MANIFESTATION OF CLIMATE CHANGE ON THE LIVELIHOODS OF WOMEN IN KWALE COUNTY, KENYA

BY

GITHOGORI HELLEN WAMBUI

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DECLARATION

Declaration by Candidate

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Hellen Wambui Githogori

SHRD/PGD/01/14

Declaration by the Supervisors

This thesis has been submitted with our approval as University Supervisors.

Sign:_____ Date:_____

Prof. Leonard S. Mulongo

Department of Geography

Moi University

Sign:_____ Date:_____

Dr. Alice Kurgat

Department of Sociology, Psychology and Anthropology

Moi University

DEDICATION

This work is dedicated to my dear husband Mwongera Mbogo and my entire family for their consistent support and encouragement throughout this process.

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The realization of this work has been a concerted effort with input from various people. I wish to express my gratitude to God for the strength, provision and protection He has granted me throughout this endeavor. I also appreciate the management of Moi University for providing the opportunity for me to undertake this study. Then to my supervisors Prof. Leonard S. Mulongo and Dr. Alice Kurgat, I appreciate your readiness to assist in this work, your positive criticism and corrections. It went a long way to making this work meticulous

ABSTRACT

Climate change constitutes one of the development challenges in the 21st century. In Kenya, the formulation of a regulatory framework for enhanced response to climate change hasn't adequately managed the resulting outcomes. Available studies have indicated that the effects of climate change are widespread, however, this study focused on women as a specific vulnerable group which has been affected by climate change in order to derive appropriate mechanisms of mitigation and adaptation. The purpose of the study was to establish the manifestations of climate change on the livelihoods of women in Kwale County, Kenya. It was guided by the following objectives: to assess the women's perception of climate change in Kwale County, evaluate the impact of climate change on the livelihoods of the women in Kwale, assess the adaptive strategies to the effects of climate change by the women in Kwale County and determine the challenges encountered in the implementation of the adaptation strategies. The study was based on the Sustainable Livelihoods Framework. A descriptive survey research design was utilized and the target population was 192 women groups that are active in Kwale County each with an average of 10 members. The sample size was determined using Yamane formula and the sampling techniques utilized were simple random and purposive sampling. The instruments of data collection were structured questionnaires, key informant interviews and observation. The quantitative data was subjected to the SPSS program and analyzed using the measures of frequency, percentages, mean and standard deviation. In addition, correlation analysis was done using the Pearson correlation coefficient to determine the strength and direction of the relationship between the effects of climate change and the livelihood outcomes. The Qualitative data was analyzed using content analysis and presented through illustrative quotations. The results established that increase in temperatures at 95%, decrease in rainfall amounts at 89.2% and increased incidences of drought at 96.2% were the highest perceived changes in climate in the study area. These perceived climatic changes were to a great extent negatively affecting the women's livelihood assests in agriculture, food security, water resources, energy resources and health. Consequently, the women were implementing various adaptation strategies with the most frequently used being diversification into non-farm activities at a mean of 3.30. However, their adaptation capacity was challenged by the barriers of lack of relevant skills and training, lack of capital, inadequate reliable information on climate change, inadequate infrastructure, poor health and the greatest barrier was water scarcity at 81.5%. The findings indicated that there was a significant moderate negative correlation between the effects of climate change and the livelihood outcomes at 5%. It was concluded that the women were well aware of the changes in climate. Even with the onset of the negative effects of these changes on their livelihood assets, there was a positive shift to other sources of livelihoods albeit as short term interventions because of existing barriers. The study recommended that the government and other intervening institutions should consider the existing autonomous strategies that are being used and built on them to enhance the resilience of the women thereby enhancing their potential as central agents in the process of climate change adaptation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ABBREVIATIONS

AFDB Africa Development Bank

DFID Department for International Development

FAO Food and Agricultural Organization of the United Nation

FCCC Framework Convention on Climate Change

IDS Institute of Development Studies

IISD International Institute for Sustainable Development

IPAC Intergovernmental Climate Prediction and Applications Centre

IPCC Intergovernmental Panel on climate change

NAMA National Mitigation Action Plan

NCCAP National Climate Change Action Plan of Kenya

NCCRS National Climate Change Response Strategy of Kenya

NGO Nongovernmental Organization

UNDP United Nations Development Program

UNFPA United Nations Fund for Population Activities

UNFCCC United Nations Framework Convention for Climate Change

OPERATIONAL DEFINITION OF TERMS

Climate Change**:** It is a change in the traditional state of the climate that can be identified and that persists for an extended period, typically decades or longer (IPCC, 2007).

Climate Variability: Short term fluctuations in elements of climate including rainfall, temperature and humidity attributed to both anthropogenic and natural factors (IPCC, 2007).

Adaptation: Adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities. (IPCC, 2007).

Adaptive Capacity: This the ability of a system to adjust to climate change and climate variability to moderate potential damages to take advantage of opportunities, or to cope with the consequences (IPCC, 2001).

Vulnerability: The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes (IPCC, 2007).

Mitigation: A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC, 2007).

Livelihood: Is a combination of the resources used and the activities undertaken in order to live (Scoones, 2009)

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter highlights the problem under study; it consists of the background of the study, statement of the problem, objectives, and research questions, justification of the study, scope of the study and limitations of the study. The chapter articulates key issues that lays the foundation to the study.

1.1 Background of the Study

In the world over, the reality of climate change is now well accepted and it constitutes one of the key development challenges of the 21st Century. It has emerged as one of the most serious threats to sustainable development globally. This has attracted global attention which started as an international environmental and developmental challenge beginning with the publication of the Brundtland Report in 1987 then to the formation of the Intergovernmental Panel on Climate Change in 1989, the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, and the establishment of the United Nations Framework Convention on Climate Change (GoK, 2010).

Climate change has been evidenced in the globe through the rising temperatures and increasingly variable rainfall patterns that have resulted in increased frequency of extreme weather events such as floods and droughts. For instance, it has been reported that the last two decades have recorded six years with the warmest temperatures and rainfall variability in Sub-Saharan Africa (SSA). Decreases in rainfall have been recorded in the Sahel region and increases in the East and Central African region. Consequently climate-related disasters such as floods and droughts have doubled in these regions within the last quarter century and Mozambique, Malawi, Kenya, Madagascar and Ethiopia are examples of SSA countries likely to experience

unexpected extreme climatic events (World Bank, 2009). In the Sub-Saharan region, rainfall patterns have become less predictable, precipitation has decreased on average and temperatures are rising.

In Kenya, temperatures have risen throughout the country. Rainfalls have become irregular and unpredictable, and when it rains, downpour is more intense. Extreme and harsh weather is now a norm in Kenya. Climate change has been manifested through the alternating cycles of droughts and floods. Though these are not a new phenomenon in Kenya, the frequency of their occurrence and severity have been increasing over time. For instance, the frequency of drought increased from once in every 10 years in 1970s, to once in every 5 years in 1980s, once in every 2-3 years in 1990s and every year since 2000 (Howden, 2009).

The regular occurrence of floods and droughts has continuously undermined economic development in the affected areas exacerbating poverty levels. The alternating cycles of droughts and floods do not only destroy the livelihood sources but also severely undermined the resilience of the people living in the affected areas. Kenya's susceptibility to the impact of climate change is associated with the sensitivity and fragility of its natural environment, and its high dependence on environment-based livelihoods.

Climate shocks affect livelihoods in many ways. They wipe out crops, reduce opportunities for employment, push up food prices and destroy property, confronting people with limited choices (UNDP, 2007). In these circumstances, the poorest populations and marginal groups are impacted the most. The poor and most vulnerable may have no alternative but to reduce consumption, cut nutrition, take children out of school, or sell the productive assets on which their recovery depends. These are choices that limit human capabilities and reinforce inequalities (UNDP, 2007).

These impacts of climate change affects all but not in equal measure. Climate change impacts vary among regions, generations, age, classes, income groups and gender (Solar, 2010). On the gender perspective, the impact of climate change on men and women livelihoods is not the same. Women are increasingly being seen as more vulnerable than men to the impacts of climate change mainly because they represent majority of the world's poor and are more dependent on the very natural resources that are threatened by climate change for their livelihoods (Solar, 2010).

In Kenya like in many other parts of the world, women are also vulnerable to climate change and climate variability. This is because of their household responsibilities such as collecting water and fuel wood, cooking, managing and providing child care, and greater dependence on weather-sensitive livelihoods. In all of these activities, women are at closest contact with the environment. On the other hand, as women continue to bear the effects of climate change manifestations they have not been without means to cope with the challenges.

Women have capabilities as natural resource managers and community leaders that increase their capacity to cope with various climate hazards (Mutimba *et al*., 2010). Nonetheless, their role in disasters and in the adaptation processes to climate change and Climate variability is still highly invisible (Carvajal-Escobar *et. al*. 2008).It is not enough to leave it at the negative impacts climate change has had on people's livelihood thus it is necessary to also evaluate the ways in which they have managed to survive through this changes and exploit the opportunities presented.

Kwale County is one of the six counties in the coast region. It has four major topographical features namely, the coastal plain, the foot plateau, the coastal uplands and the Nyika plateau which presented the study with a wide range of different impacts

of climate change and varied livelihood activities by the women living across this four areas.

This study therefore focused on how the livelihoods of the women have been affected by climate change manifestation and assess their adaptive strategies and opportunities that have emerged from climate change in Kwale County.

1.2 Statement of the Problem

Climate change is now an inevitable reality. Every country in the world is experiencing the drastic effects of climate change. Significant efforts have been made to deal with this challenge with the concentration of strategies being towards limiting the increase in global warming through mitigation. However, whatever the outcome of the prevention efforts the changes in climate are already underway and cannot be stopped. This reality, therefore necessitates an all-inclusive strategy that also focusses on adaptation to enable sustainability of livelihoods in the wake of climate change.

The effects of climate change are experienced differently across different community groups. However, most of the impacts have been lumped up without a particular focus on specific groups and the study area. The people who suffer the most from the negative effects are the poor people. Consequently, women being the disproportionately majority of the world's poor, are one of the most vulnerable groups to the negative effects of climate change. Even so, the most vulnerable are the most motivated to take a conscious effort towards adaptation. Women have been recognized as positive change agents whose potential can be utilized in the adaptation of climate change thereby enabling them to take advantage of the opportunities that are presented by the changes in climate through their knowledge and skills.

This study therefore sought to document the unique experiences of the women in Kwale County in the specific way in which they perceived the existing changes in climate, the effects these changes have had on their livelihoods, assess their adaptation strategies and establish the challenges they were experiencing in effecting them.

Given the limited data currently available on the specific effects of climate change on specific community groups and the invisibility that women's work still has in risk reduction and in the processes of adaptation, it is necessary to promote for more and better documentation of experiences in this field especially through scholarly work.

1.3 Purpose of the Study

The aim of the study was to determine the manifestation of climate change on the livelihoods of Women in Kwale County and their adaptation to these changes.

1.4 Objectives

The specific objectives were:

i. To assess the women's perception of climate change in Kwale County.
ii. To evaluate the effects of climate change on the livelihoods of the women in Kwale County.
iii. To analyze the adaptation strategies that the women have employed to cope with the effects of climate change on their livelihoods.
iv. To establish the barriers of successful implementation of the adaptation strategies by the women in Kwale County.

1.5 Research Questions

i. What prevailing climatic changes has been perceived by the women in Kwale County?
ii. What has been the effect of climate change on the local livelihoods?

iii. What is the adaptation practice of the women in Kwale County devised in response to the effects of climate change?

iv. What are the barriers to successful implementation of the adaptation strategies to climate change by the women in Kwale County?

1.6 Justification of the Study

Global warming is probably the most complex and challenging environmental problem facing the world today. The current weather extremes being experienced and their predicted continuance, challenge the viability of livelihoods especially those that are climate sensitive and consequently the people that depend on them for their source of living. At the center of this events are the women in the rural areas who rely on the climate sensitive livelihoods.

The absence of in depth documented experiences of these women and effect of climate change on their livelihoods warrants the keen study of their unique experiences that will help to inform policy making and framework in this climate change regime. Further, owing to the previous focus of mitigating against the negative impacts of climate change, a shift to the positive adaptation strategies by the affected community groups is important.

The invisible role of women in adaptation initiatives needs to be clearly brought out by assessing the adaptive strategies they have implemented to deal with the challenges and how they have exploited opportunities that climate change presents.

1.7 Scope of the Study

The research focused on the manifestations of climate change on the livelihoods of women in Kenya with reference to Kwale County. It highlighted on the climate variations that have been experienced, their consequent effect on the livelihoods of

women, the adaptation strategies that they have taken up in response to these effects and their challenges to adaptation. Other than just the challenges climate change has been said to offer opportunities which the study sought to determine. The Study adopted a mixed method approach comprising of both quantitative and qualitative data. Finally, the study was carried out between October 2016 and February 2017 in Kwale County.

1.8 Significance of the Study

Climate change in Kenya has for a long time been thought of as a future challenge but the recent climatic changes being experienced has started to change that perception. The documentation of the manifestations of climate change and its effects on livelihoods will ground the intensity of the threat that climate change poses to sustainable development in Kenya. This information provides valuable input to the development of climate change policy frameworks that are informed on the current situation at the local level towards the attainment of sustainable development.

The research also analyzed the adaptation strategies that the women have employed to cope with the effects of climate change and the important role they play in adaptation. This will enable the incorporation of their input in the development of policies that are specific to their needs thereby increasing their resilience and also embrace the involvement of women in championing for climate change adaptation in their sphere of influence. Finally, the study provides valuable knowledge in this field through the documentation of the unique experiences of women on the impacts of climate change and best practices from their adaptation strategies. This will inform futures studies in the relatively new dimension of gendering climate change.

1.9 Limitations of the Study

In terms of the context scope, the research experienced limitations in relation to the poor road network with most of the county serviced by earth roads. Further, some of

the areas are not accessible by the public transport network. The researcher therefore had to use other means of transport such as motorbikes to access most of the areas. Further, the high levels of illiteracy in the study area posed a potential challenge thus necessitating the researcher to seek the services of research assistants from the study area to translate and assist in data collection.

1.10 Conceptual Framework

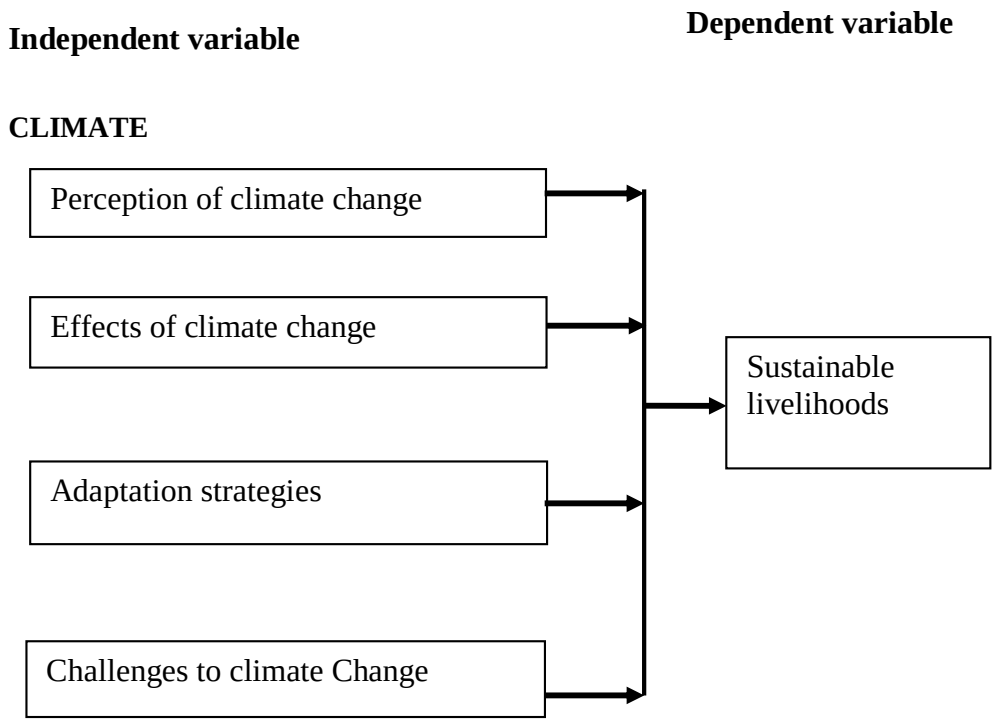

Figure 1.1: Conceptual Framework

(Source, researcher 2017)

The model illustrates the link between climate change and the livelihoods of women. It begins with the perception of climate change, then the effects begin to be felt on the livelihoods of women which necessitates the initiation of adaptive strategies that help to cope with the short term and long term basis building on the resilience of affected people and reducing their vulnerability toward attaining sustainable livelihoods. Finally, it examines the barriers that limit the successful implementation of adaptation strategies.

