ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENT STUDIES (CDS)

GENDER DIMENSIONS OF PASTORALISTS' ADAPTATION TO CONSEQUENCES OF CLIMATE CHANGE: THE CASE OF AMIBARA WOREDA, AFAR REGIONAL STATE

BY

TEWODROS HAILEMARIAM

JULY, 2011

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ACRONYMS

CSA	Central Statistics Authority
DFID	Department for International Development
EP	European Parliament
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
KII	Key Informant Interview
Masl	Meter Above Sea Level
MEA	Millennium Ecosystem Assessment
MHHs	Men Headed Households
NGO	Non Governmental Organization
SPSS	Statistical Package for Social Science
TLU	Tropical Livestock Unit
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
WARC	Werer Agricultural Research Center
WHHs	Women Headed Households
WPDO	Woreda Pastoral Development Office

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Abstract

This study was conducted in Amibara Woreda of the Afar Regional State. The study tried to investigate the gender dimensions of vulnerability to consequences of climate change. Moreover, adaptive capacity of women and men headed pastoral households which are required to take appropriate adaptation measures and major factors that constrain the strategies of the respective households are also identified. Both qualitative and quantitative data collection techniques were employed to generate all the relevant data from various sources. Primary data were collected by using household survey, key informant interview, focus group discussion and direct field observation. Structured household survey was conducted on 90 women and men pastoral households (i.e. 50% for each) selected by stratified random sampling technique from three representative kebeles. Secondary data were collected from different published and unpublished materials; in addition 40 years rainfall and temperature data from meteorology station were obtained. The data were analyzed by using descriptive statistics like frequency, mean and percentage. Some variables were analyzed using t-test to check statistically significant difference between the means of women and men headed households. The findings of the study suggest that the changes in the climate are highly recognized by all the respondents. Extensive reduction in rainfall amount, few rainy days, increased temperature and increased frequency and severity of drought are the most widely observed changes. Unlike the analysis of the rainfall data, the results of temperature data are in tandem with the observation of the community. These observed changes have brought a lot of challenges on women and men headed households. These includes: livestock population reduction and decline in productivity, livestock feed shortage, deterioration of household food security, water shortage for livestock and human use, and emergence and spread of new human and livestock diseases. Generally, women headed households who have limited access to and control over important resources and services are found to be the 'invisible and the more vulnerable' segment of the community. Both women and men headed households adopted various strategies in combination to cope with these challenges and reduce their vulnerability. However, there are various factors that seriously constrain these strategies. As a result most of the adaptation strategies of the households, more specifically women headed households strategies are becoming a no option strategy. The study revealed that the existing biased gender relation is the fundamental reason for women headed households limited adaptive capacity and their disproportionate vulnerability to consequences of climate change. Finally, the study recommends the need to enhance women headed households capacity for effective adaption by devising gender responsive interventions. Moreover, it is important to strengthen the quality and delivery of important services and on top of this, efforts should be made to ensure the participation of women to make them benefited.

1. INTRODUCTION

1.1 Background

Evidence from the Intergovernmental Panel on Climate Change (IPCC, 2007) is now overwhelmingly convincing that climate change is real, that it will become worse, and that the poorest and most vulnerable people will be the worst affected. While climate change is a global phenomenon, its negative impacts are more severely felt by poor people in developing countries who rely heavily on the natural resource base for their livelihoods. Agriculture and livestock keeping are amongst the most climate-sensitive economic sectors and rural poor communities are more exposed to the effects of climate change (IFAD, 2009).

Among the direct effects of climate change for example, there will be higher temperatures and changes in rainfall patterns, translating in an increased spread of existing vector-borne diseases and macro parasites of animals as well as the emergence and spread of new diseases. Some of the indirect effects for example will be brought about by changes in feed resources linked to the carrying capacity of rangelands, the buffering abilities of ecosystems, increased desertification processes, increased scarcity of water resources, lower production of grain, etc (IFAD, 2009).

Climate change with its overall rising temperatures and increasingly variable and unpredictable rainfall distribution is likely to affect diverse regions, locations and population groups differently. The implications for pastoral livelihoods are yet to be fully understood (IFAD, 2009).

In the arid and semi-arid areas, drought is part of a normal cycle, and pastoralists have developed some strategies to cope with it, such as mobility, livestock species diversity, reciprocity in use of resources, territorial fluidity and social safety nets. However, according to many applied research findings, the vulnerability of pastoralists to drought is very complex and diverse (Devereux, 2006). Hence, livelihood strategies in semi-arid areas are primarily geared towards coping with a high degree of uncertainty, minimizing risk and meeting subsistence needs, rather than maximizing production and profits (Scoones, 1996).

Dry lands pose different challenges for pastoral men and women because of their different roles, relations and responsibilities, opportunities and constraints, and uneven access and control of resources (FAO, 2003). The capacity to adapt to climate change is unequal across and within societies. There are individuals and groups within all societies that have insufficient capacity to adapt to climate change (Adger *et al.*, 2007).

Women are more dependent for their livelihood on natural resources that are threatened by climate change. They are particularly vulnerable to climate change because they are more prone to the adverse impacts from climate change. Their limited adaptive capacities arise from prevailing social inequalities and ascribed social and economic roles that manifest itself in differences in property rights, access to information, lack of employment and unequal access to resources (FAO, 2003). Hence, adaptation to climate change or indeed climate variability is dependent on issues such as wealth, technological power, access to information, all of which are major problem areas for women (UNDP, 2002). Further, changes in the climate usually impact on sectors that are traditionally associated with women (FAO, 2003).

In countries like Ethiopia, more than 85% of the people depend mainly on agriculture for their livelihoods, rendering them very vulnerable to climate variability and change. In recent times, a significant number of people in Ethiopia are being affected chronically by drought and/or flooding, leading to deaths of people and loss of assets. The problem is very serious in the arid and semi-arid areas, especially among the pastoralists (Yohannes & Mebratu, 2009).

This research was conducted in Amibara Woreda, Afar Regional State. The livelihoods in this region are based mainly on pastoralism and agro-pastoralism. Generally, the livelihood of pastoralists and agro-pastoralists, which are highly dependent on natural resources for livestock-keeping, cropping, fishing, beekeeping and hunting, is very sensitive to climate change. However, because of differences in wealth, technology, power, social values and natural resource bases within the communities, their vulnerability to climate change and their capacity to adapt to this also vary in time and space (Yohannes & Mebratu, 2009).

1.2 Statement of the Problem

The role of gender in influencing adaptive capacity and adaptation is an important consideration for the development of interventions to enhance adaptive capacity and to facilitate adaptation. Gender differences in vulnerability and adaptive capacity reflect wider patterns of structural gender inequality. Hence, climate interventions that ignore gender concerns reinforce the differential gender dimensions of vulnerability (Adger et al., 2007).

Despite this vital contribution of gender in understanding climate adaptation, there are major gaps in research on the linkage between gender and climate change especially in pastoral areas. As reported by Röhr (2007), the major factor preventing the mainstreaming of gender into climate change policies is the lack of data and research. According to DFID (2008), there is little existing research considering the linkages between climate change and gender. Even most of the existing research on climate change merely focuses almost entirely on impact and response. Little attention is given to investigate how gender relation affects the adaptation strategies of pastoralists to the consequences of climate change. As a result, there is scarcity of data disaggregated by sex on adaptation to the consequences of climate change and related issues.

When it comes to the study area, there are various climate change related research findings conducted in the Woreda and the region as well. However, the findings primarily focused in assessing climate change impact, vulnerability and adaptation at community level. For instance, research conducted by Yohannes and Mebratu (2009), and Fasil et al (2001) in different parts of the region overlooked the apparent existing differences among women and men pastoralists with regard to their vulnerability and adaptation strategies to consequences of climate change.

Hence, more gender disaggregated research is required in order to shed more light on levels of vulnerability and coping mechanisms of different social groups (UNDP, 2002). Gender disaggregated data taken at each of the levels will provide a strong database for future actions and measures to be gender-aware (Röhr, 2007).

To this end, the study has assessed the effects of climate change on the pastoral production system and examined adaptation strategies and adaptive capacity of female and male pastoral households. Moreover, factors that constrain their adaptation strategies and adaptive capacity have investigated.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of this study was to investigate the adaptation strategies of women and men pastoralists to consequences of climate change.

1.3.2 Specific objectives

- To figure out the major effects of climate change on the pastoral production system.
- To identify major factors contributing to the vulnerability of women and men pastoralists to consequences of climate change.
- To identify adaptation strategies of women and men pastoralists to consequences of climate change.
- To identify major livelihood resources and institutional factors which constrain adaptation strategies and adaptive capacity of women and men pastoralists.

1.4 Research Questions

- What are the major effects of climate change on the pastoral production system?
- What factors contribute for the vulnerability of women and men pastoralists to consequences of climate change?
- In what ways do men and women pastoralists adapt to the consequences of climate change?
- What are the major livelihood resource and institutional factors that determine women and men pastoralists' choice of adaptation strategies?

1.5 Significance of the Study

As it is clearly explained in various literatures, the importance of gender in climate change related studies particularly in pastoral areas has been given little attention. As a result, there is a severe scarcity of gender disaggregated data on pastoralists' vulnerability to climate change and their adaptation strategies. Hence, gender disaggregated information generated by this study will have a paramount importance in improving efforts geared towards enhancing the adaptive capacity of pastoralists thereby to reduce their vulnerability to climate change.

The finding will serve as an input for various governmental and non-governmental development practitioners operating in the area to formulate gender sensitive pastoral livelihood initiatives. Organizations working on disaster risk reduction and management activities will also benefit a lot. Because; based on the findings it will be possible to devise interventions which adequately give response to the needs and challenges of women and men pastoralists. Moreover, it enables agricultural research centers to generate and disseminate relevant technologies and management practices which take into account the specific contexts of women and men pastoralists.

1.6 Scope and Limitation of the Study

Identifying adaptation strategies of women and men pastoralists adopted in response to climate change related challenges and assessing factors constraining these strategies were the major focus areas of the study. Inline with these, adaptive capacities of the respective households are also analyzed. Though undertaking detailed vulnerability assessment was not the focus of the study, the vulnerability of women and men headed households is assessed qualitatively based on the analysis of their respective adaptive capacities.

In spite of its contribution in generating relevant gender disaggregated information, the study also has certain limitations. Due to lack of adequate time and financial resources it was not possible to include additional kebeles for undertaking prolonged and more in-depth study. As a result, making inferences to other areas will be difficult. However, with all its limitations the finding of the study will serve as a good data source and also as an entry point for those who wish to undertake similar studies in the future.

1.7 Organization of the Thesis

The thesis is organized into five chapters. Chapter one is introduction. In this chapter the rationale of undertaking this research, the research objectives and questions, and significance, scope and limitations of the study are briefly discussed. In chapter two both theoretical and empirical literatures in relation to pastoralism, climate change and gender are reviewed and presented. Chapter three gives some background information about the study area and discusses all the relevant methodological approaches and techniques that were employed in the study. Chapter five presents the results and discussions of the study in relation to the respective objectives. The general socioeconomic profile of sample respondents, pastoralists' observations of changes in the local climate, major impacts of the observed climate change, women and men headed households' adaptive capacity and their respective vulnerability, their adaptation strategies and major factors that constrain these strategies are clearly discussed in different sections of the chapter. The last chapter, chapter five, presents conclusions and policy implications.

2. REVIEW OF RELEVANT LITERATURES

2.1 Concepts and Definitions

Climate Change: refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land-use (IPCC, 2001b).

Climate variability: is the fluctuation in climatic parameters from the normal or baseline values (Abebe, 2008, cited in Yohannes & Mebratu, 2009).

Gender: refers to the different roles, rights, and responsibilities of men and women and the relations between them. Gender does not simply refer to women or men, but to the way their roles, access to and control over resources, and division of labor are determined through the process of socialization. Gender is generally associated with unequal power and access to choices and resources. It also refers the economic, social, political and cultural attributes and opportunities associated with being a woman or a man (Aguilar *et al.*, 2009).

Gender Sensitive Research Methodology: refers to a process of designing and implementing a gender sensitive research agenda. This means that the hypothesis setting, the questions asked, the time selected for data collection, the people to whom the questions are put, the area and social setting selected for research, the language used in data collection and dissemination, and the way the data is analyzed all take gender differences into account (Aguilar *et al.*, 2009).

Vulnerability: IPCC (2000a) defines it as the extent to which a natural or social system is susceptible to sustaining damage from climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate. Hence, a highly vulnerable system is one that is highly sensitive to modest changes in climate and one for which the ability to adapt is severely constrained.

Adaptation: it is adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. This refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. It involves adjustments to reduce the vulnerability of communities, regions, or activities to climatic change (Burton *et al.*, 1997).

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

2.2 Pastoralism and Climate Change

Dry lands cover 40% of the earth's terrestrial surface and are home to over two billion people, including pastoralist groups, hunter-gatherers and other traditional communities. Many of them are amongst the most vulnerable and poorest of the world (MEA, 2005).

The climate of the dry lands is characterized by scarce absolute rainfall which falls unreliably and within short rainy seasons, and which is often of limited availability for human use. High temperatures during rainy seasons ensure that much of the rainfall is lost in evaporation, and intense downpours ensure that water runs off in floods. The dry lands are also characterized by substantial and unpredictable differences in total rainfall between years, within the year and even between areas in one year (Anderson *et al.*, 2008).

Pastoralism, the use of extensive grazing in rangelands for livestock production, is one of the key production systems in the world's dry lands (Blench, 2001). Extensive pastoralism occurs on one fourth of the global land area and supports around 200 million pastoral households. In Africa, 40 percent of the land is dedicated to pastoralism and 70 percent of the population relies on dry and sub-humid lands for their livelihoods (FAO, 2009).

Pastoralism is considered as the most economically, culturally and socially appropriate strategy for maintaining the well-being of communities in dry land areas, because it is the only one that can simultaneously provide secure livelihoods, conserve ecosystem services, promote wildlife

conservation and honour cultural values and traditions (ILRI, 2006). Moreover, it is the best means to make productive and sustainable use of natural resources in arid and semi-arid areas that would otherwise remain unexploited (FAO, 2006).

Climate change effects present the development of pastoralism with new challenges (Nassef *et al*, 2009). Many pastoral areas are already degraded and climate change is further deteriorating the situation. It is frequently leading to more prolonged droughts resulting in more dust storms, but sometimes also to excessive rainfall with floods. Desertification is progressing at high rates - for example, the Kalahari Desert is expected to double its size and at the same time experience dramatically increasing wind speeds. The water availability in those areas is expected to decrease by 10-30 % within the next 40 years (EP, 2009).

Pastoralists employ various coping strategies to deal with climate and non-climate stress. However, they are increasingly less able to do so, and more pastoralists are losing their livestock assets and their livelihoods. However, pastoralism has inherent adaptive attributes which means that this production and livelihood system, if enabled to adapt, can continue to make contributions to pastoralist livelihoods, the health and integrity of ecosystems and the economies and societies of dry land nations (Nassef *et al.*, 2009).

2.3 Vulnerability, Adaptation to Climate Change and Adaptive Capacity

2.3.1 Vulnerability to climate change

Climate change is only one of many challenges facing poor people. In order to effectively reduce vulnerability, climate change adaptation must form part of a holistic response which aims to build resilience of communities to withstand the range of shocks and stresses that they are exposed to (CARE, 2009).

2.3.2 Adaptation to climate change

The discussion on adaptation to climate change in international policy has been overshadowed by discussions on mitigation. Lately adaptation is gaining more attention as it is increasingly realized that mitigation is a necessary but insufficient response, since the effects of climate

change are unavoidable to a great extent. With climate change already happening, there is an urgent need for measures to adapt to it (EP, 2009).

Adaptation to climate change is one of the approaches considered likely to reduce the impacts of long-term changes in climate variables. Adaptation is a process by which strategies to moderate and cope with the consequences of climate change, including climate variability, can be enhanced, developed and implemented (FAO, 2006).

Adaptation occurs in physical, ecological and human systems. It involves changes in social and environmental processes, perceptions of climate risk, practices and functions to reduce potential damages or to realize new opportunities. In practice, adaptations tend to be on-going processes, reflecting many factors or stresses, rather than discrete measures to address climate change specifically (Adger *et al.*, 2007)

Wealth and social differentiation affects the ability of people to adapt to climate and non-climate stress. Wealth, among pastoralists, can either be in the form of numbers of livestock, or access to better wage-paying jobs made possible through education (often secondary and postsecondary education), which safeguards livelihoods irrespective of herd size (Little *et al.*, 2008).

Moreover, assets, health, knowledge and governance are the four pillars of adaptive capacity (Anderson *et al.*, 2008). However, these are least accessible to the poor, which place them among the most vulnerable. For the most vulnerable groups, adaptation strategies are vital, as failure to adapt to climate change could lead to "significant deprivation, social disruption and population displacement, and even morbidity and mortality" (Huq *et al.*, 2003).

Components types and forms of adaptation

As both a process and a condition, adaptation is a relative term: It involves an alteration in something (the system of interest, activity, sector, community, or region) to something (the climate related stress or stimulus). Description of an adaptation requires specification of who or what adapts, the stimulus for which the adaptation is undertaken, and the process and form it takes (Downing *et al.*, 1997).

