

**LIVESTOCK-BASED RISK MANAGEMENT AND COPING MECHANISM TO
DROUGHT AMONG PASTORALISTS: A CASE STUDY OF HANDENI
DISTRICT, TANGA**

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**DISSERTATION SUBMITTED IN PARTIAL FULLFILMENT OF THE
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ABSTRACT

A case study on Livestock-based risk management and coping mechanism to drought among pastoralists in Handeni District was conducted to determine how pastoralist cope with drought in the study area. Drought is a major problem and threat to pastoral livelihoods globally. This study aimed at assessing and documenting information on Livestock based risk management and coping mechanisms in reducing drought effects. Despite the assumption that livelihood of pastoralists depends on livestock, knowledge on how to improve the resilience of pastoral communities to manage drought and reduce risks is still limited but is crucial for sustainable management system. Drought still persists regardless of many effort made to cope with it. A cross - sectional reseach design was adopted to generate information on risk management in livestock and coping mechanisms. Socio-economic data were collected through questionnaire to 160 pastoralists, focus group discussion and key informant interview. Data were analysed using statistical package for social science software to obtain frequencies and percentages while inferential statistics using regression model was carried out to determine the relationship between socio-economies of pastoral household and the selected variable. Results indicates that age influenced the socio-economies of pastoral house negatively ($\beta = -0.451$; $p = 0.808$), while education level positively but not significant ($\beta = 43.821$; $p = 0.497$), family of household positively and not significant ($\beta = 3.379$; $p = 0.50$), marital status negatively ($\beta = -53.979$; $p = 0.847$), and size of the land, positively ($\beta = 58.898$; $p = 0.004$). The findings noted that herd mobility influence the socio-economies of pastoral household positively ($\beta = 91.749$; $p = 0.01$), early warning system positively ($\beta = 316.537$; $p = 0.00$), and availability of timely market, ($\beta = 11.516$; $p = 0.021$) were significant to the socio-economies of pastoral household .Total number of animal died from drought effects was 3 666 out of 57 785 owned . Mortality was 6.34%.

DECLARATION

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

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The above declaration is confirmed

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Date

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DEDICATION

This work is highly dedicated to my brothers, sisters, clan and age mates and to my lovely parents Mr. and Mrs. Mwakalonge who laid down the foundation of my studies with all their efforts up to this stage. May the almighty God bless them all.

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LIST OF ABBREVIATIONS AND ACRONOMYS

SCBD	Secretariat of Convention on Biological Diversity
DPIRP	Drought Preparedness Interventions and Recovery programme
ACDI/VOCA	Agricultural Cooperative Development Initiatives/ Voluntary in Overseas Cooperative Assistance
TDCPU	Turkana Drought Contingency Planning Unit
TAS	Tanzanian Shillings
NSGRP	National Strategy for Growth and Reduction of Poverty
EWS	Early Warning System
SPSS	Statistical Package for Social Sciences
NGO	Non Governmental Organization
CBO	Community Based Organization
PLI	Pastoralist Livelihood Initiatives
USAID	United State of America International Development
ILRI	International Livestock Research Institute
UNDP	United Nations Development Programme
IFPRI	International Food Policy Research Institute
NDM	Natural Disaster Management
CBD	Convention on Biological Diversity
URT	United Republic of Tanzania
UNESCO	United Nations Educational, Scientific and Cultural Organization
MKUKUTA	Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania
R ²	Coefficient of determination
TAS	Tanzanian shillings
UNEP	United Nations Environmental Programme

MDG	Millennium Development Goal
°C	Degree centigrade
kg	Kilogram
km	Kilometre
IUCN	The International Union for Conservation of Nature
ha	Hectare
Fig.	Figure
FAO	Food and Agriculture Organization of the United Nations
Df	Degree of freedom
USD	United States of America Dollar
DFID	Department for International Development
SS	Sum of Square
MS	Mean Square
ODI	Overseas Development Institute
AIDB	African International Development Bank
UNFCCC	United Nations Framework Convention on Climate Change
ICID	International Centre for Integrated Development
AGEHH	Age of head of household (in years)
EDULHH	Education level of head of household (in years spent in school)
FSPHH	Household size (measured in number of family in household)
MSPHH	Marital status (1 married 2 Single 3 Divorced)
SPHH	Sex of interviewed head of household (1 male and 2 female)
LOPHH	Land ownership (measured in size of the land owned in acre)
MEPHH	Management practices (1sedentary syesten and 2 nomadic)
HMPHH	Herd mobility (measured in number of pastoralits migrated)
MAPHH	Market availability (Number of available market in specified year)

AEPHH	Availability of early warning syesytem
SEPHH	Socio-economies of pastoral households

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Drought is a major problem and a threat to pastoral livelihoods globally (FAO, 2001). Hardley (2006) show that the area to be affected will double from 25% to 50% by the end of this century and that overall people in low-income countries are four times more likely to die due to natural disasters including drought (Gaiha and Thapa, 2006).

Munich (2006) and IPCC (2007) show that changing weather patterns appear likely to further increase the frequency and intensity of adverse weather events in the low-income countries and that an increase in extreme climate events, such as droughts and floods, is anticipated (Christensen *et al.*, 2007).

Turner (2000) argues that livestock as a store of wealth play an important role in drought mitigation and risk coping strategies of pastoral households. Livestock plays an important role as economic buffer to drought-induced food deficits and when animals are commonly sold, sales profits go into purchase of food for household consumption.

In Africa, different countries face drought problem. There is a growing consensus that the frequency and severity of droughts in arid and semi-arid zones of Africa have increased in areas where pastoralism and agro-pastoralism are the dominant livestock production systems (UNEP, 2002; Dietz *et al.*, 2004). There is also a general agreement that the pastoralists and agro-pastoralists in these agro-ecological zones have become more vulnerable to climatic shocks, especially droughts (Campbell, 1999; Niamir-Fuller, 1999; FAO, 2001).

UNEP (2002) indicated that the 2000 drought in Kenya was the worst to be experienced in the country for 40 years. This country experiences major droughts every decade and minor ones in three to four years with the exception of the arid northern part where it is experienced yearly with varied consequences. These droughts have resulted in immense losses in resources and affected the livelihoods of many who depend on the ecosystem for survival, particularly the pastoralists.

Another study by Thornton *et al.* (2006) pointed out that Niger experienced drought in 2005, which was worsened by locust infestation leading to a serious food crisis. Many lives and livestock were lost due to the drought. Current maps of poverty show that Niger and Kenya have a higher percentage of poor livestock keepers than 85% of other countries in Africa and both countries are dominated by rangelands with significant pastoral and agro-pastoral populations. In addition, future projections of climate change, poverty and vulnerability show populations in both countries will become more vulnerable in the future and thus are good choice for intensive research work now to prepare for the future.

At the household level, evidence from drought in Ethiopia and Hurricane Mitch in Honduras indicates that poorer households feel the medium-term adverse effects more acutely and for a longer period than do better-off households (Carter *et al.*, 2007).

It is estimated that over one billion people depend on livestock, and 70 percent of the 880 million rural poor living on less than USD1/day are at least partially dependent on livestock for their livelihoods (World Bank, 2007a). In sub-Saharan Africa alone, 25 million pastoralists and 240 million agro-pastoralists depend on livestock as their primary source of income (IFPRI and ILRI, 2000).

Studies by ILRI (2006) and UNDP (2006) reported that livestock are socially and economically critical to rural livelihoods, thus giving high priority to ensuring the sustainable use of the natural resource base that supports them. Pastoralism is considered the most economically, culturally and socially appropriate strategy for maintaining the well-being of communities in dry land landscapes, because it is the only one that can simultaneously provide secure livelihoods, conserve ecosystem services, and promote wildlife conservation and honour cultural values and traditions.

Pastoralism and agro-pastoralism are vital to the Tanzanian economy. Homewood and Rodgers (1991) and Scoones (1992) indicates that the country relies on pastoralists and agro-pastoralists for most of its meat and milk. Extensive research conducted over several decades in arid and semi-arid rangelands has demonstrated that in terms of both protein production per hectare and environmental benefits, pastoral systems are more productive and viable than the ranching and group ranching or sedentary livestock production systems currently promoted by government and other development agents. Therefore, providing appropriate support for pastoralist livelihoods and economies could generate considerable economic benefits at both the local and the national level.

Data from National Livestock Census (2005) show that there are approximately 17 million cattle in Tanzania (the third highest population in Africa south of the Sahara), 12.5 million goats and 3.6 million sheep. 98% of the national herd, or approximately 16.7 million cattle, are in the hands of pastoralists and agro-pastoralists. About 1 500 000 cattle 2 500 000 goats and 555 000 sheep are slaughtered in Tanzania each year, producing an estimated 335 000 tons of meat for the domestic market. Exports of live animals to neighboring countries are largely unaccounted for. Three per cent of the 3.7 million households in Tanzania are pastoralists, and seven per cent are agro-pastoralist.

This amounts to approximately 370 000 households or 2.2 million people in total. It is not known what the consequences in human, economic or environmental terms would be if these people are forced to drop out of pastoralistic production.

Moreover, in 2003 the Food and Agricultural Organizations described Tanzania as having a very high level of undernourishment, with 43% of the population being undernourished directly because of drought related food shortages (FAO, 2003a). Another study done by Turner (2000) reported that the increasingly frequent and severe drought is a pervasive hazard that routinely causes great loss of livestock, the main asset of the three million pastoralist households in the region and hold severe and widespread malnutrition.

A number of studies such as URT (2003, 2007) and IPCC (2001) indicates that milk and meat production will be reduced following the stress on the grazing lands. Worth noting, the number of livestock already overwhelms the carrying capacity of many grazing grounds in central and north-west Tanzania where droughts are common. As a result, pastoralists are forced to relocate to places where pasture and water are available (Shayo, 2006; URT, 2007).

However, the tendency has already caused conflicts between different pastoralist societies on one hand and farmers and pastoralists on the other. Erikson (2005) asserts that increasing drought stress can exacerbate the conflicts and violence. Moreover, there are reported conflicts between livestock keepers and wildlife conservationists. Further deterioration in water availability will have major effects in Tanzania where already some communities (25% of the population) are walking an average of over 30 minutes to fetch water (URT, 2003).

For the pastoral land, Reid *et al.* (2004) asserted that mitigation activities have the greatest chance of success to build on traditional pastoral institutions and knowledge while providing pastoralist with food, security and benefit at the same time.

It is evidently suggested that when farmers including pastoralists have good information, they are able to make better management decision that lead to high yield and income. They may also be prepared to take more risk and invest in new ways of adopting from others sources to improve the decision making. They may also be prepared to take more risk and invest in new ways of adopting from others sources to improve the decision making (Hellmuth *et al.*, 2007).

Kivaria (2007) described coping mechanisms as responses of an individual, group or society to challenging situations. The coping mechanisms lie within the framework of the individuals, groups or society's risk aversion or tolerance level, i.e. they are instituted to minimize risk or to manage loss. In this study, risk management is defined as the systematic application of management policies, procedures and practices to the tasks of identifying, analyzing, assessing, managing and monitoring risk.

According to IPCC (2001), it is stated that managing pastoral risk is important because it is a major determinant of pastoral poverty, food insecurity and environmental health. It is therefore suggested that risk management should be seen as an integral part of a broader development strategy. Moreover, to have an effective risk management strategy, it should be incorporated or linked to other programs and strategies of rural development, food security, environmental conservation and poverty alleviation. However, knowledge on how to improve the resilience of pastoral communities to manage drought and reduce risk is still limited, but is crucial for the development of sustainable drought management

systems (Benson and Clay, 1998). Understanding local community knowledge, risk management aspects and coping mechanism to drought is of paramount important. Therefore, this study intends to assess and document information on livestock based risk management and coping mechanisms in reducing drought effects.

1.2 Problem Statement

Despite the fact that Livelihood of pastoralists depends on livestock and that mitigation activities have the greatest chance of success to build on traditional pastoral institutions and knowledge while providing pastoralists with food security and benefit at the same time, little information regarding livestock based risk management at local level and mechanisms used to improve resilience with their livestock in the study area has been reported. Therefore, understanding response mechanism at local level used by pastoralists is of paramount importance. This study aims at documenting information on livestock risk management and coping mechanism used by pastoralist to minimize adverse effects of drought and to more critically analyzing its impact on social economic aspects.

1.3 Research Justification

Drought effects still persists in the study area regardless of many strategies that have been developed to cope with it. The Problem is expected to continue and even become more severe in the future as a result of climate changes that will affect the area and mainly other parts of Africa and the worldwide at large. This research will contribute to a better understanding of nature and dynamics of vulnerability to drought shocks in pastoral and agro-pastoral systems, and the identification of livestock-based intervention (technical, political and institutional) to mitigate and cope with the situation.

This research has linkages with some major policy initiatives all of which are complimentary to one another. These policy initiatives are: Tanzania Development Vision (Vision, 2025) National Strategy for Growth and Poverty Reduction (NSGRP I, II). The beneficiaries of this finding will include; policy makers, Researchers, Planners, Community officers and the pastoralists.

1.4 Objectives

1.4.1 Overall objective

To assess and document information on livestock-based risk management and coping mechanisms in reducing drought effects in the study area.

