestation as the source of dryness and hot temperatures. They have phraseology for such a phenomenon as *piny motwo ongoro*, which loosely translates to “a dry barren land without trees”. The deep consciousness of the practical incidences occasioned by changes in climate provided the participants with a clear meaning of the unfolding changes. These were supplemented by different mystical expressions associated with behavioural patterns of flora and fauna believed to cause floods and dry spells.

4.2.4. Mystical signs for the onset of floods and dry spells

This study observed that the participants accumulated beliefs acquired from past generations about the patterns of weather, the behaviour of seasons, the timing and

magnitude of river flooding. Social constructions illustrative of the Anthropocene character to the flood disaster or drought include the reaction of human body parts. Nyar Akello noted, “My ankle, which dislocated while still a young girl, usually hurts whenever it’s about to rain. I normally feel the rain in my bones.” In local discourse, the aching of bones among the elderly with a history of some health complication signifies the approaching rains. Although the achy bones could not be used to determine the level of flooding, it informed the respondents about the potential of rainfall and, therefore, prepare for flooding including River Nyando flooding.

The behaviour of nonhuman organisms such as land animals and other living species may be used to predict onset of the rainy season. Specifically, the migration pattern of bird species often called in the local language as *magungu* (*mycteria*) serve as markers of seasonality especially the rainy season and subsequently approaching floodwater. Okumu Ogondo 67 year old observed, “The one bird that I always watch for is the *magungu*. They usually fly high and in large flocks from the North to the South. I associate them with approaching rains and flooding.” Additionally, the participants also made decisions about the change of weather and climatic conditions through observing the movement of ants. Ogondo added, “Moving colonies of ants in long lines to a higher ground tells me that the rains are coming, that could lead to flooding.” The movement pattern was claimed to be accurate by the informants, who observed that the time at which these birds migrate and ants move, indicates the magnitude and the ravaging nature of the approaching rains. However, due to climate change there has been rainfall and flooding even without the appearance of the bird species and movement of ants.

Thick dark clouds overhanging Lake Victoria to the west indicate approaching heavy rainfall and the likelihood that the area will be submerged by the rain-fed river channels’ waterways. Knowledge of the methodology is still enshrined in the local mythology and some elders seem to be more gifted in reading and interpreting cloud patterns. However, certain discussants reported that some of the predictions of cloud watchers often miss and can be very misleading, actions that were attributed to changes in seasons due to climate change. This technique is augmented by observations about local wind patterns. The fast blowing winds referred in local language to as *kalaus* (whirl wind) is interpreted to mean that the drought is approaching. Knowledge of the local methodology is still embedded in mystery and most respondents’ knowledge pool, and is applied in reading and interpreting

wind patterns.

The participants also indicated that they learned about climate and weather issues by assessing the nature and intensity of sunshine. Shaky-like rays of the hard burning sunshine, for instance, herald a dry spell and a potential drought. Despite the fact that the hard burning sunshine cannot be used to illustrate a drought, image of the rays studied using indigenous knowledge provided a view of the extent and possible duration of the dry spell. Observation of tree leaves also provided some hints about possible long time or short time climatic and weather changes. The indigenous trees such as *ng'ou*, *ober*, *yago* (*Kigelia Africana Lam.*), *othoo* (*Balanitesaegyptiaca (L)*) in the area are believed to have magical and healing connections, which an approaching dry season carries. When the indigenous trees drop their leaves it indicates that a drought season has begun.

The foregoing indigenous explanations illustrate a contextualist construction regarding the inseparable ontology of nature and society. This is illustrated by the semiotic and anthropomorphic attributes assigned to the climatic and natural conditions to complete the perception of environment. Through nonhuman organisms such as the supernatural beings (God and gods), ancestors, spirits, *magungu* bird species, and ants among others, the broader ecological evolution, including climate change provides a perspective to understanding the relational engagement/entanglement of the nonhuman species with climatic change. The deep-rooted indigenous knowledge and practices are mutable features that project the rhythmic/arrhythmic systems and processes for achieving ecological sustenance. However, the fact that some of the social actions have rendered the local ecology reflexive with emergent social challenges and imbalances offer an image of how climate change evolves.

4.3. Local attitudes about Climate Change

The respondents expressed diverse attitudes about climate change. Their judgement of the phenomenon projected images of severity and frequency of climatic disasters which was not the case before. More than three quarters (81 per cent) viewed climate change as a very serious threat to their lives and livelihoods. Conversely, 19 per cent expressed it as serious compared with none who saw the phenomenon as normal or not serious. This expression was advanced in respect of the variable climatic hazards that affected productive activities, settlement, and efforts to fight poverty. The climatic hazards

perceived to have become frequent and severe such as abnormal rainfall, flash floods, dry spells, variable temperatures, incidence of diseases, and crop failures are shown in Table 4.3.1 below.