Generally, climate change has been perceived through increased air temperatures, changes in precipitation and increased frequencies of extreme weather events. However, the ways in which climate change manifests itself varies from region to region. Therefore, it required that at the beginning of the study there is an identification of the ways in which climate change has been perceived in the study area.

The effect of climate change on the livelihoods of women relates to changes in the resource flows that are critical for the sustainability of these livelihoods. This pertains to specific capitals of agriculture, food security, water resources, energy resources, and health. Adaptation strategies are the ways in which people are able to respond and adjust to the actual or potential impacts of the changing climatic conditions to moderate the harm or take advantage of any positive opportunities (IISD, 2003). In this study they were the local actions taken by the affected women in response to the changing environmental conditions. The effectiveness of these strategies is affected by various barriers. Thereby, the study focused on highlighting the specific barriers of lack of capital, lack of water, lack of relevant knowledge and skills, lack of information on climate change, inadequate infrastructure and poor health status.

1.11 Chapter Summary

This chapter provided a contextual background of the study that built up to the statement of the problem. Further the objectives of the study were outlined, the justification of the study and the significance were given. It winds up with the limitations and conceptual framework.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter presents the relevant literature on the manifestation of climate change on the livelihoods of women. The review begins with the theoretical framework, then an overview of the literature on the concept of climate change then move on to the review of literature on the research objectives and conclude with a critical analysis of the existing knowledge gaps.

2.1 Theoretical Framework

Studies on climate change and livelihoods globally have been based on various frameworks and models. For example, some studies have been based on the vulnerability framework by Turner et.al. (2003) especially in the field of climate change adaptation. In relation to this study, the Sustainable Livelihoods Approach was utilized. This approach was conceptualized in the work of Robert Chambers and Gordon Conway particularly in the 1992 discussion paper of the Institute of Development Studies (IDS). They define sustainable livelihoods as 'A livelihood comprises the capabilities, assets and activities required for a means of living; a livelihood is sustained when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term (Chambers and Conway, 1992).

The United Kingdom Department for International Development (DFID) was one of the first proponents to utilize the Sustainable Livelihoods Approach. They built on the ideas of Chambers and Conway to develop a Sustainable Livelihood Framework. Generally, the framework depicts stakeholders as operating in a context of

vulnerability, within which they have access to certain assets. Assets gain weight and value through the prevailing social, institutional and organizational environment (policies, institutions and processes). This context decisively shapes the livelihood strategies that are open to people in pursuit of their self-defined beneficial livelihood outcomes. The framework is designed to include the vulnerability context, the livelihood assets that people depend on, the transforming structures and processes that influence and affect access to these livelihood asset and the livelihood strategies developed in order to achieve resilient livelihood outcomes

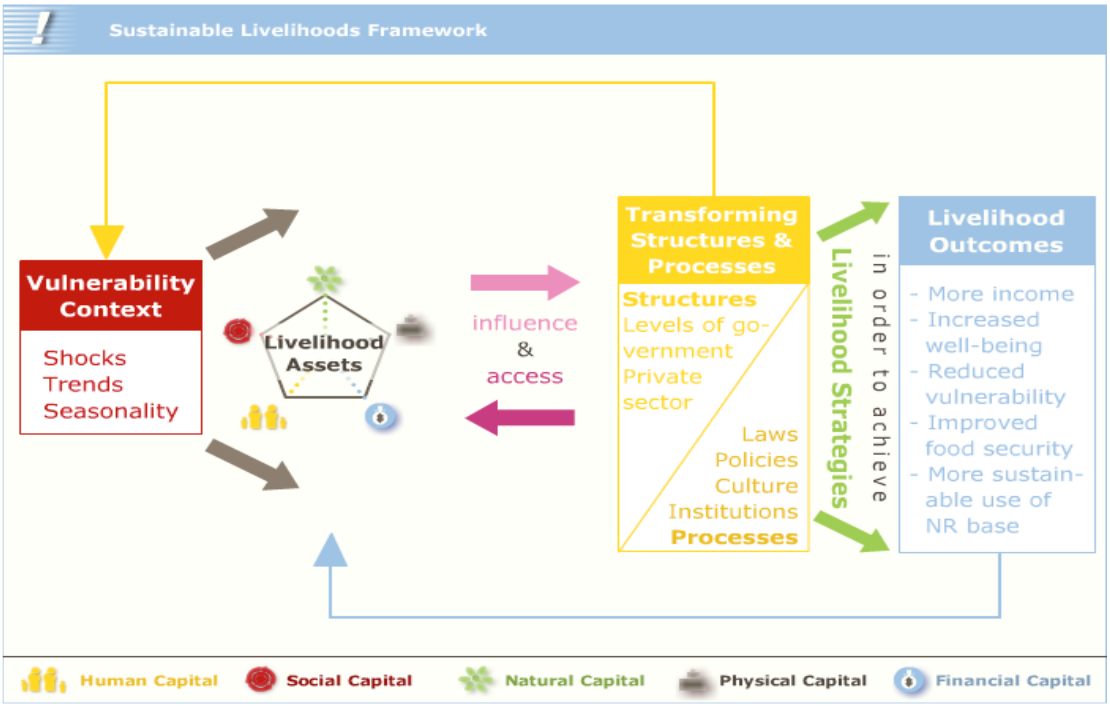

Figure 2.1: Sustainable Livelihoods Framework

Source: DFID, 2000

The vulnerability context is a reflection of the external environment in which people live. It includes the shocks, critical trends and seasonality over which people have limited or no control. These factors have a great influence on people's livelihoods and on the availability of assets. Climate change affects the vulnerability of people in society because of the shocks experienced such as unprecedented floods, droughts and

landslides. The long term trends in natural and socioeconomic processes can alter the vulnerability of societies. Enhanced climate change and climate variability establishes a trend of increased incidences of the climatic shocks that affect vulnerability. Seasonality refers to variation in availability of assets, entitlements, opportunities and requirements throughout the year. It corresponds with differentiation of vulnerability on a household and collective level (DFID, 1999).

The livelihood assets are the different capitals that people own. The approach is founded on a belief that people require a range of assets to achieve positive livelihood outcomes. The Sustainable Livelihoods Framework identifies five types of assets or capitals upon which livelihoods are built. These are the Human Capital, which is a function of knowledge, health, the quality and quantity of available labour and livelihood relevant skills (DFID, 2000). Natural Capital refers to the natural resource base, the access to and management of it, Social capital includes the networks and connections that aid people in building their livelihoods, the physical capital refers to the availability and access to infrastructure and the financial capital are the savings and income of people .These assets are vulnerable due to the impacts of climate change and in turn determine the viability of the livelihoods of people.

Policies, institutions and processes effectively determine access to various types of capital, to livelihood strategies and to decision-making bodies and source of influence, terms of exchange between different types of capitals, and returns to any given livelihood strategy. Therefore, their efficiency determines the successful implementation and sustainability of the livelihood strategies devised to enable adaptation to climate change.

Livelihood strategies comprise the range and combination of activities and choices that people make or undertake in order to achieve their livelihood goals. Livelihood

strategies are direct dependent on asset status and policies, institutions and processes. Climate change impacts on the livelihoods of people necessitates the development of sustainable livelihood strategies so that people can achieve positive livelihood outcomes that are indicated by more income, increased well-being, more sustainable use of natural resource base and improved food security.

2.2 Climate Change Concept

The Intergovernmental Panel on Climate Change defines climate change as a change in the state of average weather patterns attributed to both natural and human induced factors and which in addition to variability persists over long periods (IPCC, 2007). Other authors have defined climate change as simply the anthropogenic alteration of global climate system through combustion of fossil fuel, deforestation, and other activities that contribute to increased concentration of greenhouse gases in the atmosphere (Sexton *et al*., 2001; Weart, 2010; Trenberth, 2011; Curry, 2011). Further, Holdren (2006) defines climate change as alterations in earth's weather patterns in terms of the averages, the extremes, the timing, and the spatial distribution of weather events manifested in the form of hot or cold, wet or dry, snowpack or snowmelt, winds or storm tracks, and ocean currents or upwelling, which are in addition to rising global temperatures.

The definition by IPCC and researchers focuses on the causes of climate change thereby failing to clearly illustrate the concept itself. In Holdren (2006) the meaning is well articulated. This is because when talking about climate change, the indicators in question have to be measurable and they must portray an extremity in their behavior. This view was supported by Smith *et al*. (2000), where they say that the frequency and intensity of extreme climatic events such as drought, floods, storms and hurricanes, are also part of global climatic change. Climate on earth has changed on all time scales

even before human activity could have played a role in its transformation. But the UNFCC defined climate change "as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". However from the IPCC (2007) definition of climate change, it attributes the change due to natural variability alongside human activity. Thus in the environmental discourse, different stakeholders have characterized climate change as mainly the change in modern climate augmented by human activities such as burning of fossil fuels.

2.2.1 Emergence of climate change as a development concern

The climate change debate begun with intensive debate amongst the 19th century scientists. Since then, it has been undoubtedly the most illustrious environmental issue since the late 20th Century. The history of the climate change discourse shows that from a purely scientific concern, it has turned into a public agenda that is now more inclined to the development agenda. According to Bodansky (2001), the development of the climate change regime until the conclusion of the Kyoto Protocol in 1997 can usefully be divided into five periods: the foundational period, during which scientific concern about global warming developed; the agenda-setting phase, from 1985 to 1988, when climate change was transformed from a scientific into a policy issue; a pre-negotiation period from 1988 to 1990, when governments became heavily involved in the process; the formal intergovernmental negotiations phase, leading to the adoption of the FCCC in May 1992 and a post-agreement phase focusing on the elaboration and implementation of the FCCC and the initiation of negotiations on additional commitments, leading to the adoption of the Kyoto Protocol in December 1997.

The public attention on climate change was captured for the first time by the Brundtland Report, Our Common Future, published in 1987 which highlighted a number of environmental problems including climate change. The report stated that the world's climate is on a warming trend being driven by the unsustainable development practices of humankind (UNWCED, 1987). However, the global concern on the possibility of a changing climate was triggered by the unusual heat wave and drought of the summer 1988 (Christianson, 1999). Based on the Brundtland Report, the Intergovernmental Panel on Climate Change (IPCC) was established in 1989 to carry out periodic assessments on the global climate system. IPCC has three committees, commonly referred to as working groups, each dealing with different aspects of climate change.

Working group I deals with assessment of the scientific aspects of climate system; working group II deals with impacts, vulnerability and adaptation options; and working group III assesses mitigation options. IPCC, the leading global scientific research body on climate change, produces assessment reports based on scientific research submissions from various scholars across the world .IPCC published its first assessment report in 1990. The report of Working Group I confirmed that the world's climate is actually warming and action needs to be taken to curb further anthropogenic interferences of the climate system (IPCC, 1990). IPCC have published three more assessment reports since then and all of them point to the same direction: global warming is real. The forth assessment report, for instance, asserts that climate change is unequivocal and there is a 99% probability that it has been caused by greenhouse gases from anthropogenic activities (IPCC, 2007).

IPCC's first assessment report managed to trigger global concern in as far as climate change is concerned. This was evidenced by the 1992 UNCED (also known as the Rio Earth Summit), which was attended by heads of states from over 100 countries across

the world (UNCED, 1992). Even though the 1992 UNCED was a follow-up conference of the 1972 Stockholm Conference on Human Environment, it for the first time brought to the attention of the world the fact that climate change is happening, it is being driven by human interference of the climate system, and there is need for immediate and joint action to mitigate it while at the same time adapting to its disastrous impacts (UNFCCC, 1992). Consequently, the UN Framework Convention on Climate Change was adopted during the 1992 Rio Earth Summit to provide a framework for global action against climate change (UNCED, 1992). The implementation of the UNFCC and the Kyoto protocol has managed to ignite global action on climate change.

Most governments across the world have appreciated that climate change is happening and there is need for action against it. This is evidenced by the fact that most countries, Kenya included, have ratified and domesticated the UNFCCC and its Kyoto protocol through development of national response strategies and action plans as part of their implementation efforts. This shows the level of concern about climate change as a global problem by these nations. However, this high level of concern can also be attributed to the severity of climate change impacts being experienced by many countries around the world hence forcing governments to act to improve their resilience (UNDP, 2007).

While the international climate change debate has focused primarily on the broad scientific, political, economic and social factors it has overlooked more specific and significant social implications and consequences. Women constitute approximately 70 per cent of the world's poor; this has recently lead to the introduction of gender-sensitive perspectives in climate change debate, research and response programs (Brody*et al*. 2008).For example, considering women as potential key contributors to climate change policies is quite a new perspective on the topic (Dankelman *et al*. 2008).

2.2.2 Climate change in Kenya

Kenya has little historical or current responsibility for global climate change, and emissions are insignificant relative to the global emissions. However, the country is highly vulnerable to the impacts of climate change. The country has a complex climate that varies significantly between its coastal, interior and highland regions and from season to season, year to year, and decade to decade. This climatic variability is influenced by naturally occurring factors such as movement of the Inter-tropical Convergence Zone and the El Niño Southern Oscillation.

In recent decades, observed mean annual temperatures have increased by 1.0°C since 1960, or an average rate of 0.21°C per decade (McSweeney et al., 2009). Changes in rainfall patterns have also been noticed since the 1960s. Greater rainfall has been observed during the short rains of October to December (GoK, 2010), and the long rains of March to April have become increasingly unreliable in locations such as Eastern Province. According to the National Climate Change Response strategy (2010), climate change in Kenya has been revealed through the rise in temperatures throughout the country, the irregular and unpredictable rainfall patterns. Further, when it rains, downpour is more intense.

Between 2003 and 2007, the country suffered one of the most devastating droughts estimated to have led to the loss of 70% of the livestock. Moreover, the 1998-2000 drought is estimated to have cost the country at least 16% of GDP in each of the years 1998/1999 and 1999/2000 (World Bank, 2004), while the 2008-2011 one led to a 2.8% annual slowdown in economic growth, thereby acosting the country Kshs 968.6 billion (US$ 12.1 billion) (GoK, 2012). The 1997-98 El Niño floods are estimated to have cost the country 11% of GDP, including damage to transport and water infrastructure valued at Kshs 62 billion (US$ 777 million) and Kshs 3.6 billion (US$ 45 million), respectively

(World Bank, 2004). In addition, the country experienced one of its worst El Niños in 2007-08 with unprecedented destruction of infrastructure (Shisanya and Khayesi, 2007).

Global climate change is projected to alter Kenya's mean annual climatic conditions as well as its pattern of climate extremes. Temperatures are expected to continue to rise in all seasons, with models suggesting that warming of about 1^{o}C will occur by the 2020s, and 4^{o}C by 2100 .Warming will vary from region to region within Kenya. Greater uncertainty persists regarding how precipitation patterns might be altered by climate change. Analysis by the Intergovernmental Panel on Climate Change using global circulation models projects that East Africa will likely become wetter, particularly during the rainy seasons (Boko et al., 2007). However, analyses focused on Kenya project that a general decrease in mean annual precipitation will occur within the country, although wetter conditions are likely during the short rains of October to December.

