CLIMATE CHANGE, PASTORAL LIVELIHOOD VULNERABILITY AND ADAPTATION STRATEGIES: A CASE STUDY OF SITTI ZONE, SOMALI REGIONAL STATE IN EASTERN ETHIOPIA

By

ZIGALE TAMIR TENAW

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SUPERVISOR: **Dr**. **BUSANI MPOFU**

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DECLARATION

Name: Zigale Tamir Tenaw

Student Number: 53342100

Degree: PhD in Development Studies

Exact wording of the title of the thesis as appearing on the electronic copy submitted for examination: **Climate Change, Pastoral Livelihood Vulnerability and Adaptation Strategies: a Case Study of Sitti Zone, Somali Regional State in Eastern Ethiopia.**

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references. I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality. I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

December 2021

SIGNATURE DATE

DEDICATION

This thesis is dedicated to the loving memory of my mother W/ro Tobiya Gelaw and my father Abu hay Tamir Tenaw who passed away suddenly and untimely. *May God put their Soul in peace-Amen!* My beloved Mom and Dad, you are always in my heart. I thank you for everything!

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Abstract

Despite recognising perception as one of the most important factors in the study of climate change and variability, the link between pastoralists' perceptions, livelihood vulnerability and adaptation strategies to climate variability are not explored and empirically established in the study area. That is, the extent to which the pastoralists' perceptions in the study area enhance and /or constrain the scope of implementing adaptive responses has not been studied systematically. This study therefore analyses perceptions, livelihood vulnerability and adaptation strategies of pastoral communities within the context of climate change in Sitti zone, Somali Regional State, Ethiopia. It used both quantitative and qualitative research approaches. Data was collected by using questionnaires, focus group discussions, key informant interviews and field observations. Results reveal that pastoral communities recognise the trends of climate variability and its impacts on their livelihoods. Major indicators of vulnerability to climate variability include a decline of the pasture lands, death of livestock, reduction of water availability, reduction of livestock products and prices, the presence of environmental degradation, food insecurity and outbreaks of human and livestock diseases. Climate change and variability affects pastoral communities disproportionately. Groups of people most vulnerable to the impacts of climate changes are women, children, the poor, sick, disabled people, female-headed households and old people. Due to climate change and variability impacts, pastoral communities have been practicing various types of coping and adaptation strategies. These include livestock mobility, livestock diversification, selling of firewood and charcoal, fewer meals per day, selling of livestock and livestock products, remittances, rearing of drought resistant livestock, relief aid, herd splitting, migration to other countries, petty trading and sharing of food from their clans. The capabilities of pastoral communities to cope and adapt to the impacts of climate change hazards have been constrained by rangeland degradation, scarcity of assets, ethnic-based boundaries, conflict, bush encroachment, illiteracy, household size and lack of training and awareness. The overall findings indicate that despite the pastoralists' recognition of climate variability and its impacts on their livelihoods, context and scientific knowledge based development measures are not designed and implemented to overcome the adverse impacts of climate change in the area. There is therefore a need for the formulation and implementation of various climate change and variability related policies and strategies including strong cooperation, communication and information sharing about the extent of vulnerability among government and various stakeholders in order to address major constraints of coping mechanisms and adaptation strategies based on the context of pastoral communities.

Keywords: Adaptation Strategy, Asset, Climate Change, Constraints, Coping Mechanisms, Indigenous Institutions, Livelihood Vulnerability, Modern institutions, Pastoral Communities, Perceptions, Sustainable livelihood.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

CSA Central Statistical Authority (Ethiopia)

DFID Department for International Development

DPPB Disaster Prevention and Preparedness Bureau

EPRDF Ethiopian people's Revolutionary Democratic Front

FAO Food and Agricultural Organization

FDRE Federal Democratic Republic of Ethiopia

FGD Focus Group Discussion

HH Household

IFAD International Fund for Agricultural Development

IPCC Intergovernmental Panel on Climate Change

IISD International Institute for Sustainable Development

GDP Gross Domestic Product

GO Government Organization

GTP Growth and Transformation Plan

MoARD Ministry of Agriculture and Rural Development

MOFED Ministry of Finance and Economic Development

NGO Non-Government Organization

PASDEP Plan for Accelerated and Sustainable Development to End Poverty

PFE Pastoral Forum Ethiopia

SCUK Save the Children in United Kingdom

SLF Sustainable Livelihood Framework

SPSS Statistical Package for Social Sciences

WB World Bank

CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1. Introduction

The pastoral production system is widely practiced on the arid and semi-arid areas of Africa (66% of the total continent), Arabian Peninsula and the highlands of Latin America and Asia. It sustains nearly 200 million pastoral households that rear approximately one billion head of livestock, about a third of which are found in sub-Saharan Africa, and contributes 10% of the world's meat demand (FAO, 2001). The East African region is home to a large number of pastoralists whose means of livelihood are predominantly the rearing of livestock. The area is characterised by rainfall variability, prolonged droughts, resource degradation, human and livestock diseases and other man-made and natural disasters. These factors challenge the pastoralists' capacity to adapt to such problems, that is, they erode the livestock populations, natural capital stocks and other resource bases, and steadily reduce the capacities of pastoral communities to recover from such disasters. These impacts are exacerbated by other factors such as land use change, resource competition induced conflict, poor service provision and infrastructure, and general marginalisation of the pastoral communities. The result is a state of vulnerability and often crisis within pastoral communities and areas (HPG, 2010).

Pastoralists live in areas where the total amount of rainfall annually is not sufficient to support their means of livelihoods. They typically reside in areas where limited natural resources and severe climatic situations restrict options for various livelihood systems. They are livestock-centred, practise a mobile way of life, and have to adjust themselves to severe climatic

conditions, tolerant of health problems, kinship and social network-oriented. The issue of survival for pastoral communities in these harsh environments would be practically difficult without rearing of livestock that provide for basic needs. The significance of livestock in these areas exceeds the mere fact of fulfilling basic necessities, since they are culturally considered as the basis of life, wealth and social respect (Thornton, *et al*., 2006).

Climate change and variability, one of the major important challenges facing pastoralists, has affected food security, natural resources, health supply, grazing land and water availability in pastoral areas. Pastoralists' livelihood activities are highly vulnerable to the impacts of climate change and variability. High dependence on natural resource and climate vulnerable livelihoods, low adaptive capacity and variable weather events have all left pastoralists in precarious, vulnerable situations. Climate change and variability has a likelihood effect to determine biodiversity, pasture, water availability, agricultural productivity and livelihood strategies, and this makes the issue to be the current agenda at local, regional and national levels. The main livelihood base for pastoralists is livestock and livestock related products, which are highly vulnerable to climate change and variability. Pastoralists usually tend to diversify their livestock in terms of species to maximise the use of rangeland and water resource while minimising the risk of livestock loss from extreme weather events.

This chapter introduces the thesis and deals with the background of the study, statement of the problem, objectives of the study, research questions, the significance of the study, and scope and limitation of the research. It also outlines briefly the organisation of different chapters of the thesis. The following section gives the background of climate change, pastoral livelihood vulnerability and adaptation strategies.

1.2. Background of the study

Africa is one of the continents that are very vulnerable to the impacts of climate change. This is due to extreme poverty, reliance on rain-fed agriculture largely, environmental degradation, weak governance structures, infrastructural and technological lag in development, high population growth rates, frequent intra national and international conflicts and weak adaptive capacities to climate change and variability. Substantial hazards from climate change are real, and include disruptions of food production and water supplies, less income, destruction of homes and property, poor health and death (Opiyo *et al*., 2011). Although adaptation to climate change can reduce the harm, challenges to adaptation exist mainly in African countries where low adaptive capacity and high poverty rates shape vulnerability (IPCC, 2014). Despite the continent's increasing efforts to support and implement climate change adaptation strategies at local, national and across sectors, most of it has been reactive and based on short-term motivations (Vermuelen *et al.*, 2012). People-induced climate change is now broadly considered as inevitable, involving long-standing alters in livelihood strategies, as well as improved natural exposures and adversities. Climate change is a threat to peoples' development and Ethiopia is among the nations that are highly affected, especially in regions that are dependent on pastoral production (IFAD, 2009).

East African countries have a long history of being prone to drought, and the frequency of droughts is increasing in the last decades since 1980. By 2080, it is expected that the relative size of arid and semi-arid lands in Africa will rise from 3% to 8%. Due to rising regional temperatures and decreasing rainfall precipitation, the durations of drought are becoming persistent and more frequent. On average, the occurrence of droughts is rising from one in eight years to one in every two or three years (Medhanit, 2014). A decreasing resource base,

worsening of human wellbeing, and the subsequent household-level response of poverty driven by low return non-pastoral engagements characterise East African pastoral systems. These have mainly been caused by the occurrence of prolonged droughts and natural resource degradation, which pose serious threats to the livelihoods of pastoral households (Swift and Hamilton, 2001).

Ethiopia is one of those countries that are extremely vulnerable to climate variability and change. Its geographical location and topography, coupled with low adaptive capacity to low level of development and dependence on rain-fed agriculture, explain its vulnerability to the impacts of climate change (World Bank, 2010). Agriculture is the mainstay of its economy contributing 42% of its GDP and employing close to 80% of its population (FDRE, 2011).

Pastoralists live in a total area of 625,000km2 in Ethiopia (60% of the country's land mass) and account for about 12-15% of the country's total population. Large numbers of pastoralists in Ethiopia are mainly found in the Somali region (53%), followed by the Afar region (29%), Oromiya region (10%) and the Southern Nations, Nationalities and People's (SNNP) regional states (7%). Pastoral people are also found in Gambella (1%) and Benishangul areas (less than 1%). Livestock in pastoral areas accounts for 40% of the country's total livestock population (Sandford and Habtu, 2000 cited in Sara and Mike, 2008). The yearly gross product of the pastoral sector is estimated to be about $560 million, equivalent to 8.4% of the Gross Domestic Product (GDP). Pastoralists obtain 50-70% of their means of living from livestock and livestock products. Furthermore, climate change, which leads to drought and severe weather conditions, has minimised pastoralists' basic assets such as communal grazing land, water sources, constrained mobility and considerably decreased the quantity and productivity of livestock. Limited alternative livelihoods and changes in the indigenous land use systems have aggravated this situation (ATA, 2014). In spite of its major contribution to the overall economy,

this sector is challenged by many problems, of which climate change-related hazards are the major ones (Deressa, 2007; Ferede and Hailu, 2014).

Pastoralists' livelihoods mainly depend on their close interactions with the surrounding environment and on the wellbeing of their herds while pastoralism is a multifaceted livelihood system looking to sustain an optimal balance between scarce natural resources, livestock and people in unfavourable and varying environments. It is also a way of agricultural exploitation based on the rearing of extensive livestock where the movements of livestock are the main components of the system. Pastoral communities have long-time traditions, experiences and strategies of utilising scarce resources, characterised by mobility, flexibility, adaptability and mutual exchange. These strategies leave them to manage the variability in grazing land resources and climate that is inherent in these systems. Even though pastoralism plays important role in sustaining pastoralists' livelihoods, in contributing to nation-wide and regional economies, and in offering different environmental services, its capacity to withstand to climate change is limited (Nori *et al*., 2008). Climate change exacerbates the frequency and severity of acute incidences and shocks of climate variability events (Field *et al*., 2014).

Pastoralists' areas are facing unpredicted hot and prolonged drought, and decline in rainfall amounts and distributions. These changes have led to the reduction of herds populations and the failure or complete destruction of pasturelands, surface and ground water, crops and other assets. Particularly, rainfall has become difficult to predict and the rainfall amount has highly decreased gradually (Medhanit, 2014). Pastoralism is the most vulnerable livelihood system for the impacts of climate change, with restricted capability to survive with short-term climatic risks or to adjust to long-term trends (Conway *et al*., 2007). The rearing of livestock remains pastoralists' major source of employment that supports a large number of the inhabitants

and vital to the livelihoods of the society (Conway et al., 2007; Deressa, 2006). This sector remains, however, increasingly vulnerable to temporal and spatial variations in rainfall, partially because of the highly reliance on rain-fed livelihood, with negative implications for both national food security and poverty reduction efforts (World Bank, 2006).

The impacts of climate change events are causing several and complex problems that have resulted in chronic resource depletion in pastoralist areas (IPCC, 2014). Pastoralists have been surviving and withstanding changing ecological conditions for centuries. As a result, they have long-standing skills, knowledge and experiences for their adaptation. However, in recent years, changes in their environments from increased occurrences of prolonged droughts, pastureland encroachment and the stock of natural asset deprivation have damaged their adaptive capacities and exacerbated their livelihood vulnerability. Trends point to a pattern of climatic hazards more frequently turning into disasters. The worsening quality of the natural capital base, prolonged droughts, decreasing productivity, and diminishing livestock per capita have led to pastoral food insecurity, often forcing traditional herders to adjust to the worsening conditions (Webb and Coppock, 1997). In this study, the Sitti zone in the Somali region of Ethiopia was selected in order to assess pastoralists' perceptions, livelihood vulnerability and adaptation strategies in the area. Even though a few studies on climate change and variability have been conducted in the region, still there is limited research evidence as to whether or not climate change is perceived as a major problem or even a reality by the pastoral communities, particularly by the poor and most vulnerable groups in area. Similarly, local adaptive responses to climate variability and change are not well documented. Recognising the nature of climate change and variability impacts, key livelihood vulnerabilities and indigenous adaptive responses at local levels, and the national institutional responses are important for developing appropriate

adaptation strategies at community levels. Therefore, such research gaps instigated me to pick up this problem.

1.3. Statement of the problem

Despite recognising perception as one of the most important factors in the study of climate change and variability, researchers have given less attention to the lowland areas of Ethiopia than highland areas. As such, in the study area, the link between pastoralists' perceptions, livelihood vulnerability and adaptation strategies to climate variability are not well explored and empirically established. That is, the extent to which the pastoralists' perceptions in the study area enhance and /or constrain the scope of implementing adaptive responses has not been studied systematically. It is important to understand how differently situated pastoral communities perceive the risks of climate change, interpret and make decision to implement various adaptation strategies to manage the adverse impacts of climate change.

The success of the pastoralism based livelihood systems in Eastern Ethiopia has always been rooted in the indigenous systems' capacity to adapt to climate change and the existence of robust indigenous institutions management (Cossin, 1988). However, a decline in pastoral resource base at alarming rate due to climate change and a general weakening of indigenous institutions is affecting this capacity (Tache, 2000). Pastoral areas are increasingly becoming characterised by extreme poverty, food insecurity, severe environmental resource degradation, rainfall variability and prolonged droughts. Although the driving forces vary widely from region to region, virtually all of these factors affect the mobility of livestock, which leaves in jeopardy the sustainability of both rangeland resources and pastoralists means of living (Fratkin and Mearns, 2003). The impact of climate change and variability has greatly intensified the degree of livelihood

vulnerability of the pastoral communities. The change of rainfall, in terms of duration and intensity, and increases in temperature and environmental degradation has affected the stocks of natural resources particularly the availability of rangeland and livestock watering points. These changes, along with other man-made risks, have resulted in a decrease in the livestock quantities per household in all livestock types and a change in livestock diversity and productivity (Nanki *et al.*, 2010).

In pastoral areas with various cultures, one can expect to have and enhanced their own indigenous knowledge and skill, and how to adjust themselves to the changing climate. In this regard Mahmud *et al.* (2008) argue that developing and organising the indigenous knowledge and the skill is mostly significant for formulating practicable adaptation strategies to withstand the possible impacts of climate change. However, these are not effectively investigated and the traditional knowledge base on the issues governing pastoralists' choices to adapt to climate change related issues and the impacts of these decisions on their livelihoods are not clearly articulated in the study area. Different questions need to be posed in the context of the study area, vis-a-vis, how do pastoral communities perceive climate change and its impact on their livelihoods? What type of indigenous knowledge and assets have pastoral communities developed to adapt to changing climate? Pastoralists' perception of current climate variability and their response strategies through local adaptation measures can serve as useful input to design integrated and sustainable adaptation strategies. Assessing pastoralists' perceptions of climate variability and the existing adaptation measures is a good step to understanding what works best in terms of successful coping and adaptation strategies to climate change and variability at different levels and what improves the existing adaptation strategies. Thus, understanding pastoralists' perceptions of current climate variability and their adaptation

practices can be an essential input for adaptation policy since their strategies are mostly the result of long-term experiences and assessment of risks in their day-to-day production and consumption decisions (Dinar, 2008). This in turn helps to link successful bottom-up approaches with top-down strategies thereby ensuring the sustainability of adaptation measures.

1.4. Aim of the study

The aim of the study is to investigate the livelihood challenges facing the pastoral communities and their coping mechanisms and adaptation strategies within the context of climate change and variability in Sitti zone, Somali Regional State of Ethiopia.

1.5. Objectives of the study

The primary objective of the study is to analyse perceptions, vulnerability and adaptation strategies of pastoral communities within the context of climate change and variability in Sitti zone, Somali Regional State of Ethiopia. Secondary objectives include the following:

- to find out how pastoral communities perceive climate variability in the study area,
- to assess the extent of vulnerability of the pastoral community to climate change and variability,
- to analyse the major response strategies and constraints that determine the pastoral communities to adapt to climate change and variability, and
- to assess the roles of institutions and organisations in enhancing or hindering the adaptive capacity of pastoral community.

1.6. Research questions

In order to address the above objectives, the study strives to answer the following research questions:

- How do pastoral communities perceive climate variability?
- How do pastoral communities become vulnerable to climate change and variability?
- What are the major types of response strategies to climatic shocks implemented by pastoral communities to withstand the impacts of climate change and variability?
- What are the major constraints that determine pastoral communities to overcome the negative impacts of climate change and variability in the area?
- What are the major roles of institutions and organizations in enhancing or hindering the adaptive capacity of the pastoral communities?

1.7. Significance of the study

This study is important because it assesses the perceptions and vulnerabilities of the pastoral communities, and their adaptation strategies to climate change. It also discusses about the major constraints that determine pastoralists' adaptation strategies and the role of institutions in reducing the adverse impacts of climate change in Sitti zone of Somali Regional State. It provides insights into how pastoralists pursue different livelihood strategies in order to sustain their means of living by adjusting to very inhospitable climatic conditions in the area. The results of the study may influence policy makers to design context-based climate change adaptation strategies, and strengthen and promote existing indigenous knowledge and skills to withstand the negative impacts of climate change on the livelihoods of the people. This research is expected to

contribute to a comprehensive in-depth understanding of the pastoral communities' livelihoods in the context of climate change.

In addition, the study assesses existing coping and adaptation strategies, strengthening and promoting such mechanisms and suggests better ways of alternative approaches and strategies. Hence, it can also help local and regional administrations to modify or adapt their approaches and intervention strategies. It is hoped that this study will inspire students and researchers to embark on further investigations in this area of study through identifying the gaps in the research. Hence it will contribute solutions towards the impacts of climate change among the most vulnerable pastoral groups, mainly women, children, the poor, female headed households, elders and disabled people. In general, the study generates findings, lessons, and recommendations on how livelihood strategies can be effectively harnessed by the government and development agencies to improve the wellbeing of pastoral communities. It is also hoped that this will influence strategic approaches and interventions aimed at reducing the impacts of climate change, improving incomes and ensuring greater opportunities to improve the means of living.

1.8. Scope and limitation of the study

The vulnerable livelihoods of pastoralists explored in this study do not consider all factors such as social, economic, political and cultural ones that the societies are exposed to. All these basic stressors may be intricately related and thus require further assessment to find out the extent of susceptibility of the communities and their capability to survive and adapt to climate change. The geographical scope of the study of the research and data collection is Sitti zone of Somali Regional State with particular emphasis on two-selected pastoralists' districts namely: Shinille

and Erer districts. The focus of the study is on the pastoral communities' vulnerable livelihoods, which have been adversely affected by the changing climate. This study is delimited by geography, livelihood systems and response strategies to withstand the impacts of climate change.

In terms of livelihood systems, the research focuses on the pastoralists' perceptions, vulnerable livelihood systems and their efforts to withstand the impacts of climate change through coping and adaptation strategies. The research also focuses on problems linked to the impacts of climate change on the livelihoods of the people and the roles of institutions in enhancing or hindering the capacity of the pastoral community to overcome the impacts of climate change in the area. In the case of response strategies to climate change, the scope of the study is limited to coping and adaptation strategies rather than mitigation to the changing climate. The main reason to focus on adaptation as a response strategy is the majority of the pastoral communities are highly practice adaptation strategies for a long period of time by using their indigenous and modern knowledge while implementing mitigation as a response strategy to climate change will need high investment and negotiation with the developed countries to reduce the emission of greenhouse gases.

Research for this study encountered various problems. Transport problems, political instability in the study area, the prevalence of Covid 19 and respondents' unwillingness to provide accurate information at times were some problems that affected this research. It was also not easy to differentiate between the impact of climate-change-related vulnerability and that of other political, socio-economic events and natural threats but the researcher managed to take into consideration the possible interrelationship between climatic, political, socio-economic and natural factors.

1.9. Definitions of key terms and concepts used in the study

Livelihood is a means of living that comprises the people's abilities, resources and different activities required to secure the necessities of life. It is the sum of the methods in which individuals, households and community construct ends meet. It also refers to the ways of fulfilling the fundamental needs of life includes shelter, food and clothing. Livelihood is sustainable when it recovers from any stress of hazards or develops resilience to any vulnerability (Chambers and Conway, 1991).

Vulnerability is the features and situations of a society, system or resource that make it vulnerable to the destructing effects of a hazard (UNISDR, 2005). It is the degree to which the structure is vulnerable to supporting harm from hazards caused by climate change, and is a function of the extent of climate change, the sensitivity of the system to changes in climate and the capacity to adjust the system to changes in climate. Hence, an extremely susceptible system is one that is extremely vulnerable to modest changes in climate and one for which the capacity to adjust is highly limited (IPCC, 2007). Vulnerability is the degree to which individuals, households, communities or geographical areas are affected by disaster when hazardous events occur (IRR and SCUSA, 2007).

The livelihood vulnerability means when livelihoods of individuals, households and groups of people unable to cope with or are susceptible to natural and man-made factor. A related term vulnerability to climate change refers to when a system is susceptible and exposed to climate change hazard. It relies on the extent, magnitude and climate deviation to which a livelihood system is exposed, its sensitivity and its adaptive capacity (IPCC, 2001, P. 995). Exposure relates to the degree to which a livelihood system is susceptible to climate change. Sensitivity is the

extent to which a livelihood system is affected by climate change, while adaptability refers to the extent to which adjustments are possible in practice to a changing climate.

Pastoralists are people who mainly generate their means of living from the management of herds on rangelands. According to Ellis and Swift (1988), Pastoralists are people who drive at least 50% of their household revenue from livestock or related activities.

Climate is the average weather condition observed for a long period of years and articulated through various components such as precipitation, temperature, wind and cloud cover. It is different from weather condition, which characterises short-term atmospheric conditions observed with its elements such as temperature, rainfall, cloud cover, wind and humidity, which are observed on every day or week.

Climate change refers to constant changes of the climate system attributed to human intervention (releases of greenhouse gases into the atmosphere) that change the composition of the global atmospheric elements (temperature, precipitations, wind, cloud covers and humidity within the atmosphere) observed over a long period. It also refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its characteristics that can be observed for a long period of time (IPCC, 2007).

Climate variability means variation in the mean state of the climate and inconsistency, on temporal and spatial scales, including short-term variations that occur throughout the year (Ziervogel *et al*., 2006a). Climatic variability is the sort of variations (temperature, rainfall, occurrence of extremes); the magnitude and extent of the climate change that causes the impacts on the area of public health, agriculture, food security, forest, hydrology and water resource, biodiversity, human settlement, energy, industry, and financial services.

Adaptation is process of adjustment with environmental, cultural, political, social or economic systems in response to real or predicted natural and man-made problems and their impact, as well as to the changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities allied with climate change and other factors. Different kinds of adaptation can be differentiated, including reactive and anticipatory adaptation, public and private adaptation, and independent and designed adaptation (Smit, 2003).

Adaptation strategies are the actions that community individually or collectively carry out to adjust to changing climate in order to sustain or improve their well-being.

Adaptation to climate change is referred to the process of reacting and adapting to the impacts of changing climates situations to reduce vulnerability and improve resilience in response to observed or predicted changes in climate and connected with severe weather conditions. It is a process of regulating to real or predicted climate change and its consequences, so as to moderate challenging problems or utilise useful opportunities (IPCC, 2014).

Adaptive Capacity is the capacity of individual, people or a principle to regulate and withstand to climate change to minimise possible adverse effects, to survive the impacts, or to take the existing opportunities (McCarthy *et al.*, 2001). It also refers to the capability of the community or a system to change or modify its features to adjust with actual or estimated external pressures (IPCC, 2001).

1.10. Organisation of the study

This study has seven chapters. The first chapter presents the background of the study, a statement of the problem, objectives of the study, the significance of the study and scope and limitations of the study. Chapter two covers a literature review and conceptual framework of the study. The

third chapter focuses on research methodology, which includes a description of the study sites, research design, sampling and sampling method, method of data collection and analysis. The fourth chapter presents major findings and the discussion of pastoralist's perceptions of climate change and its impact on their livelihoods. Chapter five addresses the extents of pastoralists' vulnerability to climate change. Chapter six presents major response strategies and constraints that determine the pastoral communities' ability to adapt to climate change. This chapter also focuses on the roles of institutions and organisations in enhancing or hindering the adaptive capacity of pastoral communities. The last chapter (chapter seven), outlines the summary, conclusions and recommendations of the thesis.

CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1. Introduction

The first part of the literature review gives an over view of the causes of climate change and variability, and its adverse impacts on socio-economic development activities giving due focus on pastoralism at global, Africa and Ethiopia context. This is followed by issues addressing perceptions on climate variability and change, and vulnerability to climate change and different approaches of vulnerability to climate change include biophysical approach, socio-economic approach and integrated approach are reviewed. Issues of adaptation strategies and constraints to climate variability and change to practice various adaptation strategies are part of the review. Issues related to the roles of institutions in enhancing and/or hindering pastoralists' response strategies to the impacts of climate change and variability to sustain their means of living are also part of review. Finally, the analytical framework and its main components including vulnerability context, different type of assets, institutions and processes, livelihood strategies and livelihood outcomes are reviewed.

2.2. Climate change and variability in the global context

Global climate change and variability is emerging as one of the most complex and challenging environmental problem facing humankind today. It is considered as one of the most sever threats to development efforts with sever impacts on the environment, human health, food security, economic activities, natural resource management and physical infrastructure (Nicholson, 2014). The problem is further worsened by weather uncertainties, persistent climatic abnormalities,

environmental degradation and consequent food insecurity aggravated by increasing human population and demand for more resources. IPCC (2007) defined climate change as any change in climate over time, whether due to natural variability or human activity. According to IPCC (2014), climate change is "the change in climate that is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over comparable time periods". Both definitions recognised that climate change is attributable to human activities altering the atmospheric composition.

Climate variability has also been defined as "variations in the mean state and other statistics of the climate on all temporal and spatial scales beyond that of individual weather events" (IPCC, 2007). Based on the above definitions, one can understand that there is a fundamental difference between climate variability and climate change. Climate variability is a short-term fluctuation happening from year to year, while climate change constitutes a shift in meteorological conditions that last for a long period of time, from decades to centuries. Climate variability reveals year to year variations of climatic elements such as temperature and rainfall at several time scales. Extended droughts, forest fire, floods, cyclones and conditions that result from periodic La Niña and El Niño events are among the main indicators of climate variability. Climate variability includes variations as a result of external or anthropogenic forces (external variability) or variation that may result from natural internal processes within the climate system (internal variability) (Tasokwa, 2011).

The main indicators of climate change are increases in average global temperature; change in cloud cover and the overall precipitation; melting of ice caps and snow cover; rising global average sea level; and rising in the ocean's temperatures. In addition to these gradual changes, climate change also has impacts in the form of more weather related disasters such as

increased drought, flood and tsunamis. Various literature sources have attributed climate change to human activities such as burning of fossil fuels, industrial production and deforestation that change the atmospheric composition by increasing the amount of greenhouse gases.

Increased emissions of greenhouse gases (carbon dioxide, methane, nitrous oxide, hydro fluorocarbons) produced by human activities trap more heat in the atmosphere and thereby facilitating climatic changes (Hope, 2009). The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC, 2007) also clearly states that global warming since 1750 is the net effect of human activity. Consequently most of the observed increases in globally-averaged temperatures since the mid-20th century are believed to be due to the observed increase in anthropogenic greenhouse gas concentrations. Although the Earth's atmosphere naturally contains greenhouse gases, it is clear that industrialisation in the last millennium led to massive emission of greenhouse gases especially carbon dioxide into the atmosphere. This increased emission of greenhouse gases is causing anthropogenic greenhouse effect that leads to climate change. Anthropogenic emissions of carbon dioxide account for about 63% of the greenhouse gas warming effects in the long-term and for 91% in the short-term (IPCC, 2014).

2.3. Climate change and variability in Africa

The climate of Africa is naturally both highly diverse and variable. It includes the extreme dry and hot areas of the Saharan deserts at one end to the extreme humid lands of the Congo rainforest at the other. Climate in Africa is usually determined by three main drivers include the Inter Tropical Convergence Zone (ITCZ), the West African Monsoon and the *El Nino- Southern Oscillation* (ENSO). Most parts of the continent have a hot climate, but the humidity and amount of rainfall vary dramatically from area to area (World Book, 2009).

Africa is considered as very vulnerable continent to climate change and variability because of widespread poverty, unavailability of social, economic, political and technical resources which limits adaptation capabilities of communities and countries. Despite its least contribution to the factors that exacerbate and contribute to climate change and variability, Africa is most vulnerable to climate change (Hope, 2009). Communities located in marginal areas with very limited access to technologies for coping and adaptation are more susceptible to climate change. Climate change is more likely to worsen existing poverty through reduced food availability, accelerated water scarcity, financial insecurity and incidence of illness.

Pastoralists in Africa have historically been economically, socially and politically marginalised. Colonial policies favoured the farming communities of agriculture over pastoral communities (Sen, 1981). By the late 1970s, pastoralists were blamed for environmental degradation, desertification, and mismanagement of resources, as the hostile environment and complex land use system they employ was not well recognised (Hesse and Thebaud, 2006). Policies usually promoted sedentarisation, restricted mobility, and privatization of lands and livestock markets, which asserted that communal land resources led to overgrazing and degradation of the environment (Hardin, 1968).

Historically, different social adaptation strategies include exchanges of livestock, restocking alliances, dowries, traditional loan mechanisms, and support of the poor through livestock loans have promoted high levels of resilience among pastoral populations, enabling human existence in unpredictable and otherwise uninhabited environments (Adger, 2000). Current climate change projections indicate that most African drylands will experience rising temperature, decreasing rainfall, and increasing number and severity of extreme weather events, including flooding and drought (IPCC, 2007). Pastoralists are highly vulnerable to extreme

environmental fluctuations such as drought and rainfall duration and amount, which result in animals hungry, without water, and sick from cycles of undernutrition and disease. About 30 percent of the people in Africa lives in drought-prone areas and are vulnerable to the impacts of droughts (World Water Forum, 2000). The impact of drought is felt mainly in the Horn of Africa, the Sahel and southern Africa (Richard *et al*., 2001).

Rainfall variability and uncertainty surrounding its annual reliability have prompted pastoral communities to adapt to dynamic climatic, environmental and weather conditions throughout history. However, the speed of current climate change and variability is feared to exceed the limits of adaptation practice in many parts of the world in general and in Africa in particular (IPCC, 2007). For instance, the Horn of Africa is one region that is most vulnerable to climate change, which manifests through climate variability. The situation is exacerbated by the interaction of several stresses in the form of changeable seasons, constant climatic irregularity, widespread ecological degradation and prominent food insecurity happening at various levels, and become incapable to adjust to the impacts of these climatic related hazards (Boko *et al*., 2007). Though pastoralists in Africa have an indigenous knowledge and skill to adapt to climatic change and variation; widespread poverty, poor governance, limited access to resources and markets, environmental degradation, complex disasters and conflicts may undermine their capacity to adapt to climate change (Boko *et al*., 2007).

Countries in the Horn of Africa are often considered to be among the most vulnerable, but are also considered to be the least prepared for adverse global environmental change in the word. In the Horn region, Ethiopia has been typically considered as a home of famine, especially beginning from the last three decades of the 20th century, principally as a result of increasing vulnerability to extreme events that relate to changing climatic conditions. The pastoralist

peoples, inhibiting the low land areas of the country, with the harsh and precarious conditions of limited livelihood choices in their settings, have particularly become increasingly vulnerable to persistent poverty in recent decades partly due to their recurrent exposure to the adverse effects of climate variability and change (Aklilu and Alebachew, 2008).

2.4. Ethiopian pastoralists in the context of climate change and variability

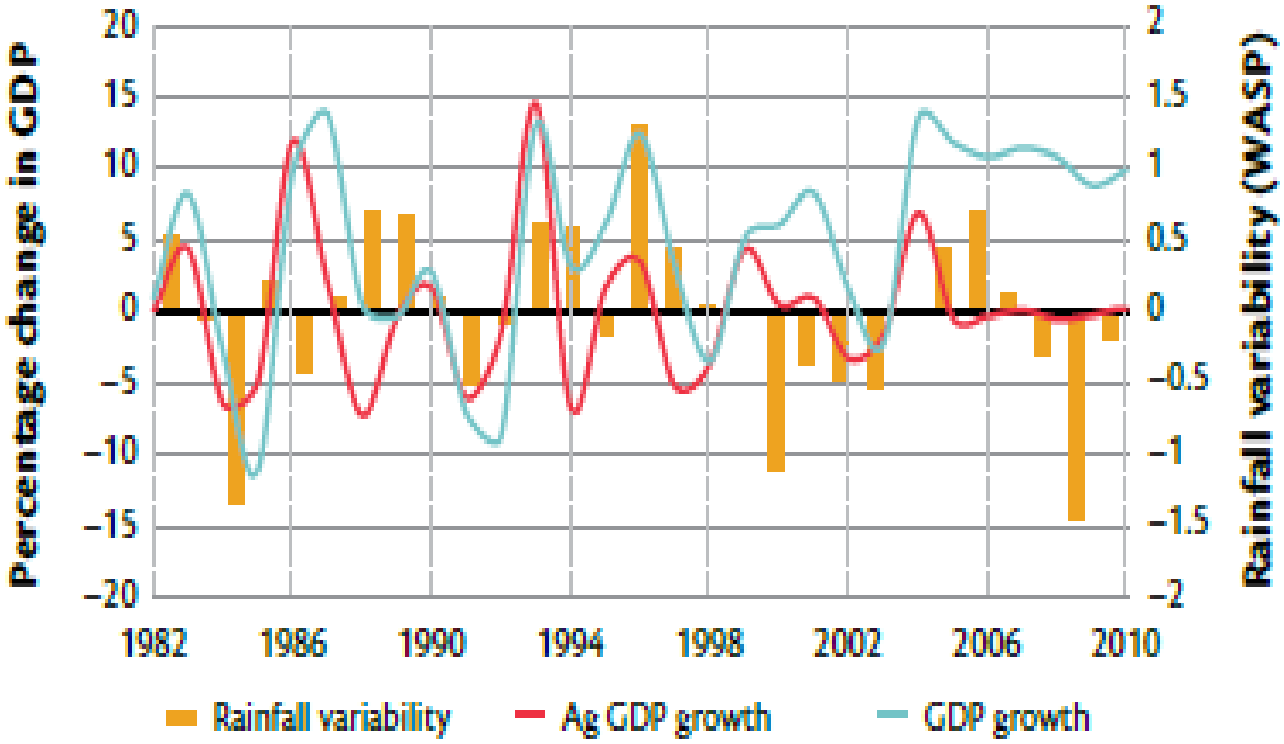
Ethiopia is situated in the Eastern Africa region and has an estimated area of 1.02 million square kilometres. It is characterised by large geographical diversity with highest altitude and low rugged mountains, flat topped plateaus, and deep valleys, incised river gorges and rolling plains. In altitude comparison, it consists from the highest elevated, mount Ras Dashen (4553 metres above sea level) to the lowest depression of the Dalol (120 meter below sea level). Altitudinal variation induces temperature changes and is a factor for the formation of three main climatic zones include cool (*Dega*), temperate (*Weyna Dega*), and hot (*Kola*). The mean annual rainfall distribution in the country ranges from a maximum of more than 2000 mm over the South-Western highlands to a minimum of less than 300 mm over the South-Eastern and North-Western lowlands. Similarly, mean annual temperature varies considerably, from lower than 15°C over the highlands to over 25°C in the lowlands. This climate variability is used to classify the three seasons in the country mainly based on rainfall regimes. These are the dry season (*Bega*) from October to January; the short rainy season (*Belg*) from February to May and the long rainy season (*Kiremet*) from June to September (FDRE, 2007).

In Ethiopia, climate variability is common and has caused several droughts and floods, undermining food security and even causing famine for decades. Previous studies have shown that climate variability and change have exerted a significant impact on the Ethiopian economy,

particularly in the agriculture sector which is dominated by small-scale farmers and highly dominated by traditional agricultural practices (Mersha and Van Laerhoven, 2018; Matewos, 2019). Agriculture is the mainstay of its economy contributing 42 % of its GDP, close to 85% of employment and 90% of exports (FDRE, 2011), clearly indicting the link between climate variability and the economy as shown in Figure 2.1. According to the World Bank (2006), current rainfall variability already costs the Ethiopian economy 38% of its growth potential. Climate change is likely to worsen this already distressing situation. The major predicted impacts of climate change on Ethiopia‘s agriculture include frequent droughts and dry spells, shortened growing season, and increased incidence of pests and diseases (NMA 2007).

The country’s climate is ranging from moist to dry with abundant and scarce soil moisture. Some studies indicate that rainfall distribution has exhibited high variability with dramatic reductions in the Belg (short) rainy season in East and South-East parts of the country after 1997 related to “anthropogenic warming in the Indian ocean” (Fung *et al*., 2005). Furthermore, greater deviations in rainfall amount and distribution occur from season to season and year-to-year. This inter-seasonal and inter-annual rainfall variability imposes extreme impacts on pasture, water resource, health, agriculture and other socio-economic systems of the nation. The expected impacts of climate change include changes in the regularity and amount of extreme rainfall, heat stress and recurrent drought.

Figure 2.1: Relationship between rainfall variability and economic growth in Ethiopia, 1982-2010



Source: Thornton *et al* (2014).

The occurrence of prolonged droughts is the major central climate-related natural hazard the country faces. In Ethiopia, the main causes for vulnerability to climate change and variability include: high dependence on rain-fed type of agriculture, which is very vulnerable to climate change and variability; shortage of water resource; limited health service coverage; fast population growth rate; early stage economic development level; limited adaptive capacity; insufficient road infrastructure in arid and semi-arid areas; absence of strong institutions and lack of awareness about trends of climate change in the areas. Pastureland, water source, cultivation, livestock rearing, human capitals and other assets are the most vulnerable to climate variability.

In terms of the livelihoods approach, smallholder rain-fed farmers and pastoralists are found to be the most vulnerable to climate change (NAPA, 2007).

Drought and floods are the major climatic hazards in Ethiopia and occur every 3 to 5 years. Since the early 1980s the country has suffered five major droughts that caused famines (World Bank, 2009). Over the last two decades, the frequency and severity of droughts has increased in many parts of the country and are likely to continue with increasing trend in global warming (Shiferaw *et al*., 2014). These droughts have caused livelihood breakdowns, aggravated poverty and triggered major catastrophes. Likewise, flooding caused considerable damages to lives and livelihoods by destroying crops, livestock and infrastructure in different parts of the country in 1988, 1993, 1994, 1995, 1996, and 2006 (ICPAC, 2007).

Climate change causes greater challenges for the pastoral communities who tend to rely on fragile natural resources for their means of living and have inadequate capacity to adapt to climate change and variability (UNFCCC, 2007). Long term changes in temperature and rainfall variability and increases in climate variability and severe weather-related conditions are already evident in several parts of African countries in general and Ethiopia in particular.

Climate change occurs due to natural and human-induced factors (AfDB *et al.*, 2003) and result in the variation of the mean weather components including precipitation, temperature, cloud cover and wind. The expected impacts of climate change and variability affects pastoral communities disproportionately, based on their livelihood strategies, resources, educational level and technological base. Hence, the livelihoods of some group of people like women, children, female-headed households, disabled people and the poor are more vulnerable than others. The existent performance of individuals, a group of people or strategies in terms of capacity to secure

livelihoods or basic needs is emphasized as the most important aspect of vulnerability (Eriksen, 2000).

Pastoralists' means of living are characterised by hazard and unpredictable situation due to variable ecological circumstances and irregular shocks (Scoones, 1995). Pastoral communities have historical experience to overcome the destructive consequences of climate change. The unpredictable climate change and other natural environmental conditions are prevent through access to and control over the communal grazing lands, mobility of herds, and indigenous organisations for reciprocal support. According to the IPCC (2001a), pastoralists' reactions to climate change include changes in strategies, practices or structure voluntarily or involuntarily to reduce possible harms associated with climate changes. Effective coping and adaptation strategies imply minimising current and expected vulnerability to climate change (Huq *et al.*, 2003a). Individuals, households, governments and other stakeholders can take such actions. Adaptation may include policy issues and strategies that reduce the extent of vulnerability and improve the ability of pastoralists and systems to adjust to climate change and variability (DFID, 2004).

The capacity to adapt depends largely on the asset base that one has or can access and how well these are exploited. The adaptive capacity of pastoral people in Ethiopia in general and Somali region in particular is considered to be low due to lack of capital, education, context based strategies, policies and technologies. Similarly, livelihoods vulnerability is considered high due to heavy reliance on rain-fed means of living, prolonged droughts and erratic rainfall, and poverty in many pastoralists area (RCRCCC, 2003).

Most parts of the Somali Regional State are typified by arid and semi-arid land which is vulnerable to recurrent drought. The area is one of the most affected and degraded areas that its

range land and water source is almost unable to sustain the traditional modes of pastoral livelihoods due to climate change and variability. The recurrent and prolonged droughts in the region are a common phenomenon in which the poor, women, disabled people and children are the primary victims of such problems. As a result of this, there is a high competition over the existing scarce resource such as water points, grazing lands and irrigation schemes (Little, 2001).

2.5. Pastoralists' perceptions of climate variability and change

Perceptions refer to the way people recognise, understand and explain observations and ideas (Vignola *et al*., 2010). Even though climate change may accompany with circumstances beyond earlier knowledge, traditional knowledge, skill and experiences remain the basis for any local adaptation strategies. Perception also refers to the way how people realise the trends and impacts of the changing events including climate change. The reality of climate change is highly gaining recognition by different scholars and political societies (Dube and Phiri, 2013). Like other natural and man-made disasters, climate change in sub-Saharan Africa, especially for the pastoral communities in Ethiopia becomes a major challenge to sustaining their means of living. In their attempts to make changes, pastoral communities give special attention to overcome existing challenges and reality based on their indigenous knowledge or experience.

The IPCC report (2007) pointed out that climate change is already having major impacts on less developed nations, particularly in sub-Saharan Africa, with the increasing recurrent and magnitude of climate change-associated events, notably recurrent prolonged droughts, strong heat, long dry season, rainfall variability and the outbreak of new livestock and human disease. Climate change vulnerability in Africa is also aggravated by several other stresses it faces such as environmental resource degradation, strong dependence on rain-fed agriculture and poor

infrastructure, also absence of technology, extensive poverty, absence of strong governance and thus low level of adaptive capacity to climate change and variability. The vulnerability of pastoral households in sub-Saharan Africa is caused not only by exposure to climate change but also by a amalgamation of various factors such as political, social, economic and environmental problems that interact with it (David *et al*., 2007).

Efficient adaptation strategy to climate change involves awareness of the changing climate and taking measures in reaction to the perceived change through adaptation strategies (Maddison, 2007). However, several findings on adaptation largely centred on the determinants of response strategies using models that merge climatic, economic and biophysical variables (McCarthy *et al*., 2001). Recognising and interpreting the perceptions of pastoralists who often directly understanding changes in weather conditions and are determined by climate variability is also very important. This is because perception is important in determining the ways in which communities react to the perceived climate change and variability in their local area context. In this regard, Adger *et al*. (2009:346) state that perception is one feature that take part a role either in limiting or enhancing decision-making both for individual and communal actions appropriate to adaptation. They further note that "perceptions of hazards, knowledge, skill and experience are imperative factors at the individual and community level in shaping whether and how adaptation measures take place."