Adaptations come in a huge variety of forms. Adaptation types (i.e., how adaptation occurs) have been differentiated according to numerous attributes. Commonly used distinctions are purposefulness and timing. Autonomous or spontaneous adaptations are considered to be those that take place—invariably in reactive response (after initial impacts are manifest) to climatic stimuli—as a matter of course, without the directed intervention of a public agency. Planned adaptations can be either reactive or anticipatory (undertaken before impacts are apparent). In addition, adaptations can be short or long term, localized or widespread, and they can serve various functions and take numerous forms (Burton *et al.*, 1997).

2.3.3 Adaptive capacity

According to Burton et al., (1997), adaptive capacity is the potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and extremes.

Adaptive capacity in human systems varies considerably among regions, countries, and socioeconomic groups. The ability to adapt to and cope with climate change impacts is a function of wealth, technology, information, skills, infrastructure, institutions, equity, empowerment, and ability to spread risk. Groups and regions with adaptive capacity that is limited along any of these dimensions are more vulnerable to climate change damages, just as they are more vulnerable to other stresses. Enhancement of adaptive capacity is a necessary condition for reducing vulnerability, particularly for the most vulnerable regions, nations, and socioeconomic groups; and promotes sustainable development across many dimensions (Fankhauser, 2001).

2.4 Climate Change and Gender

Climate change impacts affect environment, human rights, sustainable development, health and all sectors of society. Positive action, if taken in these areas, could decrease pressure from climate change. Even-though the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol lack specific language related to gender, there are numerous

international legal instruments that mandate the incorporation of the gender perspective which also apply to the existing climate change framework (Aguilar *et al.*, 2009).

Climate change will affect all countries, in all parts of the globe. But its impacts will be distributed differently among regions, generations, age, classes, income groups, occupations and gender (IPCC, 2001). The poor, the majority of whom are women living in developing countries, will be disproportionately affected. Yet most of the debate on climate so far has been gender-blind (Aguilar *et al.*, 2009). Even-though, the issue of climate change is not new, its take-up as a key development concern and its integration into pro-poor planning is a fairly recent departure. Even more recent is the integration of a gender-sensitive perspective in climate change research and responses (DFID, 2008).

Climate change and gender inequalities are inextricably linked. By exacerbating inequality, climate change slows progress toward gender equality and thus impedes efforts to achieve wider goals like poverty reduction and sustainable development. Gender inequality can worsen the impacts of climate change. Thus, gender and climate change can be a vicious circle of worsening inequalities and impact. Climate change affects women more than men. This is because of existing inequalities. The vicious circle is that the more women are affected negatively by climate change, the worse the inequalities get. And the worse the inequalities get, the worse the impact becomes (Aguilar *et al.*, 2009).

Women's and men's differential access to social and physical goods or resources is one of the key dimensions of gender inequality. Women's social positioning in many situations means that the roles they are expected to take on are often supportive and reproductive, centered on the home and local community rather than the public sphere. This does not mean that women do not play crucial roles in agricultural production or other activities crucial to sustainable livelihoods and national economies. But the roles they play are generally less visible and attract less public recognition than the work men engage in (DFID, 2008).

Climate change can have disproportionate impacts on women's wellbeing compared to men. Women and girls in developing countries are often the primary collectors, users and managers of water. Decreases in water availability will jeopardize their families' livelihoods and increase

their workloads, and may have secondary effects such as lower school enrolment figures for girls or less opportunity for women to engage in income-generating activities (Aguilar *et al.*, 2009). Women who are vulnerable and marginalized have the least capacity or opportunity to prepare for the impacts of a changing climate. As they constitute the largest percentage of the world's poorest people; they are most affected by these changes (DFID, 2008).

Because climate change affects women and men differently, a gender equality perspective is essential when discussing policy development, decision making, and strategies for mitigation and adaptation (Aguilar *et al.*, 2009).

A gender-sensitive response requires more than a set of disaggregated data showing that climate change has differential impacts on women and men. It requires an understanding of existing inequalities between women and men, and of the ways in which climate change can exacerbate these inequalities. Conversely, it also requires an understanding of the ways in which these inequalities can exacerbate the impacts of climate change on women and men. For example, girls and women may have less access to vital information on mitigation or adaptation strategies because of time constraints due to their caring and other domestic responsibilities. This lack of information and lack of opportunity to feed their knowledge into community or national-level adaptation and mitigation strategies could jeopardize larger processes of reducing climate change and its impacts (DFID, 2008).

2.5 Gender Perspective in Vulnerability, Adaptation and Adaptive Capacity

DFID (2008) further explains that gender inequality is a major factor contributing to the increased vulnerability of women and girls in disaster situations that are being increasing linked to climate change. Vulnerability is a reflection of the state of the individual and collective physical, social, economic and environmental conditions at hand. These individual and collective conditions are shaped by many factors, among which gender plays a key role. Gender-based vulnerability does not derive from a single factor, but reflects historically and culturally specific patterns of relations in social institutions, culture, and personal lives (Enarson, 1998).

It has also been found that the vulnerability and capacity of a social group to adapt or change depends greatly on their assets. Next to their physical location, women's assets such as resources and land, knowledge, technology, power, decision-making potential, education, health care and food have been identified as determinant factors of vulnerability and adaptive capacity. As pointed out by Moser and Satterthwaite (2008), the more assets people have, the less vulnerable they are and the greater the erosion of people's assets, the greater their insecurity. Data from around the world indicates that women tend to have less or limited access to assets (physical, financial, human, social and natural capital).

Climate change would place additional burdens on women by altering the roles and tasks they perform. Pastoral women are particularly vulnerable to the effects of climate change which may often add to their already marginalized situation. Their disproportionate involvement in reproductive work, their frequently insecure property rights and limited access to resources, as well as their reduced mobility due to caring for children and the elderly in situations of stress, are some of the factors aggravating their particular vulnerability (Macchi *et al.,* 2008).

At the household level, the ability to adapt to changes in the climate depends on control over land, money, credit and tools; low dependency ratios; good health and personal mobility; household entitlements and food security; secure housing in safe locations; and freedom from violence (Lambrou & Piana, 2006). As such, women are often less able to adapt to climate change than men since they represent the majority of low-income earners, they generally have less education than men and are thus less likely to be reached by extension agents, and they are often denied rights to property and land which makes it difficult for them to access credit and agricultural extension services.

Moreover, gender biases in institutions often reproduce assumptions that it is men who are the farmers. As a result, new agricultural technologies – including the replacement of plant types and animal breeds with new varieties intended for higher drought or heat tolerance – are rarely available to women farmers.

Scarcity of water poses another disproportionate impact on women as water is an essential resource for women's productive and reproductive tasks. Water scarcity increases their chores, as they need to make greater efforts to collect, store, protect and distribute water (EP, 2009).

Longer distances and increased time for women to look for water, food and firewood often lead to girls' dropping out of school as their help is needed in their families. The loss of education has lifelong impacts and results in a lower chance of them claiming their rights. Increased violation of women's and girl's rights in the context of climatic variations have also been documented, for example in the case of pastoralist communities trading their daughters at ages as young as eight years old in order to replace livestock loss from drought (EP, 2009).

Gender inequalities exist in the access to resources such as land, credit, agricultural inputs, technology, and extension and training services that would enhance their capacity to adapt. In Liberia, women produce 60% of food crops despite their lack of access to farmland, low level of technological training and knowledge, and lack of financial assistance. An analysis of credit schemes in five African countries found that women received less than 10% of the credit awarded to male smallholders (Aguilar *et al.*, 2009). Women's assets largely determine how they will be affected by and respond to the impacts of climate change. Therefore, actions should be taken to build up the asset base of women as a fundamental principle in adaptation strategies.

2.6 Climate Change, Pastoralism and Gender in Ethiopian Context

In Ethiopia, it is assumed that the temperature has been increasing annually at the rate of 0.2°C over the past five decades. This has already led to a decline in agricultural production, and cereal production is expected to decline still further (by 12%) under moderate global warming. Moreover, it has led to a decline in biodiversity, shortage of food and increases in human and livestock health problems, rural-urban migration and dependency on external support. Factors compounding the impact of climate change in Ethiopia are rapid population growth, land degradation, widespread poverty, dependency on rained agriculture, lack of awareness by policy and decision-makers about climate change and lack of appropriate policies and legislation (Yohannes & Mebratu, 2009).

In Ethiopia pastoralism is the most important economic activity as many millions of people derive their livelihoods from this occupation. It has been variously estimated that about 12% of the populations of Ethiopian are engaged in this economy. As cited in Sileshi (2006), Coppock (1994) and Yemane (2000) have estimated that 30-40% of the livestock of Ethiopia are found in pastoral and agro-pastoral areas, which are mainly situated in the dry lands. Worth noting is that pastoralism in Ethiopia is both viable and vulnerable.

Climate change will have far-reaching impacts on the livelihoods of the dry lands of Ethiopia for various reasons. The economy of these areas is pastoral and agro-pastoral, both of which are vulnerable to climate. Climate change would affect the rangelands in many ways such as change in pasture productivity, in quantity and quality, change in livestock productivity, change in distribution and incidence of animal and plant disease. Climate change and climate variability are the major challenges for this sector (Sileshi, 2006).

Like most societies, gender disparity is deep-rooted in social, economic, cultural and political structures of the pastoral communities of Ethiopia; resulting in apparent imbalance of gender power relationship. As a result, pastoral women have low economic and social status than their men counterparts (Honey, 2007). However, these are the determinants of adaptive capacity that facilitate or constrain the development and deployment of adaptive measures (Kelly & Adger, 1999).

3. RESEARCH METHODOLOGY

3.1 Description of the Study Area

Amibara district is situated in Zone Three of Afar Regional State along the Awash River in the North Eastern part of Ethiopia. Amibara which is one of the six districts of Zone three has eighteen kebeles. In terms of geographical reference, the district is located between 09'N to 10'N and 39'45 E to 40'30 E longitude covering a total area of 925,450 hectare (Getachew, 2001).

The average altitude of the district is 740 masl with mean annual temperature of 34.1^{0}C. The rainfall distribution varies from year to year, but the average mean annual rainfall is about 575 mm. In general, arid and semi-arid climatic environment is the typical characteristics of the district (Getachew, 2001).

The total population of the district is 63,280 of which, 44 % are women. The rural population of the district is 31,194 of which 43.3 % are women. About 91 % of the population lives in rural areas. The average household size in the district is five persons per household (CSA, 2008). The district is inhabited by both Afar and non-Afar. The non-Afar are mainly highlanders who came after the introduction of irrigated agriculture in the 1960s. More than 30 Afar pastoral clans live in the area (Getachew, 2001). The livelihood of the Afar largely depends on traditional pastoralism with seasonal movement of people and livestock to other areas in search of water and forage.

The district is one of the richest areas of the region with fertile arable land, huge livestock number, and some mineral resources. The area is mostly known for large scale irrigated cotton plantation schemes. These private and state farm schemes make the area one of the major cotton producing locations in the country. It is suitable to grow different crops and vegetables all year round using the perennial Awash River (Ali, 1997). Moreover, the area is accessible to regional and external markets, as it is found 250 km from Addis Ababa on the main road to Djibouti port.

However, Ali (1997) argued in his study that pastoralists of the area are negatively affected by the introduction of irrigated agriculture. He also discussed that these pastoralists have been under

constant pressure due to the expansion and development of mechanized cotton production on irrigable lands. Accordingly, they have lost most of their dry season grazing lands to these development schemes. The total size of wet and dry season land alienated from the Afar clans of the Middle Awash is about 47,141 ha of land (Getachew, 2001).

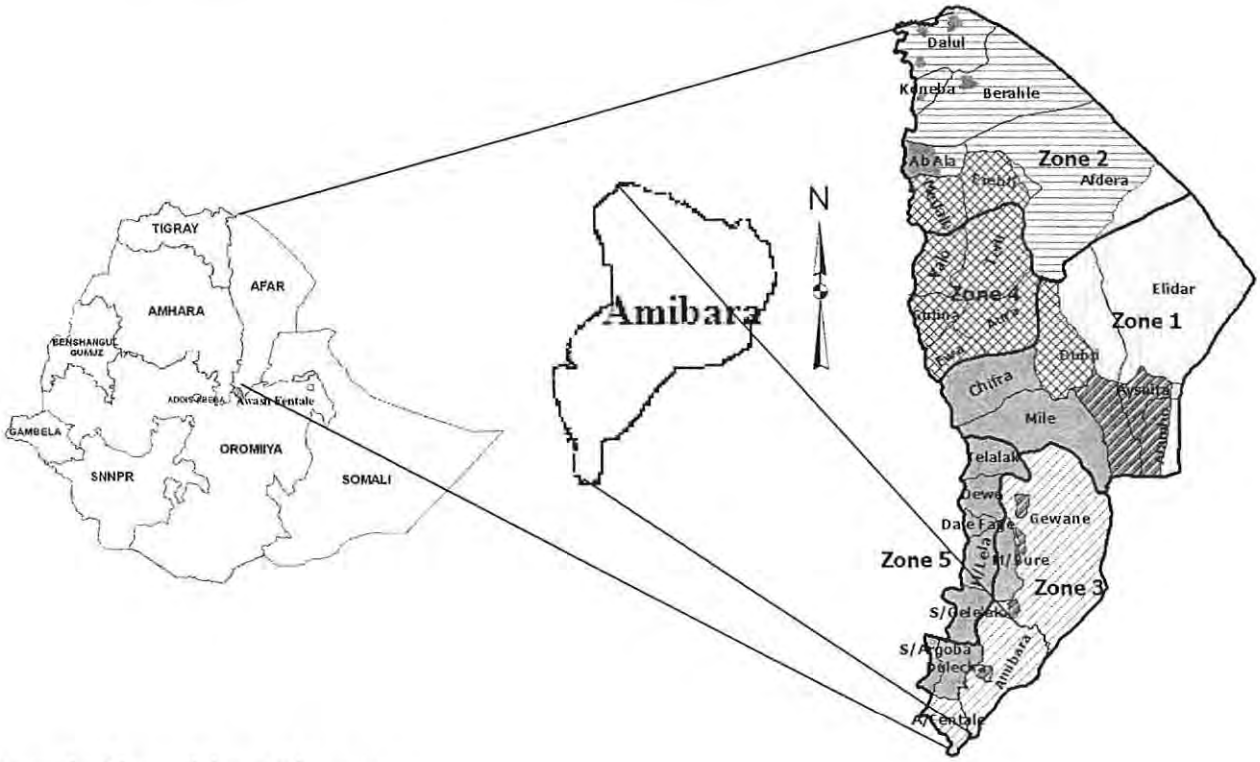

Figure 1: Map of the study area

3.2 Research Design

The primary aim of this research was to analyze and identify the general conditions of pastoralists' adaptation to the consequences of climate change in a gender disaggregated manner. To this end, descriptive study design was used to generate the relevant and pertinent data so as to assess the effects of climate change on the pastoral production system and examine the gender dimensions of pastoralists' adaptation to the consequences of climate change. Both quantitative and qualitative research approaches were employed to adequately address the research objectives. The quantitative methods include structured cross-sectional household survey and the qualitative methods include key informant interview, direct observation, focus group discussion and in-depth interviews.

3.3 Sampling Techniques

In order to select the study Woreda, kebeles and sample households both purposive and stratified random sampling techniques were employed.

3.3.1 Selection of the study area

In zone three of Afar Regional State there are six Woredas. Amibara Woreda, which is the most populous Woreda in the zone, is selected purposively to undertake this research. Since the Woreda is located in the center of Middle Awash there are a lot of government and private large scale irrigation based farms which provide employment opportunities for the local Afar community and immigrant workers. Halideghe plain which is among the largest grazing land is also located in this Woreda. Moreover, its accessibility, availability of both pure pastoralism and agro-pastoralism and familiarity of the researcher to the Woreda are among the underlying reasons for the selection of the study Woreda.

3.3.2 Selection of the kebeles and sample households

In the Woreda there are 18 kebeles where both pastoralism and agro-pastoralism are exercised. Three kebeles which have different degree of vulnerability to environmental and other stresses, bio-physical environment, socio-economic characteristics, livelihood activities and resource endowment were selected to represent the entire Woreda. Halideghe and Kele'at Buri kebeles which are pure pastoral, have no irrigation access, known for high livestock population and highly vulnerable to drought; and Ambash Bonta kebele which is agro-pastoral, has access to irrigation and access to wage labour on commercial farms were selected purposively.

In order to select sample households, the name of each household was obtained from elders and kebele chairpersons of the respective kebeles. These lists of households then stratified based on female and male headed households. Finally, equal proportion of female and male headed households that constitute a total of 90 sample households were randomly selected from the three kebeles.

3.4 Methods of Data Collection

3.4.1 Sources and types of data

As far as the types of the data concerned, both qualitative and quantitative data were collected. The quantitative data were used to quantify variations between women and men pastoralists, to predict causal relationships and to describe characteristics of the sample households. Similarly, the qualitative data were used to describe existing variations in adaptation strategies, to describe and explain relationships among socio-economic characteristics, vulnerability, adaptive capacity and adaptation strategies of women and men pastoralists. A combination of data collection methods were employed to collect data from primary sources. These include household survey, KII, FGD and direct field observation. These are discussed briefly below.