1.4.2 Specific objectives

- i) To identify livestock- based risk areas associated with drought effects
- ii) To identify socio-economic effects of drought
- iii) To examine coping mechanism and strategies against drought
- iv) To analyze the impacts of mechanisms and factors influencing socio-economies of pastoral households.
- v) To assess the sustainability of the mechanism on socio-economies of pastoral households.

1.5 Research Questions

- i) What are livestock- based risk areas associated with drought effects?
- ii) What are the socio-economic effects of drought?
- iii) What are the coping mechanisms and strategies used against drought?
- iv) What are the impacts of mechanisms and what are factors influencing socio-economies of pastoral households.
- v) How sustainable the mechanisms are on socio-economies of pastoral households

1.6 Theoretical Idea Underpinning the Conceptual Framework

The framework shows how, in different contexts, sustainable livelihoods are achieved through access to a range of livelihood resources (natural, economic, human and social capitals) which are combined in the pursuit of different livelihood strategies with known livelihood outcomes. People and access to assets is strongly influenced by their vulnerability context, which takes account of trends (for example, economical, political, technological, etc.), shocks (for example, epidemics, natural disasters, civil strife) and seasonality (for example, rains, droughts, employment opportunities). Examining the welfare of pastoralists by using elements of the sustainable livelihoods framework facilitates identification of the causes and dynamics of poverty among pastoralists.

The framework emphasizes that the overall socio economies of pastoral people depends on both access to assets, such as pasture, water, animal health services, markets, credit and education, and the environment in which these assets are combined for production and consumption purposes, namely the political, organizational and institutional infrastructure. Furthermore, the framework sets the livelihood of pastoralists in the dynamic context of risks, which affect assets and livelihood strategies.

The assumption behind the conceptual framework is that, risk management practices and coping mechanism to drought can have the effects on socio economies of pastoral households and that traditional knowledge adopted by pastoralists can have a great role in mitigating adverse effects caused by drought. Social demographic variables (age, education, sex, marital status) can have different influence on coping mechanisms and strategies and as a result affecting socio-economies of pastoral household differently. Drought can affect livestock prices, availability of forages, livestock numbers, and availability of water as results affecting the economies of pastoral households.

1.7 Conceptual framework

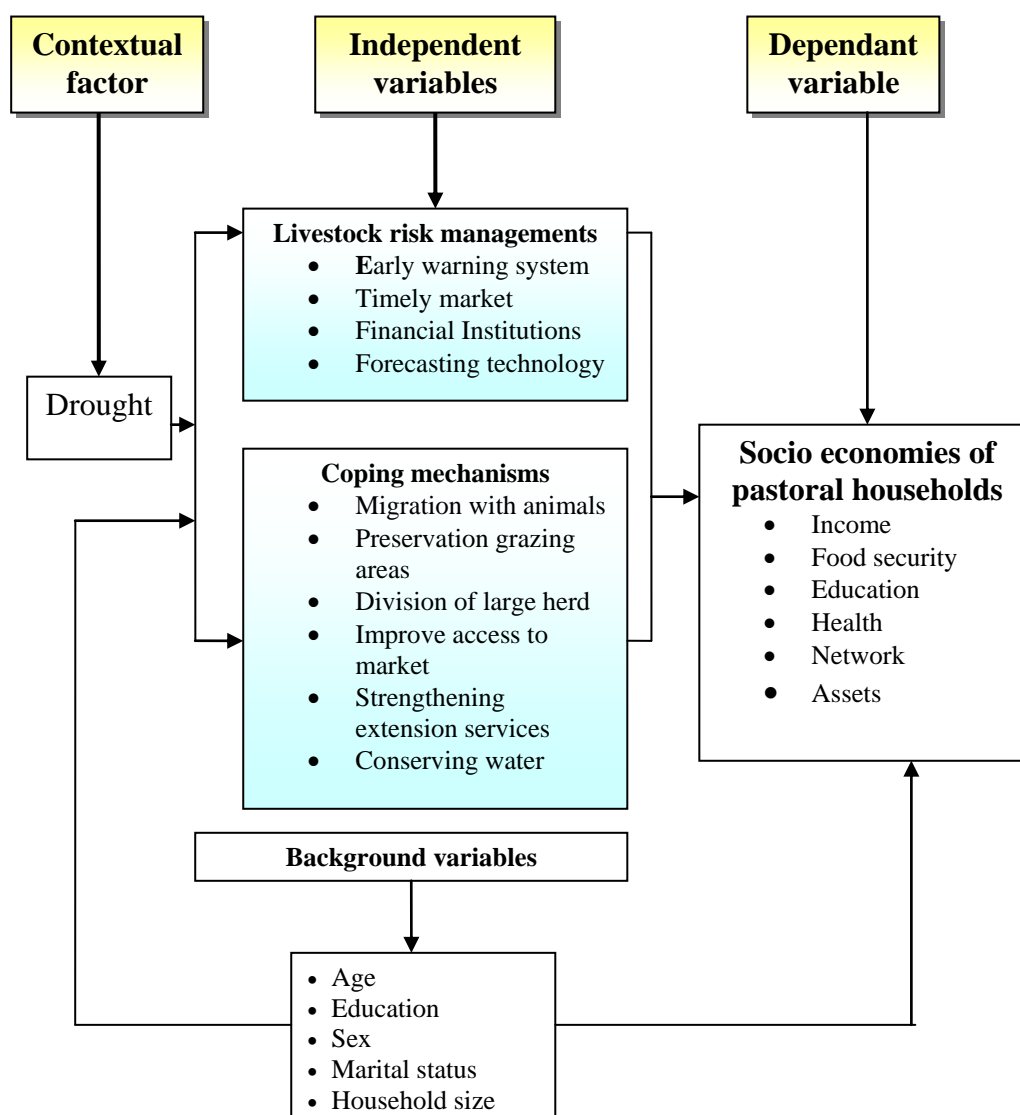


Figure 1: Theoretical idea underpinning this conceptual framework as adopted from Sustainable Livelihood Approaches Developed by DFID 1998.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Drought

Drought can be defined in many ways that are used to meet specific goals such as agricultural development planning or water resources management (Giambelluca *et al.*, 1998). According to Wilhite (1996) because drought affects so many economic and social sectors, many definitions have been developed by a range of disciplines. In addition, drought occurs with varying rates in nearly all regions of the globe. In all types of economic systems and in developing and developed countries alike, the approaches taken to define drought should be impact and region specific. Unavailable specific and objective definition in certain situations has been an obstacle to understanding drought, which has led to indecision and/or inaction on the part of managers, policy makers, and others. It must be accepted that the importance of drought is dependent on its impacts. Whatever the definition of drought is, it is clear that it cannot be viewed as a solely physical phenomenon, since it depends on how much water is needed by the society.

Wilhite and Glantz (1985) categorized drought definition into two, which are conceptual definition formulated in general terms (which is not applicable to current, i.e. real time drought assessments) and operational definition.

Literarily, drought simply means a long period of dry weather. Drought is a recurring climatic event and a global phenomenon, but its features vary from region to region. It is a chronic problem in arid and semi-arid regions and frequently occurs in humid regions as well. Meteorologists consider drought to be the result of persistent large scale fluctuations

in atmospheric circulation causing subsidence over an area (Agnew, 1989; Wilhite and Glantz, 1985) which may bring little or no rainfall to an area (Mather, 1984).

What is missing from the meteorologist definition of drought is the economic and social manifestation brought about by drought. Wilhite (1999) indicates that agricultural drought is not significant unless crop production suffers sufficiently to result in considerable livelihood loss, which is then termed socio-economic drought and that deals with drought in terms of supply and demand for goods and services. The physical water shortage starts to affect people and the ripple effects can therefore be traced through economic systems.

These effects of drought and associated pressures disrupt the functioning of a society causing widespread human and material or environmental losses that sometimes exceeds the ability of the affected society to cope using its own resources (Fitzgibbon and Hennessy, 2003). In these situations, un-usual measure or external interventions are required to support people's ability to cope with the specific vulnerability.

Conceptually, drought is considered to describe a situation of limited rainfall substantially below what has been established as a 'normal' value for the area concerned, leading to adverse consequences for human welfare. Although drought is a climatically induced phenomenon, its impact depends on social and economic contexts as well. Establishing a universal view about drought might be difficult. Drought is a normal, recurrent feature of climate that affects virtually all countries to some degree (Wilhite, 1996); Hisdal and Tallaksen, (2000) consider drought to be extreme rainfall deficits and the resulting periods of low flow of water, which can have severe effects on water managements in terms of river pollution, reservoir design and management, irrigation and drinking water supply.

Drought affects more people than any other disaster in Africa (Rekacewicz, 2002). The consequences of drought are as a result of many interacting factors such as poverty, wars and pandemics, high dependency on rain-fed agriculture, population growth, climatic change and variability, land use, increased water demand, lack of water resource management and inadequate economic development.

Wilhite *et al.* (2000) also described drought as a natural hazard that differs from other hazards because it has a slow onset, progresses over months or even years, affects a large spatial region and causes little cultural damage. According to them, its onset and end are often difficult to determine, just as its severity.

According to Wilhite (2000) drought differs from other natural disasters in three main aspects first; it is a 'creeping phenomenon', making its onset and end difficult to determine. Its effects accumulate slowly over a considerable period of time, and may linger for years even after the termination of the event. Second, the absence of a precise, common definition of drought adds to confusion about its occurrence and severity and third, damage due to drought does not normally involve damage to infrastructure (unlike flooding, earthquakes, etc). Due to its less obvious damage, it receives much less attention from media, policymakers and politicians than it warrants. Drought produces a complex set of highly differentiated adverse impacts that ripple through many sectors of the economy and reach far beyond the geography and third, drought impacts are less obvious and spread over a larger geographical area than the damages that result from other natural hazards because drought rarely results in structural damage.

At the socio-economic level and in the context of livestock keeping, drought is a function of variables that highly affect the mix of availability of grazing and water resources.

A one year or two years failure of rains may result in drought, depending on the resource base of the pastoral system. As stated by Fitzgibbon and Hennessy (2003) drought is caused by too little precipitation over an extended period. It could also be the result of increased demand for the available supply of water during periods of average or above average precipitation. Among these factors, rapid population growth and inadequate economic development are common denominators in most developing countries. These pressures are often translated into increased continuous demand for land and water resources, usually exacerbating the influence of climatic change and rainfall seasonality

Hisdal and Tallaksen (2000) believe that drought is by no means unusual or unnatural. Their conclusion is that drought is by far the most costly to our society in comparison to all the natural disaster. It kills more people and animals than the combined effect of hurricanes, floods, tornadoes, blizzards, and wildfires. Unlike other disasters that quickly come and go, drought long-term persevering damage has been responsible in the past for man migration and lost of civilizations. The amount of drought induced natural disasters has grown drastically since the 1960s. This is a result of increase vulnerability to prolonged periods of precipitation deficiency rather than because of an increase in the frequency of meteorological drought (Wilhite, 1996).

Drought affects practically all climatic regions and more than one-half of the earth is prone to drought each year (Kogan, 1997; Wilhite, 2000); Hisdal and Tallaksen (2000) states further that all climatic zones might experience drought; however, the feature can vary significantly between regions. Drought is more prominent when it occurs in potential high and medium rainfall areas; however, the most vulnerable regions are described as arid and semi-arid lands of the world, with those in Africa high on the list.

The degree of drought and the resultant land and resources degradation are said to be greater in those countries whose social and economic support systems cannot endure the effects of drought. This includes the fragile environments in dry eco-system where people have few and limited coping strategies.

During droughts pastoralists are faced with two tragic situations which affect their capacity to cope with the drought and feeding their families. There is decreased herd productivity owing to the high mortality rate, reduced or no milk production, no calving, and animal weight loss that affects the market value of the livestock. Pastoralists tend to reduce their livestock numbers during a drought out of desperation and to provide food for their families. Unfortunately, during droughts, livestock become emaciated and lose weight and do not attract competitive bids because buyers do not wish to take risks. Thus, the pastoralists are offered a highly discounted price for their livestock.

2.1.1 Conceptual definition of drought

Conceptual definition is devised in general terms to help people understand the concept of drought as well as its effects. Wilhite and Glantz (1985) describes drought as a lengthened period of rainfall deficiency, which causes widespread damage to crops, resulting to low yield. According to Wilhite and Glantz (1985), conceptual definition of drought may also be important in establishing drought policy.

2.1.2 Operational definition of drought

Various authors believe that operational definition of drought helps people to identify the beginning, end and degree of severity of a drought. This is usually done by comparing the current situation to historic average, often based on a 30-year period of record. The threshold identified as the usual established somewhat arbitrary, rather than on the

basis of its precise relationship to specific impacts. In some publications, the term operational drought is applied equivalent to water resource indicators, hence not consistent with the broad definition of Wilhite and Glantz (1985).

2.2.3 Disciplinary definition of drought

Drought is also defined by classification based on disciplinary perspectives (Rouault and Richard, 2003) which include: meteorological drought, agricultural drought, hydrological drought and socio-economic drought.