There is an increasing consciousness and growing verification that climate change causes a threat to attaining progress and poverty reduction aims in arid and semi-arid areas (Agrawala and Van Aalst, 2008). The assessment of peoples' perceptions towards climate change has two important steps that include the detection of climate change and recognising of its impacts on the livelihoods of the people. As Moghariya and Smardon (2012) state, people in Western India

could detect climate change based on their life experience (indigenous knowledge) but they did not have scientific concepts about climate change. In addition, research conducted in Eastern Tibet indicated that peoples' perception towards climate change was local level since they have limited knowledge and skill about the global phenomenon of climate change (Byg and Salick, 2009). Some people perceived that climate change has lesser or no significance in their process of productivity. However, it has significant and visible negative consequences on the livelihoods of the pastoral communities. Mubaya *et al.* (2012) indicated that climate change and variability become the major important factors that aggravate livelihoods vulnerability in arid and semi-arid Africa.

Scholars have highlighted that most of the people in east Africa are aware of changes in frequency of drought, temperature and rainfall, have restricted ability to cope with and adapt to the undesirable impacts of climate change and have various constraints to practice diverse adaptation strategies (Acquah-de Graft and Onumah, 2011). They also perceived that climate change and climate variability have led to declined livestock populations, weight, productivity and an increase in livestock loss. These resulted in loss of household income and livelihood for the majority of the people; hence, a general worsening in their welfare (Mengistu, 2009). Pastoralists' perceptions of climate change and variability have become an imperative challenge in recognising climate-people relations. Perceptions of climate change could also be determined by the neglecting of other social and environmental factors such as population growth, deforestation and soil erosion. Pastoral people have long experience about climate change and its impacts on their daily lives. Knowing how they perceive, react, and adapt to climatic changes and events is useful if one has to support them in designing and implementing adaptation strategies to climate change.

Pastoralists also perceive the core manifestations of climate change include extreme temperatures, decline the amount of rainfall, greater variation in seasonal and inter-annual amount, increased occurrence and intensity of extreme incidents, and potentially disastrous alterations of ecologies (Tompkins and Adger, 2004). These indicators will associate with both slow-onset hazards such as water table changes, erratic rainfall and rising heat intensity, and quickly unfolding events such as prolonged droughts, floods, shortage or absence of rainfall and wind. They will direct to larger exposure and sensitivity of pastoral communities through three major impacts on their means of livelihoods: increase in ecological hazards, lessening in livelihoods opportunities, and inconsequence, larger pressures on existing social institutions.

In Ethiopia, studies are conducted on communities' perceptions of climate change and variability. For instance, Meze-Hausken (2004) studied about the awareness of local farmers and pastoralists on rainfall distributions in the Northern parts of Ethiopia. The study results signify that farmers strongly understand a changing climate with heat stress and decline in rainfall amount and duration that compares with the climate evidences. Another study conducted by Deressa *et al*. (2011) reveals that farmer's perceptions to climate change are associated to age, wealth, education, and scientific evidence on climate change, social asset and agro-environmental settings. A study carried out by Kassie *et al*. (2013) examine farmer's perception in Central Rift and Kobo valley areas. Their findings explain that farmers in both areas perceive a change in their local climate and practice different response strategies that are typically linked to changing farming practices.

2.6. Vulnerability to climate change and variability

Although vulnerability is a familiar concept, different scholars define it differently. Vulnerability is fundamentally about risk, uncertainty, susceptibility and lack of security. According to IPCC (2001), vulnerability refers to the extent to which a system is susceptible to, or not capable to withstand the undesirable impacts of climate change and climate variability. Vulnerability can be stated as the incapability of a system to overcome the effects of a hostile environment. Furthermore, Kabat *et al*. (2003) defined vulnerability as the characteristic of an individual, community, and environmental system in terms of its capability to survive with and sustain itself from the impacts of climate change and other disasters. Vulnerability refers to the characteristics of an individual or group in terms of their capability to prevent, cope with, resist, and recover from the impact of a natural hazard. It engages in an association of issues that influence the condition to which someone's life and means of living is put at hazard by a distinct and particular occasion in nature or in society (Blaikie *et al*., 1994). Adger (2006) also define vulnerability as the state of susceptibility to damage from exposure to pressures connected with ecological and social change and from the absence of capacity to adapt.

Climate change-related vulnerability has been studied in terms of climate change exposure, sensitivity, and adaptive capacity. Exposure refers to the degree of magnitude, nature and frequency of climate change in a given environmental area. Sensitivity is the extent to which a group of people is negatively influenced by climate-change related problems. For the purposes of this study, sensitivity mainly relies on the major livelihood activities accomplished in a pastoral communities including the natural, human, economic, physical and social resource required to accomplish these activities, as well as the impacts of climate change on these major livelihood resource. The adaptive capacity of pastoral communities is its capacity to adapt to

climate change, to reduce or tackle the impacts, and to take benefit of the opportunities that may arise with climate change. It is understood in terms of some fundamental socio-economic determinants, a community's earlier period and recent strategies for surviving with climate factors, whether such strategies are practicable in the face of future climate change, possible strategies to anticipate and withstand future changes, as well as the various enabling situations and obstacles to adaptation (IPCC, 2001; Adger, 2006; Fussel, 2007). Vulnerability is therefore consisted of hazards or a series of hazardous occasions that communities confront in pursuit of their livelihoods, the sensitivity of livelihood to these risks, the adaptation or alternatives that communities have for administering these hazards and finally the results that explain the loss in well-being (Turner *et al.*, 2003).

A recently appeared paradigm of vulnerability research is susceptibility to climate change impacts and threat. Different literatures on climate change vulnerability has special features with others in terms of using commonly recognized terms as an essential part of its scientific agenda. In fact, climate change is a worldwide problem; which is characterised by involvement of many different actors, numerous stressors and several time scales (Adger, 2006). A number of researchers propose that climate change impacts will considerably exacerbate problems on those individuals and communities who are already vulnerable to climatic extreme incidents. It is also the fact that the impact of estimated climate changes that are attributable to worldwide climate change will unfavourably affect those communities in future making them more vulnerable to climate change impacts. In addition, the vulnerable group of people are usually marginalized and disproportionately affected by climate change impacts (Stott *et al*., 2004; Kovats *et al*., 2005).

Vulnerability study on climate change and variability dialogue has a broad range of applications. Adger (2006) states that understanding vulnerability depends on using an

integrative, coupled human-environment approach to the relations between social changes with the socio-environmental system, and how such changes shape the resilience of different systems. Leichenko and O'Brien (2002) identifies that in addition to climate change and variability, globalisation exacerbate the extent and magnitudes of rural people's exposure to new and unexpected conditions in Africa. Besides, the relation between climate variability and globalisation significantly alter rural farmers' lifestyle and adaptation strategies to climatic change and variability. Wilbanks and Kates (2010) advocates for combination of natural risk, sustainability, and society and regional resilience study within the wider structure of vulnerability research. Ziervogel *et al*. (2006) describe various extents of vulnerability of communities and/or environment to damage caused by different external stressors, and indicated several issues such as exposure to stressors (that is hazards), ecology and the human system's internal capacity to survive with, recover from, and adopt with external perturbations or stresses. Furthermore, such issues are directly connected to the system's resilience, sensitivity, or adaptive capacity.

Scholars also identified that using vulnerability in climate change discourse has two unlike meanings. O'Brien *et al*. (2004) identify vulnerability as an 'endpoint' and a 'straight-point' interpretation. Bearing in mind such 'endpoint' and 'straight-point' interpretation of vulnerability, Smit *et al*. (1999) and Burton *et al*. (2002) point out that 'end-point' explanation of vulnerability characterises the estimated net impacts of a specified level of worldwide climate change with likely adaptation alternatives and is reliable with integrated and risk-hazard approach, whereas 'straight-point' interpretation is reliable with political economy approach, and focuses on the internal side of vulnerability, for example declining socio-economic vulnerability

to any climatic hazard. In addition, this approach mostly gives attention for adjustment policy and wider social progress.

Downing *et al.* (2001) state that the important standard for quantifying vulnerability have verified difficult in part because of the fact that vulnerability is often not a directly noticeable phenomenon. Nonetheless, several efforts have been made to build up approaches to assess vulnerability over the years (Heltberg *et al*., 2009). The existing scientific evidence indicating that climate change is no longer a remote estimation but a reality whose adverse impacts on environment and the life of the people is often underestimated. In this regard, the IPCC (2007) provides tangible information that climate change is actual and it is occurring now, that it will become worse, and that the poorest in third world countries and most vulnerable communities will be highly impacted. Africa is generally considered as being highly vulnerable to climate change and variability, because many of peoples' livelihoods depend largely on rain-fed type of agricultural production, which is sensitive to climate change and variability (Boko *et al*., 2007).

The highly vulnerable individuals, groups, communities and places are those that experience the most exposure and are sensitive to stresses, and those that have the least capability to react and withstand from the existing stress (Schiller *et al*., 2001). Climate change and climate variability will have extensive implications in the 21st century (IPCC, 2012). There is substantial policy interest in: (i) identifying the specific vulnerabilities of communities that will be exposed to climate change and variability impacts; (ii) understanding how different climate impacts will affect regional systems; and (iii) how populations will respond through the process of adaptation strategies (Warner *et al*., 2009).

Vulnerability is the effect of several issues, some of which relate to policies and institutions and a scarcity of resources, rather than to special trends, shocks or features of

seasonality *per se*. Researchers identified two approaches of interpretations of vulnerability. The first interpretation is that vulnerability is a result of multiple issues such as biophysical, social, political and cultural factors, but aggravated by climate variation and change (vulnerability as a starting point approach). On the other hand, vulnerability is considered as result of climate change impacts and indicates the present incapability to withstand the existing changes (vulnerability as an end point approach). This approach is applied to determine the extent of climate change related problems and give ideas in policy development concerning the cost of climate change versus costs related to greenhouse gas alleviation efforts (Kelly and Adger, 2000). This study is inclined to use the first interpretation of vulnerability (vulnerability as a starting point) because this interpretation of vulnerability starts with multiple factors but is exacerbated by climate change and variability.

Vulnerability becomes the most important features of human life and anyone could be vulnerable to climate change. Currently, no one is completely free from the impacts of climate change. Instead, the extent and magnitude of climate change risk only differ among communities, places ad sectors, as pastoral communities (Kirby, 2006). Even among pastoral communities, vulnerability is usually related with individual characteristics, resource distribution, livestock products, gender, disability, non-farm activities and other assets. As Admassie *et al.* (2008) describe that vulnerable households are incapable to survive the impacts of climate change since their resources stock are hardly adequate to withstand the existing climate crisis while better-off households have the ability to withstand the impacts of climate change through the process of adaptation strategies. In Ethiopia, the highly vulnerable groups of people include the marginalized because of their socio-economic status, geographical location, political ideology, ethnicity, gender, sex and educational status. Poor households, women,

children, disabled and non-literate people are highly vulnerable to the adverse impacts of climate change because they are incapable to respond to the existing impacts of climate change. There are different approaches of examining household vulnerability includes biophysical, socio-economic and a combined approach, which connects both biophysical and socio-economic factors.

Biophysical approaches came into practice in the 1980s (Fussel and Klein, 2006) and considered vulnerability as the result of the loss of peoples' livelihoods, life and environmental damage. The major concern of this approach was centred around the physical impacts of climate change on the livelihoods of the people. Consequently, vulnerability is explained in terms of impacts of climate change or the extents of harm experienced by a livelihood system because of a climate change related hazard. The potential hazards of climate change to human life, the exposure and vulnerability to damage livelihoods and environment results in the occurrence of risk. In communities with limited adaptive capacity and in areas where inefficient adaptation strategy is practiced, damaging event would occur. In general, vulnerability to climate change contains the risk, alternatives for responding to risks, and the outcome in terms of welfare loss (Siegel and Alwang, 1999). The combination of hazard and vulnerability results in risks, that is, risk equals to hazard multiplied by vulnerability and divided by adaptation capacity of the people. The negative impact of risks relies on the features and strength of the hazard, the vulnerabilities and capabilities of the individuals exposed to the hazard.

However, the biophysical approach has limitations that give less concern to the role of socio-economic situations, power relations and the existing vulnerabilities that are similarly significant. It is not an adequate situation for understanding the multifaceted dynamics of vulnerability. This approach also overlooks both human agency and structural factors in creating

vulnerability and in surviving or adjusting to it. The approach overstates severe events while ignoring the main causes and daily social changes that influence differential vulnerability (Yamin *et al*., 2005). In general, the biophysical approach is usually concerned with hazards and exposure that affect communities in different areas. One of the strengths of the biophysical approach is that it is linked to extreme phenomena and hazard specific vulnerabilities.

The socio-economic approaches to vulnerability emerged around 1990s when the hazard paradigm has been criticised by many scholars about its weakness to clarify the reasons and effects of disasters in different areas such as famine in sub-Sahara region. The World Bank (2010a) states that even though the natural hazards are the main causes for people's livelihood vulnerability, sometimes risks people faced and the reasons for their vulnerability to hazards may go beyond natural hazards. Sen (1981) briefly explained that the occurrence of drought does not essentially expose individuals to famine and starvation. Other scholars stated that socially constructed disasters occurred through frequent socio-economic drought even when there is no climate change and climate variability (usually known as green famine). In Ethiopia, famine occurs when there is a significant reduction in average food accessibility per head, imply that there is a disparity among communities not accessing adequate food. An individual may have fewer chances of accessing food if he or she is not employed, does not receive any remittances or other means of sufficient income, and has no social security (Conway and Schipper, 2011). Famine may occur when people become unable to command over a sufficient amount of food and other related necessities (it is also known as a food entitlement problem). People become hungry when they are incapable to change what they have into commanding enough food to sustain their families. Therefore, the issue of food supply is not the major problem, rather food

entitlement and what is to be blamed is the massive social failure rather than the natural problem (Sen, 1981: 118).

Thus the social, economic, cultural and political systems of the communities are the central focus of socio-economic approaches to vulnerability rather than natural hazards such as climate change, climate variability, epidemic diseases, earth quake, and so on (Adger, 1999). The focus of socio-economic approach to vulnerability is people's adaptation strategies and socio-economic systems of the society while hazards only perpetuate vulnerabilities. In addition to climate change related hazards to vulnerability, the socio-economic approach associated vulnerability with resource accessibility and control, social capital, economic inequality, political suppression of particular group of people and gender discrimination (Eakin, 2008). Social vulnerability is influenced by internal factors of a system that includes poverty, health, food entitlements, housing quality, social status and access to insurance. At household level, shelter, sanitation, diet and water supply determine vulnerability while group level factors of social vulnerability includes ethnicity, caste, class, disability, gender, age and political ideology (Adger and Kelly, 1999).

Instead of viewing vulnerability as solely due to natural hazards, the socio economic approach attributes it to several characteristics such as population, place, system (exposure units), resource endowment, and the institutional structures that determine its capacities, sensitivities and exposure to climate change and variability risks (Eakin, 2012). Within the socio-economic approach, vulnerability of people is associated with low asset base, food insecurity, and poverty, political and economic marginalization, which result in reduction of people's adaptive capacity (O'Brien *et al*., 2004a). To link livelihood vulnerability to climate change and variability with poverty, the livelihoods of the poor are usually strongly linked to climate

sensitive conditions that include flooding, prolonged drought, rainfall variability, pests and diseases that obliterate their means of living while intensifying their poverty (Nyong, 2009; Hope, 2009; Nordhaus, 2007). One of the major limitations of the socio-economic approach is that it centres only on differences within community; however, communities differ not only due to socio-political issues but also because of ecological or biophysical factors. The socio-economic approach does not account for the accessibility of natural asset bases, which have the likely to offset the negative impacts of environmental shocks. For example, regions with easily available underground water can better survive with shortage of rainfall by exploiting this resource than areas without it (Deressa *et al.,* 2008). Generally, this approach gives less emphasis to climate change hazards while placing high attention to internal factors of the exposure unit (households, community, places and systems).

Integrated approaches to vulnerability came into practice in the late 1990s and in the early 2000s. Vulnerability has been viewed not as static internal characteristic rather it is a dynamic event emerging from the internal features of specific inhabitants, areas, systems, human relations and the nature of ecological interactions (Eakin, 2012). Household's vulnerability to climate change and variability depends on accessibility and control of assets, institutional and organizational structure and their adaptive capacity.

The Integrated approach to vulnerability links both biophysical and socio-economic attributes in vulnerability analysis. This approach comprises all the internal situation of vulnerability and external state (Fussel, 2007). Environmental factors include climate change and variability, soil fertility, grazing land and accessibility of water for daily consumption and irrigation (O'Brien *et al*., 2004b). It recognises that vulnerability to climate change and variability is not one-dimensional, rather, it is multi-dimensional and a function of environmental

outcomes related to changes and variations in rainfall, temperature, land features, socio-political dimensions, level of economic development and institutional capacities (Agrawal, 2010; Adams, 2006).

The second appraisal report of the Intergovernmental Panel on Climate Change (IPCC) places hazard at the centre of vulnerability analysis, focusing on biophysical drivers such as temperature, rainfall and severe climate change incidents (Nelson and Agrawal, 2008). However, in recent years, there has been growing identification that vulnerability is not only because of biophysical motives, that is, the features of the hazards, but is also a function of the system's sensitivity and adaptive capacity (Shah *et al*., 2013).

The IPCC (2007) noted that peoples inhabiting in arid and semi-arid lands, and whose livelihoods are extremely dependent on natural resources and rain-fed agricultural production, are among the most vulnerable to climate change. Human induced climate change and variability are increasingly affecting poor rural pastoral communities, who often have less capacity to react to such change. Any changes in climatic conditions exacerbated an already challenging livelihood situation. Variable and unpredictable rainfall in pastoral areas causes persistent droughts and intense floods. This deteriorates local as well as national food and water security. This characteristic has implications for economic development and poverty alleviation endeavours, particularly for the already vulnerable pastoral communities who are entirely dependent on the natural environment they reside in. Rearing of livestock, particularly goats and camels is a primary activity and means of livelihoods among pastoral societies in the Horn of Africa. This is partly due to livestock's capability to adapt the inhospitable arid and semi-arid situations and thus give a better means of livelihood than arable farming.

Climate change and variability are making increasingly vulnerable situations in delicate pastoral bionetworks. Changes in land possession and agriculture, and sedenterisation, are also breaking large-scale pastoral ecosystems into isolated systems. The impact of climate change is anticipated to increase the vulnerability of livestock systems and reinforce existing factors that are affecting herd production systems. The deterioration of livestock resources due to climate change could trigger a collapse into extreme poverty and have long-lasting effects on their means of livelihoods. For instance, during the period of long dry seasons that happened in 1999-2001 in Kenya, over 2 million sheep and goats, 90,000 cattle and 14,000 camels were died (Mutimba *et al*., 2010).

In general, the integrated approach is a comprehensive and holistic approach that uses as a practical analytical device since climate change and variability is a major concern affecting environmental quality and quantity, human development efforts, food security and other assets. Constructing and using a single index of vulnerability is inappropriate because climate change is a many different event that includes economic, social and environmental aspects. Thus, this study tends to use combined approach to complement the debate on adaptation strategies of pastoral communities to multiple stressors (Legesse, 2006; Reid and Vogel, 2006). Vulnerable pastoral regions are typified by one or more of the following problems:

- Deterioration of productive assets due to drought, floods, heat stress and livestock disease.
- Declining means of livelihoods as domestic animals holdings decrease and the human population grows.
- Deteriorating livestock productivity due to climate change impacts.

- Ecological degradation and natural resource deterioration to the point that production may decrease below recovery levels.
- Collapse indigenous institutions and social networks.
- Incapability to access markets and achieve ceiling prices for domestic animals products.
- Limited socio-economic empowerment of poor, women and disabled.
- Marginalisation in terms of roads, communications and essential services.

Summary of vulnerability to climate change

Key vulnerabilities	
• Rainfall failure or delay and long dry seasons; • Market disorders caused by trade prohibits, border closures, root insecurity, crackdowns and restrictions; • Uncertainty and inter and intra-clan conflicts due to competition over scarce pasture and water points; • Environmental degradation;	• Shortage of water in both amount and quality during dry season; • Increasing risk of diseases spreading due to high migration; • Spread of new livestock diseases; • Absence or backward infrastructure and government facilities impacting harmfully on people's capacity to adapt with hardships;

Source: Adopted from SCUK, 2004.

2.7. Adaptation strategies to climate change and variability

Intergovernmental Panel on Climate Change defines climate change adaptation as 'adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which

minimises harm or exploits beneficial opportunities' (IPCC, 2007). Adaptation to climate change carry out in a changeable cultural, social, political, economic, technological, biophysical context that varies eventually, location, and sector. These multiple factors determine the capacity of systems to adapt. Adaptation can engage in a number of practices by several actors at different stages ranging from households to institutionalised settings (Prowse and Scott, 2008).

Usually, adaptation practices that happen at household level (one beneficiary) triggered by climate changes or wellbeing changes in human systems are referred to as independent adaptations. Others that are the result of an intentional policy decisions derived from knowledge of the potential change of climatic situations are classified into intended or organisational adjustments. The literature identifies two broad categories of adaptation: reactive and proactive adaptation strategies. Reactive adaptations undertaken after the change occurs (ex-post) while proactive adaptations are often practiced in anticipation of future climate change and engage in long-term investments in large-scale infrastructure such as dams or irrigation canals. Given the complexity of predicting climate change at a local level, the majority of adaptations are anticipated to be reactive (Mendelsohn and Dinar, 2009).

There is a rapidly increasing interest and concern in the literature on how pastoral societies cope with and adapt to climate change and variability. Climate change and variability become the main driving factor towards the adoption of coping mechanisms and adaptation strategies to sustain means of living. Coping mechanisms are unplanned, reactive, and short-term responses to immediate problems, whereas adaptation strategies refer to proactive and anticipatory changes over long periods to reduce the impacts of recurrent threats or gradual changes (Berkes and Jolly, 2002). Earlier findings defined adaptation as the process of responding to withstand the negative adverse impacts associated with climate change and

variability (Smit *et al*., 2000). Smit and Wandel (2006: p. 282) defined adaptation as a process, action or outcome undertaken at household, community, group, sector, region or national level that enables the existing system to better cope with, manage or adjust to the negative impacts of both natural and human made challenges.

Adaptation sometimes has positive impacts in enhancing the adaptive capacity of groups of people and individuals. In pastoral areas, coping and adaptation strategy to climate change is considered as an inevitable and necessary response (Naess *et al*., 2009). Adaptation can be practiced at different level, including at individual level, household level, community level or at country and regional level. At household level, practicing adaptation tend to be autonomous while government organisations are mobilized to take action before the impacts of climate change (anticipatory) and deliberate policy decision based on awareness about what type of action is needed to avert the negative impacts of climate change and other human made factors (planned adaptation) (Maddison, 2007; Smit and Pilifosova, 2001). Filho and Mannke (2014) state that planned adaptation strategy considers governments' evaluations of different political, cultural, social and economic situations, and based on such status governments can make decisions to manage the impacts of climate change on the livelihoods of the people. Scientific information about the extent and magnitude of climate change is very important in making appropriate decisions and responses to minimize its adverse impacts on the livelihoods of vulnerable people. The capability of communities to adapt to climate change can be determined by the capacity to perform collectively, and consequently, it appears itself in policies and actions undertaken by community, governmental and non-governmental agencies (Adger, 2003b).

On the other hand, adaptation strategies are implemented at local level because their achievement relies on local institutions through which encourages for individual and collective

action are structured (Agrawal, 2010). Altieri and Koohafkan (2008) conducted research on 'rural farmers' innovation and local approaches in marginal environment', and they concluded that successful adaptation strategies to sustain rural means of livelihoods are usually led by indigenous institutions, local government organisations and by non-governmental organisations concerning soil conservation, water harvesting, maintaining and enhancing natural resource productivity and other assets. The effectiveness of livelihood adaptation strategy at local level needs to be acknowledged and supported by the concerned bodies based on the national frameworks of development strategies and policies. In order to achieve successful and sustainable adaptation activities in pastoral areas, acknowledging the indigenous adaptation strategy and modern adaptation strategy both at local and regional level is a key step to overcome the impacts of environmental and human made factors (Nyong and Niang-Diop, 2006, 238). Pastoralists employ mobility to track dynamic and unpredictable resource and are thus better able to respond to and cope with prolonged droughts. Mobile pastoralists do better than sedentary ones during drought, and are less likely to lose stock (Little *et al*., 2008).

Adaptation capacity of the household or community in a specific area may be determined by several factors such as institutional capacity, resource scarcity, recurrent drought and absence of context based adaptation strategy. Yohe and Tol (2002) enumerated different factors that determine adaptive capacity such as accessibility and control over resource, availability of technological alternatives for adaptation process, asset or capital, social and institutional networks, the capability of decision makers to manage adaptation strategies, and the public's perceived attribution of the source of stress. Smit *et al*. (2001) summarised determinant factors as availability of wealth, technological options, accessibility of infrastructures, up-to-date information, indigenous knowledge and skill, equality and equity, and functional institutions and

organisations. These factors may hinder or enhance adaptation activities to climate change to the degree that institutions and governance related issues are depicted as major obstacles to adaptation to climate change (Ekstrom and Moser, 2013).

Recently, scholars understand the role of both formal and informal institutions and social networks as determinant factors in the process of facilitating or even impeding the efforts of coping and adaptation strategies to climate change (Agarwal, 2010). Nyong and Niang-Diop (2006) classified the role of institutions and social relationships into two: facilitation and implementation roles. Facilitation roles include provision of information and creating awareness, reducing obstacles to adaptation, accessing basic resource for adaptation whereas the implementing role includes making tangible changes in behavioural and operational practices, and practical skill to install and operate modern technologies.

Adaptation strategies can be determined by several factors include cultural, economic, experience, policy environment and perception towards climate change related risks. Based on these factors, researchers classified adaptation approaches into three: livelihoods approach to adaptation, sectoral approach to adaptation and generational approach to adaptation (Adger and Kelly, 1999). With regard to livelihoods approach to adaptation, IFAD (2013) states that adaptation alternatives available to rural households and communities depends on climate change related risk, the stock of asset, livelihood strategies and location of a place. Using better climate change risk analysis with the help of modern tools such as meteorological instruments and Geographic Information System (GIS) can help rural pastoralists to practice and supplement indigenous adaptation strategies with innovative knowledge. Therefore, there is a positive chance for vulnerable areas to benefit from such technologies in the form of accurate interpretation and

dissemination of information and subsequent support to the efforts of livelihoods adaptation strategies to climate change.

Sectoral approach to adaptation strategy is the second approach. Clements *et al*. (2011) summarized this approach as indigenous and modern technologies and practices in the process of climate change responses for rural farming to include water access, use and management, grazing land management, soil management, vegetable management, livestock management and farming management. Adaptation strategies to survive and adjust to drought are rooted in local societies' indigenous social organisations and resource management systems. Drought are the most persistent disaster that pastoralists face to their lives and means of livelihoods. But the pastoral communities have adapted their way of life over many years to cope with scarcity of rainfall by practicing mobile way of life with their livestock across long distances, bargaining access to grazing land with neighbouring clans and engaging in non-farm activities. For example, Bryan *et al*. (2009) conducted research in Ethiopia and South Africa and highlighted various adaptation strategies such as use of drought resistant crops, food aid, wild plant gathering, diversification, changing crop planting dates, non-farm activities, livestock rearing and using irrigation as the most important livelihoods adaptation strategies.

The third type of approach to adaptation strategy is a *generational approach to adaptation*. Kelly and Adger (2000) classified this approach into two generations: first generation and second generation. The first generation adaptation studies focus on biophysical hazards and impacts based on the extent of the vulnerability. Under this approach, the range of adaptation activities includes resettlement, economic support, irrigation, drainage system and enhancements of institutional capacities. This approach usually focuses in natural risks, and it was used in combination with different models such as climate change model, economic model,

integrated system model, biophysical model and expert judgments to distinguish impacts and adaptation activities alternative (O'Brien *et al*., 2004a).

On the other hand, the second-generation adaptation studies focus on social vulnerability to climate change related hazards. Adaptation strategies linked with second-generation studies are more social issues rather than environmental. Agrawal (2010) explore and classify the adaptation strategies into five risk reduction categories namely livelihood diversifications, storage, market exchange, communal pooling and mobility, which may substitute for any of the other four categories when household levels have access to market. Among the five types of adaptation strategies, livelihood diversification is identified as the most important and widely used alternatives so that it is acknowledged as a well-known characteristic of biophysical change and strategy (Lampert *et al*., 2000). Ellis (1998) defined livelihood diversification as the process by which rural households construct a range of activities and social support capabilities in order to survive or accumulate capital, to improve their standard of living, and then to increase people's capacity to adjust themselves with the changing climate.

Pastoralists in Ethiopia have developed various coping mechanisms and adaptation strategies in order to adjust themselves with climatic change, variability and other socio-economic factors, such as diversification, migration, remittances and social cohesion to support each other. These adaptation strategies mainly occur within both formal and informal economic sectors. However, the majority of poor people have limited access to formal sectors. The livelihoods of the poor society have been affected by social and economic changes such as privatisation and commercialization of resource rights and loss of access to land, forest and water resource (Kelly and Adger, 2000). Greater and even more rapid changes in the local climate because of global warming present an additional challenge to local coping and adaptation

strategies. Deprived households and women are extremely vulnerable to the impacts of climate change. Increasing disparity among communities can intensify collective vulnerability. Strong connections exist between disparity and a lack of diversification of means of living as well as with poverty, placing further limitations in the response options (ibid).

Mobility is one of the most important way of handling domestic animals related risks. Pastoralists also adjust the composition of their livestock to the external environment. There is evidence that camels and goats, which are more drought tolerant animal, are increasing in number. Livestock compositions also allows pastoralists to reduce losses from disease. Other surviving mechanisms include decreasing the quantity and quality of food consumed during drought periods, borrowing, eating wild foods, aid from donors and getting support from clans or relatives. Remittances from their family members play a significant role during times of pressure in Somali Region. According to FAO (2007), adaptation to the unfavourable results of climate change could be viewed from two different perspectives: i) the consciousness of the hazards of climate change and their capacity to adapt to climate change and ii) how adaptation can be cautiously planned and implemented to evade the likelihood of mal-adaptation. While the former can be improved by providing significant information to the vulnerable people about the risk and consequences of climate change, the latter focuses on technical developments and government insurance, which are mainly the accountability of public agents, agribusiness and government.

To cope with and adapt to climate change and variability in sub-Saharan Africa, pastoral communities have excavated more boreholes in arid and semi-arid regions, engaged in off-farm income generating activities and have decreased the quantity of livestock, by slaughtering and/or selling them during long-lasting drought periods and restocking after the drought. Some pastoralists have inclined to livestock that can withstand water stress and hot temperatures.

The Somali pastoral communities live intimately with climatic change, traditionally adapting to the very harsh climatic situations through pastoral means of living and accumulated knowledge of their local surroundings, such as local environmental and meteorological signs. Some of the strategies adopted by pastoral people to cope with or reduce the adverse impacts of climate change and climate variability include:

- Buying and storing food crops for consumption during the drought period,
- Moving with their livestock to areas where better pastures and water points are available.
- Sharing the available resources with their neighbours through negotiation.
- Engaging in diverse activities to broaden means of livelihoods alternatives,
- Rearing of drought and disease resistant animals (came and goat);
- Reducing livestock numbers and changing herd composition (Adan, 2014).

Summary of coping and adaptation strategies to climate change

Adaptation strategies:	**Coping mechanisms:**
• Pasture survey and migration; • Controlling breeding so as to coincide birthing with the rainy seasons; • Diversify income sources – agro-pastoralists; • Livestock diversification and splitting in drought period; • Water harvesting and conservation – *berkads,* ponds, *etc;*	• Increase livestock and livestock product sales • Old/weak livestock slaughtered for consumption ; • Slaughter of newborn cattle/sheep; • Labour migration to towns; • Making and selling charcoal; • Livestock splitting ; • Reduce meals per day;

• Fodder storage (practiced by better off pastoralists); • Social support as informal insurance (*kaalmo* & *zakaa*) and • Increase pack animals.	• Reduce gifts (by better-off to poor) • Consumption of wild food; • Community-funded water-trucking to areas of good pasture and • Looking for relief aid from government and other donors.

Source: Adopted from SCUK, 2004

2.8. Constraints to climate change adaptation strategies

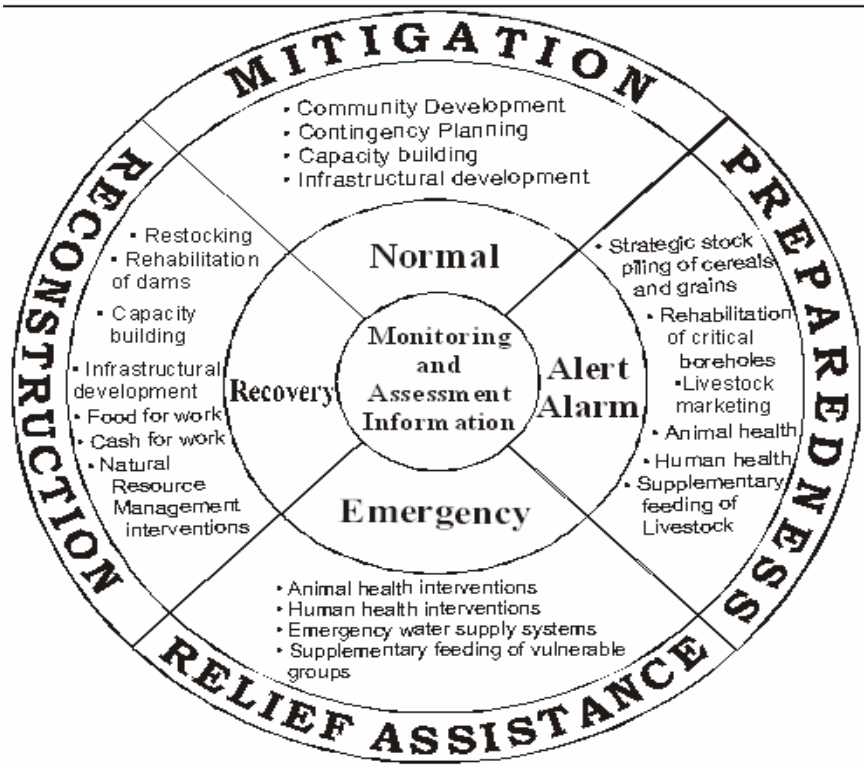
Pastoralists are struggling to adjust themselves within the existing uncertainties created by climate and non-climate change. However, people's alternatives and capabilities to make adjustments within a changing climate are constrained by environmental, social, cultural, economic, political and legal factors. The livelihoods of pastoralists are vulnerable to climate change and variability due to shortage or absence of rainfall and limited natural, financial and institutional resource (Naess *et al.*, 2009). Pastoralist's capability to withstand the impacts of climate change has been challenged by different factors such as institutional factors, access to key resource (pastureland and water points), poor infrastructure, conflict, access to credit, gender disparity, restriction in mobility, food price inflations, land disputes and land fragmentations (Mengistu, 2011).

Drought response strategies in pastoral areas face a number of capacity limitations. Many government officials, including the *woreda*, are not currently familiar with the notion of protecting livelihoods resources. Food aid is still considered as the natural coping mechanism to drought. There emerges to be a better sympathetic of the essentiality of livelihood action at

woreda (district) level, where representatives of local pastoral communities are presented in the local organisations. However, these officials often lack the technical skills to conduct proper livelihoods assessments. Several offices are characterised with shortage of qualified staffs, with poor communication services and large number of staff turnover. In some *woreda,* employees are said to be recruited based on clan quotas and sometimes include non-educated individuals. The remainders are often non-pastoralist. The overall level of skills is generally poor, especially in remote areas. Gender, age, experience, income, household size, education, access to extension services, off-farm and non-farm activities are among the major determinants of adopting climate change adaptation measures (Acquah-de Graft and Onumah, 2011).

Devereux (2006) argues that livelihood vulnerability to drought is increasing from time to time. Drought shrinks the stock of resource such as grazing lands, water points, and forests, livestock and livestock products. Such resource degradation causes herders to migrate to better area, which leads to resource competition and conflict. Drought Cycle Management (DCM) was designed with four phases of the drought cycle such as to identify appropriate activities normal, alert, emergency and recovery. As shown in figure 2.1, each phases of drought cycle has appropriate activities.

Figure 2.2: Drought Cycle Management Phase with different activities



Source: adopted from Sara Pantuliano and Mike Wekesa, 2008

Successful drought cycle management calls for proper plans to prepare for drought, adapt to its impacts and support vulnerable households to rehabilitate. Theoretically, the system should include the following:

- strong institutions, management and coordination structures at all levels;
- context based early warning and information systems;
- proactive types of drought emergency planning at all levels;
- easily available drought contingency finance from central to *woreda* level; and
- the ability to practice timely drought response strategies and to provide support to drought recovery interventions (Behnke *et al*., 2007).

Pastoralists in east Africa have been suffering from different problems caused by poverty, population growth, weak governance, natural environment degradation, conflict, high temperature, prolonged drought, population displacement and famine. Climate change and variability has become a new threat for the area that aggravates already existing problems. Impacts of climate change, when coupled with other non-climate factors, have become a new threat to the livelihoods of pastoral communities in the region.

Women in pastoralists' areas in the Horn of Africa are the most vulnerable groups because of weak adaptive capacity to avert the impacts of climate change and dependence on natural resources for their livelihoods. The disproportionate impacts of climate change on women are manifested in socially constructed gender roles and relation. Women and girls are assigned with roles and responsibilities that make them more vulnerable to impacts of climate change. During drought periods, women have responsibility to go distant areas to fetch potable water and collect firewood. This increases their work burden and affects their health as they are exposed to sexual and physical violence. Educationally, girls have higher rates of dropout from education because of their responsibilities (Medhanit, 2014).

The major challenges hindering pastoral development could be categorised in the following wider classifications.

- Environmental constraints: reduction of rainfall amount leading to constant drought, scarce pasture and water for livestock,
- Poor access to health and education facilities as a result of mobility, poor livestock husbandry and livestock health facilities and poor market outlet owing to absence of roads and information,

- Weak institutional structures to manage violent conflicts and tribal disputes, and poor governance and administrative structure and gender insensitivity, and
- Pastoral societies had not been sufficiently consulted and participated in the project development and implementation.

It is recognised that the pastoral regions have had weakly designed infrastructures, which have had direct bearing on access to essential public services such as health, education and clean water and sanitation services. As already delineated above, the problems and constraints of pastoral development are clearly multifaceted and inter-woven. Notwithstanding these problems, there is poor understanding of the entire nature of the problems. Interventions were following a piecemeal development approach and development failed to be sustainable with continuous deterioration and decline in the life and welfare of the pastoral communities (MOFED, 2005).

2.9. The Role of institutions in pastoral livelihood security

In the past, pastoralism was considered as backward and ecologically destructive production system, unwilling to accept new changes and traditional people with insignificant contribution to the national economy. Government and international agencies have often seen pastoralism as destructive, due to the assumed incapability of communal systems to control rangeland use and overstocking, inevitably leading to overgrazing and unproductive livestock management (Oygard *et al.*, 1999). Many development interventions such as forced destocking, settlement, land tenure modifications (in the form of formulation of group ranches and privatization of the rangeland) and others were tried as a means of giving solution to various pastoral crises (Ellis and Swift, 1988).

For the last several decades, Ethiopia gave a little attention to its pastoralists who is estimated to be more than 15 million (Mohamed, 2015). For The first time, the issue of

pastoralism and pastoralists had been incorporated under the 1995 EPRDF constitution. Apart from the legal recognition of pastoralism at constitutional level, instructional measures were established like department in the ministry of federal affairs that coordinate development issues in pastoral areas of the country. Moreover, Pastoralist Affairs Standing Committee was also set in the parliament to oversee the overall development activities of the pastoral communities in the country. In each pastoral regions, regional offices were also established.

The pastoral societies are well-known to have complex social structures, prone to frequent conflicts and located in the arid and semi-arid areas of the country where the environment is fragile. Frequent conflicts among ethnic groups over the use of scarce resources has been common issues in most pastoral areas of the country. There has also been a deterioration of productive resources and exacerbating household food insecurity due to prolonged droughts. Whereas, high population growth rate, and climate change are negatively affecting their adaptive capacity and stretching the capacity of local institutions and customary practices to cope with shocks and deal with resource management and sharing. As a community, pastoralists have been culturally, socially, economically and politically side-lined. Development issues faced by pastoralists include: (i) lack of strong government institutions and public participation in local decision-making processes, (ii) limited access to social facilities, particularly education and health care; (iii) reliance on extensive herd husbandry with limited developed support services, and unequal access to markets; (iv) long-term ecological degradation, particularly rangeland and water sources; (v) vulnerability to frequent droughts aggravated by climate change and variability; and (vi) increasing competition for natural resource use and ethnic conflict (MoARD, 2013).

Both indigenous institutions and modern ones play a major role in determining what alternatives groups of people and individuals have to cope with and adapt to climate change and variability. Indigenous institutions are capable of creating opportunities for the pastoral people to access and exploit various resources to withstand their livelihoods with the existing climate change. However, due to climate change and resource degradation, the effectiveness of indigenous institutions to sustain the livelihoods of people become vulnerable. Indigenous institutions are also biased to provide equal opportunities for the most vulnerable people- women, girls, female-headed households and elders- to access and utilize the existing communal resource in the area (Naess *et al*., 2009).

A system that is already practicing badly may result in additional stress as climatic change triggers dangerous effects in terms of death, health, income and welfare. In addition, the capability to survive with or rehabilitate from climate impacts, as well as the ability to withstand the long-lasting climate change, may be poor. Institutional issues that influence adoption of new technologies include access to information through extension services and access to credit. Even though African governments design policies and strategies to build climate resilient livelihoods in pastoralist areas, their effort is constrained by various factors. The formulation and implementation of any climate change related policies and strategies needs sufficient knowledge about the extent of vulnerability, the existing knowledge the population has, the coping and adaptation practices adopted the existing adaptive capacity and the perceived barriers to adaptation (Acquah-de Graft and Onumah, 2011).

Ethiopia has already designed and implemented policies, strategies and programs that intend to improve the adaptive capacity of the people and decrease the extent of vulnerability to climate change and variability. Such programs include the Plan for Accelerated and Sustainable

Development to End Poverty (PASDEP), Environmental Policy of Ethiopia, Agriculture and Rural Development Policy and Strategy, Growth and Transformation Plan (GTP), and so on (MoARD, 2013). The special pastoral programme under PASDEP aims to focus on three pillars: (1) Improve pastoral livelihoods and asset base (2) Address livestock movement within and across boundaries and (3) Protect pastoral lands. On the other hand, the major focus of GTP devoted to pastoral area development include: (1) A strategic focus on livestock resource development, (2) Primary emphasis on water resource development accompanied by (3) improvement of pasture land and the development of irrigation schemes, (4) Settlement programmers and (5) Selection and distribution of local breeds, animal health services, natural resource management and the establishment of livestock marketing (MoFED, 2010). However, due to inadequate attention and weak implementations of policies and strategies in the past, still pastoral communities are economically, politically and socially vulnerable.

At policy level, there was an emphasis on issues of sedentary way of life instead of mobile way of life. The Ethiopian Investment Policy regards the current output per livestock is low and seeks investment opportunities in the areas of modern commercial herd breeding, production and processing of meat, milk and eggs. While the PASDEP recognises pastoralism as a means of livelihood with economic benefit and cultural values, and marginalised by past policy and vulnerable to drought and conflict, it is not clear that the drive towards the 'modernisation' of the sector recognises the inherent logic of the 'traditional' system in the context of highly variable and unpredictable environment.

The government developed the pastoral policy in the year 2002. This policy focuses on sedenterisation of pastoralists without their will along the banks of the key rivers. The main objective of this policy was to change the pastoral communities into agro-pastoral systems, from

mobility to sedentary life, from a spread population too small pastoral towns and urbanization. The policy intended to fulfil different basic infrastructures such as irrigation, fixed and mobile education and health services as well as rural roads, water supply and rural energy, rural telephone services, and so on (MoFA, 2002).