3.4.2 Primary data collection

1. Household survey

A household survey was conducted to examine the adaptive capacity and adaptation strategies of both households to the consequences of climate change and factors influencing their strategies. To this end a pre-tested interview schedule that contains the following information was administered: 1) socioeconomic profile of the respondent; 2) major effects of climate change on the pastoral production system; 3) major livelihood assets; 4) effect of climate change on the household's food availability, livestock and livestock feed, water supply, livelihood, and heath; and 5) major adaptation strategies of both female and male headed households. Besides, data on the roles and practices of institutions involved in pastoral development were gathered.

Figure 2: One of the interviews with woman head of household

2. Key informant interview

KII was conducted to generate in-depth information with regard to the adaptive capacity, extent of vulnerability and, adaptation and survival strategies of women and men pastoralists to the consequences of climate change. A total of fifteen key informants, five in each kebele were interviewed. Clan leaders, elders [both women and men], Kebele administrators and development agents were the members of the KII. Moreover, the district pastoral development official head, the district women affairs office head and representatives of various NGOs involved in pastoral development were interviewed. Checklist containing different guiding questions was prepared and used.

3. Focus group discussion

The main purpose of focus group discussion is to draw upon respondents' attitudes, feelings, beliefs, experiences and reactions in a way that would not be feasible using other methods, for example observation, one-to-one interviewing, or questionnaire surveys (Payne, J. and Payne G., 2004). Six different focus group discussions were conducted to generate information about women and men pastoralists' attitudes, feelings, perception and experiences in adapting to the consequences of climate change. In each kebele two FGDs both for women and men pastoralists were conducted. Seven women and men pastoralists from different age and wealth category constituted the members of the respective FGDs. In order to guide the FGDs a checklist containing different questions was developed and employed.

Figure 3: Women focus group discussion

Figure 4: Men focus group discussion

4. Field observation

Direct field observation has been also undertaken to collect first hand information. Both the bio-physical and social environment in which both women and men pastoralists interact and respond were observed. Moreover, various pictures have been captured for some of the observed situations. Information obtained by this method was very helpful to crosscheck information generated by other data collection methods.

3.4.3 Secondary data collection

All the necessary secondary information on the bio-physical and socioeconomic aspects of the study Woreda was collected from relevant agencies in order to understand the local and regional context of the local communities. Sources of the secondary information were published and unpublished materials, Woreda and Zonal reports, socio-demographic statistics of the Woreda and the region from central statistics authority, project documents and reports of various NGOs and research reports from Werer Agricultural Research Center. Moreover, 25 years of climate data including rainfall, temperature, wind speed and evapo-transpiration were obtained from agro-metrology division of the research center.

3.5 Methods of Data Analysis

In order to analyze the data, both qualitative and quantitative data analysis techniques were employed. The quantitative data were analyzed by using Statistical Package for Social Science (SPSS) version 16.0. Hence, simple descriptive and inferential statistics like mean, frequency, tables, chi-square and t-test were used to analyze and interpret the data. Interpretative and descriptive methods of data analysis techniques were applied to analyze and interpret the qualitative data. Moreover, content analysis was used to clearly examine and identify the adaptation and survival strategies of the pastoralists in a gender disaggregated manner.

4. RESULTS AND DISCUSSIONS

In this part of the thesis the results in relation to the respective objectives of the study are discussed and presented in detail. Each and every analysis and discussion has been done based on gender, which is the main variable of the study.

4.1 General Socioeconomic Characteristics of Sample Pastoral Households

A. Gender

Gender is the main variable on which the entire research approaches and analysis of results revolves around. As shown in table 1, both women and men headed households were represented in the sample population with equal proportion, i.e., 50% for each. Originally, the plan was to select women headed households based on their proportion. Obtaining sufficient number of households headed by women was expected to be difficult. However, during selection of sample respondents it was possible to obtain a good number of women headed households and it was decided to represent them with equal proportion with that of men headed households.

In the past it was hard to obtain households headed by women in the community. Because when the husband dies one of his brothers marries the widow and there were also very rare reports of divorce. Now-days, due to the intervention of governmental and non-governmental organizations and the existing legal support such kinds of practices have somewhat decreased. Moreover, there are emerging efforts in the Woreda that maintain women's interest while making divorce. As a result number of households headed by women is increasing. This is the justification given for the increased number of women headed households by focus group discussion participants.

Table 1: Sex of the household head

Sex	N	Percent
Female	45	50
Male	45	50
Total	90	100

Source: Own survey, December 2010

B. Age

The mean, the minimum and the maximum age of women headed households are 53, 30 and 98 years respectively. Similarly, the mean, the minimum and the maximum age of men headed households are 51, 26 and 80 years respectively (table 2).

Table 2: Age of the household head

Sex	N	Mean	Minimum	Maximum
Female	45	53.16	30	98
Male	45	51.31	26	80
Total	90	-	-	-

Source: Own survey, December 2010

C. Marital status

As shown in table 3, out of the total women headed households 64.4% are widowed and 35.6% are divorced. Similarly, for men headed households' polygamy and married account 53.3% and 31.1% respectively. The rest 15.5% stands for both divorced and widowed.

Table 3: Marital status of the household head

Marital Status	Women		Men	
	N	Percent	N	Percent
Married	0	0	24	53.3
Divorced	16	35.6	2	4.4
Widowed	29	64.4	5	11.1
Polygamy	0	0	14	31.1
Total	45	100	45	100

Source: Own survey, December 2010

D. Household size

As depicted in table 4, 62.2% of women headed households have household size below six and 33.3% of them fall within the category of 7-9 household size. Only 4.4% of the households have household size above 10. For men headed households 42.2% and 33.3% of them fall within the

category of below six and 7-9 respectively. Unlike their women counterparts, 24.4% of men headed households have household size above 10. Similarly, the mean household size of women and men headed households are 6.04 and 7.98 respectively (table 20).

Table 4: Household size of sample respondents

Household Size	Women		Men	
	N	Percent	N	Percent
< 4	2	4.4	1	2.2
4 – 6	26	57.8	18	40
7 – 9	15	33.4	15	33.4
10+	2	4.4	11	24.4
Total	45	100	45	100

Source: Own survey, December 2010

E. Ethnic affiliation

All women and men headed sampled respondents belong to the Afar ethnic group. All households selected from Halideghe, Kele'at Buri and Ambash Bonta kebele belong to *Arkemela*, *Rekba Dermela* and *Sideha Bura* clans respectively.

F. Educational attainment

Table 5 below shows, all women and 88.9% of men interviewed are illiterate. Men respondents who can read and write without attending formal education are 4.4%. Only 6.6% of them are educated up to grade eight.

Table 5: Educational level of the household heads

Educational Level	Women		Men	
	N	Percent	N	Percent
Illiterate	45	100	40	88.9
No formal education but read and write	0	0	2	4.4
1-4 grade	0	0	1	2.3
5-8 grade	0	0	2	4.4
Total	45	100	45	100

Source: Own survey, December 2010

4.2 Pastoralists' Observation of Changes in the Local Climate

4.2.1 Pastoralists' perception about climate change

There are clearly visible differences between women and men headed households with regard to their sources of information concerning climate change. As indicated in table 8 (appendix 2), 68.9% of women have not heard about climate change so far, whereas 51.1% of men respondents have heard about climate change from different sources. From table 6 below, out of those who heard about climate change, only 28.6% women respondents heard about it from radio. Those who heard the same information from the local community including local weather predictors constitute 85.7%. However, 65.2% of men respondents obtained this information from radio and about 43.5% heard from the community and local weather predictors. Hereafter the term women headed and men headed households are referred as women and men respectively.

Table 6: Source of information about climate change

Source of Information	Women (N=14)		Men (N=23)	
	N	Percent[1]	N	Percent[1]
Radio	4	28.6	15	65.2
NGOs	1	7.1	0	0
Local weather predictors	12	85.7	10	43.5

Source: Own survey, December 2010 (Multiple responses are possible)

When it comes to observing changes in the local climate, respondents in all the study areas are very well aware of the apparent changes in the most important parameters of the local climate mainly in relation to rainfall and temperature. The most important parameters for rainfall are amount, distribution, pattern, frequency, duration and timing. Duration, hotness and coldness are important parameters of temperature on which changes are observed. As observed in all group discussions, all women and men respondents perceived that the climate has changed from the past and it is in the process of change.

[1] The percentage total is more than hundred since multiple responses are provided by the respondents. And the percent is calculated for those who have heard about climate change. (women=17 and men=23)

4.2.2 Local weather prediction system

Previously, there was strong local weather prediction system in the area, as mentioned by women and men focus group discussion participants. *Ginil* and *Utukbiya* are the names given for those who were responsible for local weather prediction. These days the role of these local weather predictors has been reduced due to the expansion of Islamic religious teachings. Currently there are very few people who make weather prediction at local level. However, they have been condemned and the information generated by them is no more regarded as credible by the majority of the community. Religious leaders are teaching the community not to participate in such kinds of activities and not to trust this information. Participation in either of these two is considered as an act of breaking the rules of the religion. Allah is the one and the only one who has the power to control the entire aspect of the climate. This is the most widely accepted belief among the pastoral communities. During focus group discussion, participants strongly underlined that the era of *Ginil* and *Utukbiya* is now over.

The elders, who are responsible for undertaking local weather prediction, perform the task by thoroughly examining the astronomical alignment of stars. Based on the observation, they generate information concerning the coming season. As observed in all men focus group discussions, participants were not comfortable enough to discuss more details about the entire process of the local weather prediction. The task is currently condemned. As a result they do not have the interest to talk more about it. Concerning the dissemination of the generated information, both women and men pastoralists get access to it through the well developed traditional information exchange system locally known as *dagu. Dagu* is the name given for the traditional information transmission system of the Afar people.

With regard to participation of women in local climate prediction system, focus group discussion participants in all the study kebeles confirmed that there were no women's participation in the system and the task was solely done by elder men members of the community.

4.2.3 Pastoralists' observation of the local climate

I. Observed changes in rainfall

The pastoral community has observed changes on the different attributes of the local rainfall. The changes are noticeable and rapid mainly over the last 20 years. According to them, the rainfall has significantly deviated from the long term trend in terms of amount, distribution, pattern, frequency, duration and timing. The most important change is extensive reduction in rainfall amount. Moreover, it has become more erratic and poor in distribution; there is significant delay in time of rain onset and considerable decrease in number of rainy days.

As presented in table 7, 97.8% of women and all men respondents have reported that the amount of rainfall has decreased. Similarly, women and men who observed delays in onset of rain are 55.6% and 62.2% respectively. Findings from focus group discussions show that, there is also higher degree of variation in rainfall across seasons before and after the last 20 years. The major seasons are *Karma, Gilal, Sugum* and *Hagai. Karma* is the main rainy season and *Hagai* is the dry season. Previously, the rain lasts for more than two months and its amount and distribution was good during this season. However, the current *Karma* rain is characterized as poor in amount, unpredictable, very few rainy days and poor in distribution.

Table 7: Observed changes in the rainfall

	Women (N=45)		Men (N=45)		Total (N=90)	
Change in Rainfall	N	Percent	N	Percent	N	Percent
Amount of rainfall decreased	44	97.8	45	100	89	98.7
Heavy rain in short period of time	4	8.9	1	2.2	5	5.6
Early rainfall	4	8.9	5	11.1	9	10
Delay of rainfall	25	55.6	28	62.2	53	58.9
Other	1	2.2	1	2.2	2	2.2

Source: Own survey, December 2010 (Multiple responses are possible)

Furthermore, rainfall data from 1970 to 2010 has been analyzed for the purpose of comparing the observation of the pastoralists with meteorological observation. This rainfall data is obtained from Werer Research Center meteorology station. As shown in graph 1 (see appendix 1), annual total rainfall has shown increasing trend. Similarly, in *Karma* which is the main rainy season,

there is an increasing trend (graph 2). However, this result seems quite the opposite of the pastoralists' observation. On the other hand, *Sugum* rain which is the short rainy season shows a decreasing trend (see graph 2, appendix 1). There is no difference between women and men with regard to observing changes in the local climate; both have similar observations.

Generally there is no decrease in total annual rainfall of the area, as results from weather data analysis revealed. However, number of rainy days has reduced and there is heavy rainfall within very short period of time. Apparently this kind of rain is not useful for the pastoralists and growth of grasses in rangelands since most of the water become runoff. Moreover, the gap between two consecutive rain days has increased than as it was before. Hence, even germination of grasses and other plant species initiated by the preceding rain will be aborted due to moisture stress. These all are the basis for the pastoralists' observation and these might be the possible reasons for the disparity between their observation and the analysis of weather data. The observed changes, therefore, can be taken as manifestation of climate change.

II. Observed changes in temperature

There is consensus among the pastoral community with regard to changes in temperature. All the participants of focus group discussions agreed that the temperature of the area is increasing over the last 20 years. More specifically, temperature in *Hagai* season has increased and it is getting hotter and drier. The duration of the dry and hot season has increased than as it was before. Moreover, the cool season (*Gilal*) temperature has become colder.

Similarly, temperature data from 1970 to 2010 has been analyzed and the result as shown in graph 4 and 5 (see appendix 1) reveals that there is increasing trend in temperature over the last 40 years. Hence, the observation of the pastoralists' is in tandem with the analysis of temperature data from meteorology station.

4.3 Key Impacts of Climate Change on Production System

In this section of the thesis both the direct and indirect impacts of climate change on the pastoral production system are discussed.

As reported by Agrawal (2008), the direct effects of climate change will include higher temperatures and changing rainfall patterns, which could translate into the increased spread of existing vector-borne diseases and macro-parasites, accompanied by the emergence and circulation of new diseases. Some of the indirect effects will be brought about by, for example, changes in feed resources linked to the carrying capacity of rangelands, the buffering abilities of ecosystems, intensified desertification processes, increased scarcity of water resources, decreased grain production.

As clearly elucidated in section 4.2.3, the perception of the pastoral community and the analysis of meteorological data imply that there are observed changes in the most important parameters of the local climate. Hence, it is natural that these observed changes bring various adverse impacts on important resources of the production system and of the pastoralists' livelihoods.

The major impacts of the perceived climate change on the livelihood of the pastoral community over the last twenty years are; recurrent drought, reduction in livestock population and productivity, reduction of livestock feed in quantity and quality, shrinkage of rangelands, deterioration of household food security, scarcity of water for human and livestock use, and emergence and spread of new human and livestock diseases. Regardless of their similar observations of changes in the climate, these impacts affected women and men differently. In section 4.4.2 their different degree of vulnerability to these impacts has been discussed in the light of their respective adaptive capacity.

I. Drought

The frequency and severity of drought have increased considerably over the last 20 years. There were three major droughts occurred in the area from 1970-1990. These were *Keda Amna* of the 1972/73, *Unda Amna* of the 1984/85 and the 1993/94. However, after 1991 a lot of droughts have occurred and brought damage on the livelihood of the pastoralists. According to focus group discussion participants, there is significant difference in frequency of drought occurrence before and after 1991. Before 1991 the average drought occurrence interval was 8 years, however after that the drought interval reduced to 2-3 years.

With regard to disruption of drought on livelihood, results from the survey and focus group discussions reveal that it is increasing sharply. Though the drought interval before 1991 was larger, the droughts of this period were extremely devastating compared to recent droughts. However, the major difference between the pre and post 1991 droughts is the former gives time for the pastoralists to rebuild their asset base whereas the later occur before they recover from the damage of the preceding drought.

The majority of women and men that constitute 71.1% and 66.7% respectively said that disruption of drought on livelihood has increased within the specified period of time (table 8). From the same table, 24.4% and 33.3% women and men respectively said that drought disruption on livelihoods has decreased. The major reasons given by them include; now days availability of human and livestock heath services have relatively improved, there is relatively improved water points in the villages and there is response from the government and concerned organizations than before during periods of drought.

Table 8: Disruption of drought on livelihood over the last 20 years

Disruption on livelihood	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Increased	32	71.1	30	66.7	62	68.9
Decreased	11	24.4	15	33.3	26	28.9
No change	2	4.4	0	0	2	2.2
Total	45	100	45	100	90	100

Source: Own survey, December 2010

The increased frequency of recent droughts take the lion share for the continued and gradual depletion of the most important livelihood resources of the pastoral households and consequently increased their vulnerability to subsequent droughts and other climate and non-climate hazards. FAO (2009) has found out that, the increased extent and duration of drought periods will impact the sustainability, viability and resilience of livestock and livelihoods in dry lands. Moreover, post-drought recovery of pastoral systems through herd reconstitution and replenishment of water sources will be less dependable.

II. Impacts on livestock population and productivity

In pastoral and agro-pastoral systems livestock are key assets for fulfilling multiple economic, social and risk management functions. The impact of climate change is expected to heighten the vulnerability of livestock systems and reinforce existing factors that are affecting livestock production. For pastoral communities, losing livestock assets could trigger a collapse into chronic poverty and have a lasting effect on livelihoods (Agrawal, 2008).

Almost all respondents, 97.8% of women and 93.3% of men said that their livestock population has decreased (table 9). The major reasons identified by the pastoralists are reduced availability of feed, scarcity of water and emergence of new diseases.