The government of Kenya has made considerable effort in response to the issue of climate change. This has been through the development of: a National Climate Change Response Strategy (NCCRS) in 2010, and the implementation of some of its recommendations; National Mitigation Action Plan (NCCAP) 2013-2017, and National Mitigation Action Plan (NAMA) and drafting of legislation establishing a Climate Change Authority with the responsibility of spearheading the implementation of the adaptation and mitigation plans.

However, there still remains a glaring gap in the adequacy of documentation of climate change impacts, vulnerabilities and risks in the country and especially concerning their implications on sustainable human development (KNHD, 2013).

2.3 Perception of the Changes in Climate

Rural communities in general perception of climate change is a prerequisite for them to make informed decisions on local adaptation (Maddison 2007; Slegers 2008). These perceptions are usually informed by rural communities' own experiences of how climate change impacts on their livelihoods (Slegers 2008). Additionally, climate change adaptation is a two-stage process: the initial stage is perceiving that changes in climate have occurred and then making decisions to adopt a particular measure or not (Maddison, 2007). Based on this and the above arguments, identifying how women perceive climate change is critical to helping to inform policy decisions on adaptation grounded on local perspectives and current autonomous adaptation strategies.

The Food and Agricultural Organization (2008) stipulated that climate change manifestation refers to the gradual changes in climate norms, notably temperature, and changes in the frequency, extent and severity of climate and weather extremes. According to Tompkins and Adger (2004), climate change is likely to be perceived in four main ways: slow changes in mean climate conditions; increased inter-annual and seasonal variability; increased frequency of extreme events; and rapid climate change causing catastrophic shifts in ecosystems. Further, the National Climate Change Response strategy (2010), climate change in Kenya has been revealed through the rise in temperatures throughout the country, the irregular and unpredictable rainfall patterns. Further, when it rains, downpour is more intense.

In a recent study, (Diffenbaugh *et al*., 2007), Kenya's vulnerability is evident from increasing average surface temperatures in many areas of the country: rainfall that is increasing in some regions and decreasing in others; increasing rainfall variability over time and space; and serious and recurrent episodes of drought and flooding that are already having devastating consequences on the economy, society, and environment.

2.3.1 Changes in rainfall

Changes in rainfall and other forms of precipitation will be one of the most critical factors determining the overall impact of climate change. Due to global warming precipitation amount, type and timing are changing or are expected to change because of increased evaporation, especially in the tropics (Ritter, 2006). Although studies have shown a 2% overall increase in global land precipitation (IPCC, 2001), rainfall characteristics have shown considerable variations from region to region with some areas experiencing decline and in others increase in precipitation due to increased extreme weather patterns. Decrease in precipitation has been experienced in the Sahel, Mediterranean, southern African and parts of southern Asia where much of the rains fall as intense storms particularly in the dry areas (Ritter, 2006).

A study by Xuebin Zhang and Francis Zwiers, of environment Canada in Toronto revealed that rainfall in Mexico and northern Africa decreased by nearly 70 mm per year in recent years compared to the 1925 rainfall as quoted in Boswell (2007). Wright and Jones (2003) note that rainfall in southwest Australia has declined by 15 to 20% from the late 1960s. The seasonality, amount, distribution and the timing of was witnessed over the tropical lands during the 20th Century (IPCC, 2001). Similarly, rainfall has increased by up to 50% in parts of northern Europe (Ritter, 2006). Compared to the 1925 rainfall, Canada, Russia and Europe's annual rainfall has increased by 45 mm and in Peru and Madagascar, rainfall has increased by 60 mm annually (Boswel, 2007).

Rainfall in southern Africa is likely to decrease in much of the winter rainfall region and western margins. There is likely to be an increase in annual mean rainfall in East Africa. Changes in rainfall patterns also have been noticed in Kenya since the 1960s. Greater rainfall has occurred during the short rains of October to December, particularly

in northern Kenya, where the rains have begun to extend into the hot and dry months of January and February (GOK, 2010). In contrast, local observations suggest that the long rains of March and April have become increasingly unreliable in locations such as Eastern Province (Awuor, 2009). Rainfall intensity has also changed, becoming more intense along the coast.

2.3.2 Rise in surface temperatures

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) forecasted that by 2100, the increase in average surface temperature would be between 1.8ºC and 4.0ºC globally. The panel predicted a more pronounced increase in temperatures in the African continent, to be 1.5 times greater than at the global level. This is as a result of the increase in emissions of greenhouse gases chief among them carbon dioxide, in the atmosphere thereby enhancing greenhouse effect and hence the rising temperatures. This trend has been blamed on human activities that include burning of fossil fuel, deforestation and industrial air pollution (Weart, 2010). The continued warming of the globe has led to alterations in the global climate system hence climate change.

2.3.3 Extreme weather events

An Intergovernmental Panel on Climate Change (IPCC) report on extreme weather, published in 2012, said "changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events." The rising frequency of heavy downpours is an expected consequence of a warming climate, and this trend has been observed. Some areas will see more droughts as overall rainfall decreases and other areas will experience heavy precipitation more frequently. Still other regions may not experience a change in total rainfall amounts but might see rain come in rarer, more

intense bursts, potentially leading to flash floods punctuating periods of chronic drought. Therefore, observed trends in heat, heavy precipitation, and drought in different places are consistent with global warming (Karl *et al,* 2008).

When averaged together, changing climate extremes can be traced to rising global temperatures, increases in the amount of water vapor in the atmosphere, and changes in atmospheric circulation. Warmer temperatures directly influence heat waves and increase the moisture available in the atmosphere to supply extreme precipitation events. Expanding sub-tropical deserts swelling out from the equator are creating larger areas of sinking, dry air, thus expanding the area of land that is subject to drought (Siedel *et al*, 2007).

2.4 Climate Change and its Impact on the Livelihoods of Women

According to Carney (1998), defines a livelihood as comprising the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. Assets are the basis on which livelihoods are built and these are the means of production available to a given individual, household or group that can be used in their livelihood activities.

Climate change induced impacts affect the livelihood assets on which women depend to survive and earn a living. Climate-induced changes to resource flows can fundamentally affect the viability of the livelihoods of the poor. Indeed, in many ways this is what climate change impacts are all about: changes to resource flows critical for livelihood sustainability (IISD, 2003).

The impact of climate change refers to the effects of climate change on natural and human systems. According to UNDP (2007), the impacts of climate change are manifested mainly through reduced agricultural productivity, heightened water insecurity, increased exposure to coastal flooding and extreme weather events, collapse of ecosystems and increased health risks. Further, presentation by developing countries of their own analysis of climate change impacts in their national communications to the UNFCC (2001), they signaled agriculture, food security and water resources as issues of foremost importance.

2.4.1 Climate change and agriculture productivity

The agriculture sector, including crops, livestock, fisheries, and forestry, is very sensitive to climate variability and change. This sensitivity to climate variability and change is due to the close natural connections and dependencies that exist between climatic weather conditions and the sector. According to IPCC the following are some important factors directly connected to climate change and agricultural productivity: Average temperature increase: An increase in average temperature can, lengthen the growing season in regions with a relatively cool spring and fall; adversely affect crops in regions where summer heat already limits production; increase soil evaporation rates, and increase the chances of severe droughts.

Changes in rainfall amount and patterns affect the soil erosion rates and soil moisture, both of which are important for crop yields (IPCC, 2007). Additionally, in the Kenya Human Development Report (2013), it was noted that the five most important climate variables that affect agricultural production are temperature, precipitation, atmospheric pressure and humidity, wind and sunshine and cloud cover. Moreover, climate change will increase the occurrence of extreme events like floods, droughts and hailstorms, which can also have a drastic effect on agriculture. Rising temperatures and increased

rainfall may also lead to more pests and weeds, which will reduce agricultural productivity.

Agriculture, which provides a livelihood for about three-quarters of Africa's population, is mainly rain fed. Severe and prolonged droughts, flooding, and loss of arable land due to desertification and soil erosion are reducing agricultural yields and causing crop failure and loss of livestock, which endanger rural and pastoralist populations (Institute of Security Studies, 2003).

The roles of women in agriculture vary widely by region, age, ethnicity and social status. Women are involved in agricultural production, food security as well as other related agricultural ventures (World Bank, 2009). Women comprise 20 to 50 percent of the agricultural labour force in developing countries (FAO, 2011). More than three quarters (79 percent) of women in Least developed Countries who are economically active report agriculture as their primary economic activity, which highlights the importance of the agricultural sector for women and in countries such as Lesotho, Mozambique and Sierra Leone, women constitute over 60 percent of the agricultural labour force (FAO, 2011).

Women often grow, process, manage, and market food while men are responsible for cash cropping and larger livestock (Brody et al., 2008). Hence, women's livelihoods are more exposed to the vagaries of nature and the challenges posed by changes in precipitation patterns, and, because of their limited access to the labour market, they are far more dependent than men on agricultural yields.

2.4.2 Climate change and food security

Food security is defined as a 'situation when all people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food that meets their

dietary needs and food preferences for an active and healthy life' (FAO, 2002). Climate change is affecting all four dimensions of food security in Africa, which is food availability, food accessibility, food utilization and food systems stability. Its impacts will be both short term, resulting from more frequent and more intense extreme weather events and long term, caused by changing temperature and precipitation patterns (FAO, 2008).

On food availability, climate affects food production directly through changes in agro-ecological conditions and indirectly by affecting growth and distribution of incomes, and thus demand for agricultural produce. Access to food refers to the ability of individuals, communities and countries to purchase food in sufficient quantities and quality. Falling real prices for food and rising real incomes over the last 30 years have led to substantial improvements in access to food in many developing countries. Possible food price increases and declining rates of income growth resulting from climate change may reverse this trend. Climate change has important implications for food distribution as it affects accessibility due to destruction of road, bridges and other infrastructure, and influences the functioning of markets and other social and economic institutions. Extreme weather events affect local production and therefore local income and accessibility to food. Access to food is affected by climate change due to the disruption or loss of livelihoods and price volatility of staples and animal protein source (FAO, 2008).

On food utilization, climate change may initiate a vicious circle where infectious diseases, including water-borne diseases, cause or compound hunger, which, in turn, makes the affected population more susceptible to those diseases. Results may include declines in labour productivity and an increase in poverty, morbidity and mortality. Drop in income is likely to cause the development and use of different coping strategies

like reduction in both quantity and quality food through less consumption of protein source, fruits and vegetables (FAO, 2008).

In the context of climate change, traditional food sources become more unpredictable and scarce. Women face loss of income as well as harvests, often their sole sources of food and income. Related increases in food prices make food more inaccessible to poor people, in particular to women and girls whose health has been found to decline more than male health in times of food shortages (UN Women Watch, 2009).

2.4.3 Climate change and water resources

Observational records and climate projections provide abundant evidence that water resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems (Bates *et al*., 2008).Climate change could aggravate periodic and chronic shortfalls of water, particularly in the arid and semi-arid areas of the world (Mujumdar, 2008). Further, climate models have consistently and robustly predicted that global warming will create water scarcity in semi-arid regions (Kanae, 2009).

Higher temperatures will create water shortages and will also pollute fresh water with sediments, nutrients, pesticides, pathogens, and salts. Global-warming-induced sea level rise, which will lead to saline water intrusion into groundwater and thereby reduce the availability of fresh water.

Climate change could also contribute to decreasing the level of precipitation and increasing the frequency and average length of droughts (Peterson & Posner, 2010). Such a situation leads to a sharp increase in the demand for irrigation water as well as domestic and industrial water use (IPCC, 2001). Additionally, climate-change-induced high temperatures may degrade water quality as increasing water temperature could

alter the rate of operation of bio-chemical processes and lower the dissolved oxygen concentration of water (IPCC, 2001).

The availability of water resources in Kenya has been decreasing over time as a result of persistent droughts and land-use patterns. The climate scenarios show that rainfall variability and increased evaporation due to higher temperatures will lead to further decreases in the available water. Already there are dramatic reductions in the snow and glaciers of Mount Kenya, believed to be associated with global warming. These glaciers could vanish in the next 15 years. The disappearance of the glaciers will affect agricultural activities, the availability of water for both rural and urban populations, hydroelectric production and tourist activities (Ministry of Environment and Mineral Resources, 2009). These impacts of climate change on the water resources will affect the availability of water for both domestic and productive use and consequently the livelihoods of people.

The consequences of climate change on water resources are far reaching, particularly for vulnerable groups, including women who are responsible for water management at the household level. Women and girls are responsible for collecting water. In fact, women in Sub-Saharan Africa spend 40 billion hours per year collecting water, which is equivalent to a year's worth of labour by the entire workforce of France (UNDP, 2009). As a consequence of climate change this task will become even more time-consuming and demanding.

It is estimated that women in many developing countries walk for an average of about 6 kilometers each day to collect water (UNFPA 2002). Water collection for domestic purposes is generally the responsibility of women and girls in almost all developing countries. Thus, if water supplies become scarce or contaminated, women and girls are the ones who must look for alternative sources of water. In addition, they must also

provide care if family members suffer from waterborne diseases. This increases the women's workloads, and the time spent in fetching water that may be otherwise spent on other activities to strengthen livelihood resilience, including productive activities such as crop production.

In conclusion, given the changing climate, inadequate access to water and poor water quality does not only affect women, their responsibilities as primary givers, and the health of their families', it also impacts agricultural production and the care of livestock; and increases the overall amount of labour that is expended to collect, store, protect and distribute water.

2.4.4 Climate change and health

Climate change can affect human health through a range of mechanisms. These include relatively direct effects of hazards such as heat waves, floods and storms, and more complex pathways of altered infectious disease patterns, disruptions of agricultural and other supportive ecosystems, and potentially population displacement and conflict over depleted resources, such as water, fertile land and fisheries (Pachauri & Reisinger, 2007).

Although the current evidence provided by climate science does not fully and correctly predict the magnitude of impacts of climate change, it nonetheless points to the likelihood of impact on six existing broad health concerns particularly in developing countries; These include: health effects related to extreme weather events; Cardio-respiratory diseases; Temperature related health effects; Malnutrition; Waterborne diseases; and vector borne diseases.

Developing countries such as Kenya are more vulnerable to climate-induced diseases such as malaria, whose geographic distribution is shifting as a result of changing

weather patterns which expose some regions to unprecedented health risks. This problem is further compounded by a weak public health infrastructure and high poverty levels among some segments of the population (KNHD Report, 2013).Based on WHO estimates around 150,000 deaths now occur in low-income countries each year due to climate change from four climate-sensitive health outcomes crop failure and malnutrition, diarrheal disease, malaria and flooding.

Women and girls are generally expected to care for the sick, including in times of disaster and environmental stress (Brody *et al,*. 2008). This limits the time they have available for income generation and education, which, when coupled with the rising medical costs associated with family illness, heightens levels of poverty, which is in turn a powerful determinant of health. It also means they have less time to contribute to community-level decision-making processes, including on climate change and disaster risk reduction.

2.4.5 Climate change and energy resources

Climate change can have significant negative impacts on the natural environment. In the rural areas of Africa and Asia, women and men are highly dependent on biomass, such as wood, agricultural crops, wastes and forest resources for their energy and livelihoods. However, in the face of climate change, the ability of women and men to obtain these indispensable resources is reduced (Lambrou *et al*., 2006).

It is important to note that the declining biodiversity does not solely impact the material welfare and livelihoods of people; it also cripples access to security, resiliency, social relations, health, and freedom of choices and actions (Millennium Ecosystem Assessment, 2005).The majority of the biodiversity decline has a disproportionate impact primarily on poor people in developing countries. Moreover, in many parts of

the world, deforestation has meant that wood - the most widely used solid fuel - is located further away from the places where people live.