The highly vulnerable pastoral communities to climatic hazards is the result of inappropriate policies and a lack of investment in pastoral areas. Appropriate and timely livelihoods-based climate change adaptation strategy may not stop further structural deteriorating of the pastoralists livelihoods system. Climate change particularly drought adaptation strategies take place in a situation where access to livestock health care is inadequate or absent, water supplies are limited, markets do not fully exercise, access to pasture and mobility is often restricted and conflict is common. Climate change resilience can only be improved through long-term development interventions. This means that drought preparedness can only be effective if it is underpinned by policies to strengthen the overall resilience of pastoralists' livelihoods systems.

Land tenure and land use policies in pastoral area are considered as a major constraint to sustain their means of living. Traditional titles to communal grazing land are not officially acknowledged, and the cultivable land is being increasingly taken over for investors. As a result, pastoralists have undermined their adaptation strategies, starting from mobility, and have fuelled intra and inter-ethnic conflict. Limited animal marketing policies also affect the practicability of pastoral economies. Such constraints include the lack of government support of the well-established informal cross-border trade between southern Ethiopia and Kenya, as well as between Somali Region and Somaliland, Puntland and Somalia, which prevents pastoralists from making full use of existing, vibrant markets. Another constraint also stems from inadequacies of

NGOs' and other donors' policies and frameworks. The availability of sufficient, expected and flexible funding to respond to climate change is a major problem for donors (Devereux, 2006).

2.10. Analytical framework: Sustainable livelihoods

This study employs the 'sustainable livelihoods framework' (SLF) as a framework of analysis in order to have better understanding of how and to what extent pastoralist's livelihoods are vulnerable to climate change (Satge *et al*., 2002). This framework originated from the work of scholars such as Chambers, Scoones and Conway around 1990s and used beyond quantifiable monetary variables to include assessments of vulnerabilities and social segregation. Sustainable livelihoods can serve as a useful approach to analyse and interpret multiple factors that negatively or positively influence the livelihoods of households, group of people and individuals which can originate within their own culture, natural environment, government, and so on (Soussan *et al*., 2003). Sustainable livelihoods framework is an instrument that has been developed to understand the livelihoods of the poor and livelihood components (see figure 2.2). It is important to present major factors that determine people's livelihoods and interrelationships among livelihood components such as vulnerability context, assets, institutional structures and processes, livelihood strategies and outcome (DFID, 1999). It focuses on five types of household resources include natural, social, financial, physical and human capital, using various indicators to assess exposure to natural and mad-made disasters that affect peoples' adaptive capacity (Chambers and Conway, 1991).

The term sustainability to SLF is the central issue which needs interpretation. Sustainability compares with the term vulnerability, which represents the contrary extreme of continuum showing the quality of livelihoods system (Niehof, 2004). A livelihood is believed to

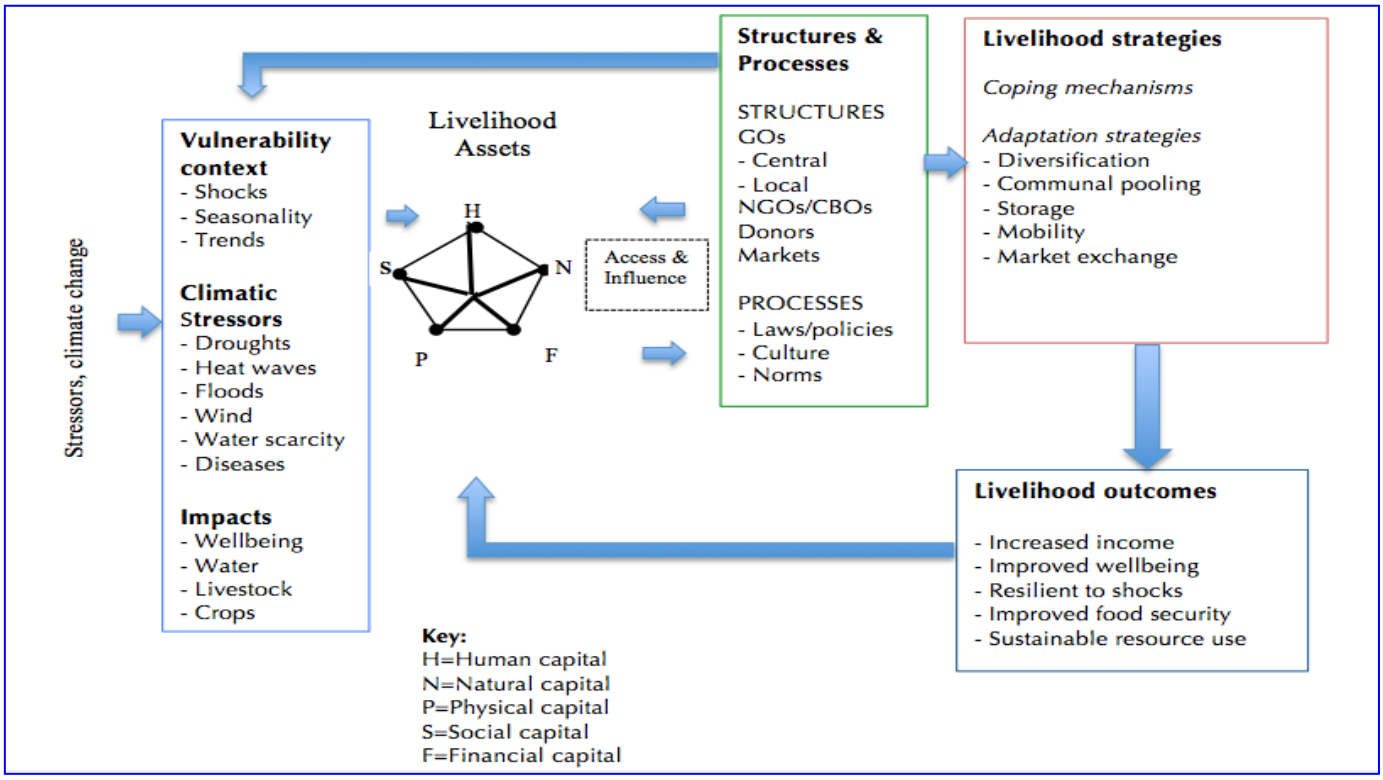
be sustainable when it can cope with and recover from natural and man-made shocks and sustain or improve its abilities without affecting the stock of natural resource (Scoones, 1998; Carney *et al*., 1999). As Tanner *et al.* (2012) stated, the process of recovery and resilience of households and societies from climate change risks depends on access and control over livelihood resources such as natural, human, social, physical and economic resources. Similarly, access to and control over resource can be determined by the underline factors that include political, social, cultural, economic, ethnicity, cast, age, wealth status, empowerment and gender.

In climate change studies, SLF works as a practical analytical instrument to recognise household and community resilience and vulnerability (Lautze *et al*., 2003). Among studies that conducted livelihood approaches around rural areas in Africa are those that explored coping and adaptation to climate change (Burton *et al*., 2003). Other scholars like Erikson *et al.* (2005) analysed the relationships between livelihoods and climate change without using sustainable livelihood framework.

Moreover, the approach being drawn from the participatory and people-centred approaches to development view people as actors, employing different livelihood strategies in the face of certain adversities such as climate change-induced hazards and other factors. In addition, the sustainable livelihoods framework recognises that peoples' livelihoods are complex and dynamic as they engage in a variety of activities. It recognises that development involves everyone (from the private sector to public ministries, from community-based organisations to newly emerging decentralised government bodies). It also understands that people's livelihood is not static; rather it is changeable through time and space as people engage in various livelihood strategies to reduce risks and improve livelihood outcomes (Satge *et al*., 2002). In general, the main components of sustainable livelihood framework includes the vulnerability context,

livelihood assets, and transforming structures that jointly influence livelihood strategies, which in turn generate outcomes related to income, well-being, vulnerability, food security, and sustainability.

Figure 2.3: Sustainable Livelihoods Framework (SLF)



Source: Adopted from IISD, 2003 and DFID, 2001

The vulnerability context forms the external environment in which people exist and gain importance through direct impacts upon people's resources status. It encompasses trends, shocks and seasonality, and represents the part of the framework that lies furthest outside stakeholders' control. There are two major conceptualisations of vulnerability, that is, contextual vulnerability and outcome vulnerability. A contextual vulnerability mainly focuses on factors that affect a system's capacity to survive and recover from the existing shocks, while outcome vulnerability is

concerned with integrated vulnerability concepts that combine information on potential climate impacts and on the socio-economic capacity to cope and adapt (Fussel, 2009).

The term shocks originated from environmental, social and economic factors. The main types of shocks include flooding, volcanic eruption, earthquake, epidemic disease, livestock disease, social crisis, conflict and violence, food shortage and price inflation. Pastoral communities are also vulnerable to seasonality. The problem is associated mostly with rain-fed agriculture where means of livelihoods depend on the amount and duration of rainfall. Some of seasonal problems are prices, employment opportunity, food insecurity, variation in the amount of rainfall and productivity. The livelihoods of households can be affected by the trends of resource, technologies, demography change, market, trade and governance conditions.

Livelihood assets can be explained as the stocks of resource that can be exploited directly, or indirectly, to generate the means of survival or above survival of the household. They are also referred as resource, capitals or livelihood building stocks that influence how individuals, households and community in a fixed area respond to the impacts of climate change. IISD (2003) point out the strategies on how households respond to the impacts of climate change depends on livelihood basis. The better the asset base, the stronger is the adaptive capacity, level of security and sustainability of livelihoods of the household (Cooper *et al*., 2008). According to the sustainable livelihood framework, livelihood assets that determine the adaptive capacity of rural communities, particularly poor people can be categorised into five, namely, human, social, natural, physical, and financial capitals.

Human capital is one of the determinants of household participation in a range of activities. It comprises knowledge, training, skills and household compositions (size, gender,

age, and dependency ratio) that translate into capability to labour and good health services, nutrition, education as well as enable the individual to follow various livelihood strategies and achieve livelihood objectives (DFID, 2000). Education is one of the major factors that determine the participation of households in various activities, which requires better skill and knowledge such as construction services, and manufacturing activities (Reardon, 1998). Studies have proved that education has a positive relationship with household involvement in various activities. For instance, education enhances knowledge and skill level, which are required for rural non-farm activities. Education can also increase confidence and then establish useful networks. Educated people have wider opportunities than non-educated family members to respond to the impacts of climate change since they have more chances to engage in income generating activities, and even can provide advice and support to others regarding how to improve their living conditions (Gordon and Graig, 2001).

Social capital designates a significant type of livelihood resources that consists of the social resource such as networks, social claims, social relations, affiliations, and associations upon which people draw when following various livelihood strategies requiring coordinated actions (Scoones, 1998). Through social networks, people can share their knowledge, skill and experience and then spread risks and claim for reciprocity in time of crisis. Households with better social networks have better opportunities to participate in different activities. Social` resource can improve and provide valuable information and even advice about a range of income generating activities. Information exchange provides ideas about unfamiliar places and based on information, household members can migrate in search of better employment (Gordon, 2000).

In the context of climate change and variability, people's relationship, trust among the community, reciprocity, exchange, and the development of common rules and regulations play a

significant role in strengthening their adaptive capacity (Adger *et al*., 2003b, Jaja and Dawson, 2014). This is significantly important for the pastoral communities where connections and institutional access, rules, regulation, rights, networks and claims generated from clan or group members and indigenous organisations play a significant role. By developing trust and relationships between different development actors and society, social asset and holistic decision making institutions are important to encourage the sustainability and legitimacy of any adaptation strategy (Adger, 2003b). In addition, the process of adaptation based on social asset can change the awareness of climate change from world to local problems to the degree that when actors perceive adaptation strategy and the risks of climate change, they will be more likely to make the connections to the causes of climate change, thereby improving their adaptive capacity (Ibid).

Natural capital is the third component of livelihood capitals under sustainable livelihood framework. Natural capital refers to the natural capital, such as land, water, forest, air quality, fish, pasture, erosion protection, wild products and biodiversity that are crucial from which rural households involve in agricultural pursuits and resource collection for both rural livelihood sustenance and income generations (Ellis, 2000b). Natural capital is of special significance for those who generate all or part of their livelihoods from resource base activities, as it is often the case for the poor community (DFID, 2000). Depending on pastoral area context, some of these natural capitals such as land, pasture, water, and forest are communally held hence they are vital and common natural property resource, often viewed as free and whose consumption is barely charged or regulated. Households with better access to natural resource especially grazing land and water are likely to be richer and accumulate capital. Inequality in access to grazing land,

water and other natural resource also brings inequality in non-farm employment opportunities and income generating activities (Gordon and Graig, 2001).

Natural capital is neither static nor is its exploitation for survival purposes interrelated to collecting activities, such as gathering wild vegetables or hunting wild animals. Natural resource is improved or augmented when it is brought under human control that enhances its productivity, as has happened since the beginning of sedentary agriculture with the development of farming systems (Ellis, 2000). Well-managed and protected natural asset can be used as a decisive asset to build up the adaptive capacity of the pastoral communities. Equal accessibility and control over communal assets is important to pastoral communities who directly depend on natural resource for their livelihoods (Kebede and Adane, 2011).

Physical capital, also known as building capital, encompasses fundamental infrastructure and technologies needed to support livelihoods. The major components of infrastructure that are important for sustainable livelihoods includes adequate water supply and sanitation, secured shelter and buildings, sufficient transport, clean and sustainable energy and access to information (DFID, 1999). Rural infrastructures have significant effect to the growth of rural incomes. Greater access to infrastructure and technologies (tools and equipment for production, improved seed, fertilizers, pesticides and traditional technologies) facilitates movement of goods and people to cities and productive areas, which attract migrants for new job opportunities. Road, electricity and telecommunications attract investors, and facilitate small and medium enterprise development. The improvement of physical infrastructures such as roads, electricity, telecommunications, and so on, may facilitate the growth of different activities. On the other hand, the improvement of infrastructures may create labour shortage in rural areas due to rural-urban migration (Reardon, 1998). Improvement of infrastructure reduces transaction costs, by

improving the flow of information and by creating new opportunities previously inaccessible to the rural population (Barrett *et al.*, 2001).

Financial capital signifies the financial resource that the community exploit to attain their livelihood objectives and it encompasses the significant accessibility of cash or corresponding that allows pastoralists to adapt to different livelihood strategies. The major bases of financial asset include available stocks (cash bank deposits or liquid assets such as herds and jewellery) and regular inflows of money (labour income, pensions, or other transfers from the state, and remittances (DFID, 2000). Financial capital plays a vital role to build and enhance resilience against climate change impacts. Access to capital or credit is one of the major difficulties for rural households and individuals to undertake a business. With only little or no start-up cash available for investment, households or individuals are limited to a small number of activities, which results in insufficient returns (Gordon and Graig, 2001). Access to credit and credit institutions is also one of the determinants that result in variation in household involvement in livelihood diversification (Reardon, 1998).

Agrawal (2010) states that stock and distribution of the five types of livelihood assets determines households and community adaptation choice and alternatives. However, the combination should not be static. Rather, it is changeable (reduced or expanded) over time and place. In addition, some resource may use more than one purpose, for instance, herd is classified as a financial capital, but in rural areas it also uses as physical capital (traction) and also considered as social capital in the form of social status.

Transforming structures and processes determine access to assets, livelihood strategies and returns from a given strategy. Transforming structures provides the necessary requirements

to access resources, manage natural resource, and give other services essential for gaining access to resources, exchanging them, and benefiting from their use through creating and enforcing legislation (ATHA, nd). Transforming structures can be functional at local level (individual, household, community and indigenous institutions), private sectors, Community Based Organisations, NGOs, governmental organizations and international institutions. Institutions have the ability to structure the problems and sensitivity to climate change impacts, facilitate individual and collective responses, and shape the outcomes of such responses (Agrawal, 2010).

Processes are important in the type of policies, legislation, rule of law, custom and power relations that determine the relationships between structures and individual efforts to adapt to climate change (Kollmair and Gamper, 2002). The implementation and efficiency of adaptation strategies usually depends on the social and institutional situations of the community in a specific area in which they are implemented. For instance, the land tenure institutions that determine access and exploitation of land are significant factors for farmers to invest or not to invest on their land and to take or not to take risks. Insecure land tenure rights result in households to making decisions to avoid long-term investments, and they become the key drivers of natural resource degradation. On the other hand, the application of strong context based institutions and policies play an important role in the process of climate change adaptation. Agrawal (2010) listed three approaches by which the nature of access to institutions and assigned resource is an important factor. First, they organise ecological risks, and thereby the nature of climate impacts and susceptibility. Secondly, they make the incentive framework within which outcomes of individual and collective action unfold. Thirdly, they act as the medium through which external interventions reinforce or weaken existing adaptation practices. However, institutions that reshape household's decision are not constant. Rather, they are dynamic as a result of the

changing nature of political interactions and other variables among relevant decision makers (Ibid).

In general, when we are thinking about policy, institutions and processes, it is important to know about the following:

- What policies and institutions exist, how they are organised and how they have been changing over time (processes)?
- What roles they fulfil (in the case of institutions) or what impact they have (in the case of policies)?
- What impact they have on the livelihoods of the pastoral communities?
- What ability-if any-the pastoral communities have to alter or influence these factors?

Livelihood adaptation strategy refers to decisions or choices made by households about pursuing a particular livelihood activity to withstand the adverse impacts of climate change and variability. The specific strategies pursued by households, in turn determine the livelihood activities of households both in terms of inputs used out puts. The livelihood activities pursued by households in turn produce a flow of income which can be used for either consumption, saving or investments. Rural farmers may expand their means of income and livelihood alternatives. Dorward *et al*. (2005) identified livelihood strategies of poor households between 'hanging in', 'stepping up' and 'stepping out' representing surviving, moving to a new livelihood alternatives and effectively graduating or existing, respectively. Similarly, Agrawal (2010) categorized livelihood adaptation strategies into five classifications including diversification, communal pooling, storage, mobility and market exchange. In general, the stronger and more diverse the adaptation strategies, the better the resilience to shocks, trends and seasonality which leads to successful adaptation strategies.

Livelihood outcomes are the achievement or outputs of livelihood strategies, such as more income increased well-being, political empowerment, gender equality, minimised vulnerability, enhanced food security and better sustainable use of natural capital bases. As IISD (2003) stated, sustainable livelihood framework does not link adaptation to climate change as unfortunate necessity in the face of adversity but embraces it as a positive opportunity for beneficial change, or no-regrets approach to adaptation. Livelihood outcomes result from the implementation of different livelihood strategies taking into account livelihood assets that people have access to and the vulnerability context and supported or challenged by institutions and processes. Sometimes livelihood strategy may generate undesirable output like resource degradation, environmental pollution, conflict, inequality, and so on.

Soussan *et al.* (2003) note the importance of the 'wider natural environment' in people's livelihoods mainly in terms of introducing various changes in the livelihood dynamics. Such external influences affect people differently depending on their resilience. The framework gives a checklist of significant matters and sketches out the method these connect to each other, while it depicts particular attention to core influences and processes and their numerous interactions in connection to livelihoods. The framework can be practiced at a range of diverse scales-from individual, to household, to household cluster, to extended kin grouping, to village region or even nation, with sustainable livelihood outcome assessed at different levels.

Some of the advantages of SLF are giving main concern for people (people-centred), supporting them to develop people's strength and realize their possible, while at the same time realising the effects of policies and institutions, external shocks, trends and seasonal changes (Carney, 1999). Other features of livelihood analysis include integrative, locally embedded, cross-sectoral and informed by a deep field engagement and a commitment to action (Scoones,

2009). This type of analysis focused on linking the micro with macro aspects by linking the local situation to the wider institutional and policy structure, thus giving the foundation for identifying the limitations to livelihood improvement that occur at local and broader economic and policy environment.

In this study, the major reason to apply sustainable livelihood framework is that the main components of SLF, including vulnerability context, asset, institutions and policies, adaptation strategies and livelihood outcomes are central to the framework. The strength of the framework reliant on its focus on local, people-centred, people's strength, and often non-sectoral with preference to agency and entitlement as well as focus on livelihood resources (Bebbington, 1999; Leach *et al*., 1999). Other strengths of the approach are that it aspires to reflect the multifaceted range of resources and activities on which communities depend for their means of livelihoods and the significance to poor people of resources which they do not possess. It gives a framework for addressing the whole range of policy issues pertinent to the poor, such as access to finance, markets, and personal security; and the need for a people-centred and participatory approach, responsive to changing situations, and capable of working at various levels from national to local, in partnership with public and private sector (Norton and Foster, 2001).

As other approaches, the sustainable livelihood framework has limitations. For example, the International Fund for Agricultural Development (IFAD) argues that the framework was neither a model that aims to include all the key components of people's livelihoods, nor a global solution. Scoones (2009) identify the limitations of the sustainable livelihoods framework as follows:

a. Limited participation with the processes of economic globalisation.
b. Low consideration to power and politics and the failure to associate livelihoods and governance debates in development.
c. Limited efforts to handle long-term change in ecological situations, and
d. Lack of discussion about long-term transformation in rural economies particularly agrarian change.

2.11. Conclusion

This chapter noted that both pastoralists and policy makers are aware of the impacts of climate change and variability that have been affecting the livelihoods of the pastoralists over the last several years. In some countries the impact of other factors were felt more deeply than the impacts of climate change and variability. However, in African countries such as Ethiopia, and other sub-Sahara African countries pastoralists felt that climate change and variability are the most critical factors affecting their livelihoods.

Existing traditions on climate change and variability originate from disaster research, political-economic viewpoints and combined approaches. These approaches have their own potencies and limitations. The potency of the hazards approach lies in emphasising the magnitude, occurrence and character of the climatic disasters and their impact on exposure units. Yet, the exposure units are not only vulnerable to climatic hazards but also to internal, social features. The strength of social vulnerability approach emphasised hitherto overlooked areas. The existence of both types of susceptibility needs the use of an integrated approach to study numerous stressors made worse by climate change. The drawback of this approach is the presence of numerous stressors, which includes layers of difficulty to analyse vulnerability. Yet,

it gives holistic means to confine the main characteristics of vulnerability to climate change and variability.

Adaptation to climate change is regarded as a dynamic social process, which takes diverse types. The efficiency of adaptation strategies depends on various endeavours at local level and countrywide frameworks of policies and institutions for the success of development goals and the management of climatic hazards. The connection between the environment and development is based on the principles of sustainability and sustainable livelihood framework.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

A scientific study design is of paramount importance and one of the most appropriate steps in the process of the research. This chapter presents both descriptions of the study area and research design. A research design guides a researcher to focus on the study and holds all the steps and parts of a research process together. This chapter explains the methodology employed to collect information and to select respondents as well as in analysing the research findings. In order to examine the perceptions, vulnerability and adaptation strategies of pastoral communities to climate change, it is essential that the investigator should develop an effective research design. The chapter also presents the methodological parts of the research in detail. Accordingly, it includes the nature of the study area, research design and approach, sampling and sampling methods, sources and data collection techniques and method of data analysis. Survey questionnaires, key informant interview, focus group discussion and observation are tools of collecting data for the research purpose. Finally, the chapter outlines the ethical issues related to the study population.

3.2. Description of the study area

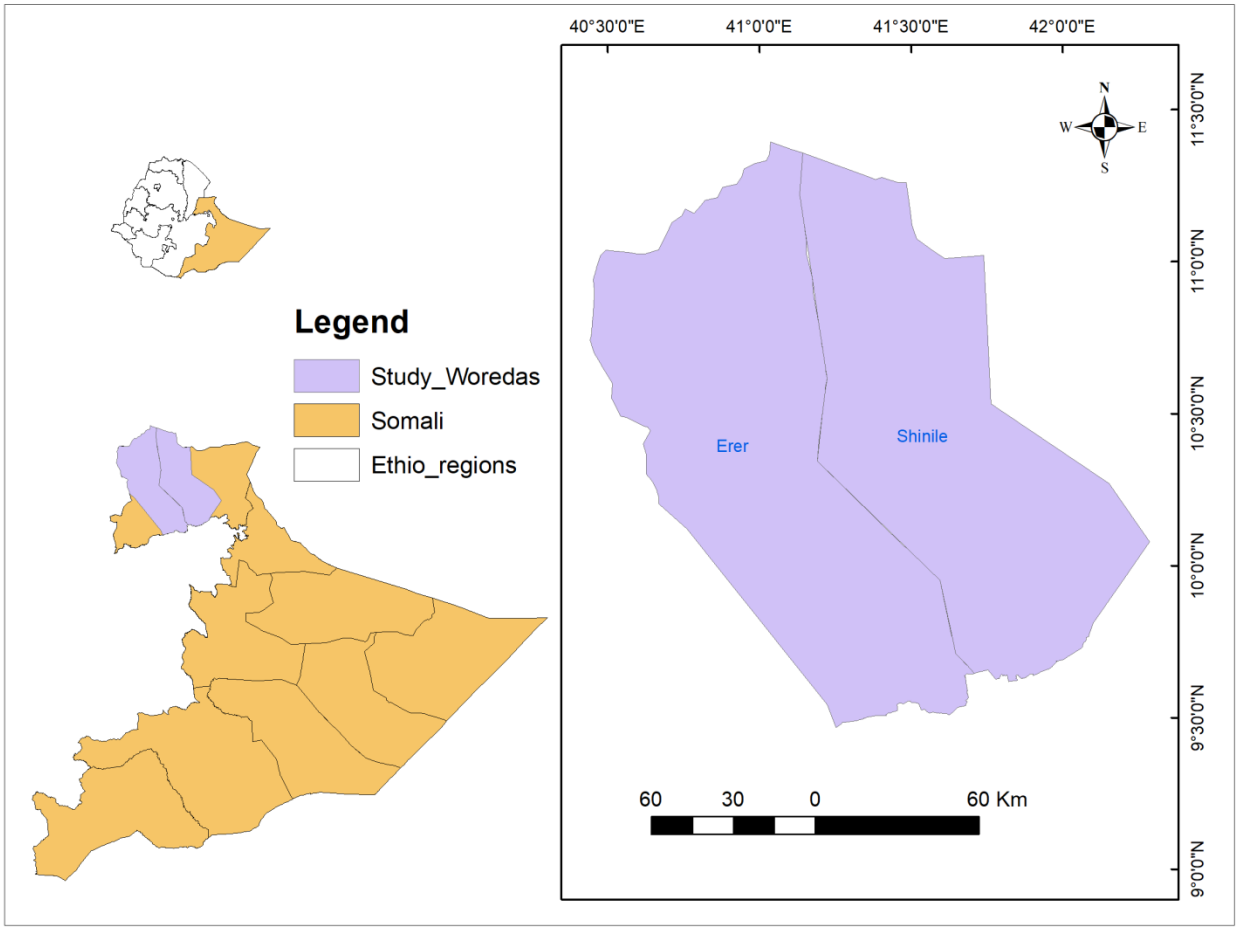
3.2.1. Location

The Somali people are *Cushitic-speaking* society living in pastoral and agro-pastoral production system in eastern Ethiopia. This region is the second largest region (next to Oromia region) in the country among the ten regional states in Ethiopia and covers with a total area of approximately 375,000 square kilometres. The Somali Regional State is geographically located in the east and southeast part of the country, and lies between 4°N and 11°N latitude and 40°E

and 48°E longitude. It shares the border with the Oromia Regional State in the West and Southwest, Afar Regional State in the North West, Kenya in the south, Djibouti Republic in the North and Somalia in Northwest and in the South. The Somali region comprises of nine administrative zones, 68 districts and 786 *kebeles* (the smallest administrative unit). The nine administrative zones are Afder zone, Sitti zone (formerly Shinille), Fafan zone (formerly Jigjiga zone), Liban zone, Shebelle zone (formerly Gode zone), Dollo zone (formerly Warder Zone), Korahe zone, Jarar zone (formerly Dagahbur zone) and Nogob zone (formerly Fik zone). Jigjiga is the capital of the Somali Regional State. The capital was formerly Gode, until Jigjiga became the capital in 1995 on account of political considerations (SRS BoFED, 2013).

Sitti zone, formerly known as Shinile zone, is one of the nine administrative zones of the Somali Regional State of Ethiopia. This zone is situated at the northwestern point of the Somali Region and it shares borders with Djibouti in the North, Somaliland on the Northeast, Fafan Zone on the southeast, Dire Dawa and Oromia Regions on the south and Afar Region on the west. The Sitti zone is comprised of six *woreda* namely Shinile, Dambal, Aysha'a, Erer, Afdem and Meisso (SCUK and DPPA, 2008).

Figure 3.1: Map of the study area



3.2.2. Biophysical feature

The elevation of the Somali Regional State ranges from 200 metres in the southern parts, to 1600 meters in Fafan zone above mean sea level; medium altitudes comprising of hilly terrain and the plateau are found in parts of Sitti, Liban, Jarar and Fik zones. The extensive area of the region (more than 80%) is considered as low land. The lowlands are arid to semi-arid, with precipitation in parts averaging less than 300 mm per year and strong temperatures, reaching up to 40°C. Wabi-Shebelle, Genale, Dawa and Weyib are the major perennial rivers in the region. Water shortage is an extensive problem in most areas, mainly those with no permanent water points (SRS BoFED, 2013).

The height in the Sitti zone ranges from 950 to 1350 metre above sea level. Its topography comprises of undulating hills, stony outcrops interspersed with plains of loose soil covered by bush and woody grasses. Three seasonal rivers, namely Erer, Hurso and Chow, and several dry riverbeds are found in the area (SCUK and DPPA, 2008).

3.2.3. Demographic characteristics

The Somali Regional State (Somali: *Dawlada Deegaanka Soomaalida*) has a total population of more than 5.3 million, 86 percent of which are rural. The average population density is 15 persons per square mile (CSA, 2012). The ethnic groups in Somali region include Somali (96.23%), Oromo (2.25%), Amhara (0.69%), and Gurages (0.14%). The Somali was the working language in the region spoken by 95.9% of the inhabitants and Oromifa (2.24%) is next to Somali language. With regard to religion, 98.7% of the total populations are Muslim, 0.9% are Orthodox Christian, and 0.3% are followers of other religion (FDRE, 2005).

Based on the 2017 population projection, Sitti zone has a total population of 591,901, of whom 308,215 are male and 283,686 female. While 86,493 are urban dwellers, 505,410 are rural pastoralist (CSA, 2017). The Sitti zone people are belonging to the Issa clan and reside in the northern parts of the Somali region which stretches from Dire Dawa to the Republic of Djibouti. The Issa is integrated under their constitutional order (*Heer Issa*) which encourages peace and stability throughout Somali region. However, the Issa has rough relations with their northern neighbour region, Afar. The defectively defined regional boundary has led to conflict and a lot of losses on both sides, and inhabitants of villages that are close to the border and along the tarmac road to Djibouti are repeatedly attacked. Some believe the long-running dispute between the Issa and Afar to access and control over the Awash River; others consider it a fight to expand

boundary and control the contraband trading route from the eastern highlands of Ethiopia and Dire Dawa to Djibouti (Devereux, 2006).

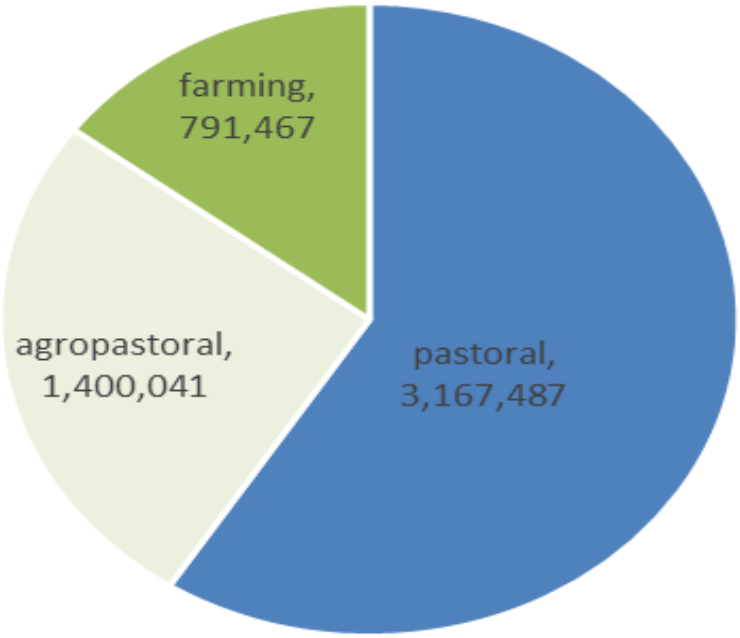
The ethnic distribution in Sitti zone is as follows, the Somalis (97.03%), Amhara (1.42%) and the rest ethnic groups made up of 1.55% of the population. The Somali language is spoken as a first language by 96.91%, Amharic by 1.36%, and Oromo by 1.34%; and the remaining 0.39% speaks other languages. The majority of populations (98.35%) are followers of the Islamic religion (CSA, 2007). The two districts, Shinile and Erer districts, were selected for this study as they have been frequently affected by climate change and variability and have experienced higher vulnerable to climate change disasters for the last decades. Based on the 2017 population projection, Shinile and Erer *woreda* have a total population of 133,038 and 100,556, respectively (CSA, 2017).

3.2.4. Economic activities

According to the Regional Disaster Prevention and Preparedness Bureau (DPPB), the rural livelihoods of the Somali Regional State can be classified into three broad livelihood zones include pastoralism, agro-pastoralism and farming. Pastoralism in the region is the most practiced livelihood, sharing about 60% of the region's rural population. In these zones, land is communally possessed and different sub-clans traditionally exercise control over the territories they recognise as their areas of origin as governed by clan settlement history. The livelihood of the overwhelming majority of pastoral people depends on rearing of livestock. Despite its lion share in the economy, pastoralist's livelihoods have remained rain-fed with traditional methods of livestock rearing. Agro-pastoralism consists of about 25% of the total rural population, and is a combination of extensive animal herding and rain-fed crop production; some may be better described as pastoralists with opportunistic farming activities-as in Nogob and some parts of

Liban Zone. The remaining 15% of the rural population comprises sedentary (Jigjiga) and riverein (Shabelle and Dawa-Ganale river basin) farmers. Both agro-pastoral and farming societies rear some livestock but farmers' livestock do not migrate and are sometimes hand-fed, only migrating with other groups if there is a severe drought (DPPB, nd.).

Figure 3.2: Breakdown of rural population by livelihood zone cluster



Source: Adopted from Jennifer Bush and Abdifatah Ismael, 2015

Wealth in pastoralists area is determined by the quantity of domestic animals specially goats, sheep and camels; for a few groups such as the Sitti pastoralists, cattle and goats are more important. In Dollo, Korahe and Jarar zones, *berkad (artificial water reservoir)* possession is significant as there are very scarce natural water sources. The deprived group of people in all livelihood zones depend on the better-off households in that they provide labour (like caring livestock) and in response they obtain rewards. The agro-pastoralist wealth status is determined mainly by herds holdings, mainly cattle, followed by land holdings while sedentary farmers'

wealth position is mostly determined by land holdings. Better-off households have more resources which allow them to cultivate more land and have better productivity.

Poor households usually engaged in various sources of income generating activities as they have fewer livestock than the better-off households. Milk and ghee are sold by pastoralists only when they are near villages or urban area. The collection and sale of firewood, charcoal, gums and engagement in petty trading and unskilled labour activities are additional sources of income for the poor pastoral communities. In the drought periods, water is sold, particularly in *berkad*-dependent areas. Renting pack animals is another important income source in Sitti zone.

The pastoral livelihood zone covers the major area in Sitti zone, where pastoralists constitute about 75-85% of the population. In Dambal district, pastoralists comprise about 40% of the population; in Erer district about 80%, in Shinile about 90% and in Ayshia and Afdem districts about 95-100% are pastoralists. The remaining of the population is largely engaged in agro-pastoralism, while a small minority (less than 5%) are engaged in commercial activities in urban or trading centres (Save the Children, 2002). Goats and camels are reared in areas where bushes are dominant, whereas sheep and cattle are found in plain areas. Cattle are believed more significant than other types of livestock because they generate milk and milk products which can be consumed and generate income. Shoats are also preferred because they are easy to sell and collect additional income. Pastoral communities have various sources of income includes the sale of livestock and livestock products, charcoal, remittance and camel rent (SCUK and DPPA, 2008).

3.2.5. Climate information

Based on the seasons of the year, the Somali region can be categorized into two areas: Sitti zone and Fafan zone to the north, and the remaining seven zones to the south. The rainfall distribution

in this region is bimodal but the timing, amount and distribution of rainfall is not uniform. Zones with main rainy season starting in July/August (*karan*), and a secondary rainy season from March–May (*diraa*') is found in the northern areas. Zones in the southern parts have a *karan* season occurring from April to June, and a *deyr* season from October to December.

Table 3.1. Rainy and dry season in Somali Region

<table>
<tr><th>Administrative Zones</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th><th>Jan</th><th>Feb</th></tr>
<tr><td><u>South zone</u>
Nogob, Jarar, Korahe, Dollo, Shebelle, Afder, Liban and Harshin woreda of Fafan Zone</td><td>Jilaal dry season</td><td colspan="3">Karan (Gu) rains: Mid-April to end of June</td><td colspan="3">Hagaa dry season: early July to end of September</td><td colspan="3">Deyr rains: early October to late December</td><td colspan="2">Jilaal dry season: January to mid-April</td></tr>
<tr><td><u>North zone</u>
Fafan and Sitti Zones excluding Harshin of Fafan Zone</td><td>Jilaal long dry season</td><td colspan="2">Diraa/Gu (Short rains) late March to late May</td><td colspan="2">Hagaa dry season: late May to late July (short dry season)</td><td colspan="2">Karan (Long rains): late July to September</td><td colspan="5">Jilaal long dry season: Six dry months (from October to March) in Sitti and parts of Fafan zones.</td></tr>
</table>

Source: Somali Regional State Livelihood Summary, 2004

Most parts of the Somali Regional State are typified by arid and semi-arid land which is vulnerable to recurrent drought. The area is one of the most affected and degraded areas that its rangeland and water source is almost unable to sustain the traditional modes of pastoral

livelihoods due to climate change and variability. The recurrent and prolonged droughts in the region are a common phenomenon in which the poor, women, disabled people and children are the primary victims of such problems. As a result of this, there is a high competition over the existing scarce resource such as water points, grazing lands and irrigation schemes (Little, 2001).

The local climate is usually characterised by harsh, with recurrent droughts being frequent and severe. The Sitti zone gets an average of 500 to 700 mm of rain per annum (SCUK and DPPA, 2008). The *Diraa*' (short rains) rain season, from mid-March to mid-May and the *Karan* (main and long rains), from mid-July to mid-October, are the two rainy seasons in the area. There are also two dry seasons such as the *Hagaa*, from mid-May to mid-July, and *Jilaal*, from mid-October to mid-March. When there is sufficient amount of rainfall, pasture and water sources are normally available, milk production is increasing, the cereal purchase power is limited, and the livestock remains near the homesteads. On the other hand, during drought seasons, the area is characterised with high scarcity of pasture and water resources, decline the amount of milk and milk products, increases the demand to purchase food crops, livestock migrates further afield, and livestock sales are high. During the drought time, livestock are usually sub-divided into strong and weak. The sheep, as well as expectant and lactating animals remain near the villages, whereas stronger livestock are taken distant areas in search of better pasture and water sources. Collection of forest products also increase during the dry season. The local people describe most of the last dozen years as drought years (Devereux, 2006).

The study area is mostly characterised by arid, semi-arid and rocky with strong heat stress and variable rainfall. Given the dominance of pastoralism in the area, the reliance on rainfall is more obvious and stronger now than in the past. A traditional practice in water harvesting includes the collection of water in wells and storage containers to sustain the

availability of supplies during the drought period. A steady problem of environmental degradation is associated to an emerging trend of widespread cutting down of the trees for conversion into charcoal (CHF International, 2006).

Table 3.2. Research Areas and Livelihood Zones (LZs)

Regional State	Administrative Zone	District	Peasant Association	Livelihood Zone
Somali Regional State	Sitti zone	Shinile district	Lastome	pastoral community
			Gaad	Pastoral community
		Erer district	Megali-Adi	pastoral community
			Aydora	Pastoral community

Source: Sitti Zone Agriculture and Rural Development Bureau, 2020

3.3. Research design and approach

This study was conducted in Sitti zone, Somali Regional State to analyse the perceptions, livelihood vulnerability and adaptation strategies of pastoral communities to climate change. A research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to obtain answers to research questions and to control variance. Research design is a technical roadmap for the overall structure and methods of investigation to a research problem in responding the fundamental questions of what, why, where, when, whom and how (Kumar 1999:74; Leedy and Ormrod, 2001:91). This study employed cross sectional research design method based on the nature, types, and purpose of the data. It was

designed to study various issues by taking a cross-section of it at one time with regard to both the study population and the time of investigation. Its aim was to find out the prevalence of problems, situation, perception or issue, by taking a cross-section of the population.

Both qualitative (to a larger extent) and quantitative method were utilised since using both approaches gives a better recognition of a research problem than either approach could alone. Creswell and Clark (2007) argue that using mixed research approaches (qualitative and quantitative) strengthens the overall research design, as the strengths of mono-approach counter-balance the limitations of the other, and can give more comprehensive and convincing evidence than a one-method approach. Qualitative data was mainly collected through semi-structured interviews with key informants, focus group discussions and observations. Quantitative data were mainly collected through questionnaires and household surveys. Throughout the fieldwork period (from September 2019 to March 2020), all interviews with key informants and group discussions were captured through tape-recording which was combined with note taking. Systematic examinations of relevant secondary data (both published and unpublished) were reviewed.

3.4. Sampling and sampling methods

Pastoral community members (clan leaders, community elders, government and NGO representative bodies and women of various age levels) where the major research participants as they possessed various experiences with and perceptions of climate change, and have become vulnerable to the impacts of climate change in the area.

From nine administrative zones of Somali Regional State, Sitti zone was purposively selected because this zone is characterised by high rainfall variability and prolonged drought. Among the nine *woredas* (districts) in this zone, two districts named Shinile and Erer were purposively selected. Two *kebeles* (villages) were purposively selected from each district that included Lastome and Gaad from Shinile district and Megali-Adi and Aydora from Erer district. The research participants in the study area were the pastoral community members. Once the study *kebeles* were identified, 120 sample households were drawn by using a systematic random sampling technique. A list of household owner in each *kebele* was obtained from the local administrative offices. Thirty respondents per *kebeles* were systematically selected, with a sex proportion of 96 (80%) male and 24 (20%) female. Allocation of sample households from the two districts, and various groups were made based on the consideration of representation, population size, heterogeneity of the group and other criteria.

For the qualitative aspects of the research, respondents were selected by using non-probability sampling method. The key respondents were selected from pastoral community members and government and NGOs officials. The major participants in this research were community elders, religious leaders, women and institutional experts. The criteria to select research participants were gender, community responsibility and awareness/knowledge about their culture, society and livelihood conditions. The snowball sampling technique was employed. The researcher began the research with the few respondents who were available to the researcher. The researcher subsequently requested these participants to recommend other appropriate respondents who had sufficient knowledge and experience about the changing climate and its impact on the livelihoods of the pastoral community. When such respondents were recommended, the researcher approached them, and asked for their willingness to

participate in this research project. When they agreed, he collected the necessary information required for the research, and then again requested them to recommend other respondents who fit the research design and were willing to provide information. This process was continued until enough data had been gathered, that is, until no more respondents were needed.

3.5. Source and data collection techniques

3.5.1. Sources of data

This study employed both primary and secondary data sources to collect the necessary information that was needed to answer the research questions. Primary data sources included household surveys, key informant interviews, focus group discussion and observations. On the other hand, secondary data sources such as books, websites, conference papers, and journals, relevant published and unpublished materials were reviewed and used.

3.5.2. Data collection techniques

Since the researcher decided to use both quantitative and qualitative research approaches, data were collected by using both quantitative and qualitative data collection methods. As such, there were two phases of data collection: that is, one phase involving quantitative data collection and the second one on qualitative data. During the first phase, quantitative data were collected through household surveys and a review of published and unpublished documents. The quantitative data was generated through household surveys from 120 systematic randomly selected households of Shinile and Erer districts. The sample frame was the list of pastoralist households in the selected *kebeles* of each district. Four *kebeles* (two *kebeles* from each *woreda*) was selected purposefully based on the severity of vulnerability of livelihoods to climate change.