Table 9: Status of livestock holding at household level over the last 20 years

Livestock Holding	Women		Men	
	N	Percent	N	Percent
Increased	1	2.2	2	4.4
Decreased	44	97.8	42	93.3
No change	0	0	1	2.2
Total	45	100	45	100

Source: Own survey, December 2010

There is also considerable reduction of livestock productivity in terms of milk and meat production over the last two decades. This is due to the existing acute shortage of livestock feed which can be associated with the observed changes in the climate. There are a lot of evidences in the literature that substantiate this fact. For instance, Rowlinson (2008) as cited in Agrawal (2008), climate change will have far-reaching consequences for dairy, meat and wool production, mainly arising from its impact on grassland and rangeland productivity. Heat distress suffered by animals will reduce the rate of animal feed intake and result in poor growth performance.

As displayed in table 10, almost all women and men respondents noted that both dry and wet season milk production at household level have decreased. The reasons given for livestock population reduction are also applicable for the decline in productivity. Interestingly, participants of focus group discussions were not comfortable to plainly conclude the decreased livestock

population as a major factor for productivity decline. There are few households with more or less similar livestock holdings as before. However, they are not obtaining the same quantity of milk today as it was in the past from the same number of livestock. Hence, acute feed shortage coupled with other factors was mentioned as the primary reason for productivity decline.

Table 10: Dry and wet season milk production over the last 20 years

	Women		Men	
Dry season	N	Percent	N	Percent
Increased	0	0	2	4.4
Decreased	45	100	43	95.6
Total	45	100	45	100
Wet season				
Increased	5	11.1	3	6.7
Decreased	39	86.7	41	91.1
No change	1	2.2	1	2.2
Total	45	100	45	100

Source: Own survey, December 2010

III. Impacts on livestock feed availability

Like any other pastoral communities elsewhere; livestock feed is the most essential resource that determines, among others, the general conditions of household livelihood and food security due to its direct effect on livestock productivity. As a result of the observed changes and increased frequency of climate hazards, livestock feed availability has tremendously reduced.

All women and men reported that there is intolerable reduction of rangeland in area coverage and productivity (table 11). The existing erratic rainfall and recurrent drought are among the major factors contributed for the reduction. Moreover, focus group discussion participants suggested other factors for the increased shrinkage of rangeland area and deterioration of productivity. These include prosopis invasion, expansion of farming and overgrazing. As displayed in table 10 (appendix 2), the pastoralists have identified various important grass species which were abundant in the past and became inaccessible over the last 20 years.

Table 11: Description of rangeland area and productivity over the last 20 years

Rangeland Area	Women		Men	
	N	Percent	N	Percent
Increased	0	0	0	0
Decreased	43	95.6	45	100
No change	2	4.4	0	0
Total	45	100	45	100
Range Productivity				
Increased	1	2.2	0	0
Decreased	43	95.6	45	100
Do not know	1	2.2	0	0
Total	45	100	45	100

Source: Own survey, December 2010

IV. Impacts on household food security

Food security occurs when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (FAO, 2002). However, there are strong evidences in the literature that all dimensions of food security are likely to be affected by climate change (Ludi, 2009). In all the study Kebeles, both women and men participants of focus group discussions have confirmed that food security status at household level is deteriorating and number of people who need food aid are increasing from time to time.

Table 12: Household food security situations over the last 20 years

Adequacy of Food	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Yes	11	24.4	19	42.2	30	33.3
No	34	75.6	26	57.8	60	66.7
Total	45	100	45	100	90	100

Source: Own survey, December 2010

As table 12 shows, 75.6% of women believe they do not get adequate food for their households on daily basis and the rest 24.4% said they obtain adequate food. In the contrary, 42.2% of men obtain adequate food for their households on daily basis and 57.8% of them are food in-secure.

Household food security situation of women and men respondents varies when we make deeper investigation at Kebele level. Out of the women who consider themselves food self-sufficient, 81.8% of them are from Halideghe kebele. The rest 18.2% are at Kele'at Buri and none of the households at Ambash Kebele reported as food secure. Similarly, more than half of men, i.e. 52.6%, who reported as food secure are located at Halideghe and 80.8% of food in-secure households are from the other two kebeles. This shows that, though women headed households in general are food in-secure, both women and men headed households in Halideghe kebele are relatively better than the rest in household food security situation.

There is no visible difference among the three kebeles with regard to extent of climate change. The observed changes in rainfall and temperature, and the associated impacts like increased severity and frequency of drought are common to all kebeles. The only difference is there is a risk of flooding in Kele'at Buri and Ambash Bonta kebeles since they are adjacent to Awash River. However, group discussion participants asserted that frequency of flooding is decreasing through time. There is no risk of flooding in Halideghe kebele. The variation in food security across the three kebeles is mainly associated with the differences in livestock resource endowment and access to rangelands.

Pastoral households in Halideghe, which is found to be better in food security situation, have higher number of livestock compared to the other two kebeles. In addition to this Halideghe plain, which is among the largest rangelands, is located adjacent to this kebele. This all contributed for the relatively good food security situation in this kebele regardless of similar extent of climate change in all the study kebeles.

According to focus group discussion participants, deterioration of household food security status and increased number of people in need of food aid are the result of loss of livestock and other important livelihood assets by the recurrent drought, which in turn is a clear manifestation of the observed changes in the important parameters of the local climate.

V. Impacts on water availability

Generally, the physical availability of water points has improved from the past in most of the study areas. This is due to the establishment of new manual and generator operating underground and tap water in the villages. However, this progress is accompanied by various factors which have seriously reversed the benefits that the community supposed to enjoy. These include; high imbalance between number of water points and users due to increased population, frequent failure of generator and manually operated ground water points and lack of proper and timely maintenance and provision of spare parts and fuel.

As shown in table 13, 77.8% of women and 66.7% of men noted reduction of water availability both for human and livestock use. Group discussion participants underlined that water availability significantly reduces in dry season. In the past, the rainfall was sufficient both in amount and distribution. As a result, there were various *duras,* naturally harvested water ponds. These *duras* were the major water sources for both household and livestock use during dry season of the year. Now days, these *duras* have completely dried due to repeated failure of rain and reduction in amount. Even in times of good rain, the water in *duras* dry very shortly due to the high rate of evaporation associated with the increased temperature.

The apparent changes in the climate are, therefore, the major reasons for natural water harvesting ponds and other water points to totally vanish. These in turn have added another burden to the already existing water problem in the study area.

Table 13: Water availability for human and livestock over the last 20 years

	Women		Men		Total	
Water availability	N	Percent	N	Percent	N	Percent
Increased	10	22.2	15	33.3	25	27.8
Decreased	35	77.8	30	66.7	65	72.2
Total	45	100	45	100	90	100

Source: Own survey, December 2010

VI. Impacts human and livestock health

New human diseases which were not known before have emerged over the last two decades. Earlier the most prevalent human disease was malaria. Now days, malaria spread has decreased to some extent. Children are more vulnerable to the newly emerged diseases. Some of the newly emerged diseases are more common in cool seasons and others like skin disease increase in dry seasons. IPCC (2007) predicted that, the negative health effects of rising temperatures increases in malnutrition, diarrheal diseases, disease and injury due to heat waves, floods and droughts. Vector-borne diseases such as malaria and dengue fever could become more widespread.

Table 14: Observed changes in human disease over the last 20 years

	Women (N=45)		Men=(N=45)	
Human disease	N	Percent	N	Percent
New human disease emerged	35	77.8	43	95.6
Increased spread of existing disease	8	17.8	9	20
Disease spread decreased	6	13.3	3	6.7
No significant change	6	13.3	1	2.2
Other	1	2.2	0	0

Source: Own survey, December 2010 (Multiple responses are possible)

As it is clearly presented in table 14, emergence of new human diseases is the most widely accepted change with regard to human health related challenges. 77.8% of women and 95.6% of men have noted this change. The newly emerged human diseases are displayed in appendix 2, table 9. In line with this, results from focus group discussions show that due to household food security deterioration and associated changes in food consumption pattern their susceptibility to disease has increased.

The pastoralists have also noticed changes in connection with emergence and spread of new livestock diseases. The pastoralists' observation is in tandem with the findings of UNDP (2009), this is increased aridity, climatic variability and hazards such as prolonged droughts often induce disease of livestock due to unavailability of sufficient fodder. Moreover, with climate change, rainfall is expected to become more variable and introduction of new livestock diseases may occur.

The vast majority of respondents that constitute 73.3% of women and 88.9% of men noted the emergence of new livestock diseases in all the study areas (table 15). The newly emerged livestock diseases are displayed in appendix 2, table 9. The existing acute shortage of livestock feed has dual role in aggravating the problem. First, due to feed unavailability livestock are becoming more susceptible to diseases. Second, huge numbers of livestock from different areas graze at Halideghe rangeland for prolonged period of time. This has contributed a lot for transmission of diseases into new areas.

Table 15: Observed changes in livestock disease over the last 20 years

	Women=(N=45)		Men=(N=45)	
Livestock disease	N	Percent	N	Percent
New livestock disease emerged	33	73.3	40	88.9
Increased spread of existing disease	10	22.2	8	17.8
Disease spread decreased	11	24.4	8	17.8
No significant change	2	4.4	1	2.2

Source: Own survey, December 2010 (Multiple responses are possible)

4.4 Adaptive Capacity and Vulnerability of Women and Men Pastoralists

4.4.1 Adaptive capacity

In this section, the vulnerability of women and men to climate change related impacts has been assessed based on their respective adaptive capacity. As noted by Burton *et al.* (1997), with regard to climate change the vulnerability of a given system or society is a function of its physical exposure to climate change effects and its ability to adapt to these conditions.

Women and men respondents' physical exposure for various climate related hazards is somewhat similar in all the study areas. Thus, both are generally vulnerable to the adverse effects of climate change hazards. However, despite their comparable physical exposure, women and men have clearly distinct adaptive capacity in terms of access to and control over important livelihood resources and services. Unfortunately, these are the major factors that determine and influence their vulnerability to climate change hazards regardless of their similar physical exposure. In this study, therefore, adaptive capacity of women and men has taken as an appropriate entry point to

shed light on their respective vulnerability. Based on the assessment of their adaptive capacity in this sub section, their different degree of vulnerability will be discussed in section 4.4.2.

Now let us look the profile of women and men sample respondents with regard to the most important household resources and other services that determine their vulnerability and capacity to adequately adapt the impacts of climate change consequences.

A. Financial capital

Livestock holding: In the study area, number of livestock holding is the major factor for classification of households into different wealth groups, i.e., rich, middle and poor. Table 16 shows women and men respondents' livestock holding in different categories. The livestock in each household is converted into TLU by using TLU conversation factors suggested by Strock *et al.* (1991) in order to standardize the size (See appendix 2, table 5).

The vast majority of women that constitute 80% owned less than 35 TLU and 20% of them owned between 35-69 livestock in TLU. There are no women who owned above 70 TLU. In the contrary, 46.7% of men respondents owned more than 35 TLU and out of these 24.5% of them are those who owned more than 70 livestock in TLU.

Table 16: Household livestock holding in TLU

	Women		Men		Total	
Livestock category	N	Percent	N	Percent	N	Percent
< 35	36	80	24	53.3	60	66.7
35 – 69	9	20	10	22.2	19	21.1
70 – 104	0	0	7	15.6	7	7.8
105+	0	0	4	8.9	4	4.4
Total	45	100	45	100	90	100

Source: Own survey, December 2010

Moreover, from table 17 the mean livestock holding in TLU for women and men are 22.2 and 55.94 respectively. The maximum livestock holding in TLU for women and men are 69 and 439 respectively. Results of the t-test analysis also show that there is statistically significant

difference between the mean TLU of women and men. This shows that women have generally small livestock holding compared to men.

Table 17: Summary statistics of livestock holding in TLU

Sex of the head	N	Minimum	Maximum	Mean	Std. Deviation	t-value
Female	45	1	69	22.2	22.249	-2.575*
Male	45	3	439	55.94	85.026	

Source: Own survey, December 2010, * significant at 5% level (see appendix 2, table 1 for t-test)

Various social and cultural factors have contributed for the few livestock possession of women. All women participated in this study are either divorced or widowed. Both women and men group discussion participants underlined that a woman has no wealth inheritance right from her parent. Likewise, she has conditional right to share wealth during divorce and death of her husband.

During divorce or death of her husband a woman will get nothing from the household's wealth. She only gets some during divorce if and only if there is a marriage contract */nikah/* in the form of few livestock or if she has sons not daughters, otherwise she leaves the house with nothing. Similarly, when her husband dies she only shares the wealth if there are sons, otherwise the entire wealth will be taken by the husband's family.

Recently, there are efforts geared towards improving the wealth inheritance right of women through teaching and creating awareness among the pastoral community. In addition to these, there are also religious laws and obligations that support women's wealth inheritance right. In spite of these increased efforts, there is no fundamental improvement with regard to wealth inheritance right of women from the past.

Income sources: Women and men respondents have different sources of income. From the table 18 below, sale of livestock, sale of livestock products and wage labour are the main income sources for 48.9%, 15.6% and 24.4% of women respectively. Similarly, sale of livestock, sale of livestock products and wage labour are the primary income sources for 55.5%, 22.2% and 17.8% of men respondents respectively. Though household labor availability is a critical problem for households headed by women, wage labor is one of the important sources of income for them.

Table 18: Main income sources

Income source	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Sale of livestock	22	48.9	25	55.5	47	52.3
Sale of livestock products	7	15.6	10	22.3	17	18.9
Sale of grain	1	2.2	1	2.2	2	2.2
Wage labor	11	24.5	8	17.8	19	21.1
Return from clan land owned by investors	1	2.2	1	2.2	2	2.2
Petty trading	1	2.2	0	0	1	1.1
Remittance	2	4.4	0	0	2	2.2
Total	45	100	45	100	90	100

Source: Own survey, December 2010

With regard to additional income sources, allowance from clan land owned by investors is the major secondary income source for 46.5% of women and 72.7% of men. Again from table 2 (see appendix 2), 39.5% of women and exactly half of men obtain their secondary income from wage labour.

There is visible difference between women and men respondents' access to income from clan land owned by investors. All men members of the community, who are above 15 years, are the direct beneficiary of this income and have inalienable right to get share from it. In contrast, women are not eligible to obtain this income. They get access to this income indirectly through either their sons, if they have any, or from their relatives in the form of remittance. This shows that women in general are denied access to the benefits obtained from the most important communal resources of the society. Moreover, the t-test analysis shows there is statistically significant difference in the mean annual income of women and men. The t-value is -2.092 which is significant at 5% level (see appendix 2, table 3).

Saving and credit: Reports of World Bank (2010) shows that, overall, men have higher access to credit than women do. It has been argued that if women in sub-Saharan Africa had access to the same inputs as men do, food production would increase by 10-20%. Similarly, the results of the survey show unavailability of formal saving and credit institutions in the study area.

Though there are no formal saving and credit service in the study area, only 8.9% of women and 26.7% of men have got access to credit service from informal sources (table 19). In spite of the unavailability of formal credit service, men have better access to informal credit services than women. Women's limited access to informal credit is directly associated with their limited capacity to repay the loan.

Table 19: Access to credit service

Access to credit	Women		Men	
	N	Percent	N	Percent
Yes	4	8.9	12	26.7
No	41	91.1	33	73.3
Total	45	100	45	100

Source: Own survey, December 2010

Women, as displayed in table 4 (see appendix 2), are better in saving money than their men counterparts. Most of them save money at their home since there is no functional saving and credit institution in the area. Lack of extra money is their primary reason for not saving. Conversely, lack of extra money was not mentioned by men as their primary reason for not saving, though it is a problem. The existing extravagance in money utilization and poor culture of saving are their major reasons. This kind of understanding was clearly observed and reflected in most of the focus group discussions and household interviews held with men.

B. Human capital

Household size: Generally, women have smaller household size than their men counterpart. As displayed in table 20, the mean household size of women is 6.04 whereas the mean household size for men is 7.98. Moreover, the t-test analysis results show that there is statistically significant difference between the means of both households. Though the mean household size of women seems a bit high, they still reported household labour shortage as their major constraint. As a result the head is expected to accomplish activities both within and outside the household. Thus, they have limited time to engage on various jobs to diversify their income. In the contrary,

men are enjoying the benefits of larger household size both in normal and hardship times. Diversification of income and sharing of household workload are extra advantages for them.

Table 20: Summary statistics of household size

Sex of the household head	N	Mean	Std. Deviation	t-value
Female	45	6.04	1.870	-3.086 *
Male	45	7.98	3.763	

Source: Own survey, December 2010, *significant at 5% level (see appendix 2, table 6 for t-test)

Training: A lot of empirical research shows that, women's very limited access to information and training will surely restrict their capacity to adapt (UNFPA, 2009). Results from the survey as indicated in table 21 are also confirming this fact. Only 13.3% of women have obtained some kind of training within the last two years, whereas 37.8% of men have got the chance to participate in training within the specified time.

Table 21: Training in the last two years

Training attended	Women		Men	
	N	Percent	N	Percent
Yes	6	13.3	17	37.8
No	39	86.7	28	62.2
Total	45	100	45	100

Source: Own survey, December 2010

C. Social capital

Social support: As shown in table 22, 40% of women and 22.2% of men obtained support from the local self-help mechanisms of the community during periods of drought and food shortage. Similarly, 77.8% of women and 60% of men obtained food aid from the government during the same period.