2.1.4 Meteorological drought

Wilhite (1999) describe meteorological drought as the first indicator of drought, which is usually region specific expressions of precipitation departure from normal over some period of time. Meteorological drought is expressed solely on the basis of the degree of dryness (often in comparison to some 'normal' or average amount) and the duration of the dry period (Wilhite and Glantz, 1985). Meteorological Drought is believed to be region specific because the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.

2.1.5 Agricultural drought

According to Backerberg and Viljoen (2003) agricultural drought refers to a situation when the amount of water in the soil no longer meets the need of a particular crop, which measures drought as a physical phenomenon. Kumar and Panu (1997) have the opinion that a close relationship exists between crop yield and water stress and therefore, crop yield is a reliable indicator of agricultural drought. When assessing and predicting agricultural drought risk, crop yield response to water stress is an essential factor. Wu and Wilhite (2004) define agricultural drought in terms of plant response by using degree of

departure from expected yield as an indicator of weather conditions for a given year on the theory that crops are good indicators of weather and their response presents a reliable tool for measuring drought. Rouault and Richard (2003) gave a time scale (3 to 6 month time scale) for agricultural drought to be the season when deficiency in precipitation results in damage to crop.

2.1.6 Hydrological drought

Hydrological drought manifests the effects and impacts of drought; it usually expresses shortages in surface and subsurface water (Hisdal and Tallaksen, 2000). Rouault and Richard (2003) said that hydrological drought is associated with precipitation shortage on a longer scale (12 months to 2 years or more) and its effects on surface and subsurface water supply. According to Rouault and Richard (2003) hydrological drought can be out of phase and its effects or impacts on various economic sectors can be appreciably different because it takes longer for precipitation shortage to become evident in soil moisture, stream flow, groundwater and dam levels.

Although Wilhite (2002) describes hydrological drought in terms of deficiencies in surface and subsurface water supplies, he believes that hydrological droughts are concerned more with the effects of periods of precipitation shortfalls on surface and subsurface water supply (i.e. stream flow, reservoir, lake level and ground water) rather than with precipitation shortfalls. Hydrological droughts are usually out of phase or lag the occurrence of meteorological and agricultural droughts.

During droughts, competition for water in these storage systems escalates and brings about increase in conflicts among water users (Wilhite and Glantz, 1985; Wilhite, 1996; West, 2008). Due to the fact that hydrological systems interconnects regions, occurrence

of drought upstream may result in serious impacts downstream as surface and subsurface water supplies are affected, even though downstream area may not be experiencing drought. Upstream changes in land use (deforestation, changes in cropping patterns) may change runoff and soil infiltration rates, which may affect the rate and severity of drought downstream (Wilhite, 1996).

2.1.7 Socio-economic drought

Socio-economic drought simply deals with drought in terms of supply and demand for goods and services. This occurs when the physical water shortage affects people and its effects can be traced to the economic systems (Backerberg and Viljoen, 2003; Wilhite, 1996). In other words, when the supply and demand is determined by demand of meteorological, hydrological and agricultural droughts. For example, the supply of an economic good (water, forage, hydroelectric power) depends on weather. In most cases, demand increases as a result of increasing population and/or per capita consumption. Therefore, drought could be defined as occurring when the demand exceeds supply as a result of a weather-related supply shortfall. This concept of drought supports the strong symbiosis that exists between droughts and human activities, reemphasizing the importance of managing natural resources in a suitable manner.

Study by Toulmin (1995) indicates that during drought pastoralists are particularly vulnerable to fluctuations in terms of trade between livestock and grain products as livestock prices plummet during drought and grain prices increase.

2.1.8 Drought in Africa

Experience from world disaster conference - KOBE Japan; Kobe Sessions on Africa; drought and early warning, drought is still the key threat to sustainable development in

Africa therefore monitoring, assessment and prediction are needed together with integrated drought management policies.

Table 1: Loss of Livestock due to drought effects in different countries

Year	Country	Incident
1981-84	Botswana	20% reduction in national herd
1982-84	Niger	62% loss of national cattle herd
1983-85	Ethiopia	(Borana Plateau) 37% loss of cattle
1991-92	Northern Kenya	70% loss of livestock
1991-93	Ethiopia	(Borana Plateau) 42% loss of cattle
1993	Namibia	22% loss of cattle; 41% loss of shoats
1995-97	Greater horn of Africa	29% loss of cattle; 25% loss of shoats
1995-97	Southern Ethiopia	78% loss of cattle; 83% loss of shoats
1998-99	Ethiopia	(Borana Plateau) 62% loss of cattle
1999-2001	Kenya	30% loss of cattle; 30% loss of shoats; 18% loss of camel
2002	Eritrea	10-20 % loss of livestock in some areas
2002	Ethiopia	(Afar and Somali) 40% loss of cattle: 10-15% loss of shoats
2004-06	Kenya	70% loss of livestock in some pastoral communities
2005	Kenya	(Mandera and Marsabit) 30-40% loss of cattle and shoats; 10-15% loss of camels
2009	Tanzania and Kenya	Maasai people lost 70-90% of livestock
2010	Niger	75% livestock threatened
2010	Somalia	70-80% livestock lost

Source: FAO, 2001

According to Rekacewicz (2002) drought affects more people than any other disaster in Africa. The consequences of drought are as a result of many interacting factors such as poverty, wars and pandemics, high dependency on rain-fed agriculture, population growth, climatic change and variability, land use, increased water demand, lack of water resource management and inadequate economic development. It could also be the result of increased demand for the available supply of water during periods of average or above average precipitation. Among these factors, rapid population growth and inadequate economic development are common denominators in most developing countries. These pressures are often translated into increased continuous demand for land and water

resources, usually exacerbating the influence of climatic change and rainfall seasonality (Fitzgibbon and Hennessy, 2003).

2.1.9 Drought in Tanzania

Nassef *et al.* (2009) in his study argued that Tanzania is undergoing extremely rapid land use change including expansion of cropping activities into savannah lands, increasing irrigation, deforestation, and urbanization. Worse still like other countries in sub-saharan Africa, the country is likely to suffer the greatest impacts of the twin threats of global warming and increasing climate variability. Climate change is expected to further shrink the rangelands which are important for livestock keeping communities in Tanzania. This shrinkage will be more aggravated by the fact that about 60% of the total rangeland is infested by tsetsefly making it unsuitable for livestock pastures and human settlements. Shrinkage of rangelands is likely to exacerbate conflicts between livestock keepers and farmers in many areas. On more commercial basis, crop and animal production has been affected negatively in areas with decreasing rainfall and vice versa.

A study by Oxfam International (2008) indicated that in the next 10 to 15 years Tanzania will see a continuation of current trends of successive poor rains, an increase in drought-related shocks, and more unpredictable and heavy rainfall events. Beyond this period the Intergovernmental Panel on Climate Change's climate models for East Africa show an increase in temperature of up to 2– 4°C by the 2080s, with more intense rain predicted to fall during short rains (October to December) over much of northern Tanzania as soon as the 2020s, and becoming more pronounced in the following decades (Climate change is likely to bring about even more erratic and unpredictable rainfalls and more extreme weather conditions such as longer and more frequent droughts. Where this happens, the delicate balance on which pastoral systems depend is undermined as the quality, quantity

and spatial distribution of natural pastures are mainly shaped by rainfall. Predicted changes in rainfall patterns are bound to result in increasingly scarce, scattered and unpredictable pastures. As a result, access to pastures will become more difficult, leading to loss of livestock and livelihoods. However, there are also significant negative consequences including loss of livestock through heat stress and loss of land to agricultural encroachment.

Nassef *et al.* (2009) stated that responding to climate change will require a long-term approach to provide the investments necessary for appropriate and sustainable development, allowing pastoralists either to adapt to their changing environment, or to transition out of pastoralism into alternative livelihoods. But (Tenga *et al.*, 2008) in his study argues that this approach must be affected through a rights-based way to increase the integration of pastoralists into political, social and economic systems at national and regional levels, thus addressing the fundamental problems of marginalisation and weak governance that lie at the root of the chronic poverty and vulnerability of pastoral areas. However, Tanzania like many African countries currently has limited capacity to adapt to changing climate and extreme weather conditions such as drought and floods which greatly affect and continue to affect pastoralists. Considerable investments are needed to build local adaptive capacity so that the country is better able to respond to the challenges that climate change presents. Most of the major public policies and legal framework lack entry points or are weak to support implementation of priority management options that could enhance pastoralist's livelihood and resilience against impacts of climate variability and change.

In addition, Tenga *et al.* (2008) describes that the livelihoods of pastoralist communities largely depend on livestock. He further explained that Pastoralism is practiced in a

sensitive and insecure environment characterized by highly spatial and temporal rainfall distribution, which often results in long and dry periods. Therefore, pastoralism as an economic activity is indeed a precarious enterprise because it depends heavily on sensitive ecological systems.

2.1.10 The vulnerability of pastoral livelihoods

Dercon (2001) in his study describe that examining the welfare of pastoralists by using elements of the sustainable livelihoods framework facilitates identification of the causes and dynamics of poverty among pastoralists. He further explain that the livelihoods framework emphasizes the overall livelihood of pastoral people must depends on both access to assets, such as pasture, water, animal health services, markets, credit and education, and the environment in which these assets are combined for production and consumption purposes, namely the political, organisational and institutional infrastructure. He further, describe that the livelihoods framework sets the welfare of pastoralists in the dynamic context of risks, seasonal and long-term trends which affect assets and livelihood strategies and determine the level of vulnerability.

According to Blaikie *et al.* (1994). 'Vulnerability' refers to the capacity of a population to anticipate, cope with, prevent major decline in well-being, and recover from the adverse impact of shocks. Vulnerability is not a new concept, but interest and concern have been growing in recent years.

Siegel and Jorgensen (2001) define drought vulnerability as degree to which households are susceptible to the adverse effects of drought. Vulnerability depends on a combination of factors such as income, occupation, family structure, gender, social class, caste, cultural factors and health.

Patrick (2003) in his study indicated that the more directly dependent a population is on the natural resources base of an area, the greater their vulnerability when there is interference in the productivity of that natural resources base. This situation is factual in dry lands occupied by people considered the most ecologically and politically marginalized group on the globe. The most limiting natural resources in the dry lands is water. Complete disruption in rainfall can initiate disaster such as famine on a catastrophic scale.

The terms 'vulnerable' and 'vulnerability' are often equated with 'poor' and 'poverty' (World Food Programme, 2005). The most basic definition of vulnerability is derived from its Latin root *vulnerare* which means 'to wound' therefore vulnerability is 'the capacity to be wounded'. Gallopin (2006) describes vulnerability as a concept that has been used in different research traditions, but there is no agreement on its meaning.

According to Olga and Wilhite (2002) most definitions of vulnerability contain a common thread. They all agree that vulnerability shows the degree of defenselessness of society to a hazard, which could vary either as a result of variable exposure to the hazard, or because of coping abilities. Coping abilities according to Downing and Bakker (2000) include protection and mitigation. Factors such as economics, technology and infrastructure are better understood, while individual and societal factors are more difficult to understand and conceptualized.

Vulnerability has damaging effects on livelihood and not just life and properties, the more affected people are those that find it hardest to reconstruct their livelihoods following the disaster. Olga and Wilhite (2002) state further that vulnerability is closely correlated with human infrastructure and socio-economic conditions. According to them, as a rule, the

poor suffer more from hazards than the rich, although poverty and vulnerability are not always correlated. Drought vulnerability varies for different individuals and nations. In developing countries, drought vulnerability constitutes a threat to livelihood, the ability to maintain productive systems and healthy economics. While in developed economies, drought poses significant economic risks and costs for individuals, public enterprises, commercial organizations and governments (Downing and Bakker, 2000). The degree to which a population can be affected by drought depends largely on various response or coping options available to them, or their degree of vulnerability, which in turn can be decreased by adequate pre-drought planning and mitigation of effects during the event or the lack of it.

Patrick (2003) pointed out that vulnerability to drought is complex, yet it is essential to understand so as to be able to design drought preparedness and mitigation strategies, relief policies and programs. He states further that response options available to less prosperous households or societies are very low. Poverty and vulnerability are not the same, two households or societies may have similar levels of poverty but different levels of vulnerability, for example, one household or society may be primarily dependent on just one or two forms of income generation, such as mono-cropping for exports, while another may depend on diversified livelihoods. Both groups can have the same level of income, yet, when they are both exposed to a shock such as drought, the former will likely become poorer than the latter because there is a greater exposure to risk and/or because they have less response option.

2.1.11 Marketing behaviour during drought in Africa

Study by Sandford (2006) shows that the annual losses in inter-drought years for pastoralists are often 10-20% caused by dry season fodder shortages and disease. Despite

these losses sales rarely reach 5% of herd size in average years. He further explains why not more animals are marketed before they succumb given the potential for losses to diseases. The following were the reasons for this apparent reluctance to market more stock; declining livestock/human ratio (fewer animals per household); traditional values remain oriented towards livestock accumulation lack of markets and market information and lack of access or knowledge of alternative investments to livestock.

2.1.12 Drought experiences during the early 1800 in Africa

According to Van Zyl and Vogel (2009), it is argued that limited official reports of drought, its impacts and associated responses to early drought in the first decade of 19th century were not available. Reachable reports on drought record showed negative impacts on farming activities, among coping mechanisms or responses used include stock movement. In these periods, large numbers of stock mortality were reported, in order to reduce such effects, animals were moved from drought infested areas to areas with better grazing and water availability.

