SOCIO-ECOLOGICAL TYPOLOGIES TO CLIMATE VARIABILITY AMONG PASTORALISTS IN NAMWALA DISTRICT OF ZAMBIA: AN ENVIRONMENTAL EDUCATION PERSPECTIVE

By

Shepande Kalapula

A thesis submitted to The University of Zambia
in fulfillment of the requirements
for the degree of Doctor of Philosophy
in Environmental Education

THE UNIVERSITY OF ZAMBIA

LUSAKA

2019

DECLARATION

I, **Kalapula Shepande**, declare that this Thesis is entirely my own work. I further declare that this work has not previously been submitted for the award of diploma, degree or any other qualifications at this or any other University. To the best of my knowledge, this Thesis contains no material published or written by another person, except where all sources I have quoted been indicated and acknowledged by means of references. The Thesis has been written in accordance with the guidelines for Doctor of Philosophy Degree Theses of the University of Zambia.

Signature..... Date.....

Candidate

Signature..... Date.....

Supervisor

COPYRIGHT

APPROVAL

This thesis by KALAPULA SHEPANDE is approved as fulfilling the requirements for the award of the degree of Doctor of Philosophy (PhD) in Environmental Education by The University of Zambia.

Examiner 1	Signature	Date
…….....	.....	.....
Examiner 2	Signature	Date
…….....	.....	.....
Examiner 3	Signature	Date
…….....	.....	.....
Chairperson/ Board of Examiners	Signature	Date
…….....	.....	.....
Supervisor	Signature	Date
…….....	.....	.....

DEDICATION

To all pastoralists in Zambia in their quest to learn to live with climate variability and change

ABSTRACT

Climate variability and change are likely to continue bringing new weather patterns that pastoralists are unfamiliar with in view of increasing temperatures and prolonged flood or drought conditions. Thus, a study involving one hundred and twenty pastoralists was conducted in Namwala District in the Southern part of Zambia with the aim of assessing complexities of social-ecological typologies to weather-related shocks and providing an understanding of historical and contemporary synergies in the utilisation and management of common property resources. To attain its objectives, the study employed a mixed methods approach in which both qualitative and quantitative techniques were used. The research utilized typical case sampling in which questionnaires, interviews, oral histories and transect walks were used to collect data.

The study shows that pastoralists were aware of their local environment and were conscious of the ways climatic variations affected their livelihoods. Pastoralists were facing several climatic related constraints that hindered livestock production. These include livestock deaths and diseases, drought and floods, shorter rainfall season, weather variability and unpredictability and drying of surface streams. In view of these effects, the study shows that pastoralists had put up various resilient strategies that included herd mobility and splitting, capital projects, increased cash investment into the herd and diversification with mixed livestock among others. The results also reviewed that population in cattle had increased resulting into reduced area available for grazing per cow with respect to access to water and pasture. This implies that the Kafue Flats is prone to overgrazing in view of combined increased floodplain agriculture, successive droughts and influx of 'green pasture seekers' from outside Namwala. Furthermore, the study established that land was one of the most important resources to pastoralists despite increased individualization, particularly along the edges of the Kafue Flats. Pastoralists identified social typologies as local knowledge, networking, mutual support, mobility, innovation, labour, practices and social networks while ecological typologies were the Kafue floodplain, grass species, Kafue river, streams, lagoons, pans, and land. Thus, climate variability, altered Kafue River flow and land tenure insecurity had continued to threaten the resilience of pastoralists.

The study concludes that despite pastoralists facing a number of climate variability related effects and altered flow of the Kafue River, pastoralism in Namwala had survived, demonstrating resilience, dynamic and self-adaptive behaviour. Different categories of pastoralists within similar agro-pastoral communities and households responded differently to opportunities and constraints resulting from climate variability. Hence, the study recommends the involvement of local pastoralists and provision of environmental education in all pastoral activities. It is also submitted that, rather than being replaced, customary land tenure and traditional land administration structures in rural Zambia should be adapted to local social-economic and ecological realities. Thus, environmental education in pastoral social-ecological typologies, in general, and the management of common property resources like the Kafue Flats, in particular, depends on preserving and nurturing existing social, economic and ecological components and their interactions that enable pastoralists to renew and reorganize livelihoods.

Key words: Climate variability, Common property resources, Environmental education, Pastoralists, Resilience, Social-ecological typologies, Traditional ecological knowledge

ACKNOWLEDGEMENTS

I extend my heartfelt gratitude to my supervisor Dr. Liberty Mweemba for teaching and sharing with me his time, knowledge, guidance and motivation. Sir, I remain indebted. I am also truly grateful to Professor Ephraim Tobele Gwebu, Dr Lwiindi Mudenda and Dr Rusmas Masinja for their valuable contribution, support, advice, direction and inspiration towards the study.

My special thanks go to all the informants, pastoralists, Chiefs Mukobela, Mungaila, Nalubamba and Muchila including headmen in all zones, all Government Officials and the people of Namwala for generously sharing with me their experiences, insights and knowledge used in this report. Particular thanks go to all key informants for their valuable information towards the production of this report. I would also like to thank the research assistants; Noombo, Nang'anzwe, Shilooyo and Muungo for their effort and patience to travel and work with me in the four vast chiefdoms to collect data.

I further wish to extend my sincere gratitude to my parents Mr Boaz Kalapula and late mum, Evelinah Shimafumba, for their moral support and encouragement. Other special and sincere thanks go to my wife Waiti and children, with whom, since 2008, we have gone through moments of sadness and joy. For her support and understanding, I say once again thank you Kennia and continue being kind and a pillar to the Kalapula family at large. Words cannot express how grateful I am to you for all your daily prayers, encouragement, patience and love. Your daily inspiration and emotional support throughout this study has been tremendous.

Having pursued formal education for the past three decades, that has culminated, and is indeed embodied in this present work, only the *Baila* saying captures it all; "*chatakamana chakazoosha*" and I end through their environmental education world view: "*...we pastoralists are happy when land is giving and when it is not we cannot do much. We live by and follow the mood of the sky, and herd our livestock in accordance with its mood...*"

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ADAPT	-	African Dams Project
AfDB	-	African Development Bank
AI	-	Artificial Insemination
APFM	-	Associated Programme for Flood Management
BSA	-	British South Africa Company
CBNRM	-	Community Based Natural Resources Management
CBOs	-	Community Based Organisations
CBPP	-	Contagious Bovine Pleural Pneumonia
CPRs	-	Common Property Resources
CSBZ	-	Cold Storage Board of Zambia
CSO	-	Central Statistical Office
CVRI	-	Cardiovascular Research Institute
DAPH	-	Department of Animal Production and Health
DAO	-	District Agriculture Officer
DMMU	-	Disaster Management and Mitigation Unit
DMTC	-	Disaster Management Technical committee
DNEI	-	Diseases of National Economic Importance
DVO	-	District Veterinary Office
ECA	-	Economic Commission for Africa
ECF	-	East Cost Fever
EE	-	Environmental Education
EIA	-	Environmental Impact Assessment
FAO	-	Food and Agriculture Organisation
FGDs	-	Focus Group Discussions
FISP	-	Farmer Input Support Programme
FMD	-	Foot and Mouth Disease
FNDP	-	Fifth National Development Plan
FRA	-	Food Reserve Agency
GDP	-	Gross Domestic Product
GIS	-	Geographic Information Systems
GPS	-	Global Positioning System
GRZ	-	Government of the Republic of Zambia
HI	-	Heifer International
IFAD	-	International Fund for Agricultural Development
IK	-	Indigenous knowledge
IPCC	-	Intergovernmental Panel on Climate Change
ITCZ	-	Inter-tropical Convergence Zone
ITT	-	Itezhi-tezhi
IWRM	-	Integrated Water Resources Management
MACO	-	Ministry of Agriculture and Cooperatives
MLF	-	Ministry of Livestock and Fisheries
MMD	-	Movement for Multiparty Democracy
MTENR	-	Ministry of Tourism Environment and Natural Resources
NFA	-	Namwala Farmers Association
NGOs	-	Non-Governmental Organisations

NLSP	-	Namwala Livestock Support Programme
PF	-	Patriotic Front
PRA	-	Participatory Rural Appraisal
PRSP	-	Poverty Reduction Strategy Paper
RRA	-	Rapid Rural Appraisal
SADC	-	Southern Africa Development Community
SAP	-	Structural Adjustment Programme
SESs	-	Social-ecological systems
SETs	-	Social-ecological typologies
SDG	-	Sustainable Development Goal
SLIP	-	Smallholder Livestock Investment Project
SNA	-	Social Network Analysis
SNV	-	Stiching Nederlandse Vrijwilligers
SPO	-	Southern Partners Organisation
SWECO	-	Swedish Engineering Consultants
TADS	-	Trans-boundary Animal Diseases
TB	-	Bovine Tuberculosis
TEK	-	Traditional Ecological Knowledge
UN	-	United Nations
UNFCCC	-	United Nations Framework Convention on Climate Change
UNIP	-	United National Independence Party
UNZA	-	University of Zambia
VEO	-	Veterinary Extension Officer
WMO	-	World Meteorological Organization
WWF	-	World Wide Fund for nature
ZANACO	-	Zambia National Commercial Bank
ZEMA	-	Zambia Environmental Management Agency
ZESCO	-	Zambia Electricity Supply Corporation
ZMD	-	Zambia Meteorological Department
ZNFU	-	Zambia National Farmers Union
ZVAC	-	Zambia Vulnerability Assessment Committee
7NDP	-	Seventh National Development Plan

A GLOSSARY OF ILA WORDS

Chibwantu	-	traditional beverage drink
Chifumo-fumo	-	morning
Chiko	-	bride wealth or *lobola*
Chilobe	-	floods
C*hishi*	-	territory or area
Chiyumayuma	-	drought
Denkete	-	common cattle diseases known as East Cost Fever (Theileriosis)
Ibanda	-	the Kafue flood plain/ecotone seasonally flood plain where the Ila people practice transhumance and graze their animals after floods recede
Ikubi	-	commemoration
Ing'ombe	-	cattle
Kuboola	-	taking cattle back to the upland in December and January when the water rises in the plain
Kulomba	-	borrowing something from someone
Kulutanga	-	cattle outposts on the Kafue Flood Plain where pastoralists graze their animals in the dry season
Kuwila	-	transhumance drive of cattle from the upland to the Kafue floodplain
Kushisha	-	temporarily transfer of cattle to trusted associates usually relatives and close friends
Lubono	-	total assets owned by the an individual or family including cattle
Lutanga	-	cattle outposts/cattle camps
Mabishi	-	sour milk
Mangolezha	-	late afternoon
Mukupa	-	milk
Mulundu	-	upland area which is not usually flooded
Masuntu	-	cattle slaughtered at a funeral
Muunza	-	noon or mid-afternoon
Mwami	-	chief
Nankokwe/masale	-	perennial bunch of grasses, forbs and shrub vegetation (grass species comprising of *Brachiaria sp* and *Hyperrhenia sp* respectively
Shibbuku	-	headman or headwoman
Shimunenga	-	Ila traditional ceremony celebrated on the weekend of the full moon in October in Maala village of Chief Mungaila in Namwala district. It is also a name given to the spiritual man. Similar to *Shimunenga* is the *Shikaumpa* ceremony practiced in Baambwe village of chief Mukobela in the first week of November every year.

DEFINITION OF TERMS

Climate change - any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer).

Climate variability - a change in the climate that fluctuates annually or longer resulting in either floods or drought, arising from either natural causes or human activity. It is the departure from normal way of livelihoods or difference in magnitude between climatic episodes.

Common property resources (CPRs) - resources held by an identifiable community of interdependent users and only particular individuals share rights to a resource.

Coping strategies - strategies that households and communities use, based on skills and resources, to adapt to various social, economic, political and environmental.

Environmental Education - refers to an organized effort to educate people about the natural environment, and how to manage their behaviour to live sustainably.

Kafue Flood Plain - the area of very low relief in the Kafue Basin between Itezhi-tezhi dam and the Kufue gorge. It is 250km long and 100km at its widest point.

Land tenure in this thesis uses White (1957, p.172) definition as "the rights of individuals or groups over arable, grazing and residential land, how such rights are acquired, what they consist of, how they operate in the holding, transfer and inheritance of land and how they may be extinguished"

Livelihood - comprises the resources (skills, technologies and organizations) and activities required to make a living and have a good quality of life.

Pastoralists - cattle keepers generally understood as rational economic and environmental actors, whose production goals and rationales are determined not only by cultural and ideological considerations, but by constraints and opportunities imposed by the wider environmental education and climate variability.

Resilience - the ability of a social-ecological system both to withstand perturbations from, for instance, climate or economic shocks and to rebuild and renew itself afterwards.

Social-ecological - understood in terms of a unit of analysis such as a human-environment system or a catchment system, or a social group, livelihood, or sector and relate and interacting together. Social here means human actions while ecology means mutual relations of living organisms to their environment, their habits and mode of life.

Social-ecological typology (SET) - an integrated system of ecosystems and human society with reciprocal feedback and interdependence. The concept emphasizes the 'humans-in-nature' perspective (vulnerabilities and forms of resilience).

Traditional ecological knowledge (TEK) - local knowledge generated and transmitted, over time, by those who reside in a particular locality, to cope with their agro-ecological and socio-cultural environment; it indigenous knowledge (IK), or rural people's knowledge or cultural knowledge in Africa passed down from generation to generation.

Typology - an attempt to designate procedures that lead to the building up of types, help analyze a complex reality of factors that mediate between geophysical conditions and events, on the one hand, and human abilities to cope with, take advantage of, or adapt to those conditions and events, on the other hand. Typologies have been used in rural studies primarily to assess multiple, complex, diverse network ties among members of a community to provide them with actionable choices about how to live their lives.

Vulnerability - the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Pastoral environmental education resilience building - learning to live with change and uncertainty with peace of mind about change and renewal of a livelihood system within a dynamic realm that integrates both the opportunities and assets available to a group of people for achieving their goals and aspirations, as well as interactions with, and exposure to, a range of beneficial or harmful ecological, social, economic and political perturbations that may help or hinder a group's capacity to make a living in the utilisation and management of common property resources.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter provides the background information, statement of the problem, aim, objectives, research questions, rationale, conceptual and theoretical frameworks. The definition of the terms, limitations of the study and organisation of the report are also given.

1.2 Background to the study

Social-ecological typologies (SETs) are rooted in observation that similar climatic events can produce very different levels of socio-economic impact, depending not only on the location and timing of occurrence, but also the resources and agility of the societies who experience climate variability and change effects. The degree of effects depends on the ways in which the natural triggering event interacts with particular ecosystems and with the specific characteristics of the society affected (Malone, 2009), including its level of economic development; the types of livelihoods of its members; education levels; and other factors that determine both how resilient the affected population is as well as what resources are available for adaptation in rural areas.

Social systems are structures where humans live and operate, and these systems are embedded in ecological systems, allowing humans to exist within a coupled social-ecological system (Walker and Salt, 2006). An *ecological system* can be understood as an ecosystem, which is made up of biotic (plant, animal) and abiotic components such as water, air, nutrients, etc. (The Resilience Alliance, 2007). *Typologies* are forms of livelihoods used in rural studies primarily to assess multiple, complex, diverse network ties among members of a community to provide them with actionable choices about how to live their lives (Kirsten, Perret, and d'Haese, 2002). Thus, typologies help in building up types and analyze a complex reality of factors that mediate between geophysical conditions and cultural events. Norgaard (1994) explained the co-evolutionary nature of the societies and nature, in which ecosystems are the results of human interventions over millennia, and, in turn, human societies are affected by the ecosystems they depend upon. The social and ecological systems are coupled human and natural systems. In coupled human and natural systems, there are reciprocal linkages between people and nature, characterized by complex feedback loops (Liu *et al*., 2007). It is impossible to address these systems separately if

we want to understand environmental education of livelihood typologies as a whole, as any dynamics occurring in one part of the coupled system could inevitably affect the other parts.

Both natural systems and social systems are considered complex systems in themselves, and their interactions contribute further to making these typologies more complex (Berkes *et al*., 2003). Complexity was described by Gunderson *et al*., (2002) as the variety of structures and processes that occur within a system. For example, any attempt to manage one kind of natural resource would cause surrounding resources to adapt around this management intervention. This event possibly will change the performance of the whole ecosystem and eventually affect people and their livelihoods.

As a result, social-ecological systems will re-organize or adapt to the change. Thus, social-ecological typologies are not only complex, but also adaptive. They are shaped by changes or disturbances that make the system both complex and adaptive (Gunderson *et al*., 2002). A complex resource system as a whole system is made up numerous interrelated functioning sets of ecological, social and economic systems across a range of scales (Gunderson *et al*., 2002). To understand the dynamics of a complex system, a resilience perspective has emerged that focuses on the complex relationships between ecosystem development and social dynamics (Folke, 2006; Gunderson *et al*., 2002). Hence, pastoralism and climate variability operate in the same way over many scales of time and space. Pastoralism is expected to continue adapting to ever varying climate in view of increased floods and droughts over a wider range of spatial scales. Spatial scale is a hierarchy of the multiple pastoral livelihoods in view of climate variability, i.e. from a small reserve pasture of an individual herding family to the range of seasonal pastures of that family and to the entire communal pastureland of several herding families.