As we can observe from the table below, larger number of women obtained local support from the community and food aid from the government at times of drought and food shortage. This is a clear reflection of their greater vulnerability for these hazards. Though supporting poor households in times of hardship is age old culture of the Afar pastoralists, the existing social self-help mechanisms are decreasing from time to time for various reasons, as reported by group

discussion participants. Given the weakening trends in the local social support systems, women in particular are expected to be more vulnerable for future climate change related hazards.

Table 22: Social support from the community and food aid from government

Social support	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Received	18	40	10	22.2	28	31.1
Not Received	27	60	35	77.8	62	68.9
Total	45	100	45	100	90	100
Food aid received						
Yes	35	77.8	27	60	62	68.9
No	10	22.2	18	40	28	31.1
Total	45	100	45	100	90	100

Source: Own survey, December 2010

D. Other important services

Early warning information: Early warning systems and improved climate information can help pastoralists to take appropriate actions in a timely manner depending on expected weather conditions (UNEP, 2009). Generally the current early warning system in the Woreda is very poor and it is not functioning properly. Within the Woreda Pastoral Development Office there is a department responsible for organizing and disseminating early warning information to the pastoralists. The department focuses on drought related early warning information. However, currently the department is not well organized to properly and timely deliver this information.

Table 23: Access to early warning information

Early Warning Information	Women		Men	
	N	Percent	N	Percent
Yes	3	6.7	14	31.1
No	42	93.3	31	68.9
Total	45	100	45	100

Source: Own survey, December 2010

Despite the existing poor early warning system, men have better access to this service as they have for other important services. Women that constitute only 6.7% have access to early warning information, but 31.1% of men have access to the same service (table 23).

Agricultural Extension: Access to agricultural extension service in Ethiopia varied widely across regions, ranging from 2% in Afar to 54% in Tigray (World Bank, 2010). This shows that the provision of the service is very poor in the Woreda in particular and the region in general.

When we look at access to this service in the study area, only 11.1% of women have got access to agricultural extension service whereas 89.9% of them did not get the service. In the contrary, 33.3% of men respondents, who are threefold of their women counterparts, have got access to agricultural extension service (table 24). Moreover, men are by far better than women in type and number of services they have obtained. They have got supports and advices, for example, in livestock production and disease control, crop production and management, natural resource conservation and management and also received inputs like livestock medicine and fertilizers.

Table 24: Access to agricultural extension services

Extension Service	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Yes	5	11.1	15	33.3	20	22.2
No	40	88.9	30	66.7	70	77.8
Total	45	100	45	100	90	100

Source: Own survey, December 2010

> The following statement clearly reveals women's position in relation to the service. "*I know there are development agents assigned to the village, I see them and I know what they are doing. However, so far I haven't been visited by and obtained information from them. I am totally denied the service they are providing for others.* " (Women, 55, Ambash Bonta kebele)

Improved agricultural technologies: The following statistics substantiates women's limited access to important services. From table 25, only 6.7% of them have got access to improved agricultural technologies from different sources. In the contrary, 35.6% of men have got access to the same service. The main providers of this service in the study area, as identified by the respondents, are WPDO, WARC and few NGOs. Women are completely omitted from the agricultural technology dissemination formula of these organizations.

Table 25: Access to improved agricultural technologies

Agricultural Technologies	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Yes	3	6.7	16	35.6	19	21.1
No	42	93.3	29	64.4	71	78.9
Total	45	100	45	100	90	100

Source: Own survey, December 2010

Health Extension: As to respondents access to health extension service, significant number of women and men respondents that constitute 64.4% and 68.9% respectively have got the service (table 26). Unlike agricultural extension agents all health extension workers are females. Hence, this has contributed a lot in facilitating communication with women which could otherwise be difficult for men health extension workers due to cultural communication barriers. This could be the possible reason for women's better access to health extension service.

Table 26: Access to health extension services

Health Extension	Women		Men		Total	
	N	Percent	N	Percent	N	Percent
Yes	29	64.4	31	68.9	60	66.7
No	16	35.6	14	31.1	30	33.3
Total	45	100	45	100	90	100

Source: Own survey, December 2010

As discussed in this section, there are noticeable differences between women and men sample respondents' access to and control over important livelihood resources and services. Women have lower status than men in financial capital in the form of livestock holding and income sources, human capital in terms of availability of household labour, training and skills, and in their access to early warning information, extension service and improved agricultural technology. Therefore, in general they have limited capacity which is vital to adequately adapt climate change related hazards.

4.4.2 Vulnerability to consequences of climate change

Vulnerability is a function of the nature and types of assets households and individuals possess (Agrawal, 2008). Moreover, vulnerability is a reflection of the state of the individual and collective physical, social, economic and environmental conditions at hand. These individual and collective conditions are shaped by many factors, among which gender plays a key role. Gender-based vulnerability does not derive from a single factor, but reflects historically and culturally specific patterns of relations in social institutions, culture, and personal lives (Enarson, 1998).

Table 27: Key Indicators of Vulnerability at Different Levels

Community Level	Household Level
1) Poverty	1) poverty
2) inequality	2) dependence on risky resources
3) social capital	3) asset portfolios
4) social entrepreneurs	4) occupations
5) institutional interconnections	5) skill sets
6) institutional density	6) information availability
7) institutional effectiveness	7) labor availability
8) gender composition	8) institutional access
9) cultural factors (whether indigenous)	9) literacy
10) age compositions	10) gender balance

Source: Adopted from Brooks *et al.* (2005)

Brooks *et al.* (2005) has identified various key indicators of vulnerability both at community and household levels (table 27). Lower status in terms of household level indicators means, that particular household has limited capacity to adapt and is more vulnerable to climate change related consequences. There are ample convincing evidences from the study that show the lower status of women in most of the key household level vulnerability indicators. This means, there are visible disparities between women and men in terms of their poverty level, dependence on risky resources, asset portfolios, occupations, information access, labour availability and literacy.

Women's poor financial condition is an outcome of their few livestock holding and limited opportunity for wage paying jobs. Livestock holding is dictated by the exiting social and cultural norms which denied their wealth inheritance right. This in turn has a crippling effect on their

income level. Moreover, as a result of their smaller household size there is extensive workload on the head and this has contributed a lot for their limited access to wage paying jobs.

As discussed in the above sections availability of important household resources are worsening from time to time for various reasons and these have been also aggravated by the observed changes in the climate. These have brought additional burden on women due to the increased time and distance required to obtain these resources. The increased burden due to resource scarcity coupled with limited labor availability has blocked them from diversifying their income sources by engaging on wage paying jobs.

During periods of drought both households face food shortage, shortage of water for livestock and human use, shortage of feed and death of livestock. As reported by women and men focus group discussion participants, in these periods they have to purchase food items, supplementary livestock feed and medicine for livestock from market and collect water and feed from areas where available. However, women's limited financial capacity and the higher prices of those items in market are severely constraining them. Moreover, due to their less household labor availability their workload tremendously increases during these periods. Thus, women are more vulnerable to drought. This is because men are relatively at good position in livestock holding, income and household labor availability, but these are major problem for women.

The other reasons contributed for women's higher vulnerability to climate change related hazards are their poor access to training, early warning information, agricultural extension services and improved technologies. As a result they are disadvantaged in obtaining vital information that can augment their knowledge and skill with regard to livestock production and management and other important day to day activities. Moreover, they have poor access to improved agricultural technologies and inputs. These all made women more vulnerable to hazards than men since they lack the required capacity to reduce vulnerability and damage on livelihood.

As indicated in section 4.3, extinction of important grass and other plant species are among the key impacts of the observed changes in the climate. As a result grass and plant species which are important to construct traditional Afar houses have vanished and become difficult to obtain. Women and men focus group discussion participants in all the study areas have confirmed that

construction and regular maintenance of Afar traditional houses are totally the responsibility of women, and men have no role in all these activities.

However, collecting and preparing important construction materials like grasses, woods and plant species have become backbreaking task. Moreover, in Kele'at Buri Kebele there is heavy wind which is damaging the houses and increased the frequency of rebuilding and maintaining damaged houses. These all have greatly aggravated the already existing burden of women headed households in particular and pastoral women in general, and made them more vulnerable in the face of the adverse impacts climate change.

Deterioration of pastoral households' food security situation is the other manifestation of the negative impacts of climate change. Obviously, the observed change in the climate, with its associated impact on rainfall and temperature, takes the lion share in aggravating livestock feed availability decline and emergence and spread of diseases. Even though these have far-reaching effect on the food security condition of both households, the impact on women is higher. As a result of women's few livestock holding together with their lower income, which is insufficient to fill food deficit, their household food supply is inadequate. Thus, they are more vulnerable than their men counterparts.

As noted by focus group discussion participants, among the different segments of the pastoral community, women are more vulnerable to climate related hazards. And their vulnerability to these hazards is directly linked to and emanates from their limited capacity in terms of financial capital, human capital and access to other important services.

In this section we have seen women's greater vulnerability in the face of various climate change related hazards. However, this does not mean all men are not vulnerable. There are also men who have lower adaptive capacity. Here, the general logic is households who have lower adaptive capacity are more vulnerable than those with better capacity. The challenges that are facing both households are more or less similar. However, the specific contexts of each household are quite different to the level that can greatly influence the outcome of their efforts geared towards minimizing vulnerability and damage on livelihood.

What is the reason that makes the vulnerability of women more complex and persistent than those men who have similar capacity to adapt? The findings of the study suggest that the underlying reason is the existing extreme gender inequalities which stem from the inherent social and cultural configuration of the community. These well established social and cultural norms are the fundamental factor that hampered women from accumulating wealth and accessing important communal resources.

Hence, women's vulnerability is a function of their poor adaptive capacity shaped by the existing biased gender relations and the increased frequency and severity of hazards that contributed for livelihood resources depletion. However, men's vulnerability is greatly associated with the gradual depletion of livelihood assets due to the increased frequency and severity of hazards.

4.5 Adaptation Strategies of Women and Men to Consequences of Climate Change

As clearly illustrated in section 4.2, various changes have been observed in the local climate. These changes in the climate have brought major challenges on important livelihood resources of the pastoralists which are discussed in section 4.3. Moreover, in section 4.4, the vulnerability and adaptive capacity of women and men have been clearly outlined.

Both women and men respondents have adopted various adaptation strategies to cope with climate change consequences thereby to lessen their vulnerability. In the preceding section we have seen the differences between women and men with regard to possession of livelihood resources and access to other important services. However, according to Agrawal (2008) most adaptation choices households and communities choose depend upon the nature and combination of assets and opportunities they have.

4.5.1 Coping strategies for drought

Recurrent drought is one of the major climate change consequences observed in all the study areas. The frequency and severity of drought is increasing from time to time. During periods of drought the pastoral community faces various challenges like shortage of feed, food and water, and death of livestock. These all pose burden on the pastoral households' general wellbeing and

demand greater efforts to cope with or adapt to the challenges thereby to reduce livelihood damage.

In the study area, complete failure or insufficient amount of rainfall in one season can trigger drought. This has immediate and tremendous impact in reducing livestock feed and water availability, and death of livestock. It also facilitates disease outbreak. These all contribute to household food availability and income decline. In response to these challenges both women and men employed different coping strategies in combination.

Table 28: Drought coping strategies

	Women=(N=45)		Men=(N=45)		Total=(N=90)	
Coping strategies	N	Percent	N	Percent	N	Percent
Selling livestock	9	20	16	35.6	25	27.8
Taking livestock to other areas	43	95.6	42	93.3	85	94.4
Bringing water and feed from other areas	20	44.4	25	55.6	45	50
Doing nothing	1	2.2	2	4.4	3	3.3
Other	3	6.7	1	2.2	4	4.4

Source: Own survey, December 2010 (Multiple responses are possible)

As shown in table 28 above, both women and men adopted various strategies mainly to reduce damage and death of livestock. The most important strategy for both households is taking livestock to other areas where feed and water is available. 95.6% of women and 93.3% of men employed this strategy. Bringing water and feed from other areas is used as a strategy by 44.4% of women and 55.6% of men. Some 20% of women and 35.5% of men employed selling livestock as a strategy during this time. Here it is important to understand the reason why they sell livestock. Their primary intention was not to convert livestock resource into cash and simultaneously reduce death; rather they only sell few livestock to obtain money in order to purchase important household items from market.

Generally, both households prefer moving to other areas in search of feed and water. In this case men go with camels to very distant places but adult women and men together manage cattle. Women and children are also responsible to look after small ruminants. However, for two reasons this major strategy is in serious trouble and becoming less effective. First, most of the

grazing lands are situated in border areas. They face intense conflict with neighboring clans on this resource during this time. This in turn leads to death of human life and raiding of livestock, and consequently their mobility is highly restricted. Second, they follow alternative conflict free paths to search grazing areas. However, even after long distance travel obtaining sufficient feed is very unlikely. Moreover, it is quite difficult to obtain both feed and water side by side. Thus, they are expected to search water in other places. These all have contributed a lot for death of weak livestock and suffering of the pastoralists.

With regard to collecting and bringing livestock feed and water from other areas, in the first place this task is totally done by women in both households. Men's role in this activity is nil. Due to the scarcity and unavailability of these resources within the villages, women are expected to move longer distance. Hence, workload of women greatly increases during drought periods.

The respondents were asked what strategies they undertake in advance if they get early warning information concerning drought is about to occur in the coming year. Most of women and men that constitute 46.7% and 42.2% respectively said that they will not take any measure in advance based on early warning information (see appendix 2, table 7). This is greatly attributed to the lower value given to the importance of early warning information by the majority of the pastoral community. This is because most of them do not consider the information as reliable.

About 35.6% of women and 26.7% of men reported that they will accumulate livestock feed in advance (see appendix 2, table 7). Frankly speaking, the pastoralists have very limited practice of storing livestock feed even at good seasons for use in stress times. The following speech taken from one of the men focus group discussion participants substantiates this reality.

> *"I know many non-Afar people in my neighborhood who collect and store livestock feed in their compound during good seasons. Even, I know how and why they are doing this. You very well know the work culture of the Afar people, so how dare you expect most of us to do this?"* (Men, 45, Ambash Bonta Kebele.)

But, women respondents found better in accumulating livestock feed during good seasons for later use in shortage periods. As explained above, collecting livestock feed from anywhere is

exclusively women's job and responsibility. This could be the justification for their higher percentage in adopting storing livestock feed as a strategy. Destocking is a strategy for only 15.6% of both women and men. Women who adopted storing food for the family and leaving the area as strategy constitute 15.6% and 24.4% respectively. Similarly, the corresponding figures for men are 22.2 % and 28.9 % respectively (see appendix 2, table 7).

4.5.2 Strategies for livestock feed shortage

Livestock feed shortage is the most challenging problem for the pastoral households. Livestock feed availability, which is highly dependent on and influenced by rainfall amount and distribution, is the single most important factor that determines livestock productivity in particular and the wellbeing of the pastoral household in general. Hence, women and men respondents adopted various strategies in combination to overcome this critical problem.

The strategies adopted by women and men are the clear indication of the existing differences in their respective adaptive capacities, roles and responsibility. Taking livestock to other places in search of feed is again the major strategy for 93.3% of women and 95.7% of men respondents. About 37.8% of women and 24.5% of men give priority for milking animals when feed availability decline (table 29). There are clearly visible disparities between women and men on adopting stored feed utilization, forage crop production and purchasing livestock feed as strategy.

Women that constitute more than twofold of their men counterparts use stored livestock feed as a strategy. On the other hand, none of women and 13.2% of men headed households produce different forage crops in order to supplement feed. In Ambash Bonta kebele there are both pastoralists and agro-pastoralists households. Some of the agro-pastoral households who have land cultivate crops. About 31.1% of men that is almost double of women (17.8%) adopted purchasing additional feed from market as a response strategy for the same problem (table 29).

Table 29: Feed shortage strategies

	Women (N=45)		Men (N=45)		Total (N=90)	
Strategies	N	Percent	N	Percent	N	Percent
Using stored livestock feed	10	22.2	4	8.9	14	15.5
Producing forage crops	0	0	6	13.2	6	6.6
Purchasing livestock feed	8	17.8	14	31.1	22	24.4
Destocking	6	13.3	7	15.5	13	14.4
Taking livestock to other places	42	93.3	43	95.7	85	94.4
Giving priority for milking animals	17	37.8	11	24.5	28	31.1

Source: Own survey, December 2010 (Multiple responses are possible)

The higher percentage of women in adopting utilization of stored livestock feed as a strategy is attributed to their primary role in feed collection and accumulation. Land is important resource and smallholder crop cultivation is highly dominated by men since they have control over the resource. This is the reason contributed for the adoption of forage crop production by higher percentage of men. Lack of money is also constraining women from purchasing livestock feed.

4.5.3 Strategies for household food shortage

As discussed in section 4.3, as a result of the noticeable changes in the climate and its subsequent negative impacts on feed availability and livestock productivity, household food security has severely deteriorated. In rainy season household food security condition is relatively good due to improved livestock feed availability. However, in dry and stress periods food availability immediately drops and a good number of households become food insecure. During these periods, both women and men adopted different strategies to cope with the problem.

In table 30, for 68.9% of women and 95.6% of men, selling livestock and other assets to purchase food items is the most widely adopted strategy. Reducing meal frequency is another important strategy for 46.7% women and 55.6% men. Use of stored food is also an adaptation strategy adopted by 20% of women and 42.2% of men. Additional strategies include reducing amounts of food consumed, and utilization of other food items which are not consumed in good seasons.

