A GENDERED ANALYSIS OF VULNERABILITY TO CLIMATE CHANGE AMONG SMALLHOLDER FARMERS: THE CASE OF SAME DISTRICT

TATU SAID MNDMBO

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO. TANZANIA.

2013

ABSTRACT

Climate change has gendered differentiated impact and vulnerability. The main objective of this study was to examine the impact of climate change on small holder farmers and their gendered differentiated vulnerability in Same District. Specific objectives of the research were; i) to determine a gendered perception of climate change and variability; ii) to analyse climate change and variability impacts on livelihoods; iii) to determine differentiated gender roles associated with smallholder livelihoods and iv) to assess vulnerability among men and women to climate change. The study was conducted in Makanya and Hedaru wards in Same District. A cross sectional research design was adopted. A representative sample of 120 respondents was randomly drawn. Both qualitative and quantitative methods for data collection were used. Likert scale was also used to address perception on climate change. The methods used under qualitative data collection were Focus Group Discussion, Key informants Interview and field observation while quantitative data were collected through questionnaire survey. The Statistical Package for Social Science (SPSS) Version 12.0 was used for data analysis. Results show that through socially constructed roles and responsibility, women seem to bear the most burdens from climate change impact. About 90% of households farm work was perceived to be women roles. It was also noted that the perception was different basing on gender. Great proportion of women (95%) associated climate change to spiritual power. This shows their limited knowledge as climate change is not associated with spiritual beliefs. It was also found that in trying to cope to climate change women become more vulnerable as household men members migrate to urban areas. It was also found that livelihoods have also changed as a result of climate impact. Farmers have been more involved with off farm activities as crop farming has become unsustainable.

DECLARATION

I, TATU SAID MNIMBO, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

Tatu Said Mnimbo

(MA. Rural Development)

11/11/2013.

Date

The above declaration is confirmed

Dr. J. S. Mbwambo

(Supervisor)

11/11/2013

Date

COPYRIGHT

ACKNOWLDGEMENTS

Various institutions and individuals have morally and materially contributed to the completion of this report, I am grateful to all of them. My first and sincere gratitude should go to my research supervisor Dr. J.S. Mbwambo for his tireless effort and constructive criticism and guidance towards the success of this work. I appreciate the advice on various issues and methodologies he extended to me throughout the study.

I also give my appreciation to all members of the academic staff of the Development Studies Institute (DSI) and other staff members from different departments at Sokoine University of Agriculture for their useful comments during the development of the research proposal. I do also appreciate the contribution of ECAW for their valuable financial assistance in this study. My sincere gratitude should go to Prof. S. Tumbo and Prof. H. Mahoo for their mentoring and support. I also thank my parents Said Mnimbo and Margret Amani for their love and care.

I appreciate and particularly feel indebted to the villagers in Makanya and Hedaru wards, my sisters Rachel and Faith. Lastly, but not least I would like to thank Mr. Clemence Ngoka for his assistance during field work.

DEDICATION

This study is dedicated to the Almighty God, creator of the universe and source of all knowledge, who has enabled me to pursue studies up to the higher degree level in the university. It is also dedicated to my husband Mr. Joseph Massimba for who encouraged me throughout of my studies, and my son Christian for enduring my absence during my studies.

TABLE OF CONTENTS

ABSTRACT i

DECLARATION ii

COPYRIGHT iii

ACKNOWLDGEMENTS iv

DEDICATION v

TABLE OF CONTENTS vi

LIST OF TABLES x

LIST OF FIGURES xi

LIST OF APPENDICES xii

LIST OF ABBREVIATIONS AND ACRONYMS xiii

CHAPTER ONE 1

1.0 INTRODUCTION 1

1.1 Problem Statement 2

1.2 Justification for the Study 2

1.3 Objectives of the Study 3

1.3.1 Overall objective 3

1.3.2 Specific objectives 3

1.4 Research Questions 4

1.5 Conceptual Framework 4

CHAPTER TWO 6

2.0 LITERATURE REVIEW 6

2.1 Definition of Key Concepts 6

2.1.1 Vulnerability 6

2.1.2 Adaptive capacity 7

2.1.3 Adaptation ability 7

2.1.4 Gender ..... **Error! Bookmark not defined.**

2.1.5 Gender vulnerability to climate change 9

2.1.6 Climate change 9

2.1.7 Climate variability 10

2.1.8 Climate change adaptation 11

2.2 Climate Change Impact 11

2.3 Climate Change Impact and Livelihood 12

2.4 An overview of Climate Change 13

2.5 Regions mostly Affected by Climate Change 15

2.5.1 Impact of climate change and vulnerability 16

2.5.2 Smallholder farmers vulnerability to climate change 17

2.5.3 Global responses to climate change 17

2.5.4 Gender and climate change 20

2.5.5 Climate change and indigenous knowledge 22

2.6 Theoretical Background 23

2.6.1 Theories of climate change vulnerability and gender 23

2.7 Previous Studies on Climate Change and Gender 24

2.7.1 Studies on gendered vulnerability of smallholder farmers 24

2.7.2 Research in the world 25

2.7.3 Research in africa 26

2.7.4 Research in Tanzania 27

CHAPTER THREE **29**

3.0 METHODOLOGY **29**

3.1 Description of the Study Area 29

3.2 Research Design 31

3.3 Data Collection 31

3.3.1 Qualitative data 31

3.3.1.1 Focus group discussion 31

3.3.1.2 Key informants 33

3.3.1.3 The analysis of gender roles using harvard analytical framework 33

3.3.2 Quantitative data collection 34

3.3.2.1 Questionnaire Survey 34

3.3.3 Methods of Data Analysis 35

3.3.3.1 Qualitative data analysis 35

3.3.3.2 Farmers perceptions on climate change 35

3.3.3.3 Climate change impacts on livelihoods 35

3.3.3.4 Relationship between climate change and gendered vulnerability 36

CHAPTER FOUR **37**

4.0 RESULTS AND DISCUSSION **37**

4.1 Demographic and Socio-Economic Characteristics of the Respondents 37

4.1.1 Age categories of the respondents 39

4.1.2 Household size 39

4.1.3 Sex of the Households' head 40

4.1.4 Education 41

CHAPTER THREE **29**

3.0 METHODOLOGY **29**

3.1 Description of the Study Area 29

3.2 Research Design 31

3.3 Data Collection 31

3.3.1 Qualitative data 31

3.3.1.1 Focus group discussion 31

3.3.1.2 Key informants 33

3.3.1.3 The analysis of gender roles using harvard analytical framework 33

3.3.2 Quantitative data collection 34

3.3.2.1 Questionnaire Survey 34

3.3.3 Methods of Data Analysis 35

3.3.3.1 Qualitative data analysis 35

3.3.3.2 Farmers perceptions on climate change 35

3.3.3.3 Climate change impacts on livelihoods 35

3.3.3.4 Relationship between climate change and gendered vulnerability 36

CHAPTER FOUR **37**

4.0 RESULTS AND DISCUSSION **37**

4.1 Demographic and Socio-Economic Characteristics of the Respondents 37

4.1.1 Age categories of the respondents 39

4.1.2 Household size 39

4.1.3 Sex of the Households' head 40

4.1.4 Education 41

4.2 Socio-economic activities 42

4.2.1 Occupations 42

4.2.1.1 Land ownership 43

4.2.1.2 Household labour 44

4.3 Gender Roles and Responsibilities 44

4.3.1 The activity profile 45

4.3.2 The access and control profile 47

4.5 Relationship between Community Perception and Meteorological Data 50

4.6 Temperature Variations 54

4.7 Climate Change and Livelihoods 56

4.7.1 Types of Agriculture in the study villages 56

4.8 A gendered Climate Change Vulnerability 60

CHAPTER FIVE 62

5.0 CONCLUSIONS AND RECOMMENDATIONS 62

5.1 Conclusions 62

5.2 Recommendations 64

5.3 Limitations to the study and Suggestions for Further Research 65

REFERENCES 67

APPENDICES 85

LIST OF TABLES

Table 1: Demographic characteristics of participants in Focus group Discussion.... 32

Table 2: Summary of the chosen sample from the study population 35

Table 3: Demographic and socio-economic characteristics of the respondents 38

Table 4: Descriptive statistics of demographic and socio-economics characteristics..... 38

Table 5: Age categories of the respondents in each village 39

Table 6: Household Size categories across villages 40

Table 7: Sex of Household heads 41

Table 8: Education of household head..... 41

Table 9: Main occupation of the respondents in the study villages..... 42

Table 10: Type of land ownership in the study area..... 43

Table 11: Household and hired Labour 44

Table 12: The activity profile of the study area 46

Table 13: Showing the access and control profile..... 47

Table 14: Farmers perceptions and knowledge on climate change..... 48

Table 15: Distribution of types of agriculture..... 57

LIST OF FIGURES

Figure 1: Conceptual Framework showing gendered vulnerability to climate change ... 5

Figure 2: Administrative Boundaries of Hedaru and Makanya Wards 30

Figure 3: Rainfall in Makanya catchment (Source: Tanzania Metrological Agency) ... 52

Figure 4: Dry spell events (Source: Tanzania Metrological Agency) 54

Figure 5: Maximum temperature variations (source: Tanzania Meteorological Agency). 55

Figure 6: Minimum temperature variations (source: Tanzania Meteorological Agency). 56

LIST OF APPENDICES

Appendix 1: Climate change impacts and livelihoods 85

Appendix 2: Vulnerability matrix showing climate change vulnerability and impact by gender. (adapted from the handbook of climate vulnerability and capacity building analysis, CARE, 2009). 87

Appendix 3: Questionnaire survey 88

Appendix 4: Focus group discussion questions 97

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
CCAFS	Climate Change Agriculture and Food Security
DAC	Development Co-operation Directorate
DFID	Department For International Development
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GAT	Gender Analysis Tool
GHG	Green House Gases
HIV	Human Immunodeficiency Virus
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFPRI	The International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
JGCRI	Joint Global Change Research Institute
MDG	Millennium Development Goal
NAPA	National Adaptation Programmes of Action
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFPA	United Nations Population Fund
URT	United Republic of Tanzania
USA	United States of America
USAID	United States Agency for International Development

SPSS	Statistical Package for Social Scientist
TCCAR	Tanzania Climate Change Alert and Resilience
WEDO	Women's Environment Development Organization
WID	Women In Development
WMO	World Meteorological Organization

CHAPTER ONE

1.0 INTRODUCTION

Addressing the threat of climate change has become a global priority. In this respect, there has been a long debate regarding the identification of gender perspectives and the involvement of women in addressing climate change (Dankelman 2002; Denton 2002; Dennison 2003; Duddy 2005; WEDO 2007; Parikh 2007; Carvajal *et al.*, 2008). According to IPCC (2007), communities will be more vulnerable to the impacts of climate change and that these will affect men and women differently. The anticipated differences in the impacts of climate change along gender lines are attributed `to the existing inequalities such as unequal access to resources, gendered divisions of labour and decision-making power which may affect the ability to respond to the effects of climate change (WEDO, 2007; Parikh, 2007; UNFCCC, 2007). In most cases, women are expected to be more vulnerable than men to the impact of climate change as the former are reported to constitute the majority amongst the poorest and the most disadvantaged groups in society (Denton, 2001; Banda,2005; Brody *et al.*, 2008). However, although women may be the most vulnerable, it has also been acknowledged that they function as agents of change in the management of community natural resource, innovation, farming and care giving. Women, therefore, play a key role in the community's adaptation to climate change (UNDP, 2009). Thus, any intervention aimed at reducing the impact of climate change including climate variability can only be effective if gender differentiated impacts and vulnerability are taken into account. . However, while there is a plethora of literature, research and development (See for example, The Grantham research on climate change, the Joint Global Change Research (JGCR),Tanzania Climate Change alert and Resilience (TCCAR) and Climate change Agriculture and Food Security (CCAFS) studies on climate change. There is limited analysis of gender differentiated impact on

climate change and variability, therefore this study aimed at linking gender to climate change for the development of effective climate change policies that are gender responsive.

1.1 Problem Statement

Both the Kyoto Protocol (1993) and the United Nations Framework for Climate Change (UNFCC) of 2007 model address climate change impact with limited focus on differentiated vulnerability among men and women. Moreover, the current frameworks in which the threats of climate change are being addressed have limited analysis on gender perspectives (Dankelman, 2002; Dennison, 2003; Parikh, 2007; Duddy, 2005; Carvajal *et al.*, 2008). As a result, decisions regarding climate change have not been adequately addressing the special needs of women and other vulnerable groups.

According to Lambrou and Piana (2006), gender is the missing component of the response to climate change because many people tend to forget addressing gender when talking about the climate. There is thus insufficient knowledge regarding gender differentiated data on climate change vulnerability in Tanzania. Consequently, policies and decision makers are not well informed and most interventions are not gender sensitive (CARE, 2007). Thus, this study addresses locality specific gendered impact vulnerability to climate change by using a rural community in Tanzania.

1.2 Justification for the Study

Incorporating a gender perspective in all climate change policies and initiatives is critical to solving the climate crisis. The effects of climate change vary across different segments of the population, especially for various social groups. Gendered differentiated vulnerabilities are also locality specific. In many cases, women are more vulnerable to the

negative effects of climate change because of their lower social status in most countries. Many impoverished women, especially those in the developing world, are farmers and depend on the natural environment for subsistence and income. By further limiting their already constrained access to physical, social, political, and fiscal resources, climate change often burdens women more than men.

Locally and globally, governments as well as non-governmental organizations respond to climate change. Some of these efforts focus on mitigating the effects of climate change while others aid societies in adapting their lifestyles to changes in their environment. Most policy responses in the late 20th and early 21st century either did not focus on the social effects of climate change or did not consider gender in these efforts (Brandt and Svendsen, 2003). Therefore this study will make a theoretical contribution in filling this gap.

1.3 Objectives of the Study

1.3.1 Overall objective

The overall objective of this study was to examine the impact of climate change on small holder farmers and their gender differentiated vulnerabilities.

1.3.2 Specific objectives

The following were specific objectives of this study:

(i) To determine a gendered perception of climate change.

(ii) To analyze climate change and impact on livelihoods.

(iii) To determine differentiated gender roles associated with smallholder livelihoods.

(iv) To compare men and women vulnerability to climate change.

1.4 Research Questions

The research was guided by the following questions

(i) Are women and men impacted by Climate Change differently?

(ii) What are the physiological, political, economic and societal causes of the differences in vulnerability?

(iii) What are the current coping and adaptation strategies to climate change and capacities of women and men in coping with and adapting to climate change?

(iv) How can the capacity of women and men in coping with and adapting to climate change be strengthened?

1.5 Conceptual Framework

This study used the framework presented in Fig. 1. This frame work is preferred because of its holistic treatment of gendered and livelihood variables. The framework assumes that climate change will not only have differentiated impact according to gender, but also men and women will have different extents of susceptibility and vulnerability. The vulnerability will hugely depend on allocation and distribution of household resources (Bartlett 2008). Gender inequalities with respect to households' assets utilization and distribution greatly determine the extent of vulnerability among members of the household (Fisher, 2006).

As shown in the conceptual framework, the impact of climate change is based on access to resources and differences in the roles assigned to men and women. However, the extent of vulnerability will be intervened by farm factors, socio-economic factors, and demographic factors; the dotted lines show the cause-effect relationship, that farm factors bring out of the gender differentiated vulnerability and also gender differentiated vulnerability can be caused by farm factors and socio-economic and demographic factors.