Table 4.3.1. Climate change hazards in Ahero Irrigation Scheme

Climate hazard	Frequency	Percentage (%)
Rainfall		
Increased	75	71.4
Decreased	15	14.2
Constant	15	14.2
Total	105	100
Flash floods		
Increased	70	66.7
Decreased	10	9.5
Constant	25	23.8
Total	105	100
Dry spells		
Increased	85	81.0
Decreased	10	9.5
Constant	10	9.5
Total	105	100
Temperatures		
Increased	85	81.0
Decreased	10	9.5
Constant	10	9.5
Total	105	100
Incidence of diseases		
Increased	65	62
Decreased	15	14.2
Constant	25	23.8
Total	105	100
Incidence of crop failures		
Increased	95	90.5
Decreased	0	0
Constant	10	9.5
Total	105	100

Nearly three quarters (71.4 per cent) of the respondents observed that rains were abnormal compared with 14.2 per cent who viewed the condition as constant or decreased. This observation was reinforced by responses from focus group discussions as shown by 46 year old Mrs. Lusi Omondi, “In the last ten years or so, there has been too much rain compared with the past. During the long rains, we experience a lot of destruction of our homesteads, property and crops.” (FGD: 14.10.2016).

Abnormal rainfall reduces the respondents' coping ability, thus increasing livelihood losses. This is related to the increase of flash floods. More than two-thirds (66.7 per cent) observed that flash floods were frequent nearly three times (23.8 per cent) of the respondents who perceived the condition as constant. The abnormal rains and flash floods were destructive to the respondents' settlement and livelihood means. The respondents based their perception of flash floods on the scales of rainfall experienced in the past two decades. This finding is consistent with IPCC (2013, 2014) reports, which indicate that climate change causes abnormal rains and flash floods that destroy poor people's lives and livelihoods.

According to Obiero et al. (2012), climate change is expected to lead to destructive floods occasioned by abnormal rainfall and increased flooding in the Nyando River Basin. This could lead to devastating effects to the people's socio-economic activities, especially agriculture. The destructive nature of abnormal rainfall and flash floods to livelihoods inspired the respondents to alter their productive practices and settlement as will be elaborately discussed under adaptation and mitigation strategies elsewhere in this section.

The phenomenon of dry spells also occasioned fear. More than three quarters (81 per cent) of the respondents viewed climate change as having increased. This was identical to the attitude about high temperatures. The similarity in attitudes was reported in view of the challenges the twin conditions caused to local lives and livelihood. The negative consequences included decimation of crops, alteration of planting dates, increased famine, poor water quality, and reduced water quantities. The dry spells were undesirable whenever they extended beyond their usual time. Although the climatic variations were necessary for balancing of the local weather patterns, they threatened livelihoods when they led to the drying up of seasonal rivers and streams. During focus group discussions, 55 year-old Mrs. Aloo Ayugi stressed the frequency and severity of dry spells, "Dry spells have become very common. Even the present sun is harsher than it was before. Whenever it appears it burns everything and leaves our ecosystem 'naked' [destroyed]."

The discomfiture and anxiety borne by the respondents is illustrative of the end impact of dry spells to the participants' food production and survival. Food security has become a major challenge to most developing nations with low adaptive capacity to climate change.

This has presented further stress to vulnerable communities, which depend on agriculture but are experiencing droughts induced by climate change (IPCC, 2014). Another FGD member observed:

Each time there is a dry spell here we experience a lot of challenges. We can't plant anything on our farms. The local rivers dry up. We lack water for drinking. Even our livestock die for lack of grass. We go through a lot of difficulties (Mrs. Maro Omondi, 31; FGD; 10.10.2016).

This finding concurs with that by Ogalleh et al. (2012), which found that farmers in Laikipia district perceived frequent droughts as a major risk to agricultural production. This is further supported by Obiero et al. (2012:102) who observed that “in the Lake Victoria region, record drought in 2009 reduced water flow in major rivers, including Nyando, to record low levels”, adding that “over the past 20 years, a number of streams, such as Ombeyi, Atoyien'go, Nyalbiego and Obuso, previously permanent, have become seasonal”, thus drastically affecting the people's key economic activities such as agriculture, fishing and trade.

The incidence of increased diseases also led to human suffering. Nearly two-thirds (62 per cent) of the respondents noted that there has been an increase of diseases in the area. This was more than four times (14.2 per cent) of those who felt that diseases had reduced, and nearly three times (23.8 per cent) of those who thought that diseases were constant. Human diseases reported included malaria, cholera, dysentery and typhoid. Children were cited as the worst affected of the groups, as they were least adaptive to the conditions. Floods presented the greatest challenge with reports of numerous health complications. They were said to be highly contaminated, with dangerous pollutants, such that when individuals came into contact with them, they contracted life-threatening diseases. This was illustrated by most discussants during FGDs as captured in the excerpt below:

In the past we had 'good' floods. They did not result in a lot of losses as is today. Children could be rained on and none would contract any diseases. But current flash floods are different; they are 'harsh' and 'full of death'. Each time they appear, they make our children sick. (Mrs. Lelo Oloro; 65; FGD; 17.10.2016).

The above observation highlights distress borne upon juxtaposition of the nature of floods experienced in the spatiotemporal period. The expression in which the respondents constructed an anthropomorphic state about “good” floods is reflective of the less destructive floods experienced in the 1970s pre-irrigation scheme compared with those experienced in the post-irrigation scheme. Hence the “harsh” and “full of death” floods were representative of the episode of climate change. Wandiga (2006) in his study of three districts of the Lake Victoria region countries - Kenya, Uganda and Tanzania and similarly found that human diseases such as malaria, cholera and typhoid had increased due to climate change. Despite there being concurrence in the findings, the studies involved people from different cultural backgrounds, with diverse cultural beliefs. This is because different cultural groups are affected by different climatic hazards, and would comprehend human diseases based on their specific experiences. More fundamentally, such changes in knowledge systems could enable people to dynamicize their productive technologies in order to enhance their adaptation to their ecological changes.