In this respect, solving rural poverty entails overcoming many problems, some of which are very familiar: assuring food security, improving agricultural production and maintaining a sustainable natural resource base. But other hazards and threats such as climate variability and change have recently gained heightened attention. "*Climate change promises to alter fundamental features of the natural resource base, for example, through changes in patterns and timing of precipitation and water supplies and changes in soil characteristics, together increasing the risks and uncertainties associated with traditional paths of livelihoods for generations*," (Jazairy *et al*.,

1992: 106). In all countries, industrialized and developing alike, the threats posed by the impacts of resource degradation and environmental externalities are becoming increasingly apparent.

More than 2.4 billion people live with less than USD$1.25 a day and depend on agriculture for their livelihoods (United Nations, 2014). Vulnerability to climate-related shocks is a constant threat to their food security and wellbeing. As climate change increases the frequency and intensity of these shocks, the challenges faced by food insecure farmers also increase. It has been noted that though climate change is a global phenomena, its impacts and magnitude vary across multiple levels and scales from a household through national to regional and global standpoint. The fluctuation of global climate system traced to about two centuries ago is attributed to both natural processes and anthropogenic activities. The latter is what has actually led to vast modifications of the climate system leading to adverse consequences to the earth's ecological and social systems (Intergovernmental Panel on Climate Change [IPCC], 2007b; Tschakert *et al*., 2008; Yanda and Mubaya, 2011). With mounting evidence for climate change impacts, their consequences and implications are confined to local environments as 'climate variability' (IPCC, 2007a). Evidence suggests that those societies carrying the heaviest burden due to impacts of climate variability and change are surprisingly the least responsible for greenhouse emissions, land and water alterations and have least capacity to adapt. In this regard, Africa is projected to be continuously hit severely by these impacts because of sensitivity of its core economies; crop cultivation, livestock keeping and tourism, to mention but a few.

The consequences of these climatic alterations are starting to become more visible as climatic conditions and ecosystems begin to change given emission rates of 2°C rise in temperature as highly probable and inevitable (Stern, 2006). As a result of this trajectory, social-ecological typologies are at greater risk of adverse effects including but not restricted to: decreased cereal productivity and coastal flooding in low latitudes; animal and plant species extinction threats and annihilation of marine ecosystems particularly coral bleaching (IPCC, 2007b). Apparently, recent extreme weather events on the globe pose a threat of increased sensitivity to potential dramatic socio-economic impacts for all countries (Yanda and Mubaya, 2011).

Thus, the characterization of African climate is largely dominated by droughts and floods. Given the observed and projected climate change impacts, chances are that Africa will be affected more

severely than other regions despite its 4% contribution to global greenhouse gas emissions. This is due to greater vulnerability of Africa's economy, such as crop production, livestock keeping and tourism, to climatic variability, geographic exposure and low incomes (Collier *et al*., 2008; Yanda and Mubaya, 2011). Though Africa is expected to bare the largest burden of climate variability impacts, it is in fact the least responsible for global carbon emissions (Collier *et al*., 2008; Deressa and Hassan, 2009). To this end, whereas most efforts to curb climate change impacts in developed countries are concentrated on carbon emission reduction, developing countries and particularly Africa are occupied with adaptation to climate change. Thus, poor countries are yet to witness the worst consequences. In Southern Africa, many of the adverse impacts are already at play (Collier *et al*., 2008). One of the socioeconomic sectors that will bear the heaviest burden to climate variability is pastoralism given its sensitivity to variations and extreme weather. Droughts and floods are already manifesting themselves as most common results of climate variability.

In many African pastoral societies, deterioration of pastures during droughts in particular have resulted in poor health and death of livestock impacting on food and livelihood of herders (Challinor *et al*., 2007). Pastoralists depend directly and indirectly on the products of their livestock, so they have developed multiple coping mechanisms to deal with droughts in particular. These include keeping diverse species of livestock, emigration out of the pastoral system until the perturbation passes, and economic livestock diversity among others (Galvin, 1992, Galvin *et al*., 1994). However, these strategies have become constrained especially in the present century due to two main factors; firstly an increasing human population along with a stable or declining livestock population and secondly a decreasing land use area (Grandin, 1988, Galvin, 1992, Fratkin, 1997).

In Zambia, droughts and floods, as common manifestations of climatic variations, have intensified and increased in recent years (Mweemba and Wu, 2010). Since 1980s, Zambia has suffered droughts which resulted into crop failures, livestock decimation and siltation of reservoirs with negative effects on people's livelihoods (Sichingabula, 2004). The flood/drought events, depending on their magnitude, may result in disasters (Namafe, 2004; Namafe and Slater, 2010). Disasters are events that are associated with the impacts of human-induced or natural hazards which cause serious disruption in the functioning of a group of people causing widespread human, material or environmental losses that exceed the ability of the affected people to cope using only their own resources (Disaster Management and Mitigation Unit [DMMU], 2015).

The above climatic hazards and disasters caused by climate variability and extreme weather events are a threat to economic growth and development, food security, water, health, energy and the sustainable livelihoods of rural communities. With over 70% of the population living below poverty line, Zambia's vulnerable communities do not have sufficient capacity to cope with, or adapt to, the impacts of extreme weather events (Mweemba and Wu, 2010). These weather shocks (floods and droughts) have increased in frequency over the past three decades, costing the nation an estimated US$13.8 billion, 0.4% equivalent in annual economic growth. These trends are expected to intensify in the future. Projected temperatures are expected to increase by 3-50^{o}C by 2100, with average precipitation declining during the early rainy season and intensifying thereafter. In the absence of adaptation, rainfall variability alone could cost Zambia US$4.3 billion loss in Gross Domestic Product (GDP) and keep an additional 300,000 people below the poverty line over the next decade, and reduce annual GDP growth by 0.9% (World Bank, 2011).

Thus, climate variability and change is affecting social-ecological productivity and exacerbates poverty. This is because agriculture in Zambia has the potential of enhancing economic growth and reducing poverty. The livestock sector is one of the key economic sectors in Zambia with a GDP contribution of 7.4% in 2010 and 6.4% in 2009 (GRZ, 2010). It also accounts for about 35 percent of national output. Of Zambia's total land area of 75 million hectares (752,000 square km), 20.3 million hectares is grazing land. With the country having four times more grazing than arable land, the country's potential relies more in livestock production than the crop sector which continues to receive the major share of the government support of agriculture. Despite its huge potential for growth, the development of the livestock sector in Zambia has been stifled by a number of barriers, among them climate variability. It was in this regard that the Fifth National Development Plan (FNDP) positioned the agricultural sector as one of the driving engines for economic growth (Government of the Republic of Zambia [GRZ], 2006). In particular, the livestock industry plays an important role in the livelihoods of many people, particularly in rural communities of Zambia in which their role is even more critical (GRZ, 2000).

Climate variability and change in Southern Province, one of the worst hit Province in Zambia, located in agro-ecological zone II, poses major impacts resulting from extreme and recurrent dry conditions. In Namwala, located along the Kafue Flats in Southern Zambia, the farming and cattle grazing typologies depend on a rich ecosystem nourished by the seasonal flood cycles of the Kafue

River. However, the flooding patterns of the Kafue Flats are now significantly altered by the Itezhi-tezhi Dam (constructed 1978 and a newly completed hydroelectric power station) which regulates water flow for the downstream Kafue Gorge Dam (constructed 1972), a hydroelectric generator for most of the nation. Seasonal flooding is now often unpredictable in its timing and duration. Vegetation and wildlife patterns have changed dramatically and flood-dependent livelihoods are threatened by water-level irregularities (Mulongo, 1985).

The Ila people of Namwala District in Southern Province, engage mostly in cattle keeping, fishing, hunting and subsistence farming. Mapani (2008) stated that the main livestock produced are cattle, goats, pigs, sheep and poultry, and more recently donkeys. Livestock serve many roles in pastoral society: as both the means and outcomes of production, as sources and objects of labour, as values, and as social, cultural and capital goods. Thus, in the Ila traditional set up, cattle fulfil a number of roles in social functions such as traditional ceremonies and payment for dowry (Jaspan, 1953). They also contribute to production through draught power for ploughing, transport and manure (Fielder, 1973). It was also stated that "cattle are seen as the main form of security in Ila traditional society, being a store of wealth and in a way fulfilling the accumulatory role" (Rootselaar and Bwalya, 1990: 494). Further, studies among the Ila (Jaspan, 1953; Fielder, 1973) and the Lozi (Beerling, 1986; Sikana, 1997) showed that a family needed a minimum of 30 to 50 heads of cattle to live reasonably and to fulfil their social obligations. Livestock production is the main occupation of the local people in the district with most households rearing cattle. This, therefore, qualifies the district to be called a pastoral district. It is also worth mentioning that there are no commercial farms in Namwala and all animals are reared traditionally with almost every pastoralist practicing transhumance in Kafue Flats (which is a common property resource [CPR]).

However, the above traditional paths of social-ecological systems are set to change. Over the last four decades, Namwala District experienced an increased mean annual temperature of 1.2°C, and decreased mean rainfall of 1.9mm/month, whereas rainfall seasons have become less predictable and shorter, with rainfall occurring in fewer but more intense events (GRZ, 2009). Both average annual temperature and rainfall are projected to increase by 3.7°C and 3% respectively by 2100. From 1991, the intensity and frequency of droughts and floods and the number of people affected also changed, with a net trend towards more floods and, over a longer time-period, droughts. Moreover, the area affected by floods and droughts appears to have expanded. The 1991/92,

1997/98, and partial droughts from 2000-2005 and 2011-2015 left nearly two thirds of the district with little or no rainfall while the 2007/08 and 2009/2010 flooded most communities. Furthermore, weather shocks and cattle diseases such as corridor disease, heartwater and many other diseases, have continued to hinder livestock production. These social-ecological typologies have negatively affected the way of life of the people of Namwala which they have enjoyed for decades. The social-economic situation of the people has drastically changed and indeed food security situation is threatened. Livestock production remains far below its potential. "The recurrence of droughts has depleted animal grazing resources and drinking water, thereby negatively affecting the productivity of the livestock sector," (GRZ, 2006: 47). Traditional communal grazing has, in part, been blamed for the frequent outbreaks of cattle diseases in the district since land ownership is still generally under traditional tenure.

Previous studies on Namwala concentrated on the role of cattle in traditional society and related constraints such as inadequate human resource and cattle diseases. Others have concentrated on downstream impacts of large dams on human settlements, as opposed to consequences of upstream reservoir on economic activities, and emphasized on quantitative studies that focused solely on hydrological issues. Literature specifically on Namwala include anthropological studies (Jaspan 1953; Fielder, 1973; Rennie, 1985; Chabwela, 1994; Haller, 2007; Haller and Merten, 2008); agriculture and cattle husbandry (McLean, 1961; Mulongo, 1985); ecological surveys (Casarotto, 2013; Kunz *et al*., 2013; Ramsar, 2013; Namafe, 2004); Kafue River governance and management of CPRs (Foster, 1953; FAO /UNDP, 1968; Chabwela, 1994; Chabwela and Haller, 2007); government and NGO reports (ZEMA/GRID/UNEP, 2013; WWF, 2006) and studies on efforts to introduce inclusive environmental flows of the Kafue River (Churchill, 2010; Casarotto, 2013; Kunz *et al*., 2013). The definitions and effects of climate variability and change of these studies on pastoralism, Kafue River flooding, flow and flux and land tenure are poorly established and required some in-depth social-ecological analysis. This study therefore integrated spatial zoning and seasonal calendars with photovoice observations to create a more complete picture of climate variability and change in the management of common property resources (CPRs).

1.3 Thesis statement

The thesis statement is that the daily lives and livelihoods of an estimated 13,500 households in Namwala are affected by climate variations and management of common property resources

(CPRs). *'Social-ecological typologies to climate variability'* study was combined with qualitative, context-driven, community participant methodologies and quantitative data using photovoice observations to create fresh understandings of the complex ecological, economic and social components among pastoralists whose livelihoods depend on a dynamic floodplain environment. The study established social-ecological typologies and management of CPRs problems with emphasis on flood-dependent livelihoods. Thus, pastoralists within similar agro-pastoral communities and households are likely to respond differently to constraints and opportunities resulting from climate variability and change. This entails that pastoralists are rational economic and environmental actors, whose production goals and rationales are determined not solely by cultural and ideological considerations, but by constraints and opportunities imposed by the wider social-economic and change in physical environment. Uncertainty is a central element of the future by pastoralists. It is this uncertainty that imposes risks and warranted this study, as it enabled a defined response whilst uncertainty required an adaptive approach to an uncertain future as opposed to a reactive approach to changing circumstances. Accordingly, this uncertainty is envisioned to continue to pose a fundamental dilemma for resilience among pastoralists.

1.4 Environmental education context of the study

Africa is one of the regions that bear the harshest effects of climate variability and change, yet its efforts to combat climate change through environmental education (EE) are not strongly linked to its curricula and ecological conditions. The encounter of Zambia with colonialism in the past has kept its curriculum in the margins of its educational systems, thereby impeding its environmental education at local levels. Thus, contextualising and localizing the curriculum in a manner that reveals the possibilities whereby 'learning as connection' is achieved, capabilities are recognised, and quality and relevance in education would potentially enhance environmental education (Namafe and Chileshe, 2010). In rural communities in Zambia, indigenous methods of weather forecasting among small scale farmers are particularly useful owing to the inadequacy or non-availability of scientific weather forecasting instruments and weather data (Mweemba, 2014). Thus, reliance on IK for weather forecasting, farming and food storage practices in such contexts is locally useful (Ross *et al.,* 2011). Specifically, there exists within IK systems among farmers a wealth of information on patterns of climate variability and associated warning signs, availability of water, seasonal changes, vegetation patterns and changes (Galvin *et al.*, 1994), which are useful for climate change adaptation practices but are still not fully incorporated in their daily lives.

Further, the capacity of EE to solve the ecological crises by producing an environmentally sustainable society is uncertain. The marginalization of EE in mainstream education, its precarious position within broader concepts of (environmental) sustainability and the lack of critical evaluation of current practices finds it characterized by anecdotal narratives. Thus, the majority of EE definitions adopt a tone that often marginalises any non-cognitive connections with the natural environment, including pastoralist's attachment to a particular landscape or world view that shapes their sense of place, or any emotional connection (Stern, 2006).

The importance of managing CPRs in relation to EE, assumed by pastoralists as traditional ecological knowledge (TEK) was needed. Traditional systems encourage development of practices and rules based on community-based processes and it provides locally grounded ways of resource management that could serve as alternatives to top down management. Berkes (2008: 274) discussed that the use of TEK provides an entry point to implement co-management and self-government of the natural resource will help finding "a new balance against an expert dominated positivist science." Thus traditional management systems are characterized not only by an extraordinary similarity, but also a remarkable diversity. Because EE, hereby in form of TEK among pastoralists, has been developed over multiple generations, it expands and gets revised on regular basis, providing TEK more legitimacy of not being just knowledge of past, but knowledge of the present. Having such a dynamic nature, it accumulates sufficient level of diversity to adapt to ever-changing circumstances, i.e. pastoralists adapting to climate variability and change.

While climate variability has previously been thought as a problem primarily affecting future generations, this study tried to demonstrate that the human impacts of climate change - including lost livelihoods, food and water scarcity, cattle diseases and increased changes in grazing patterns - are *already* being felt. Due to their close relationship with the land and water, pastoralists have been observing and reporting the effects of climate variability and are trying to cope with and adapt to these variations. These variations are of particular interest to indigenous people, not just because they have a particular physical and spiritual relationship with land, water, and associated ecosystems and tend to be among the most vulnerable to climate variability and change, but also because they have a specialised ecological and traditional knowledge relevant to finding the best solutions (Ellen and Harris, 2000). Otherwise, tangible TEK practices have the potential of building environmental education and adaptive capacities to climate resilience and reorganization.