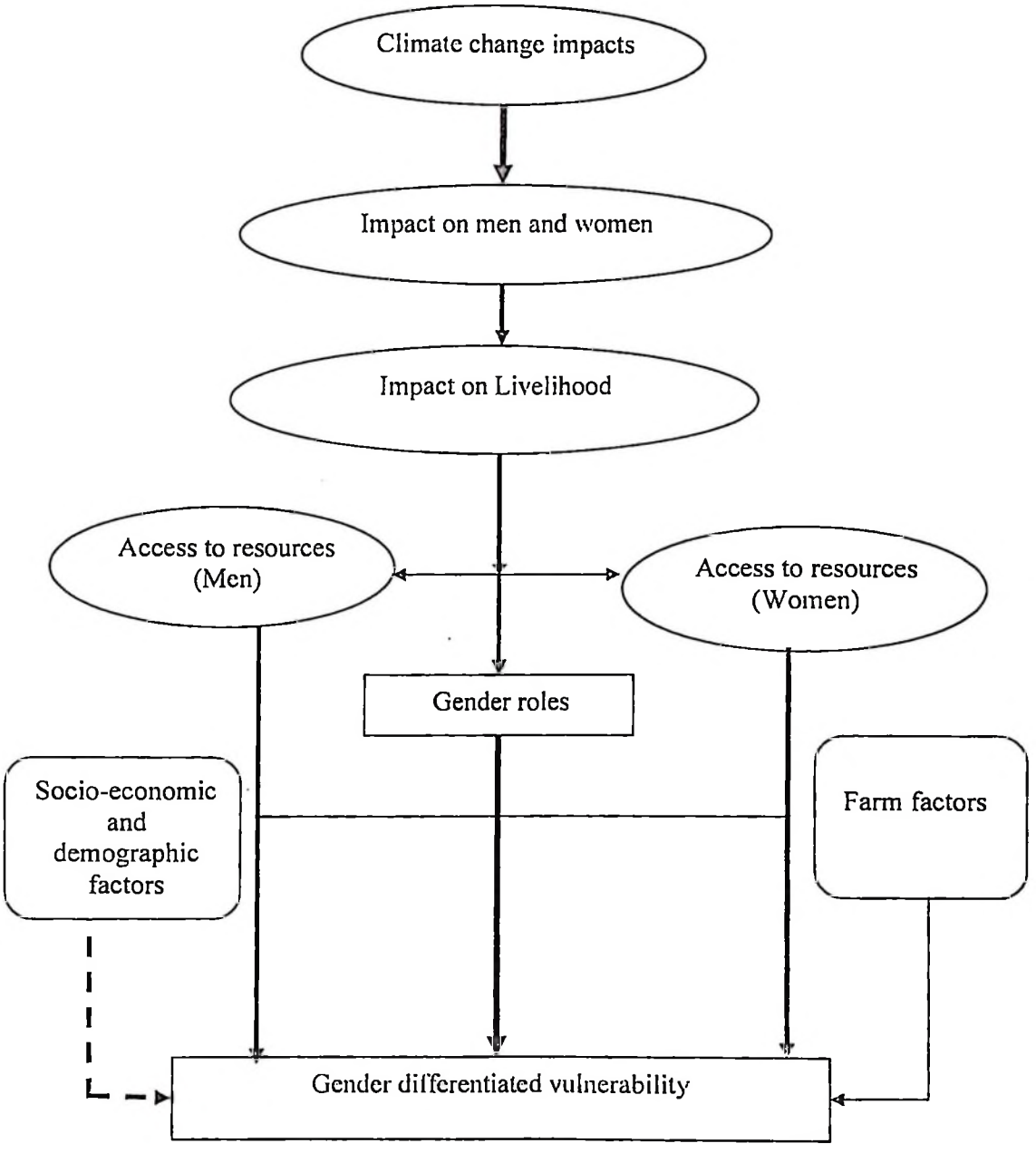

Figure 1: Conceptual Framework showing gendered vulnerability to climate change

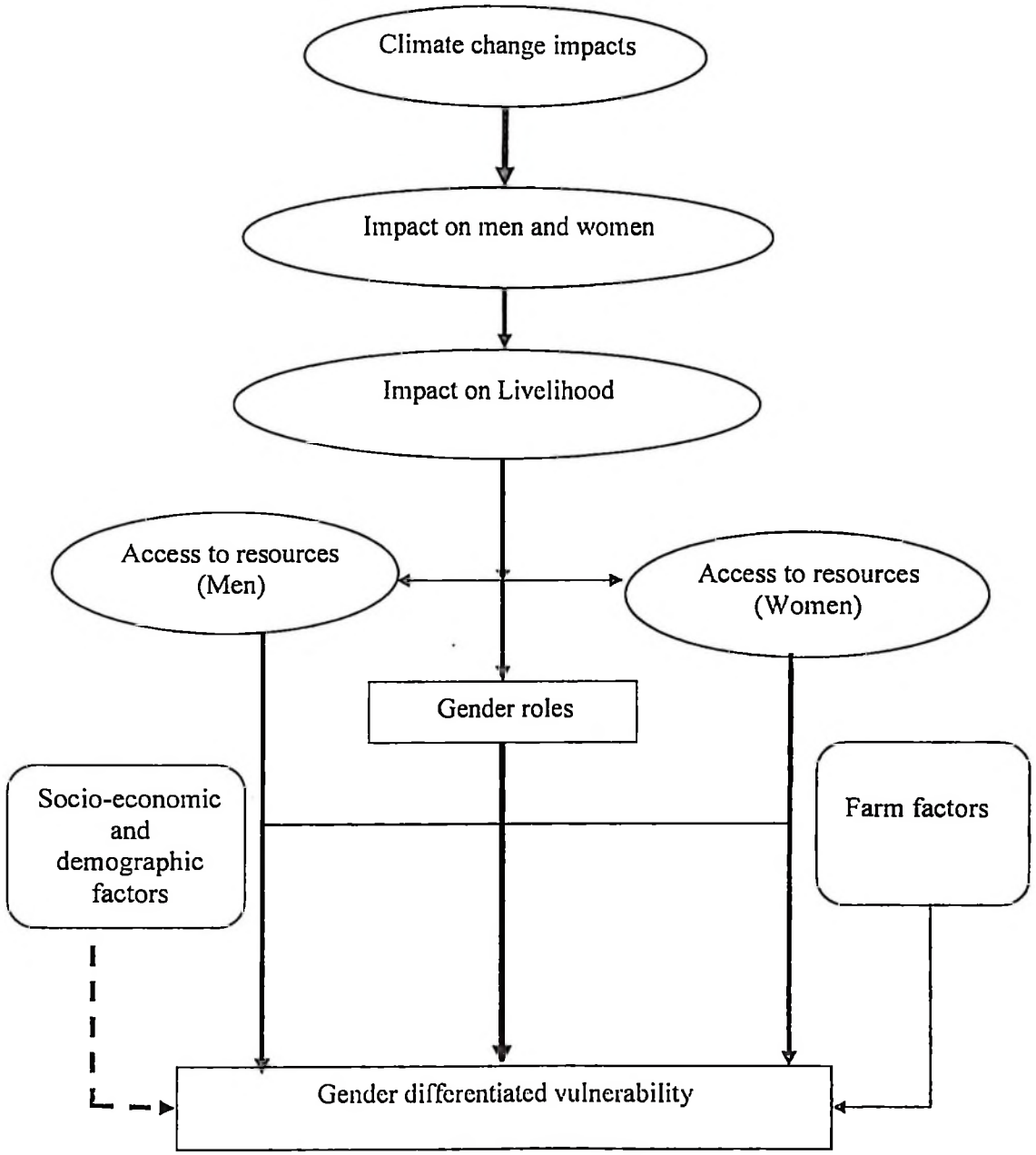

Figure 1: Conceptual Framework showing gendered vulnerability to climate change

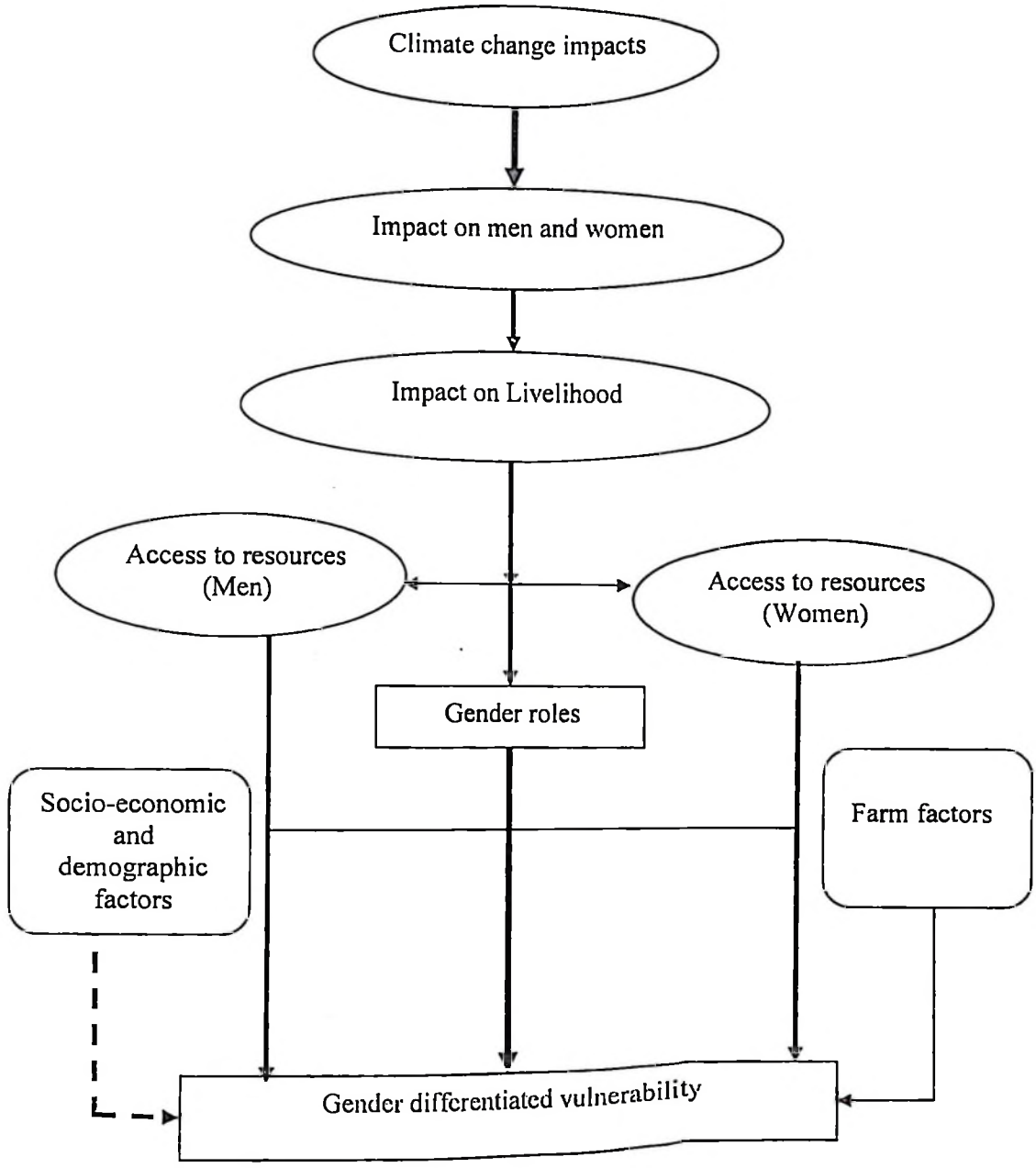

Figure 1: Conceptual Framework showing gendered vulnerability to climate change

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Key Concepts

2.1.1 Vulnerability

The concept of vulnerability has long been used in disaster risk reduction and international development, in reference to social groups, communities and even nations that are considered to be particularly at risk from environmental or other phenomena and which may be in need of external support. In the context of climate change, this concept has gained even greater currency (Blaikie, 1994 cited by Cannon, 2008). There are key issues which appear in almost every scholar's definition of vulnerability, and involving such aspects as exposure, sensitivity and adaptive capacity. For example, vulnerability is defined by Eriksen *et al.* (2007), as a function of exposure, sensitivity and adaptive capacity.

In terms of exposure, some geophysical areas will be more affected than others for example; low-lying coastal areas may be more affected by sea level rise and extreme weather events than inland areas. Quite often, there are spatial dimensions to poverty and social exclusion, with the poorest being forced to live in the most marginal lands, fragile soils, steep slopes and flood prone areas in both rural and urban areas because they have lesser access to land than is the case with others (Agarwal, 1992).

Sensitivity to meteorological changes is a second component of vulnerability, and women and poorer people tend to rely more on climate sensitive resources (such as water, and fuel wood), because of the roles assigned to them in the household or because of the nature of the livelihood options open to them. Further work is needed to understand the

gender roles ascribed to women and men in different societies and how these change in broader contexts of agrarian and urban transformation (Abdullah *et al.*, 2009).

2.1.2 Adaptive capacity

The third component of vulnerability is the adaptive capacity, which refers to the ability of individuals, communities and organizations to innovate, self-organize, and respond to uncertainty. A key natural resource is land, for which poorer or disadvantaged groups, including women and female headed households, commonly have less well-defined rights and more insecure access. The existing patterns of poverty and inequality are thus overlaid by climate change leading, in all likelihood, to a worsening of these inequalities as climate change impacts begin to bite (Denton, 2004). Despite the fact that there are many definitions of vulnerability, the definition of vulnerability used in the study is adopted from Fussel and Klein (2006) who define vulnerability as a degree to which a system is susceptible to, and unable to cope with adverse effects of climate change, including climate variability and extremes. This definition is adopted because it is characterized by the progressive inclusion of non-climatic determinants of vulnerability to climate change, including adaptive capacity, and the shift from estimating expected damages to attempting to reduce them.

2.1.3 Adaptation ability

The ability to adapt (resilience) to external changes at a household level depends on the control over resources such as property and finances; freedom to make decisions; health and freedom to move around; and food security and freedom from violence. Compared with men, women are generally deprived of these things because their social roles keep them subordinated to men. Their interaction with the outside world is also limited and denies them timely information such as advanced climate related warnings which limit

their preparedness to meet the challenges. Thus, lack of gender equality burdens women with lack of independence and freedom (UNDP, 2007).

2.1.4 Gender

According to Lyimo-Macha and Mdoe (2002), gender is the differences in social roles that women and men play and power relations between them. Gender relations influence how communities, households, and institutions are organised, how decisions are made and how resources are used. Gender is defined by FAO, 1997 as 'the relations between men and women, both perceptual and material. Gender is not determined biologically, as a result of sexual characteristics of either women or men, but it is constructed socially. It is a central organizing principle of societies, and often governs the processes of production and reproduction, consumption, and distribution' (FAO, 1997).

In this study gender is used to explain the relationship between men and women and not their biological differences, this study is adopted from WHO (1998), the study was adopted because it describes the characteristics, roles and responsibilities of women and men, boys and girls, which are socially constructed. According to WHO, gender is related to how people are perceived and expected to think and act as women and men because of the way society is organized, not because of biological differences.

Aspects of sex will not vary substantially between different human societies, while aspects of gender may vary greatly (WHO, 1998). Despite this definition, gender is often misunderstood as being the promotion of women only. However, as we see from the FAO definition, gender issues focus on women and on the relationship between men and women, their roles, access to and control over resources, division of labour, interests and

needs. Gender relations affect household security, family well-being, planning, production and many other aspects of life (Bravo-Baumann, 2000).

2.1.5 Gender vulnerability to climate change

There is a strong relationship between gender, livelihood, and poverty. This relationship has been explored by many researchers, and significant to their findings is the relationship between climate change and people's livelihood, which is dependent on the natural resource base and poverty. The subordinate role of women in societies plays a critical role in determining people's ability to cope with vagaries of nature including climate change (Wamukonya, 2001).

What has been recognized in studies on gender is that majority of the poor, worldwide, are women because of the existing gender inequalities. Despite this established linkage, gender issues have not played a major role in the discourses on climate change. This has inevitably affected both policy and planning for sustainable development in many developing countries. However, a focus on gender differentiated impacts of climate change and gender issues has only recently gained momentum around the world. It is also noted that communities in developing countries and which are highly dependent on local natural resources are likely to be vulnerable to the effects of climate change (Tandon, 2007).

2.1.6 Climate change

There are many different definitions of climate change given by different institutions; for example, IPCC TAR (2001a) defines climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The definition of climate change adopted in the current study comes from IPCC TAR (2001b) which

defines climate change as a statistically significant variation in either the mean state of the climate or its variability, persisting for an extended period (typically decades or longer).

Climate change may be due to natural processes or external forces, or persistent anthropogenic changes in the composition of the atmosphere or on land-use. UNFCC Article 1 defines 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.

2.1.7 Climate variability

Climate variability refers to variations in the mean state of the climate and variations in other statistics (such as the occurrence of extremes) on all temporal and spatial scales beyond that of individual weather events. The average range of temperature for a location, as indicated by minimum, maximum and average temperature values, is an example of a measure of climate variability (Armentrout, 2008). Climate variability differs from climate change in the sense that the latter refers to a long-term change in the state of the climate and which is identified by changes in the means and/or variability; or changes in the frequencies or intensities of extreme events. This report describes climate variability at different points in time based on climatic data as well as farmers' descriptions of "average weather" (what farmers call "average weather" is equivalent to climate variability). Farmers' descriptions are given equal footing to scientific measurements because documenting how farmers' frame the conditions they experience is crucial for understanding their responses to the said conditions (Roncoli, 2006; Tschakert, 2007).

2.1.8 Climate change adaptation

Climate change adaptation is defined by Adger *et al.* (2007) as the ability or the potential of a system to respond successfully to climate variability and change, and it includes adjustment in behaviour, resources, and technology. Adapting to climate change involves the ability of a system to change in a way that makes it better equipped to manage its exposure and sensitivity to climate hazards and cope with adverse impacts (IPCC 2001; USAID, 2007).

2.2 Climate Change Impact

The impacts of climate change are well documented by IPCC and the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), the United Nations Development Programme, and the United Nations Educational Scientific and Cultural Organization (UNESCO). As highlighted in the climate change literature, the key impacts of climate change are associated with sea level rise, changes in the intensity, timing and spatial distribution of precipitation, changes in temperature and the frequency, intensity and duration of extreme climate events such as droughts, floods, and tropical storms (IPCC, 2007; USAID, 2009; UNDP, 2009). Climate change is already impacting populations and ecosystems around the globe, exacerbating poverty and leading to infrastructural breakdown; it threatens to constrain development efforts by decades, profoundly affecting the whole community. However, such impact will not be felt equally. Those with the fewest resources particularly women who are the majority of the world's poor, will be most susceptible to its negative effects. At the same time, women's vulnerability can obscure the fact that they are an untapped resource in the efforts of coping with the effects of climate change and reduce the emissions that cause it. As innovators, organizers, leaders, educators and caregivers, women are uniquely positioned to help curb the harmful consequences of a changing climate. Incorporating a

gender perspective into climate change policies, projects and funds is crucial in ensuring that women contribute to and benefit from equitable climate solutions (UNFPA, 2009).

Studying climate change impact, it is important to understand dynamics of poor people's livelihoods, in order to comprehend how they will be affected by climate change, how they might respond with the resources they have, and how these conditions can be reflected and built upon for successful adaptation strategies.

2.3 Climate Change Impact and Livelihood

A livelihood comprises the capabilities, assets (including both material and social resources) 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 DFID (1999).

According to (IPCC, 2007), women are generally on the receiving end of the effects of increasing environmental degradation and depletion of natural resources, because of their involvement in, and reliance on, livelihoods activities which depend directly on the natural environment. For example, environmental degradation surrounding rural communities may increase the distances that women have to walk in search of clean water and firewood in order to perform their daily household chores.

Impact of climate change on livelihoods is assessed by looking at three key elements, which are climate change impact assessment, vulnerability assessment and coping strategies (Senbeta, 2009). The impact assessment might mean the extent of damage inflicted by climate change on livelihood (crop cultivation and livestock tending) and

social systems. Normally impact alone is not sufficient to explain consequences of climate impact on different members of the society (McCathy, 2001). Vulnerability assessment provide details of the consequences on the different members in the society and this assist in the decision-making process of specific stakeholders of a sector about their options for adapting within the scope of their resources (Nkem *et al.*, 2007).

To assess vulnerability of rural livelihood strategy in context of shocks and other stressors Ellis (2000) used indicators such as asset (market, land holding, water availability, biological resources, social interconnectedness, labour or human capita, saving and credit availability) and asset access modification by social relations, and organizations. Thornton et al., (2006) also used several natural capita, physical capita, human capita, financial capita and social capita to analyze vulnerability. Senbeta (2009) used exploratory approach, the selection of indicators or themes was based on the analysis of responses from local society and previous vulnerabilities, how and why they are vulnerable. Coping strategies are all possible strategies to reduce vulnerability to climatic impacts. There are two kinds of responses to crisis that overlaps across the temporal scale, coping mechanisms and adaptive capacity. Coping mechanisms are the actual responses to crisis on livelihood systems in the face of unwelcome situations, and are considered as short-term responses (Berkes and Jolly, 2001). Adaptive strategies are the strategies in which a region or a sector responds to changes in their livelihood through either autonomous or planned adaptation (Campbell, 2008).

2.4 An overview of Climate Change

Climate connotes the totality of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over long periods (Birkmann, 2006).Furthermore, climate is a description of normal day-

to-day weather, including seasonal extremes and variations for a specific location or region (Verloo, 2005). Climate is far from static, it has natural year-to-year variations, and extremes in temperatures and weather events that have been occurring throughout history. But not all changes in climate are due to natural processes. Humans have also exerted some influence. Through building cities, industries and altering patterns of land use, peoples have changed climate at the local and global scale (Kantola, 2010).

For more than 50 years, the Earth's climate has been changing because of increasing greenhouse gases (water vapour, methane, carbon dioxide, nitrous oxide, and halocarbons) emission from the burning of fossil fuels such as coal and oil, as well as deforestation and other human activities such as agriculture and mining (Birkmann, 2006). The warming of the Earth's atmosphere and water bodies, loss of land and sea ice, and rising global sea levels are not new phenomena. However, these global changes have been occurring at increasing rates in the last 30 years, particularly in the last decade (Kantola, 2010). Scientific studies show that climate change will continue, and accelerate, in the years ahead, with significant impacts on everything from coastlines and health to water supplies, ecosystems, and other natural resources (Birkmann and Wisner, 2006).

According to the Millennium Development Goal and the United Nations Development Programme (2007) reports, climate change might pose a threat on access to food through a decrease in rainfall pattern and results into a decrease in crop yields which would result into an increase in the global hunger (Reid *et al.*, 2009). These effects threaten the achievement of MDG 1 which in turn will cause loss of livelihood assets, displacement of people or migration which may lead to reduced access to education opportunities thus hampering the realization of MDG 2(Boko and Parry, 2007). Depletion of natural resources and decreasing agricultural productivity may place additional burden to

women's health and reduce time for decision making processes and income generating activities, worsening gender equality and women empowerment (MDG 3) (Lombardo and Meier, 2006). However according to Armentrout (2008), we cannot stop natural climate change but we can reduce humankind's contribution to the accelerated rate of atmospheric pollution.