The respondents also reported that animal and crop diseases have increased. Animal diseases outlined were foot and mouth disease (*athany*), and diarrhoea (*adiew*). Crop diseases included crop yellowing (*miguna miguna*), wilting, blight and leaf rust. These were reported in respect of the experiences prior to the establishment of the rice scheme. As a result, crops were failing further exacerbating food insecurity. In the local folk ideology of small-scale farmers, increased droughts and high temperatures were indistinguishable from climate change. The finding reflects the IPCC (2014) reports and research by Ogalleh et al. (2012), which have posited that climate change is exacerbating the destruction of crops and death of livestock through variable diseases and pests. According to Olsson et al. (2014: 798-799):

Livelihoods are dynamic and people adapt and change their livelihoods with internal and external stressors. Yet adverse impacts of weather events and climate increasingly threaten and erode basic needs, capabilities, and rights, particularly among poor and disenfranchised people, in turn reshaping their livelihoods.

In view of the foregoing, the respondents’ worldview of climate change has been constructed and expressed through the variant climatic hazards. These have negatively affected human and animal survival as well as their livelihood means, including

productive activities such as agropastoralism and other economic activities. The spurring frequency and severity of the climatic hazards presents the clearest image of the people’s perception and expression of the evolving ecology. This situates itself within the emergent knowledge systems that practically express the way the people are coming to terms with challenges occurring in their ecology. This outlook could be important in informing intervention, response and policy programmes geared towards combating the phenomenon of climate change.

4.4. Sociocultural responses to Climate Change

The response mechanisms of the respondents were mainly influenced by local experiences and knowledge. These strategies were engaged to deal with the climatic hazards indicated in Table 4.3.1 earlier in this section. It is worth pointing that the strategies fell into long-term and short-term mechanisms as will be shown in Tables 4.4.1. (a) and 4.4.1. (b).

Table 4.4.1(a) Adaptation to flash floods and dry spells

Strategy	Frequency	Percentage (%)
Select sites for homestead	25	23.8
Construct houses with certain materials	20	19.0
Hedge homesteads with vegetation	8	7.6
Women group participation	24	22.9
Youth group activities	28	26.7
Total	105	100

It is notable that youth (26.7 per cent) were actively engaged in climate change intervention. Their involvement was through the use of telephony technology to alert community members about the hazards of climate change. In particular they posted images of flooded areas on social media. These were shared with others in order to enhance the people’s awareness. During focus group discussions, Mr. Achuodho Kech, 32-year-old discussant said, “In times of floods we take pictures of these spots and post them on *Facebook* and *WhatsApp* in order to reduce losses.” The youth had learnt about particular flood-prone sites, therefore, they leveraged on the benefits of the new media to share information in real time that could inform other people’s action and response.

In addition, the youth engaged in structural engineering developments and tree planting exercises unlike before when the older people mainly led such tasks. This was corroborated by another observation below from a discussant in the FGDs:

With increasing challenges of floods and dry spells to the local biodiversity, we have chosen to spearhead the saving of our environment. In times of floods, the young men open up the clogged water passages and runways, while the young women assist in planting trees. So, all of us contribute to the conservation of our environment. (Mr. Awis Ler, 34; FGD; 10.10.2016).

The involvement of the youth in climate change matters is important if societies are to achieve sustainability in their environment. According to IPCC (2013), the youth are vulnerable groups, as they are not always involved in discussions that affect their lives and livelihoods nor have their perspectives been well addressed. Therefore, it is imperative to appreciate the innovative strategies of the youth and establish how they could not only enhance their participation in but also lead to the management of climate change.

Further strategies of diversifying adaptation witnessed the involvement of women in climate change matters. The respondents (22.9 per cent) have mainstreamed climate change issues into their group agendas. This is realised by ensuring that they undertake measures to enhance their adaptation to the vagaries occasioned by climate change. An informant, for instance noted as shown below:

For a long time, we women did not care about the environment. Yet we are the most affected with the change of 'environment' [climate], since we are the ones heavily engaged in farming and other food producing activities. Due to climate change, it is difficult for us to feed our families as result of lack of food. Therefore, in our women groups we educate fellow women to not destroy the environment by cutting down trees. (Mrs. Apisi Losa, 64; 17.10.2016).

In most African societies, women are prime actors in agriculture, serving as food producers. Hence they are worst affected when the sector is destroyed by climate change. Yet it is not known how women navigate issues of climate change to cope with the phenomenon. Therefore, the finding on the increasing participation and engagement of the youth and women in climate change matters presents an emerging pattern of

“organisation” in the society in which diverse groups are becoming key players to enhance adaptation towards variable natural phenomena. This is a key principle of the cultural ecology theory which recognises the role of organisation in ecological adaptation.