In poor communities in most developing countries, women and girls are responsible for collecting traditional fuels, a physically draining task that can take from 2 to 20 or more hours per week. As a result, women have less time to fulfil their domestic responsibilities, earn money, engage in politics or other public activities, learn to read or acquire other skills, or simply rest.

2.5 Climate Change Adaptation Strategies

The IPCC defines adaptation as the, "adjustment in natural or human systems to a new or changing environment, which moderates harm or exploits beneficial opportunities (IPCC, 2007). Similarly, Smit and Wandel (2006) defined adaptation as any process, action or outcome in a system, ecosystem, household, community, group, sector or region that helps the system to better cope with, manage, or adjust to the changing conditions, stress, hazards, risks, or opportunities associated with climate change.

In the past, more attention has been devoted to mitigation both in scientific research and policy debate. Further, until recently, it was a controversial issue because it was perceived as locally focused on particularly vulnerable groups or places, generating fears that attention to adaptation could detract from mitigation efforts for the global good (Ayers and Forsyth, 2009). However, perspectives have changed and slow progress on mitigation coupled with increasing evidence of the impacts of climate change especially in vulnerable developing countries least able to manage them, has seen adaptation rise up the international policy agenda. It has emerged as an urgent policy priority, prompting action both within and outside the climate change negotiations (Parry *et al.* 2005). Adaptation focuses on reducing risk and on capacity development.

Adaptation needs vary across geographical scales, that is, local, national, regional and global, temporal scales coping with current impacts versus preparing for long-term change. The key goals of adaptation strategies are to reduce vulnerability to climate-induced change and to sustain and enhance the livelihoods of poor people. According to Agrawal (2008), the basic coping and adaptation strategies in the context of livelihoods risks can be classified into a set of four analytical types: mobility, storage, diversification, market exchange and communal pooling. Where successful, these responses either reduce spatial, temporal, asset-related, and/or community-level risks directly, or reduce them by pooling uncorrelated risks associated with flows.

Mobility is perhaps the most common and seemingly natural responses to environmental risks. It pools or avoids risks across space, and is especially successful in combination with clear information about potential precipitation failures. Storage pools/reduces risks experienced over time. When combined with well-constructed infrastructure, low levels of perishability, and high level of coordination across households and social groups, it is an effective measure against even complete livelihood failures at a given point in time. Diversification reduces risks across assets owned by households or collectives. Highly varied in form, it can occur in relation to productive and non-assets, consumption strategies, and employment opportunities. It is reliable to the extent benefit flows from assets are subject to risks and risks have different impacts on the benefit streams from different assets.

Communal pooling refers to adaptation responses involving joint ownership of assets and resources; sharing of wealth, labor, or incomes from particular activities across households, or mobilization and use of resources that are held collectively during times of scarcity. It reduces risks experienced by different households. Exchange is perhaps

the most versatile of adaptation responses. Usually it is viewed as a means to promote specialization and increase revenue flows.

Communities in developing countries have spontaneously developed strategies to cope with extreme climatic variability. Others have started to consciously design and implement adaptation strategies. This is known as autonomous adaptation. Autonomous adaptation, also known as spontaneous adaptation, "does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems" (McCarthy *et al*., 2001). Further, studies have shown that local communities in the Sahel had successfully achieved some level of sustainable livelihoods by adapting continuously in their farming, livestock- keeping, and other income-earning activities (Mortimore, 2000). However, very few efforts have been made to support communities' autonomous adaptations to changing climatic patterns and the weather extremes that they give rise to.

Adaptation has been a top-down approach where the strategies are designed at the top and cascaded down to the people. The International Institute for Sustainable development (2003), criticized this approach by stating that adaptation is not something that is done to or for people; it is something that they do for themselves and that it may or may not be supported by external agencies. Consequently, adaptation strategies need to be rooted in an understanding of how the poor and vulnerable sustain their livelihoods, the role of natural resources in livelihood activities and the scope for adaptation actions that reduce vulnerabilities and increase resilience of poor people. The planned adaptation policies should come in to strengthen the capacities of communities and local organizations and link local adaptation needs to regional, sectoral and national policy frameworks and decision making processes.

2.5.1 Women and climate change adaptation

According to the IPCC, the ability to adapt to climate-induced changes is a function of several factors including wealth, technology, information, skills, infrastructure, institutions, equity, and empowerment. On the household level this translates into control over land, money, credit, low dependency ratios, good health and personal mobility, household entitlements and food security, secure housing in safe locations, and freedom from violence (Lambrou & Piana, 2006). It goes without saying that the women of the least developed Countries are severely challenged in many if not all of these aspects of life. Nevertheless, experiences have shown that women are not unable to cope with the challenges brought about by the changes in climate.

At the same time, women's involvement in agricultural production and their dependency on biomass energy mean that they possess great amounts of indigenous knowledge as well as untapped resources and skills that make their participation in discussions about adaptation to climate change absolutely necessary, however neglected it might be. This knowledge needs to be recognized and it further more exemplifies that women are not without means when it comes to handling climate change and often exhibit surprising resilience (UNDP, 2009).

Women play a pivotal role in natural resources management and in other productive and reproductive activities at the household and community levels. This puts them in a position to contribute to livelihood strategies adapted to changing environmental realities. Their extensive knowledge and expertise, that can also be used in climate change mitigation, disaster reduction and adaptation strategies, make them effective actors and agents of change (Women Watch, 2009).Despite the importance of recognizing gender-related differences, both the United Nations Framework Convention on Climate Change and the Kyoto Protocol fail on referring the issue.

2.6 Barriers to Climate Change Adaptation

Barriers are defined as factors, conditions or obstacles that reduce the effectiveness of adaptation strategies (Moser, 2010). In a perfect world with no market failures, there would be a hundred percent success in the effectiveness of adaptation strategies. However, due to existing constraints autonomous adaptation may not be optimal. Socio-economic factors, resource constraints and psychological factors have been widely identified as the major barriers to adaptation of farmers (Nhemachena *et al*. 2007).

The barriers include poverty levels, societal hierarchies, lack of communication in case of threat, lack of information on adaptive measures, lack of access to credit, maladaptation, force of habit, and the perception of the importance of climate change and adaptation. Fankhauser *et al*. (1999) argue that for autonomous adaptation to be effective, individuals must have the right incentive, knowledge, resources and skills to adapt efficiently.

Despite the international significance attached to climate change adaptation, there remains a lack of understanding of the key barriers that impede the effective implementation of adaptation strategies by households across sub-Saharan Africa. Better understanding of the vulnerability of women to climate variability requires exploration of the barriers that constrain the implementation of adaptation strategies.

2.7 Role of Institutions in Climate Change Adaptation

According to Agrawal (2008), Institutions influence the livelihoods and adaptation of rural households in three important ways; they structure the distribution of climate risk impacts. How particular social groups and populations will be affected by climate hazards is in part a function of the physical and structural characteristics of the hazard. It is also in part a function of the way macro- and micro-level institutions in a variety of domains affect distribution of risks related to climate hazards; they constitute and

organize the incentive structures for household and community level adaptation responses which shape the nature of these responses.

Institutional incentives are key in determining whether adaptation responses will be organized individually or collectively because institutions affect the emergence of leadership in different contexts, costs of collective action, and the extent of transactions costs; they mediate external interventions into local contexts, and articulate between local and extra-local social and political processes through which adaptation efforts unfold. External interventions in the shape of finances, knowledge and information, skills training, new institutional inputs, and technological support can assume many different forms. Local institutions shape the acquisition and distribution of these interventions in fundamental ways, thereby affecting the degree of success of such interventions.

2.8 Synthesis of the Literature Reviewed

The reviewed literature revealed that the debate on the eminent changes of climate and global warming is well underway. However, a critical evaluation of the literature indicated that there are still some few gaps on which this study was justified to be carried out to fill.

Right from the global approach to our local's approach on the fight against climate change, the literature reviewed revealed that much of the research and discourse on climate change adaptation has focused on the scientific, technical and infrastructural aspects of addressing the challenge. This means that the social dimension of the impact of climate change on people's livelihoods and by extension women, is still not at the top of the priority list. This is despite the fact that in 2008, the UN's Commission Status of Women Council featured Gender and Climate Change as an emerging and important issue facing women.

Due to women's marginalized position in society, climate change is expected to result in climate change having a greater impact upon women, especially poor women (Lambrou and Piana, 2006). Globally, the adaptation experiences of marginalized sub-groups such as women, children and the elderly are lacking representation in climate change literature. Even so, many studies show that women have been instrumental in organizing themselves and others around environmental issues and sustainable development which is a finding worth validating through this study. Policies and programs to address climate change need to harness women's unique knowledge and ability to act as powerful agents of change. Additionally, the literature on women in climate change is highly dependent on the literature on experiences from natural disaster management which are inclined towards the immediate vulnerabilities of women rather than the long-term implications of climate change on their livelihoods.

An examination on the existing climate policy in Kenya and other international organizations shows that even with an understanding of the relationship between gender, poverty and vulnerability in relation to climate change, there has been insufficient focus on the incorporation of a gender analysis into the development and implementation of climate change laws. Further the documented changes in climate are based on the scientific evidence of the national climatic patterns. Thereby necessitating a focus on the local people's perception on the changes Gender needs to be more central to all policy development. Further, while several studies have been carried out on the impact of climate change on local livelihoods in Kenya, there is very little dedicated literature to understanding the impact of climate change on the livelihoods of the locals and women in particular. Existing studies have mainly focused on the issue of climate change awareness and mitigation. This calls for a need of local studies that focus on the impacts of climate change on specific local livelihoods.

The available literature on adaptation is very location specific, which makes it difficult to draw general lessons on adaptive strategies. Therefore requiring a balance between the top-down approach and bottom up approach to adaptation support by institutions. Although much work on climate change and social responses to climate risks recognizes the relevance of institutions to adaptation, existing work on the subject has tended either to focus on highly specific case studies of local adaptation, or to examine national level policies around adaptation. Comparative analyses of adaptation strategies that provide broadly generalizable insights into the role of different kinds of institutions, show how institutions link local responses to external interventions, and examine the institutional articulation at the local level among different kinds of institutions are sorely needed.

Finally, given the fairly recent interest in the topic of gender differentiated impacts of climate change, limited empirical information is available. The bulk of the available information comes from self-published literature by international organizations, nongovernmental organizations, and private foundations, as well as aid and disaster relief organizations. A smaller but slowly growing body of academic literature is looking into this area, especially in development and environment related journals, with publications starting a decade or so ago (for example; Carvajal Escobar and Denton 2002). While some publications provide a broad overview for navigating gender issues in the context of climate change, a majority of these are case studies that are specific to a certain area due to the highly contextual nature of the subject.

In resonance with Arrora-Johnson (2011), literature about climate change and gender has so far been written mainly to advocate for a gender perspective within international politics, and that it has been marred by a lack of data and evidence. This signals that caution is necessary when examining evidence for gender differentiated impacts on

climate change to ensure that claims are supported by sound findings and data, and are not merely based on assumptions, projections, or speculations. This therefore necessitates the increased contribution of academic research in this field to add on to credible conclusions of this agenda of climate change.

2.9 Chapter Summary

The chapter discussed the theoretical framework, reviewed the available literature on concept of climate change with a focus on its emergence as a developmental concern and its reality in the Kenya. It also covered the constructs of climate change that's affect the livelihoods of women which were; the women's perception of the changes in climate, the impacts on agricultural productivity, food security, water resource, health and energy, the adaptation strategies and barriers to adaptation. Finally, the relevant gaps were explained through a comprehensive synthesis of the literature reviewed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

The chapter discusses the methodology and techniques adapted in carrying out the research study. It presents the: description of the study area, research design, target population, sampling technique and sample size, data collection instruments, data collection procedure, validity and reliability and data presentation, analysis and interpretation.

3.1 Study Area

Kwale County is one of the six Counties in the coastal region and is known for its vibrant tourism sector because of the white sandy beaches and coral reefs. More to the sandy beaches, the county boasts of four major topographic features namely four major topographic features namely the Coastal Plain, the Foot Plateau, the Coastal Uplands and the Nyika Plateau. This topographic features are spread over four administrative Sub-counties namely Matuga, Kinango, Msambweni and Lunga Lunga (KCDIP, 2013).

The coastline in Kwale County is about 250 kilometers. This strip of land consists of corals, sands and alluvial deposits. The Foot Plateau, which is behind the Coastal Plain, lies at an altitude of between 60 and 135 meters above sea level. The plateau has a flat plain surface with high potential permeable sand hills and loamy soils. This zone is composed of Jurassic rocks and sandy hills consisting of Magarini sands ideal for sugar cane growing. The Coastal Uplands, commonly known as Shimba Hills rise steeply from the foot plateau at an altitude of between 135 to 462 meters above the sea level. This topographical zone is made up of many sand stones hills that include the Shimba Hills (420m), Tsimba (350m), Mrima (323m) and Dzombo (462m). This is an area of medium to high agricultural potential. The Nyika Plateau, also referred to as the

hinterland, rises gradually from about 180 meters on the western boundary of the county. The region is underlain by basement rocks system with exception of occasional patches of reddish sand soils. Occupying over a half of the county, the region is semi-arid and the soils are generally poor. The main activity here is livestock rearing (KCDIP, 2013).

The county has monsoon type of climate which is hot and dry from January to April/May, while the period from June to August is the coolest in the year. Rainfall is bi-modal with short rains being experienced from October to December, while the long rains are experienced from March/April to July. Average temperature ranges from 26.30C to 26.60C in the coastal lowlands, 250C to 26.60C in Shimba Hills, and 24.60C to 27.50C in the hinterland (KCDIP, 2013).

The human population of Kwale County was projected to be 713,488 persons in 2012 comprising of 346,898 males and 366,589 females. The county population growth rate is 3.1 per cent, and the sex ratio is 95 male per 100 females. In 2012, the labour force stood at 352,353 persons consisting of 165,636 and 186,718 male and female respectively, representing 49 per cent of the total population. This age group was projected to increase to 386,811 and 411,634 people in 2015 and 2017 respectively. Women and youth constitute the majority of the labour force. Majority of the labour force is engaged in the agricultural sector, with about 90 per cent in subsistence farming (KCDIP, 2013).

The county was purposively selected because of its distinct geographical and climatic differences spread across the entire county therefore exuding the potential of experiencing various impacts of climate change. Further, this uniqueness of the county would increase the validity of the findings to facilitate generalization across other regions.