1.5 Statement of the problem

The observed climate variability in Zambia, as elsewhere in the world, is attributed to both natural processes and anthropogenic activities. Southern Province is one of the worst drought prone Provinces in Zambia with most of the people depending on agriculture for their livelihoods (Roland *et al*, 2007). In Namwala, the roots of ecological vulnerability are linked to ever changing social-ecological typologies, unsound traditional ecological knowledge (TEK) practices and unfavourable government policies. This is so because the cattle economy is linked to flooding of the Kafue River and drought which have implications for the grazing of cattle throughout the year (Mulongo, 1985). Large floods and unscheduled releases have resulted into widespread destruction of crops, livestock and homes, while drought years have led to widespread loss of livestock, overgrazing and drying up of lagoons and pans needed for livestock watering. Despite the ecological importance, rich natural resource base, economic significance of and functional values of the Kafue Flats ecosystem, the area is reported to be the most ecologically disturbed wetland in Zambia (Kunz *et al*., 2013), with limited TEK of dynamic climatic variations. Specific impacts include lack of EE understanding of changes related to floodplain vegetation, decreased cattle health, and reduction in flood water. These impacts have threatened the economic and food security among pastoralists in Namwala. Pastoralist's limited TEK to changes in grass species and composition, with less grass for grazing and thatching their homes is exacerbated. The government has failed to find solutions to intricacies intertwined in social-ecological problems bedeviling Ila agriculture in general and animal husbandry in particular. Very little work has been done on the construction and rehabilitation of dams coupled with unpredictable regulation of the Kafue River. This is partly because, there are no well-defined river regulation and dam construction/rehabilitation programmes. Hence, animal husbandry and food production typologies have been rendered vulnerable to environmental shocks.

Thus, vulnerability to drought and floods has increased in Namwala. Despite pastoralists and agro-pastoralists having adapted very well to climate variability and change in the past, these populations have become vulnerable to climate variability in large part because their EE for coping with climate variability have become constrained. Therefore, as climate variations ranging from short term droughts to long-term climate shifts occur, the ability of pastoralists to maintain their livelihoods in their traditional lands using traditional TEK pastoral systems has been altered, particularly when these fluctuations are layered with other typological stressors. Therefore, while

drought years have led to widespread ecological changes and differential EE resilient strategies among pastoralists, the increase in the number of cattle has led to their concentration in the Kafue flood plain (see Figure 3.1) to access water and pasture, both in reduced quantity and quality. Accordingly, government programmes and improved management practices among pastoralists have led to increase in the population of cattle from 123,016 in 2010 to 123,738 in 2011, 128,898 in 2012 to 132,797 in 2013, and 135,306 in 2014 to 139,945 in 2015 and 145, 445 in 2016. This increase has reduced the area available for grazing per cow with respect to access to water and pasture regimes. Compounded by droughts and increase in cattle numbers, the hectarage per cow has continued to decline from 3.8, 2.6 to 1.9 and 3.7, 2.4 to 1.7 in 2005 and 2017 in the Flats, lagoons and dry land respectively. This means that the Kafue Flats is prone to overgrazing in view of combined increased floodplain agriculture, successive droughts and increase in cattle numbers. Thus, climate variability, ecological dynamics and lack of coherent EE with nature have continued to threaten the resilience of pastoralists. Furthermore, during dry season, cattle are grazed in big mixed herds on the flats leading to overgrazing and spread of diseases. These big herds are difficult to control and cattle wander freely, often become easy prey to rustlers, hyenas and even crocodiles. The losses due to depredations, apart from weather-related, are frequent and sometimes described as large (Fielder, 1973). It is because of these social-ecological typologies that this study investigated responses from EE perspective among pastoralists in Namwala to climate variability and how it has affected pastoral systems in particular and the rural economy in general.

1.5.1 Aim

The aim of the study was to examine social-ecological typologies to climate variability among pastoralists and provide an environmental education perspective in the utilisation and management of common property resources (CPRs) in Namwala District.

1.5.2 Objectives

The objectives of this study were to:

i. Investigate the effects of climate variability and change on pastoral system.
ii. Evaluate resilience status of pastoral system to weather shocks that build up the ability to live with change and uncertainties.
iii. Determine the effects of the Kafue river regulation on pastoral land use.

iv. Examine land tenure governance in the utilisation and management of common property resources.
v. Devise environmental education linkages in understanding pastoral social-ecological typologies.

1.5.3 Research questions

The study was guided by the following questions:

i. What are the effects of climate variability on pastoral system in Namwala?
ii. What is the resilience status of pastoral system to climate variability?
iii. What problems has the Kafue River regulation impacted on pastoral land use?
iv. How does land tenure governance affect pastoral community-based management of CPRs?
v. What are the rural pastoral environmental education linkages in understanding social-ecological typologies in Namwala?

1.6 Significance of the study

This study attempted to establish how social-ecological and pastoral typologies, as part of climate variability and change, have shifted production seasons, disease control and modified the set of feasible animal husbandry goals and livelihoods. Preserving and enhancing livelihoods requires TEK that are capable of performing well in the face of disruptive events. Typological concepts were the central concepts for this study because together they provided a framework that linked biophysical climatic sensitivity to social/economic factors that mitigated or amplified the consequences of environmental changes. It is envisioned that this would help to integrate land and water management through the process of Integrated Water Resources Management (IWRM), the Seventh National Development Plan (7NDP), Vision 2030 and Sustainable Development Goal (SDG) number thirteen (13) on combating climate change and its impacts. This would help in understanding water and land policies on CPRs with related effects on pastoral regimes given the newly completed Itezhi-tezhi hydroelectric power station.

This study is crucial because it sought to examine traditional ecological knowledge (TEK) in relation to climate variability and change that were community based, locally owned and managed, primarily aimed at enhancing resilience of poor rural communities whose livelihoods depended on shared natural ecosystems. Thus, typologies were sought to be social and economic from the TEK

point of view. Pastoralists identified social typologies as local knowledge, networking, mutual support, mobility, innovation, labour, practices and social networks while ecological typologies were the Kafue floodplain, grass species, Kafue river, streams, lagoons, pans, and land. Understanding these typologies was necessary in building community resilience to, and coping strategies for, climate variability and change among pastoralists through EE, manifested as TEK. Therefore, the rationale of this study was that in a country like Zambia that is now struggling to rebuild its economy, there is need to concentrate efforts to diversify the economic base with agricultural production especially livestock rearing. This could be achieved by ensuring that all major components to agricultural production such as access to land, livestock rearing and utilization and management of wetlands such as the Kafue flats are well managed.

Given the paucity of micro-level information on contemporary climate variability and changes in production goals and rationales among traditional cattle keepers in Namwala, it was envisioned that this study would contribute to the understanding of changing goals and strategies under different socio-economic and historical circumstances among the Ila people. Also, the results would add information that contrary to 'cattle complex' argument of cattle accumulation, the traditional cattle keepers are infact rationale economic actors, whose production goals and rationales are determined not only by cultural and ideological considerations, but by constraints and opportunities imposed by the wider socio-economic environment. Further, this study is significant because of its impact in engaging pastoralists in the research locale on their TEK from climate variability especially drought and floods, as well as its ability to contribute to a broader understanding among both academics and development practitioners about water and land management, animal husbandry and the value of floodplain ecotone economies and ecosystems.

In addition, the study was an attempt to add to the understanding how pastoralists interpret the natural environment by providing empirical evidence to the complexities that underpin interpretations of the natural environment and its associated problems. Closely aligned are social typologies such as local perceptions, climate related signs, values, customs and outcomes of daily lives in which the study attempted to highlight EE of local environmental dynamics through informal education or TEK practices among pastoralists, which can be related to ecological typologies such as grass species, pans and land. This was envisioned as a key role in understanding local EE issues through behaviours and practices rooted in social and cultural norms.

Recognizing an expanded scope of climate change, and holistically consider issues of ecology, development and history within specific locale locations, are critical facets of the study. The emphasis was to ascertain sustainable and adaptive strategies on pastoralist's willingness to take charge of their own needs while understanding ecological dynamics in land and water caused by climatic variability. This was due to the fact that different households, regions and nations have different capacities to contain this challenge given their level of economy, geographical setup, tools and knowledge to mention but a few. It was on this basis that the study sought to explore ways in which traditional pastoral system are learning to live with climate change and uncertainty.

1.7 Conceptual framework

People's principal ways of making a living and the important livelihoods in the area/society are crucial types of information in analyzing typologies. The study adapted and modified the conceptual framework provided by Ingram *et al.,* (2010). The framework was however modified to fit into this study. The framework explains climate variability and change (the environmental conditions and environment-related stresses) that have relevance to food system functioning, changes and effects on pastoral traditional systems. These factors are grouped and displayed in four vertical columns of Figure 1.1. These are not meant to be completely exhaustive sets of all possible factors; rather these represented those that were considered in the study. The conceptual elements in Figure 1.1 is an attempt to show graphically the pathways of relationships flowing from left - changing environmental conditions (independent variables) to right - food security outcomes and changes and impacts on pastoral systems (dependent variables) that received attention in this study. These linkages are represented by arrows connecting specific factors.

The linkages start with changing levels and patterns in environmental conditions (temperature and rainfall). Changes in these aspects are indicative of changing environmental conditions. These changes are associated with corresponding changes in the intensity and frequency of extreme events like drought and floods. These environmental changes affect environmental functions and services linked to pastoral systems. This results into changes in patterns of environmental contexts such as change in water shortages, heat stresses and increased submergence.

Following the observed climate change effects on pastoral system, the most immediate action is for the system to cope and eventually adapt to impacts. This can involve different players ranging

from herders themselves who devise coping and adaptive strategies to national and international adaptation initiatives. Apart from adaptation, efforts have also been directed on mitigation of climate change by reducing emissions and other human activities that contribute to their concentration. Environmental impacts, in this case greenhouse gas concentrations that depict changes in the climate system such as altered precipitation or temperature regimes largely depend on the effectiveness of mitigation measures. The knowledge of how people use their resources (land, water, forests etc.) allowed an assessment of whether or not climate variability would cause material changes in the economy and way-of-life of a community. If so, the full accounting of resources and other factors such as service sector activities would indicate whether the society can redirect typologies to alternative human activities and sources of income (Figure 1.1).

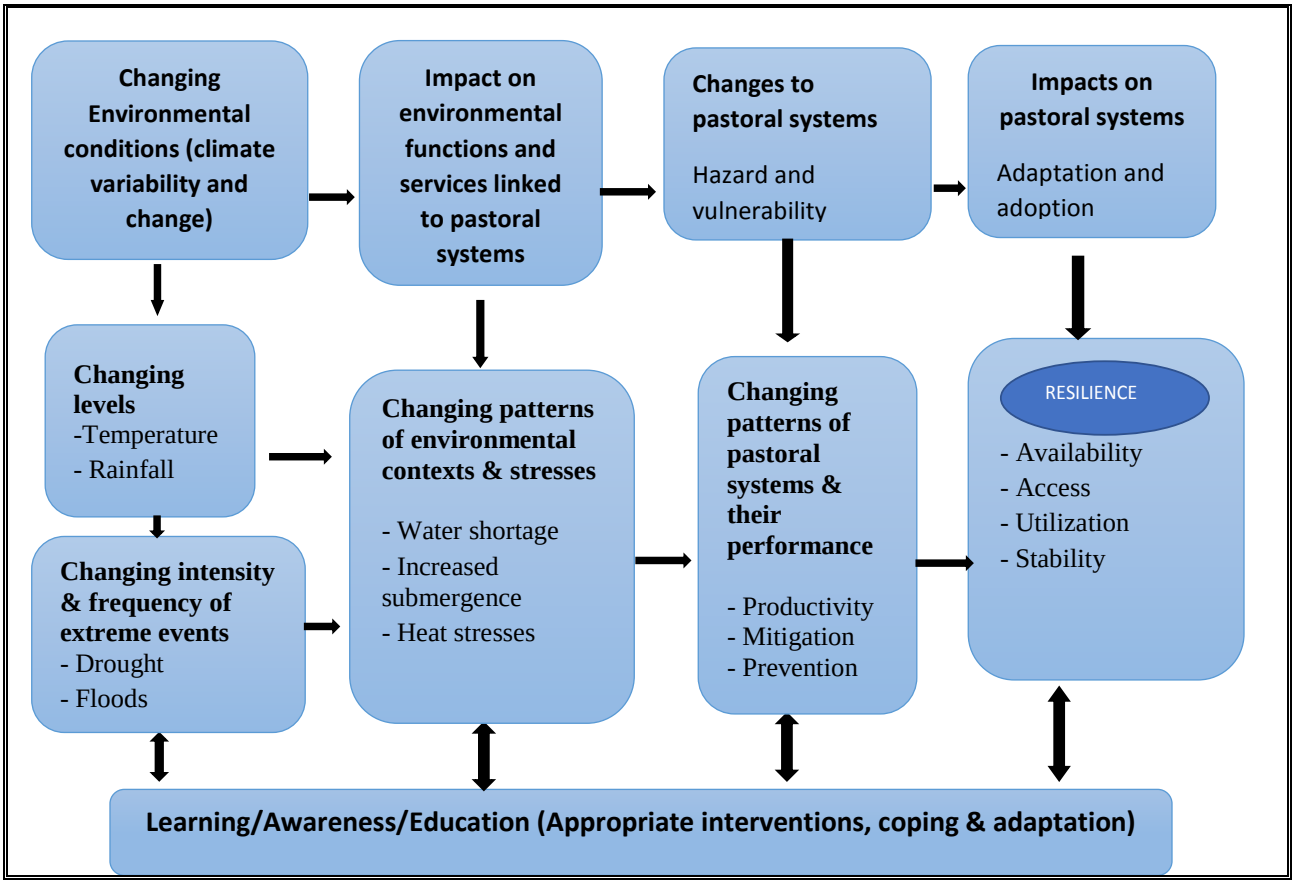

Figure 1.1: Conceptual framework of a resilient pastoral typology

Source: Ingram et al., (2010)

The framework supports this study as it showed how appropriate interventions were key in moderating climatic effects on social-ecological typologies leading to changes and impacts on

pastoral systems. For example, awareness creation on why and how pastoral systems are vulnerable to climatic shocks, stresses or long-term climate change is key to developing coping and adaptation options among pastoralists to climate variability. However, there still exist gaps in literature on indigenous environmental education on the dynamic linkages between climate variability and pastoral systems. This is because pastoralism is highly vulnerable to changing environmental patterns hence devising appropriate environmental education is key in determining resilience. A resilient pastoral society is one which would withstand effects of drought, for example, while opening up opportunities that will sustain livelihoods.

1.8 Theoretical framework

This study was based on Holling's adaptive renewal cycles nested across hierarchical scales of social and ecological system (Figure 1.2). The theory was adopted to describe adaptive cycles of any social and/or ecological system. Holling (2001) suggested four phases in each scale, namely *exploitation, conservation, release* and *reorganization* (Figure 1.2). The four phases of the adaptive cycle illustrates the movement of a system through these phases: a period of rapid growth and exploitation (r) leading into a long phase of accumulation, monopolization, and conservation of structure and resources, during which resilience tends to decline (*K*); a very rapid breakdown or release phase (creative destruction [Ω]) and, finally, a relatively short phase of renewal and reorganization (α) (Holling, 2001). Gunderson *et al.* (2002) stresses that the most surprising thing about adaptive cycles is perhaps that, the sequence of the phases; release, renewal, growth, and conservation; can be used as a way of thinking about many types of social-ecological typologies, including lakes, businesses, land, cultures, although the sequence of phases is not always the same.

Resilience of the system changes as it goes through the adaptive cycles and when the system has accumulated ample capital in *K* phase, it becomes increasingly vulnerable to changes and novelties. During this conservation *K* phase, a small disturbance is suggested that it can push the system out from the stable domain into catastrophe due to reduced resilience of the system (Gunderson *et al.*, 2002). In the last α-phase, if there is still sufficient level of memory of previous components, the predecessor system pattern may reassert itself. At the same time, it could also get introduced to things new to the system, such as new species, new institutions, ideas, policies and industries, and the emerging system, whether it is in the same or a different configuration, gains resilience (Walker *et al.,* 2002). Reorganized social and ecological systems will be similar, but not

identical to the previous ones and will be distinguished by newer qualities or novelties developed as a result of the response to the particular type of disturbance (Holling, 1973).