Recent analysis suggests that temperature increases and climate change affect not only the level of economic output, but also the rate of economic growth. It has been estimated that, for certain developing countries, a 1°C rise in temperature in a given year reduces economic growth by an average of 1.3 % (Dell *et al.*, 2012).

Furthermore, higher temperatures have wide-ranging effects, reducing not only agricultural output but also industrial production and influencing political stability. The most important global response to climate change, the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), is widely seen as a failure. Its greenhouse gas (GHG) emission target (a collective GHG reduction of 5.2% among industrialized countries compared with 1990 levels) was too low to make a significant difference; the treaty exempted highly populous transitional countries such as China and India; and the United States failed to ratify the protocol. President Obama has promised a dramatically different path based on steeper GHG reductions and leadership in global governance (IPCC, 2012).

2.5 Regions mostly Affected by Climate Change

According to Morton (2007) geographical location can partially be the reason for climate change to impact developing countries; this is because many low income countries are located in tropical and sub-tropical regions which are said to be particularly vulnerable to

rising temperatures and in semi-desert zones which are threatened by decreasing water availability (Tubiello and Fischer, 2007; Heltberg, 2008). According to Cline (2007), by 2080 agricultural output in developing countries may decline by 20 percent due to climate change while output in industrial countries is expected to decrease by 6 %.

In its report on vulnerability to climate change, the intergovernmental Panel on Climate Change reveals that those with the least resources have the least capacity to cope and are most vulnerable (IPCC, 2007). Africa is generally acknowledged to be vulnerable to climate change especially because of its low coping and adaptive capacities. This vulnerability in Africa is not only caused by Climate Change but through a combination of social, economic and other environmental factors that interact with climate change (Ericksen, 2008; Adger, 2006). The regions which are mostly affected by climate change include those with high population growth rate (the highest in the world), widespread and growing poverty, low literacy rate, many environmental disasters such as floods and droughts; and this also includes regions characterized by corruption, poor governance, presence of weak institutions, and conflict (Nkomo *et al.*, 2006).

2.5.1 Impact of climate change and vulnerability

The IPCC (2007) notes that "climate change impacts will be differently distributed among different regions, generations, age classes, income group, occupations and genders. The impacts of climate change will fall disproportionately upon developing countries and the poor persons within all countries, and thereby exacerbate inequities in health status and access to adequate food, clean water, and other resources." Brandt and Svendsen (2003) report that People living in poverty are more vulnerable to environmental changes and the gender poverty links shows that 70 % of the poor in the world are women and their vulnerability is accentuated by race, ethnicity, and age.

Moreover, it is reported by Denton and Parikh (2003) that Vulnerability to climate change can accentuate non-climatic stresses such as those related to migration, urbanization, as well as lack of limited food and energy security, poor management of natural resources, loss of traditional coping skills, and health risks. These climate change risks will impact progress towards all Millennium Development Goals (MDGs) directly and indirectly, but especially those of poverty reduction, gender equality and environmental sustainability.

2.5.2 Smallholder farmers vulnerability to climate change

According to (Barnett, 2001), an associated activity of farming which form a livelihood strategy whose main output is consumed directly and few, if any in the market, is known as subsistence farming. As Morton (2007) observes, small holder farmers who are mostly located in tropical areas are mostly vulnerable because they face demographic, socio-economic and policy trends that limit their capacity to cope with climate change.

According to Adger *et al.* (2003), small holder agriculture faces challenges and risks such as drought and floods, crop and animal diseases, and market shocks. This can be felt by the entire community or individual households. Smallholder farmers are vulnerable to climate change because they are in a diverse and risk prone environment, they own small subsistence farms, holding them under traditional or informal tenure systems and marginal conditions (Morton, 2007).

2.5.3 Global responses to climate change

Initially, the climate change field was dominated by the biophysical sciences, but in recent years the development community and social sciences have engaged more fully in identifying the numerous development implications of a changing climate (Wamukonya and Skutch, 2001). From a slow start, there is now increased analysis of the social,

political, economic and cultural dimensions of climate change (Verloo, 2005). However, it is not always easy to separate the climatic and non-climatic factors at work, and which are creating change in a particular place. In many smallholder farming systems, for example, farmers are already coping with and adapting to the on-going shocks and stresses, including, but not limited to, climate variability (Wardya *et al.*, 2010). Therefore, teasing out how the climate and gender dynamics will interact in any particular place is not that easy and particularly over longer time horizons.

Climate change is expected to lead to an increase in extreme events, increasing climate variability, and longer-term shifts in means (e.g. average temperature and precipitation). Only some climate change impacts (such as sea level rise and glacial melt) can be attributed directly to anthropogenic climate change (Huq and Ayers, 2007). In many other areas, climate change is currently experienced as an increase in extreme events and their intensity (although no one hurricane or flood can be attributed to climate change) and/or increasing climate variability. In some regions of the world, local communities, such as those in the dry lands including the semi-arid zones of Tanzania, are already experienced in coping with and adapting to climate variability (Gyampoh *et al.*, 2008). Literature by other authors on climate change show that, there is some increasing evidence from local populations that the levels of variability and unpredictability are increasing beyond what they are normally used to and in parallel with localised processes of environmental change in many areas (Maddison, 2006; Nelson and Stathers, 2009). According to Sadik and Byg (2007), it is important to note that climate variability should not be conflated with climate change. Although farmers are widely reported to be experiencing increasing variability and increased frequency of extreme events now and despite the fact that these experiences of variability are real and important, their relationship to global processes of climate change still remains problematic.

Climate changes which are more clearly linked to increased greenhouse gas (GHG) emissions, and in particular changes in means (of temperature and precipitation), are only beginning to be apparent, and most projections of them look into two or more decades into the future (Salick and Byg, 2007). It is thus easier to establish the relationship between gender and climate variability, than it is between gender and climate changes which are only just beginning to emerge. As a result, many of the studies on gender and climate change are necessarily somewhat speculative. Moreover, these challenges relating to long-term climate change combine with the maelstrom of change processes affecting many rural and urban societies in the global South and indeed around the world (Salick and Byg, 2007).

In smallholder farming systems in dry land areas, for example, farmers have already developed adaptive livelihoods to cope with the on-going uncertainty and climate variability; however, t they are also faced with larger-scale trends (e.g. HIV/AIDS pandemic, regionalising and globalising markets, population growth in urban centres, ageing rural populations etc.). Many rural households are engaged in off-farm livelihood activities, including seasonal mobility and trade, to make a living and some are making a permanent move to urban areas (Macchi *et al.*, 2008).

Given all of this, is it is not surprising that there is limited theoretical work and empirical information on the differentiated impacts and processes related to climate change, exacerbated by the continuing lack of attention to gender issues in some quarters (Wamukonya and Skutsch, 2001). There is limited exploration (conceptual and empirical) so far as to how gender dynamics shape climate change vulnerability interventions; but because policies, programmes and projects are being devised and are beginning to be

implemented, there are lessons to be learned about improving gender equality and promoting women's empowerment (Wardya *et al.*, 2010).

Developing countries are likely to be the most affected by such adverse impacts of climate change, which will mostly be abrupt and irreversible in nature. The Intergovernmental Panel on Climate Change (IPCC) cites a sobering statistic that between 1970 and 2008, 95 % of all natural disaster-related deaths occurred in developing countries (IPCC, 2012).While developing countries are likely to be affected, women as indicated in the next section are highly vulnerable.

2.5.4 Gender and climate change

In global climate change initiatives and policy meetings, gender issues have rarely been addressed, particularly in relation to the impact of climate change For example, many debates have focused primarily on mitigation efforts (reduction of carbon emissions and other greenhouse gases), and on the associated actions required by governments and institutions to mitigate climate change (World Bank, 2004). Despite the guiding principles within the United Nations (UN) system to incorporate gender considerations, climate change policy-making (most visibly, the UN Framework Convention on Climate Change, UNFCCC) has failed to adopt in vulnerability gender-sensitive approach (Barnet and Finnemore, 2004).

This failure cited above, not only generates concerns in terms of respect for gender equity, it also leads to shortcomings in the efficiency of climate related adaptation and mitigation measures. Vulnerability to climate change can exacerbate the impacts of non-climatic stressors such as increased migration, rapid urbanization, uncertain energy

security, unsustainable management of natural resources and the loss of traditional coping mechanisms (Dietz and Douglas, 2008).

Responding to climate change is not simply a matter of reducing the amount of greenhouse gas emissions into the earth's atmosphere, but is also about helping countries to build adaptive capacity and develop a sense of preparedness in mitigating the negative impacts of climate change. In order to achieve this, it is important to understand the framework of analysis for gender and climate change that addresses vulnerability, adaptation, mitigation and the manner in which engagement can take place (Delaney and Shrader, 2000).

Only fairly recently, it has been recognised that women will be disproportionately affected by climate change compared to men, because of widespread entrenched gender inequalities. Gender inequalities mean that women and men have differing roles, resources, rights, knowledge and time with which to cope with climate change (Cannon, 2002). According to Majule (2008), women are affected differently, and often more severely by climate change and associated natural disasters such as floods, droughts, cyclones and storms. Further, women are disproportionately represented in poor populations, and are relatively more reliant on climate-sensitive livelihoods (FAO, 2007).

There is a lack of representation of women and of gender issues in climate change policy and decision-making from the local to the international levels. At national levels, vulnerability assessments and the National Adaptation Programmes of Action (NAPAs) for Least Developing Countries lack adequate gender analysis, (Dankelman, 2008), although there are a few positive elements in a small number of cases (UNFPA and WEDO, 2009). At the international level in the climate negotiations this absence has

been noted for some time and gender activists are attempting to tackle it, with some progress on inclusion in the UNFCCC texts (Dankelman, 2008).

2.5.5 Climate change and indigenous knowledge

Indigenous knowledge has been defined as institutionalized local knowledge that has been built upon and passed on from one generation to the other by word of mouth (Osunade, 1994). Indigenous knowledge has value not only for the culture in which it evolves, but also for scientists and planners striving to improve conditions in rural localities; it is also the basis for local-level decision-making in many rural communities (Mundy and Compton, 1991).

Indigenous communities have long been recognized as being particularly vulnerable to the impacts of climate change due to a close connection between their livelihoods, culture, spirituality and social systems and their environment (Gyamphoh, 2008). At the same time, however, this deep and long-established relationship with the natural environment affords many indigenous peoples with knowledge that they have long used to adapt to environmental change, and are now using to respond to the impacts of climate change. The knowledge set is influenced by the previous generations 'observations and experiment and provides an inherent connection to one's surroundings and environment. Therefore Indigenous Knowledge is not transferable but provides relationships that connect people directly to their environments and the changes that occur within it, including climate change (Woodley, 1991). However the indigenous people may not understand the science of climate change but they rightly observe and feel its effect. In spite of the significant role played by indigenous knowledge in different areas of climate change, traditional knowledge is still usually neglected in academic, policy and public discourses on climate change (Gyamphoh, 2008). Examples of indigenous

knowledge commonly used in developing countries include, intercropping, rainfall predictions, conservation tillage, cultivation of more than one staple grain.

2.6 Theoretical Background

2.6.1 Theories of climate change vulnerability and gender

Both climate change and gender have been central to debates surrounding sustainable development. Climate change is represented by MDG7 "Ensure environmental sustainability" and gender by MDG3 "Promote gender equality and empower women". However, none of the MDGs can be looked at separately; rather, a holistic approach is needed as there are many linkages between the MDGs themselves. Similarly, gender and climate change should be examined together, if progress in this area is to be made.

Climate change and global warming have become one of the most pressing environmental concerns and the greatest global challenges in the society today, despite the fact that a consensus has never been reached in the debates over its causes and consequences. As this issue continues to dominate the international agenda, researchers from different academic sectors have for long been devoting great efforts to explore effective solutions to climate change (Barnett, 2001).

Scholars and researchers have looked at climate change from many perspectives, Political, Social, Economic, Scientific and Environmental. While technologists and planners have been devising ways of mitigating and adapting to climate change; the economists have been estimating the cost of climate change and the cost of tackling it; and development experts have been exploring the impact of climate change on social services and public goods. However, Cammack (2007) points out two problems, namely

the disconnection between the proposed solutions to climate change from different disciplines; and the devoid of politics in addressing climate change at the local level.

According to DAC (1998) report, the systematic gathering and examination of information on gender differences and social relations in order to identify, understand, and redress inequities based on gender is essential. The gender analysis adopts a Gender Analysis Tool (GAT) and reconfigures relevant theoretical constructs from feminist theory, critical race theory, and postcolonial theory within a multidisciplinary framework. This results in an analytical tool that places the African woman and girl-child at the centre of the construct and seeks to identify the multiple ways in which her lived experience is informed by local culture, age, gender, rural-urban status, socio-economic and ethnicity, and the like. The methodology and components of gender analysis are shaped by how gender issues are understood in the institutions concerned. There are a number of different approaches to gender analysis, including the Gender Roles or Harvard framework, and Social Relations Analysis (Elson and Evers, 1998).

2.7 Previous Studies on Climate Change and Gender

2.7.1 Studies on gendered vulnerability of smallholder farmers

Empirical research done by Cutter (1995), Denton (2002) and Enarson (2002) has shown that Entitlements to elements of adaptive capacity are socially differentiated along the lines of age, ethnicity, class, gender, and religion. As Dankelman (2002) argues, climate change is often seen as a technical problem, requiring technical solutions. However, there are many social (for example gender) and political aspects to this complex issue. Likewise, it is often argued that climate change is gender neutral, implying that it affects women and men in the same way. Yet in many cases, communities interact with their physical environment in a gender-differentiated ways. It is evident that women have

different positions and face different challenges from men in coping and adapting to climate change.

According to Aggarwal (1992 cited in Tipilda and Kristjanson 2008), women and men livestock keepers typically face different livelihood opportunities and constraints in managing livestock as well as in coping with health challenges such as HIV/AIDS, poor access to markets, services and technical information, periodic drought and disease, competing resource uses, policies that favour larger-scale producers or external markets, and weak institutional frameworks. In most systems, women provide labour for the various tasks related to livestock but may or may not control the process of decision making, particularly over the disposal of animals and animal products. Likewise, women may be involved in production, but may or may not own the means of production, including livestock, land, and water (Tipilda and Kristjanson, 2008). Furthermore, Women's Environment and Development Organization, WEDO (2007 cited in Dankelman *et al.*, 2008) state that women, as the majority of the world's poor, are the most vulnerable to the effects of climate change. Thus, during natural disasters, often more women die than men because they are not warned, cannot swim or cannot leave the house alone (Dankelman *et al.*, 2008). When poor women lose their livelihoods, they slip deeper into poverty due to the increase in inequality and marginalization they suffer from because of their gender. As a result, climate change presents a very specific threat to women's security (Dankelman *et al.*, 2008)

2.7.2 Research in the world

According to IPCC (2007), "there are societies and groups throughout the world with insufficient capacity to adapt to climate change; a good example is women within subsistence farming communities. These women are disproportionately burdened with the

costs of recovery and coping with drought in many parts of the developing world". Also it is observed by Parikh and Denton (2003) that the effects of climate change which is manifested in the increase of extreme weather conditions such as hot summers, droughts, storms or floods, impact women more severely than men, both in developing and in developed countries. For example, the 20 000 people who died in France during the extreme heat wave in Europe in 2003 included significantly more elderly women than men. These may have been much affected not only due to biological differences but also due to roles women play.

2.7.3 Research in africa

Climate change is a major threat to sustainable growth and development and to the achievement of the Millennium Development Goals in Africa (Lorena, 2009). According to Schneider *et al.* (2007), Africa is likely to be the continent most vulnerable to climate change. Similarly, Boko *et al.* (2007) also projected that in many African countries and regions, agricultural production, food security and water stress would likely be severely compromised by climate change and climate variability.

Africa is particularly vulnerable to climate change because of its overdependence on rain-fed agriculture, compounded by factors such as widespread poverty and weak capacity to adapt to climate change. The main longer-term impacts include: changing rainfall patterns affecting agriculture and reducing food security; worsening water security; decreasing fish resources in large lakes due to rising temperatures; shifting vector-borne diseases; rising sea level affecting low-lying coastal areas with large populations; and rising water stress (Mendelsohn *et al.*, 2000). The impact of climate change on Africa is likely to be severe because of adverse direct effects, high agricultural dependence, and limited capacity to adapt. Direct effects vary widely across the continent, with some areas

(e.g. eastern Africa) predicted to get wetter, but much of southern Africa getting drier and hotter (Boyd, 2002).

Crop yields will be adversely affected and the frequency of extreme weather events will increase. Adaptation to climate change is primarily a private-sector response and should involve relocation of people, changes in the sectoral structure of production, and changes in crop patterns (Brooks and Adger, 2005). The role of government is primarily to provide the information, incentives, and economic environment to facilitate such changes. Adaptation will be impeded by Africa's fragmentation into small countries and ethnic groups, and by poor business environments. On the mitigation side, there is a need to design emissions-trading frameworks that support greater African participation than is the case at present and that include land-use change. Mitigation undertaken elsewhere will have a major impact on Africa, both positive (e.g. new technologies) and negative (e.g. commodity price changes arising from bio-fuel policies) (Brandt and Svendsen, 2003).

2.7.4 Research in Tanzania

A number of studies conducted recently in Tanzania have acknowledged the occurrence of climate change and variability coupled with significant impact on various natural resources including agriculture which is the main source of livelihood in rural areas (Majule *et al.*, 2008; Agrawala *et al.*, 2003).Climate-related impacts such as floods and droughts have now become a regular phenomenon with substantial effects on economic performance and livelihood of communities that depend on rain-fed agriculture in rural areas. A study by Ngana (1983) on drought and famine in Dodoma District indicates that the presence of dry spells in critical periods for most crops contributed considerably to crop failure and famine. Given the over-dependence on rain-fed agriculture by the

majority of people living in rural areas, climate change has been one of the major limiting factors in agriculture production thus resulting in food insecurity and low-income generation.

According to the report on development and climate change in Tanzania (Aggarwal *et al.*, 2003), the in-depth sector analysis focuses on the climate change impacts and policy responses on the Mount Kilimanjaro ecosystem. Glaciers on Mount Kilimanjaro have been in a general state of retreat on account of natural causes for over a hundred and fifty years. Due to a decline in precipitation coupled with a local warming trend that has been recorded in the second half of the twentieth century Kilimanjaro ice cap is now projected to vanish entirely by as early as 2020 (Okereke, 2008).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

This study was conducted in Same District. Same District was selected because it is among the semi-arid regions of Tanzania whose farmers are highly affected by climate change. In this district, Hedaru and Makanya were selected because they are among the wards which suffer shorter periods of rain (less Masika rains) and long periods of dry spells together with other climate variables in recent years compared to other semi-arid areas.

The Wards were chosen also due to the fact that they depend only on rain water for crop irrigation through the Ndiva and Canal irrigation systems which make them vulnerable to climate impact through lack of rain compared to other semi-arid areas. According to the 2000/01, household surveys, the district fell within regions with worst assessment of food poverty due to poor yields brought about by lack of rain (URT, 2005).