Figure 3.1: Location of Kwale County

Source: KCIDP, 2013

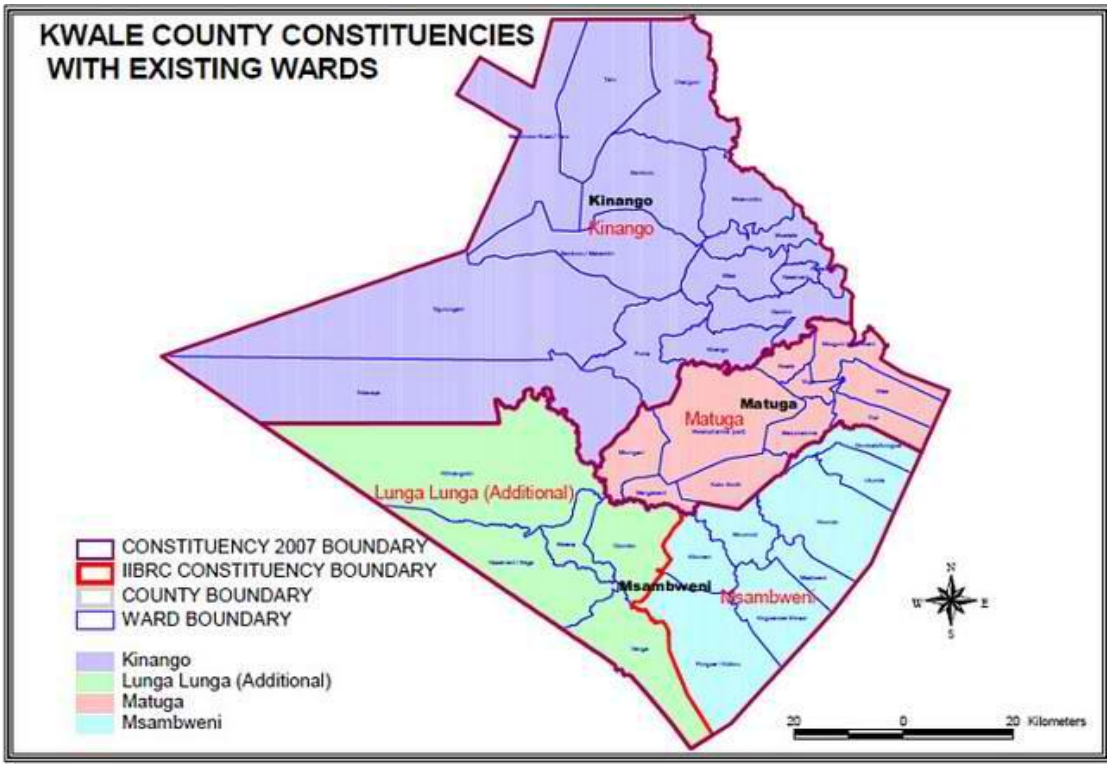

Figure 3. 2 Map of Kwale County

Source: KCIDP, 2013

3.2 Research Design

There are various research designs that are utilized by researchers to guide different studies based on the nature of the research problem. In relation to the research problem, this study was guided by the descriptive survey research design. This design involves identifying the current status of a population and examining a situation as it is. This design was ideal for the study because it enabled the determination and reporting of current situation pertaining the reality of climate change on the livelihoods of the women in Kwale County.

3.3 Research Approach

The study was based on the mixed method approach. This approach facilitated for the generalization of findings to the population and still develops a detailed meaning of the concept through in depth and extensive experiences of individuals to expand

understanding of the research problem from one method to another. The quantitative data was collected by use of structured questionnaires issues to the women while the qualitative data was collected by conducting key informant interviews and observation to enable validation of the quantitative data.

3.4 Target Population

The target population for this study were the women in the registered women groups in Kwale County and four key informants. At of the time of the study was carried out, there were 1018 registered women groups in Kwale County. However, only 192 groups were active each comprising of an average of 10 members. The study was limited to the active women groups.

3.5 Sample Size and Sampling Technique

3.5.1 Sample Size

The sample size was determined using the Yamane (1967) formula as shown below

$$n = \frac{N}{1 + N(e)^2}$$

Where n = required sample size

N = the target population

e = the error limit (0.1 for a sample between 100 to 1000)

The formula was applied as follows:

$$n = \frac{192}{1 + 192(0.1)^2}$$

$$n = 65$$

This implied that of the 192 women groups in Kwale County, 65 were used as the representative sample.

3.5.2 Sampling procedure

Sampling is the process of selecting a number of individuals for study in such a way that the individuals selected represent the large group from which they were selected.

Table 3.1*:* Sampling Frame

Sub-County	**Distribution of active group (x)**	**Sample size (Y) Y= x/N*n**	**Percentage Sample Size to Target Population**
Lunga-Lunga	50	17	34
Msambweni	7	2	29
Matuga	50	17	34
Kinango	85	29	34
	N=192	**n=65**	

***Source*: Author (2017)**

The researcher used simple random sampling to select the sixty five groups based on their distribution across the four sub-counties then applied purposive sampling to select two leaders from each of the 65 groups, bringing the total number of respondents issued with questionnaires to 130 participants.

3.6 Instruments of Data Collection

The study used the following instruments of data collection: questionnaires, key informant interviews and observation.

3.6.1 Questionnaires

Primary data was collected by use of structured questionnaires. The questionnaires were administered to the respondents from the women groups. The questionnaire generated a considerable amount of quantitative data and thereby enabling the researcher to obtain a wider coverage of descriptive data at comparatively low cost in terms of time, money

and effort. The questionnaires allowed for uniformity in the manner in which questions are asked and make it possible for responses to be compared across respondents. Valid and comprehensive questions about the manifestations of climate change on the livelihoods of women were designed. The items on the questionnaire were divided into two sections: Part A covered the demographic characteristics of the population, the second section was divided into five segments each addressing the specific study objectives. Linkert scale was used to structure the questions in the questionnaire in order to guide the appropriate responses and quantify the responses.

3.6.2 Key informant Interviews

Key informant interviews were used to obtain information from key persons dealing with climate change issues. The interview schedule was administered to the County Director Meteorology, a traditional weatherman and two agricultural extension officers. The interviews were done face to face by the researcher and guided by a schedule comprising semi-structured interview questions. This method enabled the researcher to obtain first-hand information from experts and also provided an avenue for a wider scope of information to support and validate findings obtained from the survey questionnaire.

3.6.3 Observation

The researcher used unstructured observation which entails monitoring all aspects of the phenomenon that seem relevant to the study. It provided formation relating to what is currently happening and is not complicated by either past events or future changes. The data was recorded by use of photography. This helped to validate responses from the questionnaires and offer further information on the issues of climate change and livelihoods in the study area

3.7 Data Collection Procedure

The process of data collection started by obtaining the necessary authorizations to collects data in the study area. This entailed a research permit from the National Council for Science and Technology (NACOSTI), authority letters from the Kwale County Commissioner and County Director of Education. The researcher then conducted a training for the research assistants on the data collection exercise to ensure consistency and correct interpretation of the questions. After the training, a total of 130 questionnaires were administered to the women in the sampled groups.

On the interviews, the researcher conducted face-to-face the interviews personally with the key informants at different scheduled times. The interviews were taped and the responses also written down based on the questions on the interview schedule. Finally, the researcher traversed the County observing the different phenomenon that existed at that time relating to the manifestations of climate change and recorded the occurrences by taking photographs.

3.8 Validity and Reliability of Research Instruments

The researcher carried out a pilot study in order to test the reliability and validity of instruments. The pilot study was carried out during the month of July 2016 in Kilifi County using a small sample of 30 respondents. The objective of the pilot study was to establish the relevance of the data collection instruments , identify any problem that would occur at the actual time of the data collection process and check that questions are understandable to the respondents.

3.8.1 Validity

The validity of the questionnaire items and interview schedule was ensured through content validity. This entailed the rational analysis of the instruments by my supervisors

and experts in this field. The questionnaire and interview items were reviewed for readability, clarity and comprehensiveness.

3.8.2 Reliability

Reliability measures the degree of accuracy in measurement. It refers to the extent to which the instrument when used over and over and gives consistent results. The researcher used Cronbach's Alpha reliability test which gave a reliability coefficient of 0.81, where an (α) coefficient 0.7 and above is termed as reliable.

3.9 Data Analysis and Presentation

Initially, data was edited through the careful scrutiny of the completed questionnaires to ensure that the data was accurate, consistent and well arranged to facilitate coding and tabulation. Then coding was done to enable efficient analysis. The Quantitative data was be subjected to the SPSS program and then analyzed using descriptive and inferential statistics. The descriptive statistics included: frequencies, percentages, means and standard deviation. The findings were presented in tables and charts. Further, the test for correlation between the effects of climate change and livelihood outcomes was conducted using the Karl Pearson's coefficient of correlation. The qualitative data was analyzed using content analysis where themes were developed from the collected data and grouped based on the questions they addressed. The data was presented through illustrative quotes.

3.10 Ethical Considerations

In adherence to the ethical standards in research, clearance to carry out this study was sought from the National Commission for Science, Technology and Innovation, the local administration and the leaders of the Women groups. The respondents were be briefed on the purpose and nature of the study prior and during the time of data

collection. The respondents were also assured of confidentiality of the data collected by clarifying that the information is intended only for academic purposes.

CHAPTER FOUR

DATA PRESENTATION ANALYSIS AND INTERPRETATION

4.0 Overview

The chapter entails a detailed address of data presentation, analysis and interpretation. It is organized in sections namely; response rate, demographic profile, forms of climate in Kwale, effect of climate change in Kwale, adaptation strategies in Kwale, challenges to adaptation and the livelihood outcomes of the women in Kwale. The descriptive statistics are then used to determine the correlation that exists between the effects of climate change and the women's livelihood outcomes.

4.1 Response Rate

Response rate is the proportion of returned filled questionnaires to the total number of questionnaires issued out. In this study 130 questionnaires were issued out to the respondents by the researcher assisted by the research assistants. All the 130 questionnaires were returned and therefore giving a response rate of 100%.

4.2 Demographic Profile of Respondents

Successful analysis of people's livelihoods to a great extent is influenced by their demographic profile. The socioeconomic factors influence the women's capacity to adapt to climate change by either inhibiting or enhancing it. For the purpose of this study it was necessary to understand the demographic characteristics of the women which in turn provided a foundation on the further analysis and understanding of the impacts and adaptation to the effects of climate change. The demographic variables considered in this study were; age, education level, duration of stay in the county and the sources of income of the respondents.

4.2.1 Level of education

Education has a key role to play in promoting understanding and helping individuals and community to make informed choices to respond to challenges posed by climate. The results on the education level of the respondents showed that 69.2% of the respondents had primary level of education, 20.8% secondary and 6.2% tertiary 3.1% never schooled at all with less than 1% having university education. This revealed that the majority of women that took part in this study had only the basic education (primary level).

The value of education is established in enhancing the ability of the respondents to sustainably cope with the changes in climate. Being that majority of the women had just the basic education level could have been one of the probable factors that might be influencing their adaptation capacity. In a study by Addisu *et al.* (2016) in Ethiopia, they ascertained that the higher the education level of the respondents, the higher the understanding about climate change adaptation. Thus the respondents were heavily relying on their experiences rather than on education to perceive and cope with the effects of climate change on their livelihoods.

Table 4.1: Level of Education

	Frequency	Percent	Valid Percent	Cumulative Percent
Never	4	3.1	3.1	3.1
primary	90	69.2	69.2	72.3
secondary	27	20.8	20.8	93.1
Tertiary	8	6.2	6.2	99.2
University	1	.8	.8	100.0
Total	130	100.0	100.0	

Source: Author 2017

4.2.2 Age of respondents

The results in Table 4.2 on the age of respondents revealed that 71.5% were between 31- 50 years of age and 27.7% were aged 18-30 years. A mere 0.8 %(n=1) was 51- 60 years of age. Climate Change disproportionately affects people across different ages with the young and aged being the most vulnerable and least able to effectively engage in climate change adaptation. The results of this study indicated that majority of the women were aged between 31-50 years old. This implies that they were in a good position to enhance their resilience and actively engage in adaption practices. Further, this age group was within the active work force cited in the Kwale County Development Integrated Plan (2015) that is between age group 15-64 years and comprises a majority of women and the youth. This implies that most of the women have the physical capability to work.

Table 4.2*:* Age of Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
18-30yrs	36	27.7	27.7	27.7
31-50Yrs	93	71.5	71.5	99.2
51-60Yrs	1	.8	.8	100.0
Total	130	100.0	100.0	

Source: **Author 2017**

4.2.3 Length of Stay

The results on the length of stay of the respondents show that 19.2 % had stayed for over 40 years 57.7% of respondents had stayed in Kwale for 20-40 years, 23% had stayed and for less than 20 years (23%) as shown in figure 4.4. Climate change takes place over a span of many years. Therefore, with the majority of respondents having

stayed in the study area for over twenty years means that they had the advantage of experiencing and observing the different changes that had taken place overtime and formed the right source of information to establish the resulting effects on their livelihoods. Additionally, this experience is presumed to enable them structure their lifestyles around the historical and current climatic conditions thus making them more likely to be aware of the effects and signs of climate change with a view to improve their livelihoods.

Table 4.3: Length of stay

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less 20 Yrs	30	23.1	23.1	23.1
	20-40 Yrs	75	57.7	57.7	80.8
	over 40 Yrs	25	19.2	19.2	100.0
	Total	130	100.0	100.0	

Source: Author 2017

4.2.4 Main Source of income of respondents in Kwale County

The question on the main source of income for the respondents as aimed at identifying the livelihood options that the women relied upon for their survival. The findings revealed that 45.4% of the respondents were engaged in small scale businesses, 39.2% were in farming and 12.3% were casual laborers. Only one respondent (0.8%) was involved in fishing and one pensioner. Finally two respondents indicated that they are involved in cattle buying and selling, forming the 1.5% of the ‘others’ category.

The reviewed socio-economic profile of the study area had indicated that majority of the work force which included women and the youth were involved in subsistence

farming. However from the findings most of the women indicated that they were mainly involved in off-farm activities which entail small scale business (45.4%) and casual laborers (12.3%). From observation, the researcher noted that the businesses mainly involved trading in the market. The implication of this findings were that the women had to an extent moved from primarily relying on the traditional farming sector into alternative sources of livelihood rather than solely relying on farming. However, these alternative sources are still closely associated to the agricultural sector which is very weather sensitive thus threatening their sustainability in the onset of continued negative the effects of climate change. Further, a significant percentage of the respondents (39.2%) relied on farming as their main source of income implying that they could adequately articulate the effects climate change has had on agriculture.

Table 4.4*:* Main source of income

	Frequency	Percent	Cum. Percent
Farming	51	39.2	39.2
Fishing	1	.8	40.0
Casual Labour	16	12.3	52.3
small scale business	59	45.4	97.7
Pension	1	.8	98.5
Others	2	1.5	100.0
Total	**130**	**100.0**	

Source: **Author 2017**

4.3 Perceived Changes in Climate

Climate change adaptation is a two-stage process: the initial stage is perceiving that changes in climate have occurred and then making decisions to adopt a particular measure or not. Hence, the first objective of the study was to determine the perceived climate changes by the women in Kwale County. The respondents were asked about the changes they had observed and experienced in terms of the surface temperatures,

rainfall amounts, rainfall predictability and the extreme weather events with reference to incidences of drought and floods in the study area. The findings are presented in Table 4.5.

Table 4.5: Perceived changes in climate

	Increased	Decreased	Unchanged
	%	%	%
Temperature	94.6	5.4	0.0
Rainfall	10.8	89.2	0.0
Predictability of rainfall	11.2	88.0	0.8
Incidents of drought	96.2	2.3	1.5
Incidences of floods	30	68.0	2.0

Source: **Author 2017**

The county director of meteorological services, the agricultural extension officer and the local weatherman all said that the study area had been experiencing a change in its climate over the years. Though there was no clear timeline for the major changes, the traditional weatherman indicated that:

> "*In the 1980s and 1990s the weather patterns were more predictable and we would make more accurate forecasts that residents relied on".*
> Traditional weatherman, Kwale County, 2016.

4.3.1 Changes in Temperature

On the perceived changes in the surface temperatures, the findings presented in Table 4.5 reveal that an overwhelming majority of the respondents at 94.6% indicated that the temperatures in Kwale County have increased and 5.4% indicated that the temperatures had decreased.

Though the data from the Kenya Meteorological Department on temperature trends in Kwale County is scanty, the County Director of Meteorology gave an affirmation through his expert assessment that indeed the temperatures were changing with higher maximum temperatures and lower minimum temperatures". He said that the temperatures being experienced were higher than normal and during the expected cooler months, the temperatures got lower than the expected.

According to the IPCC (2001), overall Africa has warmed by an average of 0.7^0C over the past century. Data from the Kenya meteorological department indicates that since the 1960s, the minimum temperature in Kenya has generally risen by 0.7-2.0^{0}C and the maximum temperatures by 0.2-1.3^{0}C depending on the region and season with the coastal region having a decrease in minimum temperatures by 0.3-1.0^{0}C and increase in maximum temperatures by 0.2 -2.0 ^{0}C . This validates the observations by the respondents of whom the majority agreed that indeed the surface temperatures in the County were changing with an increasing trend.