The respondents also mentioned particular conventional mechanisms used in promoting adaptation to flash floods and dry spells. These included 23.8 per cent who selected specific sites to establish their homesteads; a further 19 per cent have constructed their houses with particular materials; and 7.6 per cent who have encircled their compounds with euphorbia and other forms of vegetation. Site selection for house construction is necessary for reduction of losses by floods from both abnormal rainfall and the River Nyando flooding. This is captured in the excerpt below:

Before one establishes his homestead one surveys for a strategic place that can be least affected by floods. The land here lies on low land, which is inundated during heavy rainfall. Since we know the points that are worst affected by floods, we don't build on such points to prevent our homesteads from being washed away. We construct our homesteads on *thur* (higher grounds) (Mr. Joseph Okong'o; 68; 11.11.2016)

From the foregoing, strategic house construction was not only an adaptive mechanism but also a symbolic practice that presented socialising component of the physical landscape for human survival. This humanised physicality of the landscape afforded the construction and expression of a shared milieu of cultural continuity amongst the people. By affirming that ‘everybody knows points that are worst affected by floods’, it could be understood that the indigenous knowledge was a lifelong revelation in the community cultivated through enculturation.

This indigenous knowledge was reinforced by indigenous architectural technologies in which houses are built with iron sheets and mud walls. The women respondents revealed that they encircled houses with mounds of soil often called *ndiri*. The materials do not offer permanent protection against flooding, but they are preferred because they allow quick and cost-effective repair of the houses after flooding. Permanent structures are less preferable due to their high cost. When asked whether the nature of housing had to do with their low economic status, Mrs. Loise Aoro, 37 year old discussant observed to the contrary, “Our house design and content are not due to poverty. Rather, the floods in this

area are very strange; they don't wash away our houses as in other places. They 'eat' at their base and sink houses under the earth." The spectacle of sinking houses occasioned by flooding was visible in most households across the villages. Concerned about the practical threat to their dwelling, the participants sought to 'give their houses life' and sustenance by creating artificial protection accomplished by raising their bases all round. She added empathically, "This house of mine was not this size. But the frequent flooding by River Nyando has 'shortened' [sunk] it. To save it from further 'shortening', I've encircled it with *ndiri* so that it can slightly hold back floodwater."

Suffice it to note, the perpetuation of *ndiri* technology – despite its reduced protection against flash floods, was predicated on the way the knowledge played out to fulfil the people's cultural domain. This traditional practice was embedded in a perspective that perceived houses as living structures with "life and histories of involvement and relations with both human and nonhuman inhabitants of their environment" (Ingold, 2000:188). Through it, they could accomplish the latent customs and traditions associated with the house that were significant for sustainable dwelling.

The participants' enlivening of indigenous architectural technologies within their customs and traditions could also be linked to the studies by Carsten and Hugh-Jones about the house. Carsten and Hugh-Jones (1995:2) observed that the house is both a physical structure and symbolic relational enterprise. It's an agent of socialisation through "...architectural, social and symbolic significance..." This means that other than being a structure for occupancy, construction of the house is also influenced by certain traditions, customs practices and rituals which shape the owners' relationships and ideas about them. These strengthen the bond between the people and the houses they inhabit.

With regard to coping with high temperatures, 7.6 per cent of the respondents have fenced their homesteads with euphorbia plantations (hedges) to act as barriers against strong winds and whirlwinds (*kalausi*), which destroy homesteads by blowing away houses. This observation was supported by responses from qualitative data. The participants asserted Luo customs associated with homesteads as indicated by 73 year-old, Mr. Gari Pek, a key informant, "A Luo traditional home is not supposed to be left 'bare' without a hedge." This had a component of protection to both the people and other organisms. More importantly, the forestation maintained a relational cosmology to achieve an ecological

balance between the humans and their environment.

High temperatures are also regulated through indigenous architectural designs and materials undertaken on houses in respect to variable weather conditions. Through non-participant observation, houses were seen to bear certain designs. Firstly, semi-permanent houses have eaves that act as ventilation during hot weather conditions. There are not grass-thatched houses, which are traditionally known for their cooling effect throughout the year. Lack of grass-thatched houses could be attributed to the dwindling vegetation cover (grass twigs) through clearance of fields for human settlement. Some respondents have improvised traditional mats as ceiling material for their houses. The traditional mats are made of papyrus reeds (*par*) and then suspended on the houses' rafters under the roof. This absorbs the sun's heat during the hot conditions, leaving the house cool.

4.4.1. Adaptation of agriculture to unusual weather patterns

Climate change affects local agricultural production leading to the adoption of diverse sociocultural response strategies. A majority of the strategies are reactive in nature, just like the abrupt climatic conditions. However, they are also predictive as they are designed in anticipation of potential future weather conditions such as flash floods and dry spells as shown in Table 4.4.1. (b).

Table 4.4.1(b).Adaption of agriculture to unusual weather patterns

Strategy	Frequency	Percentage (%)
Shifted planting dates	55	52.4
Mixing long and short cycle crops	25	23.8
Diversified crops	10	9.5
Sought employment elsewhere	0	0.0
Irrigated farms	8	7.6
Planted drought resistant crops	3	2.9
Farmed along the rivers/streams	3	2.9
Sold livestock	1	0.9
Total	105	100

Due to changes in the local seasons and weather patterns, more than half (52.4 per cent) of the respondents engaged in subsistence farming shifted planting dates to conform to the emergent climatic conditions. This was nearly twice (23.8 per cent) of those who

mixed long cycle and short cycle crops. Respondents who planted drought resistant crops such as cassava, sorghum, millet, and sweet potatoes were represented by 2.9 per cent. During focus group discussions, Mr. Madho Anyona, 44 year old decried petulantly, “Rains are delaying and not following their months as before. When that happens I just wait until they have come, then I can begin planting. I can’t waste my seeds because I won’t have another to replace.”