In the second phase, qualitative data were collected through in-depth one-on-one interview with key informants, focus-group discussions, observations and document analysis to complement data obtained through quantitative data collection instruments. The nature and importance of each of these methods are described below.

3.5.2.1. Survey questionnaires

The study employed a survey questionnaire as a tool to gather quantitative information. Household survey was conducted in four selected *kebeles* of the two districts, that is, *Gaad* and *Lastome kebeles* from Shinile district and *Megali-Adi* and *Aydora kebeles* from Erer district. The *kebeles* were selected purposefully based on the intensity of the vulnerability of pastoralists to climate change. The designed questionnaires were distributed and quantitative data were collected from 120 households of the Shinile and Erer districts. The sample frame was the list of pastoralist households in each *kebeles*.

3.5.2.2. Key informant interview

The key informant interviews were employed using semi-structured interview schedules, for topics prepared to guide specific questions during the interview. An in-depth interview with key informants was employed in order to have thick description about perceptions of climate change, livelihoods vulnerability and local adaptation strategies to climate change in the area. In-depth key informant interview is a method of accessing the life experience of people and the meanings they attach to their experiences. The respondent's own ideas, opinions and experiences can be captured, described and discussed by using semi-structured interviews (Silverman, 2001; Patton, 2003).

The key informants were purposively selected based on the knowledge of their culture, trends of local climate change and livelihood susceptibility as well as expertise and experience

gained in working closely with pastoralists in the region. Key informant interviewees were selected based on the information provided by Development Agents (DAs) that work with pastoralists in the *woreda* by depending on snowball sampling technique. The DAs recognised pastoralists who can give the needed information and identified potential interviewees as people who are either born in their own *kebeles* or have lived in their *kebeles* for several decades in order to be able to give context-based thorough information on the topics. Moreover, other interviews were conducted with governmental sectoral officials such as Disaster Prevention and Preparedness Bureau (DPPB), Water Bureau, Pastoral Development Organisation (PDO), Information and Communication Bureau (ICB), Women, Children and Youth (WCY) and Agricultural and Rural Development Bureau (ARDB). These interviews were helpful in providing significant information on the nature of climate-induced shocks and the patterns of livelihood vulnerability in the districts.

The instrument is used to generate narrative accounts about past and recent impacts of climate change in the area. It is also suitable to generate the respondents' perceptions and views of climate change. The research participants' knowledge and experiences about adaptation strategies or constraints to adapt was also generated through this instrument. All interviews were accomplished by the researcher and two assistants (with close supervision of the researcher) who helped in taking-notes, tape-recording, and in probing on issues that require further clarifications. The researcher engaged research participants in a lively, engaging and interactive process of revealing how the institutions and organizations enhance or hinder the capacity of pastoralist to sustain their livelihoods.

3.5.2.3. Focus group discussion

FGD is a form of discussion carried out that aims at collecting relevant information on topics of interest. It is handled by a researcher and allows group interaction, such that respondents are able to build on each other's ideas and comments to provide in detail views not achievable from individual settings. FGDs have the advantage that unforeseen remarks and new opinions could be investigated easily while discussing issues (Robson, 1993; Bloor *et al*., 2001).

A total of four focus group discussions, each group containing five to seven participants, were conducted to assess the perception of the pastoral communities about climate change and to identify various traditional survival and adaptation strategies to climate change and related issues. Focus group discussions as a tool were employed to qualify or substantiate the data collected through the in-depth interviews and other tools. In this situation, the researcher created conducive environment to engage the participants in the focus group discussion to provide explanations, details and interpretations about the perceptions, vulnerability, response strategies and the roles of institutions in enhancing or hindering pastoralists' capacity to avert the impacts of climate on their livelihoods. The data were collected from focus group discussion with pastoral livelihood leading communities at *kebele* level for each selected district. The FGDs were consisted of respondents with diverse age (18-60 years) and sex groups, selected purposefully since the research goal require gaining various perceptions, confirm opinion and attitudes from groups to help elaborate clarify and counter-check ideas and experiences that were obtained through other methods. The main responsibility of the researcher was to elicit the focus group discussion by asking questions and getting the participants to engage in extensive and in-depth analytical and interactive responses. The method was expected to yield a broader range of perspectives regarding all of the issues addressed in research questions.

3.5.2.4. Observation

Observation is one of the data gathering instruments that was employed in this study to assess the impacts of climate change on the livelihood of the pastoral communities. The researcher observed the overall livelihood conditions of the selected *kebeles*. This method particularly helped to notice how climate change and variability has affected the study *kebeles* and complemented the information gained from documents and other sources. The researcher observed selected climate change induced vulnerable areas in Sitti zone and selected districts so as to assess crucial factors that affect the livelihoods of the pastoral communities. The physical and environmental conditions were observed. The researcher also observed institutional and organisational structures that enhanced or hindered the capacity of pastoral communities to withstand the impacts of climate change. Besides, observation also offered the researcher the opportunity to confirm data acquired through other instruments.

3.5.2.5. Secondary document analysis

Secondary data was collected from existing records, published and unpublished materials, and different activities report of governmental and non-governmental institutions and organisations. In addition, relevant federal and regional government policies, strategy documents, and reports were critically assessed and analysed. Such documents were used to provide background information about the study area and livelihood vulnerability, the types of adaptation strategies and constraints to adapt in the area. To access these documents, appropriate institutions and organisations in Sitti zone, Shinile and Erer towns were visited. These sources of data provided information that helped to answer research questions related to vulnerability, adaptation strategies and the role of institutions and organization to withstand the effects of climate change on the livelihoods of the pastoral community.

3.6. Method of data analysis

Data analysis is the process of linking and interpreting data that are collected from the respondents (Kumar, 1996). As explained earlier, the study used both qualitative and quantitative research approaches (mixed method approach). The collected data through different tools such as through questionnaires, in-depth interviews, focus group discussions, observations and secondary materials were organized carefully and scientifically. The data was checked and crosschecked in terms of quality, accuracy, and completeness of the responses. Then, description of data variables, determination of relationships between variables, and identification of important variables was carried out. The data were coded, edited and tabulated so as to assist data entry into computer. The data were analysed and interpreted by using different techniques based on the nature of the data.

Qualitative analysis in livelihood vulnerability focused on conversations, text and interactions in order to describe perceptions, and to make inferences. Qualitative analysis depended on the researcher's understanding and interpretations. The qualitative data collected through the FGDs and key-informant interviews were coded and analysed using the general inductive approach, which is a methodical procedure for analysing qualitative data where the analysis is directed by specific objectives. Besides, the qualitative analysis in this research focused on content analysis and narrative analysis. Narrative analysis is a systematic procedure of qualitative data analysis in which the investigator asks and take notes to the stories of the subjects, attempting to appreciate the relationships between the experiences of the individuals and their social framework. Narrative analysis is a flexible approach that can be used with both written and oral communications, and in a variety of settings. According to Creswell (2002),

five specific steps were taken in the analysis of the data (i) investigation of the data by reading through the audio transcripts and written memos; (ii) coding the data by dividing and labelling the manuscript; (iii) using codes to develop themes by combining similar codes together; (iv) connecting and interrelating themes; and (v) constructing a narrative.

The quantitative data collected through household survey questionnaires from selected participants was described, analysed and interpreted by using the descriptive statistics technique. These data were coded, edited, compiled, screened, analysed and presented by using Statistical Package for Social Science (SPSS 22). The quantitative data was analysed through frequency, percentage and graphs. Confidentiality is the key ethical issue given particular attention throughout the process of data collection, mainly as there was some information assumed to be of personal opinions of pastoralist, government and NGO officials and experts.

3.7. Validity and reliability of the data

In this study, the validity and reliability of the data was checked through various methods. In the internal validity of the research, the investigator ensured the internal consistencies of respondents both during the time of data collection and analysis and interpretation of the collected data. Internal validity helps to confirm the meanings of the data provided by the respondents that the investigator endorsed. Internal validity can also be established by a constant checking and comparison across different sites, times, cases, and individuals (Lewis and Richie, 2003).

In the external validity of the research, the researcher tried to use data triangulation or qualitative cross validation by collecting converging data and procedures of analysis and relying on diverse theories. The three forms of triangulation that are important for this research are triangulation of sources (that is, comparing data from different qualitative methods indicated

earlier), triangulation through multiple analysis (for example, using different analysis to compare and check data collection as well as interpretation) and theory triangulation (that is, illustrating experiences and the research participants' subjective understanding of the experiences in light of multiple theoretical propositions). This is called theory-based generalisation or theory-based external validity (Lewis and Richie, 2003).

3.8. Ethical issues in the research

Adhering to the code of conduct that has been accepted and practiced by the research professionals was considered. Before the beginning of data collection, the researcher explained the aims and significance of the research to the research participants. The data collectors who speak and write Somali language were trained by the researcher how to collect information without violating the right and dignity of respondents. The necessary data was collected with the physical presence and strict supervision of the researcher. The whole process of the research was carry out with due respect to ethical considerations by maintaining the consent of the research participants to participate in the study and treated the respondents' views with utmost confidentiality and acknowledgement. All sources of materials used for this study were duly acknowledged. In addition, a high degree of openness, cultural conformity and dignity regarding the purpose and nature of the research was taken into consideration.

Generally, the respondents in the research process participated voluntarily, free from any oppression or undue influence, and their rights, self-respect and independence were respected. The researcher attempted to capitalise the benefit of the research and reduce the possible risk of harm to respondents. The researcher provided adequate information about their right to refuse participation outright, or to withdraw consent given at any stage of the research, without

undesirable consequences, penalty and so on. The respondents were informed that they were free to object to and refuse to allow the use of data gathering devices and to object to, such as camera, tape recorder, and so on. The study used sustainable livelihoods framework as analytical instrument to sketch survey instruments and to analyse the results thereof.

3.9. Conclusion

The study was conducted in Sitti zone, Somali Regional State. Cross sectional research design method was employed. Both qualitative and quantitative research approaches were adopted. Sampled respondents (120) were selected by using systematic random sampling technique while key informant interviewees and focus group discussants were purposively selected based on their knowledge and experience abut climate change impacts in the area. Data were collected through household surveys, focus group discussions, semi-structured key informant interviews and observation. In addition, both published and unpublished documents were reviewed. Data were coded, edited, entered into computer and analysed by using Statistical Package for Social Science (SPSS 22).

The validity and reliability of the data was checked through data triangulation method and by checking the internal consistencies of respondent's views. The process of fieldwork and data collection involved ethical issues and practical challenges. The process of research was employed with due respect to ethical principles by maintaining the willingness of the respondents to provide relevant information and treated the respondents' ideas with confidentiality and acknowledgement. The following chapters present the results and discussion of the findings.

CHAPTER FOUR: PASTORALISTS' PERCEPTIONS TO THE IMPACTS OF CLIMATE CHANGE AND VARIABILITY

4.1. Introduction

This thesis investigates pastoralists' perceptions and livelihood vulnerability to climate change in Sitti zone of Somali Regional State, Eastern Ethiopia. It attempts to examine the perceptions of pastoral communities and their efforts to adapt to the changing climate and variability. To this end, data were collected through questionnaires, key-informant interviews, FGD, observation and document reviews. This chapter, therefore, presents the results of the study obtained from the households of two districts - Shinile and Erer. One hundred and twenty household heads were involved in the study. Since the survey was carried out using the face-to-face data collection method, all participants filled in and returned the questionnaires that were handed to them (this was before the outbreak of Covid-19). This contributed to a high response rate.

The results were organised and structured into different sub-topics. The first sub-topic profiles and discusses the background of the respondents. The second one discusses the perception of pastoralist on the manifestations of climate change. The third sub-topic is about the access to the climate change information system. The fourth sub-topic addresses the characteristics of livelihood resources (natural resources, human resources, financial resources, social resources and physical resources). The final sub-topic presents the major sources of pastoral livelihoods. Both quantitative and qualitative data were presented using different tools such as frequency tables, pie charts, bar graphs, pictures and narratives.

4.2. Background profile of the household respondents

Table 4.1 below provides the background profiles of the sample households who participated in this study. As mentioned earlier, the study sampled respondents of households from two districts of Sitti zone such as Shinile and Erer districts. It investigated the demographic and socio-economic characteristics of the respondents. Accordingly, the main background profiles of household respondents such as sex, age, marital status, educational status, family size and number of dependents at household level were highlighted.

Table 4.1. Demographic Characteristics of household survey

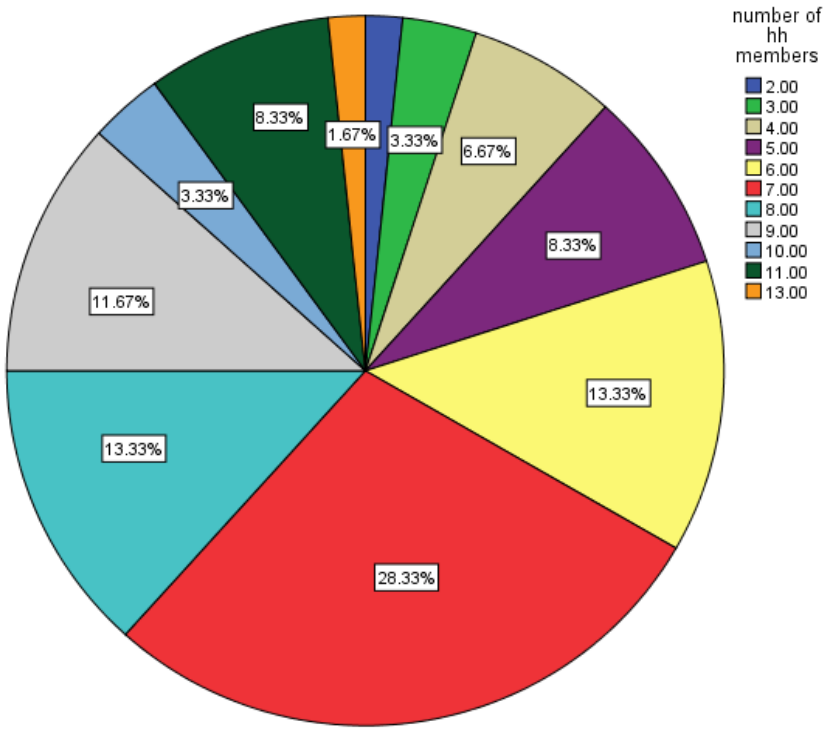
Family issues	**Mean**	**SD**	**Minimum**	**Maximum**
Family size	7.18	2.20	2	13
No. of dependent	2.92	1.41	0	6
HH Characteristics	**Frequency (N=120)**	**Survey in each districts**		
	All districts	Shinile district	Erer district	
Sex:				
Male	96 (80%)	49 (81.7%)	47 (78.3%)	
Female	24 (20%)	11 (18.3%)	13 (21.7%)	
Total	120 (100%)	60 (100%)	60 (100%)	
Age group:				
Less than 21	4 (3.3%)	2 (3.3%)	2 (3.3%)	
21-30 years	16 (13.3%)	8 (13.3%)	8 (13.3%)	
31-40 years	30 (25%)	11 (18.3%)	19 (31.7%)	
41-50 years	38 (31.7%)	21 (35%)	17 (28.3%)	
51-60 years	22 (18.3%)	12 (20%)	10 (16.7%)	
Greater than 60 year	10 (8.3%)	6 (10%)	4 (6.7%)	
Total	120(100%)	60(100%)	60(100%)	

Marital Status:			
Married	91 (75.8%)	44 (73.3%)	47 (78.3%)
Single	2 (1.7%)	2 (3.3%)	0 (0%)
Divorce	14 (11.7%)	9 (15%)	5 (8.3%)
Widowed	13 (10.8%)	5 (8.3%)	8 (13.3%)
Total	120(100%)	60(100%)	60(100%)
Educational Level:			
Non-literate	62 (51.7%)	30 (50%)	32 (53.3%)
Read and write	44 (36.7%)	26 (43.3%)	18 (30%)
Primary level	8 (6.7%)	0 (0%)	8 (13.3%)
Junior level	6 (5%)	4 (6.7%)	2 (3.3%)
Total	120 (100%)	60(100%)	60(100%)

Source: Field survey, 2019/20

Table 4.1 shows that, most of the respondents were male-headed household who accounted for 80% of the participants, whereas female-headed household respondents accounted for 20% only. Sex is one of the important variables in socio-economic studies because many social and economic conditions are a function of sex. 31.7% and 25% of the participants fell between the age groups of 41-50 years and 31-40 years old respectively. More than 50% of the respondents fell between the age of 31 and 50 years old. With regard to marital status, the majority of respondents (75.8%) were married. This is not surprising as being married explains the dominant social expectations and norms set by society. Approximately 22.5% were either widowed or divorced and 1.7% of the respondents were single and had never been married before.

Figure 4.1: Number of household members



Source: Field survey, 2019/20

The average household family sizes of the respondents were 7.18 persons per household with a standard deviation of 2.2. The average family size was greater than that of the national average 4.3 (CSA, 2010). Such enormous family size in the area may be connected with the polygamy culture that is commonly practiced in the study area. Similar results were reported in the studies conducted in Afar region and Sidama zone, Ethiopia (Hameso, 2014). This implies that the presence of large family sizes might have negative effect on the accessibility and availability of food and other assets at household level.

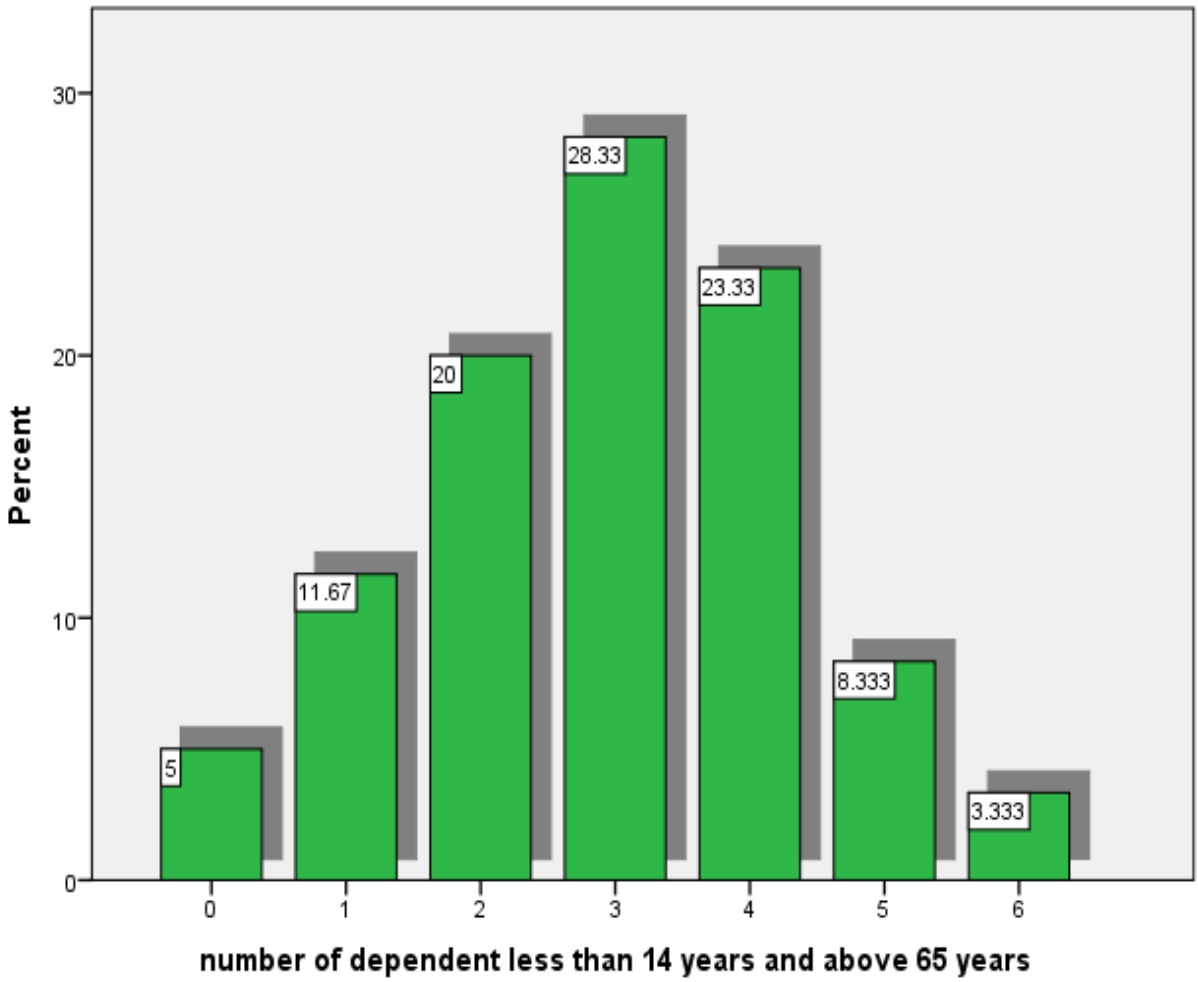
The maximum and minimum family size of the participants at household level is 13 and 2 respectively. Households with seven family members accounted for 28.3% and small family size (two members) accounted for 1.67%. In other words, over 60% of households had seven and above family members (Figure 4.1). The result indicates the presence of high fertility rate and the pervasiveness of extended family conditions in pastoralist's areas, implying the strength of social and family ties in taking care of children and vulnerable adults and the underprivileged people. Silvestri *et al.*, (2012) argued that having large family size enables to have higher labour that is needed to carry out different farm activities. On the other hand, households with large family size have less coping and adaptive capacity to the impacts of climate change and usually vulnerable to food insecurity. Opiyo (2014) indicates that household size has a significant influence on the vulnerability of the households to climate change and climate extremes. Smaller household are usually less susceptible to climate extreme events such as drought and rainfall variability. This is because food scarcity is one of the main challenges during drought and the smaller the household size, the easier it is to cope with scarcity of food.

Education is a basic component of human capital that can help to equip and empower pastoral households to contribute to their resilience and increase their productivity within changing climatic conditions. It also helps to guide the day-to-day activities of each individual to undertake livelihood activities such as livestock rearing, resource management, trading activities and the like effectively and proactively. Qoranic education is very important to the pastoral people. Those who have not passed through the system are known as *caamo* (the non-literate) and are less respected in the community. Those who have learned the Qoranic School and memorized the Qoran acquired and got additional knowledge are referred as *Culumo (*the knowledgeable) and are well respected in the community. Most families have young children

who attend Qoranic School *(dugsi)* mainly during the wet season. The educational status of the respondents varied from non-literate to the junior level of education, of which 51.7% of them cannot read and write (non-literate) and about 5% of the respondents had educational qualifications that ranged from the completion of grade 5 to grade 8. This implies that the vulnerability of communities to climate variability in the study area was high as illiterate households are reluctant to adopt new adaptive technologies and have low employment opportunities on non-farm activities as compared to their counterparts. This result is supported by the studies conducted in Afar region and dry lands of Africa which indicated that education enhances household's resilience to climate-induced shocks and stresses (Kebede and Adane 2011). Lack of formal education affects the ability of the household to understand and interpret climate information for decision making (Opiyo *et al*., 2014). Educated household heads have better chance to understand, interpret and act on information and available opportunities.

Figure 4.2 below shows that 28.33% and 23.33% of respondents have 3 and 4 dependent family members respectively. The maximum and minimum numbers of dependent family (less than 14 years and greater than 65 years old) at household level are 6 and 0 respectively. The average size of dependent family members of the respondents was 2.92 persons per household with standard deviations of 1.41. This indicates that the majority of the participants have a large number of dependent family sizes. As dependent family size increases, the need for enough basic needs also increases. It determines the participation of household heads in the labour market by involving low paying activities so as to fulfil both their basic needs and the needs of the unproductive members of the household.

Figure 4.2: Number of dependents less than 14 years and above 65 years' old



Source: Field survey, 2019/20

4.3. Perception of Pastoralists about the manifestations of climate change

This section focuses on how pastoralists perceive the various forms signalling the occurrence of climate change (meteorological conditions that observed for long period of time) and climate variability (short term fluctuation happening from year to year). It is unavoidable that climate change causes major problems to the livelihood of pastoralists, who depend on natural resource

for their livelihood activities. Pastoral livelihood activities are mainly climate-sensitive as the climate is one of the major inputs for the production and productivity of various assets. Climate change and variability can exacerbate the impacts of livelihood challenges in arid and semi-arid areas. Of all the natural resource-based land uses in the dry lands, pastoralism functions better within the perspective of wider rainfall inconsistency and unpredictability. It, therefore, presents a more logical adaptation route than livelihood activities and land uses which do not have the advantage of mobility (Nori and Davies, 2006).

Despite perception is one of the most important factors in the study of climate change and variability, researchers have given less attention to the lowland areas of Ethiopia than highland areas. In this regard, a study conducted by Deressa *et al*. (2011) confirmed that most studies on perceptions about the impacts of climate change and variability on livelihood of people and their climate change adaptation strategies are conducted in highland areas of Ethiopia where there is a relatively better environment for communities to realise and respond to the impacts of climate change. The concept of perception has been aligned usually with psychological impacts for several years and it was difficult to recognise and ask how someone can adjust to climate change and variability in an adequate way if he/she does not recognise the current and future climate change and variability possibility as a reality. It is rational to argue that the first step towards coping and adaptation strategies to climate variability is the perception of the problem by the affected communities. Even though climate variability may bring incidents further than preceding knowledge, local experience and perceptions remain the base for any local coping and adaptation strategies.

Similar to other changes, climate change results in uncertainty. In their efforts to make sense of changes, people provide meaning to live reality based on their perception and

experiences. It is, therefore, significant to describe people's perception with reference to climate variability. From the perspective of climate variability, perception is described as the process by which people obtain information or stimuli from their surrounding and change it into psychological consciousness (Ban and Hawkins, 2000). Perceptions also refer to the way people identify, become aware, understand and interpret observations and concepts of climate change and variability (Vignola *et al*., 2010). Perception is, therefore, an exceptionally complex concept. It restricts itself to social perception that is concerned with the results of social and cultural issues on cognitive structuring of our physical and structural environment. This varies with the individual's previous experiences and current situates or attitudes performing through needs, values, memories, social circumstances, and expectations (Saarinen, 1976).

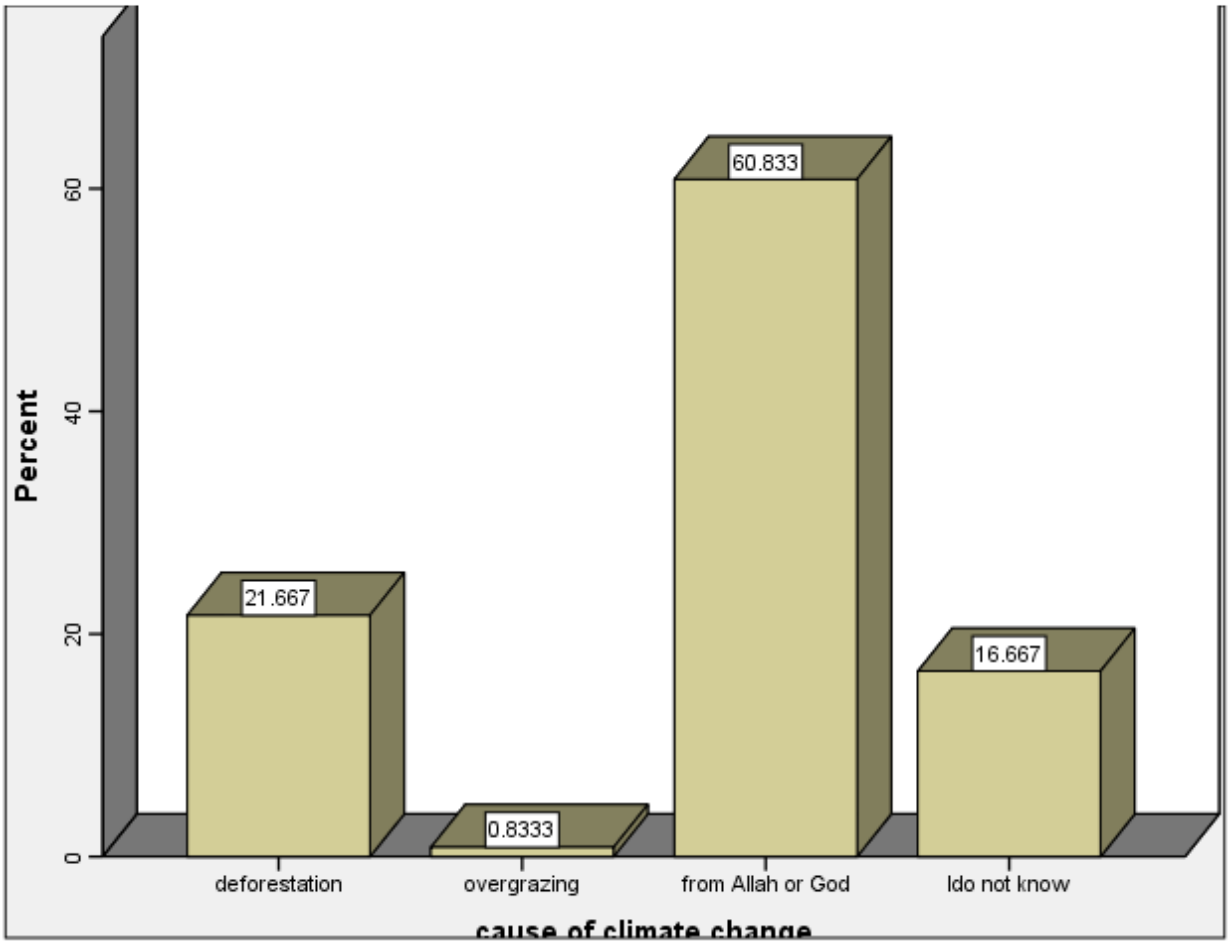
Contexts, beliefs, experiences and personal confidences have a large impact on how one perceived climate change and variability. The majority of key informants and focus group discussants stated those three decades before, the study area was covered by indigenous thorny trees, bushes and wide savanna grasslands, and was characterised by sufficient amount of rainfall, water sources and pastureland throughout the year. The temperature of the area was not as harsh as today. There was no scarcity of natural resources like pastureland and water points, and there was no stiff resource competition like today. Therefore, the majority of pastoralists had large numbers of livestock with better livestock productivity and other assets, and led a decent life. Currently, however, pastoralists recognised that their livelihood systems are highly becoming vulnerable due to climate change and variability.

To assess the pastoralists' overall climate change and variability perception, a question aimed to identify whether they perceived or not was forwarded. In view of that, 98% of the respondents recognised that climate variability is a real phenomenon in the study area. The

finding is in line with Belayneh et al. (2012) study in Eastern Ethiopia, who discovered that most of the respondents have recognised climate change and variability. According to IPCC (2014), climate change and variability are already perceptible in diverse places and with different intensities all over the world.

The results in Figure 4.3 revealed that the main causes of climate change and variability are Allah (60.8%), deforestation (21.6%), they didn't know the causes (16.6%) and over grazing (0.8%). The household survey result indicates that despite pastoralists are aware about climate change and variability, the majority of respondents have not scientific knowledge about the causes of climate variability. Large number of respondents recognise the changes in climatic conditions and attribute it to punishment of Allah, and other respondents reported that they didn't know the causes of climate variability. This implies that pastoralist households have not sufficient scientific knowledge about the main causes of climate change and variability in the study area. Without scientific knowledge about the real causes of changes in climatic conditions, it is difficult to plan, interpret and take appropriate decision to implement context based coping and adaptation strategies to withstand the adverse impacts of climate change and variability. The overall results indicates that there is a need for launching awareness campaigns on causes of the changes in climatic condition and on measures that should be taken at household and community level, to bring all households of the pastoral community at equal footing.

Figure 4.3: Causes of climate change and variability in the study area



Source: Field survey, 2019/20

Studies conducted in Western India on rural people's belief understanding of climate change and variability indicated that most respondents recognised climate change and variability but they didn't know about the scientific causes of climate variability (Moghariya and Smardon, 2012). Wolf and Moser (2011) stated that people who believed in a higher God who also manages the weather events were more possible to consider that they as community were incapable to address

climate change and variability. This was aggravated when scientific knowledge about climate change and variability was limited. In this instance, a natural disaster, especially climate change and variability related hazards were seen as a punishment from God. This means that while people know that the climatic condition is changing, their belief that God was in control of the weather left them largely powerless.

Few respondents recognised that man-made factors such as deforestation and over grazing are the causes of climate change and variability. The pastoralists' perception on the causes of climate change and variability was almost in agreement with the study by Mihiretu *et al*. (2019) in the arid lowlands of eastern Ethiopia, who identified high rate of deforestation, natural resource depletion, poor soil and water management practice and rapid population growth as common climate change causes.

During key informants interviews, participants highly associated the causes of climate variability with the punishment of Allah in response to people's disobedience. They believe that they have all transgressed against their Allah, particularly in relation to poor conservation of the natural resource that Allah gave upon them. Hence, the changing climate is Allah's retribution to mankind, and Allah can overturn climate variability if they believe accountability for their actions. Few key informants of experts attributed the causes of climatic variability to the worldwide climate change events such as deforestation, degradation of resources and environment, emission of pollutant gases form industry and vehicles.

Most of the focus group discussion participants confirmed that the main causes of climate change and variability in the study area are Allah, deforestation, natural and environmental degradation, overgrazing, mismanagement of water and soil resource. Experts and officials also

attributed the cause of climate change to the emission of pollutant gases from industry, poor management of natural resource, mainly forests and over grazing, with population growth considered as a major driving factor for climate change and variability. Human beings were seen as the major causes to climate change and variability or contributed by their negative actions on the environment, for instance, felling of trees for charcoal, firewood, settlement and farming in a fragile environment (land use change). The barren land becomes hot and increases evaporation of the little moisture in the soil, intensifying the impacts of climate changes and variability. In this regard, Lorenzoni *et al*. (2007) found that although the majority of people report being understand of climate variability and its causes and prove some concern, they could not make clear in detail its causes, consequences and solutions. They consider that climate change is caused by man-made and natural causes, but usually do not recognise the details. In some cases, the experts still link climate change with the depletion of the stratospheric ozone layer, greenhouse effects and climate variability.

Indicators of climate variability include recurrent prolonged droughts, temperature, precipitation, floods, cloud covers, forest fire, cyclones and conditions that result from periodic El Niño and La Niña events (Tasokwa, 2011). Major elements of climatic conditions in the study area are dynamic and difficult to predict. They all appear to accord that the short rains (*Gu)* are becoming more unpredictable and almost unpredictable for water source and pasture. Human populations are increasing, the climate is changing from time to time and environmental stocks are degraded due to climate change and human intervention. The key informants and focus group discussants also pointed out that such climate change events are more and more becoming part of the long-standing climatic condition trends in their areas, with marked decline and delays frequently observed in the starting dates of the *karan* rains and rising temperature during the dry

season (*Jilaal*). For example, pastoralists in the study districts often used the word '*berha*' which can be approximately translated to mean 'arid region' inappropriate for animal rearing to refer to the current climatic change in their areas. This entails that pastoralists recognise abnormal weather conditions and take this as a symptom that some irreversible process of change is happening in their local climate which already changed what they believe is 'normal'.

There is an agreement among the focus group discussions and key informant interviewees including experts and officials across the areas that climate variability has taken place and is now an ongoing process. The reported changes included dramatic rising in temperature, decline in rainfall amounts, delayed onset and early cessation of rainfall; increased rainfall variability with frequent dry spells; and increased incidences of droughts and flood events. The majority of group of peoples and government representatives reported an increase in drought frequency from every 5-8 years to every 2-3 years. The finding of scholars about pastoralist's perceptions prove that most the people in east Africa are aware of changes in temperature, drought and precipitations, and have inadequate ability to cope with and adapt to the unfavourable effects of climate change and have obstacles that prevent them from practicing different adaptation strategies (Acquah-de Graft and Onumah, 2011). Pastoralists also perceived that the climate change and climate variability have led to declined herd populations, weight and an increase in livestock loss. These resulted in loss of household income and livelihood for the majority of the people in general and women in particular; hence, a general deterioration in their welfare (Mengistu, 2011).

Participants were asked about the major manifestations of climate change and variability in the study area. They perceived that new different forms of manifestations of climate change on pastoral communities include prolonged drought, shortage of rainfall, heat stress, scarcity of pasture and water sources, rainfall variability, death of livestock and environmental degradation.

As shown in table 4.2 below, pastoral communities have been affected by various climate change hazards especially with the increasing warming trend (heat stress), recurrent droughts and decline of rainfall amount that they observed in the last decade, with the daily as well as night temperatures increasingly felt above normal for the dry season. These hazards have the highest degree of impacts on community's livelihood resources, and occur very frequently.

Except the occurrences of flood (3rd rank), the rests of manifestation/indicators of climate changes such as prolonged droughts, decline in rainfall amount, heat stress, scarcity of rangeland and water sources, rainfall variability and death of livestock due to drought were put under first priority indicators/manifestations of climate change and variability in the study area. Regarding rainfall amount, frequency and duration of the rainy season, households specified a range of changes they had perceived. The majority of focus group discussions and key informant participants confirmed a decline in the number of rain days coupled with frequent droughts over the past three decades. The respondents were expressed their concern about greater variability and seasonal changes which determined their capability to forecast rainfall distributions and plan their grazing managements accordingly. In addition, the majority of participants reported that the shorter rainy seasons has led to longer dry periods in between seasons, which resulted in higher pressure on the available pasture resource and water points.

Table 4.2. The manifestations of climate change and variability

Manifestations of climate change	**Rank of manifestations of climate change**									
	1st		**2nd**		**3rd**		**4th**		**5th**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Occurrence of prolonged drought	120	100	0	0.0	0	0.0	0	0.0	0	0.0
Death of livestock due to drought	108	90.0	12	10.0	0	0.0	0	0.0	0	0.0

Occurrence of Floods	30	25.0	12	10.0	46	38.2	18	15.0	14	11.7
Outbreak of new Livestock disease	90	75.0	28	22.3	2	1.7	0	0.0	0	0.0
Decrease the amount of rainfall	120	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Rainfall variability (early and late rainfall)	115	95.8	5	4.2	0	0.0	0	0.0	0	0.0
Erratic rainfall	64	53.3	34	28.2	12	10.0	8	6.7	2	1.7
Stiff resource scarcity and competition	106	88.3	14	11.7	0	0.0	0	0.0	0	0.0
Degradation of some species of grasses	106	88.3	12	10.0	2	1.7	0	0.0	0	0.0
Environmental degradations	100	83.3	18	15.0	2	1.7	0	0.0	0	0.0
Scarcity of rangeland and water sources	116	96.7	4	3.3	0	0.0	0	0.0	0	0.0
Heat stress	118	98.3	2	1.7	0	0.0	0	0.0	0	0.0
Wind	60	50.0	34	28.3	10	8.3	10	8.3	6	5.0

Source: Field survey, 2019/20

4.3.1. Occurrence of prolonged drought

Recurrent, prolonged droughts, worsened by El Nino effects, are having a devastating humanitarian impact on water, sanitation and hygiene, food, livelihoods, health and nutritional situations in Somali region. Pastoralists means of livelihoods are characterised by various risks and unpredictability due to changeable ecological conditions and occasional shocks (Scoones, 1995). Minor rise in temperature has gigantic consequences in such areas as it contributes to climate change condition related hazards such as drought, pests and diseases, scarcity of water, and imperfect hydrological cycle. All respondents identified drought as the persistent climate variability-related problems that pastoral communities have experienced over the past several years. In 1990/91, severe drought (known as *hurgufa*) with catastrophic impact occurred and a large number of livestock died due to scarcity of pasture and water sources followed by new

livestock and human diseases. The frequency of drought has increased and happens every 2 years. Aklilu and Alebachew (2009) argued that previously, drought occurred in every 5 to 8 years, but now it occurs every 2 to 3 years. Death of livestock due to prolonged droughts is a very challenging problem that affects the adaptive capacity of pastoral communities.

Recurrent, prolonged droughts resulted in low productivity of livestock, death of lactating animals and calves, reduction of milk and meat production, lower prices of livestock and increase in grain prices and failure in crop production (Fassil, 2001). It has been observed that rangeland is declining in the area, though the area was formerly rich with rangeland resource. Rangeland is the most important natural resource base for the pastoralist livelihood system. Increased bush encroachment, reduction of rainfall, termite infestation and expansion of cropland are major factors behind the decline of pasture production over the years. It shows that the impact of reduced rangeland productivity has direct implication on the pastoralist household and the wider pastoral livelihood system as it affects the supply of milk and other livestock products (Nardone *et al.*, 2010). Devereux (2006) also argues that pastoralist's livelihood vulnerability to recurrent drought is increasing steadily. Drought shrinks the stock of resources such as grazing lands, water points, forests and livestock and livestock products. Such resource degradation causes herders to move to very distant areas with their livestock in search of better grazing areas and water points which lead to stiff resource competition and conflict among different ethnic groups.

Elders stated that pastoralists' response strategies to the recurrent droughts and climate change include selling of charcoal and firewood, chat production near water sources, fattening of cattle, animal and other petty trading, government support in the form of safety net, emergency and contingency programs. Under safety net program, a household with six or below family

members is likely to send one family, usually the father to participate in development works, mainly in natural resource conservation so as to acquire some amount of food distribution. The Food for Work Program usually involves the poor pastoralists in soil conservation practices, terracing and forest management programs.

4.3.2. Decline in rainfall amount

Pastoralists live in arid and semi-arid areas that experience different livelihood shocks due to changes in environmental, social and economic circumstances. Pastoralists are highly vulnerable to repetitive livelihood shocks due to shortage of precipitation which devastate their livestock and livestock products. Research participants perceived that the decline of rainfall as the main indicator of climate change and variability. The dry season has become longer, and shorter main wet seasons (*karan*) and failed more often. The consecutive failures of *Diraa (*short rains season*)* and *Karan* (main rainy season) have massively affected water availability of *birkas* and ponds, which are mostly used as water source by communities living throughout the Sitti Zone. Drought is generally accompanied by scarcities of water, heavy dust, shortage of food and fodder; spread of new livestock and human diseases; and high frequency of conflicts, all of which contribute to a vicious circle of poverty. The beginning and ending of the rainy time is also becoming more unpredictable. The rain may end very early and be more erosive because there is less vegetation cover. According to elders, droughts in previous times resulted from a failure of either the *Diraa*/*Gu* or the *Karan* wet season. Gradually, however, this has changed to the failure of both wet seasons. Moreover, rainfall is highly localized, which puts narrower limits on mobility and leads to higher risk of the spread of livestock diseases and conflicts, because large livestock are collected in the same areas favoured by the limited rains.

Key informant interviewees have recognised changes in the atmosphere as well as the different attributes associated with the local rainfall in the study area. The changes in climate conditions, primarily precipitation, are noticeable and have been rapid mainly over the last decade. In this regard, respondents perceived that rainfall has deviated from its ordinary in terms of amount, distribution, frequency and duration. The amount of rainfall is insufficient to sustain the availability of pasture and water sources, to grow different types of crops. Moreover, rainfall has become more erratic and poor in distribution. There is also a significant delay of the onset of the rainy season and a considerable decrease in number of rainy days.

According to Devereux (2006), the people of Sitti zone have relatively restricted mobility to the rest of Somali Region and this exacerbates the impacts of prolonged droughts, as they have not sufficient places to migrate with their livestock to search grazing land and water. The local climate is inhospitable, with droughts being recurrent and harsh. Significantly, the rainfall distribution, particularly in Shinile district is different from other parts of Somali Region. The main rains come in the middle of the year, and are called '*Karan*'- equivalent to the long rains called '*Kremt*' in the neighbouring Ethiopian highland regions. Dependence on one main rainy season, and the long period in between rains, makes Sitti zone very vulnerable to droughts. Local people describe most of the last large number of years as drought years.

Generally, there is a widespread awareness that absence of rain for several consecutive years have become more usual, or even "continuous", during the last decades. These droughts are blamed for escalating poverty, leading to decline the qualities and quantities of herds and flocks, and deteriorating the ability of traditional restocking mechanism, known locally as '*jiisin*'. Because of the increasing uncertainty associated with climate change, some pastoralist

with access to credit and other opportunities are now diversifying their means of livelihood alternatives to withstand the negative impacts of climate change and variability.