Sivakumar and Wilhite (2002) indicated that the effects of drought accumulate slowly but the impacts spread over a larger geographical area than the damages that result from other form of natural hazards. When these occurs, most of the policy responses to drought tend to address the immediate needs, providing what are usually more costly remedies and attempt to balance a competing interest in a balanced atmosphere.

Drought impacts extend beyond the areas physically affected by drought after the event has ended (Coleen *et al.*, 2006). Like other hazards, the impacts of drought are diverse and can be classified broadly as economic, environmental and social (Paul, 1998; Wilhite *et al.*, 2000; Coleen, 2006). Like many other hazards, drought impacts span through

economic, environmental and social sectors and this can be reduced through mitigation and preparedness. For virtually all regions, droughts are a normal part of climate changeability. As a result, it is important to build up plans to deal with these extended periods of water shortage in a timely and orderly approach as they evolve. This planning process according to Wilhite *et al.* (2000) needs to occur at various levels of government and be integrated between these governments' levels.

2.2 Pastoralists

According to Rass (2006) Pastoralists are people who depend primarily on livestock for subsistence. They inhabit those parts of the world where the potential for crop cultivation is limited due to lack of rainfall and extreme temperatures. Rass (2006) stated further that there are about 120 million pastoralists in the world, of which about 50 million pastoralists live in sub-Saharan Africa, many of them roaming the dry sub-Saharan belt that stretches from Mauritania to Ethiopia. The type of livestock kept by pastoralists varies with the region of the world, but they are all domesticated herbivores that normally live in herds and eat grasses or other abundant plant foods.

2.2.1 Economics and values of pastoralism

A Study by World Bank (2007a) indicate that livestock are the fastest growing agricultural sector, and in some countries account for 80 percent of GDP, particularly in dry lands. The study explain further that of the 880 million rural poor people living on less than USD1/day, 70 percent are at least partially dependent on livestock for their livelihoods and subsequent food security.

Another study done by ILRI (2006) and UNDP (2006) reported that despite increasing vulnerability, pastoralism is unique in simultaneously being able to secure livelihoods,

conserve ecosystem services, and promote wildlife conservation and honour cultural values and traditions but the value of pastoralism has often been undermined. This is supported by the study done by Hatfield and Davies (2006) who indicated that desertification often occurs where policies undermine the pastoralist system, while where pastoralism has been supported by appropriate policies, biodiversity and ecosystem integrity have usually been enhanced. This study further explains that multiple values are associated with pastoralism: direct values, for example livestock sales, products such as meat and milk, employment, transport, and knowledge; and indirect values such as inputs into agriculture, wildlife and tourism. They also include ecosystem services (such as biodiversity, nutrient cycling and energy flow) and a range of social and cultural values.

Homewood and Rodgers (1991) describe that for centuries, pastoralists in Tanzania like elsewhere, have survived harsh living conditions, through empirically developed indigenous techniques of livestock management on the rangeland, constant mobility, and seasonal migrations that combine with biodiversity conservation (However, they are now confronted with shrinking grazing lands due to pressures from the growing human population, and associated need for food and land for arable crop farming. Wildlife conservation with its need for large tracks of land for national parks and wildlife sanctuaries is also increasingly forcing pastoralists off their land or to adopt sedentary livestock production systems (Shem *et al.*, 2005).

2.2.2 Pastoralism with livestock productivity

According to IPCC (2001) and URT (2003) it is argued that livestock productivity, survival and distribution will be affected through reduced quantity. Pastoralism is in many areas the only economically viable development option and yet many countries see the achievement of the Millennium Development Goals (MDG) as being linked to the

restriction of mobility of pastoral people. In fact, the achievement of MDG is compatible with pastoralism. Hence, maintaining and enhancing adaptable and flexible pastoral systems in the face of increasing environmental and global economic challenges is necessary if Millennium Development Goal to end extreme poverty and hunger is to be realized and quality of range-land and prevalence of vector-born livestock diseases. The study also indicated that deaths of large numbers of livestock due to lack of water and pasture has been of repeated occurrence in Tanzania in recent years hence threatening livelihood of pastoralists in the country. Some hopes however exist as a number of pastoralist societies have started to learn alternative livelihood support activities. Such adaptations however are only useful for short-term and non-severe effects of climate change. In addition, distribution of tsetse flies could shift into North Eastern Tanzania and thus reduce land for human settlements, grazing ranges and other developments (IPCC, 2001).

Another study done by SCBD (2009) also indicated that Pastoralism is facing a number of threats, not the least of which is from climate change. For example, CBD Technical Series No. 41 (highlights diseases affecting livestock which are projected to increase in scope and scale as a result of climate change, including, trypanosomosis (a disease which can lead to anemia, weight loss, low productivity, and possibly death if left untreated). Furthermore, increased frequency of extreme weather events including floods and droughts may overwhelm the existing resilience of pastoral systems. It is therefore suggested that there is a need for increased and continued monitoring of the observed and projected impacts of drought on pastoralism. In applying the precautionary approach, there is also a need to examine existing policies and practices in order to ensure that the natural adaptive capacity of pastoral systems is maintained or restored through, for example, conserving indigenous livestock breeds and fodder varieties, maintaining

freedom of movement, and identifying and supporting traditional coping mechanisms such as water capture and management, and market access. It is further suggested that Pastoralism should not be seen as intrinsically expansionist in nature, but as an efficient production system of use and exploitation of range resources.

Markakis (2004) in his study put emphasis on the double imperative nature of the pastoralist mode of production, namely extensive land use and freedom of movement in order to have access to dispersed, ecologically specialized and seasonally varied grazing lands and watering holes and to provide forage for different livestock species.

Report by UNDP (2006) shows that many pastoral systems are steeped in traditional management and practices. This report further stated that pastoralism is a livelihood system tied to ecosystem services with complex systems of social, political and economic organization. However, centralized decision-makers are often unaware of the challenges pastoral communities face in achieving and/or maintaining sustainable livelihoods as there are few mechanisms for local communities to transmit their knowledge to outside decision makers, and the communities are often economically and politically marginalized. In fact the erosion of indigenous and local knowledge, innovations and practices can reduce both the environmental and economic sustainability of pastoralism. As such, when managing pastoralism for biodiversity conservation and poverty reduction, it is important to ensure that the appropriate policy framework is in place to support and preserve indigenous and local knowledge, institutions, innovations and practices.

According to Lamprey (1983) it is stated that Pastoralism is heavily influenced by natural perturbations and extreme events such as floods, drought, fire, pest infestations and disease epidemics. As such, pastoral systems actively manage risk and thus maintain a

high degree of adaptive capacity. In cases in which risk management is not practiced and adaptive capacity is eroded through misdirected development efforts or maladaptation, perturbations can result in a cycle of unsustainable use, degradation and poverty. As such, establishing and supporting risk management measures is an important policy tool. This report further indicated that pastoralist communities draw upon their local knowledge of livestock rearing, subsist largely from the sale of livestock and livestock products. However, pastoral livelihoods are highly vulnerable to drought, animal disease outbreaks and other disturbances.

Study by Lamprey (1983) and (Reid *et al.*, 2008) indicated that complementary herd species allow livestock to take maximum advantage of available resources in different ecological niches, similarly to wild species assemblages mixed herds also ensure that the herd owner is buffered against species-specific disease outbreaks. However, a study by Cooke (2007) shows that the ratio of species herded depends on cultural preferences, environmental parameters and the personal choices of the herders themselves.

Another study by Leeuw *et al.* (1991) show that in years following drought, the proportion of livestock held in the small stock (sheep and goat) herd will increase because small stock reproduce at 2-4 times the rate of cattle, one to four kids per year as opposed to one birth every year and a half to two years for cattle so they are particularly useful and important after droughts and other disasters. Goats are frequently sold for cash, given as gifts, or slaughtered for food or ceremony because the amount of money and food generated by a single goat is optimal for day to day transactions.

2.3 Coping Mechanisms

Kivaria (2007) described coping mechanisms as responses of an individual, group or society to challenging situations. However, coping mechanisms lies within the framework of the individuals, groups or society's risk aversion or tolerance level. In other words coping mechanism are instituted to minimize risk or to manage loss. According to him, it is stated that while some coping mechanisms may be brought into play by a stress factor, other coping mechanism may be an intensification of an already in-built mechanism. He bases his view of coping mechanism on livestock herds and broadly grouped them into managerial and community strategies. These managerial strategies includes movement and migration, various aspects of herd management, supplementation of grazing with other feeds, changes in herding labour with intensification of stress, management of diseases (both human and livestock) and changes in human diet. Community strategies on the other hand includes: sharing, loaning and giving of livestock as gifts and institution of legal restriction necessary because the rangelands resources (forage and water) are shared by parties with conflicting and varied interests. Eriksen *et al.* (2005) describes coping mechanism as the actions and activities that take place within existing structures, such as production systems.

Adams *et al.* (1998) defines coping as an array of short-term strategies adopted in response to crisis. According to them, the aim of coping is to maintain the various objectives of the households, including livelihood security, consumption, health and status, thus ensuring individual and/or collective well-being. These objectives includes livelihood security and status, which are longer term objectives involving strengthening of assets, income and social position to maximize future claim on resources, the other objectives are immediate and these are food consumption and health objectives, which

involves finding sufficient food and income to meet the health and nutritional needs of the household (Adams *et al.*, 1998).

2.4 Risk Management

Report by ILRI (2006) highlighted that risk management lies at the heart of maximizing livelihoods out of the pastoral livestock production without compromising the sustainability of the natural resource base. This report explains that managing pastoral risk is important because it is a major determinant of pastoral poverty, food insecurity and environmental health. Hence, risk management is the systematic application of management policies, procedures and practices to the tasks of identifying, analyzing, assessing, managing and monitoring risk.

In addition, it is a way for an individual, household, community or organization to avoid losses and maximize opportunities. It is a continuous, adaptive process that needs to be integrated into all relevant aspects of the decision making procedure of an individual, household, community or organization. Moreover, risk management should be seen as an integral part of a broader development strategy. According to the report, it is stated that in order to have an effective risk management strategy, it should be incorporated or linked to other programs and strategies of rural development, food security, environmental conservation and poverty alleviation.

ILRI (2006) stated further that managing risk in the livestock sector requires a combination of risk mitigation and financial approaches. Hence, Pastoral and herd management must therefore be complemented by financial mechanisms that provide herder households with immediate liquidity after a disaster.

Study by Ndikumana *et al.* (2000) indicate that Livestock herders manage the composition, size and diversity of animals in order to cope with variable feed resources and as a traditional form of insurance against livestock deaths during drought. This argument is inline with what is reported ILRI (2006) which shows that slaughtering livestock and preserving the meat, conserving of grazing areas for times of extreme drought, division of large herds into smaller units and species, stock loaning between relatives and friends, collection of wild fruits and bartered cereals, and begging for food can be good option for managing risk caused by drought.

Report by World Bank Development (2001) argued that for policy making it is important to distinguish between idiosyncratic and covariant risks. The management of covariant risks often calls for public sector engagement and investment, while idiosyncratic risks are normally best dealt with by the household itself. Risk management strategies can be sub-divided into risk reduction, risk mitigation and risk coping strategies. In principle the preferred approach should be first to reduce the likelihood of risks, then to mitigate the negative impacts of a shock so that the need for coping strategies is minimized.

Aklilu and Wekesa (2002) in their study reported that much has been written about the need for urgent action early in a crisis to protect livelihoods of pastoralist against drought and proposed that early interventions can mitigate the effects of drought on pastoralists thereby reducing the need for major life-saving emergency response. This report further noted that, whilst there is increasing recognition in government circles and within aid agencies and donors of the importance of early livelihoods interventions, particularly in pastoral areas, the system is still overwhelmingly geared towards post-disaster responses largely centred on food aid.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

The study was conducted in Handeni District. The area was chosen based on availability of pastoralists and due to the fact that very few studies have been carried out on pastoralists compared to other places in Tanzania. Eight villages comprising of four wards and two divisions were involved in the study.

3.1.1 Location

Handeni district is situated in the south western part of Tanga. It covers an area of 6433 km² at an attitude ranging from 600-1000metres above sea level. According to National population census of 2002, there were 248 633 people with annual growth rate of 3.3%. In the year of 2011/2012, the population was estimated to reach 332 024. Handeni is one of the eight districts of Tanga region in Tanzania which is bordered to the west by Kilindi District, to the north by Korogwe District, to the east by Pangani District and to the south by the Pwani Region. Handeni District is administratively divided into 7 divisions, 19 wards and 112 villages.

The majority of the population is living in poverty despite abundant potentil of land for agricultural productivity and relatively good climate, adequate rainfall and large labour force. This is due to low level of education, technology change, poor infrastructure, unreliable source of water for irrigation, poor marketing network for cash and lack of reliable cooperative societies.