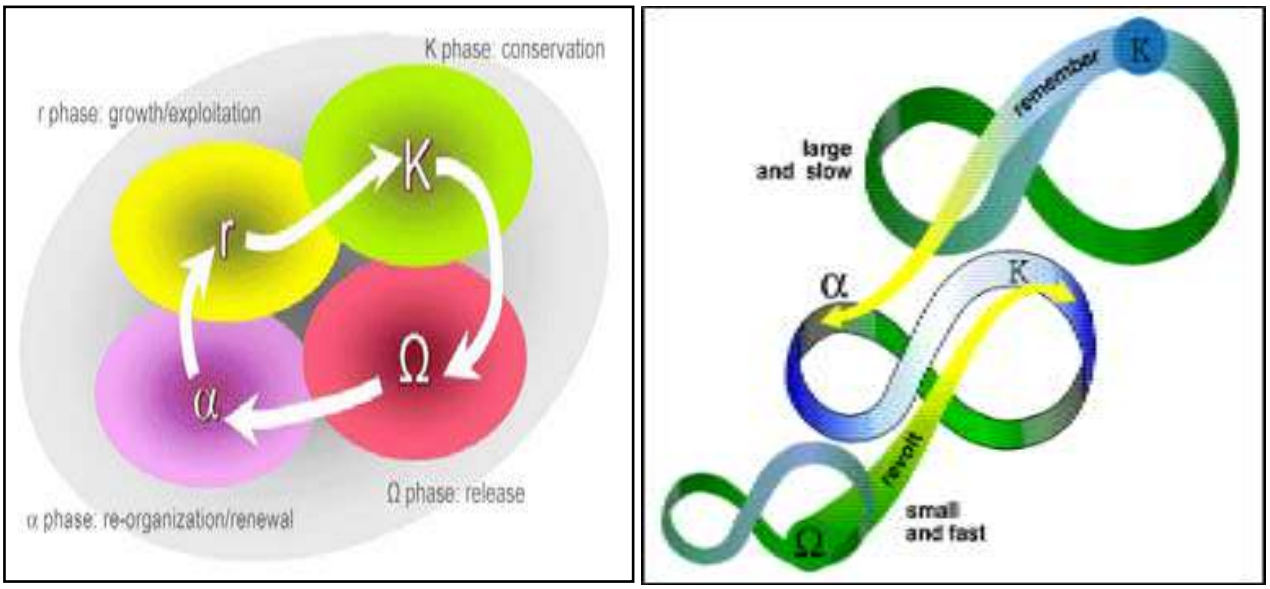

Figure 1.2: Holling's adaptive renewal cycles

Source: Holling (2001)

In a resilient social-ecological system, these four phases of the adaptive cycles repeat themselves again and again (The Resilience Alliance, 2007). Changes anywhere in the lower scale in the social-ecological typology can affect the stability of the system at a lar*ger* scale and will cause some changes to it (Figure 1.2). Ecosystems and social-ecological systems across scales are basically comprised of hierarchies and adaptive cycles forming together a *panarchy* (Holling, 2001). The term panarchy describes the interactions between faster, smaller cycles and lar*ger*, slower cycles, and these interactions in a panarchy combine learning with continuity (Holling, 2001). "No system can be understood or managed by focusing on it at a single scale. All systems exist and function at multiple scales of space, time and social organization, and the interactions across scales are fundamentally important in determining the dynamics of the system at any particular focal scale," (The Resilience Alliance, 2007:50).

Thus, memory and novelty are the main features that make up adaptive capacity of social-ecological typologies and resilience (Berkes *et al.,* 2003). The ecosystem is reorganized drawing upon the ecological memory of the previous system by utilizing a diversity of species and the

existence of species groupings (functional groups) developed as a result of the previous cycle of growth (Gunderson *et al.*, 2002; Folke *et al*., 2003). The social system reorganization depend on the number and types of people present after the disturbance that is described as collective social memory of experiences with resource and ecosystem management, including social capital, traditional knowledge and wisdom (Gunderson *et al.,* 2002). In addition to memory, novelty is an essential element of resilience that is defined as the ability to innovate (Berkes *et al.,* 2003). For the social-ecological system to be resilient, it is important this system be exposed to disturbances that play a constructive role in resource management by creating the opportunity for renewal (Berkes *et al.,* 2003). In a resilient social-ecological typology, disturbance has the potential to create opportunity for doing new things, for innovation and for development.

This study fitted in Holling's Adaptive Renewal Cycles in the sense that social-ecological typologies operate over multiple linked scales of time, space and social organization comprising different categories of pastoralists in a commonly owned resource - the Kafue Flood Plain. Spatial scale is a hierarchy of the multiple regions, levels or units, such as from a small reserve pasture of an individual herding family to the range of seasonal pastures of that family and to the entire communal pastureland of several herding families (represents the Kafue Flood Plain). Drought provides an example of a pastoral system characterized with gradual changes and abrupt transitions. If drought and/or high concentration of grazing cattle (as disturbances) is continuous for several years, overgrazing increases causing irreversible changes in a more extensive scale of social-ecological system resulting into selling and losing cattle, emigration to other regions and keeping diverse forms of livestock, among adaptive strategies that pastoralists may employ. When a perturbation passes following stability in rainfall or dam construction to reduce overcrowding of cattle stock in the Kafue Flood Plain for example, the system can reorganize itself forming a natural capital that allows the regeneration of grass. This understanding of pastoralist's environmental education towards vulnerability and resilience underpinned this study.

The philosophical underpinning of the study was premised on the basic principles of the approaches in social sciences namely critical realism approach. These are explored in detail under methodology (Chapter 4). Consequently an eclectic methodology was adopted that employed a combination of research methods, normally associated with the different social science research

perspectives. This was meant to serve different but complementary purposes to investigate social-ecological typologies and rural livelihoods.

1.9 Organization of the thesis

To understand social-ecological typologies, the study examined community-based rangeland environmental education and awareness in building resilience of the coupled social-ecological linkages in Namwala. This thesis reports on findings investigated on the elements and components of SETs using qualitative, exploratory and quantitative explanatory methods. It is divided into seven chapters including this one. This chapter provides background information, the statement of the problem, aim, objectives, research questions, and the rationale, conceptual and theoretical frameworks, limitations and definition of terms related to the study.

Chapter two reviewed secondary literature by considering: social-ecological typologies of vulnerability and resilience; climate variability and change in Africa and Zambia; the role of cattle in agricultural development in rural Africa; traditional cattle keeping in Zambia; the role of cattle in the Ila economy in Namwala district and historical cattle development programmes before and after independence. The relationship between women, customary land ownership and the livestock sector are also considered in this chapter. In addition the Chapter also reviews land tenure and the livestock sector in Namwala; common pool resources and common property institutions; and traditional and scientific education in managing CPRs, and research gaps.

Chapter three consists of the description of the study area. This includes the location of the study area (Namwala) within Southern Zambia; climate; soils; vegetation; the Kafue River and the annual floods of the Kafue flood plain; geology and topology; population and the socio-economic activities. Socio-economic activities are addressed under the general way of life of the people and the state of infrastructure in the district. Chapter four presents the methods that were used in this study. To start with, research design and the factors that influenced the selection of the study area are given. This is followed by selection of the study area, training of research assistants and pre-testing of questionnaire, the sampling and data collection procedures. Finally, ethical considerations, implication of the theory and data presentation and analysis are outlined.

Chapter five presents the results of the study. This is done by first looking at the demographic characteristics of pastoralists, pastoralists' views of climate variability and climatic induced risks,

local perceptions and indicators and changes in production goals for keeping cattle. Secondly, the chapter investigates the effects of climate variability and change on pastoral system and examined their resilience status to weather shocks that build up the ability to live with change and uncertainties. Further, the chapter examined the effects of the Kafue river regulation on pastoral land use and land tenure governance in the utilisation and management of CPRs. The final component of the chapter devised EE linkages in understanding pastoral social-ecological typologies, applicable in Namwala and could be applied in other similar environments.

Chapter six discusses the results based on the components of key research questions: reducing vulnerability and strengthening resilience in the face of climate variability among pastoralists; reorganization and revaluing the Kafue River flow and flux for pastoralism; empowering and improving livelihoods through land tenure security; and rural pastoral social-ecological linkages - from the view point of environmental education. The last chapter gives the conclusion of the study and recommendations based on results from the study.

1.10 Summary

In sum, this chapter is introductory. It has presented the context of the study through background information and statement of the problem in which the adequacy of social-ecological typologies with regard to the aim, objectives and research questions related to climate variability were explored. Further, the chapter also highlighted the significance of the study in relation to environmental education in which pastoralists are learning to live with change and uncertainty. A review on conceptual and theoretical frameworks and definition of terms has also been given. The chapter concludes with the layout of the thesis. The next chapter presents literature review.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The purpose of this review was to explore existing literature as it pertains to the climate variability and change; globally, at continental level, regional and country level. The review also explores drought situation in Zambia and historical perspectives of drought on agriculture in Southern Province, vulnerability and resilience of people to floods, pastoralism and climate variability and change in rural Africa, and evolution and development of cattle rearing in Zambia. The review further addresses traditional cattle rearing in Zambia and Southern Province, role of cattle industry in Namwala, land tenure and the livestock sector in Namwala with focus on how climatic factors have impacted on pastoral systems and ultimately food security situation of households.

2.2 Social-ecological typologies of vulnerability and resilience

2.2.1 Vulnerability

Vulnerability is increased by the wider context of uncertainty created by climate change and other long term trends which are often not well understood by poor people. Furthermore, if people have weak access to, and influence over, the institutions and policies that govern their access to resources and decision making, they can do little to address the underlying causes of their vulnerability (Berkes *et al.,* 2003; IPCC, 2007). Vulnerability has been studied across a wide range of disciplines and is often considered more difficult to define than resilience (Schoon, 2005). Traditionally it has been studied in the field of geography in relation to natural hazards and poverty, and more recently in relation to climate change and adaptation. There are a number of ways to categorise approaches to the study of vulnerability (e.g. Fenton *et al.* 2007). These can be summarised as: (1) Vulnerability to a hazard, (2) Vulnerability as a 'state' and (3) Vulnerabilities as components of a community. Brooks (2003) distinguishes between vulnerability to physical threats as defined in the hazards literature and research which applies vulnerability as a 'state'.

2.2.1.1 Vulnerability to a hazard

Within the study of natural hazards, a community's vulnerability arises from the physical aspects of the threat itself. A community's vulnerability is defined by the frequency, magnitude, timing, and intensity of the hazard (Fenton *et al.*, 2007), with a focus on broad-scale impacts. Human and social elements are usually considered as secondary to the biophysical impacts (Eakin and Lynd

2006; O'Brien *et al.*, 2004). From this perspective, vulnerability is defined as an outcome of a hazardous event, and does not include the characteristics of the community which shapes its response to a hazard or other changes.

2.2.1.2 Vulnerability as a 'state'

Vulnerability as a 'state' is used to describe a community as inherently vulnerable or not. This view of vulnerability considers the components of the community which make it vulnerable (e.g. socio-economic factors such as poverty, inequality, housing quality and access to services), rather than focusing on the characteristics of a hazard or change. However, when vulnerability is viewed as a 'state', these characteristics are used to label a whole community (or subsections of a community) as intrinsically vulnerable and, by extension, less able to cope with stressors, shocks and change (Brooks, 2003).

2.2.3 Vulnerabilities as components of a community

The resilience approach taken in this study acknowledges that communities and other systems such as families, individuals and ecosystems, have aspects or components which may be vulnerable to specific changes (e.g. reduced access to water). However, this approach also takes into account the resources and adaptive capacities of communities (or these other systems) which enable those vulnerabilities to be overcome. From this perspective, vulnerability is not a deterministic 'state', and vulnerable characteristics are only one part of a whole system that shapes a community's response to a change. In general, there is much debate about the relationship between resilience and vulnerability. Some authors suggest that they are opposites (with a reduction in vulnerability, resilience increases), while others argue that the relationship is more complex (Brooks, 2003). This proposal sees vulnerability as only one component of a community which determines its resilience. This perspective incorporates the idea that a community (and its vulnerabilities, resources and adaptive capacities) is dynamic and multifaceted. Resilience does not necessarily mean that a community is *in*vulnerable (Fenton *et al.*, 2007) - a community can be resilient and vulnerable at the same time. For example, a community might include groups who are vulnerable to a reduction in water availability because of their reliance on that water for livestock watering. However, the same community may have the social resources and adaptive capacity to build another economic base (e.g. ecotourism) that does not depend on water availability. Different communities are also vulnerable and resilient to different challenges (Gallopin, 2006).

2.3 Understanding social-ecological resilience

The term 'resilience' was first used by engineers to refer to the ability of a material to return to a pre-existing state after being stressed (Pimm, 1984). Resilience has also been studied for many decades within psychology, in the context of individuals coping with trauma and major life events (Bonanno, 2005). The concept of resilience was also applied within ecology, when Holling (2003) used it to describe the ability of an ecosystem to absorb and adapt to change and maintain its existing state of functioning. In the late 1980s, the ecological concept of resilience was applied to understand interactions between people and the environment (Janssen and Ostrom 2006). In this context, the resilience concept was used to recognise the complexity of community-environment interactions, and the complexity of change. More recently, work on resilience has also included the social-ecological dimensions of change.

Recent perspectives on resilience can be summarised into three major views - a common aspect in all perspectives is the ability to withstand and respond positively to stress or change: (1) Resilience as stability: Buffer capacity (2) Resilience as recovery: Bouncing back, and (3) Resilience as transformation: Creativity (Adger, 2006; Folke 2006; Maguire and Hagan 2007).

2.3.1 Resilience as stability

The stability view of resilience, developed from early ecological studies, defines resilience as the ability to return to a pre-existing state. This view of resilience is measured as the amount of disturbance a system can tolerate ('absorb') before it shifts to another state (Holling, 2003 in Folke, 2006). Some researchers describe a threshold beyond which a community is unable to return to its functional state.

2.3.2 Resilience as recovery

The recovery view of resilience relates to a community's ability to 'bounce back' from a change or stressor to return to its original state. Resilience here is measured as the time taken for a community to recover from a change (Maguire and Hagan 2007; Pimm 1984). A resilient community is able to return to its pre-existing state relatively quickly, whereas a less resilient community may take longer or not be able to recover at all. The stability and recovery views of resilience have a deterministic understanding of resilience in that they see a community (or an individual, or an ecological system) is seen as having an inherent character which enables it (or

does not enable it) to cope with a stressor. This view implies that a community as a whole either *is* or *is not* resilient. It fails to take into account the dynamic nature of change and communities, which is recognised in the third view: resilience as transformation.

2.3.3 Resilience as transformation through education or learning

Social-ecological typologies recognizes the powerful capacity of people to learn from their experiences and to consciously incorporate this learning into their interactions with the social and physical environment and effects from human and environmental conditions. This view of typologies is important because it acknowledges that people themselves are able to shape the 'trajectory of change' (Herreria *et al.,* 2006) and play a central role in coupled human-environment systems and impacts caused by the climate variations (Figure 2.1).

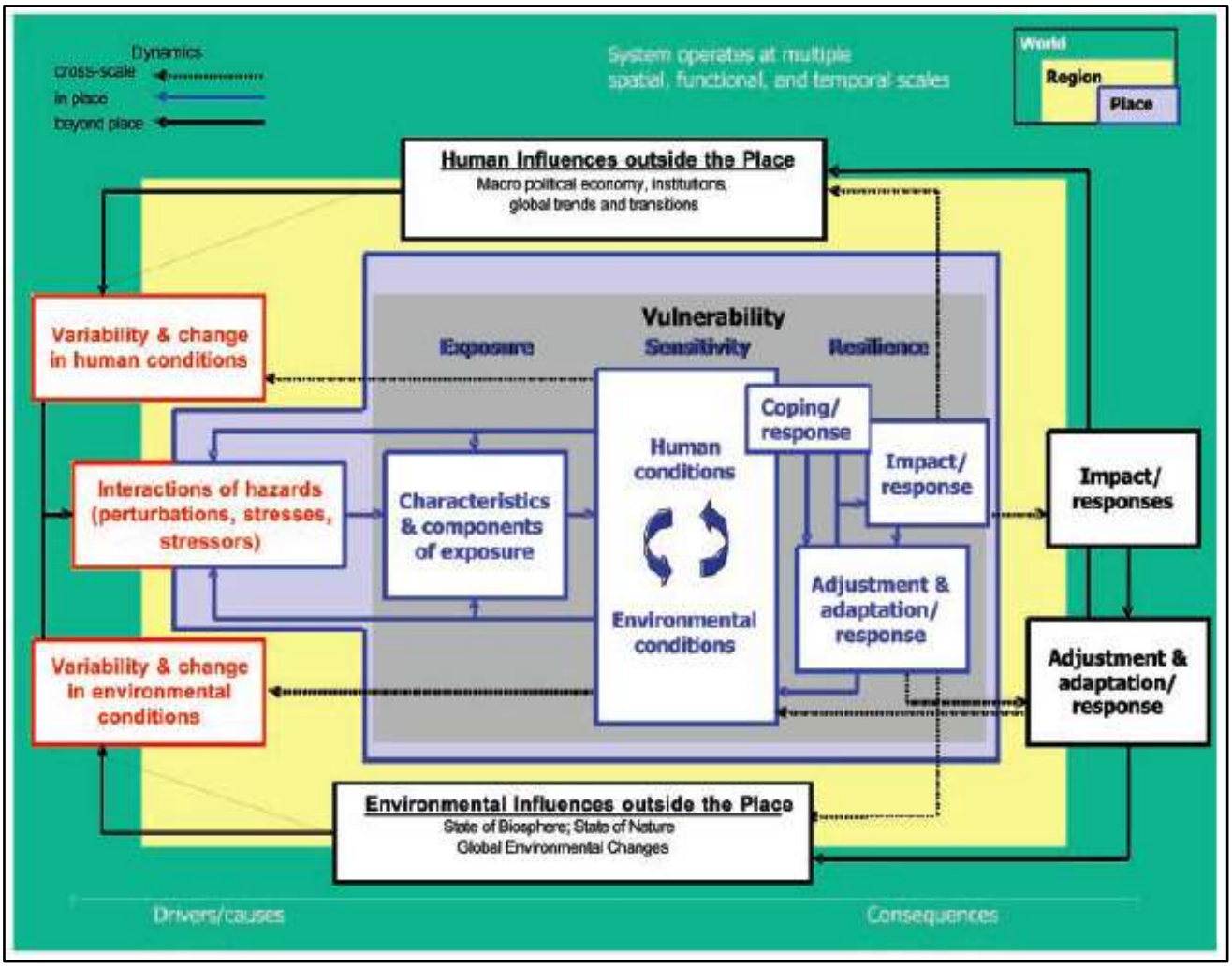

Figure 2.1: Coupled human-environment systems

Source: Folke *et al*., (2006)

The basic relationship (Figure 2.1) consists of: (*i*) linkages to the broader human and biophysical (environmental) conditions and processes operating on the coupled typology in question; (*ii*) perturbations and stressors-stress that emerge from these conditions and processes; and (*iii*) the coupled human-environment typology of concern in which vulnerability resides, including exposure and responses (i.e., coping, impacts, adjustments, and adaptations). These elements are interactive and scale dependent, such that analysis is affected by the way in which the coupled typology is conceptualized and bounded for study.