4.3.3. Heat stress

The majority pastoralists in the study area, climate change is an actuality manifesting through changing seasonal patterns, increased desertification, intense heat wave, drought, unpredictable rainfall, changing wind speed and directions and changes in their ecosystems as well as the appearance or spread of new livestock and human diseases (Hameso, 2014b). Pastoralists perceive that the occurrence of strong heat for longer periods of times is now a widespread phenomenon. Respondents rank heat stress (98.3%) under the 'first' column of major manifestation of climate change in the study area. Very strong heat almost throughout the year in general and during the months of January, February, March, April, May and June in particular is sever in the area since the last decade. The community perceived this increasing heat stress as due to the impact of climate change. Elders stated that the temperature condition of the study area in the previous times was not as harsh as today; however, it has now changed an alarming rate and has become very severe. When the shortage of water sources and grazing lands combined with the incidence of intense heat, it will have its own consequences and burdened on the health conditions and resistance of their animals' body conditions to withstand and resist the drought periods.

One key informant, Ali Wahib, in his mid sixties from Aydora kebele, Erer district, recall that change in climatic conditions by comparing it to the last three decades. His narration also indicates the impacts of climate variability and the desperation of his community:

> I have never seen such a drastic temperature change and shortage of rainfall in the area. When I was a young, this place was characterised with conducive temperature and sufficient amount of rainfall. Today, however, rainfall variability, prolonged drought, intense heat and scarcity of basic natural resources are the most challenging problems in the area.

The DAs perceived that there would be more climate change and variability impacts in the future given scarcity of pasture and water for their livestock; if not appropriate measure is made. They also consider that heat stress, number of hot days, inconsistent rainfall will increase, and rainfall amount will decrease in the future exacerbating the climate change related problems.

4.3.4. Livestock diseases

Almost all respondents of the FGDs reveal that the incidences of new animal diseases in their district is usually linked with the rising temperatures (heat stress) and scarcity of sufficient grazing land and water sources. Discussants felt that new livestock diseases are affecting their livestock. However, most of them unable to provide reasonable clarifications on the fundamental connection between increasing livestock disease and climate change and variability. In this regard, only few FGDs participants were able to come up with significant explanations that indicate the likely impacts of hot temperature and lack of rainfall on herds health by referring how the hot temperature and scarcity of rainfall creates unfavourable conditions for the reproduction and subsequent spread of diseases among livestock.

According to Elders, *Undugul*, *Gubilo*, *Migida* (fatal new livestock disease), *Assedaho* and *Gali Dalka* (camel diseases) are among the livestock diseases that have manifested in recent times in the study area. They revealed that *Gubilo* and *Undugul* have no traditional medicine, but

Midiga has traditional medicine that pastoralists use a tree named *Gelato* with butter as herbal medicine. It was also discussed that type of human diseases such as cancer, cholera, typhus, typhoid, malaria, HIV AIDS and tuberculosis are killer diseases in the area.

Key informants from Pastoral Development Bureau (PDB) and Agriculture and Rural Development (ARD) offices pointed out that the change in climatic situations mostly affect animal health through declining the accessibility of pasture and water point making them more vulnerable to different diseases. They confirmed that the latest infestation of animal diseases in study areas include mouth and foot diseases.

4.3.5. Environmental degradation

Environmental crises and problems throughout the world in general and in arid and semi-arid regions in particular are widespread and increasing rapidly. In this case, respondents perceived that currently, the stock of diverse species of rangeland grasses, water sources, forests and wild animals are declining steadily because of several and interconnecting issues. Some of the causal factors in the decreasing nature of rangelands biodiversity species and forests include changes in land use pattern (from communal to private), deforestation, overgrazing and persistent droughts. Clearing of forest in the form of charcoal production and firewood collection as an alternative means of livelihood strategy due to the impact of climate change is becoming a daily activity among the poor pastoral societies. As a result of this, the various plant species are now decreasing and even disappeared at an alarming rate. The same is true for the various types of animal species due to scarcity of grazing land, water points and livestock disease. The practice of the extensive form of charcoal making among the pastoral communities as one of means of livelihood diversification is due to the impacts of climate change on the well-established and long periods of pastoralists livelihood practices. The historical and traditional type of the practice

of pastoralists livelihood strategy is under pressure due to the impact of worldwide climate change leaving pastoral communities forced to adapt to such changes.

The expansion of desertification is usually aggravated with the wide practice and expansion of deforestation for charcoal production to survive the impacts of climate change and climate variability. There is also stiff competition over scarce pastureland and water points and this leads to conflict among ethnic groups. Formerly, there was no scarcity of resource (pastureland and water points) due to the relatively small number of population and relatively better climate conditions so that there was no rigid competition for fundamental resource like water and grazing land. However, nowadays the population is increasing and climate is changing at an alarming rate while the vital natural resource in which pastoralist are dependent for their livelihood are degrading steadily.

FGDs in the study areas shown that some decades ago, there were numerous types of wild animals and species of plants, but most of them disappeared due to human-made and natural factors, which led to decline of habitats, water and other resource. Community elders also confirmed that the wide grassland was the residence of different species of vegetation as well as wild animals like hyena, antelopes, fox, and the like. However, presently none of them are living in these areas since the existing ecosystem does not sustain their feeding habits. This indicates that the environmental degradation of this vast grassland in the last thirty to forty years is due to the combined impact of climate change and population growth. Pastoralists are disappointed with the appearance of the new events in that not only wild animals lost their homes but also human beings harvest trees and bush plants for house construction if the practice of deforestation continues like this. With the convergence of increasing population pressure and decreasing natural resource, there is the practice of violate the communal cultural moral values and attitudes

that assists pastoral communities in the study area live together in peaceful and harmonious manners. For centuries, pastoralists were known and praised for their culture of pro-environment. Community elders added that there was a vast rangeland in Sitti zone. In these vast rangelands there was the availability of pasture/grazing resource and forest coverage for their animals. If there were drought, pastoralists had enough space to move to or the room to roam and search for pastureland and water resource. However, nowadays the vital natural resource, especially pasture land and water points in which pastoralists are dependent for their livelihood are very scarce due to the occurrence of prolonged drought in the study area.

Various species of indigenous plants, particularly important grasses disappeared due to climate change, invasion of *Prosopis Juliflora* (*Woyane/ Derghara*) and other unwanted bush encroachment. Some of the already disappeared species of grasses which were identified by community elders in local language includes: *Dariif, Darremo, Cawsmacah, Moqalxidh, Qawl Barelay, Goon, Xarfo, Modah buur, Carancer and Yaryaraed.* According to Fassil (2001), bush encroachment and unwanted plant species has been considered as a severe danger that exacerbates the decline of the rangeland pasture and causes the disappearance of most important grass and replacement of aggressive bushes that are not necessary for the livestock or the pastoral communities in the area.

Figure 4.4: Invasion of *Prosopis Juliflora*

Source: Field survey, 2019/20

Prosopis Juliflora locally named as *Woyane/Derghara* is widely invading the grazing lands in the study area. Key informants and FGDs stated that efforts were made to clear this unwanted thorny and toxic bush encroachments with the help of GOs and NGOs like Farm Africa so as to replace into grazing land. Another type of bush encroachment of pastoralist's rangelands is the *Klignole bushes* - the one that grows alone by destroying other species of plants and grasses. Both *prosopis* and *Klignole* bushes are varieties of weeds that are not palatable to pastoralist's livestock, and invading and destroying the grazing land. Besides, elders revealed that in addition to *prosopis and Klignole*, *parthenium hysterophorus* or congress grass is also an inedible wild plant, which invaded upon Somali rangelands in the study area. *Parthenium hysterophorus* or congress grass is locally named as *Feremisisa*. Beruk (2003) stated that in addition to reducing the quality and quantity of grazing lands, the rapid expansion of unnecessary bushes has negative effects on the composition and consumption of milk and milk products by making it a bitter taste. As a result, pastoralists have ceased consuming milk produced from animals feeding on

congress grass. The species has invaded grasslands along roads and railways and is spreading into rangelands easily everywhere through the help of train and vehicles. Generally, respondents perceived that various indicators for climate change and variability include the following:

- Recurrent and prolonged droughts in the area
- Rainfall variability
- increasing temperatures
- New human and livestock diseases, and as a result the number of livestock also decreases steadily
- Recurring strong wind is very common
- Species of grasses and other plants have been changed and even disappeared steadily due to drought and invasion of toxic plants.

4.4. Access to climate change information

Pastoralists have been practicing various kinds of indigenous surviving mechanisms and adjustment strategies which are born out of essential to offset the impacts of climate change. However, most of the mechanisms and strategies have not been efficient as there are no formal scientific well-defined ways of their application, and they are also practice once the hazards have already caused enormous harm. Restricted attempts practiced in preventive measures in the area, although there is lack of accurate information for the pastoral communities. Early Warning Systems (EWS) are monitoring tools intended to stay away from or minimise the impact forced by a threat to life, assets, environment or livelihoods (Cetina and Nadime, 2008).

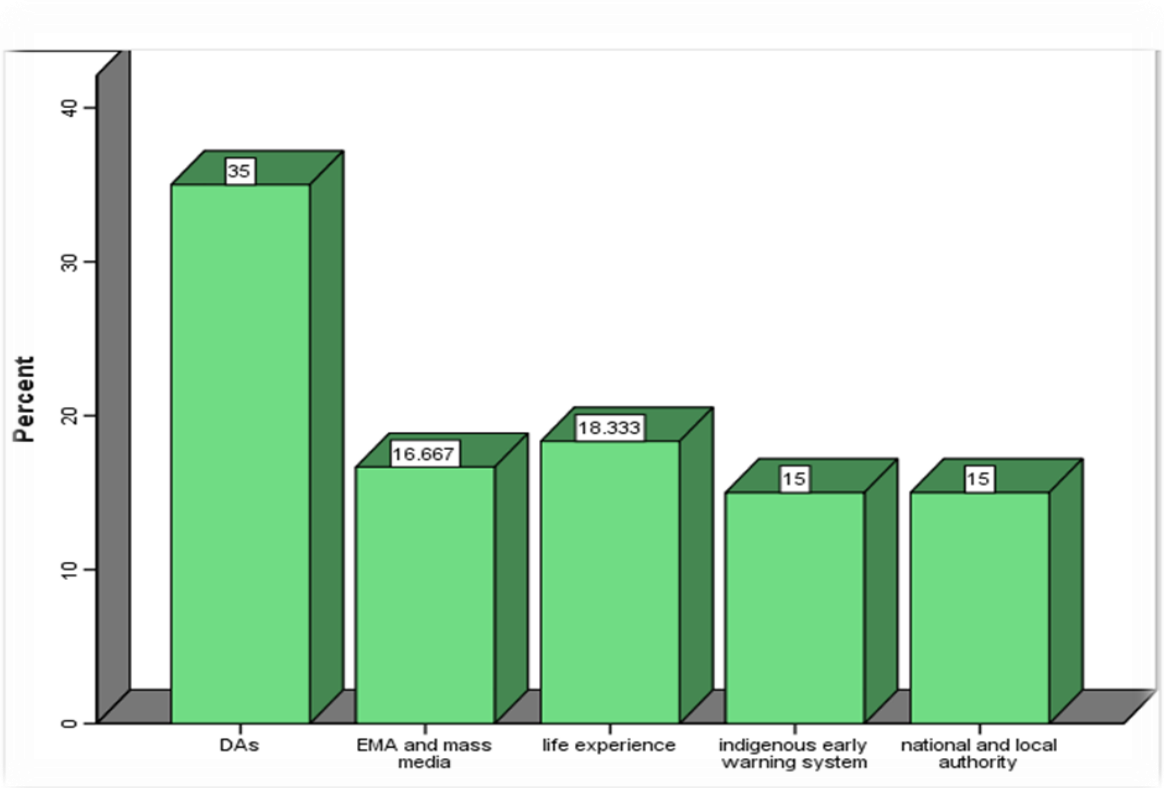
Climate change information systems do not sufficiently exist in pastoral area, or are ineffective, or break down at critical points-risking destruction, loss, and poverty. The existing

scientific climate change information and warning system has been criticized for being too complex and resource intensive that require skilled staff at all levels and also require well-organised communication channels, which is lacking or not suitable for pastoral areas in Ethiopia; and lack of baseline information. Climate change related information is widely recognised as worthwhile and necessary in enhancing resilience to climate change induced hazards, protecting economic resources, and progress gains. It helps community to adapt to and defend against the uncertainties of climate change (Teshome, 2012).

Information sources on climate change and variability such as drought, rainfall variability and amount of rainfall, flood, pests and diseases is highly demanded by all pastoralists in the studied areas. In addition to individual and communal experience, pastoralists also received information from external sources that include extension workers and experts. According to survey data, as shown in Figure 4.5 below, pastoralists identified Development Agents as the main sources of climate change information (35%). Respondents also confirmed that life experience (18.3%), Ethiopian National Meteorological Agency (ENMA) and mass media (16.7%), indigenous early warning system (15%) and national and local authorities (15%) have equivalent importance in providing climate change information for the pastoral communities in the study area.

In addition to the above climate change information sources, elders identified several traditional indicators to predict and disseminate climate change hazards information for the pastoral communities. In response to the absence of sufficient scientific forecasting and dissemination of information, the society has practiced their own indigenous early warning system to predict potential climatic change hazards and prevent their impacts. Locally, the traditional climate change forecasters are called '*Xidigiye'* in Somali region.

Figure 4.5: Sources of information about climate change.



Source: Field survey, 2019/20

The community recognises and practices a wide range of traditional forecasting mechanisms which base on local knowledge and experience without scientific basis. In the study areas, different climate change indicators identified by the local community elders include: astronomical observation, speed and direction of wind, animal behaviour, animal intestine, starting day of a New Year, the level of ground water, cloud cover, earth cracks, spider net and night weather.

4.4.1. Astronomical observation: Well experienced and aged people in the community can forecast and distribute climate change hazards information by observing the movement and

direction of the stars and the moon in the sky. Such type of observation and forecasting, climate change impacts are the sole role of male elders because they have better information, knowledge and skills than females.

4.4.2. Wind direction and speed: People use the speed and direction of wind to forecast about the rainfall and the occurrence of drought. Wind blowing from the South and East indicates occurrence of rainfall, while wind blowing from North and West implies the occurrence of drought.

4.4.3. Animal behaviour: This is also one of the most frequently used indicators of climate change hazards. When drought is about to come, domestic animals begin to consume animals' "carcasses; Hyenas do not woof at night, and it also stops consuming carcasses of dead animals. Animal salivation and rolling of unmated sheep are signs of upcoming rainfall. Birds "squeak" is also another important indicator of approaching rainfall. According to the community elders, when something bad is going to happen, livestock crowd together and refuse to go to grazing area and watering points.

4.4.4. Animal intestine: As per the experience of the community elders in the study areas, the intestine of animals could help to predict various climate change and other man-made hazards, including rainfall shortage, occurrence of droughts, pest and disease prevalence, conflict, and even death of a human beings. They use various animal intestines to make short-and long term predictions. For instance, to predict hazards coming shortly, a goat's intestine is used and, for long term prediction, about eight months to more than a year, cattle's intestines are used. Currently, only a few elders use animal intestine to forecast climate change hazards because it needs much time and special skill to observe and interpret animal intestine.

4.4.5. Starting Date of a New Year: In most of the study sites where this research was carried out are populated by followers of Islamic religion and they employ the Hijra calendar system, which focuses on Moon as the centre of the system for performing religious activities. According to the elders, if the first day of a new year is on Wednesday, Saturday or Sunday, then climate change and other hazard are expected.

Pastoralists used to believe highly in traditional forecasting and have been the beneficiaries of such generated information and used it in their decision making process. However, religious leaders lost trust in the practice of the traditional forecasting and this was eroded over time and failed. For instance, using a starting day of a new year to predict drought is no longer a reliable indicator as drought is happening every year regardless of the day when a new year is starting. But there is still a chance to win back the trust of the community by creating awareness on religious leaders, government officials, and communities that traditional forecasting base knowledge, skills, and experiences and, hence, should not be considered as a sinful act.

The pastoralists in the study area stated what they can do if they get accurate information about the future climatic conditions. If a bad scenario is forecast, destocking, mobility, diversification, variety selection and food aid request will be considered, while during better scenario, expansion of agricultural activities and purchasing animals (restocking) for better production will be sought.

Generally, access to climate change information and early warning system is significant to improve the adaptive capacity of pastoral communities in the study area. In the absence of scientific climate change related information, the pastoral communities and local business depend heavily on traditional climate, forecast made using different climate change hazard and

early warning indicators. However, the traditional climate change forecasters' interest and ability gradually declines to provide climate change information, and religious leaders also discourage the traditional forecasting. As a result, the demand for scientific information on climate forecast and early warning advisory increased. This implies that Development Agents (DAs), the Ethiopian National Meteorology Agency (ENMA) and other mass media can assist pastoralists through provisions of scientific climate change information and early warning services. Continuous discussion with religious leaders to improve their attitudes towards the role and contribution of traditional climate change forecasters is very important to sustain climate change information from traditional forecasters in the study area.

4.5. Conclusion

This chapter discussed the survey data results comprising demographic and socio-economic issues, perception of pastoral communities about the manifestations of climate change and access to climate change information. The average household family size and dependent family members of the respondents were 7.18 and 2.92 persons per household respectively. This indicates that the majority of the pastoralists have large family sizes and dependent family members, a phenomenon that might have an implication on the competition of livelihood resource among pastoralists.

The local context, peoples' experience, beliefs and personal certainties have a huge impact on how people perceived climate change and variability. The majority of the household survey respondents, key informants and focus group discussants perceived the changing climate condition through recurrent, prolonged droughts, shortage of rainfall, high temperature and rainfall variability. The existing information and community observations indicated that climate

change and variability together with other pressures is considerably affecting ecosystems and biodiversity resource of the pastoralist area.

Pastoral communities have two main sources of climate change information system which include scientific climate change information source and indigenous way of climate change information source. The existing scientific climate change information and warning system has been criticised for being too complicated and resource intensive, requiring skilled staff at all levels and well-organized communication channels, which is lacking or not suitable for pastoral areas in Ethiopia. There are few well-experienced and skilful aged elders who can provide climate change information to the pastoral communities by using astronomical observation, speed and direction of wind, animal behaviour, animal intestines, starting day of a New Year, level of ground water, cloud cover, earth cracks, spider net and night weather. However, religious leaders and educated pastoral communities raised questions about the accuracy of information and applicability of the indigenous climate change forecasting and gradually abandoned this exercise.

CHAPTER FIVE: PASTORAL LIVELIHOOD VULNERABILITY TO CLIMATE CHANGE AND VARIABILITY

5.1. Introduction

The concept of vulnerability invented in research communities investigating entitlements, on the one hand, and risks and hazards, on the other (Adger, 2006). The same author also defines vulnerability as the state of susceptibility to destruction from exposure to stresses linked with ecological and societal change and from the lack of ability to adjust. The vulnerability notion came out from the acknowledgment by these research societies that focus on perturbations alone (ecological, socio-economic, technological) was inadequate for understanding the response of, and impacts on, systems (social groups, ecosystems, places) exposed to such perturbations (Wisner *et al.*, 2004). Climate change-related vulnerability has been studied in terms of climate change exposure, sensitivity, and adaptive capacity. This chapter discusses the second objective of this study, that is, to 'assess the extent of vulnerability of the pastoral community to climate change and variability'. The chapter therefore discusses the results of the study on pastoral livelihood vulnerability to climate change and variability with the discussion of sub-sections such as climate change stressors and impacts, vulnerability to climate change and variability, impacts of climate change on livelihood resource, highly vulnerable groups of people to climate change, characteristics of livelihood assets and sources of pastoralists' livelihoods.

5.2. Climate change stressors and impacts

Pastoralism is one of the main climate vulnerable sectors owing to its reliance on rain-fed activity. Respondents reported important multiple climatic stressors that affect pastoralist's

livelihoods includes recurrent droughts, heat waves, new livestock and human diseases, environmental degradation, water scarcity, bush encroachment and scarcity of pasture in the area (see Table 5.1). Such types of multiple climate change hazards have negative impacts on the livelihoods of the pastoral communities. Fields (2005) argues that the occurrence of multiple climatic stressors includes frequent drought, strong heat, infectious human and animal disease, unfair economic competition, resource degradation, and conflicts, combined with the scarcity of resource for adaptation, currently critical challenges for African pastoral communities struggling to adapt to climate change and variability. Likewise, reliance on livestock and agriculture and absence of modern irrigation means that African farmers are particularly vulnerable to scarcity of rainfall. These climate variability can result in over-grazing and, deterioration of natural resource, and increased pressure on wild animal species and exposure to various transmitted diseases.

Respondents were asked to rate the main climatic stressors that impacts the livelihoods of pastoral communities in the study area as 'increased', 'the same' or 'decline'. Accordingly, respondents reported that climatic stressors such as recurrent prolonged droughts (95%), environmental degradation (90.8%), heat stress (86.7%), livestock disease (71.7%) and bush encroachment (78.3%) have increased gradually in their area. In addition, they also confirmed that the quality and quantity of pasture (93.3%) and availability of water (83.3%) has decreased gradually and is unable to sustain their means of living. Researchers argue that pastoralists livelihoods in arid and semi-arid regions is the most vulnerable system to climate change which manifests in the short term by climate change and inconsistency, a circumstances exacerbated by the interaction of several stresses or hazards in the form of weather uncertainties, recurrent prolonged droughts, floods, sever ecological degradation and eminent food insecurity occurring

at various levels, and low adaptive capacity to the impacts of these climate related events (Boko *et al.*, 2007). The IPCC (2007) further reports that pastoral communities living in arid and semi-arid lands (ASALs) and whose livelihoods are extremely dependent on natural resource (pasture and water) are among the most vulnerable groups to climate change stressors.

Table 5.1. Observed climatic stressors that affect pastoral livelihoods

Climatic stressors	**Trends of stressors**		
	Increased (%)	**Same (%)**	**Decline (%)**
Occurrence of drought	95.0	5.0	0.0
Heat waves	86.7	10.0	3.3
Livestock diseases	71.7	20.8	7.5
Human diseases	68.3	28.3	3.4
Environmental degradation	90.8	6.7	2.5
Bush encroachment	78.3	20.0	1.7
Water availability	5.0	11.7	83.3
Pasture quality and quantity	0.0	6.7	93.3

Source: Field survey, 2019/20

Prolonged drought was considered by the participants as one of the most common hazards that highly affect pastoral communities in their area. Participants sustained that frequent, prolonged drought events have increased in severity over the past decades and has led to the deterioration of the livestock assets and other assets. Angassa and Oba (2007) stated that the greatest threat to livestock management and to sustaining livestock production was the occurrence of prolonged droughts. Key informants and focus group discussants argued that drought was considered as the

number one climatic change hazards that impacts pastoralists' livelihoods. The recurrent and prolonged droughts are the main causes for the presence of other climatic stressors that affects the livelihoods of pastoral communities including declined pasture availability which leads to scarcity of pasture, overgrazing, and land degradation. A long dry season in the pastoral area resulted in a barren land and drying up of water sources which lead to scarcity of water availability. Women and girls travelled long distance areas seeking drinking water for their families. This implies that the vulnerable group of people particularly women have not sufficient time to engaged in various coping and adaptation strategies to sustain their means of living.

Elders also identified the impacts of drought on food insecurity and livestock rearing activities in the pastoral area. Prolonged drought increased the prevalence of new livestock disease. The body conditions of livestock have deteriorated severely and decreased their productivity (milk and meat), prices and household's incomes. The drought also causes pastoralists' food insecurity and malnutrition, involuntary pastoral mobility; high rate of school dropout because of mobility in search of better grazing land and water sources; disruption of development endeavours; occurrence of livestock and human diseases; and increased competition over scarce resource and leads to conflict to maximize their benefit. Decreasing herd's population and productivity during seasons of droughts created food insecurity, which forced the households to engage in diverse livelihood strategies to sustain their means of income. The following quote from the KII participant illustrates clearly the change in climatic conditions and its effect on the livelihoods of pastoral communities.

> I have few livestock that are not enough to feed my families even for two to three months. Therefore, I consider myself as poor though slightly better than those who do not have either livestock or other means of income. Since my income

> from livestock is barely enough due to the impacts of climate variability, I always try to search additional income by engaging in charcoal production and Safety Net Program (food for work). Since such income is not sufficient to fulfil my families basic need, I always have dream to migrate to Middle East to work hard, earn more and lead a decent life. But still I cannot implement my ambition because my kids are too young and I have not enough money to migrate to the intended area" (Mistofa Fuad, 41 years old, from Lastome kebele, Shinile district).

In the study area, the outbreak of new livestock diseases was attributed to a combination of changes in climatic condition and decreased disease resistance. Livestock low resistance to disease stemmed from scarcity of pasture in both quantity and quality, heat stress, as well as increased water shortage. In this regard a study by Alemayehu (1998) confirmed that due to climatic variations, frequent droughts and land use changes, vulnerability to livestock death is a common phenomenon in pastoral areas.

Not only do the recurrent, prolonged droughts and heat waves affect livestock rearing and livestock productivity but also the absence of well-organised extension and animal health services, and shortage of adequate and qualified staff members and transportation system challenge pastoralism system in the areas as reported by development agents. The main impacts of climate change and variability on herd and human diseases have been on infections that are vector-borne. Increasing heat stress has created suitable environments for the expansion of vector populations and easily transmitted disease from one species of livestock to another. This leads to outbreaks of livestock and human disease. Endemic livestock infections and the outbreak of new disease species linked with insufficient extension service, leave the livestock sub-sector more susceptible to climate change hazards. Climate change and variability also influence the spread

of disease indirectly through changes in the distribution of livestock. Arid areas relatively becoming more suitable for camels and goats than other cattle in the study area. When various species of livestock are gathering together around water sources, the spread of parasitic diseases are highly increasing. The livelihoods of the pastoral communities are usually strongly linked to climate sensitive conditions (stressors) that include prolonged drought, heat waves, flooding, pests and diseases that negatively affect their means of livelihoods while intensifying their poverty (Nyong, 2009; Hope, 2009; Nordhaus, 2007).

Focus Group Discussants revealed that most pastoralists' livelihood vulnerability is attributable not only to the recurrent prolonged droughts, but also to the associated effects of other factors. They recognised that the dry season is becoming longer and the amount and duration of rainfall is extremely declining or failing gradually, leading to a severe scarcity of pasture availability and water shortage, spread of livestock and human diseases, and exacerbation of recurrent conflicts among Afar and Issa Somali ethnic groups in Erer district. The occurrence of prolonged drought and long dry season has led to the decline and death of pastoralist's livestock assets. They confirmed that there is a dramatic decrease in cattle population. Restocking of pastoralist's livestock assets has become unthinkable because of the degradation of pastoralist adaptive capacity due to the occurrence of frequent drought cycle and long dry season in the study area. Devereux (2006) argues that livelihood vulnerability to drought is increasing gradually. Drought shrinks the stock of resource such as grazing lands, water points, and forests, livestock and livestock products. Such resource degradation causes herders to migrate to better area which leads to resource competition and conflict. Thus, one can imagine how the livestock is dramatically decreasing in quantity due to the combined effects of climatic stressors.

The extent and magnitude of climate change impacts differ among pastoral communities. Pastoralists' livelihoods vulnerability is usually related with individual characteristics, resource access and ownership, livestock products, gender, disability, non-farm activities and other assets. As Admassie *et al.* (2008) stated that vulnerable households are susceptible to withstand the adverse impacts of climate change since their asset reserves are insufficient to withstand the existing climate crises. The better-off households have better opportunity to withstand the adverse impacts of climate change through the process of adaptation strategies while poor households, women, disabled people and non-literate people are more susceptible to the unfavourable impacts of climate change because they are incapable of responding to the existing impacts of climate change. O'Brien et al (2004a) stated that vulnerability of pastoral communities to the adverse impacts of climate change stressors is usually associated with low asset base, food insecurity, and poverty, political and economic marginalisation that result in reduction of people's adaptive capacity.

Focus group discussants confirmed that extreme heat wave was a major climatic change hazard in the study area. Strong heat wave has greater negative impacts on the livelihoods of pastoral societies. As summarized in Table 5.2, the impacts of strong heat stress are very similar to the impacts of prolonged droughts in the pastoral area, which include reduced pasture accessibility; increased the rate of water evaporation-leading to water scarcities; loss of weight and death of animals; decreased herds prices and household incomes; declined milk and milk products; food insecurity and undernourishment; increased incidence of human diseases; decreased labour productivity; and increased conflicts over scarce resource. The following quote from a male FGD participant illustrates how much milk and milk products are getting scarcer in these days due to the recurrent and prolonged drought situations in the study area as follows:

> These days I and my family are not going to drink pure milk without mixing and multiplying with water and other additives unless there are guests like religious leaders and elders who visit us. My family use that small amount of milk to mix with the leftovers of coffee bean (this is made after the leftovers of coffee bean is boiled enough like a coffee) so that it will be enough for my family to feed them only once a day. I believed that it is nutritionally poor and unsatisfactory, but we do not have any choice at hand at this moment" (Wahil Ahmed, 56 years old, from Megali-Adi kebele, Erer district).

Focus group discussants in the study districts also mentioned that extreme heat stress fosters the disappearance and substitution of valuable species of grasses by bushes, thereby contributing to vast areas bush encroachment like *prosopis juliflora*. Bush encroachment in the study area is considered as a major impact and most of the grazing lands have been occupied. Some invasive species of grasses are indigenous while others are new. The majority of these bushes have not any significance (and are undesirable) for pastoral communities and their livestock, and some bush species can even cause harms and livestock paralysis. Key informant interviews with government officials verify that shrub encroachment is the major significant factor determining sustainable animal production, food security and improved livelihoods. Accordingly, the challenges facing pastoralists is becoming a danger to feed their livestock and to insure food security in the area. During fieldwork, I observed that most of the landscape in Shinile and Erer districts had been invaded with unwanted bushes and was disappeared of grasses due to bush encroachment and poor rains in the area. The natural resource in the area was highly degraded and land had become barren due to long dry seasons, deforestation, overgrazing, recurrent droughts and extreme heat waves.

Environmental degradation can be both an impact and magnifier of changing weather conditions. Indeed, elders in the study districts pointed out the impact of drought and strong heat wave on grazing land availability and growth, leading to pasture scarcity, overgrazing, and land degradation. Environmental degradation is contributing to intensify local temperatures and increased water shortage, thereby exacerbating the local climate change and sustaining its negative impacts. Climate variability is expected to aggravate livestock disease and pest distribution, range, prevalence, incidence and seasonality but the extent of change remains extremely uncertain. In general the overall response of respondents indicates that pastoralists in the study area are vulnerable to the negative impacts of climate variability owing to the predominance of rain-fed agriculture on unfavourable climatic condition and this is further exacerbated due to low level of engagement of households income generating activities

Table 5.2. Summary of key informant interviews and FGDs on impacts of climatic stressors

Hazard	Local indicators	Impacts
Prolonged drought	• Decrease the intensity and timing of the rainfall, • Absence of long and short rainy seasons, • Occurrence of recurrent drought increased, • Formation of long dry season.	• Decline the accessibility of pasture-leading to scarcity of pasture, • Decreased water sources-leading to water scarcity, • Loss of weight and death of livestock-resulting in decline livestock productivity and population, • Reduced animals price and disease resistance during drought, • Declined incomes at household, • Food insecurity and malnutrition (mostly affecting highly vulnerable groups), • Increased school drop-out rates, • Women traveling distant areas in search of potable water

		and firewood, • Incidences of human diseases increased .
Extreme heat stress	• Increased drought, recurrent windy days and dusty months, • Disappearance of water sources due to drought, • Disappearance of significant species of grasses and replaced by dangerous species of thorny bushes.	• Scarcity of grazing land and shortage of water availability, • Decline productivity and production due to their poor condition, weight loss and death, • Decline livestock resistance to disease and reduce household incomes, • Food insecurity and malnutrition, • Increased competition over scarce resources and leads to conflicts among ethnic groups, • Invasion of bush like *prosopis juliflora.*
Livestock diseases	• Very weak physical condition, • Very thin, • Reduced production and productivity, • Livestock deaths.	• Livestock weight loss and death, • Reduced livestock productivity and reproductivity, • Absence of market facilities and decline households' income, • Scarcity of stable food and animal products,
Human diseases	• Food insecurity and Malnutrition, • Spread of vector and water borne diseases, • More sickness.	• Decreased human labor and productivity, • Decline household income, • Human deaths, especially children below five years old due to sanitation problem.
Shrub encroachment	• Degradation of forage, • Decreased in pasture availability, • Invension of *Prosopis Juliflora*	• Decreased pasture in both quantity and quality, • Increased presence of predators, • Food insecurity, • Disappearances of various species of grasses.
Environmental Degradation	• Soil erosion, • Barren land.	• Strong heat and scarcity of water availability due to drying up of water sources,

		• Poor pasture production and decline forest stocks, • Increased soil erosion-leading to the reduction of soil fertility and productivity.

Source: Field survey, 2019/20

5.3. Vulnerability to climate change and variability

Since vulnerability is not directly observable phenomenon, it is difficult to put clear defining criteria to quantify vulnerability (Downing, 2001). Vulnerability is recognised as a multi-dimensional property coming out from the structure of human interactions and reliant on geographical location or inhabitants, connected with past patterns of asset distribution, associations of social respect and economic exclusion and the political disempowerment of particular social groups. Thus, vulnerability of people or systems is not only associated to climatic hazards but is also associated with social, economic and political factors in nature (Eakin, 2008). It is, therefore, important to define vulnerability from climate change and climate variability perspectives. From this point of view, vulnerability is defined as 'the extent to which biological and socio-economic and geophysical systems are vulnerable to, and incapable to survive with adverse impacts of climate change and variability. This definition lets wide conceptualisation of the degree to which pastoral societies are not capable to resist the undesirable impacts of climate variability on their livelihoods. Hence, vulnerability relies on the extent to which inhabitants are susceptible to climate variability impacts, on its sensitivity to the impact and on its ability for adapting to them (IPCC, 2007). The vulnerability of households was considered as a function of a systems' or household's exposure to climate stressors, their sensitivity, and adaptive capacity to cope with these conditions (Smith *et al.*, 2000).

Pastoralists are experiencing various climate change induced problems such as livestock death and decreased productivity, deterioration of grazing land, shortage of water availability and increased the occurrence of disease, joblessness, food price inflations and malnutrition of children. These problems are further worsen by high population growth, weakly designed development projects as well as impacts of drought. Arid and semi-arid parts of Ethiopia especially the pastoral areas are highly vulnerable to prolonged drought and long dry seasons. Drought occurs anywhere in the world but its impact on the livelihoods is not as severe as in arid and semi-arid areas of Africa in general and in Ethiopia in particular (NAPA, 2007).

Respondents reported the major indicators of vulnerability include decline the pasturelands in both qualities and quantities (98.3%), death of livestock due to the occurrences of prolonged drought (95.8%), reduction of water availability (93.3%), reduction of livestock products and price (91.7%) and the presence of environmental degradation (90.3%). They also confirmed that food insecurity (88.3%), heat stress (86.7%), the occurrence of human and livestock disease (80.8%) and migration of family members to other area (70.8%) are among the major climate change and variability related hazards that negatively affects the livelihoods of the pastoral communities in the study area. Based on the survey data, as shown in Table 5.3, both Shinile and Erer districts are almost similarly affected with climate variability events since they have similar geographical location, weather conditions, socio-economic and livelihood systems. Findings show that communities' vulnerability to the likely impacts of climate change relies upon both the nature of the changes in natural phenomenon and the nature of the human-made social, political and economic systems in a given place at a given time (Mitchel and Tanner, 2006).

Table 5.3. Indicators of vulnerability to climate change

Indicators of vulnerability	Both districts Frequency (%)		Shinile district		Erer district	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Death of livestock due to prolonged drought	115 (95.8)	5 (4.2)	96.7	3.3	95.0	5.0
Reduced livestock productivity and price	110 (91.7)	10 (8.3)	95.0	5.0	88.3	11.7
Decline range in quantities and qualities	118 (98.3)	2 (1.7)	100.0	0.0	96.7	3.3
Decline the amount of water	112 (93.3)	8 (6.7)	96.7	3.3	90.0	10.0
Food insecurity	106 (88.3)	14 (11.7)	91.7	8.3	85.0	15.0
Increase heat stress	104 (86.7)	16 (13.3)	90.0	10.0	83.3	16.7
Occurrence of human and livestock disease	97(80.8)	23 (19.2)	76.7	23.3	85.0	15.0
Environmental degradations	109 (90.3)	11 (9.7)	96.7	3.3	85.0	15.0
Limited mobility due to scarcity of pasture	81(67.5)	39 (32.5)	75.0	25.0	60.0	40.0
Migration of family members to other areas	85 (70.8)	35 (29.2)	66.7	33.3	71.7	28.3
Scarce resource induced conflict	68 (56.7)	52 (43.3)	51.7	48.3	61.7	38.3
Occurrence of flood	74 (61.7)	46 (38.3)	55.0	45.0	68.3	31.7

Source: Field survey, 2019/20

FGD and key informant interviewees argued that drought is the most climate change hazard that affects pastoral communities in the study area. Climate variability has direct and indirect impacts on herds population and production. The direct impacts of climate change mostly result from the occurrence of long dry seasons, prolonged droughts and other extreme climate events that lead to the decline of animal population, health, growth and reproduction. Climate change and variability amplifies the heat stress on herds, with harmful effects on animal production and productivity. Under current climate change conditions, livestock suffer from heat stress almost throughout the year in the study area. Extreme hazards, such as strong heat waves, regular

droughts, wind and environmental degradation often have substantial negative impacts on livestock production systems and food security at household level. Indirectly, climate variability affects animal productivity through changes in quantity and quality of pasture and water sources, and changes in the spread of disease vectors and parasites. Changes in rainfall and temperature patterns may result in the distribution of diseases and parasites into new areas. The result signals the need for designing and implementing development intervention that enable pastoralists to engage in other alternative means of activities to support their means of living.

Climate change and variability are making increasingly susceptible situations in fragile pastoral ecosystems. The impact of climate variability is likely to increase the vulnerability of livestock systems and strengthen the existing issues that are affecting livestock production systems. Losing livestock resources due to occurrence of prolonged drought, long dry seasons, strong heat and spread of livestock disease could induce a collapse into persistent poverty and have lasting negative effects on livelihoods. For instance, during the dry season that happened in 1999-2001 in Kenya, it was estimated that over 2 million shoats, 90,000 cattle and 14,000 camels died (Mutimba *et al*., 2010).

With climate variability, the location, distribution and productivity of pastures and water sources are bound to decline. In the study areas, herd size and production is negatively affected and declining gradually due to the severe scarcity of pasture and water caused by climate change impacts such as heat stress, prolonged drought, environmental degradation and bush encroachment. As a result, pastoral communities make decisions to sale their livestock at low prices and buy food crops at high prices. Livestock sales during drought seasons were intended to destocking and buying cereal crops to sustain food security at household level (Cossins, 1988; Desta and Coppock, 2004). Despite the unfavourable prices, selling a number of livestock during

drought seasons were an indication of poor livestock body condition, as well as the presence of extra stock in the local markets. It was not unusual for pre-drought livestock prices to fall by as much as 30%, while grain prices increased (Cossins, 1988). GRM (1989) states a case during the 1983/1984 droughts when cattle prices reduced by 60%, compared to the 1991-1992 droughts when the price of cattle declined by 90%. Grain prices during droughts could increase by as much as 150% (Cossins, 1988). Desta and Coppock (2004) argue that over a period of 17 years, cattle holdings per household exhibited a downward trend, showing a lack of recovery to pre-1980/1981 drought levels.

Generally, the FGDs and key informant interviews summarised major impacts of climate change and variability on livestock population and production as follows:

- The presence of extreme heat waves, occurrence of prolonged drought, livestock disease, scarcity of grazing land and water points contribute to decrease livestock productivity and reproductive performance. This includes sluggish growth rate of calves, decrease of body weight, decreased milk and meat production and poor reproductive performance in mature animals.
- Increased the occurrence of new livestock diseases was reported during the drought season, when livestock are not in a condition due to shortage of water and feed supply.
- Increased temperature in the study area is causing extreme heat wave on livestock. The potential effects of the occurrence of strong heat wave on livestock include shortage of pasture-leading to low milk production, loss body weight and increased vulnerability to diseases, and hence contributing to decreased livestock productivity.
- Shortage of water availability in the community ponds and boreholes has been observed due to the presence of long dry seasons. Critical water shortage was observed particularly

in Shinile districts. Water sources are drying up-leading to pastoral communities travelling long distances with their livestock in search of water and pasture. Not only reduction of livestock production but also the size of livestock per household has declined gradually due to the effects of climate change and variability.

- Prolonged drought seasons and increased heat stress have resulted in reduced pasture quantity and quality. Because of frequent rain failures due to climate variability and invasion of unpalatable species of plants, there is scarcity of pasture for their livestock to feed.
- Apart from extreme heat stress, prolonged drought seasons and long dry season, shrub encroachers and alien invasive species are causing significant decline of livestock pasture. Invasive species such as *Prosopis juliflora* and *Parthenium hysterophorus* have expanded in rangelands of the pastoral districts. The bush encroachers are threatening the livelihoods of pastoralist and the ecosystems.
- Climate variability induced droughts and degradation of rangelands force pastoralist to migrate to other places in search of feed and water resource, which might be a cause for conflict especially between Issa of Somali and Afar ethnic groups due to competition over scarce resource (pasture and water).

The result indicates that the impacts of climate variability on livestock population and production become unthinkable to reverse its impact with the existing traditional coping and adaptation strategies. Hence, there is a need for context based scientific intervention to support and solve the scarcity of pasture and water for pastoralists' livestock during drought season.

Pastoral communities living in arid and semi-arid lands, and whose livelihood systems are highly dependent on natural resource and rain-fed production system, are among the most

vulnerable to climate change. Climate change and variability is increasingly affecting the vulnerable group of pastoral communities, who often have the least capacity to withstand the adverse impacts of climate change. Any alterations in climatic conditions exacerbated an already challenging livelihood situation. Variable and unpredictable rainfall in pastoral areas causes frequent droughts, scarcity of pasture, water shortage and occurrence of floods. Such hazards undermine local as well as country level food and water security. This characteristic has connotations for economic progress and poverty alleviation endeavours; particularly for the already susceptible pastoral communities who are entirely reliant on the natural environment they live in (IPCC, 2007).

During the recurrent prolonged droughts and long dry seasons there is migration from different area of the Somali region. During the drought season, migrants of different types from different regions constantly moved into the study area. This resulted in higher pressure and competition over scarce pasture and water source on which pastoralist are heavily dependent for their survival livelihood strategies. From the discussion, respondents revealed that a large number of pastoralists are coming in from Somaliland and Punt land, exploiting the pasture and water reserves in short periods of time. This in turn generates a burden on the limited and scarce natural resource and on the competition between the rival ethnic groups in the region.

Pastoralists' vulnerability to climate change conditions has increased in terms of the spread of human, livestock and plant diseases in the study sites. Bamlaku (2016) argues that since the livestock have less chance to access sufficient pasture and water during drought seasons, the spread of animal diseases widely occurred. The old ones, weak, sick and the lactating animals are more vulnerable to diseases and unable to travel long distances as a result they stayed near their homesteads . If there is better sources of pasture and water sources around

their homestead areas, there will be abnormal competition over such scarce resources to access and exploit them and are more vulnerable to various diseases when they are concentrated around such areas. Moreover, since livestock are weak and already lost their natural resistance, large number of animals die when the rain comes after a long drought seasons.

Land is communal resource among the pastoral communities. They have their own forms of traditional land tenure systems that govern them for long period of time on how to access, own, utilise and manage their communal resource. It is based on the societal norms, values, principles and sanctions that are guided and governed by their indigenous institutions and culture. The 1994 Ethiopian Constitution declares that all land is the common property of the various ethnically based regional states and Article 40 says, that:

> *Ethiopian pastoralists have a right to free land for grazing and cultivation as well as the right not to be displaced from their own lands. Law shall specify the implementation.* Article 41 also promulgates that *Ethiopian pastoralists have the right to receive fair prices for their products that would lead to improve in their conditions of life which should be the objective that guides the state in the formulation of economic, social and development policies.*

Moser (1998) links climate change vulnerability to resource ownership including pastureland, as well as the entitlement that the household or individual can control in the face of exposure. Hence, the accessibility to and availability of resource to households and individuals influence the degree to which they are vulnerable to the impacts of climate change.