4.3.2 Changes in Precipitation

On the changes in precipitation, two aspects were queried, that is, the changes in rainfall amounts and rainfall variability. The respondents to the questionnaire were asked to select a response about the precipitation trends from three options, 'increased', 'decreased' and 'unchanged'. From the results in Table 4.4, 89.2% of the respondents observe that the amount of precipitation had decreased while 10.8% of them being of the view that the rainfall amounts had increased. On the aspect of variability, 88.0% of the respondents observed that rainfall predictability had decreased while 11.2% observed that predictability had increased and 0.8 % indicated that it had remained unchanged. From the results, the general sentiment was that the precipitation levels and predictability had decreased in Kwale County.

Agriculture officer 11, indicated that in the long rains season the rainfall levels had decreased from the expected 800-1200mm to less than 800mm and in the short rains season the levels had reduced to less than 600mm. In addition, he had observed that there was a delay with the onset of the expected rainfall seasons and in some instances the rains occurred when least expected making it difficult for the people involved in agriculture to adequately plan for their farming activities.

Even so, the County Director of meteorology was of the opinion that the rainfall amounts had not really reduced but had become variable. The available data from the department of meteorology in figure 4.2 shows a trend of increased variability in rainfall rather than significant decrease in rainfall levels in Kwale County between the years 1995 to 2015. This contrast on the perceived changes in the rainfall amounts is a reflection of the views of Conway (2009) who stated that there is persistence in uncertainty on the impact of climate change on the rainfall amounts in Africa.

> "*The unreliability of rainfall is the most probable cause of the respondents' view that rainfall levels have reduced but what is certain is that indeed the rainfall patterns are changing and becoming harder to predict"* Director of Meteorology, 2016

This corroborates with the findings recorded in the NCCR (2010) report on the evidence of climate change in Kenya as regards rainfall being that the most visible feature is the increased variability year to year and during the year.

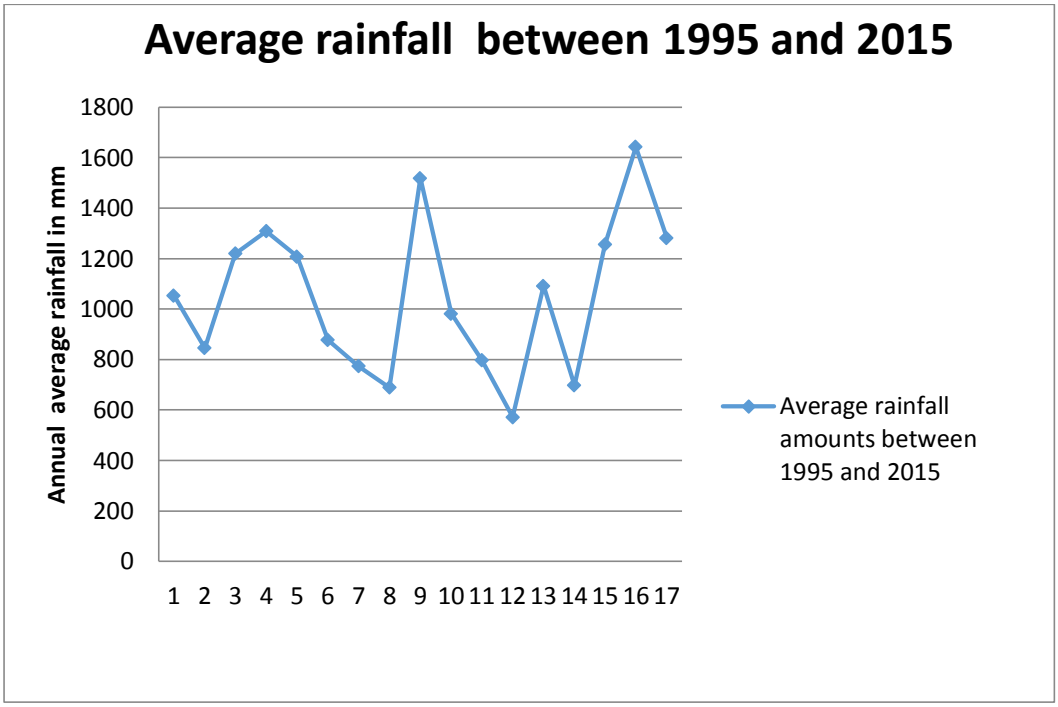

Figure 4.1: Average rainfall 1995-2015

Source **KMD (2016)**

4.3.3 Extreme weather events

The respondents perceived changes on extreme weather events was queried by focusing on the changes of the incidences of floods and droughts they had observed over the last 30 years. On the incidences of floods as shown in table 4.4, 30% of the respondents indicated that the incidences of floods had increased, 68% indicated that they had decreased and 2% observed that the incidences of floods had remained unchanged. On the incidences of drought, an overwhelming majority of the respondents that is, 96.2%, reported that the incidences of drought had increased while 2.3% reported that they had decreased and 1.5% observed that they had not changed. The perceived increase in the incidences of drought can be explained to be as a result of increasing average temperatures and longer dry periods attributed to climate variability being experienced in the county.

The agricultural extension officer 11 affirmed that indeed the drought incidences were on the increase especially in Kinango Sub-County. He observed that even though the area was already vulnerable to droughts, the severity and frequency had increased with the action of climate change

The incidences of floods were observed to have decreased by the majority of respondents which is was consistent with their earlier perceived decrease in precipitation amounts. However, the director of meteorology pointed out that though this was the perceived view, there were areas in the County such as Vanga in Lunga-Lunga Sub- County that were experiencing increased flooding due to increased intensity of rainfall over short periods of time. This could have been the reason 30% of the respondents reported that the incidences of floods had increased.

These findings indicated that the women were able to adequately observe and perceive the changes in the climatic conditions in the area. They were highly aware of their local environment and how it was changing. This perceptions were validated to a great extent by the information collected from the experts in the study area. This outcome was expected to contribute positively to adaptation by being able to associate effects and develop adaptation strategies.

4.4 Effect of Climate Change on the livelihood sources of the Women in Kwale County

The second objective of the study was to evaluate the effect of climate change on the livelihood sources of the women in Kwale County. Responses were categorized as strongly agree to strongly disagree on 11 items pertaining to the vulnerable livelihood sources. This areas include; agriculture, food security, water resources, biodiversity and health of the women. In this study the Likert scale responses were considered to be

ordinal level of measurement (i.e. we can only say that one score is higher than another, not the distance between the points). Therefore it categorized the opinions of respondents concerning climate change. Responses under *strongly agree* and *agree* were consolidated under *agree* category. Responses under *disagree* and *strongly* disagree were consolidated under *disagree* category. This resulted in three point likert scale of *agree*, neutral and *Disagree.*

Table 4.6: Effects of climate change in Kwale County

	Agree	**N**	**Disagree**
	%	%	%
Incidences of crop failure have increased	97.7	0.8	1.5
Crop production has been affected	84.6	1.5	13.9
There's a decline in food quantity and quality	85.4	1.5	13.1
Cost of food has increased	96.2	1.5	2.3
Quality and health of livestock decreased	87.2	5.0	7.8
There are increased pests and weeds	81.6	3.8	14.6
There is scarcity of fodder	96.9	0.0	3.1
There is scarcity of water	92.3	0.0	7.6
There is increased disease outbreak	91.5	0.8	7.7
There is scarcity of wood/fuel	49.3	5.4	45.3

Source: **Author 2017**

4.4.1 Impact of Climate Change on Agriculture

The agriculture sector is highly dependent on the climate stability which makes the sector very vulnerable to the changes in climate. According to the findings in table 4.6, 97.7% of the respondents agreed that the incidences of crop failure had increased, 1.5% disagreed while 0.8% maintained a neutral position. 84.6% of the respondents agreed that crop production had been affected by changes in climate, 13.9% of the respondents

disagreed and 1.5 % were neutral. Some of the respondents justified their responses by explaining that they had been planting crops such as maize and beans but they dried up before maturity because of failed rains and high temperatures that strained the growth of the crops. On the impact of climate change on livestock keeping, the findings indicated that 87.2 % of the respondents agreed that the quality and health of livestock had declined while 7.8% disagreed and 5.0 % were neutral. This finding was supported by the results on scarcity fodder where an overwhelming 96.9% of the respondents were in agreement that there was scarcity in fodder to feed the animals.

The agricultural officer 1, based in Kwale Agriculture office stated that the change climatic conditions in the region have defined food production in the area, stating that;

> "*There is increased frequency of droughts in the region, temperatures are high and lower rainfall. This has affected agriculture production especially in the semi-arid areas in the County like Kinango. Annual rainfall and its distribution over the year is very irregular. Apart from livestock rearing, the suitability of the area for agriculture is restricted to drought resistant crops like sorghum, millet and cassava. Most of the time less drought resistant crops like maize have had a high risk of failure."* Agriculture Officer, Kwale County, 2016

Further, there was consensus that the livestock quality has declined because of scarcity of fodder and water thereby the livestock fetch low prices in the market and in some extreme cases, death of livestock occurred.

Agriculture is also vulnerable to the increase in weeds, pests and diseases. According to respondents, 81.6% agreed that there is an increase in weeds and pests. In support of their responses they indicated that their crops were being attacked by new weeds and pests and the usual ones were prevailing more often necessitating the use of pesticides. Agriculture Officer 11 affirmed this response by sharing that there were new pests and diseases. He attributed this development to the changes in temperature.

> "*We have a new disease called tutta absoluta which is attacking tomatoes and the great grain borer has become a menace in attacking stored grains. I think this has been brought about by the changes in temperature which provides an enabling environment for the weeds and pest to thrive*." Agriculture Officer 11

These results uphold the findings of Dahal (2011) in his study of the impacts of climate change in Nepal which revealed that different invasive species, weeds and pests had been increasing and spreading very fast, damaging both agricultural and forest lands. He attributed the development to the change in temperature and rainfall patterns which are creating favorable environments for pests, diseases and invasive species to emerge, spread and encroach on agricultural land, forest lands and other pasture land.

The findings brought forth the reality of the increased threat that climate change has posed on the agricultural sector. This sector has largely been affected negatively by the continued changes in climate being that most of the activities are weather dependent. The traditional food sources, on which the women largely depend on as their sole source of food and income, becoming more unpredictable and scarce as a result of climate change in Kwale County.

As crop yields reduce, harvests are lost and fodder becomes scarce, the women insisted that they had to look for have alternative ways to sustain their livelihoods and cushion themselves from these impacts. This reality is what had mainly influenced the shift in their main economic activities from primarily being involved in farming but now engaged in other non-farm activities.

Plate 4.1 Maize with stunted growth

The photo in Plate 4.1 was taken in Msambweni in October 2016. The maize in the far back had stunted growth was as a result of delayed short rains leading to wilting and immaturity. Also in the picture the ground is dry with very sparse vegetation.

4.4.2 Impact of climate change on food security

Agriculture and food security are linked. The negative effects of climate change on agricultural productivity contributes to increased food insecurity. From table 4.5, 84.5% of the respondents agreed that there was a decline in the quantity and quality of the food available, 13.1 disagreed while 1.5% was neutral. Further, 96.2 % of the respondents agreed that the changes in climate had caused an increase in the cost of food, 2.3% disagreed and 1.5 % were neutral.

Additional information from the agriculture officers revealed that the increased incidences of droughts in the study area had contributed to increased food insecurity.

The increased drought was attributed to the increase in surface temperatures and rainfall variability in the study area.

> "*Even without the incidences of drought, the county was yet to attain food security. Climate change has increased vulnerability of the County to an already pressing problem of food security."* Agriculture Officer 1, Kwale County

Feeding in the household is usually the responsibility of women. The findings from the study revealed that when there was crop failure and reduction in crop yields, food shortages were being experienced which translated into reduction in the quantity of food available for consumption. These shortages then lead to increase in food prices which make food more inaccessible to the women. Consequently, the women had to dig dipper into their pockets to provide food hence reducing their financial capital. Further, the drop in income could also have been a likely cause of the reduction in both quantity and quality of food as a coping strategy. Some of the women commented that they would skip some meals or reduce the portions consumed at each meal.

4.4.3 Impact of climate change on water resources

Availability of water is crucial in the sustainability of all livelihoods. From table 4.5, 92.3% of the respondents agreed that there was increased water scarcity. This implies that the majority of the areas in the study area were experiencing challenges in availability of water in the prevailing climatic conditions. Even so, a mere 7.6 % disagreed on there being an increased scarcity in water as a result of climate change.

The respondents further explained that they had to walk for longer distances to fetch water following the drying up of closer water pans, wells and rivers. This outcome was supported by the Agriculture officers 1 and 11, who confirmed that with the reduced rainfall and onset of droughts, the water pans and wells dried up frequently thereby requiring the women who are responsible for fetching water to spend more time and

walked for longer distance in search of water for their domestic use and irrigation. They estimated the distance to between 2 to 3 kilometres.

This finding was similar to those of other studies like for example in Vietnam, Shaw (2008) found that the women had to collect water from water sources that are farther away as each drought takes its toll. In rural South Africa, women reported walking increasing distances to collect water, as much as 15 kilometers in some cases (Babugura, 2010). The women indicated that the increase in time spent to fetch water reduced the time utilized in engaging in other activities that would enhance their livelihood thereby affecting their productivity.

This agreed with Brody *et al*. (2008) that as a consequence of climate change, the task of water collection will become even more time-consuming and demanding.

Plate 4. 2 Marere River

Plate 4.2 illustrates low water volume in Marere River during drought. The river is one of the main sources of water in Kwale. The photo was taken in February 2017.

Plate 4.3: Woman Fetching Water from a ditch

As a consequence of water scarcity the woman had resulted to depend on ditch water because there was no water around from the conventional sources**.**

Plate 4.4: Water Pan in Kinango

4.4.4 Impact of climate change on energy resources

The most common source of energy in Kwale County is wood fuel. The women are therefore highly dependent on biomass such as wood and forest resources for their energy and livelihoods. Consequently, 49.3% of the respondents agreed that there was

scarcity in wood fuel while 45.3 % disagreed. The respondents who were experiencing a shortage in wood fuel were mostly located in the arid and semi-arid locations of Kwale County where there was a significant decline in forest resources therefore they had to travel for longer distances in search of firewood. This impacted negatively on their ability to fulfilling this traditional role of collecting firewood and reduced the time they had to attend to other domestic responsibilities, earn money, acquire other skills or simply rest.

On the other hand the significant percentage of respondents who disagreed that there was scarcity of food fuel (45.3%) were mostly located in areas where there was still a significant coverage of forest resources especially in Msambweni and Matuga Sub-Counties therefore they could access firewood easily. However, this would be a temporary situation because increased pressure on the available forest resources meant that in the long-term there would be depletion thus scarcity.

Finally, despite the shift and advocacy to utilizing renewable and clean energy such as biogas, the women in the study area were still relying on wood fuel that remains susceptible and vulnerable to climate change.

Plate 4.5: A woman collecting firewood

Plate 4.5 illustrates a woman collecting firewood in Tsimba Location which is located in one of the forested areas of the county.

4.4.5 Impact of climate change on human health

From the table 4.6, 91.5% of the respondents agreed that there was an increase in disease outbreak in the study area, 7.7% disagreed while 0.8% were neutral. These results are consistent with the projections in IPCC report (2001) that stated that climate change is expected to exacerbate the occurrence and intensity of future disease outbreaks and may increase the spread of diseases in some areas. In justification to their responses the respondents said that they were frequently being treated for various illnesses especially malaria and dengue fever. However they couldn't relate this development to the changing climate.