2.4 The rural poor's dependence on natural resources

Although access to primary natural resources is important for many rural households, it is particularly important for the rural poor. In large part, this is due to the fact that the livelihoods of the rural poor are disproportionately dependent on crop and animal agriculture and other natural resources. Reports from the Food and Agriculture Organization [FAO] (2006) offer some illustrative statistics. Household income that is dependent on natural resources - "environmental income" - comes from a wide diversity of agricultural sources, both in cultivated settings (cropland and some grazing) and "wild" or uncultivated sources, including forests, fisheries (marine and inland), wetlands, and natural grasslands. More than 90 percent of African agricultural production is estimated to come from small-scale producers (Baumann, 2002).

As a result of this dependence on primary natural resources, the rural poor are especially vulnerable to climate variability and change. A central challenge, then, is to develop mechanisms to enhance the resilience of the poor to adapt to these many sources of uncertainty and vulnerability (Sahn, 1989). .The rich, on the other hand, can more easily substitute physical, financial and human capital for natural capital, and thus have a better 'fall-back' mechanism that helps reduce vulnerability. The vulnerability of the rural poor is a prime distinguishing aspect of their livelihoods and lives (Ellis and Allison, 2004; International Fund for Agricultural Development [IFAD] (1995).

The dependence of the poor on common property and open access resources creates yet another obstacle and source of vulnerability. Common property resources have, in many cases, been sustainably managed for generations, but where tenure systems are weakened or where governance and enforcement mechanisms are ineffective, they may be used and exploited in a *de facto* open

access manner. Access to these resources - including many forests, fisheries, marine resources, grasslands, etc. - is important to the livelihoods of the poor in many countries. CPRs were found to contribute 15-25 percent of household income in India (Jodha, 1986); other estimates, for India and elsewhere, are even higher (Dasgupta, 2005). But it is these same resources that are often under the greatest threat in many countries as a result of population growth, intensification of production and resulting environmental degradation, resource appropriation for state or private use, and the frequent lack of effective governance systems. Poor households dependent on these resources thus face an additional challenge to sustaining their livelihoods due to the lack of ownership and control they enjoy over these resources on which they are so dependent (Millennium Ecosystem Assessment, 2005). Hence, natural resources vary in the degree to which they are "naturally" available versus being altered by human actions.

Access is a central criterion to assuring sustainable rural livelihoods. Natural resources become natural "assets" when access is assured, either through asset ownership or other forms of secure access and control. Natural capital or natural assets are often considered one of the five forms of capital, the others being financial capital, physical capital, social capital, and human capital (IFAD, 1995). Rural poor people who lack access to natural capital and other forms of capital are challenged on many fronts: obtaining food, accumulating assets and responding to shocks and misfortune. "Access is determined by formal and informal rules and institutions that govern who can use natural assets, when, where, how and for what purposes," (Jazairy *et al*., 1992: 45).

Natural resources vary widely in the rules that govern access to them. Access to some resources is primarily held by individuals, while access to other resources may be shared across larger groups, including the state, and some resources are effectively not held by anyone. Such open access resources, including many forests and wetlands, are among those facing the greatest current pressures due to growing populations, accompanying resource demands, and the common lack of effective institutions that govern access. Because access entails rights, it is also fundamentally affected by social and political processes reflecting the distribution of power in communities and societies, by market forces reflecting the distribution of wealth, and by environmental forces which are often influenced by human activity. Natural resources, particularly open access resources and those managed under common property systems, are under severe threat in many countries, as are the livelihoods of many of the poor who depend on them (Jazairy *et al*., 1992).

2.5 Climate variability and change

Climate variability and change are the most important environmental challenges facing the world today. According to Easterling *et al*., (2000), climate change is possibly the greatest environmental challenge facing the world this century. This has been supported by a spate of conferences, campaigns, reports and research work on climate change over the past 20 years just to mention but a few.

Scientists have argued that climate change and variability are mainly driven by the emission of greenhouse gases (GHGs), such as carbon dioxide, methane and nitrous oxide (IPCC, 2007a). Although there are other sources of emissions, agriculture is one of the most important contributors of emissions of GHGs and the sector is increasingly being recognized for its potential to be part of the solution (IPCC, 2007a). According to Smith (2008) energy and chemical intensive farming has led to increased levels of GHG emissions, primarily as a result of the land clearance, soil degradation and intensive animal farming. Research shows that the earth has become warmer during the previous century. The IPCC (2001) reports that the average surface temperature of the earth has increased during the 20th century by about 0.6°C ± 0.2°C, (the ± 0.2°C means that the increase might be as small as 0.4 °C or as great as 0.8°C). The IPCC has further reported that it is warmer today around the world than at any time during the past 1000 years. In addition, extreme weather events are now on the rise worldwide and are more likely to happen in the future (Easterling *et al*., 2000).

Therefore, it is clear that the earth is warming and the serious doubts over this fact and that the human emissions of greenhouse gases such as carbon dioxide (CO_2) as the primary cause of it are disappearing in the face of mounting evidence from around the world. Global and regional shifting of climate patterns and their potential effects on the biophysical and human systems has become an important topic over the recent decades.

Thus, climate change can no longer be avoided. In fact, it is here to stay. Although it is still uncertain which effects climate change will have in different localities, most models indicate that they will be stronger near the equator - and hence in Sub-Sahara Africa than in most other major regions on earth. For example, since 1970s, intense and longer droughts have been observed especially in the tropics and subtropics (IPCC, 2007a). It is also predicted that countries that

depend heavily on the primary sector (such as agriculture), are likely to be more adversely hit than countries that have a more diversified economic base.

2.6 Climate variability and change in Africa

Africa, according to IPCC (2007b), is one of the continents that is most vulnerable to climate change and climate variability despite only 4% contribution to global greenhouse gas emissions. Thus, agricultural production and food security is likely to be severely compromised by climate change thereby putting some regions of marginal agriculture out of production. It is thus, of paramount importance that measures are taken to mitigate the consequences of climate change by way of research, adaptation and domestic resources mobilisation as most of agriculture is rain-fed.

Climate change manifests itself largely through its impact on water resources i.e. floods and droughts which are increasingly apparent in many parts of the Africa. Floods and droughts undermine farm yields and national harvests reducing household and national food availability, and agricultural income derived from crop sales. Their impacts on other sectors of a nation's economy can also be devastating. Since the IPCC third Assessment Report on climate Change, IPCC (2001), observed temperatures have indicated a greater warming trend since the 1960s. Although these trends seem to be consistent over the continent, the changes are not always uniform. For instance, decadal warming rates of 0.29°C in the African tropical forests and 0.1 to 0.3°C in South Africa (Kruger and Shongwe, 2004) have been observed.

Climate change can also be observed in the form of precipitation. For precipitation, the situation is more complicated. Rainfall exhibits notable spatial and temporal variability (Hulme *et al*., 2005). Inter annual rainfall variability is large over most of Africa and, for some regions; multi-decadal variability is also substantial (IPCC, 2007a). Thus, in Africa, the impacts of climate change vary widely with some areas getting wetter while others becoming even drier and hotter (Collier *et al*., 2008). Whereas it is still challenging to predict current and future impacts of climate change with such diverse streams, it is clear that livelihoods of poor and marginal societies particularly in rural Africa have a high propensity of experiencing significant shift following dwindling of their environment and availability of resources they depend for their sustenance (Easterling *et al*., 2000). In Southern Africa, many regions are drought prone and the vulnerability of the population to drought is high with more than 40 per cent of the region's people living in dryland areas.

Increased inter-annual variability has, however, been observed in the post-1970 period, with higher rainfall anomalies and more intense and widespread droughts reported. The lack of water is the largest constraint to sustainable livelihoods. Rapid runoff during the rainy season frequently results in a high proportion going to waste or even becoming destructive.

According to Cull and Vincent (2004), between 1988 and 1992, over 15 drought events were reported in various areas of Southern Africa. There has also been an increase in the frequency and intensity of El Niño episodes. Prior to the 1980s, strong El Niños occurred on average every 10 to 20 years. However, the early 1980s marked the beginning of a series of strong El Niño events: 1982/1983; 1991/1992; 1994/1995; and 1997/1998. The episodes of 1982/1983 and of 1997/1998 were the most intense in the last century. Paradoxically though, the 1991/1992 El Niño, which was considered as a moderate event, caused a major drought throughout Southern Africa.

2.7 Climate variability and change in Zambia

Zambia's climate is highly variable, with frequent droughts, seasonal and flash floods, extreme temperatures and dry spells. Floods and droughts have increased in frequency over the past three decades, costing the nation an estimated 0.4% in annual economic growth. These trends are expected to intensify in the future. Projected temperatures are expected to increase by 3-5 ^{O}C by 2100, with average precipitation declining during the early rainy season (October to December) and intensifying thereafter. In the absence of adaptation, rainfall variability alone could keep an additional 300,000 people below the poverty line over the next decade, and reduce annual GDP growth by 0.9%. Climate change and variability are in turn affecting agriculture and natural resource productivity, thereby exacerbating poverty and contributing to decline in economic growth (African Development Bank [AfDB], 2013).

Zambia is party to the United Nations Framework Convention on Climate Change (UNFCCC), which entered into force on 21st March 1994. The Convention calls on all Parties to address the issue of greenhouse gas emission inventories and develop appropriate adaptation measures. Specifically, Article 4 of the UNFCCC calls upon all Parties to prepare national communications that describe inventories of greenhouse gas emissions, mitigation and adaptation to climate change. To date, Zambia has completed the following studies (ECZ, 2000): Greenhouse Gas Inventories; Vulnerability and Adaptation Studies; and Mitigation Studies. Zambia has also

completed its initial communication. It has also signed and ratified the Kyoto Protocol on regulation of carbon emissions. Within the past years the country has experienced droughts, floods and normal conditions with the frequency of occurrence of drought and floods and their intensity and magnitude being on the higher side. The country has experienced an increase in drought frequency and intensity in the last 20 years (Kanyanga, 2008). The most serious ones have been drought, seasonal floods and flush floods, extreme temperatures and dry spells.

Notably, all the sectors of the economy are vulnerable to climate variability and change with the most affected being agriculture, water, wildlife, forestry, health and energy. As pointed out by (Kanyanga, 2008; MTENR, 2007), food and water security, water quality, energy and the sustainable livelihoods of rural communities are some of the areas that have been adversely. In Southern Province, several shocks that affect the production activities of people in Kalomo and Choma are drought, loss of livestock, livestock diseases, plant pests and diseases, erratic rainfall, increases in input prices and floods. Drought and food insecurity were cited frequently as the most serious threats to household livelihood.

So far, African countries are expected to suffer more by the global climate change due to weak adaptive capacities of their economies and high vulnerability (IPCC, 2000). According to Bhadwal (2006), high vulnerability is as a result of high dependence on rainfall. Across Sub-Saharan Africa and Zambia in particular, rural communities have extensive experience in dealing with climatic uncertainties and food security implications. They are highly aware of the production and price risks they face, and have therefore developed an array of risk management strategies and coping mechanisms. Subsistence livelihoods have evolved a number of coping mechanisms to manage weather variability, including drought years and low crop yield. Commonalities in coping are evident across diverse regions, involving a complex hierarchical decision-making process of sacrifice and use of support networks to endure periods of food insecurity. These strategies initially involve responses including alterations to diet to include more famine foods, and during times of acute and/or prolonged stress borrowing from kin, selling productive assets, and eventually migration. As famine progresses, survival strategies thus become more desperate, whereby domestic resources are increasingly committed and potential for reversing the strategies become more constrained (Casarotto and Kappel, 2013).

2.8 Drought and historical perspectives on agriculture in Southern Province

In Southern Africa, Zambia is one of the countries highly impacted on by severe weather and extreme climate events. Zambia has experienced an increase in drought frequency and intensity in the last 20 years. The droughts of 1991/92, 1994/95 and 1997/98 worsened the quality of life for vulnerable groups such as subsistence farmers (Kajoba, 1998; Sichingabula, 1998).The observed temperature from 32 meteorological stations in Zambia was analyzed to detect trends in temperature change over last 30 years. The mean temperatures computed for the agro-ecological zones (Figure 2.2) for three time periods, November to December, January to February and March to April, indicate that the summer temperature in Zambia is increasing at the rate of about 0.6℃ per decade, which is ten times higher than the global or southern African rate of increase in temperature (Roland *et al*, 2007).

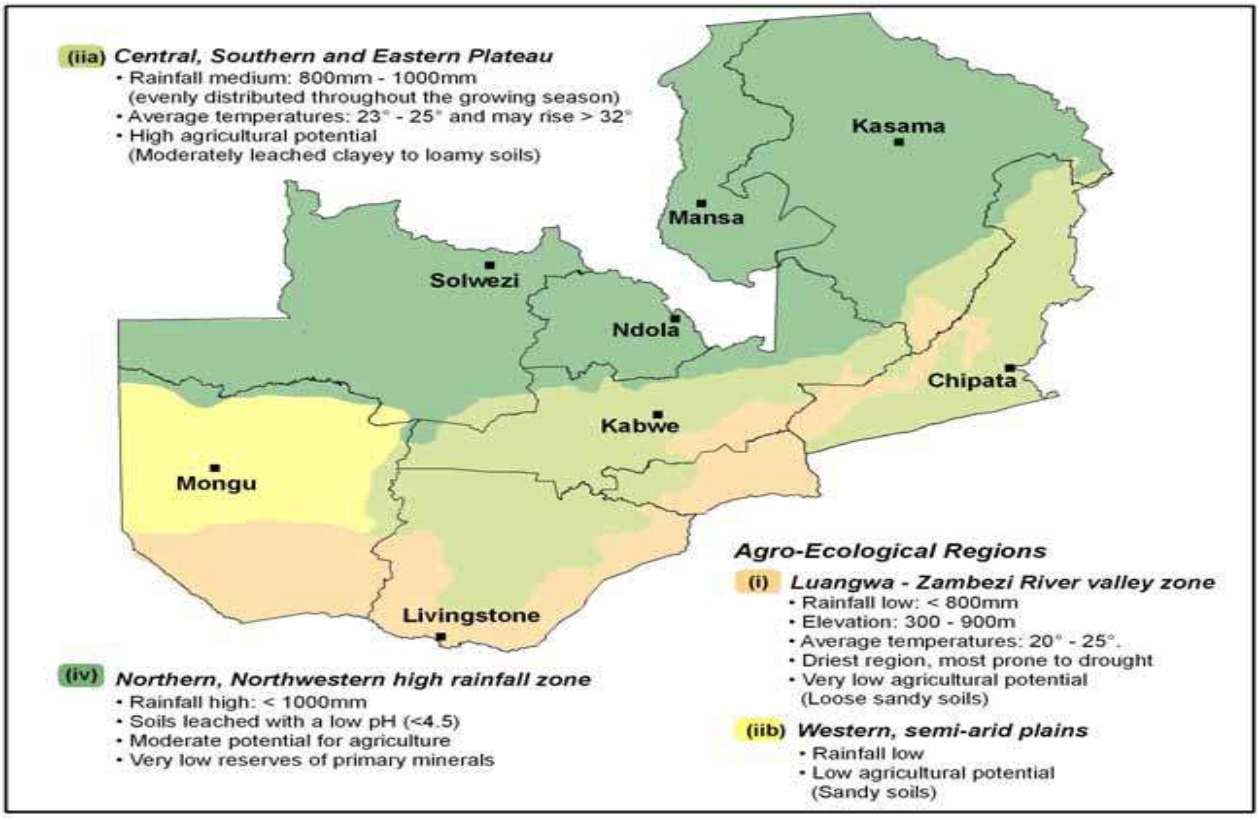

Figure 2.2: Agro-ecological zone map of Zambia

Source: Government of the Republic of Zambia, ILUA [GRZ, 2004] p. 40

Agriculture in Southern Province like many other parts in Zambia, depend on rainfall to a very large extent. Since the 1990s, crop production in the country has faced the negative impacts of extreme climate events which are believed to be manifestations of long-term climate change. The

Province has experienced some of its worst droughts in recent years. Significant rainfall deficits at critical stages of crop growth have frequently led to a serious shortfall in crop production and grass for livestock (Sichingabula, 1997).