The knowledge of failing seasons occasioned by erratic weather patterns is critical in preparation for the planting cycle. However, the respondents identify the mixing of long cycle and short cycle varieties as a measure to ensure some harvests are recorded as highlighted below by another FGD participant:

When I first came here I used to plant indigenous maize seeds because they were maturing fast; but they stopped yielding well and today I plant hybrid ones. I also mix the maize with vegetables, which I can then harvest and sell to get money if the maize fails. (Mrs. Jare Okello, 39, FGD; 10.10.2016).

The finding on mixing of long cycle crops which require long rains and short cycle crops that produce under minimal rains is in agreement with that of a study by Ogalleh et al. (2012) among farmers in Laikipia district, which found that the farmers adopted intercropping maize, beans and potatoes so as to adapt their agriculture to droughts. The traditional knowledge of weather forecasting and seasonal trends embedded in the local people’s indigenous knowledge enables the respondents to make clear decisions about the timing of their farming cycles. This can be linked to the cultural ecology theory in that evolving knowledge on emerging seasonal changes in Ahero Irrigation Scheme has enabled the respondents to develop new productive strategies and mainstream them within their old farming practices to adapt to the climatic hazard of dry spells caused by climate change.

Generally, the body of adaptation mechanisms for agriculture with a huge significance level among the participants in Ahero Irrigation Scheme sub-location is shifting of planting dates followed by interspersing of long and short cycle crops. These have been corroborated by qualitative data from focus group discussions and key informants. Other mechanisms used to adapt farming included 9.5 per cent of the respondents who diversify

to other crops that have the potential for better returns as opposed to traditional crops such as maize and rice. The crops include vegetables (*sukuma wiki* (*Brassica oleracea*), *osuga* (*Solanum nigrum*L.), *dek/akeyo* (*Gynandropsis gynandra* (L.) Briq.), *bo* (*Vigna unguiculata* (L.) Walp.), legumes (peas), horticultural crops (tomatoes and watermelons) that require little amount of water to yield. The crops are sold at the nearby Ahero market, in Kisumu town about 25kms from Ahero, and also in Nairobi about 350kms away.

Some respondents irrigate and farm along the rivers and streams as an adaptive strategy to climate change. In particular, 7.6 per cent of the respondents plant yams and vegetables along the Rivers Nyando and Miriu by irrigation, even though it is generally expensive owing to the high cost of fuel. They irrigate short cycle crops like vegetables and tomatoes. The respondents also plant drought-resistant crops such as cassava, sorghum, potatoes and millet. The crops are favoured because they not only yield under minimal rainfall conditions, but their harvests also last longer than the maize produce. This observation was confirmed by some discussants as shown in the excerpt below:

Sometimes our maize crop has failed due to little rainfall. As such, we plant crops such as sorghum, millet, and cassava. Whenever they yield they last longer than maize produce. (Mr. Ano Oluoch, 53, FGD; 14.10.2016).

The respondents demonstrated that cultivating crops that could withstand low rains could be profitable. Therefore, they had reverted to crops such as sorghum, cassava and millet, which have better yields in rain deficient periods. The finding bore concurrence with that by Cohen & Atieno-Odhiambo (1989) on the “insecurity” of the maize as a food crop amongst the Luo of Siaya. Their finding of the Siaya people was that maize was ‘sweet’ and a ‘light’ crop, which was consumed and completed faster than indigenous crops such as sorghum, cassava and millet perceived as heavy crops. Even though the findings may concur, more so, the fact that both studies were conducted among the Luo, the practice was characterised by different climatic conditions experienced. The motive for the adoption of indigenous crops was to safeguard people from food insecurity. However, the Luo of Siaya disregarded maize crop due to its fast depletion. Inversely, the Ahero people adopted indigenous crops in respect to the extreme climatic conditions that have reduced the productivity of the maize crop. A key informant corroborated this observation as

shown below:

The one crop that I don't depend on entirely is maize. It is a signal of hunger. If you walk around this sub-location you won't see even a single granary. In the olden times every homestead had not one but more than two granaries depending on the number of wives one had; and these were always filled with harvests such as sorghum, millet and finger millet from the previous harvest. The farms produced well; and people did not have to toil to get good harvests. But maize crop has wasted us a great deal. It cannot withstand the change of environment [climate]. This has forced us to return to our previous 'heavy' foods such as cassava and sorghum. With them we manage to have some good harvests, which we store in sacks, so that we can depend on if the rains fail. However, you cannot rely on food stored in sacks. These food sacks are just hunger in themselves. It's difficult nowadays (Mr, Opong Bunge, 67; 3.11.2016).