According to URT (2012), Same District had a population of 212 235, Makanya had 9505 people; Hedaru had the population of 20 231. Makanya is in Latitude 4°19'59.988"S and Longitude 37°51'0.000"E while Hedaru has location of Latitude 4°30'0.000"S and Longitude 37°54'0.000"E. The major staple food grown in the area is Maize, Pigeon peas, Beans, sunflower, Ground nuts, and Vegetables. Fig. 2, shows the administrative boundaries of Hedaru and Makanya wards.

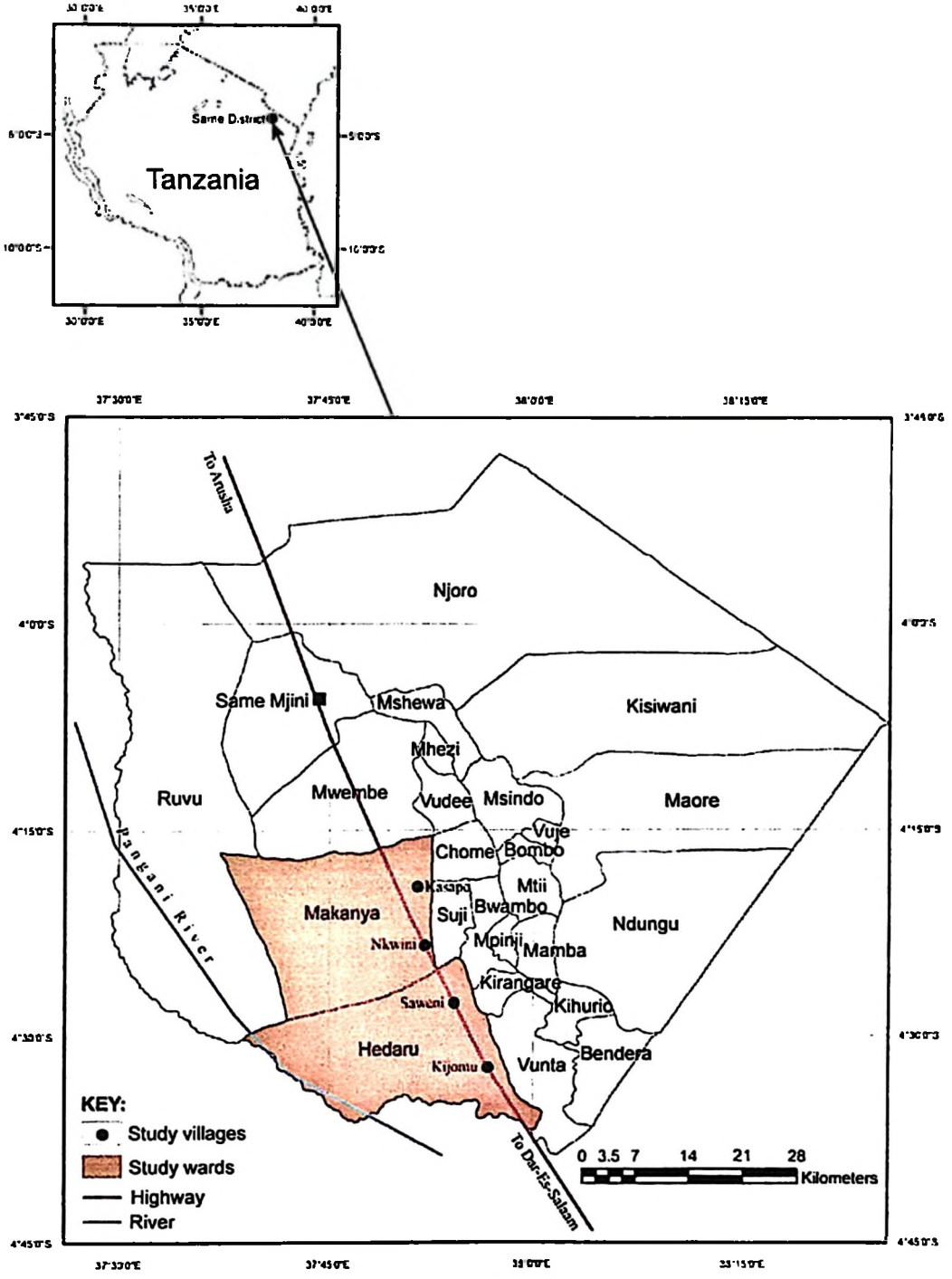

Figure 2: Administrative Boundaries of Hedaru and Makanya Wards

3.2 Research Design

This study employed a cross-sectional research design. This design is essential for descriptive statistics and allows collection of data from different groups of respondents at a time (Bailey, 1995). Cross-sectional research design is considered to be favourable since it is economical and allows comparison of the variables of interest (Babbie, 1990). This research design helps the researcher to collect information by asking questions to representative sample of the population at a single point in time.

3.3 Data Collection

The research was divided into two phases which were grouped according to type of data and data collection procedures as discussed in the subsequent sections. The first phase was qualitative data collection it focused on the collection of data from key informants, Vulnerability Matrix, and Focus group discussions (FGDs). This phase also involved pre-testing of questionnaire to check for its relevance, followed by the correction of items which were found to be problematic. The pre-testing of the research instruments was carried out in Hedaru village. Phase II was based on quantitative data collection.

3.3.1 Qualitative data

3.3.1.1 Focus group discussion

The FGDs meant to cover the vulnerability analysis based on gender, impacts of climate related changes, with particular attention to livelihoods and socio-economic impacts. A total of eight (8) FGDs were held, involving two (2) FGDs in each village with a sample of 10 people in each group. Purposive sampling was employed in obtaining the respondents because a set of elderly men and women who are conversant with the area and its climate were required. This included 8 influential people and 2 village leaders. Participants in FGD were invited one day in advance to attend a focus group session in

each village. All participants sat in a round table for discussion .The researcher was the moderator while the assistant (village chairperson) assisted in recording the discussions. Kiswahili and Pare languages were used in the discussions (interpreters were used to translate Kiswahili to Pare and vice versa.

Through focus group discussions, men and women were given the opportunity to voice their experiences and concerns regarding past and current climatic events. Both men and women provided knowledge that enhanced the capacity to understand how they are currently affected by climate and how future climate change is likely to affect them.

Table 1: Demographic characteristics of participants in Focus group Discussion

Description	Female	Male	Hedaru focus group	Makanya focus group
Education	36 no education 4 Std four	40 no education	No education	Standard 4 and no education
Occupation	Farming and Business	Farmers	Farming and Business	Farmers
Participant	40	40	4	4

Vulnerability analysis, method was used to determine the impacts of climate change on important livelihood resources, to determine which livelihood resources are most vulnerable. This was achieved by preparing the matrix on the flipchart, asking the group to identify their most important livelihood resources, asking the group to identify the resources they consider to be important in their well-being, then asking the group to identify the greatest hazards of their livelihoods, the group then decided on a scoring system for the hazards against the livelihood resources and to complete the matrix the participants then decided on the degree of impact that each of the hazard has on each resources involving coming into consensus with the whole group.

3.3.1.2 Key informants

Several key informants participated in the research. These included District officials, village leaders and researchers who were doing their research in Same District for years (Especially in Makanya ward). Each one of these had a role to play in providing relevant information which was crucial for the study. For example, the district officials helped in issuing a letter to village leaders to introduce the researcher and also helped in the lottery process of sampling surveyed villages which in their experience were mostly affected by climatic changes due to exceedingly dry spells. Village leaders participated in FGDs and in providing names of each household in each village which was ultimately used in selecting the sampled household. The researchers who were present in the surveyed village helped in providing Meteorological data and scientific information on the harvest in relation to rain.

3.3.1.3 The analysis of gender roles using harvard analytical framework

To analyse and identify gender roles and responsibilities, the Harvard analytical framework which was designed for gender analysis was used. It was developed by researchers at the Harvard institute for international development in the USA working in collaboration with WID office of USAID, at a time when the efficiency approach to integrating women in development work was gaining prominence in development circles (Cleaver, 2000).

The framework consists of a matrix for collecting data at the micro (community and household) level. It has four inter related components: the activity profile which answers the question "who does what? "the access and control profile which identifies the resources used to carry out the work identified in the activity profile by gender, the influencing factors which charts out the influence gender differences has in the above two

profiles, and the project cycle analysis which examines a project or intervention in the light of gender disaggregated information. The framework also contains a series of checklist consisting of key questions to ask at each stage of the project cycle: Identification, design, implementation and evaluation (Lorena, 2009).

3.3.2 Quantitative data collection

3.3.2.1 Questionnaire Survey

A structured questionnaire with both open ended and closed question was used to obtain quantitative data from the sampled respondents. The questionnaire was used to collect the demographic, socio-economic, and climate change factors. The questionnaire was pre-tested and correction were made accordingly in one village in Hedaru ward, four days before carrying out the main study and the necessary adjustments and corrections were made before the final administration of the tool. Kiswahili language was used in the administration of the questionnaire in order to avoid language barrier.

Sampling strategies for questionnaire survey

A multi-stage sampling technique was employed to get households from different villages. According to IDRC (2003), multi-stage sampling technique is useful in large and diverse population. Purposive sampling was used to select 1 division out of 6 divisions (Same division), and Hedaru and Makanya ward among 31 wards in Same District, 2 villages were selected from each ward to make a total of 4 villages. About 30 respondents were used from each village to make a total of 120 households from 4 villages. These were randomly drawn from each village register. Lottery method was used in selecting household. This type of sampling was employed in order to give each household an equal chance of being selected. Table 2 gives the summary of the sample size in the study population.

Table 2: Summary of the chosen sample from the study population

Ward Sample Frame	Selected Villages	Number of Households	No. of selected Household	%
Hedaru	Kijomu	580	30	5.2
	Gavao/Saweni	525	30	5.7
Makanya	Nkwini	549	30	5.5
	Kasapo	625	30	4.8
Total		2,279	120	5.3

3.3.3 Methods of data analysis

3.3.3.1 Qualitative data analysis

The qualitative data were recorded and summaries were made. The analysis relied on the information provided by the respondents according to the theme used in the discussion. For example, the respondents' perceptions were analyzed through likert scale. It is however important to note that the analysis used in summaries and original statements are included to obtain the looming of the respondents to some issues.

3.3.3.2 Farmers perceptions on climate change

The first objective aimed at determining the community perceptions on climate change with a gendered outlook. These were analyzed by using a likert scale. The likert scale consisted of ten questions. A five level scale of strongly agree, agree, not sure, disagree and strongly disagree were employed to measure perceptions. Descriptive statistics accompanied by histograms were used to show the respondents' perception.

3.3.3.3 Climate change impacts on livelihoods

Cross tabulation and descriptive statistics were used to analyze climate change impacts on livelihood in the study villages. This type of analysis was used to test how community

members are affected by the changes of climate in their livelihood as the result brought about by changes in rainfall pattern and severe drought in their crop production.

3.3.3.4 Relationship between climate change and gendered vulnerability

It is nearly three decades since Boserup (1970) called into question if women and men benefited equally from economic development. Since then, gender issues in agriculture have become an important subject of inquiry. Gender is a socio-economic variable used to analyze roles, responsibilities, constraints, opportunities and incentives of people involved in agriculture (Poats, 1991). However, the focus of the debate and empirical research has primarily been on the role of women in crop production to the virtual exclusion of their roles and those of men and children in livestock farming. Correlation was employed in the analysis of objective two and three of this study. Correlation shows the relationship between the dependent variable and independent variables or explanatory variables which was used because of its ability to explain the relationship among a set of variables (Julie, 2005).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Demographic and Socio-Economic Characteristics of the Respondents

The study area is home to people that have diverse backgrounds. Social and economic conditions can shape the ideas on climate change. This section offers a glimpse of what this population looks like, who they are, how they live and work and where they come from, to understand how those characteristics can affect their vulnerability to climate change. Table 4 presents the summary of demographic characteristics, where details of each characteristic are given in its respective sub-section. Table 3 is an extension of Table 2 and provides the descriptive statistics of the demographic and socio-economic characteristics of the study area. Household heads in Kijomu and Gavao/Saweni villages are much older by about 5 years compared to Nkwini and Kasapo. The education level, in terms of years of schooling, for household heads in Kijomu, which is 5.7 years is lower compared to the other three villages and especially in comparison to Nkwini and Gavao/Saweni with more than 7 years of schooling. Also, household size is relatively high at Kijomu compared to the other villages. This implies that Kijomu is likely to be having lower adaptive capacity compared to the three villages.

Table 3: Demographic and socio-economic characteristics of the respondents (n=120)

	Villages			
	Kijom(n=30)	Gavao/Saweni (n=30)	Nkwini (n=30)	Kasapo (n=30)
Education household head				
Primary School	23	27	29	28
Secondary School	1	3	0	2
No education	6	0	1	0
Marital Status				
Married	26	24	22	25
Divorced	0	4	2	2
Widow	4	2	4	3
Widower	0	0	2	0
Labour				
1-3	1	4	3	1
4-6	16	18	18	19
6-10	6	6	6	5
> 10	5	1	2	2
Land Owned				
1 acre	1	1	2	3
2 acre	6	7	4	7
3 acre	11	9	7	7
4 acre	2	3	5	5
5 acre	2	3	1	4
6 and above	7	5	11	4
None	0	2	0	0
Years lived in Hedaru/Makanya				
All life				
Number of years	19	12	25	26
	11	18	5	4

Table 4: Descriptive statistics of demographic and socio-economics characteristics

Labour	Kijomu		Gavao/Saweni		Nkwini		Kasapo	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Household head age	50.5	17.89	48.5	14.03	58.1	16.24	55.4	14.48
Years in education	5.7	3.00	7.4	1.22	6.8	1.28	7.3	1.01
Household size	5.6	1.75	4.9	1.67	5.4	2.43	4.9	1.82
Household labour	2.7	1.11	2.2	0.86	2.3	0.88	2.7	1.37

4.1.1 Age categories of the respondents

Age of the respondent is important in determining the vulnerability of the household against the scourge of climate change (Field, 2008). According to the results, the minimum and maximum ages of the respondents were 24 and 104 years respectively (in Kijomu village).

Table 5: Age categories of the respondents in each village

	Kijomu %	Gavao/Saweni %	Nkwini %	Kasapo %
< 25 years	0.0	0.0	0.0	0.0
25-35years	23.5	35.5	23.5	17.6
36-50years	28.9	31.6	21.1	18.4
>50 years	20.6	19.0	28.6	31.7

The results show that 23.5% of the respondents in Kijomu, 35.5% in Gavao, 23.5% and Kasapo 17.6% were at the age range of from 25 to 35 years, while 28.9% of the respondents in Kijomu, 31.6% in Gavao, 21.1% in Nkwini and 18.4% in Kasapo were at the age range from 36 to 50 years. The results imply that majority of the respondents were mature (25-50 years). This shows that in the study area the age structure is dominated by middle aged people. These results are in contrast by the results reported by URT (2012) which show that the age structure is dominated by young people. This trend may be attributed to that many youngsters do migrate due to hardships of live in the rural areas resulting from the impacts of climate change.

4.1.2 Household size

Household size is defined as a number or group of persons who usually eat and share some common living arrangements (Cannon, 2008). Determining the household size for statistical surveys has a special meaning; Table 6 presents the household size categories of the study villages.

Table 6: Household Size categories across villages

Household Size	Kijomu		Gavao/Saweni		Nkwini		Kasapo	
	n	%	N	%	n	%	n	%
< 5 people	13	43.3	12	40.0	11	36.7	11	36.7
6-9 people	13	43.3	12	40.0	14	46.7	14	46.7
>9 people	4	13.3	6	20.0	5	16.7	4	13.3
Total	30	100.0	30	100.0	30	100.0	30	100.0

The results from Table 6 show that, the study villages had the household size of less than 5 people, of between 43.3% people, and 13.3% of more than 9 people, which were few. According to FGDs the household size maybe attributed to the trend of having unmarried sons and daughters staying with their parents even though they are grown enough; and also the tendency of daughters bearing children in their parents' homes and thus increasing the household size. More demographic and socio-economic factors are discussed in their respective sub-sections.

4.1.3 Sex of the Households' head

Table 7 shows that 15 % of the households were headed by females whereas 84.1% of the households were headed by males. Based on these results, it is most likely that many of gendered decisions are carried out by men. Focused Group Discussions revealed that except for female household heads; women had little influence on decisions concerning major farm issues despite the fact that women were the major producers of agricultural produce. The results of the FGD revealed further that while women's earnings continue to represent a larger part of a family's income, households that are headed by woman earn lower income than those headed by men.

Table 7: Sex of Household heads

Sex of the household head	Frequency	Percent
Female	19	15.8
Male	101	84.2
Total	120	100

4.1.4 Education

Education is an essential tool that enables farmers to combine new technologies with their traditional ones in dealing with vulnerability to climate change (Gyampoh, 2008). So it was important to obtain data on the respondents' education as this relate to the aspect of vulnerability and which is the focus of this study.

Table 8: Education of household head

Education level	Kijomu		Gavao/Saweni		Nkwini		Kasapo		Total	
	n	%	n	%	n	%	n	%	n	%
Primary	23	76.7	27	90.0	29	96.7	28	93.3	107	89.2
Secondary	1	3.3	3	10.0	0	0.0	2	6.7	6	5.0
No education	6	20.0	0	0.0	1	3.3	0	0.0	7	5.8
Total	30	100.0	30	100.0	30	100.0	30	100.0	120	100.0

The results from the study (Table 8) shows that 89% respondents had completed primary school education, 5.0 had completed secondary school in all four villages and 5.8% had no education at all. However, the results show higher achievement in primary school enrolment than the national primary education enrolment status which stood at 69.1% in 2002 (URT, 2006), and therefore this indicates that majority of the respondents are attending primary education. The fact that there are respondents with no education at all might be attributed to their age which ranged from 50 to 104.

4.2 Socio-economic Activities

4.2.1 Occupations

According to Dankelman *et al.* (2008), economic activities are human activities which are performed in exchange for money or money's worth, or those efforts which are undertaken by man to earn income, money, wealth for his life and to secure maximum satisfaction of wants with limited and scarce means. Economic activities are the main occupation of the respondents in the study area. The respondents in the study area were asked to state their main occupation, with the purpose of determining their major economic activities. Table 10 presents the main occupations carried out in the study area.

Table 9: Main occupation of the respondents in the study villages

Activities	Kijomu		Gavao/Saweni		Nkwini		Kasapo	
	n	%	n	%	n	%	n	%
Agriculture	30	100.0	28	93.3	25	83.3	25	83.3
Livestock	11	36.7	20	66.7	18	60.0	19	63.3
Business	1	3.3	2	6.7	0	0.0	0	0.0
Employed	0	0.0	1	3.3	0	0.0	0	0.0

More than 80% of respondents were involved in agriculture, those keeping livestock ranged between 36.7% and 66.7% respondents, while in Kijomu and Gavao/Saweni few of the respondents also engaged in businesses and employment. The main businesses observed were shop keeping and small businesses like bites-vending. Some respondents were engaged in casual labour. These people reported to have been working on commercial sisal plantations known as Mohammed Enterprise Estate as part time labourers, and some were hired to work on other off farm activities of onion harvest at Makuyuni and Ruvu earning little for the families.