Handeni District agro-Ecological zones

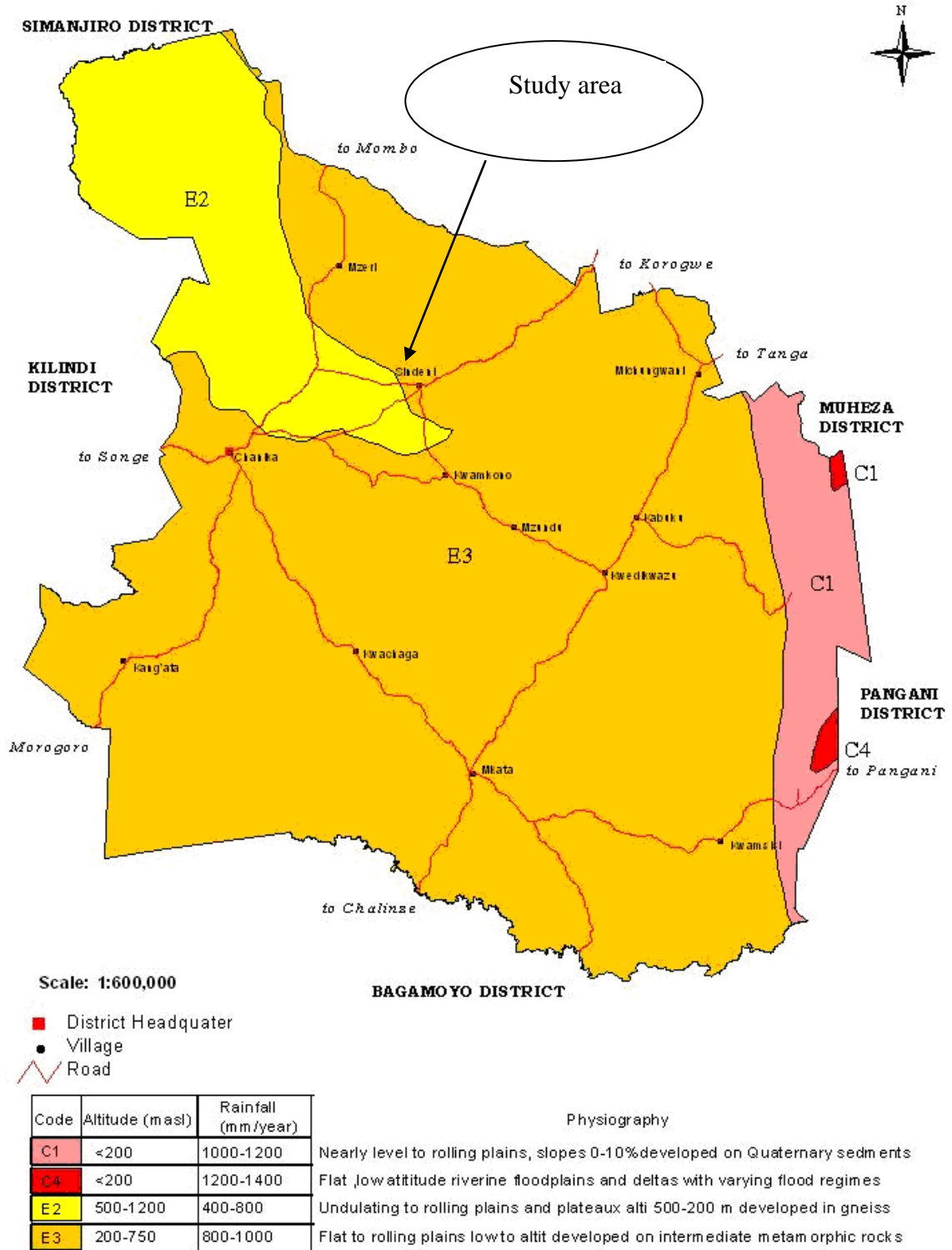


Figure 2: Map of Handeni district in Tanzania region showing the location of the study villages

3.1.2 Socio-economic profile

The main source of livelihood of the District population is Agriculture. According Local Government Monitoring Data of 2010, about 93.1% of the household rely on Agriculture for income either in cash or kind.

3.1.3 Agriculture

Out of the total area of 643 300ha, the potential area arable land is 30 9356ha (48% of the District area. Out of this 92 809.5ha are currently under crop cultivation. The crops grown are maize, beans cassava, millet, cotton, sunflower, and pigeon pea, oranges, coconut banana and vegetables. There are also large scale farms covering a total area of 3124ha with title deed and 1620ha have not been surveyed. Sisal is the main crop raised in estate. The markets of crop are in Tanga, Dar es Salaam Moshi and Arusha.

3.1.4 Livestock

Livestock is the second most important production activity in the district where 99 670 cattle are indigenous, 735 improved cattle, 180 138 goats (of which 6161) are improved breed, 17 728 sheep, 1696 donkeys, 24 520 pigs, 439 509 chickens (11 099 are improved breed). Potential range land is estimated to be 33 943ha which can carter for 140 580 animal units according to Handeni carrying capacity of 2ha/AU/ Year. Currently Handeni has about 122 790 animal units including wild life and therefore is in a position of adding 29767 animal units without affecting range land management and environment. The natural vegetation is savannah woodlands with river bank forest.

3.1.5 Environment

The District has 37 forest reserves of which 6 are central Government Forest Reserves (CGRF) covering 21 970.2ha and 31 are local authority forest (LAFR) covering an area of

31 290.4 ha. Out of the 37 forest reserves 25(43 779.2ha) are productive, while 13 (9481ha) are protected forest. The forest area is under threat of disappearing due to illegal harvesting, rampant bush fire, mining, overgrazing and shifting cultivation.

3.1.6 Investment opportunities

The main investment opportunities are; Fruit growing, beef ranching, dairying, Sheep rearing, honey processing and mining. The main ethnic group are the; Zigua (66.1%) and Nguu (17.9%). Other ethnic groups include the Maasai pastoralists, whose estimate was not given in the record.

3.2 Research Design

In this study, a cross-sectional research design was done in which data was collected at a single point in time. The reason for choosing this method was due to the limited resource available in terms of time, labour, and material. But more important due to the nature of the study objectives.

3.3 Sampling Procedure

A sample size of 160 pastoralists was selected for the study. The sample size for the research was determined using the following formula recommended by (Kothari, 1993).

$$n = Zpq/e^2$$

Where:

n = Desired sample size (where proportion is greater than 10000)

Z is the standard normal deviate set at 1.96 (in sample at 2.0) corresponding to 95% confident interval

p is the proportion in the largest population estimated to have a particular characteristics

$$q = 1.0 - p$$

e^2 = Degree of accuracy desired, usually set at 0.05 or occasionally at 0.01

Therefore the sample size was calculated as: $((1.96)^2 * 0.1 * (1 - 0.1)) / (0.05)^2 = 134$
 However, a sample size of 160 households were randomly selected based on convenience to increase accuracy of the data. The selection of the household was guided by the village register book. A sampling unit was household.

3.4 Sampling Technique

In the district, two divisions namely chanika and sindeni were purposively selected. In the selected division, four wards namely chanika, kibaoni, misima and sindeni were purposively selected. In the selected wards eight villages namely banju, kilimila, konje, malezi, msomera, mbagwi nzeri and sindeni were purposively selected. The reason for choosing divisions, wards and villages was based on availability of high number of pastoralists. From each village 20 pastoralists was selected using simple random sampling method

3.4 Data Collection

3.4.1 Primary data

Two types of data namely primary and secondary data were collected. Primary data was collected using household survey using questionnaire, focus group discussion and key informants interview. The questionnaire comprising of open and closed ended questions were administered to heads of households. (Appendix 1). Two focus group discussions were held in each selected village. Each group was formed of 7 to 12 participants of different age and sex. The discussion was guided by a checklist of questions for discussions. For key informants interview, village leaders, community workers and

extension officers form this part of the data collection method in order to cross check answers given by respondents. The key informants interview followed immediately after the administration of questionnaire. The questionnaire was pre-tested in order to verify if it could be understood by respondents and to check if it addressed the issues under investigation. After pre- testing, necessary correction were made.

3.4.2 Secondary data

These data were collected from difference sources including, District offices in Handeni, different literatures on pastoralists and from village registers

3.5 Data Analysis

Both quantitative and qualitative methods of data analysis were employed. For quantitative data, descriptive and inferential statistics were used. Socio-economic data were analyzed under descriptive statistics. In descriptive statistics, frequencies and percentages were computed to summarize the results. For inferential statistics, regression model was applied to identify the relationship between socio economies of pastoral household and the selected background variable characteristics, management strategies and coping mechanism variables. Socio economies of pastoral household are hypothesized to be a positive function of selected variables.

The regression model was as follows;

$$SE(PHH) = \beta_0 + \beta_1(AGEHH) + \beta_2(EDULHH) + \beta_3(FSPHH) + \beta_4 (MSPHH) + \beta_5(SPHH) + \beta_6(LOPHH) + \beta_7(MEPHH) + \beta_8(PSPHH) + \beta_9(MPPHH) + e_i$$

Where SE (PHH) is the Socio-economies of pastoral households (Measured as the number of animals possessed)

β_1 (AGEHH) Age of head of household (in years)

β_2 (EDULHH) Education level of head of household (in years spent in school)

β_3 (FSPHH) Household size (measured in number of family in household)

β_4 (MSPHH) Marital status (1 married 2 Single 3 Divorced)

β_5 (SPHH) Sex of interviewed head of household (1 male and 2 female)

β_6 (LOPHH) Land ownership (measured in size of the land owned in acre)

β_7 (MEPHH) Management practices (1 sedentary system and 2 nomadic)

β_8 (HMPHH) Herd mobility (measured in number of pastoralists migrated)

β_9 (MAPHH) Market availability (Number of available market in specified year)

β_{10} (AEPHH) Availability of early warning system (1 available and 2 not available)

$\beta(1-10)$ coefficient of the independent variables

e_i = random error

The analysis of the quantitative data was performed using Statistical Packages for Social Science (SPSS) computer program. Data was coded and made suitable for addressing the specific objectives after being analyzed. For qualitative data; the data was collected through focus group discussion and key informants interview analysed using structural content analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Household Characteristics

Household characteristics which are discussed here include; age, sex, education level, marital status and family size.

Table 2: Socio demographic characteristics (n=160)

Variables	Frequency	Percentage
Education level of respondents		
Informal education	107	66.9
Primary level	53	33.1
Secondary level	0	0.0
Distribution of respondents by sex		
Male	136	85.0
Female	24	15.0
Marital Status of the respondent		
Marriage	159	99.4
Single	1	0.6
Divorced	0	0.0
Family size of pastoral household		
1-4	13	8.1
5-9	59	36.9
10 and above	88	5.0
Age categories		
Below 20	1	0.6
21-40	61	38.1
41-50	42	26.3
Above 50	56	35.0

4.1.1 Respondent's by education level

Results revealed that 66.9% of the respondents attained informal education while 33.1% attained primary education. No respondent who had attained secondary education (Table 2). Despite of the majority (66.9%) of the respondents being attained informal education they still have aware of issue of drought and that they experience it in their

daily life. The results also indicated that the majority had knowledge on the causes of drought, indicators and measures to be taken in mitigating it when drought occur.

However, various authors have emphasized the importance of education in any development interventions. For example, Bray (1999) reported that the increase in education level increases the awareness, create positive attitude and values which may motivate people to manage natural resources sustainably. In addition skills and education in management of natural resources increases working efficiency and productivity.

Moreover, study by Adell (2009) stated that education is central to the reduction of poverty and to full participation in political life. However, pastoralists are falling behind in education although the acquisition of skills are needed in the modern world, with girls be more vulnerable. This study from Adell further indicates that there are specific challenges to pastoralists' participation in education, mainly associated with mobility and remoteness. Therefore, Countries with significant pastoralist populations which do not provide adequate education programmes to them will miss their Millennium Development Goals, and therefore will lag behind economically, and will risk political unrest. Hence, policy lesson might be to develop new strategies for primary and secondary education and for all aspects of learning which equip pastoralists to deal better with modern life, including poverty eradication. If low pastoralist enrolment and high drop-out rates continue, countries with significant pastoralist populations will not reach their Millennium Development Goals, national economic development will be slowed, rural economic diversification will be impeded, and political unrest will grow. This report further states that education is an important part of the solution to poverty since it provides the skills which allow pastoralists to diversify and grow their economies. There are strong positive links between education and economic growth, between

education and better child health and lower mortality, and between educations and democracy. The absence of education makes higher productivity in pastoralism and economic diversification out of pastoralism difficult, and prevents pastoralists from working their way out of poverty. The lack of education magnifies gender disparities in the wider society.

Growing marginalization of pastoralists has already translated into political unrest, a dangerous development in a world dominated by poverty and insecurity. Hence, Strategies are needed not just for primary education, but for all aspects of education, learning and skills acquisition which equip pastoralists to deal better with economic diversification, with increasing productivity, and with the state. Such a strategy should address the needs not only of children, but also of adults, and should differentiate by gender (Krätli, 2009).

4.1.2 Distribution of respondents by sex

The study findings as presented in Table 2 revealed that majority of the respondents were men by 85.0% compared to women 15%. This shows that majority of women were left out doing other activities. Study by Niamir- Fuller (1994) argues that many pastoral policies have ignored the important roles that women play in pastoralism including the decision making and the labour they contribute to raise children, maintaining household, treating diseases, animal care, managing water resources and in providing resources such as construction material and fuel wood, as such the view experience and need of women are often left out of decision making process.