The traditional granary was perceived as a sign of abundance that was guaranteed by the 'heavy' crops. Therefore, the return to hardy crops was conceived in the desire to achieve food security, that was becoming a challenge in the contemporary period of climate change. This finding partly matches that of a study by Shikwati & Amuhaya (2005) in Kitui and Makueni districts, which found that farmers cultivated drought resistant crops during droughts. Whereas the former study finding is concerned about how geography has inspired the adoption of certain food crops, the present study shows how culture aids the interpretation of sustenance, thereby conditioning the re-adoption of certain indigenous food crops in the era of climate change. The aforementioned adaptive strategies were supplemented by short-term mechanisms that would enable the respondents to minimize the effects of climate change as shown in the following section below.

4.4.2. Short-term mitigating of climate change

Short-term indigenous strategies played essential roles in mitigating the effects of flash floods and dry spells. This was necessary in order to minimize the severity and impact of these conditions to the local lives and livelihoods. More than two thirds (66.7 per cent) of the respondents said that they undertook indigenous structural engineering developments to reduce the severity of flash floods. Essentially, these were adaptive strategies that were categorized as mitigation mechanisms. These include digging trenches (*ohula*) and

terraces; building dykes along the riverbanks often referred to as (*ohinga/okuta*); and building gabions among other strategies as indicated in Table 4.4.2.

Table 4.4.2. Short-term mitigation strategies against flash floods and dry spells

Strategy	Frequency	Percentage (%)
Undertake local structural measures (dig trenches, terraces, build dykes, gabion)	70	66.7
Migrate to evacuation centres	10	9.5
Dig pans/ponds	5	4.8
Farm along the rivers and streams	20	19.0
Total	105	100

The respondents are aware of the spots where the local rivers would break their banks and inundate the area. Therefore, they constructed dykes, trenches and terraces at those points as well as around their homesteads in order to redirect the flow of floodwater. This reduces losses both to homesteads and property. The participants were observed digging trenches and terraces; they also constructed dykes along Rivers Nyando and Mirui at Masara in Kakola village. Comparatively, Sayers et al. (2013) observed that, people in San Antonio U.S.A used embankment dams to control the flow of the flash floods (alongside non-structural measures). Similarly, in Almaty, Kazakhstan, dams are also used to retain flash floods and mud flows from nearby mountains.

Such structural measures may not be viable in combating flash floods. However, they are useful in redirecting flows, stabilizing slopes and strengthening properties as opposed to defending the floodplain. Arguably, the micro strategies in Ahero Irrigation Scheme are significant because they not only reflect the people’s local ecological and cultural context, but may also affect sustenance in the nearby localities. This could be linked to the macro feature of the ritual of hailstorm arresting whose manifestations could be felt in other nearby localities other than Ahero sub-location. Therefore, different cultural systems generate variable adaptive technologies/strategies depending on their different ecological zones which is embedded in the cultural ecology theory.

Other short-term strategies that were used to mitigate effects of climate change include cultivation of crop along rivers and streams represented by 19 per cent of the respondents. During dry spells, water becomes scarce increasing the cost of irrigation. The respondents, therefore, take advantage of their farms being nearer to the rivers and use the water for irrigation. But this does not sustain rice farming, as the crop requires a lot of water. Furthermore, 9.5 per cent whose homesteads are not erected on higher grounds temporarily migrate to safer grounds during flash floods. Flash floods diminish people's adaptive capacities, hence the most affected households temporarily move to the nearby Kogalo Evacuation Centre where they stay until the floods have subsided. The evacuation centre, in Kakola village, was constructed with financial assistance from Japan International Cooperation Agency (JICA). Some households migrate to the nearby primary schools such as Masara, Kegoche and Obiayo.

The threat of dry spells also inspires diverse short-term measures in the area. As shown in Table 4.4.2, 4.8 per cent of the respondents who lived near the River Nyando dug water pans (*yawo*) to conserve water for future use. This observation was supported by responses from in-depth interviews and represented by the remark below:

During droughts we go through a lot of suffering. We lack enough water. So those of us who live around River Nyando, dig pans to conserve water and use it for drinking, watering animals and small-scale irrigation (Mr. Oloo Ogodo not his real name, 63; 7.11.2016).

The finding is consistent with that of a study by Macharia et al. (2012) in Nyeri and Laikipia districts where farmers dug individual water pans, which were then used for harvesting and storing rain water for later use in farming when piped water was not forthcoming.

In conclusion, the respondents in Ahero have developed adaptation technologies in agriculture and settlement to enhance coping. These are informed by indigenous beliefs and knowledge reflective of their local ecology, attitudes that provide practical perceptions of their evolving ecological systems. The technologies of dwelling as socially constructed through site selection for homesteads, and production mechanisms, are illustrative of the infrastructural features within the cultural ecology theory that enhance

people's adaptation to their environments. There was a misconception regarding what the respondents regarded as mitigation measures, as these pass for adaptation strategies, in normal climate change discourse. In general the mechanisms have contributed to the management of climatic conditions within the local context.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary, draws conclusions and makes recommendations in line with the study objectives.

5.1. Summary

The study examined cultural perspectives that shape the people's interpretation, explanation, and the sociocultural adaptation to climate change effects. To accomplish that objective, cultural perspectives were delineated to key components such as indigenous beliefs, local attitudes and sociocultural response strategies. These constructs and how they are connected with climate change are explained in the critical review of literature in chapter two.