During group discussions, most of the respondents confirmed that the study area has been highly deteriorated over several decades. High rate of deforestation, degradation of grazing

land and water points, as well as environmental degradation are important drivers of vulnerability in the area. Cutting down of trees for firewood, charcoal production and livestock feed, overgrazing, land use change and inappropriate natural resource use have led to increased soil erosion, lower quality and quantity of pasture, bush encroachment, and declined feeding capacity for herds and humans per unit area. In major parts of the study area, large areas have been encroached by undesirable species of thorny bushes like *prosopis juliflora* that destroys the nutritious species of grasses. The occurrence of regular droughts does not give rangelands enough time to recover, leaving large areas bare, thus vulnerable to removal of soil by wind and water. Some of the coping mechanisms practiced by pastoral communities, such as felling of more trees to make charcoal and collect firewood for market further contribute to forest degradation, and decreases their resilience to climate variability as resource become scarcer. This implies that excessive cutting down of trees and invention of unwanted species of bushes exacerbate the vulnerability of pastoral communities in the study area. This signals the need for an integrated approach to create environmental friendly income generating activities to sustain pastoralists' means of living.

The grazing land plant dynamics are vulnerable to stress like changes in rainfall amount and distribution, strong heat wave, frequent drought, overgrazing, invasion of undesired species of plants, land use change and long dry season. The rangelands have been highly affected by these changes. Deteriorations of pasture is the major challenge for pastoral livelihood in the study area. Major degradation of pasture in both quantity and nutritional quality in the rangelands as well as occurrence of regular drought and barren areas were observed in the area by the researcher. Generally, the deterioration of rangeland both in quantity and quality is not only linked with a decline of vegetation cover, but also with invasion of pastureland by shrubs of

unpalatable and of little economic value and through collection of fuel wood and charcoal production to support their subsistence means of living.

Climate variability is likely to exacerbate pest and disease distribution, prevalence, occurrence and seasonality but the extent of change remains highly doubtful (IPCC, 2007). The possible impact of climate variability on human health is comparatively easier to understand than those on livestock physical condition. Nonetheless, climate change is anticipated to affect both agent of disease and vector habitat suitability through changes in temperature, rainfall, humidity, long dry season and wind conditions (Agrawala and Van Aalst, 2008). Strong heat stress and prolonged droughts are expected to have harmful impacts on both livestock and human health and disease resistance (IPCC, 2007). In the study region, human health has always been a problem having one of the highest child mortality rates in the country, inextricably associated to climate related risks such as drought and floods, and the inadequacy of medical facilities and qualified and trained local personnel. Malaria, Tuberculosis and water born disease like diarrhoea are the most commonly reported human diseases in the study area. Food insecurity, undernourishment and poor child growth and development are some of the indirect impacts of climate change-related exposure on human health.

Climate change and variability cause increased risks to Somali pastoral communities. Incidence of drought is part of the usual cycle of life in the area where the amount of rainfall is characterised with insufficient at the best of times. Livestock, particularly cattle, are the first vulnerable to the impacts of climate change hazards (drought). The occurrence of frequent drought in the area resulted in declining the quality and quantity of grazing land. Pastoralists livelihoods are considerately adjusted to conditions of limited and variable rainfall. Water shortage is also making the situation more difficult. Livestock in the region already suffers from

the burden of endemic and newly emerging varieties of livestock diseases, which can be connected to the changing climate and the extreme weather conditions (IPPC, 2007). The lack of desirable grazing land and the resultant under-nutrition of cattle exposed livestock to various drought and waterborne vector diseases. Opportunistic diseases, most internal and external parasites and infectious diseases are common challenges for the pastoral communities during drought seasons. New and unidentified diseases also cause for most illness and livestock deaths. Livestock diseases exacerbate the rapid loss of livestock population and reduction in livestock products such as milk supply and meat during disaster incidence. During extended dry seasons, it is too difficult to access grazing land and water points for livestock. The physical condition of livestock at this time makes them vulnerable to various diseases. This implies that livestock related disaster interventions should be focused mainly on animal health and nutrition, livestock water supply and building on existing community adaptation systems. The importance of solving the water shortage was echoed by FGDs discussants as follows:

> Lack of water is one of the biggest challenges facing pastoral communities. We need the government and NGOs to assist in building boreholes and water pans for us and our livestock. This will stop the water borne diseases affecting people and also save our women and children the danger of traveling long distance in search of water.

5.4. Highly vulnerable groups to climate change and variability

The third world countries like Ethiopia are extremely vulnerable to climate change impacts due to backward socio-economic system and widespread poverty, thus restricting their adaptive

capacity. Within countries, communities in arid and semi-arid areas with scarce natural resource, and those in drought-prone lowland areas are particularly vulnerable to climate change and variability. Often the poorest households, female-headed households and sick people are likely to suffer the most from climate change impacts. Similarly, pregnant and lactating women, children, aged people, and the disabled people are highly vulnerable to the negative impacts of climate change and variability (Medhanit, 2014). The most vulnerable groups such as children, the elderly, the sick and people living with disabilities have been disproportionately impacted by climate change events (Dulal *et al*., 2010). Pastoral communities are possible to be among those extremely vulnerable groups since they depend on natural resource and climate situations for their livelihoods. The most vulnerable individuals, groups, communities and places are those that experience the most exposure and are sensitive to stress, and those that have the least capacity to respond and ability to withstand from the existing stress (Schiller *et al*., 2001).

Respondents were asked to identify and rate the extent of vulnerability of different segments of people to the impacts of climate variability in the study area as 'very high', 'high', 'medium' and 'low' (see Table 5.5 below). Accordingly, survey result shows that the most vulnerable group of pastoral people to the impacts of climate variability are women (85%), children (86.7%), the poor (83.3%), disabled people (78.5), the marginalized female-headed households (78.3%) and old people (53.3%). During group discussions, respondents confirmed that woman, children, female headed households, disabled, the poor and aged people are highly vulnerable for climate change and variability. Different findings confirms that different groups of people in pastoral areas include children, women, people living with HIV/AIDS, female headed households, disabled people, elders, poor and sick people are extremely vulnerable groups to the impacts of climate change and variability since these groups often have limited adaptive

capacities and lower access to resources for adaptation practices (NMA, 2007; Amsalu and Adem, 2009).

Table 5.4. Vulnerable groups to the impacts of climate change

Segments of vulnerable people	Extents of vulnerability (%)			
	Very high	**High**	**Medium**	**Low**
Women	85.0	15.0	0	0
Children	86.7	13.3	0	0
Disabled people	78.3	21.7	0	0
Poor people	83.3	16.7	0	0
Middle income group of people	3.3	36.7	60.0	0
Rich people	1.7	3.3	43.3	51.7
Female headed household	78.3	21.7	0	0
Old aged people	53.3	46.7	0	0

Source: Field survey, 2019/20

Different experts reported that climate change and variability negatively affects men and women's livelihood differently. Climate change and variability have posed additional workloads for women. For instance, during prolonged drought seasons, women and girls have responsibility to fetch water and collect firewood by traveling a very long distance areas. Women usually have limited access to different assets, information, services and decision-making power. The collective effects of more frequent shocks with inadequate 'recovery time' to re-build up assets, and weak governance and safety nets are resulting in acute food insecurity, undernourishment

and limitations on the resource available to them to develop their resilience and adapt to climate change over time. It is recognised that women are often excluded and marginalised from economic, social, cultural and political activities.

Key informants from the Women, Children and Youth office reported that women are exposed to various problems, like malnutrition, workload and health problem. Pastoralists' women are particularly highly vulnerable to the impacts of climate change because they have triple roles, limited power, experience and occupy a marginal position in society. Women have various responsibilities to engage in reproductive activities, such as fetching drinking water from remote areas, charcoal production, collecting of firewood, giving birth, rearing of their children, caring elders, food preparing and feeding of their families and caring ruminant animals. Charcoal production forces women to walk even longer distances in search of firewood, meaning more hours each day on the road, reducing their productive hours. During drought seasons, accessing water and firewood is too difficult. Even at times when the water is very scarce due to droughts, they are forced to walk long distances to fetch water. As a result, women are forced to travel to very remote areas to collect firewood and to fetch drinking water. They wake up too early (5am) to travel very distant areas (up to 20km) to fetch water. Women are not only engaged in reproductive activities but also they engaged in productive activities and community engagement. They are overburdened with the triple role (reproductive, productive and community engagement) and have lower opportunities than men to cope up and adapt the negative effect of climate change in the study area. Kasperson and Kasperson (2001) describe that women are the most vulnerable group to the impacts of climate variability due to distinctions in their socially constructed roles, skills and societal expectations.

Men and women have been exposed to climate variability hazards differently or have different experience and degrees of climate change vulnerability. Women usually have limited incomes, lesser access to credit and decision-making authority, and lower control over resources, increasing their vulnerability to climate change impacts. Key informant interviewees stated that women are more vulnerable than men to climate change related hazards. Women are already more vulnerable to food shortage and have limited chance to visit health centres. The negative impact on women's health is evident not only in terms of under nutrition, but also in terms of disease, sexual harassment and injury. Women have not equal power as male partners in livestock-holding and highly vulnerable to the ill effects of climate change.

In the study site, women have various reproductive responsibilities include child care, looking after sick and old livestock, milking livestock, fetching water, collecting firewood, charcoal production and cooking food. Climate change induced risks result in extra workloads on women and girls in many ways and make them susceptible to its impacts. Particularly, during drought years, the greater burden on women increases to accomplish their household responsibilities. The work burden is higher for poor women since the responsibility of feeding family members by collecting firewood, fetching water and collecting wild plants. During drought, strong heat or at times of conflict, pastoral children, especially girls, are forced to drop out of school. In this regard a study by Medhanit (2014) describes that women and girls have various household tasks that make them more vulnerable to impacts of climate change. Such workloads negatively affects their health conditions as they are exposed to sexual and physical violence. Educationally, girls have usually higher rates of school dropout because of their additional household responsibilities.

Women's vulnerability to climate change and variability usually linked to a scarcity of vital assets combined with limited access to climate change information system and little power to make decision, rooted in gender prescribed norms values and behaviours. Literature also confirms that men react to natural and man-made shocks like floods, drought or conflict is unlike from the way women will face a similar situation. This is due to the socially constructed responsibility that may put one sex in a more susceptible condition compared to the other. Women, for example, will face more challenges to accumulation reproductive roles such as caring for children and the elderly in provision of food and care than men in such situations. Gender related differences in vulnerability are strongly influenced by disparities in resource possession (for example, access to and control over resource); their respective risk preferences; social and cultural norms that determine household dynamics; and political economy issues within the community and at a national level too (Ellis, 2000).

The structure of the household among pastoral community is highly characterised by the patriarchal system. Socio-culturally identified roles determine women and men's responsibilities within the study area. Women and men's division of labour as well as roles at community level and within the household are well defined. Elders identified that the male are the head of the household and the overall decision maker while women are not in a position to make decision over their assets. Women are expected to work from 14 to 16 hours per day, and take responsibility to supply firewood and drinking water at household, care and watering of small livestock, milking and dairy production, food preparation and traditional house construction. Women are also responsible for marketing dairy products, and in poorer households, they are expected to feed the family from the sale of fuel wood. In addition to domestic activities, women are also expected to participate and contribute in productive and community engagement. This

result shows that due to socially constructed roles and responsibilities, women have not time to information about the impacts of climate variability and adaptation strategies to sustain their means of livelihoods. As a result, accessing new technology to women to reduce their work burden and continuous awareness creation about gender equality should be given to the communities.

Development Agents identified the major factors that intensify women's vulnerability to climate change and variability are poverty, the division of labour, lack of voice in climate and development debates, allocation of property based on gender and weak enforcement of rights. The disparity of the impact of climate change reveals the complexity of social, cultural, economic, religious, technological, governance and environmental factors that play a key role in determining women and girl's vulnerability to disasters. Even among pastoral communities, vulnerability is usually related with individual characteristics, resource distribution, livestock products, gender, disability, non-farm activities and other assets. As Admassie *et al.* (2008) stated that vulnerable groups are incapable to withstand the impacts of climate change since their resource stocks are insufficient to survive with the existing climate crisis while better-off groups have the capability to withstand the impacts of climate change through the process of adaptation strategies. The highly vulnerable groups of people include the marginalised due to their socio-economic status, geographical location, political ideology, ethnicity, gender, sex and educational status.

During discussions with key informant interview, respondents describe that female-headed households are highly vulnerable to the effect of climate change because they have no sufficient experience as male-headed households on how to cope with and adapt to the negative effects of climate change. Because of division of gender role, female-headed households have

not equal experience and opportunity to diversify their means of living. For example, the rural pastoral women have not the right to involve in income generating activities while male have the experience and the right to participate in income generating activities in both rural and urban areas such as daily labourer and other activities. Thus, men have better skills, experiences and opportunities to cope with the negative effects of climate variability than female-headed households through diversification and other strategies. Generally, female-headed households vulnerability to climate change and variability related risks are associated with their limited accessibility to scarce asset, education, skill and other resources, and lack of empowerment. Various findings (Admassie *et al.*, 2008) indicate that male-headed households have better experiences and skills to adapt to the impacts of climate change than female-headed households.

During focus group discussion and key informant interview, participants stated that during drought seasons, children are assigned search for pasture and drinking water by travelling to distant areas. They did not attend their education, that is, they are forced to drop out from school. Girls are responsible to share their mother's role and outside activities like rearing of goats and other ruminant cattle. They are expected to collect firewood and fetching of water from a very remote area. Thus, they cannot attain their education properly. Although specific impacts on children are rarely mentioned in the literature, with the exception of some links to malnutrition, children are often considered as highly affected group in terms of having heightened vulnerability to climate change. For the case of Kenyan pastoralists' children, problem of availability of sufficient food means they are vulnerable to undernourishment and dropping out of primary school (Roncoli *et al*., 2010). Children also involve in livestock rearing which places them at the front position of frequent conflicts, and cattle raiding. In the pastoral areas, children may get insufficient amount of milk during prolonged drought seasons since the

livestock are moved to remote locations with no adequate feeding and water sources (Gebresenbet and Kefale, 2012).

Generally, the livelihood of pastoralists is increasingly vulnerable to climate change hazards. However, pastoralists vulnerability to climate variability and their capability to adapt to this impact also vary in time and space because of differences in wealth, power, social values and natural resource bases within the communities. The degree of vulnerability to climatic variation impact among the pastoral communities can be summarized as follows:

- Women, children, elders and disabled people are usually the most vulnerable to climate change.
- The main vulnerable groups are usually poor households with fewer livestock and less voice in decision-making process in the community.
- Minorities within the clans and sub-clans are more vulnerable than the majority and more powerful pastoralists who are involved in herding livestock and other activities.
- People who rear camels and goats are lesser vulnerable to climate change impacts than those herding cattle and sheep.

5.5. Characteristics of livelihood assets: The five key capitals

Pastoralism in Ethiopia is a direct source of livelihood communities who live in the vast lowlands and drought-prone areas of the country. Despite living in the most fragile and degraded ecosystems, pastoralist and pastoralism made a significant contribution to the national economy of the country through livestock products. Climate variability is predicted to have a larger negative impact on the livelihood assets of the pastoral communities. Participants were asked

whether they had access to listed livelihood assets or not (see Table 5.5 below). Accordingly, rating of access to social asset in all districts accounted for 85.5%, while the corresponding figure for financial capital is 49.4%. Natural capital scored the least percentage (21.7%) in all districts. It appears that social asset serves as a redress for lost natural and other types of livelihood resources. This is in proportion to earlier studies that highlighted the supportive role of social resources in decreasing transaction cost, that is, lesser monitoring costs of hired labour, easier incentives for pooling resource and better distribution of information (Ruben and Heras, 2012).

Table 5.5. Access to livelihood assets at household level

Types of livelihood assets	Shinile district		Erer district		Both 2 districts	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Human capitals	**37.34**	**62.66**	**34.68**	**65.32**	**36.0**	**64**
Health facilities	50.0	50.0	46.7	53.3	48.3	51.7
Adequate nutrition	20.0	80.0	13.3	86.7	16.7	83.3
Education	43.3	56.7	46.7	53.3	45.0	55.0
Skill	46.7	53.3	46.7	53.3	46.7	53.3
Trainings/workshops	26.7	73.3	20.0	80.0	23.3	76.7
Natural capital	**20.0**	**80.0**	**23.34**	**76.66**	**21.66**	**78.34**
Arable land	13.3	86.7	16.7	83.3	15.0	85.0
Grazing land/pasture	16.7	83.3	23.3	76.7	20.0	80.0
Water accessibility	16.7	83.3	20	80	18.3	81.7
Forest products	23.3	76.7	30	70	26.7	73.3
Biodiversity	30.0	70.0	26.7	73.3	28.3	71.7
Financial capital	**52.39**	**47.61**	**46.43**	**53.57**	**49.42**	**50.58**
Livestock	100.0	0.0	93.3	6.7	96.7	3.3
Saving	36.7	63.3	46.7	53.3	41.7	58.3
Credits	73.3	26.7	65.0	35.0	69.2	30.8
Remittances	83.3	16.7	80.0	20.0	81.7	18.3
Pensions	0.0	100.0	0.0	100.0	0.0	100.0
Wages	16.7	83.3	3.3	96.7	10.0	90.0
Jewelry	56.7	43.3	36.7	63.3	46.7	53.3
Social Capital	**82.84**	**17.16**	**88.11**	**11.89**	**85.47**	**14.53**
Good network and	100.0	0.0	96.7	3.3	98.3	1.7

connection						
Trust and Mutual support	93.3	6.7	96.7	3.3	95.0	5.0
Formal and informal groups	73.3	26.7	86.7	13.3	80.0	20.0
Common rules and sanctions	100.0	0.0	100.0	0.0	100.0	0.0
Collective representations	93.3	6.7	86.7	13.3	90.0	10.0
Participation in decision making and leadership	53.3	46.7	63.3	36.7	58.3	41.7
Supporting each other	66.7	33.3	86.7	13.7	76.7	23.3
Physical capital	**42.85**	**57.15**	**33.33**	**66.67**	**38.04**	**61.96**
Access to all weather road and transport	60.0	40.0	43.3	56.7	51.2	48.3
Housing and safe buildings	46.7	53.3	30.0	70.0	38.3	61.7
Access to water and sanitation	46.7	53.3	36.7	63.3	41.7	58.3
Clean and affordable energy sources (electricity, solar, etc)	50.0	50.0	33.3	66.7	41.7	58.3
Access to communication/information	73.3	26.7	60.0	40.0	66.7	33.3
Tools and equipment for production	13.3	86.7	6.7	93.3	10.0	90.0
Access to agricultural inputs	10.0	90.0	23.3	76.7	16.7	83.3

Source: Household survey, 2019/20

In terms of districts, Erer district has better access to social capital (88.1%) than Shinile district. On the other side, Shinile has better access to physical capital (42.85%) and financial capital (52.39%) than Erer district. Such variation to accessibility to livelihood assets could be due to the severity of climate change impacts on the resource and other man-made constraints like lack of governments' commitment to support pastoralist's effort to with stand the impacts of climate change.

5.5.1. Human capital

Human capital comprises health facility, family size, adequate nutrition, education, skills and workshop/training (Carney, 1999). The human capital of the pastoral communities has been negatively affected due to climate change and variability. Respondents reported that accessing health services (51.7%) and education (55%) for their family members based on their income capacity and in the context of their lifestyle is very difficult. The pastoral area is characterised by recurrent, prolonged droughts and little or absence of precipitation for a long period of time. In order to search for better grazing land and water sources for their livestock, pastoral communities are forced to move with their cattle to very distant areas. Such mobile way of life due to drought and shortage of rainfall affects the educational sector especially the Alternative Basic Education (ABE) in the area. DAs confirmed that in 2015 nearly 11 ABE schools were closed in Shinile district when children moved away with their families and livestock. Access to water and food is the basic driver that determines regular school attendance. The numbers of mobile schools are also limited in number and difficult to mobilise the needed school infrastructure. Teachers are not willing to move to distant areas with the parents of the students. As a result, large numbers of non-literate pastoralists are found in the study areas (see Table 5.5). Educated people have wider opportunities than non-educated family members to respond to the impacts of climate change since they have more chances to engage in non-farm income generating activities, and can even provide advice and support to others regarding how to improve their living conditions (Gordon and Graig, 2001).

There is a relationship between climate variability and animal and human health. During group discussion most respondents confirmed that households with health problems have lower human asset as they assign a considerable part of their limited resource to take care of illness.

Using part of the households' scarce income to care for illness affect their financial resource base, thereby shrinking the capability to withstand the impacts of climate change and variability. Since rearing of livestock is labour intensive, ill health due to increased occurrence of diseases associated to climate change and variability could negatively affect pastoralist's human capital (food security, education, skill and training) because households with health problems are incapable to withstand the impacts of climate change and variability. Although it was not possible to obtain nutrition data, widespread visible signs of malnutrition were observed on adult pregnant/lactating women and children in the research site. The result shows that health facilities, adequate nutrition, educational and training centres are found at early stage in the study area. This implies that non-educated communities, households and individuals with health problems and food insecurity usually have less adaptive capacity to the impacts of climate variability.

5.5.2. Natural Capital

Natural resource is the natural capital accumulations, and ecological services from which capital flows and services useful for livelihoods are obtained (Ellis, 2000). Natural capital is the essential source of livelihood in pastoral communities, such as the Sitti zone pastoral community. According to respondents, ownership or availability of natural capital such as grazing land, water accessibility and forest product is lower in Shinile district than Erer due to the severity of climate change impact (see Table 5.5). Like in other pastoral areas in Ethiopia, land is communally owned. Land rights are reserved for pastoral communities rather than individuals, and land is an undivided part of the social system where the right to use is determined by clan or ethnic members.

Although the grazing land is a critical asset for pastoralist, the quantity and quality of pastureland has been gradually being degraded due to the recurrent, prolonged droughts and scarcity of rainfall. Key informants reported that the availability of pasture, browse and water is a serious problem in all study districts. The scarcity of pasture in pastoral areas has caused substantial deterioration of livestock body conditions (mainly shoat and cattle) and negatively affected livestock productivity, market value and weakened their resistance to diseases and caused more deaths.

During focus group discussion, respondents reported that currently pasture and browse conditions in most parts of districts, especially in Shinile is significantly deteriorating due to the impacts of climate change and variability (recurrent droughts with poor rainfall). Competing for invasive species of trees like *Prosopis Juliflora* as a source of livestock feed is pronounced in Shinile and Erer districts which are evidence for the depletion of pasture and browse. Key informants stated that the number of livestock per household has been being depleted gradually due to the scarcity of pasture, water sources and livestock disease. Pastoralists engaged in charcoal production for sale as an alternative means of livelihood. However, charcoal production in pastoral areas exacerbates the destruction of biodiversity. This implies that for the last decades or centuries natural capitals were the very survival of pastoral communities in the study area. Currently, however, the stock of natural capital particularly grazing land and water sources are rapidly deteriorated and unable to sustain livestock rearing due to the impacts of climate change and variability.

5.5.3. Financial capital

Financial resource comprises of a stock of liquid financial resource such as money, savings and access to credit, and less liquid resource such as livestock, food stocks, and reciprocal claims

(DFID, 2004; Ellis, 2000). Financial capital plays a significant role in building and enhancing resilience against climate change impacts. Despite their high risks, these means of saving are chosen by pastoralists over banks, because they are not only a means of living, but also play a significant role in determining their social status.

Respondents had less access to financial capitals like saving (41.7%), wage (10.0%) and pensions (0.0%) whereas they have better accessibility to livestock (96.7%), remittance (81.7%), and credit (69.2%) (see Table 5.5). Availability of micro finance institution to access credit for the pastoral communities was confirmed by FGDs. However, pastoral rural micro-finance provides credit for the pastoral community without provision of business capacity building training. As a result, except for a few pastoralist who engage in petty trading, the majority of the pastoral communities spent this money in buying food crops for their families and to restock their livestock. Their livestock numbers decreased not only because of death but also through the process of destocking due to recurrent, prolonged droughts in the area. Livestock population decrease and the stock for other means of livelihoods become degraded gradually because of climate change. The area had become barren land, and the temperatures of the area became too harsh. However, pastoralism (rearing of livestock) persists as the main means of livelihood for the pastoral communities in the area.

DAs identified that recurrent drought conditions in the entire zone have affected livestock due to high scarcity of water, pasture and crop residue availability from adjacent neighbouring zones. The available pasture in some pocket areas of the district was overgrazed earlier during drought season. During field observation, although there was a varying degree of appearance of the livestock within each district (Shinile and Erer districts), the body condition of animals observed particularly in Shinile was very weak due to lack of water and pasture. The grazing

land in the region had become exhausted, barren land. The major water sources for animals have been *Birka*/ponds. However, due to recurrent, prolonged droughts, most ponds have dried and some of them have very little water. Current major water sources in the study area are limited to bore holes where poor households cannot afford to pay the water fee at the borehole points due to low productivity of animals.

Key informants and FGD participants noted that migration of household family members, especially girls, to Middle East and other neighbouring countries (Djibouti) are considered as livelihood strategy and major option to support and diversify their means of living in the form of remittance. In rural pastoral rainfall-dependent communities, remittances from family members and friends play an essential role in supporting pastoralists to withstand the livelihood impacts resulting from climate change and variability.

The better-off households wanted to save their money without interest in the bank but the government banks in the pastoral area are very remote from their residences which discourages savings among pastoralists. During field observation, government Banks were only found in the district towns (Shinile and Erer towns). This implies that the government of Ethiopia did not give due attention about the accessibility of a Commercial Bank of Ethiopia and other saving institutions based on the context of pastoralists' lifestyle and religion.

5.5.4. Social capital

Social capital is the type of livelihood resources that consists of the social resource such as set of connections, social claims, social relations, affiliations, and associations upon which people draw when following various livelihood strategies necessitating coordinated actions (Scoones, 1998). Through social networks, people can share their tangible and intangible assets and then spread risks and claim for reciprocity in times of crisis. Households with better social networks have

better opportunities to participate in different activities and improve their means of living. Social resource can improve and provide valuable information and advice about a range of income generating activities (Gordon, 2000).

Social capital mediates resource flows among pastoralist that are often critical to household livelihood, consumption, health, and status. In pastoral areas, social capital is important for sustainability of livelihoods. Respondents reported that, as shown in Table 5.5, the most critical social capitals that are still practiced and influence pastoralist's livelihoods in the study district include good network and connection (98.3%), trust and mutual support (95%), common rules and sanctions (100%), collective representations (90%), participation in decision making and leadership (58.3%), and supporting each other (76.7%). A form of social capital such as common rules and sanctions, good network and connections, and trust and mutual support are highly practiced among the pastoral communities where access to participation in decision-making and leadership is slightly less accessed and practiced. In the current changing climate, people's relationship, trust among the pastoral community, reciprocity and exchange of common rules and regulations play an important role in enhancing their adaptive capacity to climate change. Adger (2003b) stated that developing trust and relationships between different development actors and society, social capital and holistic decision-making institutions are important to promote the sustainability and legitimacy of any adaptation strategy.

Elders stated that supporting each other whenever there is food insecurity by sharing the available food and animals is the social capital of the pastoral community. Pastoralists have social exchange systems which involve the contribution of livestock, livestock products and other items as a response to different risk exposures and social obligations. This reciprocity based social assistance system helps pastoralist to share asset loss due to different environmental

shocks such as droughts. Therefore, any form of social support and risk sharing practices among pastoralists can be considered as an informal insurance product. The informal insurances have also religious, kinship and neighbourhood basis.

Islam is the dominant religion that helps to redistribute wealth and risk through *Zakaat* (the most well-known social support system) within the pastoral society. *Zakaat* is a religious obligation on every Muslim to make monetary or in kind contributions to the poor and destitute ones. As pastoral resources are often managed on a collective basis, their informal insurance mechanisms are often kinship-based. As a result, livestock and other assets circulate regularly within the clan members from the better off to the poorer. Pastoralists' households sometimes request for support from neighbours even during normal times in order to meet their needs. They often resort to sharing of lactating animals or their milk products to maintain social ties. Based on the relationship of the recipient household and the wealth level of the donor, the beneficiary household may be entitled from the lactating animal, only the milk of the lactating animal, or only the offspring of the lactating animal. Access to this type of support is related to 'belonging' in the community. Pastoralists who relatively have good network with clan members, relatives, friends and marriage relationships with wealthy family manage to recover easily after crises with the assistances obtained from their network. Bonding social resource is based on some exclusive features such as family kinship, ethnicity or nationality (Woolcock, 2001).

Among Somali pastoralists, there is strong reciprocity assurance system during social and economic crises called '*Xoohologuyu*'**.** Under the '*Xoohologuyu*' upon a request of victim fellow community member (often via their clan elders), clan members contribute livestock to indemnify the loss. Clan elders administer *'Xoohologuyu'* where elders' committee decides the need for contributing to a clan member's loss. When there is a need for contribution, the elders'

committee determines each community members‟ share of the contribution based on his/her wealth level. Under '*Xoohologuyu*', households are only entitled to get the support if they have lost almost all of their livestock and have no any other means to revive their livelihood without the support of their relatives and clan members (Helland, 2006).

5.5.5. Physical capital

Physical capital is resource used in making of goods and services. Buildings, irrigation, canals, roads, tools, machines and so on are physical capital (Ellis, 2000). The major components of infrastructure that are important for sustainable livelihoods includes adequate water supply and sanitation, secure shelter and buildings, sufficient transport, clean and reasonable energy and access to information (DFID, 1999). Respondents indicated that their areas did not have much physical capital accessibility for pastoral communities. Access to physical capital (see Table 5.5) is stated in terms of having access to communication (66.7%), access to all weather roads and transport (51.2%), access to water and sanitation (41.7%), clean and affordable energy (41.7%), housing and safe building (38.3%) and access to agricultural inputs (16.7%). The highest physical capital accesses for the pastoralist are communication, and tools and equipment for production with lower percentages.

Key informants reported that even though accessibility of physical capital is found at early stage, availing roads and means of transportation, drinking water, clean and affordable energy, communication and housing are essential to improving knowledge, skill, technology and means of production, which facilitate the development of pastoral communities. In Erer District, the accessibility of physical asset is more retarded than in Shinile district. There is only one road that connects Erer and Dire Dawa town but when it rains this is impassable. The problem of poor roads and public transportation has harmfully affected the livelihoods of pastoral communities,

for instance, it is difficult to diversify, obtain supplies into rural areas, and this restricts trade with other areas. Access to electrical energy is restricted around district capital towns and villages found near the main district road. Charcoal, firewood and animal dung are the major source of energy in the study area. According to the International Energy Agency, this is not astonishing since 85 per cent of Ethiopia's total population have not access to electricity (IEA, 2011).

5.6. Major sources of pastoralists' livelihoods

Apart from manifestations of climate change and livelihood resources, the household survey included questions on major sources of livelihood in the study area. Pastoralism is a source of livelihoods for millions of people in the study region. Participants were asked to rate their livelihood sources ranging from very important to not important (Table 5.6 below). Accordingly, respondents ranked the first four livelihood sources in terms of their importance. The most important sources of livelihood (which contribute considerably to total food, status and cash income in such a way that a decrease in access to that source may have an important effect on total means of livelihoods) were livestock rearing, charcoal and firewood, remittance and relief aid. The largest percentage of respondents (95%) indicated that rearing of livestock is the chief source of livelihood. Regardless of the quality and quantity of livestock, almost all households are engaging in rearing of livestock as the main source of livelihoods in the study area. The rearing of livestock in the pastoral area is the mainstay (backbone) of economy, which accounts for nearly 46% of GDP, 73% of employment, and nearly 80% of foreign export earnings (ATA, 2014).

Table 5.6. Major sources of livelihoods at household level

Livelihood sources	Very important (%)	Important (%)	Not sure (%)	Less important (%)	Not important (%)
Animal husbandry	95.0	1.7	3.3	0.0	0.0
Corp cultivation	0.0	13.3	8.3	60.0	18.3
Petty trading	31.7	50.0	0.0	11.7	6.7
Livestock trade	8.3	40.0	3.3	31.7	16.7
Permanent employment	8.3	5.0	1.7	5.0	80.0
Sale of fire wood and charcoal	76.7	15.0	1.7	6.7	0.0
Casual laborer	50.0	31.7	1.7	10.0	6.7
Rental house in town	10.0	25.0	0.0	15.0	50.0
Remittance	73.3	18.3	0.0	6.7	1.7
Pension allowance	3.3	0.0	0.0	3.3	93.3
Free relief aid	56.7	40.0	0.0	1.7	1.7
Safety net/Food for work	53.3	45.0	0.0	1.7	0.0
Sale of handcrafts	8.3	30.0	5.0	35.0	21.7
Traditional medical practice	1.7	15.0	5.0	43.3	35.0
Contraband trading	7.5	34.2	0.0	15.0	43.3

Source: Field survey, 2019/20

The percentage of respondents under 'very important' rating categories for charcoal production, remittance and relief aid are 76.7%, 73.3% and 56.7% respectively. About 53.3% respondents took safety net or food for work program as 'very important' part of their livelihood while 50% reported as casual labourers under 'very important' category. Under 'important' category, respondents reported petty trading (50%) and livestock trading (40%) are important sources of livelihoods in the study area. However, pension allowance and permanent employment were reported under 'not important' categories because the majority of pastoralists in rural area are not qualified in education to engage in permanent employment.

According to Key Informants and FGD discussants, charcoal production and firewood collection for market is one of the most important sources of livelihood for the pastoral

communities since the impacts of climate change greatly affect their livestock. They added that in the district and even in the entire zone (Sitti zone), there is high milk scarcity mainly attributed to lack of feed and water for livestock due to prolonged droughts, migration to other areas and low calving rate. The market demand for livestock was also very low because their body conditions had deteriorated severely in the district. The number of livestock and their productivity is significantly hampered by lack of feed, such as natural pasture and water scarcity coupled with recurrent common diseases, and is unable to secure their means of livelihoods.

As a result, the production and sale of charcoal and firewood was a livelihood option mostly for destitute households, as indicated during the FGDs. It was revealed that it is labour intensive and environmentally destructive. Households involving in this activity are those who are settled near the highway and urban areas with market for wood fuel. Bamlaku (2016) stated that presently there is a high rate of firewood collection and charcoal production in the pastoralists regions as a survival livelihood strategy by those households or individuals who are forced to stop or nearly stop their major livelihood system, that is, rearing of livestock.

Culturally, Somali people assist one another whenever there are climate variability related hazards by sharing the available resource especially the livestock. However, the extent and magnitude of such type of social bonds and supporting each other become exhausted gradually due to the severe impacts of climate variability on their livestock and other asset. In recent years in particular, food security in pastoralist areas is of great concern due to climate change and population growth which resulted in reduced grazing lands and water sources. This is because socio-economic change and climate change coupled with the increasing globalisation of markets are placing growing pressure upon rangelands; increasing the vulnerability of pastoral communities (Sadler *et al.*, 2012).

Relief aids and safety net program (SNP) are important means of livelihood for many households in the study area. Government and NGOs are undertaking a food distribution program to the drought-affected households with relief aid and SNP (food for work). According to Bamlaku (2016), the safety net programs were initially in the principle of food for work but have now changed into natural resource conservation work. This means every household head is expected to participate in natural resource management, preservation programs and other community engagements (like soil conservations, watershed management, rural road construction, reforestation and pond construction) in their respective villages two days per week so as to be given the fixed rationing for each vulnerable household usually one quintal (100 kg) of wheat. DAs also confirmed that in addition to providing food crops and edible oil for those household who directly participated in natural conservation program, there is also a free support program in the safety net for household heads who cannot directly participate in community development works due to health problems and aged communities.

Remittances are becoming a major source of livelihood in the study area. According to pastoral development officers, the remittances mostly come from household family members who were mostly in urban areas in the region, Dire Dawa, Addis Ababa, and outside the country like from Djibouti and Middle East countries. Young family members are usually not willing to engage in the rearing of livestock as their families, instead, they look for ways out of the pastoral production system because their families' livestock numbers per household continue to decline due to drought, heat stress, disease, scarcity of pasture and water in the area. FGD discussants reported that younger family members have the responsibility to migrate to urban areas and other neighbouring countries like the Middle East and Djibouti in searching for paid jobs, and then supporting their families through remittance to minimise the adverse effects of climate change.

In addition, searching for daily work (as casual labourers) in the nearby and other distant major towns like Dire Dawa, Jigjiga and district towns, especially by youth groups of both sexes is also considered as a source of livelihood in the area. During discussions, respondents added that some pastoral communities, particularly women who are close to the main highway or rural towns engaged in various forms of petty trading as a livelihood activity to augment the income of their household. This implies that currently pastoralists are practicing livelihood diversification as an adaptation strategy to withstand the adverse impacts of climate change and variability.

5.7. Conclusion

This chapter discussed the results of the research on climate change stressors and impacts, vulnerability to climate change and the highly susceptible groups to climate change. The major multiple climatic stressors that impacts pastoralist's livelihoods in the study area include occurrence of frequent drought, heat stress, long dry season, livestock and human diseases, environmental degradation, water scarcity, bush encroachment and scarcity of pasture in the area. Such types of multiple climate change hazards have negative impacts on the livelihoods of the pastoral communities. Among the climatic stressors, drought was considered as the number one climatic change hazards that impacts pastoralist's livelihood system in the study area. Drought occurs anywhere in the world but its frequency and impact on the livelihoods of the people is not as severe as in arid and semi-arid areas.

Vulnerability to climate change is intensifies by food shortage, poverty, low productivity, over-population and uncertainty. Livelihood strategies, inadequate education, access to and control over resource, poor local institutional capacity and services, and gender are the central factors that determine pastoral vulnerability and add to increase their susceptibility to climate change. Among the major factors that contribute to socio-economic vulnerability of pastoral

communities include rapid population growth, poverty and hunger, poor health, low levels of educations, gender inequality, social exclusion, fragile, marginal and/or hazardous location, resource degradation, and lack of access to infrastructure, resource and services.

Climate change hazards greatly affect the livelihood activities and assets of the pastoral communities in the study area. When climate change hazards become more severe and frequent from time to time, redistribution of asset and supporting systems are becoming difficult to implement, as the number of people needing social support is increasing gradually. The extent and magnitude of livelihood vulnerability to the negative impacts of climate change varies across location, environments and communities depending on their exposure, sensitivity and adaptive capacity to climate-related hazards. Women, children, female-headed households, disabled people, the elderly, poor and sick people are the most vulnerable group of people to the impacts of climate change since these groups often have lower adaptive capacities and limited access to resource/assets for adaptation practices.

CHAPTER SIX: COPING MECHANISMS AND ADAPTATION STRATEGIES TO CLIMATE CHANGE AND VARIABILITY

6.1. Introduction

This chapter presents the third and fourth specific objectives of this study, that is, to 'analyse the major response strategies and constraints that determine the pastoral communities to adapt to climate change' and to 'assess the roles of institutions and organisations in enhancing or hindering the adaptive capacity of pastoral communities.' This chapter therefore presents the findings of the study on climate change coping with and adaptation strategies. The chapter is subdivided into three components: climate change coping mechanisms and adaptation strategies, factors enabling and/or constraining adaptation strategies, and the role of institutions and organisations in enhancing and/or hindering adaptation strategies to climate change. Both qualitative and quantitative data were analysed.

Dry and semi-dry areas in the country are highly vulnerable to the impacts of climate change and variability (Aklilu *et al*., 2009). Similarly, Burnett (2013) stated that the south eastern parts of Ethiopia has been recognised as one of the most vulnerable areas to climate change and variability, and are regularly faced with climate-related hazards include recurrent, prolonged droughts, rainfall scarcity and variability and heat stress. Pastoralists are highly vulnerable to the impacts of climate variability due to social, economic and environmental factors. In particular, high levels of poverty, rapid population growth, highly dependent on rain-fed livelihoods, high levels of environmental degradation, chronic food insecurity and occurrence of regular drought (Aklilu *et al*., 2009).The variability of rainfall and the increasing temperature are a cause for frequent drought and famine. It is now well identified that climate

change and variability poses severe threat to the means production, natural resource base and the livelihood of communities. The threat is particularly severe in the dry lands. In recent years, adaptation to climate change in pastoral areas has received increasing attention. Therefore, this chapter aims to give an overview of coping and adaptation strategies undertaken in pastoral areas in response to climate change and variability.

6.2. Climate change coping mechanisms and adaptation strategies

There is a rapidly increasing interest and concern in the literature on how the pastoral communities cope with and adapt to climate change and variability. Climate change become the main driving factors towards the adoption of different coping mechanisms and adaptation strategies to reduce the adverse impacts of climate change risks. Adaptation strategies are classified into two broad categories, proactive and reactive adaptation strategies. Proactive adaptation strategies are often carried out in expectation of future climate change and implement long-lasting efforts in constructing large-scale infrastructure while reactive adaptation strategies practiced after the incidence of hazards (ex-post) to withstand the impacts of climate change and variability. Given the complexity of forecasting climate change at a local level, the majority of adjustments strategies are likely to be reactive (Mendelsohn & Dinar, 2009).

Response mechanisms to man-made and natural problems including climate change can be grouped into coping mechanisms (short-term) and adaptation strategies (long-term). The coping mechanisms are short-term, unplanned and reactive response mechanisms to immediate problems, whereas adaptation strategies refer to proactive and anticipatory changes over long periods of time to reduce the impacts of climate change or gradual changes (Berkes and Jolly, 2002). Intergovernmental Panel on Climate Change defines adaptation strategies to climate

change as ‘adjustment in natural or man-made systems in response to actual or expected climate change impacts which minimizes harm or exploits beneficial opportunities’ (IPCC, 2007). Adaptation engages in adjustments to improve the practicability of socio-economic activities and to minimize their susceptibility to climate change and variability, including its recurrent drought and other severe incidents (Smit *et al*., 2000).

Currently, pastoralists are facing numerous challenges including climate change, abnormal competition over scarce resource-leading to conflict, severe poverty, and inappropriate laws and policies. These all affect their coping and adaptation strategies. Pastoral communities have experience and skills on how to adapt to climate change and its impacts on their daily lives. Recognising how they perceive, react, and respond to climatic change and events is useful to support these communities in formulating and implementing coping and adaptation strategies. Pastoral communities have in-depth experience, skill and knowledge of local climate change and variability as part of their indigenous environmental knowledge (IPCC, 2001).

For many centuries, pastoral societies in the east African countries in general and in Ethiopia in particular have been adjusting their livelihood strategies to the changing climate events (Davies and Bennett, 2007). The frequent droughts have been a major issue for several decades among the pastoral communities in Ethiopia (Little, 2012). Pastoralists’ strategies to cope with and adapt to these long dry seasons are deeply rooted in pastoral societies’ traditional social structures and resource management systems with close supervision of their customary institutions (Homann *et al*., 2008). Due to the increasing nature of climate variability in the region, its inhabitants are forced to practice various forms of coping mechanisms and adaptation and strategies. Pastoralists’ coping and adaptation strategies to climate change are considered as inevitable and necessary to avert the adverse impacts of climate change and variability in the

area. Their exercise for adaptive capacity includes both tangible assets, such as natural and financial resource, and intangible assets such as experience, traditional knowledge, skills and opportunities to make decisions and implement changes for the sustainability of their livelihoods (Rebecca *et al*., 2010).

Pastoralists have been implementing various forms of coping mechanisms and adaptation strategies which are usually emanated from indigenous knowledge and skills to minimize the impacts of climate change, environmental degradation and other socio-economic problems on the livelihoods of the pastoral communities. Webb and Coppock (1997) state that pastoral communities have been coping and adapting with a changing climate condition for hundreds of years. As a result, they have long lasting knowledge, skill and experience for their coping mechanisms and adaptation strategies. Leulseged (2010) describes that the common adaptation strategies in pastoral site of the Somali region are livestock diversification, livestock splitting, migration to urban areas, asset diversification, food aid, mobility, remittance and petty trading. There are also a number of coping mechanisms especially practiced by the destitute and medium income groups, including forced labour migration, sale of assets, selling of firewood and charcoal, collecting wild fruit and fewer meals. However, the majority of such strategies have not been efficient as there are no well-defined means of their implementation, and they are implemented once the hazards have caused huge damage.