During FGDs the respondents reported that livestock keeping was difficult to changes in climate, as severe drought affect both livestock and crops. Because of lack of water and

fodder to the livestock many livestock do not survive and therefore farmers give up on rearing livestock to avoid this risk. In this respect, one resident in Nkwini village during focus Group discussion said. "lots of cattle died due to lack of fodder, many farmers keep only local chicken, other farmers give their cattle (locally known as *Kuvivija*) to relatives who come from better-off villages as a strategy of adapting to climate change" (Mr Manongi, in FGD Nkwini village).

4.2.1.1 Land ownership

During the survey, the information on land ownership was collected from every respondent in terms of whether land was inherited, purchased, or allocated by village government as shown in Table 10 in all the study villages, 58.3% of the respondents inherited the land from their parents, 13.3% purchased the land, and 3.3% hired the land. This was mainly in Nkwini, Saweni and Kasapo. Land ownership was slightly different in Kijomu village in which 25.0% of land was given by the government because the people were displaced as their land and homes were washed away by floods in 1997. As a result, there was no land to be inherited as was the case in other three villages. Nevertheless, land availability was not the main problem to the respondents as most individuals had inherited enough land for their farming. Observation showed that the land was very dry and less productive.

Table 10: Type of land ownership in the study area

Land Ownership	Kijomu		Gavao/Saweni		Nkwini		Kasapo		Total	
	n	%	n	%	n	%	N	%	n	%
Inherited Land	0	0.0	20	66.7	30	100.0	20	66.7	70	58.3
Purchased	0	0.0	8	26.7	0	0.0	8	26.7	16	13.3
Government	30	100.0	0	0.0	0	0.0	0	0.0	30	25.0
Hired	0	0.0	2	6.7	0	0.0	2	6.7	4	3.3
Total	30	100.0	30	100.0	30	100.0	30	100.0	120	100.0

4.2.1.2 Household labour

Household labour is said to be important in smallholder farming. According to the theory of Marx Weber, in the topic that is integral to his analysis of capitalist mode of production, there is high value of labour-power that can be brought together in a meaningful way in the household production (Marx, 1977). The results indicate that 87.5% of respondent uses household labour in utilizing farming activities, while 12.5% respondents uses hired labour. This implies that to a large extent household provides the labour force used in agricultural production. It is therefore important to note that any coping strategies on vulnerability to climate change should involve household members as they are the ones affected most by its impact. Table 12 shows the household labour in the study area.

Table 11: Household and hired Labour

Labour source	Kijomu		Gavao/Saweni		Nkwini		Kasapo		Total	
	n	%	n	%	n	%	n	%	n	%
Hired labour	10	33.3	5	16.7	0	0.0	0	0.0	15	12.5
Household labour	20	66.7	25	83.3	30	100.0	30	100.0	105	87.5
Total	30	100.0	30	100.0	30	100.0	30	100.0	120	100.0

4.3 Gender Roles and Responsibilities

Gender roles are those behaviours, tasks and responsibilities that a society considers appropriate for men, women, boys and girls. In some rural societies, commercial agricultural production is mainly a male responsibility. Men usually prepare the land, irrigate crops, and harvest and transport the produce to the market. They own and trade large animals such as cattle, and are responsible for cutting, hauling and selling timber from the forests (FAO, 1998). In most societies, rural women have also the primary responsibility of maintaining the household. They raise children, grow and prepare food, manage poultry, and collect fuel wood and water (Birkmann, 2006). Gender roles are

defined by the socio-cultural norms of a particular society. In most of the societies the family systems are based on the gender roles and it is the pre-designed gender roles that help members of the family to run the family with bound responsibilities (Boyd, 2002).

4.3.1 The activity profile

If little or no information is readily available on the gender division of labour within the target population, it is often useful to draw up an activity profile for different gender groups such as men and women. The use of this profile gives gender differentiated roles of among gender groups in the household.

To a great extent, women seem to be more involved in household labour than men including boys. They (women) heavily shoulder agricultural production activities. For example, 75 % of ploughing and crop sowing is performed by women (Table 17). This indicates that women are the main producers in subsistence farming households in the study area. Similar findings where women were found to be heavily involved in extra workload were reported in a study by Babugura (2010) in a village in South Africa. The author further found women to be hardest hit by climatic stressors. It is also interesting to note that despite their big contribution to agricultural production, women are least involved in selling farm produce.

Less involvement of men in the production activity may have implication on household vulnerability. This is because they reduce household labour for farm activity leading to low yield. About 75 % of the respondents reported that men were involved in selling farm products. This shows that they (men) also control the income from farm production. The tendency of controlling income further marginalizes women in terms of decision making.

Table 12: The activity profile of the study area

Activities	Number of respondents	% respondents			
		Women	Girls	Men	Boys
Productive Activities: Agriculture:					
Harvesting	119	44.5	16.0	22.7	16.8
Ploughing and crop sowing	119	63.0	6.7	27.7	2.5
Animal feed preparation	119	47.1	14.3	21.8	16.8
Income generating:					
Selling Farm produce	119	27.7	4.2	59.7	8.4
Small business	119	64.7	10.9	16.8	7.6
Reproductive activities:					
Water related					
Cooking and water fetching	119	77.3	2.5	17.6	2.5
Fuel Related:					
Wood collecting	119	67.2	16.8	8.4	7.6
Food preparation	120	83.3	16.7	0.0	0.0
Child care	120	66.7	16.7	8.3	8.3
Taking care of the sick	120	75.0	16.7	4.2	4.2
Cleaning and repair	120	58.3	8.3	25.0	8.3
Market related	120	33.3	4.2	58.3	4.2

Activities related to domestic chores are also women's and girls' activities. This is expected of a society like the one in the study area whereby women generally have subordinate positions. They are burdened by both farm work and food preparation at home. Also 77 % of the respondents said that women are the ones engaged in small business which households engage in to gain income. These activities include selling buns and bites. However, households earn very little from such businesses activities due to poverty level in the study area, and this might be a reason why men are not involved in these income generating activities thus, there is a clear gender disparity in terms of roles.

4.3.2 The access and control profile

The Access and control profile considers productive resources such as: land, equipment, labour, capital, credit, education, and training. The Access and control profile differentiates between access to a resource and control over decisions regarding resource allocation and use. It enables planners to consider whether or not the proposed project could undermine access to productive resources, or if it could change the balance of power between men and women regarding control over resources. Table 13 shows the access and control profile in the area and that, women had access in land, equipment, labour, cash and education for example all women reported to have access to land respondents but only 25% had control over it. 41.7% women respondents had access to education but none of them had control of education because they could be taken out of school any time by husband or parents, this explains the extent to which women are restricted from participating equitably in managing or running projects.

Table 13: Showing the access and control profile

Resources and benefits	Number of respondents	Access (%)		Control (%)	
		Women	Men	Women	Men
Resources:					
Land	120	100.0	100.0	25.0	100.0
Equipment	120	75.0	100.0	33.3	75.0
Labour	120	100.0	100.0	25.0	100.0
Cash	120	83.3	100.0	16.7	100.0
Education	120	41.7	100.0	0.0	100.0
Benefits:					
Asset ownership	120	100.0	100.0	0.0	100.0
Basic need(shelter, Clothing and food)	120	66.7	83.3	33.3	100.0
Political power	120	41.7	100.0	16.7	100.0
Decision making for sale of produce	120	33.3	73.3	33.3	100.0
Capital	120	20.0	75.0	16.7	100.0

For example, if women have limited access to income or land, they may be unable to join groups, which provide production inputs and commercial opportunities, or to become independent commercial producers. In some subgroups, men may also suffer from the same disadvantages.

4.4 A Gendered Perception of Climate Change

This section addresses specific objective number one and the respective study question which aimed at identifying farmer's perception towards climate change. Farmer's perception on climate change increases the probability of farmers taking measures against vulnerability to climate change according to their gender (IFPRI, 2007).Table 14 shows the summary of farmer's perceptions and knowledge on climate change.

Table 14: Farmers perceptions and knowledge on climate change

		(Strongly Agree %)		(Strongly Disagree %)	
S/no	Climate change parameters	Women	Men	Women	Men
1	Climate change is the cause of failure in agriculture.	90.8	90.0	0.8	0
2	Women understands climate change	99.2	91.6	0	1.7
3	God is the causal of drought in the area	0	0	80	95.0
4	Deforestation is one of the factors contributing to climate change	84.2	91.6	0.8	0
5	Solution to climate change is on God's hands	3.0	2.5	13.0	52.5
6	Strong winds more frequent	76.7	75	0	0
7	Temperature increased	97.1	96.9	0.0	0.0
8	Climate is changing	100	100	0	0

The results presented in Table 15, from the farmers' perception on climate change show that 90% male and 90.8% female farmers strongly agreed that climate change affect agricultural production in many aspects. The results from respondents show that 99.2 % of women understand climate change and 91.6% of men strongly agree that women do know and understand matters patterning climate change. This trend may be caused by the respondents' involvement in subsistence farming in the study area. So to them, agricultural related factors are the impacts that can be easily observable.

Almost all men and women strongly agree that Deforestation is one of the factors contributing to climate change. This was noted from the fact that fuel wood was found to be the main source of cooking energy. It was also noted that both women and men strongly agreed that women and children are more affected by climate change than other people. It was also noted that men also believed that climate change affects other groups in the same way as it affects women (Table 15).

The perception on whether drought and dry spells are caused by God was sought. The intention of this statement was to observe whether or not the respondents believed that climate change is associated with religious belief. A question on spiritual perception was relevant as it was observed that the respondents in study area are very religious. The results show that majority (95.0 %) of the respondents strongly disagreed that God was the cause of drought and dry spells in their area. This implies that majority of the respondents accepts that drought and dry spells are not associated with religious belief. The results also indicate that 3.3% of the respondents agreed that drought and dry spells are caused by God, this group of respondents is dominated by elderly people who believe that in former years, there was no scarcity of rain because people were not sinful as they are now days, and therefore God is punishing the people by not giving out rain and

putting a tight knot on dry spells and drought. The rest (1.7%) were undecided on linking God with climate change.

Women seemed to be more inclined to spiritual perception with respect to climate change than men. Table 15, about 63% of women also perceived that the solution to climate change is on Gods. Only about 13% of men agree with this statement. This different perception has also been reported by Swai *et al.* (2012) in a study conducted in dry semi-arid areas of Bahi and Kondoa in Tanzania. The authors found the perception to vary not only between men and women but also between villages. It seems that women in rural areas are not well informed of the exact nature of climate change. Men have access to Climate change information therefore they know in more detail what climate change is as opposed to women.

4.5 Relationship between Community Perception and Meteorological Data

Understanding farmers' perceptions on rainfall variability is crucial in anticipating the impacts of changing climate patterns, as only when a problem is perceived with the appropriate steps be taken to adapt to it (Slegers, 2008). With this understanding, this study sought data on people's perception on climate change and evidence from meteorological data.

Rao (2008) observed that while researchers focused on meteorological drought data. Agricultural drought occurs when there isn't enough moisture to support average crop production on farms or average grass production on range land while meteorological drought occurs when water reserves in aquifers, lakes and reservoirs fall below an established statistical average. Farmers use indigenous knowledge for example insects, flower blossoms and onset of sun to predict, and while researchers use complex

mathematical rules farmers use simple practical approximations of available soil moisture to characterize onsets and termination of rainfall. Despite these differences, it is crucial for both donor and local communities to better acknowledge the local contexts on climate change for climate policies (Jennings and Mcgrath, 2009). According to, the village chairperson of Nkwini village which was one of the most impacted villages by climate change in the study area, lack of rain is perceived by many farmers as evidence of climate change. He was quoted as saying that; "drought in the areas, has even caused species believed to be drought-resistance to stop producing."

There was also concern on the unreliability and scarcity of rainfall in the study area. Respondents raised their concerns on rainfall variability and unpredictability. During FGD in Hedaru one female had the following comment: 'In the past rain started in July to drive dust away, ended in September; the rains for planting used to arrive in October, it also used to rain over Christmas 'in the past it was normal to plant in October, now the rains are very late and for most of the time there aren't enough for planting'. A similar observation was made by another woman during FGD in Makanya; who put it in this way: 'nowadays, it is difficult to tell the difference between the start of the rainy season started and the normal showers. 'In the past there was a specific season but rains can come any time now' (A woman participant in Makanya FGD). The FGDs further indicate that they received good rains in 2006 and experienced significant drought in 2007 and 2009 seasons.

In order to have deeper insights of the actual rainfall pattern, to complement what has been gathered from the respondents' experience, it was important to observe meteorological data and compare with farmers' responses. The meteorological data which covered the period of 10 years from 2001-2010 are presented in Fig. 3 and 4.

The comparison is made for general climatic trends of rainfall and temperature and for specific years of which farmers indicated abnormal rainfall amounts. Meteorologically, unreliability of rainfall can be explained by rainfall trends and dry spells, while climate change can be explained by long-term trend in rainfall amounts and dry-spells as well as long-term trend of minimum and maximum temperatures.

Fig. 3 depicts rainfall trend. Over time, both Masika (MAM) and Vuli (OND) rainfall seasons are highly variable, no clear increasing or decreasing trend, this might be because the data is only 10 years long. Enfors and Gordon (2007) analysed long term seasonal rainfall data (1957-2007) and found that "Masika" rainfall had a declining trend but was not statistically significant where as "Vuli" showed no change. This agrees with the trend observed in this study.

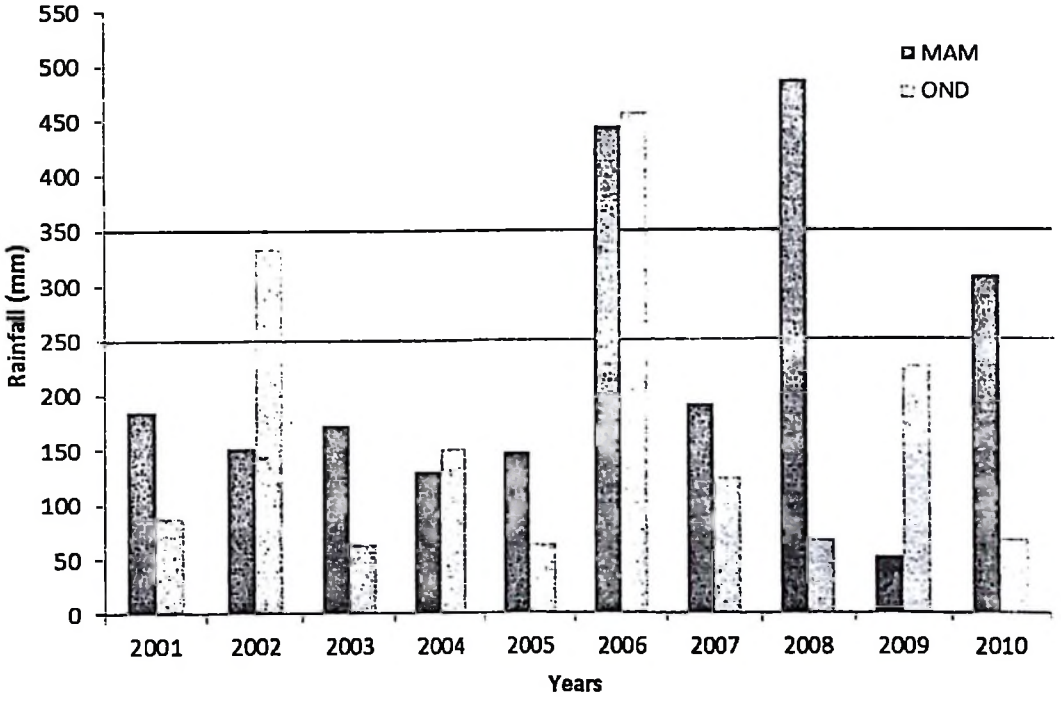

Figure 3: Rainfall in Makanya catchment (Source: Tanzania Metrological Agency)

Enfors *et al.* (2010) also noted that small-scale farming systems in the semi-arid and tropics operate on a thin line between failure and success. In the case of western Pare lowlands where this study was carried the crop failure line was established at 250mm of rainfall where farmers could experience yields lower than 1 t/ha whereas at 350mm and above, farmers could realize yields exceeding 2t/ha (Enfors *et al.*, 2010). With respect to Fig. 3, this means out of the 20 cropping seasons only 3 seasons had rainfall amounts exceeding 350mm. Fifteen cropping seasons (75%) had rainfall amounts less than 250mm. Comparing to the information given by farmers, it is true that rainfall is scarce and highly unreliable. Also, farmers perceived that rainfall was scarce in 2007 and 2009. This is clearly indicated in Fig. 3 which showed that in those years the area received less than 250 mm of rainfall in all seasons. For 2006, the area had adequate rainfall in both seasons, this also agrees with farmer's perception. In general, between 2006 and 2010 (five years), in which farmers may have the ability to accurately recall the events, it is only 2006 seasons that were better and 2007 and 2009 years, which were worse.

With regard to the occurrence of dry spells (Fig. 4) the following observations can be made: There has been a continuous occurrence of dry spells of 21 days or more in almost every year in at least one season with exception of 2006 seasons. This has significant importance in crop yield because in most cases such dry spells cause crop failure if the crop is entirely rain fed. Its effect can partially be reduced if farmers will be practicing rainwater harvesting, which is common practiced in the area. It can be clearly seen that in 2007 and 2009 years, in which farmers indicated that were drought years, the 21-days dry spells occurred twice in the Vuli seasons.

Enfors and Gordon (2007) based on 50 years of data (1957-2007), found that dry spells occurrence in Same District for Masika seasons to be on increase and occur late in the

season affecting grain filling stage. The increase was found to be statistically significant (p=0.024). The extended analysis in this study (Enfors and Gordon) done in 2008-2010 shows that trend has not yet changed. Based on analysis of rainfall amount and distribution it implies that rainfall is scarce and unreliable and is likely the main drivers of crop failure. These observations show that farmers perceived dry spells as becoming stronger and therefore causing bad yields in farms and livestock production due to lack of fodder.