Regarding the first objective, the study found that the respondents in Ahero Irrigation Scheme sub-location had diverse indigenous beliefs through which they interpreted and explained climate change. These included religion, signal of hailstorm and the associated ritual to arrest its occurrence. They also interpreted and perceived climate change through nonhuman organisms such as the semiotic signal of *magungu* bird species, which acted as markers of seasonality. The bird species were important in declaring the onset of the rainy season. However, the phenomenon of climate change has interfered with their movement such that they appear even when rain is not expected. Other nonhuman organisms included ant movements and behavioural patterns of livestock.

For the second objective, it was found that local attitudes are expressed in respect of the effects, severity and frequency of the climatic hazards on the people's livelihood means and settlement. Local climatic conditions such as abnormal rainfall, flash floods, increasing dry spells, high temperatures, diseases and increasing crop failures provide the image of conditions by which individuals in the study area construct their experiences, draw comparisons and conclusions about the changing state of the climate in the area.

Thirdly, it was found that the respondents use different sociocultural strategies to combat climate change. These include long-term (adaptation) and short-term (mitigation) mechanisms informed by traditional knowledge and experience of the climatic conditions. The diverse methods used to collect data enhanced the understanding of how people

engaged with their ecology and interacted with climate change. This further facilitated the understanding of the way cultural ecological principles of structure (organisation), superstructure (culture) and infrastructure (productive technology) enabled the people to organise their practices and innovate new technologies that would enable them to promote their livelihood and survival.

5.2. Conclusions

The local people in Ahero believe that climate change is caused by God. The people also hold varied indigenous beliefs about the change of local climate such as ritual of hailstorm arresting, marginalisation of indigenous institutions, and sins among others as shown in chapter four. Although the majority of respondents were Christians, their religious beliefs were entwined with local indigenous beliefs. Therefore, religion, in general, shapes the people's construction and explanation of climate change in Ahero Irrigation Scheme sub-location.

Local attitudes were able to communicate the way they perceived climate change in their ecology. The elements of severe and frequent climatic conditions completed the image of the impact these caused to the people's lives, livelihoods and settlement. The magnitude of climate change hazards experienced by local people determines the extent to which they resort to religious beliefs for psychological adaptation to the phenomenon.

Finally, the people in Ahero Irrigation Scheme sub-location resort to long-term and short-term indigenous strategies to combat the effects of climate change. These strategies are micro in nature given that they are undertaken at a local level, despite the greater magnitude and frequency of the hazards. The strategies, however, could be visualised as macro in nature. Since they could also affect sustenance in other localities in similar ways the activities that exacerbate climate change are heavily concentrated in far away industrial nations but which come to affect developing nations. However, there is a misconception regarding what the people consider as mitigation strategies against adverse effects of climate change. They describe structural adjustments measures, as opposed to strategies geared towards reduction of the greenhouse gases, as mitigation measures.

5.3. Recommendations

From the study findings, a number of recommendations can be made in line with the study objectives.

5.3.1. Policy Recommendations

A majority of people in Ahero Irrigation Scheme sub-location interpret and explain climate change through diverse religious constructions and indigenous ideologies, including mystical and superstitious manifestations. Therefore, policy makers should consider how indigenous beliefs embedded in cultural domains could inform the expression of the natural phenomena. Since people remain in constant engagement with the nonhuman world that reflect their lives and perception of environment. This could be done through engaging community elders with indigenous knowledge on local weather systems. By so doing, the people will be able to reinforce the value system of their culture, and feel as being part and parcel of solution to natural phenomena unfolding in their ecology.

Secondly, climate change has caused immense anxiety due to its devastating effects to the people's settlement and livelihood means. They view climate change as a threat to their survival. Therefore, it is essential that local people's attitudes about climate change should inform adaptation and mitigation strategies spearheaded by national and international agencies geared towards combating climate change. It could be done by building on the people's opinions and views about specific climatic hazards experienced and their impacts. This could then be taken up by agricultural experts and climatologists to guide the designing of specific, contextualised strategies.

Thirdly, the people in Ahero Irrigation Scheme sub-location are greatly attached to their traditional strategies of managing climatic conditions. This could be significant within the policy frameworks discussed in chapter two. This is because sociocultural strategies offer people practical solutions to the local natural phenomena occurring in their ecology. Therefore national and global policies on agriculture and settlement, for instance, could immensely gain acceptance by the people, and achieve the desired effect, if they are designed within the local people's strategies.

It is also recommended to the local people that it would be beneficial to adopt some national policies into their traditional strategies. This is because some of their indigenous prediction and warning signs for climatic hazards such as flooding have become unreliable. Hence they are unable to guarantee adaptation and life sustenance.

5.3.2. Suggestions for further Research

Firstly, a study should be conducted to determine how climate change has affected social networks, indigenous knowledge and institutions in the area. This was not done at the time, since it was considered out of the scope of this study. However, through the course of the study it emerged that certain the people's practices could be contributing to the preservation of environment.