According to Allan *et al.,* (1945) in Kajoba (2008), "the Tonga people were originally shifting cultivators who practiced subsistence agriculture combined which cattle raising, before the coming of colonial rule," (Allan *et al*., 1945: 2). The major crop that they cultivated was local maize. This was done on the fertile plateau soils. "It was also possible for the Tonga to keep cattle because the plateau was free from the tsetse fly. Other subsidiary gardens were prepared for sorghum and pulses," (Allan *et al.,* 1945: 6 and 81).

Although the Tonga were originally shifting cultivators, it would seem that there were gradual changes in land usage. The use of cattle manure could have facilitated some families to work the same land for several decades with fallow periods (Allan *et al*., 1945: 55 and 57). Earlier, Trapnell and Clothier (1937: 35) indicated that "the Tonga had 'developed a more elaborate and stable system' of cultivation in the southern plateau woodland."

Thus, the cultivation of local maize and other cereals, plus pulses, groundnuts, cucurbits, and sweat potatoes; and the rearing of cattle that provided meat and milk to the diet, seem to have combined (with secure land rights for both men and women), to ensure relative food security for Tonga society, and therefore resilience of rural Tonga communities at a subsistence level, before 1990s after which climatic variability characterized with flash floods and frequent droughts have affected these agriculturalists and pastoral community's livelihoods. Although Tonga society was also negatively affected by labour migration, the food production system exhibited an element of resilience in that the people adapted to the forces of modernization.

Since the 1992/93 marketing season when liberalization of maize marketing was effected, small-scale farmers were to sell their maize either to the lending institutions (to facilitate loan recovery), or they had to find other private buyers who were supposed to have entered the market. These difficult changes that small-scale farmers were expected to adjust to in the agricultural sector as a result of liberalization policies, were compounded by adverse weather conditions, leading to a severe drought in the 1991/92 season. The drought which was considered the worst in that century, plus others that the country experienced in 1994/95, 1997/98, 2000/01 and 2001/02, impacted

negatively on maize production throughout the country especially in Southern Province, making rural society more vulnerable to food insecurity (Sichingabula, 1996).

These droughts reduced production of maize and other crops by as much as 60% nationally (Tiffen and Mulele 1994; Kajoba, 1998). While area planted to maize in the late 1990s reached a peak of 1 million hectares, accounting for about 70 percent of the total cropped area, this declined significantly, probably due to policy and environmental shocks. Furthermore, in cattle keeping areas such as the Southern Province, with 40% of the share of cattle in the traditional sector, the devastation of livestock by outbreak of cattle diseases (especially foot and mouth disease, east coast fever and contagious bovine pleural pneumonia) [CBPP], exacerbated the impact of drought and the food insecurity situation (Kalapula, 1984).

Shocks are a key element in the human-environment systems in which households seek to achieve their livelihood strategies. Shocks usually refer to sudden events that have a significant impact - usually negative on livelihoods (Kajoba, 2008). They are irregular and vary in intensity and include events such as natural disasters, civil conflict, losing one's job, a collapse in crop prices for farmers, etc. Common shocks among the households (in order of being cited by more households) included drought, loss of livestock, livestock diseases, plant pests and diseases, erratic rainfall, increases in input prices and floods. The rankings of the shocks in terms of severity show that drought is the single most important shock experienced by households in Southern Province (Sichingabula, 1996; Sichingabula, 1997; Roland *et al*., 2007; Kajoba, 2008).

2.9 Vulnerability and resilience of farmers to floods

In Zambia, the major causes of vulnerability of people to floods are many, complex and interrelated. The recent extreme event in relation to floods occurred in the 2007/08 rainy season, affecting a wide geographical area in the country (Zambia Vulnerability Assessment Committee [ZVAC] (2008). Between the years 2002 and 2007, Zambia experienced two major floods (2002/3 and 2006/7) (DMMU, 2015). The country further experienced massive flooding in the years 2008/9 and 2009/10. DMMU (2015) reported that the 2007 floods affected 41 out of 72 districts in Zambia which included areas never before affected by flooding. Historical data proves that recent floods have been more widespread and more frequent and in some years too early in areas where they are expected late (DMMU, 2015).

2.9.1 Factors contributing to increasing flood risks in the Kafue Basin

There are three broad categories of disasters caused by flooding that have afflicted the people of the Kafue River Basin (DMMU, 2015). These are natural floods, human induced floods and complex humanitarian emergencies (such as outbreak of diseases that are flood related). Factors contributing to increased flood disasters in the Kafue Basin could be both natural and anthropogenic, summarized as follows:

i. Intensive economic use of the flood plains for fishing, agriculture and livestock farming.
ii. Seasonal release of water at Itezhi-tezhi Dam and storage at Kafue Gorge creates room for flood inflow in the middle of the rainy season thereby affecting fishermen living by the river banks and herdsmen who graze their cattle in the flood plains.
iii. Environmental degradation of watersheds caused by uncontrolled and unregulated human activity, especially large-scale deforestation due to overgrazing, charcoal production and poor cultivation practices, resulting in increase in flood peaks and frequencies, reduced flood carrying capacity of the rivers due to excessive siltation of their beds, shifting of river courses causing erosion of the banks and formation of lagoons in the flood plains, landslides in the upper and middle catchment areas causing mass erosion and subsequent siltation of river channels, and outbreaks of diseases such as foot-and-mouth and other tick-borne diseases.
iv. Prolonged period of dry years from the 1980s to 1990s led to people to encroach in flood prone areas both in terms of settlements and agricultural activities.

2.9.2 Flood prone areas of the Kafue Basin

The Kafue catchment has two major natural flood control features, which contribute to the low yield of catchment outflows compared to the catchment average rainfall. The Kafue River has a mean annual flow of 350 m3 s-1 near the confluence with the Zambezi River (Chabwela, 1994). The mean annual flow represents only 6.2% of the mean annual rainfall of 1057mm falling over the catchment. The main features of the Basin are extensive dambos, the Lukanga Swamps and the Kafue Flats, which have been known to be prone to flooding as shown in Figure 2.3. At peak flows the Kafue River also experiences riverine flooding which is quite extensive in some areas. This riverine flooding has been known to disrupt farming such as cattle husbandry and other activities done along the river banks because it makes grazing impossible.

The Kafue Flats is the second biggest flood plain in Zambia after the Barotse flood plains, extending for about 255 Km long and covering an area of 6 500 km2, comprising the Kafue main river channel, lagoons and swampy areas. “They are one of Zambia’s most commercially important and agriculturally productive areas, providing both economic and ecological benefits to the country,” (Zambia Environmental Management Agency [ZEMA] *et al.,* 2013: 87). With the

impoundment of the Kafue River, first at Kafue Gorge in 1972 as Stage I development, and second at Itezhi-tezhi in 1978 as Stage II, this has produced hydrological changes in the Flats, resulting in drastic alteration of the flow and flood patterns. Nearly half of the Kafue Flats wetland is grazed through the transhumance or *'Kuwila'* system. However, this practice has become less dependable because of poor flood patterns. Between August and November during the dry season more water is released from Itezhi-Tezhi dam which inundates the grazing ground. Consequently, the herds of cattle are pushed in the areas with poor grazing forage. In addition, the lack of good grazing grounds makes the cattle vulnerable to cattle disease, and since early 1990s, cattle population has drastically declined in Kafue Flats (Rennie, 1978; Haller, 2004; Kunz *et al*., 2013).

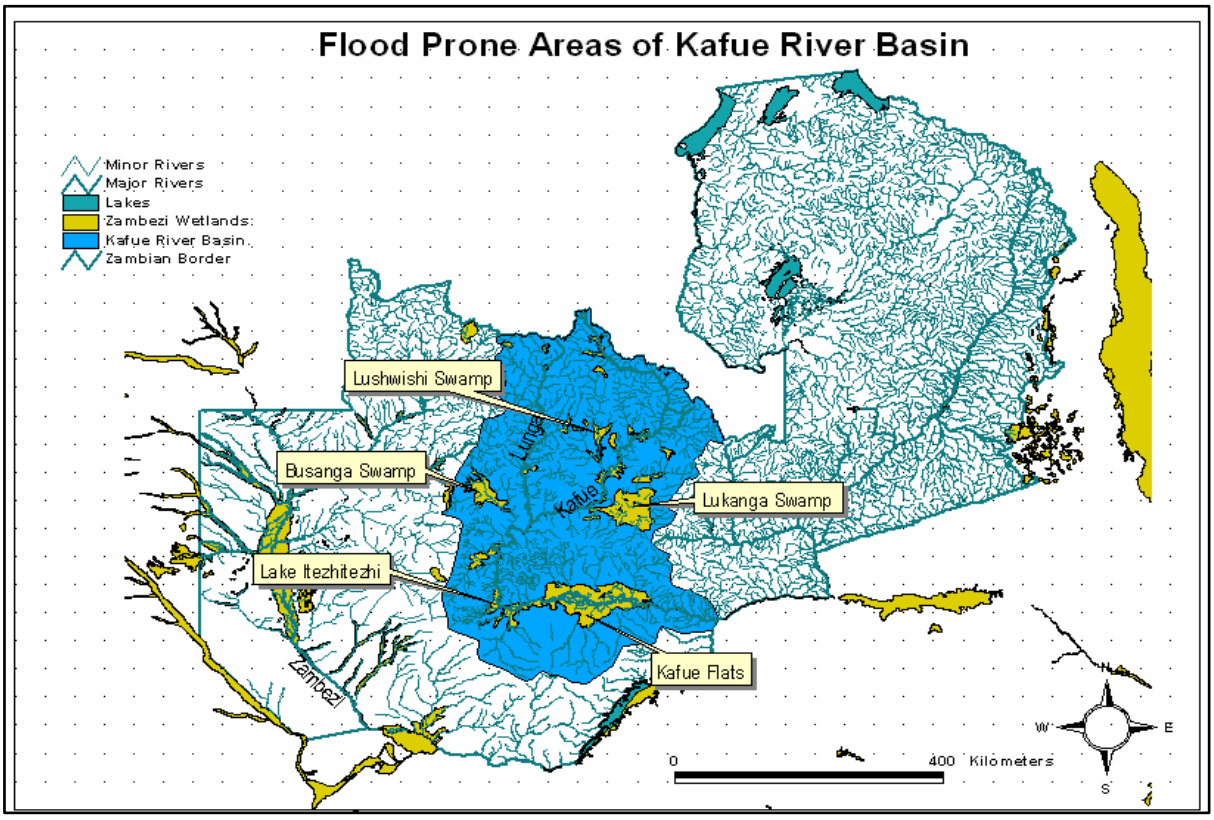

Figure 2.3: Location of Kafue Flats as a major flood prone area in the Kafue Basin

Source: GRZ (Associated Programme Flood Management [APFM] (2007), p. 20

2.10 Pastoralism and climate variability and change in rural Africa and copying strategies

In Africa, as in other continents, cattle forms part of the worldwide distribution of livestock rearing. Pritchard (1979), contends that the great part of Africa's people probably seven out of every ten adults live directly off the land either by cultivating the soil or by grazing animals. Hans (1982) and Barrett (1999), argue that livestock are vital to subsistence and economic development

and their products often constitute the only source of income in rural areas and hence the only way in which farmers can procure the improved seeds, fertiliser needed to increase crop yields.

More than 60% of the people in Africa depend on livestock, especially cattle for their livelihood. In Niger, it was found that cattle manure is used in crop production. In the Sahel as well as West Africa, the most common way to fertilise land is to use cattle manure on the crop fields (Nestel *et al.,* 1973). Investment by farmers in livestock is a widespread practice. Cattle serve as a means of saving and accumulating capital and as a productive asset, providing not only meat, milk and manure but also draught power. Scoones (1995: 64) pointed out that "in Lesotho, investing in cattle earned the equivalent of a 10 percent interest rate, while a bank account lost 10 percent because of inflation". Conditions in many other African countries are probably similar. In Mali and Nigeria, especially among the Fulani, pastoralists have bought crop inputs by selling their cattle and hiring out their oxen to other farmers.

Climatic variability, particularly the spatial and temporal distribution of rainfall, affects livestock production systems profoundly through its impact on forage and water resources (Behnke *et al.,* 2006). Ellis and Swift (1993) state that when feed and water resources decrease, livestock struggle to maintain weights and the incidences of malnutrition and diseases rise. To avoid morbidity and mortality, producers sell off non-essential and weakened stock at low prices. Since producers over a wide geographic area may be affected simultaneously by drought, they offer livestock on the market at the same time, and so depress prices. While livestock prices fall, cereal prices rise, as do the prices of other staple foodstuffs. "Terms of trade between products that livestock owners sell and the goods they buy worsen and livestock producers' income decline," (Kalibaba, 2000: 12).

Without ways to control supply in many African countries, non-equilibrium, opportunistic pastoral systems are plagued by market disequilibria. Significant, non-marginal shifts in supply, following the cycle of drought and recovery, play havoc with livestock prices, marketed surplus and producer incomes, not to mention consumption patterns for livestock products. Given the inherent instability of supply, governments and private traders under-invest in livestock marketing infrastructure and facilities. The key issue underlying African livestock marketing is not supply but rather strategic public sector interventions to competitive, efficient and flexible markets. (Scoones, 1995; De Haan, 1999).

Private livestock traders are opportunists. During drought periods, they procure animals at very low prices, knowing that producers are trapped for cash to buy grain and other necessities. While some traders may not serve livestock producers well, this does not mean conspiratorial, clan or class-based conflict. It is true that buyers and sellers have diametrically opposed interests, particularly if they are buying on open, spot markets and mutual trust between buyer and seller does not build up. Yet, despite the fact that traders strive to procure animals from producers at lowest prices, studies of returns to livestock trading enterprises typically show that net returns are modest (Staatz, 1979).

One of the most pervasive, powerful and unaltered sources of uncertainty impinging on African agro-pastoral systems is climate variability. Today, climate variability exerts a major influence on human lifestyles and land use patterns. Other problems include; poor marketing, lack of land ownership, poor livestock service provision, inadequate restocking of cattle stock, insufficient and ineffective extension services, recurrent cattle diseases, expensive veterinary drugs and sometimes their non-availability and poor management practices. These have drastically reduced livestock numbers leading to high poverty levels and food insecurity in rural Africa (Scoones, 1995).

To cope with the fluctuation in forage yield resulting from climatic variability, (Scoones, 1995: 59) outlined that pastoralists have developed a variety of survival strategies that include:

i. Maximizing herd size during favourable periods so that animal losses during drought do not reduce herd size below a variable level;
ii. Using adaptive breeds and taking advantage of animal physiological processes which make lower demand on forage during periods of low supply;
iii. Adjusting herd composition so that animals with lower nutrient requirements are kept during dry periods;
iv. Keeping herds with a mixture of animal species which feed on different vegetation.

2.11 Evolution and development of cattle rearing in Zambia

The livestock sector can be a major contributor to GDP and a pathway out of poverty. In addition to the direct financial benefits, livestock play many roles for smallholder farmers as it provides food, manure, traction, a savings mechanism, and social status. Livestock includes cattle, pigs, goats, sheep, and poultry, among others. Statistics regarding livestock population in Zambia are

fairly weak (Strategic Visions Limited, 2011). This is because there has been no livestock census conducted since the 1970s. Currently government rely on the veterinary department to capture livestock statistics in the country. According to veterinary department, "livestock sector in Zambia comprises about 3,038,000 cattle; 758, 501 goats; 466,506 sheep; 711,707; pigs and 75, 938,123 poultry," (GRZ, 2011: 15).

The Livestock sector remains a major source of income for many Zambians (especially those living in rural areas). About 45-47% of the rural population in Zambia depend on livestock for their livelihood. For example, the International Livestock Research Institute (2006) reports that 39.2% of rural income comes from livestock, higher than the 20.9% from crops. Animal sales alone account for 26% of rural household incomes (Freeman *et al*., 2008, cited in World Bank, 2011). Despite its huge potential for growth, the livestock sector in Zambia continues to face a number of challenges and productivity of the sector remains very low.