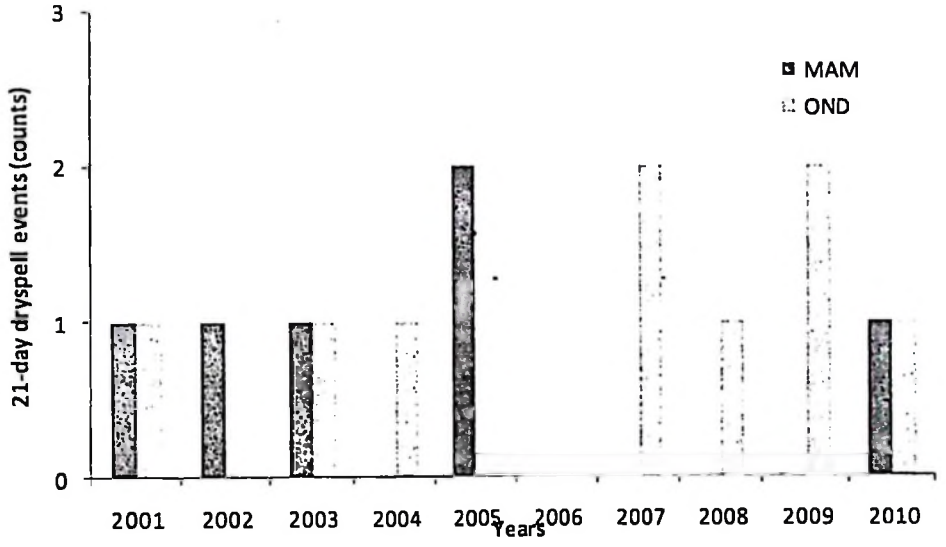

Figure 4: Dry spell events (Source: Tanzania Metrological Agency)

4.6 Temperature Variations

Another climate change variable that was analyzed in this study was temperature. This was observed using meteorological data. Maximum temperature data was from 1958 to 2003 (46 years) while minimum temperature data was from 1958 to 2007 (50 years). Maximum temperature data from 2004 to 2007 could not be obtained because of lack of data for that period from Same weather station. The analysis revealed a decreasing trend for maximum temperature (Fig. 5) while an increasing trend of minimum temperature

(Fig. 6). However, in both cases their trends were not statistically significant (maximum temperature p=0.637 and minimum temperature, p=0.508). Since the two trends are not statistically significant it can be concluded that the major contributing factor to unreliable harvests in the area is due to unreliable and unpredictable rainfall patterns.

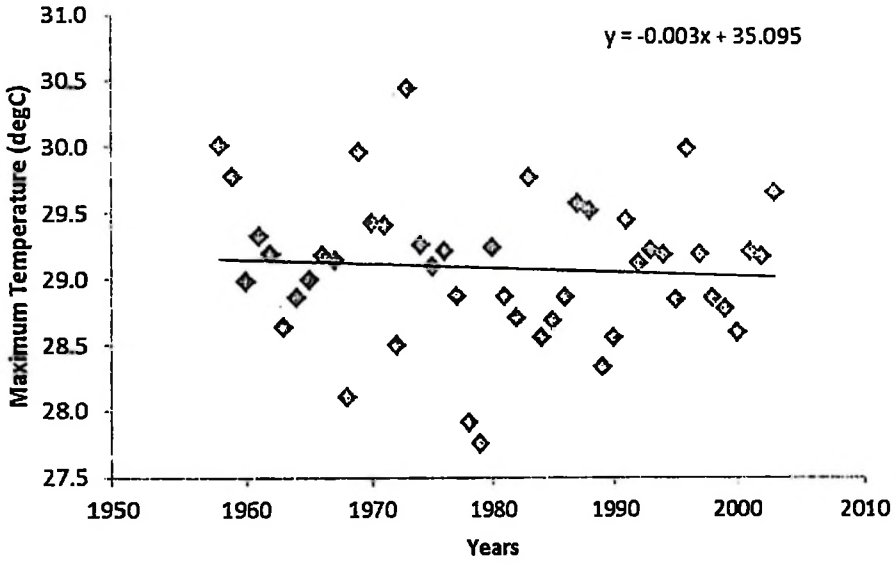

Figure 5: Maximum temperature variations (source: Tanzania Meteorological Agency).

The changes in temperature, rainfall patterns and declining water availability will strain agricultural and livestock production already hindered by land degradation and price shocks and gender wise, this will result in food and economic insecurity of women and men especially in areas dominated by rain fed production, with as much as 50% reduction of yield from rain fed agriculture in Sub-Saharan Africa by 20201 (FAO, 2010). Decline of the agriculture sector will particularly affect women who are responsible for approximately 75% of household food production in Sub Saharan Africa, (65%) (Dietz, 2008). Girls and women risk greater malnourishment in societies and families that may privilege limited food resources to male members of households. Responsible for

providing water for their families, increasing water scarcity will also increase the burden on women and girls who will have to spend more time and effort to carry, store and purify water. It may also lead to more economic hardship as families (Gurung, 2011).

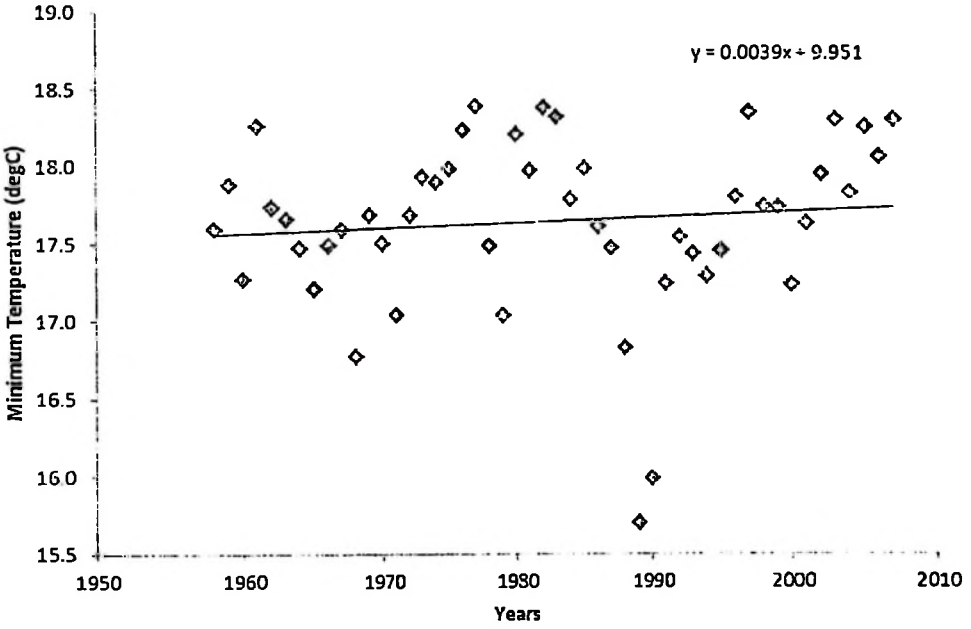

Figure 6: Minimum temperature variations (source: Tanzania Meteorological Agency).

4.7 Climate Change and Livelihoods

4.7.1 Types of agriculture in the study villages

Agriculture is one of the most widespread activities in the world, but its character is not uniform across the world. For example, the study area can be classified as a semi-arid region and livelihoods are based on crop and livestock farming and occasional casual labour engagement in Ruvu and Mohammed Enterprise Estate. These are two large sisal estates which offer casual labour employment to most of the men in the study area. There are a number of ways to classify agriculture and some of the major criteria which

can be adopted include the scale of farming, crop and livestock combinations, intensity of farming, means and ways of disposal of the farm produce and the level of farm mechanization (Eriksen, 2007). This study classified agriculture based on the scale of farming and the combination of crop and livestock.

The results in (Table 15) show that 69.2% respondents were involved in subsistence farming and 27.7% respondents were involved in both subsistence and commercial farming. The prevalence of subsistence farming has the impact of increasing vulnerability to drought. Farmers in the study area depend on crops produced for both household food consumption and cash earnings and therefore they tend to be hit the hardest by the impacts of climate change. The studies by Paarola (2009) conducted in Morogoro Region has also indicated that subsistence farmers tend to be impacted the hardest by climate change in Tanzania. The author further argues that by expanding farm land to cope with the impact of climate change, farmers further cause environment destruction leading to more impacts. It can thus be deduced that climate change has impacted smallholder households by changing their livelihoods in terms of moving away from more productive commercial farming to vulnerable subsistence farming.

Table 15: Distribution of types of agriculture

Agriculture practice	Kijomu		Gavao/Saweni		Nkwini		Kasapo		Total	
	n	%	n	%	n	%	n	%	n	%
Subsistence	25	83.3	13	43.3	23	76.7	2	6.7	83	69.2
Commercial	0	0.0	2	6.7	0	0.0	0	0.0	2	1.7
Subs. & commercial	5	16.7	14	46.7	7	23.3	7	23.3	33	27.5
Livestock keeping	0	0.0	1	3.3	0	0.0	1	3.3	2	1.7
Total	30	100.0	30	100.0	30	100.0	30	100.0	120	100.0

During the FGDs, it was revealed that earlier in 2007 before the climate was extreme, farmers were doing commercial agriculture due to high rainfall and therefore they used to sell pigeon peas to many customers from Kenya, but since rainfall is no longer predictable, farmers produce and get little yield for subsistence.

In adapting to climate change, farmers in the study area cultivate a variety of crops which are tolerant to drought and have shorter maturing period as the adaptation strategy. The results from key informants' interviews revealed several challenges that limit the adaptive capacity of farmers' livelihoods. These challenges include lack of improved seeds, lack of access to water for irrigation, lack of current knowledge of modern adaptation strategies, lack of capital, and lack of awareness and knowledge of climate change. All these challenges became a constraint to the adoption of modern techniques in combating climate change in the area.

Furthermore, the FGD's conducted in the study villages also revealed that rainfall unpredictability, prolonged drought 8and pest and disease problems are the leading cause to frequent crop failure and increased yield variability. Farmers are being forced to cultivate larger areas of land to obtain sufficient food. Despite these problems, it is only a few men who take part in the coping strategies for climate change as majority of the men migrate to the urban areas. This apparently increases the burden on women. In explaining migratory tendency, the following was reported during FGD: "A lot of our men move to the urban areas, during drought seasons. So, we are left behind to take care of the family which is very hard. Sometimes these men don't send back any money to support us" (A woman in Makanya FGD).

From the analysis of FGD, migration is not a new coping strategy in this region, but it is reported to be increasing, undermining family relationships as women are perceived to be abandoned during the period of food scarcity. Young people's perceptions of future rural livelihood opportunities are also being negatively affected. However, other studies have reported positive outcomes to women, resulting from male migration as a livelihood strategy; in that such migration can lead to more freedom in decision-making among women over household cash, which can also increase due to remittances (Cleaver, 2000). However, in this study, the migration is perceived a more negatively; first, it should be noted that as a strategy migration is gender biased as women and old people have limited opportunity to migrate because of their strong attachment to family roles. This shows that livelihood strategies are also gendered. Vulnerability to climate change in the context of rural agrarian livelihoods is influenced by exposure to climatic (and non-climatic) hazards and the underlying sensitivity of the natural resources base to such hazards.

The combination of the two factors gives rise to the potential impact on natural and human systems (McCarthy *et al.*, 2001; IPCC, 2007). The ability to respond to these impacts determine how vulnerable individual communities are to climate change. Communities which are highly impacted and possess weak adaptive capacity are usually the most vulnerable. The hazards identified by the communities and their perceptions of variability and recent changes are broadly in line with scientific evidence for this part of the country (INGC, 2009). Sensitivity to climate change depends primarily on the main livelihood activities, the key livelihood resources, and the effect of climate hazards on these activities and resources. According to the vulnerability Matrix conducted in the study villages, the respondents listed the livelihood resources which are most important to them and how such livelihoods are vulnerable to climatic change. This matrix is presented in (Appendix 1).

4.8 A gendered Climate Change Vulnerability

Gender intersects with age and health as factors in determining vulnerability (Lombardo and Meier, 2006). During the women's focus groups discussions in the study villages, it was revealed that children, women, elders, widows and widowers, orphans, and the long-term sick people are the poorest and most vulnerable to climate change, because of their increasing inability to secure food in the times of drought. Women with small children in Hedaru and Makanya are less able to take up labouring opportunities because of their child-care responsibilities and cultural norms. Thus, increased food shortages were reported to be affecting the health of these women, because they were eating fewer and poorer quality meals per day. It would appear that, in many ways, the existing inequalities, created as they are by social norms and inequitable power relations are already being compounded by increased climate variability in the study area.

The vulnerability matrix was constructed using data collected from Hedaru and Makanya. The vulnerability across gender was assessed in three dimensions. These are household based vulnerabilities, community strategies and resources. At a household level, vulnerability was assesses basing on gender differentiated roles; and it was noted that as women are the main caretaker they were more vulnerable as they were to provide food to small children. And traditionally, male own and have dominant power over household resources. For example, they can decide on trading even households' assets during drought. In doing this, they may use money for personal interest instead of for the interests of the household.

With regards to household size, the vulnerability increases with the increase of households' size; the larger the size, the bigger the burden of supporting the household in terms of basic resources such as food. This is especially the case, during climate change

related adversity such as poor crop production. The age composition of household members also matters. The households with young children are more vulnerable to climate change this study noted that 14 per cent of households which had more than 10 members and households with people were found to be mostly hunger stricken (Appendix 2).

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

This chapter presents conclusions and recommendations emanating from the major findings of the study. The first part discusses conclusions basing on the study objectives. The second part gives recommendations to different stakeholder in the area of climate change vulnerability in Tanzania. These recommendations specifically target the policy makers and researchers in the area of climate change vulnerability among small holder farmers. It is hoped that through the findings from this study, policy makers may design more relevant strategies to ensure that communities, particularly small holder farmers become less vulnerable to climate change.

5.1 Conclusions

Gendered perception of climate change: Climate change from gender perspective reveals that women and children are disproportionately affected by vulnerabilities. This perception was shared by both men and women in the study. It was further noted that women are not well informed about the causes of climate change as they relate climate change solution to spiritual power referring to God as central in mitigating climate change and its impact. This shows that there is gender differentiation in climate change perception. On the other hand, men and women have shown similar responses on their perceptions to climate change in other studied parameters. Some of these parameters were the effect on climate change on agriculture, the effects of climate change on women and children and beliefs on God being the cause of climate change.

Climate change impact on livelihoods: This study also addressed the climate change impacts on livelihoods. The livelihoods were perceived as activities set to have undergone

dramatic change as they have been impacted by climate change. For example, there has been a huge influx of men from the study area to urban areas. This further burdens women in the already drought stricken vulnerable community. Other livelihood changes are with respect to cropping patterns, which include using drought resistant seeds varieties and expansion of farm land. Households increase farm areas as the output per hectare declines as a result of drought caused by climate change. Households have also been found to be devoid of capital assets, knowledge, and technology of adapting to climate change as strategies geared towards improving livelihoods so as to reduce vulnerability.

Gender roles and responsibilities: On gender differentiated roles, this study revealed some notable inequalities with respect to activities distribution across gender groups involved in this study. These groups were men, women and children. Through socially constructed roles and responsibilities, women seem to bear the most burdens from climate change impacts. Women seem to be assigned most of the productive tasks in the households. Activities such a ploughing and crop sowing are solely shouldered by women. Not only that women do productive activities but also they are heavily involved in household chores such as fetching water. The distribution of household productive tasks is thus highly skewed to burden women. This has an impact of diverting women's energy from most productive tasks to less productive activities leading to more vulnerability of the households. On the other hand, activities involving actual recourse ownership and expenditure are men dominated. This gender differentiated role has direct impact on household vulnerability in the study area which is dominated by labour intensive subsistence farming. Vulnerability would have been much reduced if men would have equally shared crop production tasks with women.

Men and women vulnerability: This study also found that some groups in the population are more vulnerable to climate change. It was revealed that households headed by women, elders, and widows are more vulnerable. This is because these people were found to be among the poorest in terms of assets possession. They were unable to secure foods in the times of drought. The results also associated women with dependent children to vulnerability. Some of these were unable to secure labour because they had small children that required constant care. Compared to men they could not grip opportunities for casual labour in labour absolving sisal estates in the area. Women are also found to be affected by community coping strategies to climate change. For example when men migrate to urban areas as a coping strategy women are left behind in dire situation to take care of the family. When a migrating household member doesn't provide any assistance such as remittances, the household becomes more vulnerable. Thus gendered related vulnerability was a notable phenomenon in the study area.

5.2 Recommendations

The study recommends for the policy strategies for minimizing gendered rooted climate vulnerability among small holder farmers in Tanzania. Concerted effort need to be done to empower women. One approach of empowerment is to educated women on both the cause and impact of climate change. This is because women seem to have limited knowledge on climate change in general and on solutions to avoid or minimize climate change impact. Proper knowledge on this will enable them to address the location specific strategies of adapting to climate change and thus minimize the vulnerability. Education will also empower women to have decisions on household resources and expenditure which has been found to favour men in this study.

It is also recommended that the policies toward addressing climate change vulnerability should be gendered. Policy makers should realise how different groups in the community are impacted by climate change. The recognition of women and children related vulnerabilities should be at the forefront of policy formulation and implementation. The commitments to achieving gender equality must take on board gender differentiated impact and vulnerability to climate change.

It is further recommended that the government and other development agencies should create opportunities for off farm income earning activities in rural areas. These opportunities will be created by several measures including rural industrialization (by encouraging small industries in rural areas). This recommendation result from the findings of this study that dependency on farm income alone is unsustainable due to climate change related impacts. Rural off farm activities will also reduce urban migration and hence men will stay in the rural areas instead of leaving their deprived households during time of adversity.

5.3 Limitations to the study and Suggestions for Further Research

Limitations: The results of this study cannot be used to generalize Tanzania as each community is unique and will differ in culture and values. However, the findings are an important step in unveiling the dynamics and realities of gender differentiated impacts of climate change. In addition, with a wide scope of analysis and time constraints this report cannot claim to be exhaustive, nevertheless every effort has been made to ensure that key emerging issues are highlighted. Geographical mapping of vulnerability is often suggested as the most useful tool for identifying vulnerable groups. However, it is doesn't reveal gender specific vulnerabilities. Generally vulnerability should be assessed through

the vulnerable, and separate consultations with the women may turn out to be uncovering gender differentiated vulnerabilities and gender-sensitive adaptive response.

Suggestions for further research: This study suggests the following two areas on vulnerability to climate change impacts for further investigation in order to fill the knowledge gap relating to this study's findings

i. Studies on vulnerability to climate change impacts needs to be conducted in other drought hit areas in Tanzania with particular focus of addressing contexts specific vulnerability. This is due to the diversity of agro ecological and socio cultural characteristics of rural areas in Tanzania.

ii. There is a need to carry out empirical investigation on the link between migration and climate change related vulnerabilities in rural areas in Tanzania. This is suggested because in this study migration of men was found to be one of the leading courses of vulnerabilities in small holder farmers households

REFERENCES

Abdullah, A., Muyungi, R., Jallow, B., Reazuddin, M. and Konate, M. (2009) *National Adaptation Funding Ways Forward for the Poorest Countries*. International Institute for Environment and Development, London. 22pp.

Adger, W. N., Agrawala, S., Mirza, M. M. Q., Conde, C., O'Brien, K., Pulhin, J. and Pulwarty, (2009). *African Journal of Environment Science and Technology* 3(8): 206 – 219.

Agarwal, A. (1992). *The Grass is Greener on the Other Side*: A study of Raikas, migrant pastoralists of Rajasthan. Issue Paper No. 36. International Institute for Environment and Development, London. 15pp.

Agarwal, B. (1997). Bargaining and gender relations: Within and beyond the household. *Feminist Economics* 3: 1 – 5.

Aggarwal, P. (2003). Impact of climate change on Indian agriculture. *Journal of Plant Biology* 30: 189 – 198.

Armentrout, J. M. (2008). *Response to Climate Change, Adaptation and Mitigation Requires a Robust Economy Report.* Cascade Consultant Inc., Damascus, Oregon. 47pp.

Babugura, T. (2010). *Gender and Climate Change South Africa Case Study*. Heinrich Boll Stifting, Southern Africa. 49pp.

Babbie, E. R. (1990). *Survey Research Methods*. Wards worth Publishing Company, California. 396pp.