According to the household survey results for this study, nearly all of the respondents (97.5%) acknowledged that pastoralists have practiced various forms of coping mechanisms and adaptation strategies to avert the adverse impacts of climate change on the livelihoods of the pastoral communities in the study area. Due to the difficulty of predicting climate change and variability at a local level, most pastoral communities practiced reactive type of adaptation

strategy in the study area. Coping mechanisms and adaptation strategies that have been practiced by respondents' households are highlighted below.

6.2.1. Pastoralists' coping mechanisms to the impacts of climate change and variability

Coping mechanisms are short-term response mechanisms employed by pastoralists. The pastoral communities in the study area have developed different coping mechanisms to the impacts of climate variability and its extreme events over the years. However, respondents agreed that increase in frequency and magnitude of extreme climatic events is increasing their vulnerability to these extreme climatic events. This study revealed the different mechanisms used by pastoralists to survive to the impacts of climate variability and its extremes. Table 6.1 summarizes the coping mechanisms and the percentage of households using the survival mechanisms in the study area. Fewer meals per day (96.7%), governmental and NGOS aid (87.5%), herd splitting (86.7%), daily labourer in nearby town (80.8%) and food sharing from their clans (5576.7%) were some of the coping mechanisms identified by the respondents. Other response mechanism identified by the households include harvesting of wild fruit, borrowing cash from institutions and contraband trading.

Table 6.1. Types of pastoralists' coping mechanisms to climate change and variability

Coping mechanisms	Both districts (N=120)		Shinile district (N=60)		Erer district (N=60)	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Governmental and NGOs aid	87.5	12.5	88.3	11.7	86.7	13.3
Herd splitting	86.7	13.3	88.3	11.7	85.0	15.0
Sharing food from their clans	76.7	23.3	75.0	25.0	78.3	21.7
Fewer meals per day	96.7	3.3	98.3	1.7	95.0	5.0
Daily laborer in nearby town	80.8	19.2	83.3	16.7	78.3	21.7
Involving in contraband trade	62.5	37.5	65.0	35.0	60.0	40.0
Borrowing cash from institutions	56.7	43.3	55.0	45.0	58.3	41.7

Use of wild foods	59.2	40.8	56.7	43.3	61.7	38.3
Using livestock blood	43.3	56.7	38.3	61.7	48.3	51.7

Source: Field survey

On coping mechanisms discussions with focus groups, experts and key informants revealed that there are various types of coping mechanisms that the pastoral communities practice to cope with the adverse impacts of climate variability in the study area. Some of the major coping mechanisms practiced by pastoral communities include reduction of food intake, looking for daily work, herd splitting, slaughtering of weak animals, destocking, borrowing or sharing grain from others, borrowing money and purchasing of food on credit and collecting wild fruits. Currently, however, wild fruits which used as an alternative sources of food are no longer available due to the impacts of climate change and human interventions. The FGD agreed with one of them who said that:

> Wild foods were readily available when I was young and the pastoralists usually fed on them when there was shortage of food or during mobility with their livestock. The changes in climate and land use have destroyed the trees and the fruits are no longer available*"* (Kedir Yesuf, 57 years old, from Gaad kebele,Shinile district).

6.2.1.1. Splitting of livestock

During severe drought seasons, the implementation of livestock and family splitting is becoming more usual among pastoral communities as reported by elders. During prolonged drought periods, the livestock is divided into smaller groups. Sheep, lactating and physically weak herds remain with family members such as mothers, children and older men near villages, while other large numbers of stronger livestock such as camels, cattle and goats are moved further to distant

areas by young men in search of better water and pasture sources. In recent years, frequent droughts and their impacts on the availability of scarce resources (pasture and water points) has led to dividing not only animals but also family members for longer times due to long distance migration to look for better pasture and water sources. In this regard study conducted by Ali (2008) showed that during drought seasons, pastoralists divide their livestock and family members into different places. The splitting of livestock and families relies on the types and physical condition of animals and labour availability and requirement for those particular animals in particular locations. The dividing of livestock and families are risk minimisation mechanisms that have been practiced by pastoralist. Livestock may be kept in several different areas to reduce the effects of localized droughts, and disease outbreak.

During the FGDs, respondents revealed that several households were splitting their livestock into strong and weak livestock. The stronger herds were moved to distant areas in order to search for better pastures and water points while the weaker livestock were kept near the permanent homesteads and fed with supplementary feeds. Households often split during the drought seasons, with the stronger herds being taken further afield to find suitable water and pasture, usually close to rivers and boreholes. This implies that women are responsible to care weak animals and dependent household family members. As a result they may not have sufficient time to practice various survival mechanisms to withstand the adverse impacts of climate variability.

6.2.1.2. Fewer meals per day

Pastoral communities faced with livelihood shocks practiced a similar range of coping strategies to pastoral households elsewhere. During focus group discussion and key informant interview, respondents reported that another coping strategy employed by poor households during

prolonged droughts was to decrease the frequency of meals per day by cutting down on unnecessary consumer goods. This coping mechanism is not at all new to these communities who are repeatedly affected with food insecurity. For pastoral households experiencing food shortages, giving the limited food for male children, husband, girls, and finally mother respectively, is a common practice.

6.2.1.3. Mutual assistance

For a long period of time, pastoral societies have developed and gone through interrelated systems of traditional social networks based on the key principles of mutual exchange of resources, accepting of differences, respect and peaceful co-existence. Clans are the basis for pastoral socio-cultural and political organisations. Individuals within the clan are likely to help each other in times of disasters. This kind of mutual support is common among relatives and clans in the study area which is a kind of wealth redistribution informal insurance within each clan.

During FGDs and key informant interviews it was disclosed that pastoralists have indigenous culture of helping each other (food, cash and productive resource) in times of climate adversity. By merging voluntary and compulsory social networks of redistribution of resource, the pastoralists address problems ranging from daily food gaps to loss of livestock throughout dry seasons or other man-made factors. The vulnerable households sought help from relatives, friends and clan members when their traditional means of livelihood have been affected by climate change hazards. Such sharing of assets has been often in the form of herds gifts in the case of clans, or giving out milk animals in the case of friends and relatives. Provision of milk cow is the common inter-household system of food sharing. Such redistribution of assets as a coping mechanism is in accordance with mutually developed social responsibilities and customs.

Elders and Development Agents revealed that there are indigenous cultures for sharing food, cash, pack animals and cow milk from better-off households to destitute households in the study area. The most frequently resource distributions in the region was gifts known as: *ciyi*-transfer of meat to neighbours after a slaughter; *Allah bari*- feeding the poor; *awino*-preparing food for the hungry; *qharan*- food or animals contribution to relatives; and zero-interest grain loans. The second most frequent resource transfer is 'free' labour (*goob*). Among pastoralists, *goob* takes the form of watering and grazing livestock in return for a day's food plus tea or *khat*. Transfers of animals are also common among rural households. The owners of livestock often provide milking livestock to relatives (*irmaansi*), to be cared for in exchange for their milk or new offspring. On the other hand, better-off households with owners of pack animals will provide a camel or donkey to poorer relatives. Other significant means for transferring herds are contributing animals in the process of restocking of poor relatives who have lost their animals (*xoolo goyn*), and provide livestock as a gift to newly married couples (*kaalo*). These are vital mechanisms for pooling resources and reducing risks, but many respondents complain that the better-off households are declining to support vulnerable households.

The result shows that the better-off households are currently degraded their capacity and/or unwilling to transfer resources to the poor households. The scope of supporting may be restricted to one's immediate family, increasing the vulnerability of those who are excluded from community assistance systems, but have no close relatives to assist them. In this regard the study by Little *et al.* (2006) noted that during times of occurrence of hazards, informal insurance networks (mutual support) in general are weakened, since wealthy households diminished their resources for social distribution.

6.2.2. Pastoralists' adaptation strategies to the impacts of climate change and variability

Adaptation strategy to climate change and variability are long-term response strategies employed by pastoralists. The pastoral communities in the study area have developed various adaptation strategies to withstand the negative impacts of climate change and variability. Households in the study sites applied various types of adaptation strategies to reduce the adverse impacts of climate change and variability related hazards. Sampled respondents were asked to name the types of climate change and variability adaptation strategies they employed. Some of them include livestock mobility (97.5%), livestock diversification (91.7%), selling of firewood and charcoal (95.0%), selling of livestock and livestock products (94.2%) and remittances (90.8%). Respondents also revealed that rearing of drought resistant livestock (89.2%), migration to other countries (81.7%), petty trading (69.2%) are also among the major adaptation strategies practiced in the area (see Table 6.2). In this regard, McKee (2008) confirms that pastoral communities have developed and practiced different adaptation strategies to overcome the challenges of climate change and variability. These comprise diversification of herd species, early warning systems, traditional pasture and water conservation systems, mobility, petty trading, migration, remittance, and selling firewood and charcoal. Thus, the historical accounts indicate that adaptation strategies had been practiced in dry and semi-dry parts of Ethiopia before the concept of "climate change" was developed.

Table 6.2. Types of pastoralists' adaptation strategies to climate change and variability

Types of adaptation strategies	Both districts (N=120)		Shinile district (N=60)		Erer district (N=60)	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Rearing of drought resistant livestock	89.2	10.8	91.7	8.3	86.7	13.3
Selling of livestock and livestock products	94.2	5.8	95.0	5.0	93.3	6.7
Relied on remittance	90.8	9.2	91.7	8.3	90.0	10.0
Migration to other countries	81.7	18.3	78.3	21.7	85.0	15.0
Selling of fire wood and charcoal	95.0	5.0	93.3	6.7	96.7	3.3
Livestock diversification	91.7	8.3	93.3	6.7	90.0	10.0
Petty trade	69.2	30.8	71.7	28.3	66.7	33.3
Broker	50.8	49.2	58.3	41.7	43.3	56.7
Save cash in the bank	39.2	60.8	45.0	65.0	33.3	66.7
Livestock mobility	97.5	2.5	98.3	1.7	96.7	3.3
Invest in property in town	22.5	77.5	26.7	73.3	18.3	81.7

Source: Field survey, 2019/20

Almost all FGDs and key informant interviewees confirmed that pastoral communities have a long period of indigenous knowledge and skills to practice various types of adaptation strategies so as to withstand the negative impacts of climate change and variability. They revealed that engaging in petty trading, livestock mobility, rearing of drought resistant livestock, charcoal production, selling of livestock, migration to other countries and livestock diversification are among the types of adaptation strategies they employ to adjust to the changing climatic conditions in the area. Findings revealed that pastoralists have involved in a number of adaptation strategies in order to adjust and live with climate variations and uncertainty (Orindi *et al.*, 2006). The majority of individuals and households utilize a mixture of adaptation strategies to avert the impacts of climate variability on their livelihoods. When pastoralists' livelihood resource are affected by recurrent drought, they move to engage in and search other means of alternatives (Thomas *et al.*, 2005).

Because of the impacts of climate change and variability, pastoral communities have practiced different forms of adaptation strategies in order to minimise the adverse impacts of prolonged drought and rainfall variability on their livelihoods. Adaptation strategies are developed from their own rich and long years of real life experiences to the arid and semi-arid rangelands where there are unpredictable weather conditions and the pastoralist are experiencing vulnerability. The major types of adaptation strategies practiced by pastoral communities are discussed in detail below.

6.2.2.1. Mobility

Pastoral communities have adjusted their means of life over several decades to survive with scarcity of rainfall by practicing mobile way of life with their livestock across long distances and bargaining access to pastures and water sources with neighbouring clans. Mobility is a natural resource management strategy usually accomplished by pastoral communities for effective use of scarce rangeland and water resource to maintain livelihoods in the face of climate variations in arid and semi-arid land ecosystems. The key informants revealed that pastoralist's mobility with their livestock in search of pasture and water as one of the key forms of adaptation strategies. Pastoral mobility is a type of indigenous and lifelong pastoralists' experience so as to adjust themselves to the changing climate and to improve their production and effectively utilizes their scarce resource (pasture and water). Such activities were appreciated and accepted among the majority of pastoralists in the form of supporting each other when members of clans are highly affected by drought at one time and others do the same when affected. However, pastoralists' mobility in recent times is facing various constraints due to the influence of climate change and variability, regional boundary and scarce resource competition that result in ethnic conflicts rather than a normal pastoral way of life.

Focus group discussants stated that the present condition of water, pasture and browse in Shinile and Erer districts has been significantly deteriorating gradually due to prolonged droughts and rainfall variability. The impact of the invasion of *prosopis juliflora* in competing with trees and grass is pronounced in the study districts which are evidence for depletion of pasture and browse. As a result, livestock was affected leading to migration to distant areas in search of better pasture and water sources to their livestock. Ali (2008) argued that mobility is one of the key indigenous adaptation strategies that have been practiced by pastoral communities in response to climate changes and variability in search of pastures and water availability for their livestock.

Pastoral societies regulate the composition of their livestock to the external environment. Elders reported that large number of livestock from rain deficit areas of Shinile, Erer and other districts of Sitti zone unusually migrated out of their normal grazing areas for an extended period of time to Dembel areas bordering with Oromia and Dire Dawa administrative city, parts of Mieso district, some areas of Afdam district. The mobility is abnormal and started earlier than in the past. The first mobile livestock were the camels to mountain areas two months before the previous migration times. The cattle of Shinile district migrated to other districts to get better pasture and water points. All types of livestock migrated including lactating cows, except some livestock of week body condition and unable to move such long distance. This implies that the impacts of climate change and variability in the rearing of livestock has become severe and beyond the adaptive capacity of the pastoral communities.

It is well known that pastoralists inhabited areas are constrained with drought, poor quality and quantity of pasture, scarce water sources, low rainfall amount and severe temperature conditions. As a result, there are limited options to pastoralists for effective and sustainable

grazing land use other than mobile livestock production. In recent years in particular, food security in pastoralist areas is of great concern due to prolonged droughts, heat stress, long dry seasons, population growth and urbanization which resulted in reduced grazing lands and water points. This is because climate change and socio-economic change coupled with the increasing globalisation of markets are placing growing pressure upon rangelands and water points; increasing the vulnerability of pastoral communities (Sadler *et al.*, 2012).

6.2.2.2. Livestock diversification

Diversifying various species of livestock is one important alternative adaptation strategy to the impacts of climate change. It helps to overcome the impacts of climate change and variability in the study area. Livestock diversification in favour of camels and goats is another significant way of pastoralists adaptation strategy to climate-induced changes in rangeland ecosystems. Adaptation and risk reduction are possible through maintaining mixed herds containing different animal species which can withstand different climatic and ecological conditions (Toulmin, 1994).

Traditionally, pastoral communities were predominantly a cattle pastoral system in the study area. However, as pastoralists faced climate change and variability related challenges, most of the Sitti zone pastoralists now try to diversify their livestock species to including browsers (camels and goats) as an alternative adaptation strategy. The diversity of livestock species has ecological and economic implication. According to the elders, in addition to cattle, goats and camels become the main parts of livestock species reared by pastoralist. Pastoralists diversify their livestock species in order to make rational use of environmental diversity. Rearing of various species of livestock can help pastoralist to take the advantages of the mixed nature of ecosystems. Rearing all these types of livestock by a single household is one of the strongest

indications of adaptation strategy for climate change and variability. In this regard study conducted by Ali (2008) stressed that pastoralist for their resilience to drought, heat stress and diseases; they rear different livestock species, especially goats and camels. Mandleni and Anim (2011) also revealed that pastoralists diversify their herds species to efficiently exploit the limited resource (grazing land and water) and that livestock diversification as adaptation strategy is possible through sustaining diverse livestock which can overcome various climate and environmental impacts.

There is evidence that more drought tolerant animals such as camels and goats are increasing in number. Livestock diversification into diverse species allows households to sustain herds that feed on various species of plants, enhancing their alternatives for exploiting resources from the rangeland. Livestock diversification also enables pastoralist to minimize losses from disease. Key informant interviewees reported that previously, the rearing of cattle was the most important production system. However, there is the tendency to integrate different types of animal species such as camels and goats which was not common to the existing communities' way of life. The rationale why the pastoralists adopted these animals is because camels and goats are browsers which enable them to take advantage of extracting the available bushes and trees in the areas. Most of the households among the focus group discussants already include goats and camels in their holdings. Camels are very expensive and earn high income by exporting them to Djibouti and Middle East. However, the practice of cattle production is decreasing gradually due to prolonged droughts coupled with the invasion of *prosopis juliflora* trees that are widely spread in the area and are not suitable for feeding by animals as it is toxic and badly affects their health. This implies that government should create awareness and mobilize the pastoral communities to clear such toxic, thorny and invasive species of plants.

6.2.2.3. Selling of firewood and charcoal

Selling of charcoal and firewood are another major response strategy that helps the pastoral communities to withstand the impacts of climate change in the study area. There is a high rate of dependence on collection of firewood and charcoal production in the pastoral areas as an alternative livelihood strategy by poor and medium income group of households or individuals. The production of charcoal as an adaptation strategy is also currently challenged by the rise of unwanted bush encroachment and invasion of the very thorny and toxic species of plants, *prosopis julifora*. Focus group discussants revealed that the production and sale of charcoal and firewood was a livelihood activity mainly practiced by poor pastoralists. It was revealed that it is labour intensive and environmentally destructive. For the last decades, vulnerable pastoral groups of people as an alternative livelihood diversification and coping strategy practiced charcoal production. Currently, however, as the price of charcoal is becoming too high, it attracts not only the poor households but also the better-off households engaged in this activity as an alternative of supplementary capital accumulation.

Charcoal production became a fall-back option, especially for poor pastoralists who are incapable to continue with their traditional way of life, rearing of livestock. According to key informant interviewees, charcoal making remains an important option for generating alternative means of livelihoods with regards to the number of individuals involved, coverage, market opportunity, low skill and low investment required to start this form of business as well as the free access to tree resource to produce it. The main driving force to engage in charcoal production was the deterioration of livestock size and livestock production due to the impacts of climate change hazards such as prolonged droughts, heat stress, rainfall variability, environmental degradation, livestock disease and long dry seasons.

Key informant interviews with experts reported that charcoal and firewood selling as a livelihood options give households with an alternative source of income when herds and other assets fail. However, it is important to highlight its negative impact on ecosystem and the permanent loss of livelihoods which could result from charcoal production. As droughts become more frequent, charcoal making becomes unsustainable and leading to massive deforestation. such deforestation in turn leads to the destructions of other ecosystem services, including local climate regulation. With future climate change and increasing drought risks, pressures on forest resource are likely to increase, unless more sustainable alternative sources of energy are supplied and other substitute income-generating activities are put in place. The regeneration of acacia species is very slow and it usually takes at least two decades for a tree to mature and make charcoal. The result indicates that since drought occurs approximately each year, firewood and charcoal selling results in considerable forest degradation, making this strategy obsolete in the long run, and leading to an escalation of climate change and variability impacts in the study area.

6.2.2.4. Selling of livestock and livestock products

For pastoralists, herd is a central resource for the people, fulfilling various economic, social and risk management functions. During focus group discussion and key informant interviews, respondents revealed that livestock and livestock product selling are considered as very important adaptation strategy and sources of cash for most pastoral households in the study area. Livestock provides food either directly (milk, meat, blood, and so on) or indirectly (buy food crops, tea, medicines, education, and so on) to support family's livelihoods. Livestock are also the currency of social capital-inheritance, marriage (bride wealth, dowry), initiation, compensation after conflict to make peace and so on. This builds good alliances, which can then

lead to the peaceful management of common property resource or good management of shared resources.

However, the size and productivity of livestock has been deteriorating gradually due to the recurrent, prolonged droughts, diseases and degradation of resources in the study area. During drought seasons, pastoralists' alternative adaptation strategy is to sell those livestock they think are unlikely to survive until the next rains and then move with the rest of the livestock to areas with better pastures. One major reason of selling livestock was for destocking purposes during long dry seasons and in order to buy food crops from the market. Food crops demand and livestock selling needs were highly increasing during drought seasons. The better-off households also spent the income they collected from animals sales to buy more herds for herd replacement after droughts. The destitute households might be forced to sell the few and weak livestock left in order to fulfil basic needs, with the potential of risking stock depletion more than the better-off households do. Cossins (1988) stated that the main purpose of livestock selling during prolonged droughts were to purchase grains to maintain energy intake by households. Despite the unfavourable prices, increased animal sales during droughts were a reflection of poor livestock body condition.

6.2.2.5. Migration and remittance

The ability of pastoral communities to adapt the impact of droughts has been threatened as access to resource and stability of a livelihood based solely on livestock has been reduced. When livestock numbers per household continue to decrease due to prolonged drought, heat stress and diseases, household members sought for other livelihood alternatives and support family members through remittances. As a result, remittance is becoming one major livelihood source and adaptation strategy in the study area. As focus group discussants revealed, remittance usually

comes from family members who were mostly in urban areas, in and outside the district, and in some instances outside the country. It was recognised that remittances have been increasing as many young people migrate to towns in the region and outside the region like Addis Ababa, Dire Dawa and Harar as well as across borders into Djibouti and Middle East, and then are expected to support their families.

Development Agents stated that migration and remittance are becoming gradually attractive adaptation strategy especially for young people from poor family members. Poor household heads migrated particularly to Djibouti and Middle East because they had no herds left. Even the few left over livestock were sold or left with friends and relatives. Destitute households sent their youths mainly girls to join the informal labour migration in order to support with remittance those left in rural areas while rich households moved members of their family to towns to invest in trade and businesses. Some poor households hoped to restock what their families had lost due to the impacts of climate change (Little *et al.,* 2001). Agrawal (2010) also confirms that the deprived are more possible to migrate (involuntary/pushing migration) in response to livestock failure whereas the rich are more likely to migrate (voluntary/pulling migration) and rely on trade and accumulate additional capital in urban area since the latter are more possible to have organisationally secured access to resource that make forced migration unnecessary. He expressed r pulling migration as an adaptation strategy (opportunity seeking and practiced by rich households) and pushing migration as failure of adaptation (practiced by the poor and destitute households). Thus, pushing migrations occur on a large scale due to climatic stresses, and with attendant social and political instabilities of maladaptation.

Generally, to adapt to climate change, pastoral communities have dug more boreholes in drier regions, selling of charcoal and firewood, petty trading, migration of herds, selling of

livestock and livestock products during severe drought periods and diversifying livestock. Other pastoralists have shifted to livestock that can withstand water stress and hot temperatures (goats and camel). Pastoralists are also involved in illegal trading as an option of adaptation strategy although such illegal trade is declining gradually due to the strong control by the government in the eastern part of the country in general and in the study area in particular.

6.3. Factors enabling and/or constraining adaptation strategies

Pastoral communities who inhabited in the sever and uncertain conditions of limited livelihood options have mainly become vulnerable to sustained poverty in recent decades partly due to their recurrent exposure to the unfavourable impacts of climate change. The choice of different adaptation strategies is dependent on resource endowments of households and communities, and their environmental location, networks of social and institutional relationships, institutional articulation and access, and access to resource and power.

Due to the increasing nature of climate change in the area, pastoralists are forced to develop and practice new types of coping and adaptation strategies with a close supervision of indigenous institutions. The indigenous institutions like *Xeer (*unwritten customary governance law*)* in Issa Somali serve as tools for coping and adaptation strategies to climate change, social support mechanisms due to their vulnerabilities. The pastoralists' exercise for adaptive capacity includes both tangible assets, such as human, financial, physical and natural resource, and intangible elements such as the indigenous knowledge, skill, experience and opportunities that enable them to make decisions and implement various forms of coping and adaptation strategies to withstand the impacts of climate change hazards and then to sustain their livelihoods (Rebecca *et al*., 2010). During focus group discussion respondents reported that pastoralists have

developed their own enabling factors of coping and adaptation strategies include indigenous knowledge, skill, trust, norms and values, and practiced various forms of coping and adaptation strategies to reduce the adverse impacts of climate change over their livelihoods. Pastoralists' adaptive management experiences and skills have enabled pastoralist to maintain and exploit their natural biodiversity in the study area.

DAs and other government officials mentioned access to extension services, information and training, access to markets and institutions as enabling environment to practice adaptation strategies. However, the majority of FDG and key informant participants disagree with the accessibility of scientific information and training about the impacts of climate change and variability, access to market and access to veterinary service and other infrastructures. They conclude that except extension services, others are considered as the main factors constraining pastoralist from coping and adaptation strategies. Indigenous ways of information exchange (early warning system) about weather condition, security and epidemic diseases among pastoral communities provide important information to make decisions and practice various forms of indigenous coping and adaptation strategies to minimize the adverse impacts of climate variability.

Elders revealed that traditional early-warning system is an indigenous knowledge and adaptation strategy to recurrent droughts so that the pastoral communities had been informed through their channel system and elders who have long experience about the astronomical and climate change extremes and variations. Some of the key indicators of traditional early warning systems identified by the local community elders include astronomical observations, speed and direction of wind, animal behaviour, animal intestines, starting day of a new year, the level of ground water, cloud cover, earth cracks, spider net and night weather. These help the pastoral

communities to prepare and respond timely and efficiently to such catastrophes on traditional means and sometimes report to the modern institutions for further interventions and assistance. Currently, however, the traditional method of interpreting and disseminating of climatic variation information to the pastoral communities are discouraged by religious leaders (chapter 4). The development and organising of indigenous knowledge and skills are significant for designing and implementing proactive coping mechanisms and adaptation strategies, but these are increasingly being abandoned because religious leaders discourage them. If indigenous knowledge and skills to forecast climatic variation are no longer available to pastoral communities, they will not develop and implement efficient coping mechanisms and adaptation strategies to avert the adverse impacts of climate variability. Thus, government, NGOs and private sectors should give awareness creation training for religious leaders to sustain the indigenous methods of seasonal forecasting of climatic conditions.

During key informant interviews with elders, revealed that Somalis' indigenous institutions are constructed with a very complex cultural and social network that serve a number of social and livelihood-related functions. These institutions strengthen ethnic cohesion, and provide an informal insurance (social safety net) for the pastoral communities that brings some protection against the severe variability of pastoralists livelihoods. Even in relatively good years, the resources are contributed and exchanged among clans and sub-clans through animal herding agreements, compensation payments and social ceremonies. They also provide livelihood support to poor households and acting as a redistributive asset when a climate change hazards affects the lives and livelihoods of the pastoral communities. Pastoralists also mentioned that International NGOs, donors and government play vital roles in creating efficient enabling

situations and transferring resources and technical support to enhance our adaptive capacities in the study area.

Regarding the factors that determine coping and adaptation strategies, many limitations and obstacles exist. Pastoralists' capability to adapt is determined by numerous factors including increasing environmental degradation, frequent conflicts over scarce resource which restrict movement and obliterate resources that are important for adaptation and low access to scientific information on weather, climate change, markets, as well as pest and disease outbreaks. Limited education, skills and access to financial services and markets required to diversity their livelihoods; inadequate government policies, capacities and coordination; demographic pressures, and social and gender inequalities and marginalisation, which reduce the voice and adaptive capacity of the most vulnerable group of people are additional factors that affects pastoralists' capacity to adapt. Similar factors were cited elsewhere in Africa. For instance, in Zambia and Zimbabwe, multifaceted factors that determined the endeavours of coping and adaptation strategies were recognized as access to resource, information, household size, education and skill, access to resources for extended families and the capacity of the community to provide support (Mubaya, 2010).

Limited modern information channel about scientific adaptation alternatives restricts pastoralists' adaptation system; instead, they are sticking to the very traditional way of adaptation strategies. It is already described (chapter four) that the majority of pastoralist in the study sites perceived the causes of climate change and its impacts without necessarily having scientific information and scientific adaptation methods. The problem is not only of lack of new information but it is also of old channel of information and practices.

In response to the changing climatic condition of the area, pastoral households practiced different adaptation strategies to reduce the risks posed by climate change. However, pastoralists' capability to cope and adapt to climate change has been challenged by different non-climatic factors such as institutional factors, access to key resource (pastureland and water points), conflict, access to credit, restriction in mobility, food price inflations, land disputes and land fragmentations (Mengistu, 2011). Even though pastoralist faced various constraints, they struggled to implement a combination of coping mechanisms and adaptation strategies to minimise the impacts of climate change and non-climate problems in the study area.

Sampled respondents were asked to answer the types of constraints that determine pastoralists' coping and adaptation strategies they practiced. Respondents reported that a number of factors influence pastoralist's coping mechanisms and adaptation strategies in the face of climate change related hazards including rangeland degradation (96.7%), scarcity of asset (94.2%), regionalism that restrict mobility (92.5%), bush encroachment (91.7%), education (90.8%) and household size (89.2%). Respondents added that conflict, income, extension services, lack of awareness and training and grazing land encroachment are factors that determine pastoralists' coping and adaptation strategies to climate change in the study area.

Table 6.3. Constraints of coping and adaptation strategies to the impacts of climate change

Constraints of coping and adaptation strategies	**Both districts (N=120)**		**Shinile district (N=60)**		**Erer district (N=60)**	
	Yes (%)	**No (%)**	**Yes (%)**	**No (%)**	**Yes (%)**	**No (%)**
Lack of awareness and training	77.5	22.5	75.0	25.0	80.0	20.0
Grazing land encroachment	76.7	23.3	71.7	28.3	81.7	18.3
Household size	89.2	10.8	86.7	13.3	91.7	8.3
Level of education	90.8	9.2	88.3	11.7	93.3	6.7
Annual income	84.2	15.8	86.7	13.3	81.7	18.3
Scarcity of asset	94.2	5.8	96.7	3.3	91.7	8.3
Access to credit and extension services	80.8	19.2	78.3	21.7	83.3	16.7

Regionalism that restrict pastoral movements	92.5	7.5	90.0	10.0	95.0	5.0
Land enclosure	58.3	41.7	60.0	40.0	56.7	43.3
Devaluing indigenous knowledge	70.8	29.2	73.3	26.7	68.3	31.7
Inappropriate development interventions	75.8	24.2	78.3	21.7	73.3	26.7
Rangeland degradations	96.7	3.3	98.3	1.7	95.0	5.0
Bush encroachment	91.7	8.3	93.3	6.7	90.0	10.0
Insecurity/conflict	86.7	13.3	81.7	18.3	91.7	8.3

Source: Field survey, 2019/20

There is resource competition between Erer district and Afar region. Such resource competition frequently leads to conflict. There are also significant differences in determining pastoralist's coping and adaptation efforts between Shinille and Erer districts. These include level of education, asset ownership, household size and regionalism that restrict pastoralist's movement (see Table 6.3). Findings confirmed that gender, age, experience, income, household size, the level of education, access to extension services, information on climate, social capital, off-farm and non-farm income generating activities are among the major determinants that influence pastoralists to practice adaptation strategies to climate change (Acquah-de Graft and Onumah, 2011). Literacy, institutional capacity, social networks, as well as access to information, markets, technology and services are the main factors, processes and structures that determine the adaptive capacity of pastoral households and individuals (IPCC, 2007).

Pastoral development over the last several decades has been characterised by the failure of their adaptive ability, and the result has been a vicious cycle of poverty, resource deterioration and ecological degradation, which further reduces adaptation. Elders revealed that pastoralist's vulnerability to climate change is usually associated with the restriction of mobility as adaptation strategies with the region and outside the region to access scarce resource, particularly pasture and water points. Climate change and variability, which leads to decreasing of effective pasture

and water sources, poses an important challenge to the sustainability of pastoral livelihoods, and places constraints on migration with their livestock to other regions as adaptation strategies. The frequency of mobility that some pastoralists have made in the past is no longer possible to practice today. In this regard a study by Zigale (2016) confirmed that the introduction of ethnic based regional boundaries restricts pastoralists' mobility to access pasture and water sources easily because of hostility among ethnic groups. Consequently, boundary expansion is considered as one of the main strategies to control over scarce resource. Such boundary expansion and claims leads to frequent and violent conflict among clans and ethnic groups in the area. Mahmoud (2006) also stated that different government policy such as ethnic based regionalisation, ethnic politics at the national level and ethnic based boundary demarcations are major constraints to adapt and causes of conflicts among groups of pastoralist in eastern Ethiopia.

During focus group discussions, respondents reported that conflict due to competition over scarce resource and territorial expansion in the pastoralists areas also poorly constraints the efficiency and effectiveness of pastoralists' adaptation strategies and in turn jeopardizes their livelihood systems. Therefore, pastoral communities adjust themselves with such changes like reducing the number and species of their livestock to minimise the burden of their livestock on the natural resource base and to restrict the scope of their mobility out of their boundary as they face conflict from the other clan and ethnic groups. Zigale (2016) confirms that territorial expansionary moves, competition over the scarce resource, cattle raiding and counter raiding are the main causes of conflict in pastoral area. When pastoralists want to move their livestock in search of pasture and water sources, there are persistent conflicts over scarce resource, which directly determine the adaptation strategies of the people. Oba (1992) argues that extensive

drought seasons have the potential to instigate resource-induced conflicts in pastoral areas, where resource are shared among communities.

Another factor that determines the pastoralists way of mobility was the practice of land enclosure near and around their homesteads primarily reserved for grazing their livestock during drought seasons of the year as revealed by key informants (see Figure 6.1 below). There is a tendency of growing of fencing the communal rangelands as a private resource for fodder production and hay making. However, recently the practice of land enclosure as an adaptation strategy by households and individuals is condemned by clan leaders due to the scarcity of pasture land caused by recurrent prolonged droughts and population pressure, rangeland degradation, bush encroachment and invasion of palatable grasses by unpalatable species of plants like *prosopis juliflora*. Tache and Oba (2008) state that the local communal rule allows it for crop farming only. This may have motivated pastoralist to fence large communal rangelands for fodder production disguised as cereal cultivation. Thus, fencing extensive communal rangeland disguised as crop cultivation is becoming the major constraints that restrict free livestock mobility as adaptation strategy in the pastoral area.

Figure 6.1: Land enclosure practice

Source: Field survey, 2019/20

The encroachment of rangeland with unwanted bushes, such as *prosopis juliflora* and cactus, determines the practice of pastoralists' adaptation strategies which gradually reinstated the grass and tree species. From both field observations, it is clearly visible that species of important grasses and trees in which pastoralists' livestock rely on are now degraded and the area has gradually become barren lands. This has its own consequence on the scarcity of pasture for their animals. In other words, bush encroachment is a factor for determining adaptation strategies in the study area.

According to Key informants and focus group discussants, many pastoral communities in the study area have limited access to markets, scientific information on day-to-day weather condition, technology, education and health services. Pastoral communities are often being marginalised and generally have a limited access to infrastructure, resource and services which determines their adaptation options. In addition, apart from the main highways linking major towns in the region to Djibouti, many of the other roads are in poor condition. This hampers the accessibility of social services and infrastructure such as health facilities, veterinary centers,

schools and markets. With few resources at their disposal and restricted access to quality social services, pastoral communities tend to be very susceptible when climate change hazards occur. Constraints of the accessibility of appropriate medical attention and medication are usually associated with the out-break of livestock and human diseases. This results in reduced the productivity of herds and increased mortality.

Pastoral communities that lack access to asset and other infrastructure like road may be unable to easily reach to market to sale their livestock and buy food crops to cope with drought and other environmental risks. Without access to markets, communities may be forced to sale their livestock to brokers with low price, otherwise they may slaughter their cattle as an adaptive response to the changing climate in the area. Moreover, respondents also identified that lack of scientific weather condition information, lack of awareness and training; access to credit and extension services, household size, educational level and income variation among pastoralist are considered as key constraints to climate change adaptation strategy options in the study area. The capability to adjust with climate change and variability impacts is a function of various components include 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 susceptible to climate change harms, just as they are more vulnerable to other stresses. In this regard a study conducted by Zigale (2016) revealed that the main constraints that determine pastoralists' household and individuals' adaptation strategies include poor resource base, lack of economic services, lack of awareness and training, lack of rural infrastructure, and lack of opportunities.

Poverty of resources is the most important issue that determines an individual and households' response strategies to withstand the adverse impacts of climate variability over their

livelihoods in the study area. The majority of the respondents (94.2%) put scarcity of the asset base as one of the main constraints to practice context based coping mechanisms and adaptation strategies to minimise the adverse impacts of climate change and variability (see Table 6.3). Accessibility and ownership of asset enable the pastoralists' households involve in a diverse portfolio of income generating activities and then capable to withstand the effects of climate change. However, the majority of the pastoral households in this area do not have adequate resource which acts as a big obstacle to adjust them with the changing climate in the area. Scoones (1998) describes that the extent and magnitude of rural household adaptation are determined by the availability and ownership of various resources and the level of risk associated with alternative options. Swift (1998) also states that destitute households have less alternative to practice coping and adaptation strategies and these are less possible to sustain their livelihoods. Thus, poor resource base is the major limitations to adjust themselves with the impacts of climate change.

Focus group participants reported that even though there are different options to adjust with climate change and variability, there is no accessibility of rural credit institutions that considers the local context of the study area. As a result, they could not develop and practice various adaptation options due to lack of finance and credit service in the area. Gordon and Graig (2001) point out that access to financial asset or rural credit institution is one of the major problems for the rural households and individuals to diversify their means of income. With little or absence of cash available for investment, households and individuals are limited to a small number of activities, which result poor returns. Reardon (1998) also states that access to credit institutions is one of the determinants that result in variation in household engagement in livelihood adaptation strategies like diversification as livelihood strategy.

Pastoral communities in the study area have restricted education, skills, and opportunities to involve in sustainable income generating activities to overcome the impacts of climate change hazard. Most of the pastoral households and individuals are not well educated and aware to practice scientific coping and adaptation strategies to reduce the undesirable impacts of climate change and variation, and to sustain their means of livelihoods. Lack of awareness and training is also another major factor that determines to implement adaptation options in the study area (see Table 6.3). They have limited opportunities to improve their knowledge, skill, and attitude how to practice coping and adaptation alternatives in the area. Knowledge, skill and attitudinal change through training and education enable households to accept and implement scientific adaptation strategies and can sustain their livelihoods. Gordon and Graig (2001) state that educated people have a better options than non-educated family members to practice various adaptation strategies in the area. Well-educated and experienced individuals have better possibility to involve in different employment opportunities as an adaptation strategy in other areas, and can distribute their experience through advice to other people how to improve their means of living.

6.4. The role of institutions in enhancing and/or hindering adaptation strategies to the impacts of climate change

Pastoralists live in the dry and semi-dry areas of the country. They have been culturally, socially, economically and politically marginalised and underprivileged group of people. They did not have full rights to design and implement local development plans, and their free mobility have been limited by regional boundary demarcations and by inter- and intra-ethnic conflicts. Their livelihoods have been highly affected by the inhospitable climate and a degraded environment (Rahmato, 2007).

Institutional and social factors play a key role in shaping the extent of pastoralists' vulnerability to climate change and variability. Institutions are important factors for pastoralist to enhance or hinder their coping and adaptation strategies. National, regional and local institutions have greater roles in supporting how pastoralist respond to climate change impacts and manage the very fragile and scarce resource in the area. Since adaptation to climate change is local, indigenous institutions shaping adaptation strategies and improving the capacities of the most vulnerable group of people. Agrawal (2008) pointed out the function of local institutions in adaptation to climate change. He emphasised that climate change impacts adversely affects the overlooked and underprivileged social segments more disproportionately, and that indigenous institutions centrally influence how various social groups gain access to and control over to use limited resources. Agrawal (2008) further added that adaptation to climate change is inevitable local and institutions influence adaptation and climate susceptibility in three critical ways: a) they structure impacts and vulnerability, b) they mediate between individual and collective responses to climate change impacts and thereby shape the outcomes of adaptation, and c) they act as the means of delivery of external resource to facilitate adaptation, and thus govern access to such resource.

The indigenous institution leaders can call up on the better-off households to support the vulnerable group of pastoral people, which is apparently more available than in other African countries, perhaps because of the range of traditional institutions of mutual support in Somali culture. There are indigenous mechanisms for redistributing asset such as food, cash, *zakaat*, animals and labour, either on a reciprocal basis or from wealthier to poorer households. These are vital mechanisms to minimise the impacts of climate change.

Sampled respondents were asked to answer the types of advices and support that institutions provided for pastoral communities to be practiced as a coping and adaptation strategies in the study area. Respondents provided the types of advices and supports that institutions and organizations encourage pastoralist to practice as coping mechanisms and adaptation strategies includes encouraging pastoralist to settle in a specific area (90.8%), cutting and carrying fodder (87.5%), encouraging pastoralist to diversify their means of livelihoods (85.8%), planting trees and conserving soil (75.8%) and destocking during drought (68.3%). Both indigenous and modern institutions play a major role in enhancing and determining what alternatives pastoral households and individuals have to cope with and adapt to climate change.

Table 6.4. Advice and support from institutions and organizations about climate change

Types of advices and supports	Yes (%)	No (%)
Destocking during drought	68.3	31.7
Splitting herds	47.5	52.5
Encourage us to settle in a specific area	90.8	9.2
Cutting and carrying fodder	87.5	12.5
Provide improved animal feeds	42.5	57.5
Training about context based adaptation strategies	35.8	64.2
Planting trees and conserving soil	75.8	24.2
Encourage us to diversify means of livelihoods	85.8	14.2

Source: Field survey, 2019/20

During focus group discussions, experts pointed out that indigenous institutions are constructed with a very complex cultural and social network that serves as a social cohesion and livelihood-related problems. These institutions reinforce ethnic solidarity, and provide informal insurance

for the pastoralists that deliver some protection against the extreme variability of pastoralists' livelihoods. By combining voluntary and compulsory social networks of resource redistribution, the indigenous institutions play major roles in solving problems ranging from daily food problems with loss of herds through prolonged drought or other man-make factors. Indigenous institutions also encourage the pastoral communities to conserve their natural resources through planting trees and soil conservation.

Elders confirmed that the indigenous institutions play a major role in maintaining mutual support among clans and sub-clans in Somali region in general and in Sitti zone in particular where livestock rearing provides the major livelihood source. Social security and network is much more deeply embedded within the culture of the pastoral communities. There is complex mutual assistance rules of redistribution of assets such as religious rules (*zakaat*) and social norms which mean that food, cash, livestock and labour are often redistributed at the community or society level. These arrangements build social unity, sustain the social order and give a level of social security that goes beyond social support to cope with and adapt climate change impacts and other man made hazards.

Key informant interview participants reported that indigenous institutions play a better role in shaping the way that climate change hazards impact pastoral households and individuals. Formal institutions have often criticised the contribution of indigenous institutions and have exacerbated the conflict among clan and ethnic groups, while unable to fit with the complexity of range ecosystems and pastoral resource management. Nowadays the crucial role of indigenous institutions and their capacity to mobilise pastoral communities to enhance proper management and utilisation of scarce and variable resource base is increasingly acknowledged. On the other side, it is recognised that indigenous institutions may not be enough to sustain pastoralist's

adaptive capacities alone in the future. Thus, both indigenous and formal institutions should be integrated to improve and sustain the livelihoods of the pastoral communities.

Generally, indigenous institution leaders encourage and advise pastoral communities to practice various coping and adaptation options such as engage in diversification, destocking during drought season, splitting livestock and families, conserve and wise use of scarce resource and mobility to better area based on the available drought information system. According to the Department of Justice and Constitutional Development (2008), indigenous institutions leaders play an important role at the ordinary societies' level in relation to socio-cultural and economic development, and the administration of justice in the modern political system. They play two key roles: a proactive role to promote social cohesion, peace, harmony and co-existence; and a reactive role in resolving disputes which have already occurred. Broadly speaking, indigenous institutions shape the impacts of climate change hazards in three important methods: they influence how households are affected by climate impacts; they shape the capability of households to adapt to climate change impacts and follow different adaptation practices; and they mediate the flow of external interventions in the context of adaptation.