4.1.3 Distribution of respondents by marital status

Most (99.4) % of the respondents were married and only 0.6% were single (Table 2).

The finding provides an indication that most of those involved in the study area were mature.

4.1.4 Family size of the household

About 36.9% had household size of 5 to 9 persons while 8.1% had household size of 1 to 4 people. The rest 55% had household size of 10 and above persons. Mean household size was 10.76 (Table 2). This is above a mean of 4.8 which was recorded in 2007 in the household budget survey (URT, 2007). Variation can be due to factors such as migration.

4.1.5 Age of respondents

About 38.1% of respondents were aged between 21 to 40 and 26.3% aged between 41 to 50 years. The rest, 35.0% were above 50 years. Only 0.6% were below 20 years (Table 2). This indicates that the majority of household member are within the productive age and therefore labour is not likely to be limited factor in livestock risk management interventions.

4.1.6 Legal land ownership

Results indicated that 63.75% of the respondents own land while 36.25% do not own land. The findings also show that 52.25% own land with a title deed issued by village while, 47.5% own land without title deed (Table 3).

Table 3: Land ownership (n=160)

Land ownership	Frequency	Percent
Yes	102	63.75
No	58	36.25
Justification of the land		
Owned with title deed	84	52.5
Owned without title deed	76	47.5

This is supported by Nori *et al.* (2008) who argues that most pastoral lands have traditionally been communal with local institutional structures and governance preventing a ‘tragedy of the commons’.

4.2 Identification of Livestock- based Risk Areas Associated with Drought

4.2.1 Livestock based- risk areas

Findings of the study indicates that 11.9% of the respondents identify livestock losses due to increased number of death and insufficient feed resources the risk areas while, 6.3% indicates human- wildlife conflicts and increased poverty the risk area. Others 45.6% show that there is an increased diseases and competition of resource use. The rest 36.3% identify livestock losses, insufficient feed resources, human- wildlife conflicts and increased poverty to be the livestock based risk areas associated with drought Table 4.

Table 4: Livestock based- risk areas (n=160)

Livestock based- risk areas	Frequency	Percent
Livestock losses and insufficient feed resources	19	11.9
Human- wildlife conflicts and increased poverty	10	6.3
Increased diseases and competition in resources use	73	45.6
All of the above	58	36.3
Total	160	100.0

Study done by ILRI (2006) show that managing risk in the livestock sector requires a combination of risk mitigation and financial approaches. Hence, Pastoral and herd management must therefore be complemented by financial mechanisms that provide herder households with immediate liquidity after a disaster.

4.2.2 Livestock- based risk absorption mechanisms

Results indicates that 50% suggests that there should be a mechanism of preserving of grazing area for time of extrem poverty and division of largeherd into smaller units while, 20% suggests that there should be a mechanism of providing early warning to inform pastoralists about drought situation in the study area. Others 5% suggest insurance to be the absorption mechanism. The rest 25% suggest to use the combination of the above options Table 5.

Table 5: Livestock- based risk absorption mechanisms (n=160)

Livestock- based risk absorption mechanisms	Frequency	Percent
Preserving of grazing area and division of large herd	80	50
Provision of early warning, timely market	32	20
Insurance	8	5
All of the above	40	25
Total	160	100.0

Study by ILRI (2006) indicated that managing risk in livestock require a combination of risk itigation and financial approaches including provision of credit (provision of liquidity after disaster) and insurance against livestock death during drought.It can therefore be suggested that in order to have effective livestock based risk absorption mechanism a risk reduction, risk mitigation aand coping strategies should be applied in combination.

The significance of registering livestock-based risk management are: To minimize potential diseases and a means of conserving grazing areas for time of extreme drought. Another study done by Gaiha and Thapa (2006) show that identification of livestock-based interventions in risk management and coping in response to climatic shocks can inform better drought mitigating interventions and institutional of the local, national and regional livestock early warning systems. All the above will contribute to securing livestock assets and can help the pastoral and agro-pastoral households to cope better to climatic shocks.

4.3 Socio-economic Effects of Drought

Total number of animal deaths that was reported by all respondents in year 2011 as a result of drought was found to be 3 666 out of 57 785 total number of animals owned by all respondents in all villages, with the average mean of 22.91 animal died per household per year and range of minimum 3 and maximum 110. The percentage of mortality was 6.34% (Table 6).

Table 6: Amount of cattle owned and Amount of cattle died due to drought (n=160)

	Amount of cattle owned	Amount of cattle died due to drought
N = 160	160	160
Mean	361	23
Median	220.00	20.00
Std. Deviation	356.024	17.071
Variance	126753.051	291.426
Minimum	30	3
Maximum	2000	110
Sum	57785	3666

Table 7: Socio economic effects of drought (n=160)

Socio-economic variables	Frequency	Percent
Cattle lost in amount per household per year		
1-10	43	26.9
11-15	20	12.5
above 15	97	60.6
Distance travelled looking for water and pasture (km)		
1-5	58	36.0
6-10	39	24.9
>10	63	39.1
Pasture availability in terms of quality		
Available but dry	69	42.9
Not available at all	91	57.1
Availability and affordability of health services		
Not available and not affordable	42	26.1
Available but not affordable	115	71.4
Available and affordable	3	2.5
Pastoralist vulnerability to drought		
Both animals and Human being are severely affected	16	10.0
Animal dies, low milk production hence food insecurity	25	15.6
All of the above	119	74.4
Socio economic value of pastoralism		
Livestock and meat sales (income)	10	6.2
Social and cultural values	23	14.4
All of the above	127	79.4

4.3.1 Cattle losses per household per year

Results as indicated in Table 7 show that 60.6% of the cattle loss in which more than 15 cattle per household died per year, while 12.5% died between 11 to 15 and the rest 26.9 died between 1 and 10 cattle per year. Income losses as results of deaths were computed to be 41 949 000 TAS which was to be generated if animal didn't die from drought effects.

4.3.2 Distance travelled searching for water and pasture

In terms of distance travelled to search for water, results indicates that 39.1% of pastoralists was travelling more than 10 km looking for the availability of pasture and water while 24.2% travel distances between 6 to 10 km. The rest (36.0%) travel distance between 1 to 5 km (Table 7).

4.3.3 Availability and affordability of health services during drought

For the health services in terms of availability and affordability, about 71.4% indicated that services were available but not affordable while 26.1% indicates services was not available and not affordable. Only 1.9% said health services were available and affordable (Table 7).

The above situation had an impact on the number of deaths resulting to loss of income and other socio-economic and cultural consequences. This can be supported by a study done by Rothauge (1998) who indicated that the effect of drought on the socio-economic conditions of pastoralists is tremendous. Another study done by IPCC (2001) and URT (2003) argue that deaths of large numbers of livestock due to lack of water and pasture has been of repeated occurrence in Tanzania in recent years hence threatening livelihood of pastoralists in the country.

4.3.4 Pastoralist vulnerability to drought

Concerning pastoralist vulnerability to drought, about 74.4 % of the respondents indicates that they are more vulnerable to drought because both animals and human being are severely affected with animal dying, low milk production and food insecurity. About 10% of the respondents reported to be vulnerable because animals and human being are severely affected while 15.6% said to be vulnerable because animal dies, low milk

production hence food insecurity (Table 7). This can be supported by the study done by Patrick (2003) who indicated that the more directly dependent a population is on the natural resources base of an area, the greater their vulnerability when there is interference in the productivity of that natural resources base.

4.3.5 Socio-economic value of pastoralism

Concerning socio-economic values of pastoralism the findings revealed that pastoralist activities are the main source of income from livestock and meat, skin, hide and milk sales (6.3%). For social and cultural values (14.4)% and the rest of respondents (79.4%) reported that pastoralist activities were the source of income and can be used as social and cultural values (Table 7).

4.3.6 Consequences of drought effects

Consequences associated with drought which was reported by respondents were death of animals (1.9%), hunger and food insecurity (11.9%) and diseases to animals and human being (5.6%). The rest 80.6% reported that death of animals, hunger, food insecurity, diseases to animals and human being are the consequences that occurs as a result of drought (Table 8).

Table 8: Consequences of drought effects (n=160)

	Frequency	Percent
Death of animals	3	1.9
Hunger and food insecurity	19	11.9
Diseases to animals and human being	9	5.6
All of the above	129	80.6
Total	160	100.0

4.3.7 Reasons for keeping animals

For the reason of keeping animals the following were the results (7.5%) said that they kept animals because they provide them subsistence (milk, meat and blood) while (11.5%) reported that it is a the form of capital and (23.8%) said livestock serve as an important store of wealth and insurance and the rest (56.9%) kept animal because they provide them subsistence, serve as form of capital and serve as store of wealth (Table 9).

Table 9: Reasons of keeping animals (n=160)

Reason of keeping animals	Frequency	Percent
Provide for subsistence (milk, meat and blood)	12	7.5
Form of productive capital	19	11.9
Serve as an important store of wealth and insurance	38	23.8
All of the above	91	56.9
Total	160	100.0

This findings can be supported by the study done by Hogg (1997) who reported that pastoralists keep animals for several reasons. They are a form of productive capital; they provide for subsistence (milk, meat and blood), provide transport (cattle, donkeys and camels) and serve as an important store of wealth and insurance. As a form of insurance they may be imperfect as they are subject to the impact of drought and disease. However, in the absence of alternatives, particularly financial markets and institutions, they are the only form of insurance available to many pastoral households. In some cases capital/wealth is consumed directly (slaughter) but more often animals are sold to realize cash for grain purchases, and other necessities of life. The store of capital/wealth in animals is also reflected in social institutions such as marriage and inheritance. The largest transfer of livestock a male is likely to make in his lifetime is for bride wealth at marriage. Livestock are therefore a source of prestige and a means for partaking in complex networks of social obligations and reciprocity that mitigate risk (particularly for poorer households).

4.4 Examining Coping Mechanism and Strategies Against Drought

4.4.1 Respondent's reponse on drought management and coping mechanism

Results indicated that 100% of the respondents had experienced drought. The majority of the respondents (86.3%) show that drought persisted in their area between October and January each year. About 99% of the pastoralists indicates that the causes of drought were poor cultivation practices and cutting of trees for charcoal making and other uses. Indicators used by respondents in predicting drought were absence of water in rivers, dams and well as tree leaves (63.9%). The Results also indicates that 95% of pastoralists perceived a drought when rain water, wells, dams and pastures were dry.

About local knowledge used by pastoralist in predicting drought, the findings indicates that 3.8% of pastoralists predict drought by observing leaves in some trees, while 20% of them predicted drought when there is high dry spell during short rain season while 13.1% looked on wide variety of tolerant species of plant trees (Table 10).

**Table 10: Respondent's reponse on Drought Management and Coping Mechanism
(n=160)**

Experience of drought	Frequency	Percent
Yes	160	100
No	0	0.0
Causes of drought reported by the respondent		
Cutting down of trees for charcoal making and other uses	51	31.9
Poor cultivation practices	10	6.3
All of the above	99	61.9
Indicators of drought reported by the respondent		
Absence of water in rivers, dams and wells	54	33.8
Dry of tree leaves	4	2.5
All of the above	102	63.8
Perception of drought as reported by the respondent		
One year without rainfall	1	0.6
When rain water, wells and dams are dry	60	37.5
When pastures are dry	7	4.4
When 2 and 3 apply	92	57.5
Most common month of drought in a year		
October to January	138	86.2
Other time	22	13.8
Reason why pastoralist are more vulnerable to drought		
Both animals and Human being are severely affected	16	10.0
Death of animals, low milk production hence food insecurity	25	15.6
All of the above	119	74.4
Local knowledge used by pastoralist in predicting drought		
Scheduling of leaves in some plant trees e.g. Mikuyu	6	3.8
Heavy dry spell during Vuli season	32	20.0
All 1 and 2 above	101	63.1
Identification of wide variety of tolerant plant species	21	13.1

4.4.2 Coping mechanism adopted

About 66.9 % of the respondents Nomadic pastoralism as their coping mechanism while 1.2% did split animals into small group then distribute them to different locations. The rest, (31.9%) applied both technique of migrating and splitting animal into smaller groups (Table 11).

Table 11: Coping mechanism adopted (n=160)

Coping mechanism	Frequency	Percent
Migrating looking for pasture and water	107	66.9
Splitting of animal into smaller group	2	1.2
All of the above	51	31.9
Total	160	100.0

This results can be supported by the study done by Ndikumana *et al.* (2000) who argued that Pastoralists frequently migrate with their animals in search of pasture and water. It is also stated that traditional pastoral mobility resulted in the optimal utilization of the existing natural resources, by taking advantage of temporal and spatial variations in the distribution and quantity of rainfall and forage, as well as the best nutritional status of the forage. It is also an effective way of risk management through evading of drought conditions and actual or potential disease or pest outbreaks, which usually depend on climatic conditions. Additionally, pastoralism helped to avoid the overexploitation of the natural resources by reducing concentration of livestock in one area, thus leading to conservation of the biodiversity and therefore pastoralists and their livestock must possess a high degree of resource utilization mobility in order to respond to temporal and spatial variation in the distribution and quantity of rainfall and forage (Homewood and Rodgers, 1991). Mobility also enables pastoralists to manage disease risks by avoiding known area of infestation (Shem *et al.*, 2005).