Table 30: Food shortage strategies

	Women (N=45)		Men (N=45)	
Adaptation strategies	N	Percent	N	Percent
Use of stored food	9	20	19	42.2
Reducing meal frequency	21	46.7	25	55.6
Sell of livestock and other assets	31	68.9	43	95.6
Reducing amount of food consumed	6	13.3	4	8.9
Consuming food items not used in good season	14	31.1	11	24.4

Source: Own survey, December 2010 (Multiple responses are possible)

Results from focus group discussion show that women mainly at Halideghe kebele store butter during wet seasons and sell it in times of food shortage to purchase food items from market. However, lack of market for their product due to poor transport service is a challenge. Similarly, women in Ambash Bonta kebele engage on wage paying jobs, if available, to earn additional income in order to purchase consumption goods from market when they face food shortage.

In the past pastoral households used to consume various fruits and edible products obtained from different tree species in times of food shortage. Collection of these edible products from elsewhere was entirely women's task. Currently most of these edible forest products are difficult to obtain due to the eradication of these important tree species. Hence, collection of these items as a strategy for coping household food shortage has now become a laborious task for women.

4.5.4 Strategies for water shortage both for the household and livestock

Availability of water for both human and livestock use has enormously declined. Natural water harvesting ponds that were used as major water sources in the past have almost vanished. This has a direct link with the observed reduction in rainfall amount and increasing trend in temperature. The problem becomes more serious and challenging during dry seasons. Both women and men respondents of the study employed various strategies to address this problem.

With regard to water shortage for household use, women bring water from Awash River, Bilen natural spring or any other places by the help of camel and donkey. The other strategy is that they dig temporary springs along the bed of Awash or any other dried river. Women in

Halideghe kebele reported that drinking milk, if available, is also the other option to cope with water shortage.

Men also employ similar strategy like bringing water from areas where it is available by animals. But, in these households this task is completely done by women members of the family. Unlike women, men undertake other strategies to tackle household water shortage. These includes, bringing water from nearby towns like Werer and Awash Araba by vehicle, using irrigation water if available, settling around Awash river and other water sources and digging underground water.

The adaptation strategies of both households are summarized and presented in the box below.

Box 1[2]: Strategies for coping human and livestock water shortage

Women	Men
Strategy for coping household water shortage	
▪ Bring water from Awash River, Bilen natural spring or any other source by animals ▪ Drinking milk if available ▪ Digging temporary springs along the bed of Awash river when its volume decreases	▪ Bring water from Awash River, Bilen natural spring or any other source by animals ▪ Bringing water from nearby towns by vehicle ▪ Using irrigation water if it is available ▪ Settling around Awash River ▪ Digging underground water
Strategy for coping livestock water shortage	
▪ Taking livestock where water is available /Awash River or Bilen natural spring/ ▪ Bringing water for sick and weak animals, calves and milking cows ▪ constructing house around water sources	▪ Taking livestock where water is available /Awash River or Bilen natural spring/ ▪ Bringing water for sick and weak animals, calves and milking cows ▪ constructing house at water point / Awash river ▪ increase watering interval

Source: Own survey, December 2010

As far as water shortage for livestock is concerned, women suggested that taking livestock to other areas where water is available is the most important strategy. At the same time they bring water home for calves, sick and milking animals. When the problem becomes intolerable and

[2] Responses obtained from open-ended questions

hard to cope, they leave the area and construct their houses around water points. Similar to women, taking livestock to different water points and bringing water home for those incapable to walk long distances are reported by men as their important strategies. The difference is that men are more responsible for taking camels and cattle to other areas, whereas women members of the household are responsible for watering small ruminants and brining water home for incapable animals. Moreover, men mentioned increasing watering frequency of livestock as strategy for overcoming livestock water shortage.

4.5.5 Strategies for livestock disease

Almost all women and men respondents agreed that new livestock diseases which were not known in the past have emerged and disease spread has increased at alarming rate. However, there is no promising progress in expansion and coverage of livestock health services in the kebeles. Information obtained from the Woreda Pastoral Development Office indicates that, there are only five livestock clinics that are expected to provide service for the entire Woreda. These livestock clinics do not have the necessary trained manpower, medicines and other equipments. Given the severity and urgency of the problem, it is virtually difficult to satisfy the increasing demands of the pastoral community with these available facilities.

Table 31: Livestock disease strategies

	Women (N=45)		Men (N=45)		Total (N=90)	
Adaptation strategies	N	Percent	N	Percent	N	Percent
using nearby livestock clinic	33	73.3	36	80	69	76.7
traditional medicine	6	13.3	12	26.7	18	20
purchasing medicine from other area	26	57.8	32	71.1	58	64.4

Source: Own survey, December 2010 (Multiple responses are possible)

As shown in table 31, in spite of the existing scenario of livestock health service in the Woreda, the majority of women and men that constitute 73.3% and 80% still depend on the service of these clinics as a solution for livestock health related problems. At the same time purchasing livestock medicines from other areas is also a strategy for 57.8% of women and 71.1% of men. Moreover, only 13.3% women and 26.7% of men reported that use of traditional medicine is the other alternative strategy practiced in the area as a response to livestock disease.

4.6 Factors Constraining Adaptation Strategies of Women and Men Pastoralists

In the previous section various adaptation strategies of women and men pastoralists adopted in response to the consequences of climate change to reduce their vulnerability, and wellbeing and livelihood crises have been discussed. A particular pastoral household undertakes different coping strategies in combination depending on its adaptive capacity. Those with lower capacity will have limited choice to employ relevant and effective strategies to adequately cope with the hazards. Hence, adaptation strategy is a mirror image of that particular household's capacity to cope with the problems. However various factors constrain these strategies.

Different factors which constrain pastoral households' adaptation strategies have been identified. Some of the factors constrain both women and men. On the other hand, there are also factors exclusively constraining either women or men. Some factors that seriously influence choice of women's adaptation strategies can not necessarily be challenges for men. Here comes the importance of gender perspective to better comprehend existing disparities in relation to factors constraining adaptation strategies of women and men which could otherwise remain overlooked.

Women and men have identified major factors which constrain their respective adaptation strategies as summarized and presented in the box above. Household labour shortage, increased workload, low financial capacity, scarcity of house construction material, lack of employment opportunity, poor access to services, weakening of social self help system and extinction of wild food were identified by women as their major constraining factors. Here it is important to understand the relationship among these constraining factors. Because most of these factors are not mutually exclusive rather they reinforce each other.

Due to serious household labour shortage in women headed households, most of the household activities are performed by the head. This coupled with the declining availability of important household items like grass, water and fuel wood within short radius have consumed most of their time and efforts and consequently increased their workload. Consequently, they have little time to engage on wage paying jobs to earn additional income especially during stress periods.

Box 2[3]: Major factors constraining adaptation strategies of households

Women	Men
▪ Household labour shortage	▪ Extravagance and poor saving
▪ Increased workload	▪ Poor culture of planning in advance
▪ Low financial capacity	▪ Lack of commitment for destocking
▪ Scarcity of house construction material	▪ limited financial capacity
▪ Lack of employment opportunity	▪ Absence of local cooperatives
▪ Poor access to services	▪ Illiteracy and lack of awareness
▪ Weakening of social self-help	▪ Conflict
▪ Extinction of wild food	▪ Inflation
▪ Illiteracy and lack of awareness	▪ Lower livestock market price in drought
▪ Conflict with neighboring clans	▪ Absence of credit service
▪ Inflation	▪ Invasion of prosopis
▪ Lower livestock market price in drought	▪ Expansion of farming
▪ Absence of credit service	▪ In adequacy of government support
▪ Invasion of prosopis	
▪ Expansion of agricultural farm	
▪ Lack of government attention	

Source: Own survey, December 2010

Grass and wood important for constructing traditional Afar house have wiped out and become difficult to access. However, construction of traditional Afar houses is totally the responsibility of women. Thus, collecting and preparing these items have become tiresome task for them. Moreover, as explained in earlier sections wild fruits and edible tree products have become difficult to find due to the extinction of important tree species. As a result, collecting these items as a coping strategy during periods of household food shortage has severely constrained.

3 Responses obtained from open-ended questions

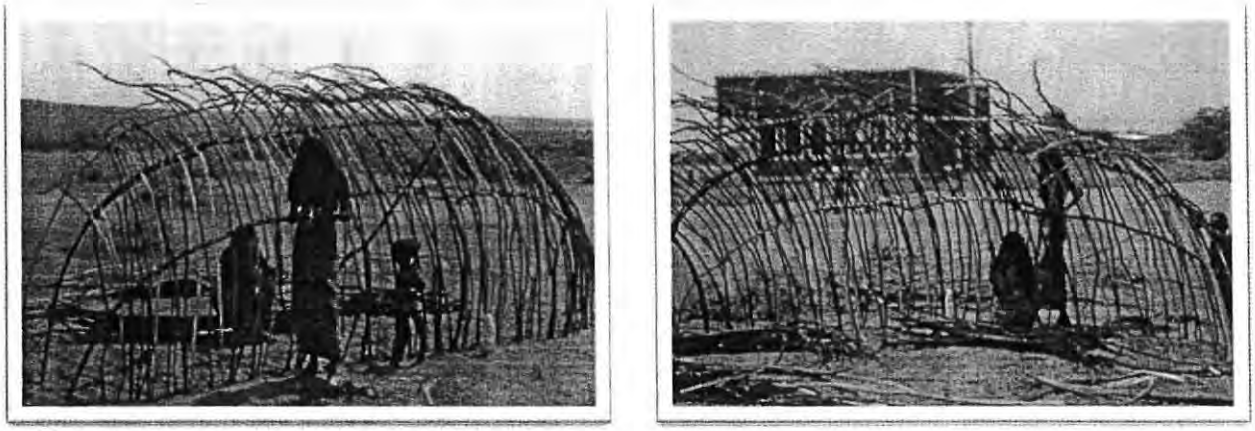

Figure 5: Women constructing traditional Afar house

Women's poor financial capacity is also constraining them from purchasing important items from market which are required to cope with household food shortage, livestock feed decline and disease outbreak in drought and other stress periods. Above all, their poor access to different services has restricted them from obtaining essential inputs and information. However, these have vital contribution in augmenting the effectiveness of their adaptation measures and reducing their vulnerability to climate change hazards.

Receiving different supports from the local community is an important coping strategy for women when household food availability turns down. Through these local self help mechanisms most women obtained support in the form of milk, milking cows temporarily, food grain and small ruminants in periods of hardship. However, this days local self help mechanisms have greatly declined for various reasons. Therefore, weakening of social self help is constraining and continues to constrain their coping strategy.

Men on the other hand mentioned extravagant way of life and poor saving, poor culture of planning in advance, lack of commitment for livestock destocking particularly in drought periods, illiteracy and lack of awareness, and absence of local cooperatives as their major factors constraining adaptation strategies.

Participants of men focus group discussions expressed that due to the existing extravagant way of life and poor saving habit particularly in relation to managing financial resources, they are

unable to put money for future use. This can be associated with the existing limited awareness about the importance of saving and inability to plan in advance.

The other critical constraint is lack of courage and commitment to destock livestock during drought time or based on early warning information. In the first place, it is unreasonable for them to make this difficult decision based on such kinds of information which they do not consider as dependable. On the other hand, if drought occurs they hope that there might be a possibility to withstand this period with minimum loss. However, the existing reality of the pastoralists is extremely different from what they thought to be. In most cases the loss on their livestock due to drought and other hazards is unbearable.

Thus, most of them are not willing to sell livestock as a response strategy to reduce the inevitable death and damage. Focus group discussion participants suggested two major reasons for this. First, due to the existing higher degree of reliance on the livestock the pastoralists in general do not have the courage to sell part of their livestock. Doing this is considered as unnecessary depletion of ones own property. Second, lower market price of livestock during drought period is also severely constraining them not to adopt livestock destocking as a strategy.

The following statement which is taken from one of the participants of men focus group discussion clearly illustrates the value given for early warning information.

> "*Let us assume I got early warning information concerning drought is about to occur in the coming few months and I have been also told to sell part of my livestock to reduce death and damage. Frankly speaking, I will not sell part of my livestock based on such kinds of information. You know, the rain is at the hand of Allah, so what if it rains a week after I sold my livestock. I do not think the Afar people do have the courage to do this.*" (Male 72, Ambash Bonta Kebele.)

Factors which are constraining the adaptation strategies of both households include; illiteracy and lack of awareness, conflict with neighboring clans, inflation, lower livestock market price during periods of drought, absence of formal credit service, invasion of prosopis, expansion of agricultural farms, lack of government attention and support. Though these are constraining both households, the burden posed by these factors on women is obviously higher due to their limited adaptive capacity.

As a result of increased conflict with neighboring communities of the Somali Issa and the Oromo Kereyu tribes on rangelands, the mobility of the pastoralists' has highly restricted. However, taking livestock to other areas in search of livestock feed is the most preferred adaptation strategy of both households during periods of feed shortage. Hence, restricted mobility is impeding them from effectively adopting this strategy. Similarly as reported by Davies and Bennett (2007), for pastoralist and agro-pastoralist populations efforts to limit mobility could lead to greater vulnerability and lower adaptive capacity.

In the face of the declining trend in livestock feed availability, taking animals to other places in search of feed is no more a viable strategy for the pastoralists. Participants of focus group discussion in all the study kebeles reported that due to intense conflict with neighboring communities on this resource, death of people and livestock raiding have increased. Though this is the reality, the pastoralist move to conflicting areas to obtain feed for their livestock and accordingly face the terrible consequences that follow, because they have no choice.

During drought and other hardship periods the pastoralists face various challenges namely food scarcity, livestock feed shortage and others that need to be addressed. In order to purchase household food, supplementary livestock feed and other important items they sell livestock as a strategy. However, the lower market price of livestock in these periods is constraining this adaptation strategy. In periods of drought the livestock become physically weak and unattractive due to feed shortage and disease outbreak and this in turn reduce their market price.

5. CONCLUSSIONS AND POLICY IMPLICATIONS

5.1 Conclusion

The primary objective of this study was to identify and document the existing disparities between women and men headed pastoral households' in their vulnerability to climate change related consequences and adaptation strategies they adopt in response to these stresses. Moreover, the study tried to investigate their respective adaptive capacities and pinpointed the major factors which constrain their respective strategies.

It is clear that merely generating disaggregated data with regard to the differential impacts of climate change on women and men is not sufficient to adequately realize the objectives of the study. As noted by DFID (2008), a gender-sensitive research requires more than a set of disaggregated data showing that climate change has differential impacts on women and men. It requires an understanding of existing inequalities between women and men, and of the ways in which climate change can exacerbate these inequalities. On the other hand, it also requires an understanding of the ways in which these inequalities can exacerbate the impacts of climate change on women and men.

Therefore, in addition to generating gender disaggregated date on the differential impacts of climate change, the study has spent some efforts to investigate the existing gender based inequalities within the pastoral community. The social and cultural norms of the community which are responsible for shaping and perpetuating these inequalities have been also assessed and presented so as to have a better understanding of the interplay between climate change impacts and gender inequality.

There are convincing changes observed in the local climate and these changes are widely recognized by both women and men headed pastoral households. Extensive changes have been observed in the rainfall and temperature of the area and these changes have become more visible and rapid over the last two decades. The rainfall has highly reduced in amount, became erratic and poor in distribution, and reduced in number of rainy days. Similarly the temperature has

become hotter and colder in dry and cool seasons respectively. Moreover, increased frequency and intensity of extreme events like drought has also observed.

These observed changes have brought various impacts on the pastoral production system and consequently on the livelihoods of women and men headed households. These include; livestock population reduction and extensive decline in productivity, shortage of livestock feed availability, extinction of important tree and grass species, deterioration of household food security, water shortage, and emergence of new livestock and human diseases.

Though all the current challenges faced by women and men are in one way or the other a clear reflection of the changes observed in the climate, it is pretty difficult to plainly conclude the changes in the climate as a sole source of all these challenges. This is because there are also a lot of other stresses that have been already challenging the pastoralists' lives and livelihoods. The most important thing that should be taken into account is the changes in the climate have brought additional burden on existing challenges of the pastoral community. But, the implication for households headed by women and other resource poor pastoralists is quite different.

Results from the study clearly show that there are statistically significant differences in the means of women and men headed households' family size, annual income and livestock holding. Women headed households are by far disadvantaged than their men counterparts in terms of possessing these resources. However, these are very crucial for the household to adequately adapt to the perceived impacts of the changes in the climate. Therefore, adaptation strategies adopted by women, whenever they are exposed to climate related hazards, are highly dependent on and determined by these limited resources that are at their immediate disposal.

On the other hand, men headed households are by far better in income since they have a good number of livestock and employment opportunity. Thus, they have relatively better capacity to cope with various impacts associated with climate change. Here it is important to understand that this is not applicable to all men in all the study kebeles. Men at Kele'at Buri kebele have few numbers of livestock and income compared with the other two kebeles namely, Halideghe and Ambash Bonta.

Moreover, women headed households in general have limited access to agricultural extension, training opportunity, wage paying jobs, improved agricultural technologies, early warning information and credit services. In the contrary, men headed households have better record in accessing these important services. Women only have better access to health extension service and they are found relatively good in saving than men.