Key informants and focus group discussants revealed that modern institutions over the last several decades had not supported the efforts of pastoralist's response mechanisms to the impacts of climate change hazards because of the presence of negative attitudes towards pastoralism. This negative attitude of modern institutions towards pastoralism and pastoral land and other resource use in particular emanated from inadequate understanding of the rationale of pastoralism and of the fact that it is a rational system in which mobility is a key adaptation strategy. They did not understand as pastoralist are the natural resource manager within a very harsh climatic conditions which maintain ecological balance among the three pillars of

pastoralism such as people, livestock and resource (pasture and water sources). Pastoralists' adaptation strategy especially mobility has been restricted through extensive land expropriation. Researchers argued that in the past, rearing of herds was considered as a backward livelihood system and environmentally unfriendly production system. They also considered pastoral communities as change resistant and very traditional people with insignificant contribution to GDP of the country. Government and NGOs have often perceived pastoralism as environmentally destructive, due to the supposed incapability of communal systems to control grazing land use and overstocking, unavoidably leading to overgrazing and wasteful livestock management (Oygard *et al.*, 1999). Consequently, modern institutions implemented various development interventions as coping and adaptation strategies include forced destocking, settlement, land tenure modifications and others without the will of the pastoral communities (Ellis and Swift, 1988).

Pastoral communities have been economically, culturally, socially and politically marginalized from the centre. The causes for development challenges faced pastoralist include: The absence of strong and functional government institutions and limited public participation in local decision-making processes; poor access to social services, especially mobile school and health centre; reliance on climate sensitive type of extensive herds production with poorly developed support services, and weak access to markets; irreversible environmental degradation, particularly rangeland and water; vulnerability to prolonged droughts and long dry seasons aggravated by climate change; and increasing competition over scarce natural resource use (pasture and water) and leads to ethnic conflict (MoARD, 2013).

Even though there are still many challenges in the development and implementation of government policies and strategies in favour of pastoralist, there are positive changes with

modern institutional structures with regard to pastoralism. The modern institutions play important roles in the processes of pastoralist's coping and adaptation strategies through the development and implementations of various strategies to overcome the impacts of climate change in the area.

The government recognises pastoralism as a livelihood system and has many positive efforts to improve livestock development and veterinary and social services. Government in the region has also given prominence to pastoralism within its formal institutions. There is a parliamentary pastoral standing committee in Ethiopia. There is a growing pastoral civil society movement raising pastoralist issues at the national level (for example, National Pastoral Day) and in some countries leading high profile land rights campaigns. Many NGOs and donors are increasingly supporting development efforts in pastoral areas.

Key informants reported that the government develops different coping and adaptation strategies for the pastoral societies to withstand the existing climate change in the area. Among various strategies, leading a sedentary way of life through settlement is the major one. The government understands that the traditional mobile way of life cannot sustain and fulfil means of livelihoods of the pastoral communities. Competition over scarce resources (pasture and water source) among pastoralist becomes the major source of conflict between clans and ethnic groups.

Key informant interview with Development Agents revealed that the availability of natural resource has been degraded due to prolonged drought, environmental degradation and overgrazing. As a result, the government decided to implement the settlement program as an adaptation strategy without the consent of the pastoral communities and without fulfilling basic infrastructures such as water, road, telecommunication, electricity, health centre and school. However, the perception and attitude of the majority of pastoral society towards settlement was

negative as elders said. Only few pastoralists are willing to lead sedentary way of life. Even though the government invested a huge amount of capital to dig out around 70 water boreholes and buried water pipe to practice irrigation, people destroyed these infrastructures during night time.

The government developed the pastoral policy in 2002. This policy focuses on sedentarisation of pastoralist without their willing along the banks of the key rivers. The main objective of this policy was to change the pastoral societies into agro-pastoral systems, from mobility to a sedentary way of life, from a spread population to small pastoral towns and urbanization. The policy intended to fulfil different basic infrastructures such as irrigation, fixed and mobile education and health services as well as rural roads, water supply and rural energy, rural telephone services etc. However, sedentarisation as adaptation strategy particularly as drought responses mechanism has been implemented in a context where access to animal health service is limited or non-existent, water services are scarce, markets do not fully function, access to land, access to education and health centre is often absent and conflict is common (MoFED, 2002).

Modern institutions also encourage and support pastoral communities to practice coping and adaptation options include livelihood diversification, destocking during the occurrence of severe drought, herd splitting, planting trees and soil conservation, distribution of local breed and address livestock movement and cutting and carrying fodders. Key informants pointed out that although livestock rearing stays the backbone of the livelihood, pastoral communities are seeking different activities to boost and steady their means of living. They realised that they no longer confined to rearing of livestock only but combining a range of jobs to build diverse portfolio of

activities is relevant to their survival. Livestock-based livelihoods of pastoral communities are becoming unsustainable and highly vulnerable to natural disasters.

The Ethiopian government has already designed and implemented policies, strategies and programs that intend to enhance the adaptive capacity of the pastoral people and reduce the extent of vulnerability to climate change and variability. For instance, the five year GTP (2005/6-2009/10) devoted to pastoral development include focusing on livestock resource development, giving emphasis on water resource development, improvement of pasture land and the development of irrigation schemes, the provision and expansion of social services and infrastructures to underserved communities, implement settlement program and selection and distribution of local breeds, animal health services, natural resource management and the establishment of livestock marketing (MoFED, 2010). However, due to lack of commitment and weak capacity of government institutions to implement policies and strategies in the past decades, still pastoral communities are highly vulnerable to the adverse impacts of climate change.

The development and implementation of inappropriate policies and strategies to pastoral area accelerate the vulnerability of pastoral communities to the impacts of climate change risks. Short-term livelihoods-based climate change response mechanisms may not solve further structural weakening of the pastoralist livelihood system. Climate change, particularly prolonged drought response strategies take place in a context where access to livestock health care is inadequate, water sources are very limited, markets do not fully function, access to land is often restricted and conflict is common. Local context based development policies and strategies can solve the impacts of climate change on the livelihoods of the pastoral communities. This means that drought preparedness can only be effective if it is underpinned by policies to strengthen the

overall resilience of pastoralist's livelihood systems. Land tenure and land use policies in pastoral area are also considered as a major constraint to practice adaptation strategies. Traditional titles to communal grazing land are not officially practiced, and the fertile land is being progressively taken over for investors. As a result, pastoralists have undermined their coping strategies, starting from mobility, and have fuelled intra and inter-ethnic conflict.

6.5. Conclusion

This chapter discussed the results of the research on coping and adaptation strategies, enabling factors and/or constraining the efforts of adaptation strategies to the impacts of climate variability and the role of institutions in enhancing and/or hindering adaptation strategies to the impacts of climate change. Results from the study indicate that, faced with the challenges posed by climate change and variability, pastoral communities have a long period of experience, skills and knowledge to practice various types of adaptation strategies in order to withstand the adverse impacts of climate change and variability. Short term coping mechanisms includes fewer meals per day, looking for relief aid and support through social networks and informal institutions, destocking during the occurrence of prolonged drought and herd splitting. The major long-term adaptation strategies practiced by pastoralist include livestock mobility, selling of firewood and charcoal, livestock diversification, migration to towns, remittance and petty trading. While such coping mechanisms support pastoralists to survive with hard times in the short-term, some of them contain a potential effect to decrease one's resource base in the long-term.

Pastoral climate change and variability adaptation practice is enabled by indigenous knowledge, skill, traditional early warning system, access to extension services and access to institutions. Major constraints to practice adaptation strategies include rangeland degradation, scarcity of asset, regionalism that restricts mobility, wealth, bush encroachment, education and

household size. Even though both indigenous and modern institutions play major role to enhance pastoralist to practice coping and adaptation strategies, indigenous institutions take a lion share to withstand the impacts of climate change hazards. At the same time, the two institutions also negatively affect pastoralist's effort to practice short-term and long-term response strategies to reduce the adverse impacts of climate change and variability in the area.

CHAPTER SEVEN: SYNTHESIS OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

7.1. Introduction

This thesis dealt with analysis of pastoralists' perception, livelihood vulnerability and adaptation strategies to the impacts of climate change and variability. The study tried to compile different views, thinking and concepts on climate change and variability issues in the context of pastoralists Somali region of Ethiopia. The whole process of the study attempted to clearly outline the socioeconomic conditions of the pastoral communities, their perceptions to climate variability and the extent of livelihood vulnerability to climate change and variability. In addition, the types of coping mechanisms and adaptation strategies, constraints of coping and adaptation strategies and the role of institutions in enhancing and/or hindering coping and adaptation strategies to the impact of climate change and variability were analysed. This chapter therefore attempts to synthesis the major findings, and then provides conclusion and recommendations.

It is evident that climate variability and change is basically taken as a sustainable development issue. Key natural resources particularly grazing land and water sources are vulnerable to changes in climatic conditions including prolonged drought, shortage of rainfall and intense temperature. Economic activities such as livestock herding, crop farming, energy production and water supply that depend on these natural resources are, therefore, sensitive to climate variations. Thus, climate change and variability represents an additional pressure on the natural resource base of Ethiopia which is already affected by increasing resource demands, unsustainable management practices and environmental degradation. These stresses will interact

in different ways across the different regions but can be expected to reduce the capacity of some ecological systems to provide, on a sustained basis, goods and services needed for successful economic and social development including adequate food and feed, good health, water and energy supplies, employment opportunities and social advancement (Epsilon International, 2011).

7.2. Synthesis of key findings

This study analysed pastoralists' perceptions of the impacts of climate change and variability, the extent of livelihood vulnerability to the impacts of climate change and variability, climate change coping and adaptation strategies and the role of institutions in enabling and/or hindering adaptation strategies to the impact of climate change and variability. Taking note of this, the synthesis of the findings, conclusions and recommendations are indicated below.

7.2.1. Key findings on pastoralists' perceptions of the impact of climate change and variability

Pastoralists recognised that climate change and climate variability already existed, and has profound impact on their livelihoods with the increasing frequency and intensity of climate variability related disasters such as high temperature, prolonged droughts, rainfall variability, the occurrence of new livestock and human diseases and resource degradation.

Pastoral communities also highlighted what they believe to be the main causes of climate change in their area. They cited the following factors as the major causes of climate change, that is, Allah, deforestation due to charcoal production, overgrazing, land use change and mismanagement of water and soil resources. Some respondents reported as they didn't know the causes of climate change and variability. The perceptions of pastoralists and their understanding of the causes of climate change are not synonymous with the perceptions of experts. The

perceptions of pastoralists emanate from their belief and life experiences with the local environment; and their worldviews are highly confined to the local area, often delinked from the global phenomenon. For example, they never attributed the cause of climate change with the emission of greenhouse gases from industries. Instead, they associated climate variability on Allah's punishment in response to people's disobedience to Allah's ways. Hence, according to them, the changing climate is due to Allah's retribution to mankind, and Allah can reverse climate change if they accept responsibility for their actions.

Pastoral areas are characterised by various forms of manifestations of climate variability that mark the real occurrence of climate change including the occurrence of prolonged droughts, declining rainfall amounts, heat stress, outbreak of new human and livestock diseases, scarcity of pasture and water sources, rainfall variability and severe environmental degradation. All of these climate change stressors affect pastoralists' coping mechanisms and adaptation strategies, which jeopardises the mainstay of their livelihoods (Fratkin, 2014). The existing information and community observations indicated that climate change coupled with other stresses is highly affecting ecosystems and biodiversity resources of the pastoralist areas.

Sources of scientific information about climate change in pastoral communities are very important to protect their livelihoods destruction from climate change induced hazards. According to the household survey results, development agents, Ethiopian Meteorological Agency and mass media, life experience, indigenous early warning system and local authorities are important sources of climate change information in pastoralist communities. In addition to scientific climate change information system, there are traditional climate variability forecasters who acquired local knowledge from their ancestors on how to predict, interpret and disseminate climate change hazard information for the pastoral communities including astronomical

observation, wind direction, animal behaviour, animal intestines, ground water level, cloud cover pattern, earth crack and spider net. However, the traditional climate change and variability forecasters' interest and commitment decline gradually in predicting and disseminating climate change information, and religious leaders also consider the traditional climate change forecasting as a sin that contradicts with religion.

7.2.2. Key findings on pastoral livelihood vulnerability to climate change and variability

Among the multiple climate stressors, drought was considered as the number one climatic variability hazards that causes decline of the productivity and number of livestock, outbreak of new livestock diseases, food insecurity, decrease in the quality and quantity of pasture, scarcity of water availability, and abnormal mobility of pastoral communities in order to search better pasture and water sources. Devereux (2006) argues that prolonged drought and long dry seasons are the main causes that lead to the decline of the stock of resources such as grazing lands, water points, and forests, livestock and livestock products. Such resource degradation causes herders to migrate to other areas, leading to resource competition and conflict.

Livestock population is drastically declining due to the combined effects of climatic stressors and restocking becomes too difficult because of the highly degradation of pastoralists' adaptive capacity to the changed climatic conditions. The findings also indicated that livestock rearing and other non-farm activities are not only affected by the occurrence of multiple climatic stressors, but also by the shortage or absence of well-educated and organised public extension education, shortage of animal health service and lack of qualified and committed staffs to support the efforts of pastoral communities to overcome the impacts of climate change on their livelihoods.

Respondents identified that the major signals of livelihood vulnerability to climate change include decline the pasture lands in both qualities and quantities, death of livestock, reduction of water availability, reduction of livestock products and price, environmental degradation, food insecurity, heat stress, the occurrence of human and livestock disease and migration of family members to other areas in search of additional income for their families. Climate change-induced droughts and degradation of rangelands forced pastoralists to migrate to other places in search of feed and water resources.

Climate change and variability is increasingly affecting the vulnerable group of pastoral communities, who often have the least ability to withstand the unfavourable impacts of climate change and variability. The result indicated that livelihood strategies, inadequate education, access to resources, poor local institutional capacity and services, and gender were the key factors that shape vulnerability and add to increased vulnerability to climate variability. The most vulnerable pastoralists have limited capability to withstand the impact of climate change events. The extent and magnitude of the vulnerability of pastoral livelihoods to climate change are determined by the accessibility, availability and ownership of livelihood assets at individual, household and community level. Mitchel and Tanner (2006) argued that the extent of pastoralists' vulnerability to climate change varies broadly within time, regions, nations, communities and households' access to and control of natural, human, social, physical, political and financial resources.

Peoples' vulnerability to the undesired impacts of climate change varies across environments and communities depending on the extent of exposure, sensitivity and adaptive capacity to climate-related hazards. The household survey result shows that the most vulnerable group of pastoral people to the impacts of climate changes are women, children, the poor,

disabled people, the marginalised female-headed households and old people. The differential vulnerability exists within communities. Women particularly face restricted access to information, resources, services and decision-making power. Kasperson and Kasperson (2001) argue that climate change impacts are expected to disproportionately affect the women, female-headed households, poor, young, elderly, sick, and otherwise marginalised populations.

In terms of the sources of livelihoods, household survey results indicated that the first four main livelihood sources in terms of their importance for the pastoral communities include rearing of livestock, charcoal production, firewood collection, remittances and relief aid. Even though the number of livestock and their productivity is significantly affected by the scarcity of pasture and water sources coupled with the outbreak of new livestock diseases, the majority of the households still engage in the rearing of livestock as the main source of livelihoods and the mainstay of their employment, income and status.

7.2.3. Key findings on coping mechanisms and adaptation strategies to climate change

Policy makers have formulated policies that have focused on coping and adaptation strategies. However, at times, those policies do not take into account the context of the area, the culture and social structure of the society. Pastoral communities have long experiences, skill and indigenous knowledge on how to respond to climate change and its impacts on their daily lives. Results from survey data indicates that households implemented a combination of various reactive forms of both coping mechanisms and adaptation strategies to reduce the negative impacts of climate change and variability.

In recent times, mobility is restricted by the influence of climate change, regional boundary and scarce resource competition which results in ethnic conflicts. Traditionally, pastoral communities were predominantly a cattle rearing pastoral system in the study area.

However, most pastoralists now try to diversify their livestock species, to include browsers (camels and goats) as an alternative adaptation strategy. Livestock diversification allows households to sustain herds that feed on various species of plants, increasing their alternatives for exploiting resources from the rangeland. In this regard study conducted by Mandleni and Anim (2011) confirmed that pastoralists usually diversify their livestock species to efficiently exploit the limited resources (pasture and water) and that livestock diversification as adaptation strategy is possible through maintaining mixed livestock which can withstand climate change impacts.

Although charcoal production and collection of firewood leads gradually to massive deforestation in the area, large numbers of pastoral communities still highly depend on such activities as a response strategy to withstand the impacts of climate change. The main driving force to engage in charcoal production is the deterioration of livestock size and livestock production. Livestock and livestock product selling are considered as very important adaptation strategy and sources of cash for most pastoral households in the study area. However, the size and productivity of livestock has been deteriorating gradually due to climate change-related hazards in the area.

As risk reduction mechanism during the recurrent, long dry seasons, many households split their livestock into weak and strong herds. The weak livestock was kept near the permanent homesteads and fed with supplementary feeds while the strong ones were moved to distant areas in order to search for better pastures and water sources. During drought seasons, pastoral communities have also an indigenous culture of resource distribution from the better-off households to the poor households. Such sharing of resources is often in the form of cash, livestock transfer among clans, or sharing of milking herds among friends and relatives. However, the scope of supporting the vulnerable pastoralists is now shrinking from the clan to

their immediate family members. Migration and remittances are also becoming an increasingly attractive adaptation strategy for pastoralists to avert the impacts of climate change and variability. Deprived households send their youths, mainly girls to join informal labour migration in order to support with remittances those left in rural areas while rich households moved members of their family to towns to accumulate additional capital.

The practice of different adaptation strategies is determined by social, cultural and economic endowments of households and communities, and their ecological location, networks of social and institutional relationships, institutional articulation and access, and access to resources and power. Indigenous knowledge, trust among pastoralist, norms, values and long experiences are some of the enabling environment for the pastoral communities to make decisions and then implement various forms of coping and adaptation strategies to reduce the impacts of climate change. Indigenous ways of information exchange about weather conditions, security and epidemic diseases among pastoral communities provide important information to make decisions and practice various forms of indigenous coping and adaptation strategies to minimise the adverse impacts of climate change in the area.

Pastoralists' capability to adjust to the changed climatic conditions is determined by various factors. The household survey result indicates that a number of factors influence pastoralists' coping mechanisms and adaptation strategies in the face of climate change related hazards including rangeland degradation, scarcity of assets, regionalism that restrict mobility, bush encroachment, education and household size. Conflict, income, lack of awareness and training, gender, age and experience are other factors that determine pastoralists' coping and adaptation strategies to climate change.

Both indigenous and modern institutions play a major role in enhancing and determining what alternatives pastoral households and individuals have to cope with and adapt to climate change and variability. Respondents identified that modern institutions encourage pastoral communities to implement coping mechanisms and adaptation strategies including encouraging them to settle in a specific area, cutting and carrying fodder, encouraging pastoralists to diversify their means of livelihoods, planting trees, conserving soil and destocking during drought season. Indigenous institutions play an enabling role to prevent and resolve the impacts of man-made and natural hazards, and to create opportunities among pastoral communities to access and fairly exploit various scarce resources to withstand the impacts of climate change.

7.3. Conclusions

The study was conducted to analyse perceptions, livelihood vulnerability and adaptation strategies of pastoral communities within the context of climate change and variability in Ethiopia focused in Sitti zone, Somali regional state. By taking into account all issues researched in the study, the following major conclusion can be drawn.

Perception on climatic variations was studied from both pastoralists and experts of different institutions point of view. The survey result indicates that most of the respondents recognised climate change and variability as a real phenomenon in the study area, but they didn't know the real scientific causes of climate variability. They highly linked the causes of climate variability with the punishment of Allah in response to peoples' failure to obey. This means that while pastoralists acknowledge that the climatic condition is changing, they believe that Allah was in control of the weather conditions and left them powerless. This scenario is likely to affect pastoralists' effort to withstand climatic hazards and adaptation to climate change at individual,

household and community level. This is therefore the result indicates the need for launching awareness creation campaigns on the causes of the changes in climatic conditions and on measures that should be taken at household and community level.

According to the study results, pastoralist communities are aware of various indicators of climate change and variability in the study area. Accordingly, occurrence of drought, variation in rainfall amount and distribution, delayed onset and early cessation of rainfall, rise in temperature, frequent dry spells, failure of the short rainy season that is vital for grazing development, and decline of water sources are perceived by the majority of pastoral households as indicators of climate change. Among the major indicators of climate change, drought became a persistent climate variability problem that severely affects the livelihoods of pastoral communities over the past several decades. Death of livestock due to prolonged droughts is a very challenging problem that deteriorate the adaptive capacity of the pastoralist communities. Hence, there is a need for context based scientific intervention to support and solve the scarcity of pasture and water for pastoralists' livestock during drought season.

Climate change information is highly demanded by the majority of pastoral communities to prevent the adverse impacts of climate change and variability on their livelihoods. The result of the study shows that pastoralist communities over the years have developed indigenous knowledge and skills of predicting and disseminating useful information about climate change and variability. Currently, however, religious leaders discourage such indigenous methods of predicting and disseminating of climatic variation information to the pastoral communities. Consequently, pastoral communities will face challenges to design and implement efficient coping mechanisms and adaptation strategies to avert the adverse impacts of climate variability.

Pastoralism becomes the most vulnerable livelihood system due to the impacts of climate change and variability. Climate variability causes in decline of productivity and number of livestock, outbreak of livestock disease, food insecurity, wide spread of poverty, decrease grazing land in qualities and quantities, scarcity of water sources and unplanned mobility of pastoralists in search of pasture and water source. The study result also indicates that climate change and variability is not the only sole factor that affects pastoralism but also shortage of human capitals and absence of context based policies and strategies are additional factors that affect the livelihoods of the pastoral communities in the study area.

The extent and magnitude of livelihood vulnerability to climate change varies across environment and communities depending on the exposure, sensitivity and adaptive capacity to climate change-related shocks. Pastoral communities characterised with scarce natural resources, and those in drought-prone lowland areas are disproportionately vulnerable to the impacts of climate change. The study result indicates that women, children, disabled people and female-headed households are the most vulnerable group of pastoral people to the impacts of climate change in the area. Because of differences in wealth status, power, decision-making, social networks, skill, experience and resource accessibility and control over within the communities, peoples' vulnerability to climate change and their capacity to adapt to this impact also vary in time and space. Resilience interventions should therefore be targeting specific vulnerable group of pastoral people.

Pastoral communities are already engaging in various types of coping mechanisms and adaptation strategies as a response strategy to withstand the adverse impacts of climate change in the area. They have indigenous knowledge and skills on how to respond to climate change and variability. Although herd mobility is one of the key indigenous forms of adaptation strategies,

mobility in recent times is facing various challenges due to the absence of alternative grazing land, introduction of ethnic based regional boundary and development of enmity among ethnic groups which results conflict. Pastoralists' adaptation strategies to climate variability is determined by various types of constraints such as rangeland degradation, scarcity of assets, regional boundary, education, household size, extension service and lack of training and awareness. Both indigenous institutions and modern institutions have a vital role to play in supporting pastoralists' coping mechanisms and adaptation strategies to the impacts of climate change and variability.

7.4. Recommendations

From the results of this study, a number of recommendations can be made to withstand and gradually reverse the negative impacts of climate change and variability on the livelihoods of pastoral communities. Firstly, both pastoralists and various experts recognise the main causes of climate change and variability differently. The majority of pastoralists linked the causes of climate change and variability with the work of Allah's punishment in response to peoples' sin while experts and other officials attributed with global warming and environmental degradation. It is therefore the government and NGOs should work to narrow scientific knowledge gaps among pastoral communities through continuous awareness creation programs by using local media with local language, training and discussion forums with pastoral communities about the main causes of climate change and variability.

Secondly, Pastoral communities have practiced a wide range of their own indigenous forecasting system to predict and disseminate potential climatic change hazards and prevent their impacts. Currently, however, such traditional method of interpreting and disseminating of climatic variation information to the pastoral communities are discouraged by religious leaders.

It is, therefore, recommended that there is a need for developing the trust of the pastoral communities by creating awareness on religious leaders, local government officials and communities that traditional forecasting base on indigenous knowledge, skills and experiences and, hence, should not be considered as a sinful acts. In addition, the use of available technologies particularly community radio and mobile phones is an effective means to win back the trust of pastoral communities towards traditional weather forecasting systems in the study area.

Thirdly, government policies and strategies need to depend on the principle of sustainable livelihoods. This means enhancing livelihood resources that contribute towards improved adaptive capacity. The findings indicated that pastoralists suffer acute shortage of various types of assets (for instance, natural asset and human asset). Scarcity of pasture in both quality and quantities and water availability due to occurrence of long dry seasons results in the decline of the productivity and number of livestock at an alarming rate. Governments' and other stakeholders' policy intervention to sustain livelihood asset should focus on the expansion of pastoralists' livelihood options and reduce the extent and magnitude of vulnerability to climate change. Instead of top-down imposing solutions, the government (from federal to local level) should be flexible, ready to learn from the local communities and act as a facilitator. In addition, based on the context of the area, the government and other stakeholders should enhance alternative livelihoods opportunities for the local pastoralists to make their own decisions since they have accumulated indigenous knowledge, skill and experience how to survive and gradually sustain their assets within harsh climate conditions.

Fourthly, major drivers of livelihood vulnerability in pastoral communities in the study area include the decline in pasture lands in quality and quantities, death of livestock due to

prolonged droughts, reduction of water availability, reduction of livestock products and price, environmental degradation, food insecurity, heat stress and the occurrence of human and livestock disease. Tangible interventions (for instance, development of infrastructures, construction of mobile school, veterinary services, health service, and so on) based on the context of the area should be taken by the government and other stakeholders with the consultation of local community leaders to address the above mentioned drivers of vulnerability in the study area.

Fifth, Somali culture has developed a range of resource redistribution mechanisms that serve to develop social cohesion in good times and spread risk in bad times. Redistribution of asset and supporting the highly vulnerable households or those who have lost assets due to climate change hazards was a common phenomenon among pastoral communities. These indigenous ways of giving and sharing mechanisms remain important, but are on the decline and restricted from the clan to relatives and their friends due to the increasing number of households in need of assistance, increase in the frequency of extreme climatic events and asset losses and might be the impacts of globalisation. Thus, instead of focusing on relief aid and safety net program which backup political objective and gradually develop dependency syndrome among pastoralists, Ministry of Federal and Pastoral Affairs and its line regional authorities should form strong coordination among indigenous institution and religious leaders to maintain and sustain the indigenous social protection systems or informal insurance among pastoral communities.

Sixth, pastoral communities are disproportionately vulnerable to the adverse impacts of climate change and variability. Among the vulnerable group of people, women are the most vulnerable group due to lack of accessibility and control over different forms of livelihood resources. They are overburden with gender triple roles and have not equal opportunities and

equities to engage in various income generating activities. Improving women's ability to adapt the sever impacts of climate change and variability in the study area needs strong collaboration and commitment between modern institutions and indigenous institutions. Therefore, Ministry of Federal and Pastoral affaires, Ministry of Women, Children and Youth Affairs, indigenous institutions and other concerned stakeholders should form strong coordination and give due attention at least to implement properly the existing policies, strategies and programs to ensure women's equality and equity among male partners.

Seventh, different types of enabling and constraining factors to the implementation of coping mechanisms and adaptation strategies were investigated. The successful implementation of coping and adaptation strategies will depend on the strong integration of government, development practitioners and other stakeholders to address major constraints of coping and adaptation strategies and building on existing better enabling conditions. Addressing constraints to cope and adapt, and build an enabling conditions should need strong coordination from federal to national level.

Finally, pastoral communities have long used coping and adaptation strategies in order to withstand the negative impacts of climate change and climate variability. However, such lifelong coping and adaptation strategies have failed to sustain their livelihoods in the area. Thus, governmental organisations, non-governmental organisations and other stakeholders should integrate both indigenous and modern types of coping and adaptation strategies to withstand the impacts of climate change and sustain the livelihoods of the vulnerable group of the pastoral communities.

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APPENDICES

Appendix I: Survey Questionnaire for Pastoral Households

University of South Africa (UNISA)

Department of Development Studies

Background information:

The purpose of this questionnaire is to collect data about the **"**Climate Change, Pastoral Livelihood Vulnerability and Adaptation Strategies: a Case Study of Sitti Zone, Somali Regional State in Eastern Ethiopia**."** This questionnaire is prepared only for academic purposes. Therefore, you are requested to kindly answer the given questions in which confidentiality of any information provided is guaranteed and valued. The results of the questionnaire will be used only for research purpose. The quality and success of this study depends on the validity and reliability of the information that you will provide for the researcher; therefore, you are requested to kindly give your genuine responses.

Thank you in advance for your willingness and cooperation to answer questions.

Household identification

A. Questionnaire Number _____ D. Name of Villages_____

B. Name of the district/woreda _____ E. Date of Interview_____

C. Name of kebele administration _____

Section 1: Demographic Characteristics

1.1. Sex of household head: 1. Male 2. Female

1.2. Age of the respondent (in years)

1. < 21 2. 21-30 3. 31-40 4. 41-50 5. 51-60 6. >60

1.3. Marital status: 1. Married 2. Single 3. Divorced 4. widowed

1.4. Family size: Number of permanent household members (including household head) at the time of survey: 1. Male _____ 2. Female _____ 3. Total _____

1.5. Number of Dependents that are less than 14years and above 65years old_____

1.6. Educational level of the respondent

1. Non-literate 2. Read and writes 3. Primary level education (grade 1-4)
4. Junior level education (grade 5-8) 5. High school education (grade 9-12)
6. College Diploma 7. University degree 8. Other, specify_____

Section 2: Pastoralists' Perceptions to Climate Change

2.1. Do you think that climate change and variability is happening in your local area for the last 10 years? 1. Yes 2. No 3. I do not know

2.2. Based on your opinion, what are the causes of climate change and variability in your area?

1. Deforestation 2. Overgrazing 3. From Allah/God 4. I don't know

5. Other, specify_____

2.3. Based on your observation, what are the manifestations of climate change in your area? (Multiple answers are possible).

S.N.	Manifestations of climate change	Rank out the manifestations of climate change				
		1st	2nd	3rd	4th	5th
1.	Occurrence of prolonged drought					
2.	Death of livestock due to drought					
3.	Occurrence of Floods					
4.	Outbreak of new Livestock disease					
5.	Decrease the amount of rainfall					
6.	Rainfall variability (early and late rainfall)					
7.	Erratic rainfall					

8.	Stiff resource scarcity and competition					
9.	Degradation of some species of grasses					
10.	Environmental degradations					
11.	Scarcity of rangeland and water sources					
12.	Heat stress					
13.	Wind					
14.	Other, specify_____					

2.4. Where did you heard about climate change and variability? (Multiple answers are possible).

1. Development agents (DAs) 2. Ethiopian Meteorological Agency (EMA) and Mass media 3. Community meetings 4. From your life experience

5. Training 6. From indigenous way of early warning systems 7. NGOs

8. From National and local authority 9. Others, specify_____

2.5. How many times drought occurred within last ten years?

1. Once 2. Two times 3. Three times 4. Four times 5. Five times 6. Six times

7. Seven and more than times 8. Every year

2.6. Do you consider climate change as a serious problem to your livelihoods? 1. Yes 2.No

Section 3: Livelihood Resources, Activities and Vulnerability to Climate Change

3.1. Did you have access to the following human capital in the last year?

S.N.	Human capitals	Answer (1=Yes, 2=No)
1.	Health facilities	
2.	Adequate nutrition	
3.	Education	
4.	Skill	

5.	Trainings/workshops	
6.	Others, specify_____	

3.2. Did you have access to use the following natural capital in the last year?

S.N.	Natural capital	Answer (1=Yes, 2=No)
1.	Arable land	
2.	Grazing land/pasture	
3.	Water accessibility	
4.	Forest products	
5.	Biodiversity	
6.	Other, specify:_____	

3.3. Did you have access to the following financial resources in the last year?

S.N.	Financial capital	Answer (1=Yes, 2=No)
1.	Livestock	
2.	Saving	
3.	Credits	
4.	Remittances	
5.	Pensions	
6.	Wages	
7.	Jewelry	
8.	Other, specify:_____	

3.4. Did you have the following Social Capital with your clan/ethnic groups?

S.N.	Social Capital	Answer (1=Yes, 2=No)
1.	Good network and connection	
2.	Trust and Mutual support	
3.	Formal and informal groups	
4.	Common rules and sanctions	

5.	Collective representations	
6.	Participation in decision making and leadership	
7.	Supporting each other (informal insurance)	
8.	Other, specify:_____	

3.5. Did you have access to the following physical capital in the last year?

S.N.	Physical capital	Answer (1=Yes, 2=No)
1.	Access to all weather road and transport	
2.	Housing and safe buildings	
3.	Access to water and sanitation	
4.	Clean and affordable energy sources (electricity, solar, etc)	
5.	Access to communication/information	
6.	Tools and equipment for production	
7.	Access to agricultural inputs	
8.	Other, specify:_____	

3.6. What are the main types of livelihoods activities for the household?

1. On-farm activities 2. Non-farm activities 1. Off-farm activities 4. Other, specify_____

3.7. What are the major sources of livelihoods at household level? (Rate their importance)

No.	Livelihood Activities	Very important	Important	Not sure	Less important	Not important
1.	Animal husbandry					
2.	Corp cultivation					
3.	Petty trading					
4.	Livestock trade					
5.	Permanent employment					

6.	Sale of fire wood and charcoal					
7.	Casual laborer					
8.	Rental house in town					
9.	Remittance					
10.	Pension allowance					
11.	Free relief aid					
12.	Food for work					
13.	Sale of handcrafts					
14.	Traditional medical practice					
15.	Hunting and gathering					
16.	Begging					
17.	Contraband trading					
18.	Others, specify_____.					

3.8. What type of animal species does the family have? (Tick)

1. Cattle____2. Camels____3. Goats_____4. Sheep_____5. Equines____ 6. Chickens____

3.9. What are the major constraints for livestock production? (Rank out their importance)

No.	Constraints	The most important constraints				
		1st	2nd	3rd	4th	5th
1.	Scarcity of pasture and water					
2.	Lack of fodder					
3.	Occurrence of prolonged drought					
4.	Prevalence of new livestock diseases					
5.	Lack of market for livestock and their products					
6.	Lack of market information					
7.	Lack of access to better breeds					
8.	Poor livestock management					
9.	Poor veterinary service					
10.	Cattle raiding					
11.	Others, specify_____.					

3.10. Rate the observed climatic stressors that affect pastoral livelihoods

Reported in Climatic stressors	Increased (%)	Same (%)	Decline (%)
occurrence of drought			
Heat waves			
Livestock diseases			
Human diseases			
Environmental degradation			
Bush encroachment			
Water availability			
Pasture quality and quantity			

3.11. Do you think that your means of living is **vulnerable to climate change**? 1. Yes 2. No

3.12. If yes, what types of vulnerability did you experience due to climate change in the area? (Multiple answers are possible).

S.N	Indicators of vulnerability	Yes (%)	No (%)
1.	Death of livestock due to prolonged drought		
2.	Reduced livestock productivity and price		
3.	Decline range in quantities and qualities		
4.	Decline the amount of surface and underground water		
5.	Food insecurity		
6.	Increase heat stress		
7.	Occurrence of human and livestock disease		
8.	Environmental degradations		
9.	Limited opportunities to move with their livestock		
10	Migration of household members to other areas		
11	Scarce resource induced conflict		
12	Occurrence of flood		
13	Other, specify----------		

3.13. How many livestock died in last year because of drought? _____

3.14. How did you observe the trends of the following means of your livelihoods?

S.N	Variables	1=Increased	2=Same	3=Declined
1.	Livestock population			
2.	Livestock disease			
3.	Livestock products (milk, meat, cheese, etc)			
4.	Non- farm income (trading, charcoal, daily laborer, handcrafts, renting asset, etc)			
5.	Pasture quality and quantity			
6.	Water availability			
7.	Food availability			
8.	Human health			
9.	Food price			
10.	Other, specify_____			

3.15. Which segments/groups of people are vulnerable to climate change impact? (Multiple answers are possible).

S.N	Segments of vulnerable people	Answer(extents of vulnerability)			
		Very high	High	Medium	Low
1.	Women				
2.	Children				
3.	Disabled people				
4.	Poor people				
5.	Middle income group of people				
6.	Rich people				
7.	Female headed household				
8.	Old aged people				
9.	Other, specify_____				

Section 4: Adaptations Strategies and Constraints to Climate Change

4.1. Did you practice coping mechanisms and adaptation strategies to withstand the impacts of climate change for the last ten years? A. Yes B. No

4.2. If your answer for question No. 4.1 is yes, did you practice the following coping and adaptation strategies?

S.N	Coping and adaptation strategies	Yes (%)	No (%)
1.	Rearing of drought resistant livestock		
2.	Selling of livestock and livestock products		
3.	Governmental and NGOs aid		
4.	Relied on remittance		
5.	Herd splitting		
6.	Sharing food from their clans		
7.	Fewer meals per day		
8.	Migration to other countries		
9.	Selling of fire wood and charcoal		
10.	Livelihood diversification		
11.	Daily laborer in nearby town		
12.	Involving in contraband trade		
13.	Borrowing cash from institutions		
14.	Petty trade		
15.	Use of wild foods		
16.	Broker		
17.	Save cash in the bank		
18.	Livestock mobility		
19.	Invest in property in town		
20.	Using livestock blood		
21.	Other, please specify_____.		

4.3. What did your family do when past drought stricken and caused food shortage in the household? (Tick in the table below)

S.N	Response strategy	Moderate drought	Severe drought

1.	Sell animals frequently		
2.	Reduce expenditure		
3.	Seek employment elsewhere		
4.	Seek supports from relatives		
5.	Use cash savings in the bank		
6.	Sell forest products		
7.	Wait for relief		
8.	Livestock slaughtered for consumption		
9.	Other, specify_____		

4.4. Did you practice livestock mobility as adaptation strategy to overcome the impacts of drought? 1. Yes 2. No

4.5. If your answer is yes, did you face the following factors that restrict your livestock mobility from place to place?

S.N	Constraints	1=yes, 2=No
1.	Scarce resource competition- induced conflict	
2.	Occurrence of Administrative boundary conflict	
3.	Scarcity of pasture and water that you want to move	
4.	Grazing land encroachment	
5.	Implementations of settlement without the will of the society	
6.	Absence of alternative pasture land due to prolonged drought	
7.	Cattle raiding	
8.	Land enclosure	
9.	Sense of ethnic rivals or enmity	
10	Other, specify_____	

4.6. What are the constraints that negatively affect adaptation strategies of Pastoralist to withstand the impacts of climate change? (Rate based on their importance) Multiple responses are possible.

S.N	Constraints of adaptation strategies	Very important	Important	Not sure	Less important	Not important
1.	Lack of awareness and training					
2.	Grazing land encroachment					
3.	Household size					
4.	Level of education					
5.	Annual income					
6.	Scarcity of asset					
7.	Access to credit and extension services					
8.	Regionalism that affecting pastoral movements					
9.	Land enclosure					
10.	Devaluing indigenous knowledge					
11.	Inappropriate development interventions					
12.	Rangeland degradations					
13.	Bush encroachment					
14.	Insecurity/conflict					
15.	Other, please specify_____					

Section 5: The Role of Institutions in Climate Change Adaptation Strategies

5.1. Have you got any support or advice on how to reduce the effects of climate change on the livelihood of the household? 1. Yes 2. No

5.2. If your answer is yes, from which institutions did you get support or advice to adapt the impacts of climate change? (Multiple answers are possible).

1. NGOs 2. Community leaders 3. Government institutions

4. Indigenous institutions 5. Different donors 6. Religious institutions

7. Mass media 8. Other, specify_____

5.3. What types of advice and support did you get during the occurrence of climate change disaster? (Rank out)

S.N.	Advice and support from concerned bodies	1st	2nd	3rd	4th	5th
1.	Destocking during drought					
2.	Splitting herds					
3.	Encourage us to lead a settled life					
4.	Cutting and carrying fodder					
5.	Provide improved animal feeds					
6.	Training about context based adaptation strategies					
7.	Planting trees and conserving soil					
8.	Encourage us to diversify means of livelihoods					
9.	Other, specify_____					

5.4. How do you rate the following government policies in relation to climate change?

S.N	Policies	1=Good	2=Average	3=Poor
1.	Environmental conservation			
2.	Land use management			
3.	Forest conservation			
4.	Access to credit			
5.	Marketing and distribution			
6.	Health accessibility			
7.	Access to education			
8.	Food safety net			
9.	Other, specify_____			

Background information for both Key Informant Interviews and FGDs

The primary purpose of these questions is to conduct an in-depth analysis on the major types of livelihood resources, peoples' perceptions on climate change, adaptations strategies and constraints to with stand the impacts of climate change in Sitti zone of eastern Ethiopia. I would like to assure you that your response will be used only for research purposes and will be kept confidentially. Therefore, you are requested to kindly give your genuine responses. I thank you in advance for your willingness and cooperation to answer various questions.

Appendix II: Guiding Questions for Key Informant Interviews of Pastoral Communities

A. Questions related to objective one: to assess the perceptions of pastoral community towards climate change and its impact on the livelihoods of the people

1. How do describe the climate of your area in the last 10 years?
2. What are the different aspects and the manifestations of climate change in the region?
3. Can you tell me your belief about the major causes for climate change?
4. How frequent drought and other forms of climate change manifestations do occur?
5. What are the trends of rainfall patterns and temperature of the area for the last ten years?
6. How climate change affects your livelihoods and the environment?

B. Questions related to objective two: to assess the extents of vulnerability of the pastoralist communities to climate change.

7. What are the major types of livelihood resources and strategies in the area?
8. Do you explain any impacts on your livelihoods and problems you faced as the result of climate change?
9. Who are more vulnerable group of people to climate change and other disasters?
10. How do you evaluate the status of livestock, rangeland and water availability over the last 10 years (type of livestock species increased and decreased in number, quality and quantity of livestock products and rangelands in dry and wet season, reason for the changes)?

C. Questions related to objective three: to analyse the major response strategies and constraints that faced the pastoral communities to adapt to climate change

11. What are the major types of livelihood strategies in this area?
12. How do pastoralists adapt to climate changes locally and regionally?
13. What are the major adaptation strategies that the community uses to minimize climate change impacts (like water stress, shortage of pasture, animal/human diseases, locust/insect infestations, severe heat intensity, bush encroachments, etc)?
14. What encourage and discourage in order to diversify your livelihoods?
15. What are the different constraints that the society face while implementing climate change adaptation strategies?

D. Questions related to objective four: to assess the roles of institutions in enhancing or hindering the capacity of pastoral community to withstand the impacts of climate change

16. Where do you get information about climate change and other disasters?
17. What are the roles of institutions (both indigenous and modern institutions) in enhancing or hindering your capacity to withstand the impacts of climate change?
18. Are pastoralists encouraged by the support of the government to diversify their means of living?
19. What type of support do you get from the government and NGOs to withstand climate change related problems?
20. What type of intervention do you expect from different institutions to overcome the impacts of climate change?
21. What is your future plan to withstand the impacts of climate change?

Appendix III: Guiding questions for GOs and NGOs Officials

1. How do you explain the existing climate change in the area?
2. What are the major manifestations of climate change in the region?
3. Explain the major impacts of climate change on the livelihoods of the pastoral societies?
4. Do you assess the extents of vulnerability to climate change related hazard? If yes, which groups of people are more vulnerable to climate change and other disasters? Why?

5. What are the major types of livelihood adaptation strategies which people practice to withstand the negative impacts of climate change?
6. What are the major challenges and constraints to practice both indigenous and modern adaptation strategies to climate change?
7. Explain the roles of your organization in maintaining the adaptive capacity of the community to climate change?
8. Does the government have context based climate change adaptation strategies to combat the negative impacts of climate change? If yes, explain their applicability in the area?
9. Does the government have mitigation strategy to climate change? If yes, explain it
10. Is there anything we should have talked about, but we didn't?

Appendix IV: Guiding questions for Focus Group Discussion of pastoral Communities

1. Explain your opinion and major manifestations of climate change in the district?
2. Do you think that pastoralists are vulnerable to climate change? If yes, explain it?
3. What are the impacts of climate change related hazards on the livelihoods of the people in the area?
4. Which groups of people are more vulnerable to climate change?
5. What are the major types of livelihoods strategies in the area?
6. What are the pastoralists doing to adapt to climate change impacts?
7. Explain the major challenges and constraints of adaptation strategies to climate change?
8. Can you explain the role of both formal and informal institutions in process of minimizing the negative impacts of climate change in the area?
9. Where do you get information about climate change and other disasters?
10. What are the special measures taken so far by various institutions to help vulnerable groups of people to climate change?
11. Is there anything we should have talked about, but didn't?