According to the respondents, being sick hampered their ability to go about various livelihood activities and when any member of the family was taken ill they had to spend more time taking care of them. The key informants reported that the cases of disease incidents had increased and specific campaigns had been arranged to sensitive people on the use of mosquito nets to prevent malaria infections in the county.

These observations by the respondents were validated by the acknowledgement in the Kwale County Development plan (2013) that the health sector has been affected by climate change and variability. While the women couldn't exactly relate this phenomenon with the climatic changes, it has been acknowledged that the rising temperatures provide an opportunity for the malaria vector to thrive hence the county has experienced increased incidences of malaria infections in the recent past.

These results uphold the findings of Brody *et a*l., (2008) which revealed that women and girls are generally expected to take care of the sick and this limits the time they

have available for income generation and education also when they are ill they are unable to carry out their livelihood activities effectively and efficiently thereby affecting their productivity. It also means that they have less time to contribute to decision-making processes including those involving climate changes.

4.5 Analysis of Adaptation Strategies to Climate Change

To analyze the adaptive capacity of the women in Kwale County, the extent of usage of some of the common autonomous adaptation strategies was examined. The summary result in table4.7 shows the mean and standard deviation of the responses to each adaptive strategy item. This study adopted the mean as the appropriate statistical tool to gauge the extent of usage of a particular strategy. The value of the mean score obtained definitely lie between 1 and 5 based on the scale used (never-1, rarely-2, sometimes-3, often- 4 and always-5). The calculated mean valued was rounded off to the nearest integer so as to classify the usage as either *Never, Rarely, Sometimes, often or always.*

Table 4.7: Adaptation Strategies

Adaptive Strategies Used	Mean	S.D	Frequency of Usage
Undertaking non-farm activities	3.30	1.429	**Sometimes**
Changing of planting dates	3.26	1.303	**Sometimes**
Storing agricultural produce	2.92	1.675	**Sometimes**
Rain water harvesting	2.91	1.736	**Sometimes**
Planting different variety of crops	2.89	1.437	**Sometimes**
Migrating to different locations	2.07	1.556	**Rarely**
Application of fertilizers	1.92	1.294	**Rarely**
crop farming through irrigation	1.68	.968	**Rarely**
Preserving livestock feed	1.44	.932	**Never**
Insuring of property and farm produce	1.38	.986	**Never**

Source: **Author 2017**

The following adaptive strategies were used *sometimes,* undertaking non-farming activities (mean=3.30, SD=1.429), changing planting dates (mean=3.26, SD=1.303) storing of agricultural produce (mean=2.92, SD=1.675), harvesting rain water (2.91, SD=1.736) and planting different crop varieties (mean=2.89, SD= 1.437).

On the other hand, the following adaptive strategies were *rarely* used; migrating to different locations (mean=2.07, SD=1.556), application of fertilizer, farming through irrigation (mean=1.68, SD=.968). Finally, Preserving livestock feed (mean=1.44, SD=.932) and insuring farm produce and properties (mean=1.38, SD=.986) were never used.

Of the strategies that were used *sometimes,* undertaking non-farm activities had the greatest use implying that the women had diversified into other activities other than farming. This outcome was in tandem with the results of the majority of respondents being involved in small scale business in the demographic profile. This was supported Agricultural Officer 1 who said that, "most the women have opted to get involved in small scale businesses and casual jobs as an alternative livelihood options. They finance their small businesses through credit that they accesses by forming groups and saving together."

This outcome is similar to findings by Yared (2014) in a study of women and Climate Change: Challenges and Adaptation Strategies in Choke Mountain, where women had started to shift to new economic systems, primarily from agriculture to other alternative adaptive mechanisms like trade and employment.

On crop production, the consistently used strategy was the changing of planting dates followed by the storage of the harvested agricultural produce then planting of different variety of crops. Agriculture officer 11 noted that some of the different varieties planted

included: passion fruits, okra, cowpeas leaves and green grams. Rain water harvesting was also used *sometimes* as an adaptation strategy. This could have been attributed to the dependency on the larger water harvesting initiative projects such as water pans that had been developed for the community by aid agencies and the county government.

Further, application of fertilizer and irrigation were rarely used as an adaptation strategy which could be as a result of existing limitations in implementation. This is despite the fact that the agriculture officers cited irrigation as one of the main interventions the county was advocating for to sustain food production. In addition, preservation of livestock feed and insuring of property and farm produce were *never* used by the respondents as adaptation strategies.

These results corroborate findings by Boko *et al*. (2007) who noted that strategies of adaptation already observed in Africa include diversification of livelihood activities, adjustments in farming operations and selling of labour.

In as much as climate change had to a great extent impacted negatively on their traditional sources of livelihoods, the findings indicated that the women in the study were already undertaking various adaptation strategies from time to time to cope with the various effects of climate change on their livelihoods. Some of the women stated that the challenge of not being able to rely on their previous activities had made them devise other means of survival that were more reliable. This in itself was a positive outcome as a result of climate change. Their ability to explore other sources of livelihoods had ultimately improved their living standards to a great extent.

Even so, it didn't escape the researcher that there lacked a consistency in the application of this strategies. None of the strategies was being used always or often. This outcome could have been as a result of underlying factors that were limiting the women's

adaptive capacity. Some of the factors may have been income levels, education level, availability and accessibility to information on climate change. This means that the strategies were more of coping strategies for short term survival rather than for the long term, which is the aim of adaptation.

Plate 4.6: Women carrying dry palm tree leaves to sell at the market

Plate 4.7: Illustrates women Selling Goats

Plate 4.8 Women selling Farm Produce

Plate 4.9: Water harvesting

Plate 4.6, 4.7 and 4.8 illustrate the alternative livelihood activities that the women in the Study area had embarked on. This featured the alternative of undertaking non-farm activities away from the traditional farming. Even so, the scope of trade is on a small-scale. Plate 4.9 Illustrates water harvesting as an adaptation strategy by the women.

4.6 Challenges to Adaptation

The study further examined the challenges the women were encountering with the application of the climate change adaptation strategies. From the findings, it emerged that the women in Kwale County were facing a host of challenges that limited their adaptive capacity to the effects of climate change as shown in the table 4.8.

Table 4.8: Challenges to Climate Change Adaptation

	Agree	N	Disagree
	%	%	%
Lack of water	81.5	6.9	11.6
Absence of relevant skills and training in adaptation	73.9	0.8	25.3
Lack of capital	76.9	0.8	22.3
Inadequate information on climate change	74.6	11.5	13.8
Inadequate Infrastructure and materials	67.7	1.5	30.7
Poor health status	64.6	0.8	34.6

Source: Author 2017

4.6.1 Lack of water

As shown in table 4.8, 81.5% of the respondents were in agreement that lack of water was a challenge to adaptation. This was especially so in their effort to engage in irrigation farming to supplement for the unreliable rainfall. This finding explains the outcome on the rare application of irrigation by the women as an adaptation strategy. This outcome was despite the fact that the County Agricultural Officers had indicated that micro irrigation was one of the interventions they were advocating for to enhance agricultural production in the County.

4.6.2 Lack of relevant knowledge and skills in adaptation

On the absence of relevant knowledge and skills as a challenge to adaptation, 73.9% of the respondents agreed that it was a factor limiting their ability to adequately adapt to the effects of climatic change. The respondents shared that they didn't have adequate knowledge about adaptation options that would enable them to cope with the climatic changes and experienced a serious skills gap due to poor access to training and extension services.

Whereas other studies have classified this constraint as an institutional barrier, the agricultural Officer 11, was of the view that also the high levels of illiteracy in the study area was a contributing factor to the slow impartation of relevant skills and knowledge provided to the women to enhance their adaptation. This view is validated in the study by Mougou *et. al* (2011) which revealed that due to lack of education and knowledge, it was difficult for people to change from inherited traditional practices to evaluate and implement the new methods. Studies by Benhin (2006) and Enete *et al.* (2008) also noted further that the level of education of farmers and access to extension services are major determinants of speed of adoption of adaptation measures to climate change.

4.6.3 Lack of capital

Adaptation strategies entail some direct or indirect cost. In this regard, 79.6 % of the respondents pointed out that they lacked the financial resources to invest in adaptation mechanisms such as irrigation systems, rainwater harvesting, and use of soil management techniques like application of fertilizers, purchase of improved seeds and breeds and diversification into other livelihood options.

In relation to inadequate financial resources, the agriculture officers conceded that a lack of consistency in funding of climate change interventions was challenging

effective support to the adaptation strategies and threatening the sustainability of the already existing initiatives for example training.

Other than the farming interventions, the women were engaging in small trading and indicated that they were unable to expand their businesses due to the lack of funds which would otherwise improve their proceeds and increase their resilience to climate change. An observation of the products they brought to the markets were in small quantities indicating their limitation in funds.

4.6.4 Lack of information on climate change

Availability of climate information is a prerequisite for climate-informed decision making and is a powerful tool that can be used to strengthen the resilience of the poor and the vulnerable against climate variability and change. The respondents were asked whether inadequate information on climate variability was challenging their adaptation capacity and from the results in table 4.8, 74.6% of the respondents agreed that it was a limiting factor.

The respondents acknowledged that the climate change information was not consistent and timely. There was also doubt on the accuracy of the information from the meteorological department on the expected climatic changes thereby reducing acceptability and trustworthiness of the information conveyed. The respondents mostly relied on their past experiences and traditional forecasters.

The County Director of meteorology indicated that the department was making considerable efforts in developing a reliable early warning system to the impending changes in climate change to the local community. They did so through public *barazas*, stakeholder forums and using the local radio stations. However the effectiveness of this information sharing was hampered by funding. They lacked a sustainable source of

funds to run the programs continuously. They had been previously supported by organizations like Care International and the Agricultural Sector Development Support Program which had since wound up their operations in the County.

Another challenge could also be related the lack of adequate equipment at the meteorological department in the County therefore they cannot produce real-time scale climate information for adaptation. This was evidenced by the scanty information on the trends in the temperature changes and gaps in the rainfall averages over the years. Similar findings by Adger *et al*. (2009), suggest that information and awareness on climate change could potentially serve as barrier to successful implementation of adaptation practices.

4.6.5 Inadequate infrastructure and materials

The lack of adequate infrastructure and materials was acknowledged as a barrier to adaptation by 67.7% of the respondents. This was related to issues with accessibility to markets because of poor physical infrastructure such as road networks in the County. The women had to trek for long distances and use means such as motorbikes as not all the areas are accessible using vehicles. When it rains the earth roads become impassible thereby limiting their access to various livelihood assets.

Another challenge was on the lack of good market systems to sell their products. For instance one respondent narrated that some women had embarked on planting water melons but on maturity, they didn't know how and where to source for a good market and therefore got little returns from the harvests and other products.

4.6.6 Poor health status

Good health is an asset for effective adaptation. A significant percentage of respondents, 64.6 % agreed that poor health had affected their ability to effectively

implement adaptation strategies. This was attributed to an increase in disease outbreak both on the individuals and other members of the household which aggravated the women's care giving responsibility of ailing family and community members.

4.7 Livelihood outcomes of residents in Kwale County

Livelihood outcomes are the final livelihood results that are shaped by the livelihood strategies. The livelihood outcomes analyzed in the study included income levels, improved well-being, reduced vulnerability, improved food security and more sustainable utilization of the natural resource base.

The results in table 4.9 showed that 90.8% of respondents reported that their income levels have been affected by the resultant effects of a changing climate. The respondents explained that they were getting earnings from sales of goods, wages and group projects but their savings were equally drained by the negative effects of climate change on their livelihood assets. Findings on the improved overall well-being indicated that 49.8% of the respondents agreed that their well-being had improved however, a significant number of respondents at 46.2% disagreed that their overall well-being had improved. Further, 43.8 % of the respondents disagreed that their ability to cope with the climatic shocks had improved while an equal number of them at 43.8 % agreed that they were better placed to deal with the future climatic shocks on their livelihoods.

This suggests that some respondents had succeeded in improving their resilience whereas the others still perceived themselves as being vulnerable to the effects of climate change. This outcome is consistent with other studies that revealed diversification to non-farm livelihood strategies rather than relying only on subsistence farming enables households to have better incomes and to better cope with environmental stresses (Bezu *et al*., 2012 and Hoang *et. al.,* 2014).

Despite the expectation that food security would be enhanced by livelihood diversification, majority of the respondents at 62.3 % disagreed that food security has improved. The resulting effects of climate change on the agricultural sector was limiting their ability to be food secure. This outcome is contrary to expectation suggesting that livelihood diversification is not sufficient rather there is need for institutional intervention to reinforce the local adaptation strategies to achieve food security.

Sustainable utilization of the natural resource base was analyzed based on the land and forest resources in the study area. From the findings, 85.4% of the respondents disagreed that there was an improvement in the sustainable utilization of forest resources while 80% of the respondents disagreed that there was an improvement in the utilization of the land resource. The respondents pointed out that some of their livelihood activities would lead to the depletion of the natural resources such as charcoal burning, logging, burning and slashing. Despite the knowledge that such activities are a serious environmental threat, they said it was a means of survival but still acknowledged that given an alternative they would advocate for conservation of this resources.

This implies that in as much as women have been identified as positive change agents in the fight against climate change, their current constraints are still undermining this potential and therefore its necessary to address this underlying issues before they van embark on advocating for adaptation to climate change.

Table 4.9: Livelihood outcomes

	Agreed	Neutral	Disagreed
Income levels have been affected	90.8%	0.0%	9.2%
Improved overall well-being	49.8%	3.1%	46.2%
The ability to cope improved	43.8%	12.3%	43.8%
Food security has improved	33.1%	4.6%	62.3%
Improved sustainable utilization of the forest resources	14.6%	0.0%	85.4%
Improved sustainable utilization of land resources	20.0%	0.0%	80.0%

4.8 Correlation result of effect of climate change and livelihood outcomes

Correlation analysis is a statistical technique of establishing relationship between variables. It establishes the nature and strength of relationship. A bivariate correlational result between the effect of climate change and livelihood outcomes was undertaken and findings are presented in table 4.10.

Table 4.10: Correlation of the effect of climate change on livelihoods and livelihood outcome

		Effect of climate change	Livelihoods
Effect of climate Change on livelihoods	Pearson Correlation	1	-.285**
	Sig. (2-tailed)		.001
Livelihood outcomes	Pearson Correlation	-.285**	1
	Sig. (2-tailed)	.001	
	N	130	130

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

***Source*: Author 2017**

The findings revealed that there was a moderate negative correlation between effect climate change and livelihood outcomes. And the correlation was significant at 5% significant level ($r=-0.285$, $p=.001$) since $p<0.05$. The implication is that the collective negative effects of climate change to the livelihoods of women specifically on agriculture, food security, water resources, energy resources and health have somewhat affected their positive livelihood outcomes of more income, improved overall wellbeing, decreased vulnerability, improved food security and sustainable utilization of natural resources . This moderate negative significance can be attributed to the action of adaptation strategies that have cushioned the respondents reducing their vulnerability and enhancing their resilience to the effects of climate change.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

5.1.1 Perception of climate change

The findings of the study on the first objective on the assessment of the women's perception of climate change in Kwale County revealed that the respondents were aware of the existing changes in the climate. The changes perceived were the increase in surface temperature (94.6%), decreased rainfall amounts (89.2%), decreased rainfall predictability (88.0%) and increased incidents of drought (96.2%). This results were further validated by data and information from the meteorology department. The results proved that despite their low educational level, the women are well aware of the changes in climate occurring in their environment. This was possibly attributed to their indigenous knowledge and experience from living in the study area over long periods of time thereby giving them an advantage to be better placed to take-up adaptation strategies.