4.4.3 Limitations of the adopted mechanism

Results from the findings show that 63.1% of the respondents indicated the mechanism to have limitation in that it results into social conflicts with farmers while 16.3% indicated the mechanism to have limitation in getting social services and 2.5% indicated the mechanism to have limitation in that it is difficult in owning land. The rest 18.1%

indicated the mechanism to have limitation in that it results to social conflicts with farmers, difficult getting social services and also difficult in owning land (Table 12).

Table 12: Limitations of the adopted systems (n=160)

Limitations	Frequency	Percent
Can result into social conflict with farmer	101	63.1
Difficult in owning land, predators	4	2.5
Limited acquisition of social services because of mobility	26	16.3
All of the above	29	18.1
Total	160	100.0

4.4.4 Pastoral system practiced

For the pastoral system practiced by the respondents in keeping animals 33.8 % of the respondents reported to practice Nomadic system while, 66.2% reported to practice sedentary system. No respondent who practiced Transhumance system (Table 13).

Table 13: Pastoral system, advantages and disadvantages (n=160)

Pastoral system practiced by the respondents	Frequency	Percent
Sedentary	106	66.2
Nomadic	54	33.8
Transhumance system	0	0.0
Advantage of the Nomadic system		
Possible to optimal utilize the available resources	61	38.1
It avoid over exploitation of the land	2	1.3
It exploit different areas of vegetation type and productivity	10	6.3
All of the above	87	54.3
Disadvantage of the Nomadic system		
Can result into social conflict with farmer	101	63.1
Difficult in owning land	4	2.5
Limited acquisition of social services	26	16.3
All of the above	29	18.1

The finding indicates that 87% of the respondents reported that nomadic system have the advantage in that it optimal utilize the available resources and also it avoid over exploitation of the land. However, the system adopted reported to have the disadvantage of resulting into social conflict with farmer 63.1%, difficult in owning land 2.5%, as well as limited acquisition of social services because of mobility 16.3%. The rest, 18.1% indicates that the system had disadvantage in that it results into conflicts with farmers, difficult in owning land as well as limited acquisition of social services (Table 13).

This finding is supported by the study done by Shem *et al.* (2005) who argue that increasing poverty due to reduced mobility, lack of alternative livelihoods, confused and competing rights, entitlements and poor provision of basic needs and increasing human and livestock populations all aggravate conflicts. For example, surveys (Shem *et al.*, 2005) in his study shows that existing number of cattle in Tanzania has already surpassed the normal carrying capacity in most of the areas. Increasing land scarcity and conflicts of interest between different land users in these and other areas have implied that huge numbers of people have migrated in search of arable land and pastures elsewhere. Additionally, the growth of the livestock population has led to increased movement of large herds of livestock to areas which traditionally had few livestock, such as Mbeya, Iringa, Morogoro, Rukwa and Coast Regions, creating serious land use conflicts. Worse, as they loose their land, some pastoralists become sedentarized, while others migrate to new areas often occupied by crop farmers, resulting in conflict and sometimes violence, particularly over the allocation of land and water resources.

In addition, Shem *et al.* (2005) argue that sedentarisation for whatever reason, without good planning and transfer of appropriate livestock management techniques, extension services and good livestock marketing systems tends to affect pastoralists and the environment negatively.

4.4.5 Government interventions

On government interventions in assisting pastoralists during drought seasons, the results indicated that 72.5% of the respondents didn't receive any assistance from the government, while only 27.5% reported to get assistance in construction of check- dams and wells (Table 14).

Table 14: Assistance from the government (n=160)

Assistance	Frequency	Percent
Receiving assistance from the governmnt	44	27.5
Not receiving assistance from the governmnt	116	72.5
Total	160	100.0

This results show that little effort is taken by the government on assisting pastoralists with drought. Study by Thompson (1992) stated that it is the role of government to support in movement of livestock, provision of information where forage is available, management of conflicts concerning access to key resources (water points, forage), support in marketing of livestock in order to ensure purchasing power and avoid waste of assets, provision of food aid to relieve pressure on food prices and supply grain directly to pastoral populations, subsidies and price control and to ensure pastoralists a minimum of purchasing power in the context of selling animals, buying food, health and nutrition support as well as to control disease outbreaks and to protect nutrient status of vulnerable groups. Further more, the study pointed out that the government should put more emphasize in conducting veterinary campaigns in order to avoid large-scale livestock deaths as a result of outbreaks of contagious animal diseases during drought. The study concluded by saying there is a need to build a successful programme in order to reduce pastoral risk and vulnerability by creating new strategies to enhance the ability of herders and herder communities to manage risk.

4.4.6 Financial Institutions interventions

On financial institutions aspects, all (100%) of the respondents reported that financial institutions had a great role to play in improving livelihood of pastoral households. About 71.9% of the respondents said the role of financial institutions need to play is to provide them with credit while 28.1% of the respondents said financial institutions need to assist in insuring pastoralists when drought occurs Table 15.

Table 15: Financial institutions (n=160)

Is financial institution has anything to play?		
	Frequency	Percent
Yes	160	100
No	0	0.0
Role needed to play		
Provision of credit to pastoralists	115	71.9
Insuring pastoralists when situation of drought occur	45	28.1

This is supported by study done by Toulmin (1995) who indicated that government needs to explore the best way of creating and managing emergency funds for natural disaster relief, including stand-by funds which can be accessed rapidly in an emergency. He further explain that government should create an economic and legal environment and institutional support conducive to the growth of agricultural banks, micro-finance initiatives, private financial institutions and financial incentives for risk management. If pastoral communities are able to develop formal or informal savings and/or insurance it will enable them to have control over the types of interventions that are required during drought, reduce the need for central government and donors to intervene, encourage self-reliance and reduce dependence.

For the National policies interventions, Katani (1999) described that in the African pastoral context there is a need for information about National policies and legal

frameworks with regard to credit union development and micro-finance, whether NGOs and CBOs pastoral associations are involved or interested in developing credit, finance and savings institutions and providing management and training. For example, micro-finance has been demonstrated to be effective in India and Bangladesh for livestock production and very poor households (often female headed) prefer to use their loans for livestock in preference to agriculture. There is evidence to suggest that investment in livestock leads in the longer run to the accumulation of other assets. There is a need therefore to investigate further on the prevalence of informal banking and credit arrangements and to increase the potential for the development of savings clubs and micro-credit in order to mitigate the impact of drought and to fund post-drought recovery. Study herd dynamics in order to establish whether there is a surplus of unproductive animals during inter-drought years and to critical analyses whether formal saving accounts can provide sufficient growth to compare with livestock production (over the drought cycle). What is needed is to create a better developed understanding of pastoral household concepts of ownership, wealth, private, communal and commercial assets before banking and credit can be introduced with confidence to these societies.

4.4.7 Local Institutions

On average, about 99.4% had the opinion that local institution needs to be established in order to increase their voices and empowerments Table 16.

Table 16: Pastoralists opinion on local institutions (n=160)

	Frequency	Percent
Community based pastoral association be established	159	99.4
Others	1	0.6
Total	160	100.0

A Study by Davies (1993) stated that fundamental prerequisite to addressing the demands of herders and communities is to establish local institutions which will apply an approach of bottom-up risk management planning mechanism which will complements the currently dominant top-down planning approach. Therefore, herders representatives, community leaders and representatives of herder cooperatives should be closely involved in the risk management planning process.

4.5 Impacts of the Mechanisms and Factors Influencing Socio-Economies of Pastoral Household

Results from the analysis indicates that age influenced the socio-economies of pastoral house negatively ($\beta = -0.451$; $p = 0.808$), while education level positively but not significant ($\beta = 43.821$; $p = 0.497$), family of household positively and not significant ($\beta = 3.379$; $p = 0.50$), marital status negatively ($\beta = -53.979$; $p = 0.847$), and size of the land, positively ($\beta = 58.898$; $p = 0.004$). Results also indicates that herd mobility influence the socio-economies of pastoral household positively and significant ($\beta = 91.749$; $p = 0.01$), early warning system positively ($\beta = 316.537$; $p = 0.00$), and availability of timely market, ($\beta = 11.516$; $p = 0.021$) were significant to the socio-economies of pastoral household. Pastoral system positively and significant ($\beta = 316.537$; $p = 0.00$). The results implies that age, education level, marital status and family size does not contribute to risk management strategy and coping mechanism to drought. Other variables which include size of the land, herd mobility, pastoral system, availability of timely market, earlywarning system and insurance contribute to risk management strategy and coping mechanism to drought (Table 17).

Table 17: Impacts of the mechanisms and factors influencing socio-economies of pastoral household (n=160)

Variables	Unstandardized Coefficients		t	P value
	BETA	error		
(Constant)	-377.035	325.884	-1.157	0.249
Herd mobility	91.749	26.821	3.421	0.001
Pastoral systems	316.537	60.252	5.254	0.000
Age of respondent	-.451	1.854	-0.243	0.808
Marital Status of the respondent	-53.979	279.482	-0.193	0.847
Education level of the respondents	34.821	51.113	0.681	0.497
Ownership of land	58.898	69.971	0.842	0.401
Size of the land	2.854	0.970	2.942	0.004
Number of the family of the respondent	3.379	5.002	0.676	0.500
Timely market, early warning syestem and insurance	11.516	23.266	0.495	0.021

SS = 202228571.445; MS = 995904.383, df = 9 ; F = 13.261 P<0.05), R² = 44.3

The statistical finding indicates that herdmobility had positive effects on number of animal possessed meaning that migration increases the number of animal surviving during drought periods because there is optimal utilization of available resources, reduce disease outbreak and avoid over exploitation of the natural resources by reducing concetration of livestock in one area.

For the availability of timely market and accessibility of information the results implies that income and asset possessed by pastoralists had great relationship with the availability of timely market and early warning information, (p = 0.021) meaning, when pastoralists are informed about drought situation they can offload the unproductive stock by selling them in good prices hence be economically stable in terms of income, food security and affordability of social services like education, health and water sevicees. Overall socio-economies of pastoral people depend on access to pasture, water, animal health, market, credit and education.

The findings imply that managing pastoral risk as a coping mechanism could reduce poverty (income from livestock sales and other by products), improve food security (meat, milk and cash) and improve environmental health (reduce land degradation). Further more, managing risk can maximize livelihood out of the pastoral livestock production without compromising the sustainability of natural resource base. Therefore, managing pastoral risk is important because it is a major determinant of pastoral poverty, food insecurity and environmental health. Analysis show that adopted mechanism has the following strength; it is possible to manage disease risks by avoiding areas of infested as well as effective utilization of the marginalized land (arid and semi- arid land); the mechanism reduces loss of animal because of the effective utilization of resources by taking temporal and spatial variation in the distribution and quality of rainfall and forage as well as nutritional status of forage, but also analysis indicated that, reduced number of loss of cattle increases income that could be generated by pastoralists through milk and meat sales and other by products thereby be food secured. However, it become possible to sale animals and have cash that may be used in various requirements like pay for school fees, paying for treatment and other social requirements.

The findings also revealed that improved access to market can make good price of products hence increasing their income. Further more, the study found out that strengthening extension services could improve health condition of animals to be sold at a good price hence increasing earning of pastoral income. More over, the study found out that conserving water could reduce distance travelling for women searching for water and therefore be involved in other economic generating activities thereby increasing their income and livelihood.

4.6 Assessment of the Sustainability of Mechanism on the Socio-economies of Pastoral Households

Sustainability of the mechanisms was assessed based on chosen indicators to measure sustainability of mechanisms which were land right, accessibility to market, availability of financial institutions, accessibility to information and use of technology. On average, about 70.0% of the respondents rated the adopted mechanism not sustainable because it does not secure land right, not accessible to market, not accessible to information, not trusted with financial institution and not accessible to information as well as use of technology while, 30% of the respondents reported that it is sustainable because it is environmental friendly and animals survive (Table 18).

Table 18: Assessment of mechanism in terms of sustainability (n=160)

Assessment of mechanism in terms of sustainability	Frequency	Percentage	Ranking
land right, market, financial institutions, information, and technology	112	70.0	not effective
land right, market, financial institutions, information, and technology	48	30.0	effective
Total	160	100.0	

The results are supported by Ganya *et al.* (2004) who argued that in order to achieve sustainable development objectives, pastoralism must be based in number of good pastoral management practices that incorporate together policy consideration, management tools as well as economic and financial instruments which include among others intergrating indigenous knowledge, innovation and practices, securing land right, forecasting technology improve market access for sustainable development as well as exploring financial mechanism and individual capacity building.

4.7 Results From the Focus Group Discussion and Key Informants

Findings from qualitative data was collected based on similar observations, thinking and opinions from members of the group. For the focus group formed, the majority of the participants indicated that women and children were the most vulnerable group affected mostly by drought effects because they do travel long distances searching water for home use and the children cannot attend school regularly because of mobility.

Other consequences that were reported to be associated with drought effects included; loss of livestock, distant grazing and places to get water for their cattle. The groups formed had the opinion that managing pastoral risk is important because is a major determinant of poverty, which lead into food insecurity and cause environmental degradation. The majority of the respondents reported that, they need government support to access water through construction of check-dams and other sources of water in order to minimize shortage of water in the study area. Moreover, the majority of the respondents reported that properly managed pastoralism can improve pastoral livelihood and consequently reduce poverty.