Bailey, K. (1995). *Methods of Social Research:* Ethnomethodological Approach. The Free Press, New York. 319pp.

Banda, K. (2005). *Climate Change, Gender and Livelihoods.* Limpopo Province, Africa. 22pp.

Bartlett, S. (2008). *Climate Change and Urban Children: Impacts and Implications for Adaptation in Low and Middle Income Countries.* International Institute for Environment and Development, London, UK. 21pp.

Barnett, J. (2001). Adapting to climate change in Pacific Island countries: The problem of uncertainty. *World Development* 29(6): 977 – 993.

Barnett, M. N. and Finnemore, M. (2004). *Rules for the World, International Organizations in Global Politics.* Cornell University Press, New York. 43pp.

Bradshaw, S. (2001). Reconstructing roles and relations: Women's participation in reconstruction in post-Mitch Nicaragua. *Gender and Development* 9(3): 79 – 87.

Barton, D. and Morton, J. (2001). *Livestock Marketing and Drought Mitigation in Northern Kenya.* Pastoralism, drought and planning report. Chatham Press, London, UK. 34pp.

Berkes, F. and Jolly, D. (2001). Adapting to climate change: social-ecological resilience in a Canadian western Arctic community. *Conservation Ecology* 5: 2 – 18.

Birkmann, J. and Wisner, B. (2006). *Measuring the Un-measurable. The Challenge of Vulnerability*. UNU/EHS Publications, Bonn. 22pp.

Boyd, E. (2002). *The Noel Kempff Project in Bolivia: Gender, Power and Decision Making in Climate Mitigation in Climate Change and Gender Justice.* Practical Action and Oxfam Publishing, London, UK. 52pp.

Boserup E. (1970). *Women's Role in Economic Development.* St. Martin's Press, New York, USA. 283pp.

Brody, A., Demetriades, J. and Esplen, E. (2008). *Gender and Climate Change, Mapping the Linkages.* Institute of Development Studies, UK. 44pp.

Boko, M. and Parry, M. (2007). *Africa Climate Change Impacts.* Cambridge University Press, London, UK. 10pp.

Brandt, U. S. and Svendsen, G. T. (2003). *The Political Economy of Climate Change Policy in the EU:* Auction and grand fathering. IME Working Papers No. 51. University of Southern, Denmark. 96pp.

Brown, P. (2006). *Global Warming, The Last Chance for Change.* Dakini Books National Printing, London. 90pp.

Brooks, N. and Adger, W. N. (2005). Assessing and enhancing adaptive capacity. In: (Edited by Chopra, K., Leemans, R., Kumar, P. and Simons, H.), *Adaptation Policy Frameworks for Climate Change Developing Strategies, Policies and Measures,* Cambridge University Press, Cambridge. pp. 165 – 181.

Cammack, D. (2007). Understanding the political economy of climate change is vital to tackling. *Prepared by ODI for UN Climate Change Conference*, Bali. 84pp.

Campbell, A. (2008). *Managing Australian landscapes in a changing climate change primer for Regional Natural Resource Management Bodies.* Department of Climate Change, Australia. 55pp.

Cannon, T. (2000). Vulnerability analysis and disasters. Gender and climate hazards in Bangladesh. *Gender Development* 10(2): 45 — 50.

Cannon, T. (2008). *Reducing People's Vulnerability to Natural Hazards.* Communities and Resilience, Research Paper No. 34. World Institute for Development Economics Research, London, UK. 19pp.

Care International (2009). Climate vulnerability and capacity analysis handbook. [http:// www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf] site visited on 1/5/2012.

Carvajal, Y., Quintero, M. and Garc´ıa, M. (2008). Women's role in adapting to climate change and variability. *Advances in Geosciences* 14: 277– 280.

Carvalho, A. (2007). Ideological cultures and media discourses on scientific knowledge: Re-reading news on climate change. *Public Understanding of Science* 16(2): 223–243.

Cutter, S. (1995). The Forgotten Causalities: women, children, and environmental change. *Global Environmental Change* 5(3): 181 – 194.

Cleaver, F. (2000). Analysing gender roles in community natural resource management: Negotiation, life courses and social inclusion. *Bulletin* 31(2): 60 – 67. ---------

Chambers, R. (1994). Participatory rural appraisal: Analysis of experience. *World Development* 22: 1253–1268.

Dahl, G. (1987).Women in pastoral production. In: Dahl G (Editor). The realm of pastoral women. *Ethnos* 52(2): 246 – 280.

Dankelman, I. (2002). Climate change: Learning from gender analysis and women's gender and development. *Climate Change* 10: 2 – 11.

Dankelman, I., Khurshid, A., Wahida, A., Gueye, B., Diagne, Y., Naureen, F. and. Rose, M. (2008). Gender, climate change and human security. Lessons from Bangladesh, Ghana and Senegal. New York. [http://ww.dnolineorg/resorcs /EDO_Gender_CC_Human_Securi ty.pdf] site visited on 20/6/2012.

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter? *Gender and Development* 10(2): 10 – 20.

Delaney, P. and Elizabeth, S. 2000). *Gender and Post-Disaster Reconstruction: The Case of Hurricane Mitch in Honduras and Nicaragua*. Decision review draft presented to the World Bank, Nicaragua 16pp.

Dell, M., Jones, F. and Olken, A. (2012). Temperature shocks and economic growth: Evidence from the last half century. *American Economic Journal Macroeconomics* 4(3): 66 – 95.

DFID (2005). Draft strategy for research on sustainable agriculture. London, UK. [http://r4d.dfid.gov.uk/project/3071/default.aspx] site visited on 20/08/2012.

Dilley, M. and Boudreau, T. E. (2001). Coming to terms with vulnerability: A critique of the food security definition. *Food Policy* 26: 229 – 247.

DAC (1998). *Gender, Equality and Culture.* In: DAC source book on concepts and approaches linked to gender equality. OECD, Paris. 57pp.

Dennison, C. (2003). From Beijing to Kyoto: Gendering the international climate change negotiation process. *ISYP Conference Advancing Human Security Halifax*, Nova Scotia, July 2003. pp. 16 – 79.

Delaney, P. and Shrader, E. (2000). *Gender and Post-Disaster Reconstruction: The Case of Hurricane Mitch in Honduras and Nicaragua.* LCSPG/LAC Gender Team. The World Bank, Nicaragua. 24pp.

Denton, F. (2001). Climate change vulnerability, impacts and adaptation: Why does gender matter? *Gender and* development 10(2): 10 – 20.

DFID (2009). *Political Economy Analysis:* Practice Paper, Department for International Development, London. 23pp.

Dietz, T. and Douglas A. (2008). Context and the commons. *National Academy of Sciences* 105: 13189 – 13190.

Dietz, T., Eugene, Rosa, A. and Richard, Y. (2007). Driving the human ecological footprint. *Frontiers in Ecology and Environment* 5:13 – 18.

Downing, T. E. and Patwardhan, A. (2004). *Vulnerability Assessment for Climate Adaptation. In: Adaptation Policy Framework:* A guide for policies to facilitate adaptation to climate change. (Edited by Lim, B., Burton, I. and Huq, S.), Cambridge University Press, Cambridge, UK. pp. 45 – 5.

Duddy, J. (2005*). Is Climate Change A Gender Issue?*. The meaning of vulnerability to global Environmental change. Geoforum. 62pp.

Ellis, F. (2000). *Rural Livelihoods and Diversity in Developing Countries.* Oxford University Press, Oxford. 25pp.

Elson, D. and Evers, B. (1998). *Sector Programme Support:* A gender aware analysis. Mimeo, GENECON, Manchester University. 12pp.

Enarson, E. (2002). Gender issues in natural disasters: Talking points and research needs. [www.gdnonlinc.org/resources/ilo-talking.doc] site visited on 24/5/2012.

Enfors, E., Barron, J., Makurira, H., and Tumbo, S. (2010). Yield and soil system changes from conservation tillage in dry land farming: A case study from North Eastern Tanzania. *Agricultural Water Management* 98(11): 1687 – 1695.

Enfors, E. and Gordon, L. (2007). Analysing resilience in dry land agro-systems. A case study of the Makanya catchment in Tanzania over the past 50 years. *Land Degradation and Development* 18: 680 – 696.

Eriksen, S. E. H., Klein, R. J. T., Ulsrud, K., Næss, L. O. and O'Brien, K. (2007). *Climate Change Adaptation and Poverty Reduction: Key Interactions and Critical Measures.* Report prepared for the Norwegian Agency for Development Cooperation, Norwegian. 43pp.

FAO (2007). People - centred climate change adaptation: integrating gender issues. Awareness of climate change from a gendered perspective. Rome. [http://ftp.fao.org/docrep/fao/010/a1395e/a1395e00.pdf] site visited on 12/6/2012.

FAO (2010). Farmers in a Changing Climate: Does gender matter? Rome. [http://www.fao. org/docrep/013/i1721e/i1721e.pdf] site visited on 1 /6/2012.

Fischer, G., Shah, M. and Van Velthuizen, H. (2002). *Climate Change and Agriculture Vulnerability. A Special Report, Prepared by the Int. Inst for Applied Systems Analysis Under United Nations Inst.* Contract agreement No. 1113. The World Summit on Sustainable Development, Johannesburg. 15pp.

Fisher, J. (2006). *For Her It's the Big Issue*: Putting women at the centre of water supply, Sanitation and Hygiene, Switzerland. 16pp.

Füssel, H. M. and Klein, R. J. T. (2004). Climate change vulnerability assessments: an evolution of conceptual thinking. Climatic change, forthcoming gender matter? *Gender and Development* 10(2): 10 – 20.

Fussel, H. and Klein, R. (2006). *Adaptation Assessment for Public Health:* Climate Change and Adaptation Strategies for Human Health, Steinkopff Verlag, Darmstadt. 62pp.

Gyampoh, B. A., Amisah, S. and Idinoba, M. (2008). Coping with climate change: How Local Communities use Traditional Knowledge in Rural Ghana. *Adaptation of Forests and Forest management to changing Climate with Emphasis on Forest Health* a *Review of Science, Policies, and Practices Workshop*. 25 – 28 August 2008. Umea, Sweden. 12pp.

Gurung, J. (2011). *Women's Exclusion from Forestry*. In: Arborvitae Attending to gender. The IUCN Forest Conservation Programme Newsletter. 18pp.

Heltberg, R. (2008). *Climate Change, Human Vulnerability, and Social Risk Management Social Dimensions of Climate Change*. World Bank Social Development Department, Washington, DC. 232pp.

Fisher, J. (2006). *For Her It's the Big Issue*: Putting women at the centre of water supply, Sanitation and Hygiene, Switzerland. 16pp.

Füssel, H. M. and Klein, R. J. T. (2004). Climate change vulnerability assessments: an evolution of conceptual thinking. Climatic change, forthcoming gender matter? *Gender and Development* 10(2): 10 – 20.

Fussel, H. and Klein, R. (2006). *Adaptation Assessment for Public Health:* Climate Change and Adaptation Strategies for Human Health, Steinkopff Verlag, Darmstadt. 62pp.

Gyampoh, B. A., Amisah, S. and Idinoba, M. (2008). Coping with climate change: How Local Communities use Traditional Knowledge in Rural Ghana. *Adaptation of Forests and Forest management to changing Climate with Emphasis on Forest Health* a *Review of Science, Policies, and Practices Workshop*. 25 – 28 August 2008. Umea, Sweden. 12pp.

Gurung, J. (2011). *Women's Exclusion from Forestry*. In: Arborvitae Attending to gender. The IUCN Forest Conservation Programme Newsletter. 18pp.

Heltberg, R. (2008). *Climate Change, Human Vulnerability, and Social Risk Management Social Dimensions of Climate Change.* World Bank Social Development Department, Washington, DC. 232pp.

Huq, S. and Ayers, J. (2007). *Critical List* the *100 Nations Most Vulnerable to Climate Change.* Sustainable development opinions series. International Institute for Environment and Development, London. 30pp.

IPCC (1995). The science of climate change: *Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change* (Edited by Houghton, J. T. Meira, L. G., Filho, B. A., Callender, N., Harris, Kattenberg, A. and Maskell, K.), Cambridge Univer. Press, UK. 572pp.

IPCC (1998). *The Regional Impacts of Climate Change:* An assessment of vulnerability. (Edited by Watson, R. T., Zinyowera, M. C. and Moss, R. H.), Intergovernmental Panel on Climate Change. Cambridge University Press, New York USA. 517pp.

IPCC (2001a). *Climate Change Synthesis Report.* The scientific basis, summary for policy makers contribution of working group No. 1. Cambridge University Press, London, UK. 881pp.

IPCC (2001b). *Climate Change Synthesis Report.* Impact adaptation and vulnerability contribution of working group No. 11. Cambridge University Press, London, UK. 1032pp.t

IPCC (2007). Constraints and capacity. Climate change. Impacts, adaptation and global Environment. *Change* 5: 181 – 194.

IPCC (2007). *Climate Change Vulnerability Assessment, Adaptation and Copying Strategies* Cambridge University Press, Cambridge. 32pp.

IPCC (2007a). Climate change Synthesis Report. *Contribution of Working Groups I, II and III to the fourth Assessment Report of the Intergovernmental Panel on Climate Change.* (Edited by Pachauri, R. K. and Reisinger, A.), IPCC, Geneva, Switzerland. 34pp.

IPCC (2007b). *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* (Edited by Metz, O.R., Davidson, P. R., Bosch, R. Dave, L. Meyer, A.), Cambridge University Press, Cambridge, New York, US. 124pp.

IPCC (2012). Managing the risks of extreme events and disasters to advance climate change adaptation. *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (Edited by Field, C. B., Barros, V., Stocker, T. F., Qin, D., Dokken, D. J, Ebi, K. L., Mastrandrea, M.D, Mach, K. J., Plattner, G. K., Allen, S. K., Tignor, M. and Midgley, P. M.), Cambridge University Press, New York, US. 44pp.

Jennings, S. and Mcgrath, J. (2009). What happened to the seasons? *Paper Presented at the Future Agriculture Consortium/center for Social Protection Conference on Seasonality, Institute of Development Studies.* Research report No. 8. University of Sussex, Brighton. 10pp.

Joekes, S. and Pointing, J. (1991). *Women in Pastoral Societies in East and West Africa.* Drylands Network Programme Issue Paper No. 28. International Institute for Environment and Development, London, UK. 30pp.

Kantola, J. (2010) *Gender and the European Union*: The European Union Series, Europe. 270pp.

Lorena, A. (2009). *Women and Climate Change, Vulnerabilities and Adaptation.* The World Watch Institute, Washington, DC. 14pp.

Lombardo, E. and Meier, P. (2006). Gender mainstreaming in the EU: Incorporating a feminist reading. *European Journal of Women's Studies* 13(2): 151 – 166.

Lambrou, Y. and Grazia, P. (2006). *Gender the Missing Component of the Response to Climate Change.* Food and Agriculture Organization of the United Nations, Rome, Italy. 18pp.

Lyimo-Macha, J. and Mdoe, N. (2002). Women and rural poverty in Tanzania: Case of selected villages in Kilosa and Morogoro Rural Districts, Tanzania. *Journal of Population Studies and Development* 9(2): 17 – 32.

Majule, A. E., Ngongondo, C., Kallanda-Sabola, M., Lamboll, R., Stathers, T., Liwenga, E. and Ngana, O. J. (2008). *Strengthening local Agriculture Innovation System in Less and More Favoured Areas of Tanzania and Malawi to Adapt to Climate Change and Variability:* Impacts, vulnerability and adaptation Sokoine University of Agriculture, Morogoro, Tanzania. 39pp.

Majule, A. E. (2008). Climate change and variability; impacts on agriculture working group Fourth assessment report. Climate change impacts, adaptation and vulnerability [http://www.ipcc.ch/SPM6avr07.pdf] site visited on 5/7/2012.

McCarthy, J. J. (2001. *Climate Change 2001: Impacts, Adaptation, and Vulnerability:* Contribution of Working Group II to the third assessment report of thc Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge. 85pp.

Mendelsohn, R. and Dinar, A. (2003). Climate water and agriculturc. *Land Economics* 79(3): 328 – 341.

Mitchell, T., Haynes, K., Hall, N., Choong, W. and Oven, K. (2008). The role of children and youth in communicating disaster risk. *Children, Youth and Environments* 18(1): 254 – 279.

Moser, C. (1993). *Gender Planning and Development.* Theory Practice and Training, Routledge, London. 120pp.

Moser, C. (1996). *Confronting Crisis: A Comparative Study of Household Responses to Poverty and Vulnerability in Four Poor Urban Communities* TWURD, World Bank, Washington DC. 201pp.

Morton, J. F. (2007). The impact of climate change in smallholder and subsistence agriculture. [http:www.pnas.org/cgi/boi/10.10773/pnas.0701855104] site visited on 18/11/2012.

Mundy, P. Compton, L. (1991). Indigenous communication and indigenous knowledge. *Development Community* 74(3): 1–3.

Nkem, J., Perez, C., Santoso, H. and Idinoba, M. (2007). Methodological framework for vulnerability assessment of climate change impacts on Forest-based development sector Centers for international forestry research. [http://www.cifor.cgiar.org/trofcca/attachment/03%20TroFCCA%20Annual%20Report%20%20%20Year%202%20-%20web.pdf] site visited on 14/4/2013.

Nkomo, J., Nyong, A. and Kulindwa, K. (2006). The Impacts of Climate Change in Africa: [www.hm-treasury.gov.uk] site visited on 14/8/2012.

Ngana, J. O. (1983). *Institute of Resource Assessment.* Research Report No. 60. University of Dares Salaam, Tanzania. 25pp.

Oates, W. E. and Portney, P. R. (2003). The political economy of environmental policy. In: *Handbook of Environmental Economics* 8: 325 – 354.

Okereke, C. (2008). Equity norms in global environmental governance. *Global Environmental Politics* 8(3): 25 – 50.

Osunade, M. A. (1994). Indigenous climate knowledge and agricultural practices in Southwestern Nigeria. *Malays Journal Tropical Geography* 1: 21–28.

Paarola, J. (2009). *Livelihoods, Vulnerability and Adaptation to Climate Change in Morogoro Region.* CSERG Working Paper No. 4. Morogoro, Tanzania. 12pp.

Pallant, J. (2006). *SPSS Survival Manual. A Step by Step Guide to Data Analysis Using SPSS.* Open University Press, New York, USA. 318pp.

Parikh, J. (2007). *Gender and Climate Change, Framework for Analysis, Policy and Action.* World Watch Institute, Washington DC. 36pp.

Parikh, J. and Denton, F. (2003). *Gender and Climate Exchange.* Oxfam Publication, Tiempo, 27pp.

Rabe, B. (2007). Beyond Kyoto climate change policy in multilevel governance systems governance: *International Journal of Policy, Administration, and Institutions* 20(3): 423 – 444.

Rancoli, C. (2006). Ethnographic and participatory approaches to research on farmers: Responses to climate predictions. Center for research on environmental decisions and South East. *Climate Consortium* 33: 81– 99.

Rao, V. (2008).In a changing climate weakening tropical easterly jet induces more violent tropical storms over the north India Ocean. *Geography Research Letter* 35: 157 – 180.