2.11.1 Cattle development programmes in the colonial period

The main interest of the British South Africa Company (BSA Co.) in Northern Rhodesia (Zambia) was the exploitation of the mineral resources. The function of the agriculture sector was to provide sufficient surplus agricultural products to feed the mineworkers. The company felt that this function could best be fulfilled by encouraging the immigration of European farmers. The colonial government's primary objective regarding African agricultural production was to maintain the status quo (Dodge, 1977: pp. 6-7). There were no specific cattle-oriented initiatives presumably because of the pressures from the settler farmers who saw Africans as directly competing with them in the market for beef. However, the various schemes aimed at encouraging the African Farm Improvement Scheme (AFIS) referred to cattle keeping-both in term with the greater use of animal manure to maintain soil fertility and soil conservation by preventing overgrazing (Allan, 1968). This attempt to create an ecologically sound system of mixed farming involved fencing of paddocks within the communal grazing areas to rotational grazing and improved pasture, along with the control of cattle numbers to match the carrying capacity of the grazing areas.

From 1903 onwards, white farmers from South Africa under the BSA Company settled along the line of rail, especially in the Southern Province of Zambia which had fertile soils and was free from tsetse flies (Roberts, 1976). The land up to 20 kilometers (km) either side of the rail was

designated as alienated Crown Land for settlement by European Commercial Farmers and Zambians were pushed in Native Reserves where overcrowding of people and animals led to soil erosion and ecological deterioration. The link of this situation to the study is that when traditional lands are overstocked with livestock, resources such as pasture and water dwindle.

2.11.2 Cattle development programmes during the First and Second Republics (1964-1991)

The growth of the urban population and the rise in real urban incomes after independence greatly increased the demand for beef. The new government under Dr. Kenneth Kaunda of UNIP introduced measures to meet the local demand. The veterinary services were expanded, especially the number of Veterinary Staff based in villages, while the expansion of the then Cold Storage Board of Zambia (CSBZ) aimed at providing finances to increase cattle sales. According to Rootselaar and Bwalya (1990: pp 493-513), some of the measures that aimed at increasing beef production among others include the following:

i. Setting up state ranches to encourage and popularise cattle keeping in the whole country and offer extension services to new cattle keepers;
ii. Setting up of the CSBZ to purchase cattle from farmers and sell the meat to the public - this organisation was present in all the provincial centres and major towns in Zambia;
iii. Initiating grazier schemes for farmers living close to state ranches as a way of transferring animal husbandry knowledge and encouraging cattle keeping. Farmers who kept cattle for the state ranches successfully were given some animals as payment;
iv. Importation of beef breeds of cattle such as the Boran and Afrikander bulls to cross breed with the local cattle aimed at improving the quality of local cattle breeds;
v. Provision of credit for the purchase of cattle, oxen and farm implements through the Lima Bank and Agricultural Finance Company (LBAFC) - these measures, however, were superseded by privatisation and liberalisation of the agriculture sector in 1991.

During this period, the government tried to achieve its food production goal by encouraging a variety of production farms, including socialist farms, cooperatives, state farms, settlement schemes, Intensive Development Zones (IDZs), and parastatal enterprises that were strongly supported among others. The Agricultural Finance Company (AFC) routinely provided seasonal loans for about half the farmers in Southern Province, while the Cattle Finance Corporation provided loans in kind for the farmers involved to build up their stock. “The statutory body, the

Cold Storage Board, purchased beef and the agricultural extension services that were theoretically available to provide advice or veterinary service when required," (Baylies, 1979: 71).

In Namwala, dip tanks, dams, veterinary laboratory, trained field officers, a quarantine station to regulate movement of cattle and routine vaccination of cattle were provided at the District Office. The tsetse control programme in the District improved animal health and reduced mortality rate, calving, management and grazing systems. However, the impacts of drought, technical and managerial problems together with cattle diseases were major detrimental factors that hindered livestock industry in the District.

2.11.3 Neo-liberal reforms and their impact on agriculture and livestock sector (1991-2001)

The MMD under Dr. Fredrick Chiluba embarked upon the Structural Adjustment Programme (SAP) by introduction of market liberalization by which the government removed subsidies on fertilizer and other inputs, decontrolled prices of commodities including maize, and opening up marketing so as to attract competing marketing organisations. "These efforts were, however, coupled with adverse weather conditions that made food production systems vulnerable to both policy and environmental shocks," (GRZ, 1998: 28).

In Southern Province, due to lack of clear government policy on the livestock sector, the devastation of livestock by outbreak of cattle diseases such as Foot and Mouth Disease(FMD), Heart water and East Coast Fever (corridor disease) exacerbated the impact of food insecurity situation. Since cattle are a source of draught power in Namwala, their loss due to livestock diseases and drought has reduced the area cultivated for maize and other cash crops (Kalapula, 2007). For this reason, livestock losses rendered some families vulnerable especially in Baambwe area. "This is because cattle is a source of livelihood as it can be sold to raise income that can be used to purchase available grain and other requirements on rural markets in the district," (Kalapula, 2007: 26).

2.11.4 Interventions in the New Deal administration on agriculture and livestock sector (2001 to 2011)

The government under the late president Levy Patrick Mwanawasa in 2001 undertook deliberate measures aimed at rebuilding the resilience of small-scale farmers who had experienced both policy (SAPs) and environmental shocks (droughts and floods) in the past ten years (Kajoba,

2008). This rebuilding aimed at reducing poverty by increasing food production, as well as ensuring national and household food security through the promotion of the production by small-scale farmers of cereals, legumes, roots and tubers as well as livestock restocking (GRZ, 2004).

In order to sustain livestock production, the government in Southern Province provided services aimed at improving animal health and control of livestock diseases. Some of the measures include vaccination of cattle against FMD and corridor diseases, restocking, stocking and increasing overall production, productivity and management of marketable livestock and livestock products (GRZ, 2008). In Namwala, about 86,000 herds of cattle were vaccinated against FMD and 300 heifers were purchased and distributed to four Chiefdoms in the district as part of cattle restocking programme in 2007. It is in this regard important to integrate crop production with cattle husbandry and land tenure in Zambia and Namwala District in particular to improve people's livelihoods and food security situation.

In the FNDP, the objective towards livestock development was to improve the productive efficiency of the livestock sector in a sustainable manner and support the marketing of both livestock and livestock products and contribute to food security and increased income. The strategies during the FNDP were to:

i. regulate and control the quality of livestock, livestock products and stock feeds;
ii. promote private sector participation in the provision of livestock and extension services and in marketing of livestock and livestock products;
iii. create and promote awareness in the conservation of animal genetic resources;
iv. facilitate implementation of disease and vector control programmes with private sector participation;
v. establish the emergence disease control fund to control transboundary animal diseases, such as FMD, CBPP, etc.;
vi. rehabilitate the vaccine unit;
vii. strengthen the early warning system;
viii. establish two disease free zones by 2010;
ix. devise efficient and sustainable diagnostic techniques in investigations of diseases;
x. enforce all legislation in the livestock sub-sector;
xi. promote and establish of abattoirs in livestock production areas and
xii. encourage, supporting and promoting poultry and small livestock enterprises as a way of empowering women and female headed households (GRZ, 2008: 50).

2.11.5 The Patriotic Front party and the livestock sub-sector (2011 to date)

The Patriotic Front remains committed to its objective of making the Agriculture sector the main stay of Zambia's economy. This unfettered commitment is premised on the fact that Zambia's

Agriculture currently employs more than 70% of the labour force and provides the main source of livelihood for more than 80% of the population living in the rural parts of the country, while contributing 20% to the National Gross Domestic Product (GDP) of the country (Zambia National Farmers Union (ZNFU), 2012; Patriotic Front Manifesto, 2016]. Within the livestock subsector, the following are envisioned;

- Establish a livestock disease free zone and qualify for exporting animal products to the European Union (EU) market;
- Strengthen disease control and prevention measures;
- Establish a livestock electronic tracer system;
- Rehabilitate all dip tanks and establish new ones in proximity to cattle owners;
- Promote Public-Private Partnerships in the construction and operation of dip tanks and other animal services;
- Establish Livestock Breeding and Service Centres;
- Promote diversification in Livestock production;
- Promote range management practices; and
- Increase Livestock extension and veterinary coverage.

2.12 Traditional cattle rearing in Zambia

Cattle have been kept for a long time by most tribes in Zambia's Southern, Western and Eastern provinces and those living in the extreme northeast region near the Tanzanian border (Yambayamba, 2006). In other parts such as Northern and Luapula Provinces of the country cattle keeping is difficult because of tsetse infestation and traditionally people in these areas have not had any cattle (Beerling, 1986).

Zambia, just like any other Sub-Saharan country also has its economy partly depending on livestock. According to Triffen and Mulele (1994: 46), "about 80 percent of cattle in Zambia are held by traditional farmers, the rest are on large scale ranches." Phiri (1989) contended that about 50 percent of the total cattle production in the country is found in Southern Province.

Jaspan's (1953: 32) arguments compliment Nestel *et al.,* (1973), ideas that cattle are kept by traditional farmers for the following reasons among others:

i. Most important for agricultural use, draught power for ploughing and manure provision.
ii. Cattle are easy to convert into cash. They act as a security for any eventuality, which requires financial obligation such as payment of school fees, purchase of food in times of drought and purchase of essential commodities such as blankets or ploughs.
iii. Cattle also have an investment function, which can be compared to that of a long-term security derived from a savings account. In this security function, cattle play as something to rely on in old age. This function can be compared to a pension.

iv. Cattle play a central role in various ways such as in marriage payment and female initiation ceremonies, funerals and religious rituals.

There are more cattle in the hands of traditional herders than commercial farmers in Zambia. According to CSO (2007), there were 2,102,245 cattle reared by traditional farmers compared to 413,345 reared by commercial farmers in 2000. This marked difference in numbers arises from the value that the traditional herders place on the quantity and not quality of their livestock in addition to lack of established markets. It is more prestigious for a man to have 500 cattle than to have 50 fat and healthy ones. However, in spite of the efforts of the government to increase production of beef, the response from traditional herders remains conservative. They only sell their animals when they have problems such as raising school fees for their children and settling disputes which require paying money. It is estimated that the traditional cattle keepers sell only three percent of their animals compared to commercial farmers who sell about fifteen percent (CSO, 2005).

With respect to markets, Zambia could raise about US $1.5 billion per annum if it matched Kenya's cattle production. Countries like South Africa, Botswana, and Kenya have taken advantage of their livestock industry and are earning large amounts of money from both beef and milk exports. Zambia can export its products to neighbouring countries like the Democratic Republic of Congo (DRC) which is a huge market. Zambia has four times more grazing than arable land and three agricultural zones which are suited for livestock production. When well utilised, Zambia can match Kenya's cattle population which would rise to US $4.5 billion additional value in total beef exports. Furthermore, the cattle industry would increase its GDP contribution to the national treasury by 10% instead of the current one per cent (Sinha, 2010).

Zambia can also emulate countries like Namibia and Botswana which supply beef to South Africa and export some to Europe. Also, apart from Congo, Angola is another potential market for beef products. In addition to regional markets, Zambia could take advantage of the international markets which are huge and very competitive. At the moment, world beef and dairy trade is worth about US $50 billion, a share to which Zambia could be part of. Increasing cattle production is good for reducing poverty in rural areas since cattle are the largest asset which they own. There is need to help the traditional cattle farmers to improve on their farming techniques so that they can take advantage of their assets (cattle).

2.13 Traditional cattle rearing in Southern Province

In Southern Province, traditional cattle keeping is largely among the Ila people of Namwala District and the plateau Tonga. Smith and Dale (1920), stresses that the Ila and the Tonga tribes are prominent pastoralists and value their animals highly for their social and economic life. In addition, Fielder (1973), stated that livestock played a critical role in food security and selling cattle has been, particularly important in Namwala as a coping strategy following the recurrent droughts in the 1950s. This is, particularly important because the proportion of households owning livestock is higher compared to many other places in the province. The distribution of livestock varies widely between ecological zones and is determined, particularly by the distribution of forage and water supplies and by the risk of disease (Foster, 1986).

According to CSO (2003), there were about 454,629 agricultural households involved in raising livestock in Zambia in 2000. There were a total of 230,967 households raising cattle in Zambia by 2000. These households constituted 35.2 percent of all livestock-raising households (excluding poultry-raising households). Out of the total number of cattle-raising households, Southern Province accounted for 24.4 percent, followed by Eastern Province with 23.4 percent while Western Province recorded 21.8 percent of the total cattle raising households. Luapula Province had the smallest number of cattle-raising households, accounting for only 1.0 percent of the total. Table 2.1 outlines livestock-raising households by province and type of livestock kept in Zambia.

Table 2.1: Livestock-raising households and types by Province in Zambia

Province	**Type of livestock**				
	Cattle	Goats	Pigs	Sheep	Donkeys
Central	26,956	30,162	7,144	598	419
Copperbelt	3,302	9,463	5,285	1,786	300
Eastern	54,014	58,865	63,627	6,921	403
Luapula	2,237	19,064	9,761	1,524	136
Lusaka	5,710	9,260	2,933	523	199
Northern	21,852	51,445	24,134	4,691	326
N/Western	10,183	17,539	6,368	2,150	115
Southern	56,292	49,306	20,032	1,264	1,513
Western	50,421	8,432	7,684	153	797
TOTAL	**230,967**	**253,539**	**146,968**	**19,610**	**4,208**

Source: CSO (2011) p.32

Livestock farmers are encouraged to take as much land as they wish under the leasehold tenure system and charge any price that will make them operate profitably for their animals and beef. For

example, Zambezi Ranching and Cropping (ZRC) has been given 80,000 hectares of land for cattle ranching in Mazabuka area and Nanga Farms in the Kafue Flats; expanding from 80 hectares to 1,600 hectares under the Commonwealth Development Corporation (CDC) investment. Cattle ranching is a major activity on this farm. On these ranches, cattle are raised from calves to the slaughtering age. Zambeef is another cattle ranching company that has contributed greatly to the increase of beef supply on the Zambian market. The company remained in a unique position in the beef industry with eight abattoirs strategically located around the country to gain access to cattle suppliers. The operations of Zambeef include: purchasing and slaughtering of traditional cattle mainly from Southern, Western and Eastern provinces and transporting them in refrigerated vehicles to their Chisamba ranch; dipping, de-worming and fattening cattle on improved feeds such as maize bran, molasses, cotton-seed cakes for about six months before slaughtering them; distributing the beef to butcheries in major towns using refrigerated trucks.

However, cattle diseases pose a challenge to the development of livestock sector in Southern Province. Mungaba (1988), reported that the corridor disease has been a major killer of cattle and has become a major constraint to the development of livestock industry with losses of about ten thousand cattle per year, especially in the traditional sector. The disease has been enzootic in certain parts of the country like Southern, Central, Western and Copperbelt Provinces (Chizyuka and Mangani, 1987).

Munyama (1994) reported that in Southern Province alone by 1993, cattle population in the traditional sector had gone down by 70 percent. It was reported that two thousand cattle died of corridor disease alone within two months in 1992 in Southern Province. The paper indicated that Southern and Western Provinces had provided 'boiling pots' due to corridor disease. In addition, GRZ (2001) noted that there was a decline in the heads of cattle slaughtered in 2001 from 18, 669 in 2000 to 14,120 mainly due to outbreaks of various cattle diseases in Southern and other provinces.

2.14 Role of cattle industry in Namwala

As to where the *Ilas* originated from, there are so many accounts by various researchers. But if you ask a typical old Ila person, the response you would get is "*uswe twakaseluka kuhwa kwizeulu ulubono lwesu*" meaning; 'we descended from heaven with all our possessions and animals'. They

point to a stone found on the banks of Namwala River which has all types of foot prints 'to prove this point'. It goes without saying that the Ila are simply part of the Bantu speaking people. According to CSO (2005), the Ila language is spoken by more than half a million people and is the 19th most popular and spoken language in Zambia, out of 72 languages. The *Ilas* are part of the Bantu Botatwe group which includes Lenjes and Tongas. They are also related to the Kaonde speaking people. Their traditional cousins are the Lozis, Luvales, Luchazis and Mbundas, owing to many battles they fought with these tribes.

Whenever traditional cattle farming are discussed in Zambia, one of the names that come to mind for many people is Namwala district of Southern Province. This is so because even with the decapitating cattle diseases that have ravaged the area in the last decade, Namwala still that has the largest number of traditional owned cattle. This can largely be attributed to centuries of old traditions whose communities' social economic well-being evolved around cattle. Wealth and power is measured by the number of heads of cattle one owns. Therefore, cattle rearing in the area rather than crop farming have taken a centre stage. However, that is not to mean that the area lacks potential for diversification in areas such as tourism with nearby Kafue National Park and Itezhi-tezhi Dam.

Within the traditional sector, cattle fulfil a number of roles in social functions, in marriage payments, and through loans to cement family and political ties, while they also contribute to the production through draught power for ploughing and transport, and particularly, through the provision of manure. Cattle are seen as the main form of security in Namwala, being a store of wealth, and in a way fulfilling the accumulatory role that land fulfils in many non-African rural societies. As a symbol of prestige, the cattle keepers in Namwala rarely slaughter their cattle for food or sell their cattle for commercial gain. Cattle, despite their numbers, do not form the major source of protein in the traditional diet, except in the provision of milk. In Namwala, especially in the Kafue Flood Plain, cattle are herded communally usually on unimproved and unprotected pasture; their grazing is not controlled except during the cultivation season when crops are protected without major land shortages (Fielder, 1973).