It is straightforward that women's limited resource endowment and poor access to important services have brought two choices which they can not escape in the face of current and future climate change related consequences. First, whenever they become exposed to the adverse impact of climate change, they bear all the losses and risks without making adequate effort to adapt and reduce damage. Second, they employ various strategies to adapt to these hazards at the expense of their future livelihood sustainability. Given the increasing trend in frequency and severity of drought hazard and in a situation of no sufficient time to rebuild their resource base, these choices are no more viable.

The existing social and cultural norms of the community have contributed a lot for women's lower social and economic status. They have impeded women from accumulating wealth thereby to enhance their economic and social status. Moreover, households headed by women are not recognized and given a full household status by the community. Similarly, most government and non-government organizations operating in the area do not recognize and incorporate them in their activities and services. Most of their services are directed to households headed by men. Therefore, households headed by women are the invisible but the most vulnerable segment of the community.

Paradoxically, the number of pastoral households headed by women is increasing from time to time for the various reasons explained in the earlier section. Therefore, neglecting this emerging but fragile segment of the community, in development and service provision endeavors will definitely exacerbate the existing livelihood challenges and consequently increase their vulnerability to climate and non-climate related hazards.

Both women and men headed households adopted different adaptation strategies in combination in response to the identified impacts of climate change. Differences have observed in their strategies adopted during periods of drought, household feed shortage, water shortage, livestock feed shortage and disease outbreak. These variations are mainly stem from the existing differences in their adaptive capacity. Moreover, adaption strategies adopted by both women and men pastoral households in response to climate change hazards are highly deteriorated and their efficiency and sustainability are uncertain and most of them are becoming less effective.

Various factors that constrain the adaptation strategies of women and men headed households have been also identified. Household labour shortage, increased workload , low financial capacity, scarcity of house construction material, lack of employment opportunity, poor access to services, weakening of social self help mechanisms and extinction of wild food are among the major factors that constrain women headed households.

There are also other factors which are common for both households. These include, for instance, conflict with neighboring tribes, inflation, lower livestock market price during periods of drought, absence of credit service, prosopis invasion, expansion of farming and inadequacy of government support. Though these are constraining factors for both households, women headed households' existing conditions coupled with the biased gender relation in the community have made them more susceptible to these factors than men headed households.

5.2 Policy Implications

Pastoral development initiatives devised and implemented with the aim of enhancing the community's adaptive capacity thereby to reduce their vulnerability will not necessarily address the needs of women headed households. Therefore, this calls for targeted and gender responsive approaches which take into account the specific contexts of both households. Based on the findings of the study the following policy implications are drawn.

- Number of households headed by women is increasing overtime. Therefore, the existence of these households within the community should be fully recognized and given full household status by organizations operating in the area. On top of this, the organizations should treat them as the way they treat any other pastoral households in their service provision endeavors.

- More effort is also needed from the concerned governmental and non-governmental organizations to improve the existing unfair gender relation through raising the awareness of the community thereby to ensure the wealth inheritance right of women.

- Generally there is a need to improve the quality and coverage of important services like agricultural extension, saving and credit, animal health and early warning information delivery. Beyond this maximum emphasis should be given for women headed households so as to enhance their access to and benefit from these services.

- Failure to take action following early warning information has brought unbearable losses on the livestock resource of the community. Because the majority of the community have very poor understanding about the importance of this information and do not consider it as reliable. Hence, efforts should go beyond strengthening the quality and timely delivery of early warning information. Ahead of this intensive work should be done to raise the awareness of the community about its importance. Besides, community based early warning system that involves women and men pastoralists should be devised and implemented

- Lack of courage and determination of the pastoralists for destocking unproductive livestock especially during drought and stress periods is a serious challenge. Hence, appropriate intervention is needed from the concerned organizations to improve the awareness of the community in this regard. Moreover, concerned organizations should participate both by purchasing and facilitating market opportunities to livestock during periods of drought when livestock price become low.

- Various water harvesting structures should be constructed through the participation of the local community in order to harvest runoff water both for livestock and household use. Inline with this, every forage development and rangeland rehabilitation efforts should be supported by water harvesting structures so as to utilize the available meager moisture efficiently.

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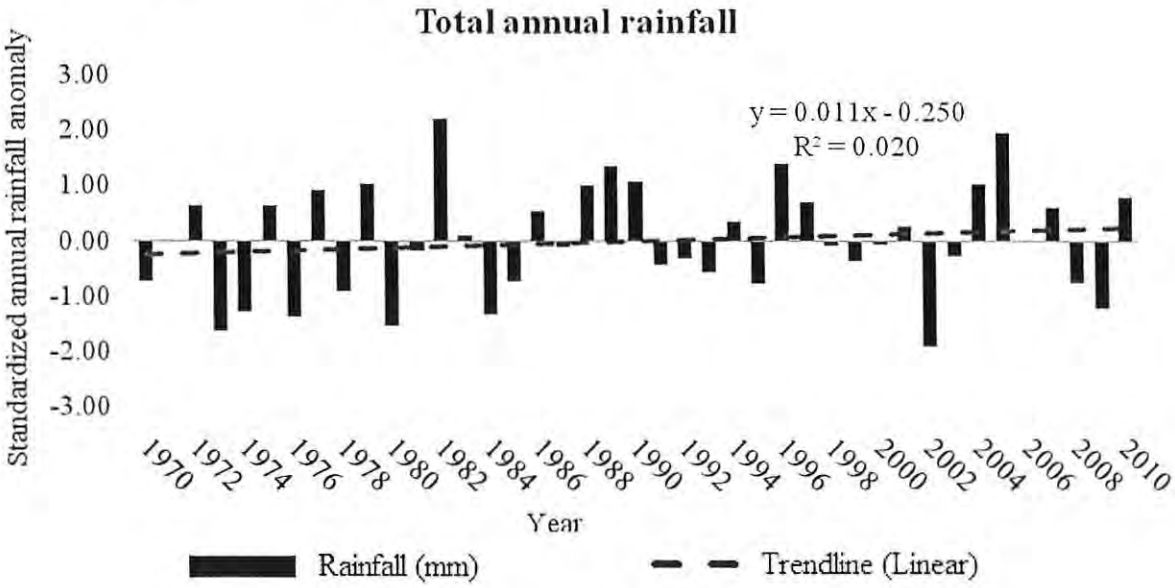
7. APPENDICES

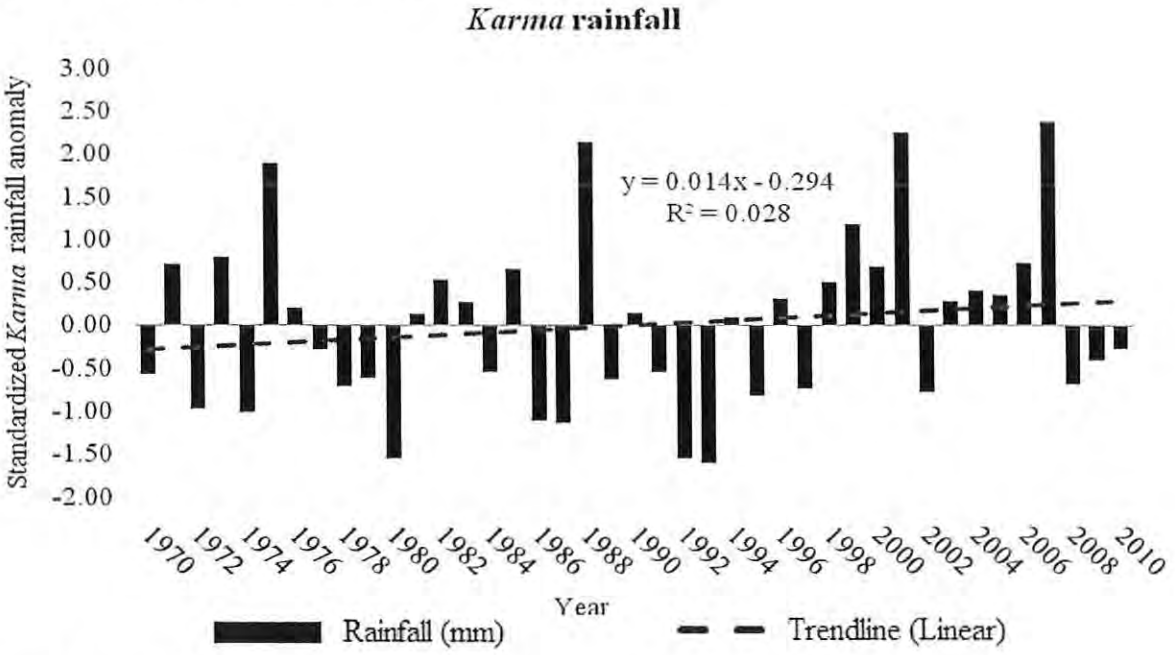
Appendix 1

Graph 1: Trends of total annual rainfall (1970-2010)



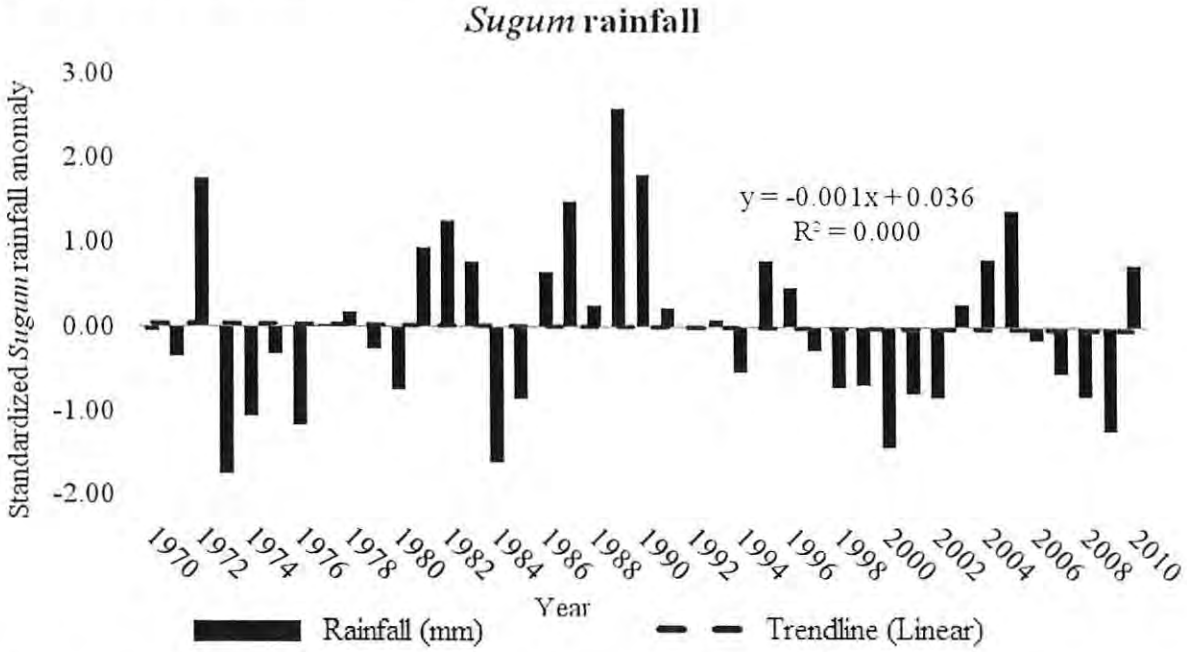
Source: Werer Research Center, meteorology station

Graph 2: Trends of *karma* rainfall (1970-2010)



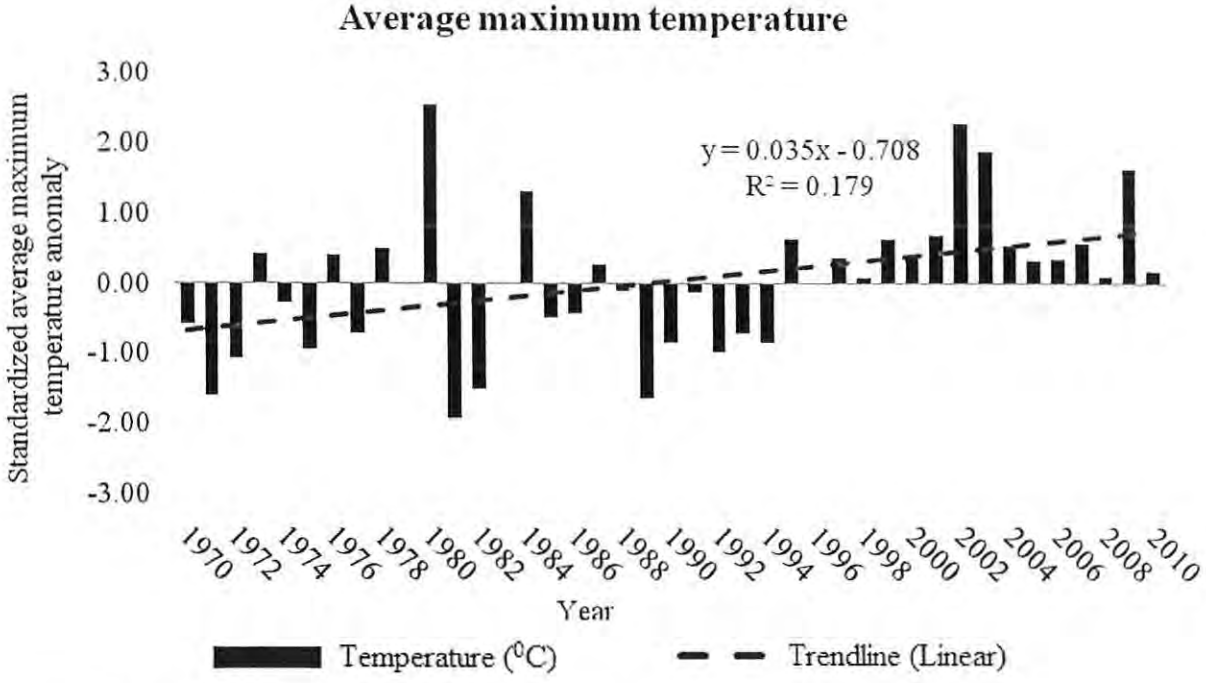
Source: Werer Research Center, meteorology station

Graph 3: Trends of sugum rainfall (1970-2010)



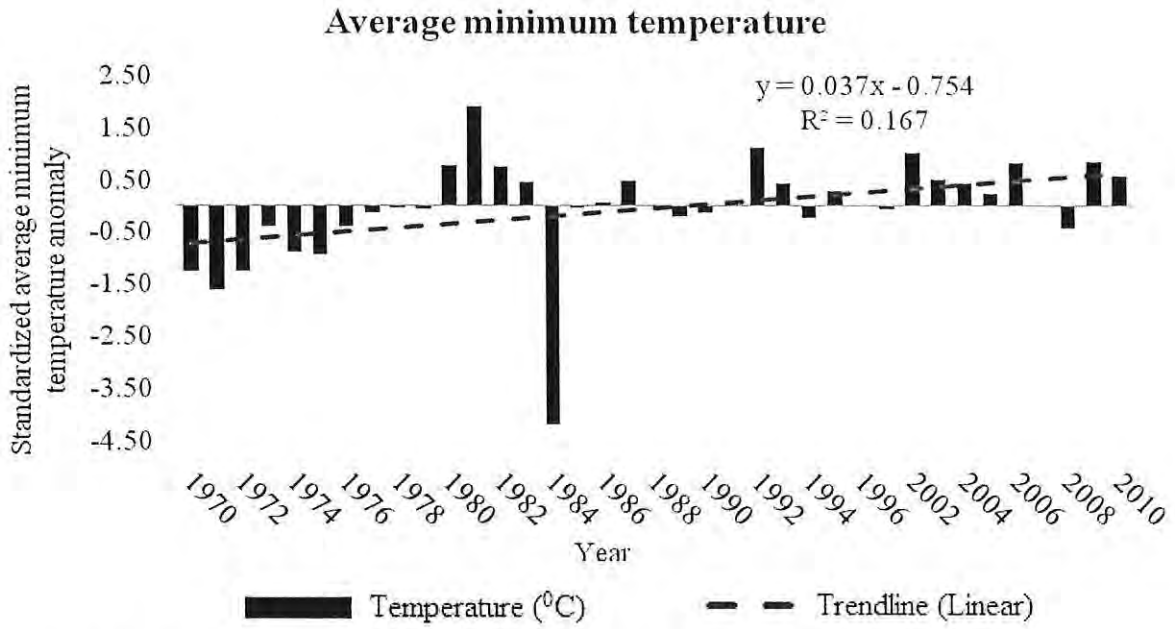
Source: Werer Research Center, meteorology station

Graph 4: Trends of average maximum temperature (1970-2010)



Source: Werer Research Center, meteorology station

Graph 5: Trends of average minimum temperature (1970-2010)



Source: Werer Research Center, meteorology station

Appendix 2

Table 1: Independent Samples Test for livestock holding in TLU

Assumptions=Equal variances not assumed								
Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
9.663	.003	-2.575	49.998	.013	-33.735	13.102	-60.050	-7.419