Furthermore, the majority requested the government to locate legally areas for pastoralists to graze and farmers for crop production. This, according to them will reduce the current conflicts because of land competition between pastoralists and farmers. Findings from key informants revealed that drought is still increasing as compared to the past. The majority make the following as their suggestions to under taken: Creation of awareness to people on the causes of drought and measures to be carried out from individual and community perspectives in coping with these adverse effects of drought. Moreover the majority had the opinion that sustainable land management use should properly be made to locate legally area for grazing and cultivation.

The governments according to their opinion through the help of extension officers should develop mechanism of measuring the carrying capacity of the available land according to the stocking rate in order to avoid overgrazing that result into over exploitation of the available resources. Moreover, they suggested that pastoralist should be educated on the importance of reducing the number of animals according to the available land in order to increase productivity.

From the District level the following were the strategies put in place in reducing the adverse effects of drought: Constructions of more chaco dams (Lambo). Currently 30 dams were constructed from different villages and cattle dip available at different places within the district. Another strategy was to create awareness to pastoralists on land tenure systems, conflicts resolutions between farmers and pastoralists and land use management. This activity was reported to be assisted by Care International through Pastoral Management Project and Enviro-care. The district had the opinion that policy of reducing number of cattle according to carrying capacity should be implemented.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings, it can be concluded that managing risk in livestock sector require a combination of risk mitigation and financial approaches. The following are the other conclusions:

- (i) Herd mobility was identified to be the main option used by the majority of pastoralists as a coping mechanism in reducing adverse effects of drought because of the fact that it optimizes the use of natural resources and enable pastoralists to manage diseases risks by avoiding known areas with infectious agents. The finding also indicates that herd mobility exploit spatially different areas of vegetation type and productivity and it utilizes fully the available resources and therefore it reduces over exploitation hence considered to be friendly to natural resources in that, biodiversity is conserved, cannot bring land degradation and it utilize effectively the marginalized land (arid and semi- arid land).
- (ii) On the other hand the findings noted that herd mobility had its limitation in that the option is confronted with shrinking of grazing land because of increased people population and need for food and land for arable crop farming. Another limitation was conservation of wildlife which results into increasing competition with pastoralist hence forcing them off their land. Moreover, herd mobility is threatened by increased land scarcity and conflict of interest between different land users that result into conflict and violence particularly in allocation of land and water sources.

- (iii) The study further conclude that good management practices and coping mechanism to drought can have an effects on socio-economies of pastoral household because it affects livestock prices, availability of forage, livestock number as well as availability of water. The study also conclude that in order to achieve sustainable development objectives pastolarism must be based in number of good management practices that will incorporate policy consideration, management tools as well as economic and financial instruments. Hence, providing appropriated support for pastoralists their livelihood and economies could generate considerable economic benefits at both local and national level.

- (iv) On financial institutions interventions the findings indicates that financial institutions have a great role to play in supporting pastoralists especially during drought. The findings revealed that early warning system and timely market have a great role to play in mitigating adverse effects of pastoral households as a result of drought.

- (v) For the knowledge base results indicates that provision of knowledge on how to improve the resilience of pastoral communities to manage drought and reduce risk is very minimal but this knowledge is crucial for development of sustainable drought management system. Hence the study conclude that the government should support in marketing of livestock aim being to ensure purchasing power and avoid waste of assets. What should be done is to establish a marketing component that will assist pastoralist in creating to more profitable market with the goal of sustainably improving their livelihood and their economic resilience. Strategy to be put in place is to enable pastoralists to sell livestock commercially

and organizing trader's trip to drought affected areas as well as opening new markets so that pastoralists get better prices.

5.2 Recommendations

Based on the conclusion, the following recommendations can improve resilience and therefore minimize the adverse effects caused by drought in the study area;

- (i) Livestock based risk absorption mechanisms require knowledge on understanding drought mitigation techniques in both economic, environmental and social aspects and that the significance of registering livestock-based risk management have several advantages in that: it avoid diseases from areas of infestation, can develop a means of conserving graze for use in time of extreme drought, can avoid resource competition and cannot bring conflicts among resource users.
- (ii) For the policy consideration what is needed is to integrate indigenous knowledge, practices and innovations into intervention strategies. There should be a developed mechanism for the pastoralists to secure land and water right without putting aside gender mainstreaming in all pastoralist development interventions. Moreover, use of forecasting technology including destocking, conserving grazing areas and water should be implemented.
- (iii) For the financial instruments both accessibility to market and availability of financial institutions must be put in place. Critical analysis must be made to study whether credit scheme has made impacts on livestock sector especially on pastoralist society.

- (iv) Management strategy must be incorporated or linked with other program strategies like Rural development and Food security. Creating knowledge base to pastoralists is important because they will be able to identify different plant species that are tolerant to the drought season and therefore be used as feed during dry season. What is needed is the government through their experts including extension officers, researchers and other stakeholders like Non-government organization and Community based organizations to work together with pastoralists in identifying those species and identifying nutritive value of the identified species.
- (v) Pastoralists contribute invaluable local knowledge to the management of biodiversity at the species level and therefore what is required is the government to recognize their knowledge and make use of it at local level. Provision of technology of conserving forage and managing of biodiversity at species level should be emphasized.
- (vi) On gender mainstreaming it is observed that many pastoral policies have ignored the important roles that women play in pastoralism including the decision women make and the labour they contribute to raise children, maintaining household, treating diseases animal care, managing water resources and in securing resources such as construction material and fuel wood, as such the view experience and need of women are often left out of decision making process. It is noted that women hold important local knowledge regarding biodiversity and make many decisions concerning the use of natural resources within pastoral household. Therefore, according to my opinion mainstreaming gender into pastoralist related policies, program and

project can contribute positively to biodiversity conservation and sustainable use and poverty reduction. There is a need of ensuring that gender issues are reflected in all aspects of pastoral development program including supporting technical knowledge system and enhancing women participation in all livestock production.

- (vii) There is a need to have an integrated drought management policies including availability of pastoral institutions, strengthening extension research linkages and provision of emergency feeding. example, opening catchment protected areas, conserving areas for grazing during dry spell, developing water harvesting technology and determining carrying capacity of grazing land in order to avoid overgrazing and over stocking. Other strategies to be carried out in mitigating drought effects must include among others be water management deepen wells, utilize water supply system properly, construct check-dam, conserve water by developing rain water harvesting system as well as conserving fodder. Also, the government should establish insuring mechanism for pastoralists so that whenever drought occurs and animal died they are compensated. Providing appropriate support for pastoralist could generate considerable economic benefit both at local level and national level hence improving their livelihood and economies.
- (viii) There is a necessity of involving pastoralist communities in the identification of strategic development and priority needs because their participation in the development process will increases their technical skills, enabling them to access information and knowledge and acquire skills in animal health, water management and information sharing. It also made the outcome of this process

more sustainable, because communities will be contributed to the development interventions including owning water infrastructure, manage and repair the delivery system and that water and pasture resources be protected by village by- laws

- (ix) Concerning reducing number of animals (destocking) the government in collaboration with extension officers, researchers and responsible Ministry must develop a way of assessing and monitoring carrying capacity of forage and stocking rate in order to avoid overgrazing that results into land degradation.

- (x) Debate on whether Nomadic or Sedentarization which one be opted by pastoralist what is important is to enhance and secure pastoralist to access to strategic resource so as to respond effectively to the impact of drought. Sedentarisation for whatever reason, without good planning and transfer of appropriate livestock management techniques, extension services and good livestock marketing systems will tends to affect pastoralists and the environment negatively because it will results in large numbers of livestock being confined in one area for the whole year, thus overburdening the grazing area and consequently damaging the environment through land degradation due to overgrazing. What is important is the acquisition of knowledge and experience to understand mitigation techniques and risk analysis (economically, environmentally and in social aspects) together with use of related decision making process at level of government from grassroots level to the national.

5.3 Area for Further Studies

There is a need to carry out further study on Herd dynamics and drought losses in order to have reliable data for planning and development purposes on herd growth, losses number and type of animals marketed over past 20-30 years ago and to critically analyze the in household have been integrated to market economy.

What is expected from this proposed study will be provision of important information for investigation into ways of managing risk in arid and semi arid pastoral system and the findings will give an indication to what extent traditional coping mechanism contribute to risk reduction.

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APPENDICES

Appendix 1: Questionnaires

A: RESPONDENTS BACKGROUND INFORMATION

Social – demographic information

Household Id -----Date of Interview -----Enumerator-----

District ----- Division ----- Ward----- Village -----

1. Name of respondent
(optional).....
2. Age of household head
(years).....
3. Sex of respondent:
4. Relation of respondent to the household head (a) Owner (b) Husband (c) Wife (d) Son
(e) Daughter (f) Others
5. Marital status of household head: (a) Married (b) Single (c) Divorced (d)
Widow/Widower.....
(e)Others.....
6. Education level: 1. informal education; 2. primary; 3. secondary; 4.
college.....
7. How many are you in your family?
8. How many of your children are attending school?
9. Years of schooling of household respondents
10. Do you own land? If YES
11. How many acres do you own?
12. Is the land owned legally?

B: Background Information on Drought Risk Management and Coping Mechanisms

13. Have you ever experienced drought? Yes/No.....
14. If yes, since when and for how long did it persist?
15. (a) What do you think are the causes of drought?
.....
.....

(b) What are the most common indicators of drought?

.....

(c) What is the magnitude of drought in your area? (Period it existed)

.....

16. What do you perceive as drought seasons? Tick (✓) the appropriate answer.

- i. One year without rainfall
- ii. Six (6) months without rainfall
- iii. When rain water wells and dams are dry
- iv. When pastures are dry
- v. Others

17. In a normal year, what are the most common drought months?

.....

18. Why do you think pastoralists are more vulnerable to drought.....

19. a) what local knowledge do you practice in predicting drought?

b) What measures do you take using your knowledge in reducing adverse effects?

.....

c) What do you think are the advantage of this management practices you normally take

20. How many cattle do you own?

21. Have u lost your livestock due to drought during the last 12 months?

- 1. Yes
- 2. No

22. If yes, (Q21 please give the actual number of your livestock you lost due to drought against each livestock category?

Cattle..... Calves..... Goats..... Sheep.....

Lambs..... Kids..... Donkey..... Others (Specify).....

23. What are the main reasons of keeping animals?

- A. form of productive capital
- b. provide for subsistence(milk, meat, and blood)
- c. provide transport
- d. Serve as an important store of wealth and insurance
- e. Others (specify)

24. What are the livestock risk areas do you think can be more affected as a results of drought?

25 According to your opinion, what are the livestock based absorption mechanism do you think should be put in place in order to reduce the drought effects in your area?

26. Which pastoral system do you practices in keeping your animals?

.....
.....

27. What do you thinks are the advantages and disadvantages of this adopted system you normally practices

.....
.....

28. What are the management practices that you normally take when this situation of drought occur. Mention as many as possible if any

.....
.....

29. Do you think this method you practices are sustainable? If YES why and if NOT Why not?

30. In the time of drought do you get any assistance from the government? If yes

.....

31. Which assistance to you normally gets from the government as a strategy of reducing the adverse effects of drought?

.....
.....

32. Are you satisfied with what the government provides to you as measure to cope with this situation of drought?

.....

33. What do you thinks the government need to do for you in improving the adverse effects of drought to the pastoral households

.....
.....

34. What do you think are the consequences that occur as a result of drought? Mention as many as possible.

.....

35. What are the long term strategies that you think should be put in place in reducing the adverse effects of drought?

.....
.....

35 What management policies do you think needed to be carried out in reducing adverse effects of drought in your area?

37 In the time of drought how long do you travel searching for water and pasture for the animals and home uses?

.....

38. What are the other problems that you think are associated with drought? Please mention.....

.....

39. What further do you think it should be done to strengths the measures to mitigate or cope with drought?

.....
.....

40. In your opinion do you think the financial institutions have anything to play in improving livelihood of pastoral household?

.....
.....

41. What is your recommendation regarding drought in relationship with pastoral livelihood in general?

.....

Appendix 2: Checklist for Focus Group Discussion

1. As a community, who are facing most the adverse effect resulted from drought? What do you think are the good approach to be adopted in mitigating these adverse effects?
2. According to your opinion do you think the government has anything to play in mitigating this situation? (Discuss)
3. According to your culture, do you think pastoralism is the proper production system to be over emphasized by the government? Give your comments
4. According to your opinion, what the government should do in order to improve the welfare of pastoralist?
5. Do you have any comments or suggestion regarding you as pastoralists , drought and your well being

Appendix 3: Checklist for Key Informants

1. Can you give a historical situation of drought in this area?
2. What traditional knowledge that have been practiced since then in order to minimize the adverse effects
3. Is there any effort done by the government in minimizing adverse effects of drought?
4. As a community member and probably leader of this area what do you think the government should do in reducing this adverse effects caused by drought to the pastoralist society?
5. Do you have any suggestion on what measures need to be done both as individual or community of pastoralists in assuring the animal continue to survive despite of presence of drought?