Reid, H., Alam, M., Berger, R., Cannon, T., Huq, S. and Milligan, A. (2009).*Community-based* adaptation to climate change: an overview' in Participatory Learning and International Institute for Environment and Development. [http://pubs.iied.org/G 02608.htm] site visited on 10/8/2012.

Senbeta, A. F. (2009). Climate change impact on livelihood, vulnerability and coping mechanisms: A Case Study of West-Arsi Zone, Ethiopia. Dissertation for Award of MSc Degree at Lund University, Lund, Sweden, 135pp.

Schneider, S. (2007). *Regional Vulnerabilities. Assessing Key Vulnerabilities and the Risk from Climate Change. Impacts, Adaptation and Vulnerability:* Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge. 116pp.

Shumaker, J. (1991). *Planning Women's Projects.* Wild Heifer Project International, Little Rock, Arkansas. 8pp.

Shivji, Issa G. (2009). *Accumulation in an African Periphery.* Mkuki na Nyota Publishers, Limited, Dar es Salaam, Tanzania. 25pp.

Swai, O., Mbwambo, J. and Magayane, F. (2012). Perceived effects of climate change on Agricultural Production: A gendered analysis done in Bahi and Kondoa districts, Dodoma region, Tanzania. *Research on Humanities and Social Science* 2(9): 59 – 68.

Tanner, T. and Allouche, J. (2011). 'Towards a new political economy of climate change and development. *IDS Bulletin Special Issue: Political Economy of Climate Change* 42(3): 1 – 14.

Tandon, N. (2007). *Bio Politics, Climate Change and Perspective.* Minerals and Energy Policy , Philip Publishers, CapeTown. 22pp.

Tipilda, A. and Kristjanson, P. (2008). *Women and Livestock Development, A Review of the Literature.* Innovation Works Discussion Paper No. 9. International Livestock Research Institute, Nairobi, Kenya. 82pp.

Thornton, P., Jones, P., Owiyo, T., Kruska, R. L., Herrero, M., Kristjanson, P., Notenbaert, A., Bekele, N., Omolo, A., Orindi, V., Otiende, B., Ochieng, A., Bhadwal, S., Anantram, K., Nair, S., Kumar, V. and Kulkar, U. (2006). *Mapping Climate Vulnerability and Poverty in Africa.* Report to the Department for International Development. ILRI, Nairobi, Kenya. 171pp.

Tol, R. S. J., Downing, T. E., Kuik, O. J. and Smith, J. B. (2004). Distributional aspects of climate change impacts. *Global Environmental Change* 14: 259 – 272.

Tubiello, F. and Fischer, G. (2007). Reducing climate change impacts on agriculture: Global and Regional Effects of Mitigation, 2000–2080. *Technological Forecasting and Social Change* 74(7): 1030 – 1056.

UNFCCC (2003). *The Convention Matters Relating to the Least Developed Countries.* Progress report of the least developed countries Expert Group. Published United Nations Office. Milan, Italy. 135pp.

United Nations Population Fund (2009). *Facing a Changing World:* Women population and climate. UNFPA, New York. 23pp.

Verloo, M. (2005). *Mainstreaming Gender Equality in Europe*: A critical frame analysis approach. The Greek Review of Social Research, Europe. 34pp.

Wamukonya, N. and Skutsch, M. (2001). Is there a gender angle to climate change negotiations? [http://doc.utwente.nl/43831] site visited on 20/7/2012.

Woodley, E. (1991) Indigenous ecological knowledge systems and development. *Agriculture Human Values* 8: 173 – 178.

WEDO (2007). Changing the climate: Why women's perspectives matter. [www. undp.org.cu/c rmi/docs/ wedoccwomen-in-2007-en.pdf] site visited on 24/5/2012.

WHO (1998). Gender and Health: [http://www.who.int/reproductive-health/publications/ WHO_ 98_16] site visited on 1/11/2013.

World Bank (2004). *Operationalizing Political Analysis:* The expected utility stakeholder model and governance reforms. PREM No. 95. World Bank, Washington DC. 85pp.

World Bank (2009). Problem-driven governance and political economy analysis: Good practice framework. Washington DC. [www.gdnonline.org/resources/ilo-talking.doc] site visited on 24/5/2012.

Wydra, M., Jay, S., Johnson, T., Draper, A., Escobosa, E., Le Cerf, E. and Maurseth, A. (2010). Empowering Women in Nepal: [http://pages.uoregon.edu/aweiss/Intl 442_542/Nepal] site visited on 22/10/2012.

APPENDICES

Appendix 1: Climate change impacts and livelihoods

Human Resources Most Important for Livelihood	Livelihood Resources Most Vulnerable	Climatic Hazard	Men	Women
-HEALTH The reduced availability of food brought about by climate related Crises and rising temperatures leads to impaired nutrition and reduced human disease resistance. This, together with health problems ascribed to high temperatures, inadequate access to safe drinking water and poor sanitation, all exacerbated by the impact of HIV/AIDS, impacts on people's ability to farm, attend to livestock, and perform other essential activities. The majority of the communities have only access to a rudimentary health post, who cannot respond to the many health problems faced by the communities(Nkwini for example had no hospital people go to Makanya town)	Agriculture -About two-thirds of the female labour force in developing countries, and more than 90 percent in many African countries, are engaged in agricultural work.	Rainfall variability this hazard was ranked highest by all interviewed Villages. Over the previous five years, rainfall patterns have shifted (communities termed this" drought"), with more frequent dry spells and dry seasons, shortening of the rainy season or non-at all.	Men are also affected by rainfall variability as they have to seek for alternative jobs to help the family.	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 women in particular as the man migrate and leave them. For example Rice was sold in 800 to 1000 in 2008 but now they buy for 2000.
-EDUCATION	BIOMASS -In the rural areas , women and men are highly dependent on biomass, such as wood, 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. -	FLOOD Inhabitants of Makanya and Hedaru are exposed to floods due to the type of building mainly with low foundation (essentially the severe 1997 flood is remembered well, but otherwise rare). This was not, however, a top three hazard in any community.	Men participate in firewood collecting but in rare occasion, if the wife is sick or if the man is widowed.	women and girls are responsible for collecting traditional fuels, a physically demanding task that can take from 2 to 10 hours per week. As a result, women have less time to fulfill their domestic responsibilities, earn money, engage in politics or other public activities or simply resting.
-FARMING		Human Diseases	Men get	Women seem to be

SKILLS		Two communities (Kijom and Saweni) included human disease pressure in their top three hazards. Common problems include respiratory ailments and , diarrhoea and malaria.	affected too by human diseases but they are not as vulnerable as women.	affected more health wise than men (take for example breast feeding women with poor food security they are likely to be under nourished).Women also are obliged to take care of sick men and other family members.
-EXTENSION SERVICES		Extreme heat Was mentioned as a severe climate hazard. Temperatures have increased significantly. Higher evaporation and transpiration rates in the growth season have led to more rapid loss of Soil moisture and heat stress is also affecting labour.	Men are affected by this the same as women	Women are affected the same as men.
		Hurricane and Strong winds Three communities (Gavao-Saweni, Nkwini and Kasapo) rated strong winds as a climatic hazard. (one was witnessed by the researcher in Nkwini village which removed iron sheet of one of the respondents house named Asha Rajabu). These cause damage to infrastructure, crops and trees. They also contribute to high rates of soil moisture loss.	Men are affected by this the same as women	Women are affected the same as men except for the case of female headed household were women tend to suffer most due lack of assistance.(like Aha Rajabu)

Appendix 2: **Vulnerability matrix showing climate change vulnerability and impact by gender. (adapted from the handbook of climate vulnerability and capacity building analysis, CARE, 2009).**

Definition of vulnerability	Men	Women	How severely affected
Water resources: Unreliable and scarce rainfall may exacerbate existing shortages of water.	Men are affected by water shortages but not as much as woman.	Women are largely responsible for water collection in their communities and are therefore are more affected when the quantity of water and/or its accessibility changes.	**High on women** (especially in Nkwini village) were as women walk up to 5 km to Makanya town or Mohamed enterprise Estate for water.
Agriculture: Increased temperature will increase evaporation and evapotranspiration and decreased and this will affect food security negatively.	Men are also affected by the changes in the yields in agriculture caused by climate change and therefore migrate to look for greener pastures.	Compared to men, women have less access to, and control over the resources that they depend upon for food and income. Long-term gradual climate change will affect agricultural and ecological systems. Because women are more dependent on land and natural resources for their livelihoods, they are more vulnerable to resource scarcity.	**High on women:** Migration will increase leaving behind women and children to face the effects of climate change including increased food production workload.
Health and Safety: Decreased water and increased temperature may increase incidences of pests and diseases	Men are affected with health issues and safety but not the same to what happens with women.	More women die than men from the direct and indirect results of natural disasters. Children and pregnant women are particularly susceptible to water-borne diseases such as diarrhoea and cholera. The elderly are at the highest risk from climate change impacts like heat stress and malnutrition. With existing patterns of gender discrimination, both women and girls suffer more health impacts during, and in the aftermath of natural disasters.	**High on women:** Because children will be more negatively affected and women will have to spend more time to care for the sick.

Appendix 3: Questionnaire survey

A QUESTIONNAIRE FOR A GENDERED ANALYSIS OF VULNERABILITY TO CLIMATE CHANGE AMONG SMALLHOLDER FARMERS

A. INTRODUCTION

VILLAGE NAME .....

WARD.....

1) NAME	
2) AGE	
3) SEX	
4) MARITAL STATUS	
5) EDUCATION LEVEL	
6) MAIN ECONOMIC ACTIVITY	
7) RELIGION	
8) FAMILY SIZE (Number of people in the household)	

HOUSEHOLD MEMBERS (Starting with the eldest)

NAME	SEX	AGE	OCCUPATION	RELATION TO THE HHH

1. Wife
2. Husband
3. Child
4. Relative

B DETERMINING COMMUNITY PERCEPTION OF CLIMATE CHANGE WITH A GENDERED OUTLOOK.

1. What is climate change?.....

   .....

2. What do you consider to be the change of climate?(eg desertification, unreliable rainfall, prolonged drought)

   .....

   .....

3. What is climate variability?

.....

.....

4. How does it differ from climate change?

.....

5. Have you ever experienced it in your village? (YES☐ NO☐)

6. In what particular areas are/were you affected?

.....

Perception	Gender Group	Str Ongly Agree	Disagree	Not Sure	Agree	Strongly Agree
7 .Is there climate change?	Men					
	Women					
	Children					
	Elderly					
	People with dis abilities					
All are affected equally?						

Perception	Gender Group	Str Ongly Agree	Disagree	Not Sure	Agree	Strongly Agree
8. Do you think climate change affects your farming system?	Men					
	Women					
	Other women					
	Children					
	Elderly					
	People with dis abilities					
All are affected equally?						

(a) The Environment in this village is changing due to human activities? YES/NO
(b) The yearly rains are not supporting crop production as before? YES/NO
(c) The cost of food crops are increasing because of climate change? YES/NO
(d) The Environment suffers from excessive de-vegetation due climate change? YES/NO
(e) There is now fuel wood scarcity? YES/NO
(f) Climate change has led to rural-urban migration? YES/NO
(g) Climate change has led to the decline of forest resources? YES/NO
(h) Climate change has led to the change of livelihood system? YES/NO

C. Analysis of Climate Change Impacts In Relation to Livelihoods.
Household Resources

EQUIPMENTS/RESOURCES	How many of these resources /equipment's does a particular household have?	If you were to sell these resources today, how much would you gain in Shs?
Cell phone/land line		
Refrigerator		
Tailoring machine		
Video ,Television		
Coach, chair, stool		
Cupboard,		
Bed		
Table		
lamp		
Cooking pot		
Iron (charcoal/electric)		
cooker (Gas/electric)		
Other cooker		
Radio cassette		
Books(supplementary)		
Car/vehicle		
Wheelbarrow		
Motorcycle		
bicycle		
cart		
Ox-cart		
livestock		
Poultry		
Donkey/Horse		
Land/Farm		
House		
Dish/Antenna		
Hand hoe		
Pesticide pumping machine		
Water pump		
Tractor		
Harrow		
Plough		
Milking machine		
Manure distribution machine		

10. SOURCES OF INCOME

	YES	NO
Own produce		
Gatherings		
Gift received		
Part time job		
Loan given		
Received Loan		
Sale		
Savings		
Withdrawals		
Salary/ Allowances received		
Farming		

11. Housing Condition As A Measure Of Wellbeing

For the main dwelling, what are the main building materials used in the construction of the following:
ROOF [ ]

Roof material
1. Iron
2. Tiles
3. Concrete
4. Grass/leaves
6 = Grass and mud
8 = Other (specify)

12. Drinking Water

Main source of drinking water [ ]
01 = Piped water
02 = Protected well
03 = Protected/covered spring
04 = Unprotected well
06 = Unprotected spring
07 = Surface water (lake/dam/river/stream)
08 = Covered rainwater catchments
09 = Water vendor
10 = Tanker truck
11 = Bottled water
12 = Other (specify)

Season	Main source of drinking water	Distance to source (in km	Person mainly responsible for the fetching of drinking water
Wet season			
Dry season			

13. Energy Use and Access By The House Hold In Cooking And Lighting

Lighting code [ ] **Cooking code** [ ]

Lighting energy	**Cooking energy**
01=Mains electricity	01=Mains electricity
02=Solar	02=Charcoal
O3=Gas(biogas)	03=Firewood
04=Pressure lamp	04=livestock dung
05=Candles	05=Crop residues
06=kerosene lamp	06=Gas
07=Firewood	07=paraffin/Kerosene
08=other (specify)	08=other (specify

.....
.....

14. Toilet Facilities Used By the Houschold
What type of toilet does your household u
Type of toilet
1 = No toilet/bush
2 = Flush toilet
3 = Pit latrine – traditional
4 = Improved pit latrine – household owned
5 = other type (specify)
.....

D: Questions about Livestock and Agriculture

A; Agriculture

15 What type of agriculture are you practicing?
1. Subsistence
2. Commercial
3. Subsistence and commercial
4. Others
.....
.....

Types of crops grown

1. Lablab (pigeon peas)
2. Maize
3. Groundnuts
4. Millet
5. Vegetables (onions, green pepper)
6. Sunflower
7. Others (explain)

.....
.....

Types of crops grown in Masika

1.lablab(pigeon peas)
2.Maize
3.Groundnuts
4.Millet
5.Vegetables(onions, green pepper)
6.Sunflower
7.others(explain)

.....
.....

Types of crops grown in Vuli

1.lablab(pigeon peas)
2.Maize
3.Groundnuts
4.Millet
5.Vegetables(onions, green pepper)
6.Sunflower
7.others(explain)

.....
.....

Yield harvest

Type of crop	Masika season	Vuli season
lablab(pigeon peas)		
Maize		
Groundnuts		
Millet		
Vegetables (onions, green pepper etc.)		
Sunflower		
others(explain)		

B: Livestock keeping

What type of livestock are you keeping?

1. Cattle
2. Goat
3. Sheep
4. Pig
5. Chicken
6. Duck
7. Others (explain)

.....

.....

Mention the amount of livestock you own

Types of livestock	Amount
Cattle	
Goat	
Sheep	
Pig	
Chicken	
Duck	
Others (explain)	

a) Does keeping of livestock help you in any way? YES ☐ NO ☐

b) If YES how?
   1. Food
   2. Business
   3. Others (explain)

c) If the livestock are for business how much do you earn Per day/ Month/Year

.....

QUESTIONS ON ACCESS AND CONTROL

Types of resources	Who controls	Who access
Farm		
House		
Livestock		
Motorcycle		
Bicycle		
Radio		
Milling machine		
Business		
Hand hoe		
Others		

a) Is your farm close or far from the farm? Close ☐ Far ☐

b) Do you keep livestock close or far from home? Close ☐ Far ☐

F: Questions about climate change

a) What do you think it means by climate change?

.....
.....

b) Do you think climate change exists?

.....
.....

c) What signs show you that there is climate change in your area? (for example drought, lack of rain)

.....
.....

d) Do you think climate change happened in your area? YES ☐ NO ☐

e) Does climate change affect you in any way? YES ☐ NO ☐

f) If YES in what areas are you affected? (eg Agriculture, Health)

.....
.....

g) I f climate change exists do you think it increases or decreases compared to last 10 years? And in what specific areas do you think it is more impacting?

.....

h) What do you think it should be done to reduce climate change impacts?

.....

G: Questions on Floods and Drought

Event	Year happened	How long it existed	The impacts(resources affected)
Flood			
Drought			

a) On the occurrence of flood/Drought were there effects on Livestock and Plants on your part?

YES ☐ NO ☐

If yes explain .....

b) What measures are you taking not to be impacted in future by Floods / Drought?

.....
.....

c) Have you ever thought of moving to other areas with less climate change impact?

YES ☐ NO ☐

If NO why?

.....
.....

d) What do you think should be done to avoid floods and excessive drought in future?

.....
.....

H: RAINFALL AND CROP YIELD

1. Have you ever missed rainfall completely or have just dust wash rains which were not enough for production? YES ☐ NO ☐
2. If YES in which years and how long did it take?.....
.....
3. Have you ever farmed and lack yield completely? YES ☐ NO ☐
4. If YES in which years and what caused the lack of yield?

.....
.....

Fill in the Table on your history on farm yield from 2007-2012

YEAR	FARM SIZE	CROPS PLANTED	DROGHT/ RAIN	CROP YIELD
2007				
2008				
2009				
2010				
2011				
2012				

5. If you experienced low yield or none at all what type of solution have you made to avoid further problems?
   a) Shifting away from the area
   b) Putting an irrigation system
   c) Changing methods of farming
   d) Off-farm activities
   e) Abandoning agriculture
   f) Others (explain)

   .....

   .....

Appendix 4: Focus group discussion questions

1) Where do communities get their early warnings on climate change from?
2) Between men and women who receives the warnings?
3) Is it only short term warnings of immediate dangers (1-5 days), or also more long term Seasonal forecast?
4) How do you currently use weather information e.g. forecasts broadcast on radio?, are the forecasts understood?
5) What traditional signs warn of bad weather or a change of season? Who holds this Knowledge?
6) What seasons does the community typically plant crops by? Has this changed?
7) Is the traditional knowledge still working?
8) Have there been occupations or services which have been abandoned / changed due to changes in the surrounding environment or climate?
9) Has the temperature/rainfall patterns changed?
10) Do you think God is responsible for the changes in climate or it is just human activities?

Livelihoods

11) In what ways are the crops you plant dependent on the weather? Do you use weather warnings to know when to harvest crops? If not, why not?
12) What changes have occurred over time in your family's way of earning income?
13) Are people using coping strategies in relation to the hazards identified?
14) Are changes in the severity of climate change putting further demand on these coping strategies? Eg. Are men having to move away to find work more often?
15) What impact does this have on the family?

Health

16) Are there some diseases that are more common during certain times of the year?
17) Have you found that some diseases have been increasing or decreasing in the last 5-15 years?
18) Are there some diseases that are more common when it rains or when it is dry?
19) If the answer is 'yes 'which type of diseases?
20) Why do you think that happens and between men and women who is most affected?
21) What actions are people / the community taking?
22) If you know that it will rain / be dry / a certain season is approaching when a disease is more common – what do you do?
23) From which source do you receive most of your information about health problems?