Secondly, a research should be undertaken to examine what impact the new media has had on adaptation to and mitigation of climate change effects in the area. The element of new media was not contemplated at the time, because it is a recent invention widely associated with the youth. It was therefore inaccurately assumed as being of little interest to the elderly, who were are known to be reservoirs of indigenous beliefs and knowledge on climate variability. Nevertheless, as the study progressed, it came to the fore that new media could be a key intervention strategy that may complement traditional strategies. Therefore, a study could reveal how both the older and new generations are making use of this new technology to promote adaptation and achieve sustainable lives and livelihoods.

Thirdly, a study should be carried out in the area to establish the way climate change has re-organised and re-ordered social relationships. This includes gender, age and other social groups in the community, since different demographics are engaging in climate change intervention differently. The attribute was not considered a crucial element in the intervention scheme then. However, during the study this element turned out to be a major plank through which new roles and engagements with ecology are mediated. Therefore, a study in the area might reveal if these new social structures and re-organisations could lead to adoption of new strategies of managing climate change.

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11. What, in your own view, is climate change?

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.....

12. In your opinion, what is the single most cause of climate change?

(a) Curses() (b) God () (c) Taboos() (d) Ancestors/Spirits()

(e) Customs () (g) Witchcraft () (h) Poverty () (i) Other ()

13. How reliable is this cause?

(a) Very reliable () (b) Reliable () (c) Mildly reliable () (d) Not reliable ()

14. What, in your view, is the greatest indicator of climate change?

(a) Abnormal rainfall () (b) Flash floods () (c) River Nyando Flooding ()

(d) Dry spells () (e) High temperatures () (f) Low temperatures ()

(g) Crop failures () (h) Increased human diseases () (i) Increased crop disease ()

15. In what ways is climate change a threat to the lives of people in this area?

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.....
.....
.....

Part C: Local Attitudes towards Climate Change

17. Is climate change a threat to people here?

(a) Yes () (b) No ()

18. How would you rate the indicators of climate change you mentioned above as a threat?

(a) Serious () (b) Very serious ()

(c) Normal () (d) Not serious ()

19. How would you rate each one of these?

(a) Increased () (b) Constant () (d) Decreased ()

20. How would you describe the frequency of these climate change hazards?

(a) Very frequent () (b) Frequent () (c) Less frequent ()

21. Does climate change need immediate response? Explain your answer.

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.....
.....

22. Climate change has led to many diseases in this area?

- (a) Strongly agree () (b) Moderately agree () (c) Moderately disagree ()
(d) Strongly disagree ()

23. What local words do you use to describe climate change?.....

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.....

Part D: Sociocultural Responses to Climate Change

24. How did you tell about climate variability in the area?

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.....
.....

25. What indigenous ways do you use to manage climate change effects?

Flash

floods.....
.....
.....

Droughts.....
.....
.....

Variable temperatures

.....
.....

Diseases.....
.....

26. What traditional way do you use to adapt to your dwelling/residence?

- (a) Site selection for homesteads () (b) Housing material choice ()
(c) Homestead hedging ()

27. Which method do you apply to adapt agriculture to climate change?

- (a) Shift planting dates () (b) Intercropping () (c) Crop diversification ()
(d) Irrigation () (e) Farm along rivers and streams ()

26. How do you rate the strategies you use to combat climate change?

- (a) Very effective () (b) Effective () (c) Slightly Effective ()
(d) Complete failure ()

27. How do community members involve in climate change mitigation?

- (a) Social groups () (b) Youth groups () (c) Women groups ()

Appendix II: Focus Group Discussions Guide

1. What do you consider as climate change? – Probe for knowledge
2. What do you believe causes climate change?
3. How serious is climate change today than before?
4. What traditional methods do you know that can be used to predict climate change?
5. What particular indigenous practices can lead to climate change?
6. What human activities can cause climate change? (Probe for moral issues)
7. What indicators signal climate change and variability?
8. What are your views on the indicators of climate change in this area?
9. Do you find it appropriate to continue living here with increased climate change effects?
10. What roles do you play during climate change? (Women, men & youth)
11. How do you respond to climate change?
12. What traditional methods do you use to control climate change?
13. Have they managed to combat climate change or not?
14. Compared with modern methods of predicting and addressing climate change, which ones do you find effective? Why?
15. Do you believe in this era you should still be using traditional ways and practices to control climatic problems?
16. What are your views on the government efforts towards mitigating climate change in this area?

Appendix III: Interview guide for Key Informants

1. How is the climate today different from before?
2. What do you believe is behind the current climate change?
3. What traditional ways did you use to predict climate variability?
4. What taboos and customs are associated with climate change in this area? Aspects to explore (beliefs, values, customs, taboos, superstitions, myths, religious beliefs)
5. How did you traditionally recognize change in climate?
6. Do you still rely on these ways to predict climate variability today?
7. Is climate change more serious today than before? Please elaborate.
8. Given the frequency and severity of climate change, how do you cope with the phenomenon?
9. What indigenous ways did you use to respond to climate variability?
10. In the face of increased climate change, should you still be using the traditional methods to control climate change? Explain.
11. Have there been any modern methods introduced here to combat climate change? Elaborate.
12. What do you think about them?
13. Do you still conduct rituals and ceremonies in relation to the environment and climatic hazards such as floods, droughts, variable temperatures and diseases?
14. How significance are these ceremonies and rituals?
15. What cultural systems have been affected by climate change in this area?
16. How have these systems been affected?