Source: Own survey, December 2010

Table 2: Additional income sources

Income source	Women=(45)		Men=(45)		Total=(90)	
	N	Percent	N	Percent	N	Percent
Sale of livestock	9	20.9	11	25	20	22.2
Sale of livestock products	10	23.3	9	20.5	19	21.1
Wage labor	17	39.5	22	50	37	41.1
Return from clan land owned by investors	20	46.5	32	72.7	52	57.8
Sale of charcoal	2	4.7	2	4.5	4	4.4
Remittance	3	7	2	4.5	5	5.6
Sale of grain	0	0	1	2.3	1	1.1
Petty trading	5	11.6	2	4.5	7	7.8

Source: Own survey, December 2010 (Multiple responses are possible)

Table 3: Independent Samples Test for annual income

Assumptions=Equal variances assumed								
Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
1.949	.167	-2.092	76	.040	-1704.754	814.947	-3327.862	-81.645

Source: Own survey, December 2010

Table 4: Saving money

Saving Money	Women		Men	
	N	Percent	N	Percent
Yes	10	22.2	6	13.3
No	35	77.8	39	86.7
Total	45	100	45	100

Source: Own survey, December 2010

Table 5: Conversion factors used to calculate Tropical Livestock Units (TLU)

Animals	TLU-equivalent
Camel	1.25
Cows & Oxen	1.00
Donkey	0.70
Ship & Goat	0.13

Source: Strock et al., (1991)

Table 6: Independent Samples Test for household size

Assumptions=Equal variances not assumed								
Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
8.647	.004	-3.086	64.490	.003	-1.933	.626	-3.185	-.682

Source: Own survey, December 2010

Table 7: Drought strategy based on early warning information

	Women=(45)		Men=(45)		Total=(90)	
Adaptation strategies	N	Percent	N	Percent	N	Percent
No measure in advance	21	46.7	19	42.2	40	44.4
Destocking	7	15.6	7	15.6	14	15.6
Storing livestock feed	16	35.6	12	26.7	28	31.1
Storing food for the household	7	15.6	10	22.2	17	18.9
Leaving the area	11	24.4	13	28.9	24	26.7

Source: Own survey, December 2010 (Multiple responses are possible)

Table 8: Information about climate change

Information about climate change	Women (N=45)		Men (N=45)	
	N	Percent	N	Percent
Yes	14	31.1	23	51.1
No	31	68.9	22	48.9
Total	45	100	45	100

Source: Own survey, December 2010

Table 9: New human and livestock diseases emerged

New human diseases emerged	New livestock diseases emerged
Diharria	Sudden death of camels
Cholera	*Guduf*
Heavy Cough	*Mesengele*
Skin disease	*Midga*
Ameba	*Undugul*
Typhoid	*Dehan*
Typhus	Bilharzias

Source: Own survey, December 2010

Table 10: Inaccessible grass species

Local name (Afar)	Species
Durfu	*Chrysopogon plumulosus Hochst*
As Ayso	*Bothriochloa radicans (Lehm)*
Melif	-
Serdoyta	*Cenchrus ciliaris*
Delaita	*Setaria verticillata (L.) P.Beauv*
Denekto	*Sporobolus ioclados*

Appendix 3

Questionnaire for the Structured Household Survey

I. Background information about the household

1. Name of the household head_____
2. Sex of the household head 1. Female 2. Male
3. Name of the Kebele _____
4. Age of the household age _____
5. Religion 1. Muslim 2. Christianity 3. Other, specify _____
6. Marital Status 1. Single 2. Married 3. Divorced 4. Widowed 5. Polygamy
7. Educational level attained
   1. Illiterate
   2. No formal education but read and write
   3. 1-4 grade
   4. 5-8 grade
   5. 9-12 grade
   6. 12^{+}
8. Number of permanent household members between 0-14 years, female_____ male_____
9. Number of female permanent household members between 15-64 years, female_____ male_____
10. Number of female permanent household members above 65 years, female_____ male_____

II. Major Livelihood assets:

a) Natural capital:

11. How many livestock do you possess currently?

No	Type of the livestock	Number
1	Camel	
2	Cattle	
3	Goat	
4	Sheep	
5	Donkey	

12. How do you describe your livestock holding in the past decade?
    1. Increased 2. Decreased 3. No change
13. If decreased, what do you think the reason? (multiple response possible)
    1. Frequent drought
    2. Disease outbreak
    3. Shortage of feed and water
    4. Destocking
    5. Other, specify

14. How do you describe the natural range cover of the area?
    1. Increased 2. Decreased 3. No change
15. If your answer is decreased, what do you think the reason?
    1. Lack of rainfall
    2. Overgrazing due to high livestock population
    3. Invasion of alien plant species
    4. Use of grazing land for crop production and other investment
    5. Other, specify _____
16. How do you describe your livestock milk production [quantity] over the past years?
    1. Increased 2. Decreased 3. No change
17. If decreased, what do you think the reason for its reduction?
    1. Shortage of livestock feed
    2. decrease of livestock number for various reasons
    3. Other, specify _____
18. Do you produce crop?
    1. Yes 2. No
19. If yes, how much hectare/*timad* of land you have? _____
20. How many years of crop cultivation experience do you have? _____
21. What are your reasons for cultivating crops?
    1. Reduction of livestock products
    2. To earn additional income
    3. To supplement livestock feed
    4. due to settlement
    5. Others, specify_____
22. What are the three major crops you grow?
    1. Cotton 2. Onion 3. Maize 4. Tomato 5. Forage crops 6. Others, specify_____
23. From where do you get drinking water the household?
    1. River
    2. Harvested water
    3. Underground water
    4. Irrigation canals
    5. Other, specify_____

b) Financial capital:

24. Do you save money? 1. Yes 2. No
25. If yes, where? 1. in my own house 2. at saving institution 3. Other, specify_____
26. If no, what is the reason?
    1. There is no such culture
    2. I have no extra money to save
    3. I do not want it
    4. Other specify, _____
27. Do you obtain remittance? 1. Yes 2. No
28. If yes, from whom you have got it?

1. My own children
2. Brothers and sisters
3. Any other relative
4. Other, specify_____

29. Do you have access to credit services? 1. Yes 2. No
30. If your answer is no, why?
    1. No credit service in the area
    2. Not interested
    3. Failure to qualify the requirement
    4. Other, specify _____

C) Social Capital:

31. Do you get any social support from the community during periods of drought/food shortage?
    1. Yes 2. No
32. If yes, what kind of support?
    1. Milk donation
    2. Borrowing of milking cows
    3. Food/grains
    4. Gift of sheep and goat if significant livestock loss occurred
    5. Gift or loan of money
    6. Other, specify _____
33. How do you describe the status of these traditional social self help over the past years?
    1. Decreased 2. Increased 3. No change
34. If decreased, what do you think the reason?_____

D) Human capital:

35. Do you have any special knowledge and skill? 1. Yes 2. No
36. If yes, what knowledge and skill you have?
    1. Handcraft making
    2. Trained local veterinary service provider
    3. Local birth provider
    4. Other specify_____
37. Do you think your family obtains adequate nutritious food on daily basis?
    1. Yes 2. No 3. I donot know
38. Have you obtained any kind of training in the last two years? 1. Yes 2. No
39. If yes, what kind of trainings? (Multiple response/MR/)
    1. about harmful practices/FGM
    2. Family planning and reproductive health
    3. Health and hygiene
    4. Livestock production and disease management
    5. Rangeland management
    6. Crop production and management
    7. Natural resource management
    8. Other, specify _____
40. From which organization did you obtain these trainings?
    1. Woreda P/A/D/O

2. Woreda female affairs office
3. NGOS
4. Werer Research centers
5. Other, specify_____

III. Access to other services

41. Do you obtain extension service?
    1. Yes 2. No
42. If yes, what kind of services you have obtained?
    1. Livestock production
    2. Crop production
    3. NR management
    4. Livestock or crop production inputs
    5. Others, specify _____
43. Did you obtain any kind of improved agricultural technologies?
    1. Yes 2. No
44. If yes, what kind of improved agricultural technologies you have obtained? (MR)
    1. Improved animal breads
    2. Improved crop varieties
    3. Farm implements
    4. Fertilizer and Pesticides
    5. Livestock medicines
    6. Others, specify _____
45. From where did you obtain these technologies?
    1. Woreda P/A/D/O 2. NGOS 3. Research centers 4. Other, specify_____
46. Are you a member of any community based association operating in your area?
    1. Yes 2. No
47. If yes, what kind of association is it?
    1. Livestock marketing
    2. Women dairy cooperatives
    3. Crop production cooperative
    4. Irrigation water management committee
    5. Other, specify _____

IV. Livelihood activities

48. What is your major income source?
    1. Sale of livestock
    2. Sale of livestock products /milk, hide and skin/
    3. Sale of crop
    4. Employment in daily labour activities
    5. Charcoal making
    6. Small business/ petty trading
    7. Remittance
    8. Other, specify _____
49. What are the other sources of additional income? (MR)

1. Sale of livestock
2. Sale of livestock products /milk, hide and skin/
3. Sale of crop
4. Employment in daily labour activities
5. Charcoal making
6. Small business/ petty trading
7. Remittance
8. Other, specify _____

50. What is your average monthly income_____ and annual income _____in Birr?

V. Perception to and manifestation of climate change

51. Have you heard about climate change? 1. Yes 2. No
52. If yes, from where have you heard about it?
    1. Radio
    2. Woreda P/A/D/office
    3. NGOs
    4. Local people
    5. Other, specify _____
53. Is there any traditional/local weather prediction system in your community? 1. Yes 2. No
54. If yes, are traditional/local weather prediction systems working properly as before? 1. Yes 2. No
55. If the system is not working as before, what do you think the reason? _____
56. Do women participate in traditional/local weather prediction system? 1. Yes 2. No
57. Have you noticed changes in the climate in your area? 1. Yes 2. No
58. If yes, what kind of change in temperature have you noticed over the last ten years?
    1. It has raised
    2. It has decreased
    3. The dry season has become longer
    4. The wet season has become shorter
    5. Other specify,_____
59. What change are you observing in rainfall in the last ten years? (MR)
    1. Significant reduction in amount
    2. Heavy rainfall in short period of time
    3. Early rain before the normal time
    4. Delay of rain
    5. No significant change
    6. Other specify, _____
60. Have you affected by flood so far?
    1. Yes 2. No
61. If yes, how do you describe its frequency after the last ten years?
    1. Increased 2. Decreased 3. No change
62. How do you describe the frequency of drought incidence compared to before ten years?
    1. Increased 2. Decreased 3. No change
63. What about the damage of the drought compared to before ten years?
    1. Increased 2. Decreased 3. No change
64. How do you describe water availability for household and livestock after 10 years

1. Increased 2. Decreased 3. No change

65. What changes have you observed in human disease after 20 years
    1. New diseases have emerged
    2. Increased spread of existing diseases
    3. Decreased in disease spread
    4. No significant change
    5. Other, specify _____
66. What changes have you observed in livestock disease after 20 years?
    1. New diseases have emerged
    2. Increased spread of existing diseases
    3. Decreased in disease spread
    4. No significant change
    5. Other, specify _____
67. If new human diseases have emerged after 20 years, what are they?
    _____
68. If new livestock diseases have emerged after 20 years, what are they?
    _____
69. What is your household food security status after 20 years?
    1. Increased 2. Decreased 3. No change
70. What changes you observed in soil moisture after 20 years?
    1. Increased 2. Decreased 3. No significant change observed
71. Do you have access to early warning information for climate hazards?
    1. Yes 2. No
72. If yes, from where you get this information?
    1. Woreda P/A/D/office 2. NGOs 3.Other, specify _____

VI. Adaptation Strategies

73. Do you migrate to other places? 1. Yes 2. No
74. If yes, what is the reason for your migration? (MR)
    1. Searching for livestock feed
    2. Searching for livestock water
    3. To escape from conflict
    4. Searching for other jobs
    5. To escape from drought
    5. Other, specify _____
75. What kind of strategies you apply to cope up livestock feed shortage? (MR)
    1. Rehabilitating the degraded rangelands
    2. Cultivating feeds at home
    3. Purchasing livestock feed
    4. Reducing livestock numbers
    5. Searching of feed in other places
    6. Giving priority for milking animals and calves
    7. Other, specify _____
76. What kind of strategies you apply to cure livestock from sickness? (MR)
    1. Going to local veterinary services

2. Using local/traditional medicines
3. Purchasing medicines from other areas
4. Other, specify _____

77. What do you do during periods of drought to reduce damage on livestock resources? (MR)
    1. Sale of livestock
    2. Taking livestock to other areas where water and feed are available
    3. Providing livestock feed and water from other areas
    4. Doing nothing
    5. Other, specify _____
78. What will you do when you face food shortage for household consumption? (MR)
    1. Purchase of food from market
    2. Reduction of number of meal in day
    3. Sale of livestock and other resources
    4. Reducing amount of feed consumed
    5. Using food items that are not consumed before
    6. Use of cheap and low nutritious food items
    7. Other, specify_____
79. What will you do if rainfall delayed? _____
80. What will you do to cope with heavy rain? _____
81. What will you do if rain starts very early? _____
82. What strategies you apply to cope with shortage of water availability for household consumption? _____
83. What strategies you apply to cope with shortage of water availability for livestock? _____
84. Is there any kind of food source that you used before but now difficult to obtain/extinct?
    1. Yes 2. No
85. If yes, what are they? _____
86. What are the reasons for their extinction or difficulty to obtain? _____

VII. Constrains to adaptation Strategies

87. What are the major problems for not effectively applying those adaptation strategies?

1._____
2._____
3._____
4._____
5._____

Checklist for focus group discussions

I. Perception to climate change and its manifestations

a) Awareness about change in climate.
b) What does climate change mean to you?
c) What do you think the reason for the change in climate?
d) What is the name of the traditional weather prediction system?
e) Who are the participants? What is the local name of this group?
f) Describe previous and current traditional weather prediction system. (its accuracy, the kind of information generated, its purpose, dissemination strategy and users of the information)
g) What are changes observed in temperature of the area over the last 20 years?
h) What are changes observed in rainfall of the area over the last 20 years?
i) Describe the situation of drought over the last 20 years. (frequency, damage on human and livestock, resilience of the community, and more vulnerable sections of the community)
j) Describe the situation of flooding over the last 20 years. (frequency, damage, resilience of the community, vulnerable sections of the community)

II. Production system, livelihood resources and access to services

a) Describe status of livestock population over the 20 years. (type of livestock species increased and decreased in number, quality and quantity of livestock products in dry and wet season, reason for the changes observed, coping strategies for the observed changes)
b) Describe status of livestock health over the last 20 years. (new diseases emerged, reason for the changes, coping strategies for the observed changes)
c) Describe status of rangeland accessibility, quality and area coverage over the last 20 years. (livestock feed availability, reasons for the changes, coping strategies)
d) Describe status of water availability for both human and livestock use. (previous and current water sources and availability, distances required to access it reasons for the changes, coping strategies)
e) Describe status of household food security situations over the last 20 years. (change in food availability, type of food consumed, reasons for the changes, coping strategies)
f) Describe status of household income sources over the last 20 years. (changes in income diversification, control of household income)

III. Migration

a) Describe migration both in wet and dry seasons. (distances covered, locations , participants in gender, reasons for migration, harmony with the host community)
b) Describe migration during drought period. (distances covered, locations , participants in gender, reason for migration)

Checklist for Key Informants

a) Do households have diversified livelihoods, including nonagricultural strategies?
b) Are households employing climate resilient agricultural practices?
c) Do households have protected reserves of food and agricultural inputs?
d) Women have equal access to information, skills and services
e) Women have equal rights and access to critical livelihoods resources
f) What are the most important livelihoods resources to different groups within the community?
g) People are generating and using climate information for planning
h) People are managing risk by planning for and investing in the future
i) People have access to early warnings for climate hazards
j) People have mobility to escape danger in the event of climate hazards
k) Men and women are working together to address challenges
l) How are hazards likely to change over time as a result of climate change?
m) Are there other social, political or economic factors which make particular people within the community more vulnerable than others?

Checklist for Woreda Pastoral Development Office

a) Do local institutions have access to information on current and future climate risks?
b) Do local plans or policies support climate resilient livelihoods?
c) Do extension workers understand climate risks and are promoting adaptation strategies?
d) Do local disaster risk management plans being implemented?
e) Which other institutions are engaged disaster risk management at local level?
f) Is there a functional early warning system in place? (kebeles covered, type of service provided, way of information dissemination)
g) Is there any targeted intervention to address women?
h) Does local government has capacity to respond to disasters?
i) Do local institutions have capacity to monitor, analyze and disseminate information on current and future climate risks?
j) Do local institutions have capacity and resources to plan and implement adaptation activities
k) Do local planning processes are participatory?
l) What are the most important climate-related hazards the region and/or ecological zone faces?
m) How are hazards likely to change over time as a result of climate change?
n) What livelihood groups or economic sectors are most vulnerable to climate change?
o) What groups within the community are most vulnerable to disasters?
p) What are the most important institutions in facilitating or constraining adaptation?
q) What are the factors constraining adaptive capacity of the most vulnerable groups?

Declaration

This is my original work and has not been presented for a degree in any other university. All source materials used for the thesis have been duly acknowledged.

Name: Tewodros Hailemariam Abera

Signature: _____

Date: _____

This thesis work has been done under my supervision as university advisor and approved by the examining board.

Workneh Negatu (PhD)	_____	_____
Advisor	Signature	Date