5.1.2 Evaluation of the effects of climate change on livelihoods of the women

On the effects of climate change on the livelihoods of the women in the study area, overall what emerged in this study is that climate change continues to negatively affect their ability to adequately utilize their livelihood assests. Climate change continues to undermine their livelihood capitals specifically, agriculture, food security, water resources, energy resources and their health. These livelihood capitals thrive on stability in climate and in the event of the eminent changes they indicated that crop failure had increased (97.7%), reduced crop productivity (84.6%), decline in the quality and health of livestock (87.2%) and scarcity in fodder to feed the livestock (96.9%).

The respondents argued that food security has always been an issue but in the event of the current climatic changes, the problem had been intensified. They agreed that there was a decline in the quality and quantity of food (84.5%) and that the cost of food had increased (96.2%). This was mainly attributed to increased incidences of drought as a result of reduced rainfall and increased surface temperatures. It was important to note that food insecurity was already an underlying problem thereby raising a critical issue that perhaps the existing livelihood stressors have been magnified with the onset of rapid climate change and variability.

The other vulnerable areas included increased water scarcity which was agreed to by 92.3% of the respondents. There was evidence of reduced water volumes in some of the rivers and water pans that serve the study area. Again, the issue of water scarcity was already an underlying stressor that was exacerbated by increased climate change. In the prevailing circumstances of water scarcity, the women had been stained in their responsibility to provide water for their households both for domestic and irrigation purposes.

5.1.3 Analysis of adaptation strategies to climate change

Even with the negative effects of climate change on the livelihoods of the respondents, the study established that the women had resulted to various adaptation measures to survive and manage in their current environment. The respondents indicated that they had sometimes diversified their livelihoods by engaging in non-farm activities, changing planting dates, stored agricultural produce harvested rainwater and planted different varieties of crops. The observed activities involved trading in the market. This was a clear shift from just engaging in subsistence farming but moving out to seek alternative means to survive.

In as much as strategies such as migration to different locations, application of fertilizers, irrigation preservation of livestock feed and insurance have been identified as key strategies in climate change adaptation they were rarely used and in the case of the latter never applied. However, provided with the necessary institutional and policy interventions, probably the respondents would be in a better position to implement these strategies.

Finally, being that none of the strategies were being applied often and always was a clear indication that they were short term interventions thereby inclined more to coping with the immediate effects of climate shocks rather than providing long term resilience. This implies that the adaptive capacity of the respondents was low.

5.1.4 Barriers to climate change adaptation

The effort to climate change adaptation is not without its barriers. Overall, the respondents agreed that scarcity of water (81.5%), lack of relevant skills and training (73.9%), lack of capital (76.9%), inadequate and reliable information on climate change (74.6%), inadequate infrastructure and materials and poor health (64.6%) were the barriers they were encountering in their bid to successfully adapt to the changes in climate.

The prominence of this barriers proved that even with the autonomous strategies, there is still need to have interventions from external agencies to support the local initiatives. This implied that despite their indigenous knowledge and experience being a huge asset in the fight against climate change their preexisting conditions need to be improved.

5.1.5 Livelihood outcomes

Overall, the reality of climate change affects the livelihood outcomes of people. Based on the findings of this study it was established that the respondents acknowledged that

their income levels had been affected (90.8%) which is an expected outcome in their prevailing environment. While most studies have had outcomes of reduced well-being of people with the manifestation of climate change on their livelihoods, the results of this study established that majority of the women indicated that their wellbeing had improved (49.8%) and reduced vulnerability (43.8%). This is probably because of their adaptation initiatives implying that even with climate change there could be positive outcomes. Even so, food security still continues to be a pertinent issue with majority of the respondents (62.3%) disagreeing that it had improved.

Majority of the respondents agreed that there was unsustainable utilization of natural resources as a result of 85.4% of the respondents disagreeing that there was sustainable utilization of the forest resources and 80% disagreeing on the sustainable utilization of land resources in the study area. Finally it was found that the negative effects of climate change on the livelihoods of the women had a moderate significant correlation with desirable livelihood outcomes. That is to say that to a moderate extent, the more the negative effects of climate variability; the less the desirable outcomes are and the less negative effects of climate variability, the more the desirable livelihood outcomes.

5.2 Conclusions

Based on the findings, it can be concluded that Kwale County is experiencing climate variability and change like the rest of the country. These changes have been manifested in the form of increased temperatures, changes in precipitation and incidences of extreme weather events mainly in the form of droughts. Further, the women have validly perceived these changes based on their experiences and observations rather than through education. This awareness of the changing trends in climate can be said to have in turn enhanced their decision making towards taking up various adaptation strategies to deal with the resulting effects. This brings in new insight that even if there is need to

continue sensitizing people on the phenomenon of climate change, the women in the rural areas are well aware of this reality.

The climatic changes have contributed to adverse effects on the livelihoods sources of the women in Kwale County. These effects have affected the traditional agricultural sector that they used to rely on as a source of livelihood, their food security has been undermined, water resources, energy sources have been limited and their health and that of their households affected. This has translated to a strain on their ability to achieve desirable livelihood outcomes. The fact that most of these issues have been problems they were already experiencing, albeit with less intensity, could be masking the action of climate change on their livelihoods hence requiring a change of strategy to specifically address the challenge of climate change.

In response to the effects of climate change on their livelihoods, the women have taken up various autonomous adaptation strategies. Their uptake of non-farm activities rather than relying on the traditional agricultural sector that is very climate sensitive has provided an opportunity for them to diversify their livelihood sources thereby reducing their vulnerability to the adverse effects of climate change and to a great extent improving their livelihoods. This means that even with the onset of the negative effects of climate change on their traditional sources of livelihoods, there has been a positive shift to other sources of income. However, there was no uptake of strategies such as preservation of feed and insurance that would aid in reducing the effects of climate change. There is need to reinforce the potential of women in adaptation as the existing strategies are short term making them a means of coping with the short term effects rather than increasing resilience in the long term.

As much as women have been identified as key change agents in the climate change debate, based on the findings of this study, their ability to effectively adapt to the

changes in climate and exploit the opportunities greatly undermined by underlying barriers such as poverty, illiteracy, access to information and health. This had reduced their adaption capacity. This shows that it is important to ensure that the women have the means and resources to implement the various adaptation strategies at their disposal to address current and expected climate change impacts on their livelihoods. This will enable the women to fulfill their potential as central agents in the process of climate change adaptation. In addition, the underlying stressor of illiteracy in the area can be said to have exacerbated the low adaptation capacity of the women.

Finally, it is a fact that climate change continues to affect the livelihoods of women. However, with proper structure that accommodate the input of their local knowledge and experiences, vulnerability can be reduced to achieve resilience through successful adaptation.

5.3 Recommendations

Based on the findings and conclusions of this study, the following recommendations have been proposed.

I. The findings indicate that the adaptation capacity of women is low. Therefore, developmental activities by intervening institutions should focus on the mentioned barriers to adaptation and strengthen adaptation by ensuring access to developmental resources such as credit, information, training and appropriate technology. This will enable the women to fulfill their potential as central agents in the process of climate change adaptation.

II. Access to information on climate change is a powerful tool that can be used to enhance implementation of adaptation strategies. In support of this, the government and other development partners need to provide support to the

Kenya Meteorological Department early Warning System to enable the timely dissemination of reliable projected changes in weather.

III. The government agencies and other intervening institutions should factor in the current autonomous strategies that are being used and built on them to enhance the resilience of the women rather than only cascading the pre-planned adaptation strategies

IV. The government should consider developing an innovative insurance scheme with low premiums to insure the women farmers against loses such crop failure due to the effects of climate change.

5.4 Recommendations for Further Research

The study was carried out with a focus on the manifestation of climate change on livelihoods of women in general. However, it emerged that the adaptation capacity of women can be affected by certain socio-economic factors and in this study they included marital status, cultural beliefs and literacy levels. Thus, is need for further research on the links between this socio-economic factors and their effect on adaptation capacity of women to climate change.

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APPENDICES

Appendix I: Climate Change Manifestation Questionnaire

SURVEY QUESTIONNAIRE FOR THE WOMEN ON THE MANIFESTATION OF CLIMATE ON THEIR LIVELIHOODS

PART A: GENERAL INFORMATION

Please write in the space provided or (√) tick appropriately,

1. What is your age bracket?

   18- 30years [ ] 31- 50 years [] 51-60 years [ ]

   Above 60years [ ]

2. What is your level of education?

   Primary [ ] Secondary [ ]

   Tertiary [ ] University [ ]

   Others (please specify)……..

3. How long have you lived in Kwale County?

   1- 20 years [ ] 21- 40 years [ ] Over 40 years [ ]

4. What is your main source of income?

   Farming [ ]

   Fishing [ ]

   Employed/Casual Labor [ ]

   Small scale business [ ]

   Pension [ ]

   Other (specify)…….

PART B: FORMS OF CLIMATIC CHANGES

Which of the following changes in climate have you observed in Kwale County?

5. Temperatures

Increased [ ] Decreased [ ] Unchanged [ ]

6. Rainfall

Increased [ ] Decreased [ ] Unchanged [ ]

7. Unpredictable rainfall

Increased [ ] Decreased [ ] Unchanged [ ]

8. Extreme Weather Events

Incidences of floods

Increased [ ] Decreased [ ] Unchanged [ ]

9. Incidences of Drought

Increased [ ] Decreased [ ] Unchanged [ ]

Other (s) specify……

PART C: EFFECT OF CLIMATE CHANGE ON LIVELIHOODS

Using the scale below, select the option which best describes your level of agreement on the following effects as a result of climate change.

1–Strongly Agree, 2–Somewhat Agree, 3–Neutral 4–Somewhat Disagree, 5–Strongly Disagree

Statement	**1**	**2**	**3**	**4**	**5**
10. Incidences of crop failure have increased due to climate change					
11. Crop production has been affected by climate change					
12. There is a decline in food quantity and quality					
13. The cost of food is increasing because of climate change					
14. The quality and health of livestock has decreased					
15. Climate change has led to an increase in crop pest infestation and weeds					
16. There is scarcity of fodder					
17. There is scarcity of water					
18. There is an increase in disease outbreak					
19. There is scarcity of wood fuel/ charcoal					

PART D: ADAPTATION STRATEGIES

Using the scale below, select the option which best describes the frequency to which you apply the listed coping and adaptation strategies.

1- Never

2- Rarely

3- Sometimes

4- Often

5- Always

Statement	**1**	**2**	**3**	**4**	**5**
20. Planting different variety of crops					
22. Changing of planting dates					
23. Crop farming through irrigation					
24. Preserving livestock feed					
25. Application of fertilizers when growing crops					
26. Storing agricultural produce					
27. Rain water harvesting					
28. Undertaking non-farm activities					
29. Insuring of property and farm produce					
30. Migrating to different locations					

PART E: CHALLENGES TO ADAPTATION

Using the scale below, select the option which best describes your level of agreement on the following challenges to climate change.

1–Strongly Agree, 2–Somewhat Agree, 3–Neutral 4–Somewhat Disagree, 5–Strongly Disagree

Statement	**1**	**2**	**3**	**4**	**5**
31. Lack of Capital has hampered adaptation to climate change					
32. Poor health status has affected the ability to implement adaptation strategies					
33. Lack of water for irrigation farming is barring efforts to survive the effects of climate change					
34. Lack of information on weather incidence is challenging adaptation					
35. There is inadequate infrastructure and materials to enable adaption to climate change					
36. There is an absence of relevant skills in adaptation strategies					

PART F: LIVELIHOOD OUTCOMES

Using the scale below, select the option which best expresses your level of agreement on how climate change has affected your livelihood outcomes

1–Strongly Agree, 2–Somewhat Agree, 3–Neutral 4–Somewhat Disagree, 5–Strongly Disagree

Statement	**1**	**2**	**3**	**4**	**5**
37.Income levels have been affected due to climate change					
38. There has been improvement of well-being					
39 .The ability to cope and recover from the effects of climate change has improved					
40. The level of food security has improved					
41. Climate change has improved the sustainability of the forest resources					
42. Climate change has improved the sustainability of the land resources					

THANK YOU

Appendix II: Interview for the Agricultural Officer

1. What changes in climate have you observed in Kwale County in terms of?

   -Temperature

   -Rainfall

   -Frequency of droughts

   -Frequency of floods

2. What are the impacts of climate change and variability on the livelihood of the women in Kwale County? In regard to:

   - Agriculture

   - Food Security

   - Water resources

   - Energy Resources

   -Health

3. What are the local adaptive mechanisms used to cope with the impact?

4. Are there any measures introduced by the extensions to improve on the resilience on people's livelihoods?

5. What are the main challenges in enhancing adaptation?

6. Are there any interventions to assist in adaptation?

Appendix III: Interview Schedule for the County Director of Meteorological Services

1. What changes in climate have you observed in Kwale County in terms of?

   -Temperature

   -Rainfall

   -Frequency of droughts

   -Frequency of floods

2. Are there any predictions that have been made on the future changes in the climate of Kwale County?

3. How is this information shared with the people of Kwale County?

4. How has the information on impending climatic changes supported the adaptive capacity of the women in Kwale County?

Appendix IV: Interview for the traditional weather man

1. What changes in climate have you observed in Kwale County in terms of?

   -Temperature

   -Rainfall

   -Frequency of droughts

   -Frequency of floods

2. Are there any predictions that have been made on the future changes in the climate of Kwale County?

3. How is this information shared with the people of Kwale County?

4. How has the information on impending climatic changes supported the adaptive capacity of the women in Kwale County?

Appendix V: Introduction Letter

MOI UNIVERSITY
SCHOOL OF HUMAN RESOURCE DEVELOPMENT
DEAN'S OFFICE

P.O. Box 3900
ELDORET
KENYA.

Tel./Fax 254-053-43153/43620 Ext.434

REF: MU/SHRD/PG/77 **20th April 2016**

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: HELLEN WAMBUI GITHOGORI - SHRD/PGD/01/14

This is to confirm that the above named is a M.Sc student in the Department of Development Studies, School of Human Resource Development taking M.Sc course in Development Studies.

She has successfully finished her coursework, submitted her Thesis proposal for examination entitled ***"Manifestation of Climate Change on the Livehoods of Women in Kwale County, Kenya"*** and she has been cleared to proceed to the field to collect data.

Any assistance accorded to her will be highly appreciated.

Yours faithfully,

20 APR 2016

DR. RUTH J. TUBEY
DEAN, SCHOOL OF HUMAN RESOURCE DEVELOPMENT

/mc

Appendix VI: Letter of Authorization

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND COORDINATION OF NATIONAL GOVERNMENT

Email address: cckwale@yahoo.com
Telephone: **Kwale 4105**
When replying please quote

THE COUNTY COMMISSIONER
P.O. BOX 1
KWALE

Ref. No. ADM.15/7/4CC/VOL.1/107

22nd August, 2015

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION
M/S HELLEN WAMBUI GITHOGORI - ID/NO.27297263

The above named has been authorized to conduct research on **"Manifestation of climate change on the livelihoods of Women in Kwale County,"** for the period ending **9th August, 2017.**

This is therefore to request that she be accorded the necessary assistance while undertaking the research project.

Kutswa Olaka
COUNTY COMMISSIONER
KWALE COUNTY

COUNTY COMMISSIONER KWALE
DATE: 22/8/16
P.O. Box 1-80403, KWALE

Appendix VII: Research Permit

15/7/14

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349,254-20-2673 2219420
Fax:+254-20-8245,318245
Email dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 59623-00100
NAIROBI-KENYA

Ref No. **NACOSTI/P/16/16017/11038**

Date:
10th August, 2016

Hellen Wambui Githogori
Moi University
P.O. Box 3900-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Manifestation of climate change on the livelihoods of Women in Kwale County,"*** I am pleased to inform you that you have been authorized to undertake research in **Kwale County** for the period ending **9th August, 2017.**

You are advised to report to **County Commissioner and the County Director of Education, Kwale County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kwale County.

The County Director of Education
Kwale County.

Acc
Please deal with this
Otaka
22/8/2016