Despite ups and downs in cattle population (Table 2.2), Kalapula (1976), stated that the Kafue Flats of Namwala District are an important grazing area for cattle owned by traditional producers,

the Ila people. It was estimated that these people grazed about 132,696 heads of cattle on the flood plain in 1974. Namwala District, located well within the Kafue flats zone, has an area of 14,638 Km^2 of the flood plain. Further, in 1971, there were 35,000 people giving a density of 9.2 persons per square kilometre. Cattle population in that year was 120,872 heads of cattle. It was stated that "this made the Ila by far the wealthiest cattle people in Central Africa, with an average of 15.1 animals to each adult male," (Fielder, 1973: 34).

Table 2.2: National cattle totals from 1994 - 2008 in Zambia

YEAR	TOTAL CATTLE POPULATION (IN MILLIONS)
1994	2,525,967
1995	2,642,200
1996	2,562,841
1997	2,700,516
1998	2,747,175
1999	2,572,488
2000	2,620,987
2001[1]	1,596,271
2002	2,517,550
2003	2,375,453
2004	2,341,970
2005	2,709,361
2006	2,799,965
2007	2,457,563
2008	2,315,327

Source: GRZ (2009) p. 32

The livestock sector in Zambia has great potential to contribute to rural poverty reduction. It contributes about 3.2% to the overall GDP and 42% to the agricultural GDP. It is dominated by smallholder farmers who consider livestock as a valuable asset due to the ease of converting it into cash. It is also an important source of pro-tein, and features prominently in cultural transactions such as dowry payment and settlement of disputes. Overall, the livestock population has been increasing with a noticeable decline between 2008 and 2012 (Figure 2.4).However, according to the 2015 Annual Livestock Report from the National Livestock Epidemio-Surveillance and Information Centre (NALEIC), the following were the estimates for each species: cattle 3,498,498; sheep 766,508; goats 1,380,100; pigs 1,108,192; and poultry 76,296,722.

[1] About 1,024,716 cattle decline representing 24.3% was recorded in 2001 due to drought coupled with disease outbreaks such as foot and mouth in Southern Province and CBPP in Western Province.

The significance of cattle can be seen from the ceremonies practiced. As the Ilas would say about Shimunenga, '*kali muntu upona ulya maila'*, translated as 'he was a human being living and eating like anybody else.' The Shimunenga Ceremony of the Ba-Ila people of Maala is celebrated in October. The ceremony involves cultural marching in traditional attire and traditional songs are chanted in honour of Shimunenga ancestral spirits at *isaka*. Drums are sounded and most importantly cattle are taken to the river, where they are displayed in the traditional manner to show off as a symbol of wealth in traditional Ila society. The occasion is marked with pit-stops for traditional beer at different places (Mapani, 2008).

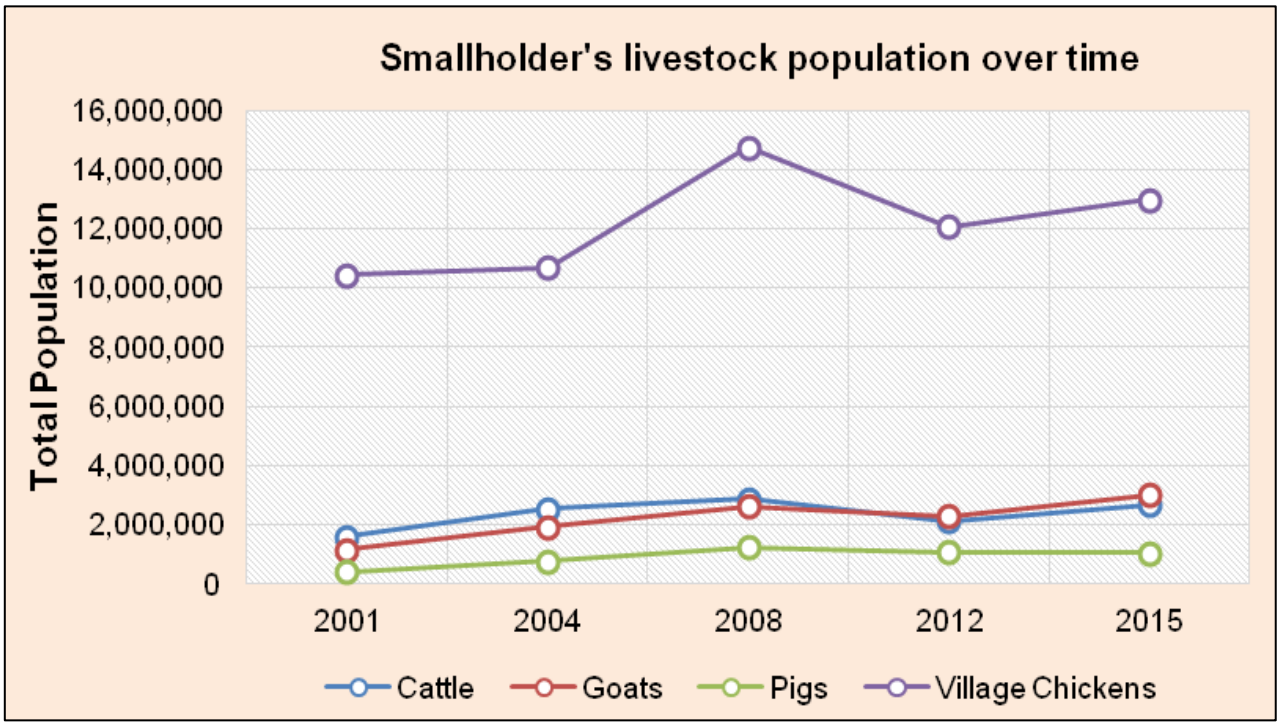

Figure 2.4: Smallholder livestock population in Zambia from 2001 to 2015
Source: IAPRI, (2016)

However, livestock productivity in Namwala is currently negatively affected by the scarcity of grazing land due to annual floods, droughts and recurrent stock diseases. The annual floods and droughts have made agriculture highly variable and unpredictable creating pressure on the plateau between arable and grazing land. Livestock diseases have led to a decline in cattle numbers from 123,421 in 1998 to 109,746 in 1999, 98,797 in 2000 to 95,287 in 2001, and 94,961 in 2003 to 94,581 in 2004. The traditional rural economy that is based on agriculture and more so on cattle keeping has become vulnerable and experiences severe challenges, especially due to recurrent stock diseases that have led to cattle losses. Because of diseases, the government has been

involved in cattle vaccination and restocking programmes. Thus, NGOs such as the Heifer International (HI) and Namwala Livestock Support Programme (NLSP) were conceived as a response to the large numbers of cattle deaths due to diseases.

2.15 The Kafue Flood Plain and its role in cattle industry

The Kafue Flats are an internationally important wetland recognized by the Ramsar Convention (Ramsar Secretariat, 2013). Wetlands are areas that are periodically or permanently flooded with water not exceeding several metres. This includes swamps, floodplains and dambos. Floodplains are zones along major river systems that are low-lying and seasonally flooded. They are of great socio-economic significance in Southern Africa due to the extent to which local communities rely on them for agriculture, fisheries, and wildlife (Breen *et al.*, 1997).

According to World Wide Fund for nature [WWF] (2006), the world's major Wetlands such as the Danube Delta in Ukraine, the Amazon Basin in Brazil, the Kanabatangan Floodplains in Malaysia, the Yangtze River Basin in China, the Kafue Flats in Zambia to mention just some are of great value in terms of agriculture, fishing and protection of biodiversity. "Partners for Wetlands focal projects in China, Brazil, Malaysia, Zambia and Ukraine are actively pursuing strategies to reverse the decline of globally significant wetland ecosystems, and in so doing, ensure that future generations will continue to be delighted by these wetland inhabitants as in ages past," (WWF, 2004: 2).

The Kafue Gorge Dam was completed in 1972 and the Itezhi-tezhi Dam in 1978 for hydroelectric power generation for the country. Creation of these dams is very beneficial as well as a thrilling human action. Both at Kafue Gorge and Itezhi-tezhi, large stretches of open water present new scenery. The Kafue Flats, located along the Kafue River, stretch from Itezhi-tezhi Dam upstream to the Kafue Gorge downstream. "It is 255 km long and 60 km wide, covering an area of approximately 6,500 Km^2 and home to about 6 million people and of course the biggest and longest river wholly confined within Zambia," (ZEMA *et al.*, 2013: 87). The catchment's area of the Kafue River Basin is 154,000 Km^2. This river basin is considered the most dynamic and active in the country and drives much of the national economy. Improving the water management regime in the flats has the potential to lead to greater ecological sustainability, improved natural resource availability, national development and greater food security for local communities [Food and

Agriculture Organisation (FAO), 1968].Tremendous influences of these reservoirs have been felt by all forms of plant, animal and human life. "It was established that the flow of the Kafue River has been substantially changed. The effect was inadequacy of grazing ground for cattle and extremely detrimental spawning areas for fish," (Sheppe and Osborne, 1971: 23).

Smith and Dale (1920), indicated that given the primary economic use of the Kafue flats at present as a winter grazing ground, cattle rearing provide draft power leading to increased agricultural productivity. In addition, the receding floodwaters deposit fine silt sediments ideal for growing crops such as irrigated rice that can be grown during the warm summer season, with stock rearing as a complementary activity. Foster (1953: 373), argues that "this procedure is normal in Texas and Louisiana (United States), and there seems to be no reason why it could not be carried out on the Kafue flats."

Pastoralism constitutes a vital source of livelihood for the people of Namwala, based on the annual cycle flooding of the floodplains of the Kafue River. Artesian fisheries are another important source of income but have from time to time been hampered with recent years of flooding disasters as a result of unusual rainfall patterns due to climate change. The Zambian water sector faces major challenges in terms of technical, financial, and institutional capacity due to lack of wetlands policy. Efforts to address these issues are ongoing but are constrained by various factors, including a current sluggish of the planned decentralization process.

2.16 Land tenure and the livestock sector in Namwala

Interest in the availability of land and water resources in the sub-Saharan region, as well as globally, is driven by concerns about food security. According to Chileshe (2005), many countries in sub-Saharan Africa are already closer to their water supply limits than to their land limits, and the need to increase the agricultural production will accentuate pressures on the water resources. Land tenure is defined as "the rights of individuals or groups over arable, grazing and residential land, how such rights are acquired, what they consist of, how they operate in the holding, transfer and inheritance of land and how they may be extinguished," (White, 1957: 172). Zambia's land tenure is categorised into two main systems: Customary and Leasehold. As at independence, about 94 percent of the total land in Zambia fell under the customary land tenure system that is controlled and allocated by traditional authorities (Economic Commission for Africa [ECA]

(2003). The leasehold tenure, accounting for six percent of the total landmass, provides for the title deeds for a period of 99 years. "This tenure system provides a sense of security and places value on land for commercial transactions," (GRZ, 2002: 55). Land ownership under statutory tenure system is often built on leasehold entitlements to the land and offered exclusive rights to the owner that guarantee security including grazing rights (Birgegard, 1993).

In managing communal grazing, in 1954, Gordon outlined the economic theory of an open access resources using fishing grounds as an example. Hardin's (1968) application of the neoclassical model to communal grazing produced the '*tragedy of the commons',* a theme often quoted by those in favour of privatizing communal grazing land. Recently, support has been growing for the view that communal grazing is a common property resource. Jazairy *et al.*, (1992) stated that the use of grazing land as a resource is restricted to a well-defined group that regulate the stocking rate. Open access implies that here there are no rules governing individual use of the resource, or that the rules are not enforced (Kajoba, 2003). Clearly, a working knowledge of the institutions that define access to communal grazing is required for policy-making, as information is scant.

Land ownership in Namwala is generally under customary tenure. Land is communally owned and the chief is the custodian of the land on behalf of the subjects. Most individuals own land through lineages or clans in a given chiefdom. The subjects usually pay something in form of cattle in order to own land. This ownership is permanent without title as long as individuals remain using that particular piece of land. More than 70 percent of the active population in Namwala are dependent on land for the livelihood that includes the management and utilisation of the Kafue flood plain for arable and grazing purposes. Farmers cultivate their land or graze their animals and control how to use it and reap the benefits to themselves (Kalapula, 1984). However, there is increase in land ownership in which individuals acquire title deeds on the upland. But the flood plain is not allocated to individuals; it is a communal grazing, farming and fishing area solely owned by different chiefs. The traditional or customary tenure in the study area is characterised by the following factors;

i. Land resources are controlled within the traditional tenure system.
ii. Land use and land rights are matters which are governed by culture and written by customary law.
iii. Land conflicts are on an increase due to commercialisation of land.
iv. Under customary tenure every household has the right to;
    - cultivate as much land as they can manage

- graze livestock anywhere except on land actually under crops
- take timber from the woodland reserves for building and for firewood
- use water resources of the land for various uses
- use sand, stones, and other unclassified minerals from the communal land and
- choose a site on which to build a house or do farming as long as the Chief in the area concerned is consulted.

2.16.1 Common property resources (CPRs) and common property institutions

The term *common property* (or communal property) captures an understanding that only particular individuals share rights to a resource and that common property is substantially different from open access, the situation where there is an absence of any rights to a resource (McKean, 2000). Communal property has been defined as a resource that is held by an identifiable community of interdependent users (Feeny *et al*., 1990). These users enjoy formal and informal rights of access to the resource and use it on the basis of some regulatory systems existing within the community. Common-property regimes can be understood as making private the rights to goods without dividing into pieces the management of common-pool resources (McKeen, 2000).

Garret Hardin's (1968) *tragedy of commons* argued that free access to a common pool resource brings ruin to all. He made an effort to illustrate that if the common resource is used without any restrictions, it will become a place of great disorder where people will try to take advantage to build up greater capital on it without thinking about the environmental impact. He emphasized that continued free access to commons will result in something very disastrous that cannot be avoided. To avoid such a tragedy he proposed two solutions - privatization of the commons or government control. However, numerous studies have looked at the issue of communal resource use from different angles (Feeny *et al.*, 1990; McKean, 2000). The factors identified by Hardin that contribute to the tragedy are open access, lack of constraints on individual behaviour, conditions in which demand exceeds supply, and resource users who are incapable of altering rules (Feeny *et al*, 1990). Having such a consumer-driven stance, he overlooked the role of adaptability of local people towards changing environmental conditions and their ability to get organized to manage communal resources. Hardin's theory has been challenged by numerous valid examples where community people were continuously successful in practicing their own communal systems of managing their common resources (Feeny *et al.*, 1990; McKean, 2000). Effective institutions originate locally through the interactions of many individuals involved in common property resources (CPRs).

Common property has institutional mechanisms to arrange and share their rights over using the resources (McKean, 2000). Absence of the institutional mechanisms will simply result in an open-access resource available to anyone and very difficult to protect and very easy to deplete (McKean, 2000). Institutional arrangements of local people, characterized by recognized past and present strengths, successes and potentials, and knowledge and self-interest of groups of users and communities, are critical to effective management of common resources (Feeny *et al.*, 1990). Management of the resource by the resource users themselves has been understood as community-based natural resource management (CBNRM).

Definition of the community-based management of natural resources is "a process by which landholders gain access and use rights to, or ownership of, natural resources; collaboratively and transparently plan and participate in the management of resource use; and achieve financial and other benefits from their stewardship." CBNRM is the process that encourages the resource users be responsible not only to exercise the rights of access and use, but also have an obligation of being good stewards and managers of the resource. This process is to be originated locally on self-voluntary basis by people whose livelihoods depend on that resource. CBNRM is one of many related concepts such as collaborative natural resource management, collaborative monitoring and conservation, participatory environmental policy, consensus-based decision making, and they all have the core principle to include stakeholders in policy making for "win-win" solutions (Fernandez-Gimenez *et al*., 2008).

2.17 Traditional and scientific education in managing common property resources

This section describes different knowledge types and its relationship to community-based management. The principle of resilience emphasize on combining different types of education/knowledge for learning that talks about "creating platforms and involving user groups and interest groups for knowledge sharing about complex ecosystem management and for relating to uncertainty and surprise," (Folke *et al*., 2003:375).

Scientific or Western education and indigenous or non-Western education are two different paradigms built on different background and with different purposes. For example, Mongolian pastoralists share a common education base with its set of norms, attitudes and practices. The herders' traditional ecological knowledge (TEK) and perceptions reflect their pasture use norms

and herding practices and this education system persisted over centuries being modified by flexible local institutions and management practices (Baival, 2012; Fernandez-Gimenez, 2000).

Indigenous education could be understood as the local knowledge held by indigenous peoples or local knowledge that is only specific to a given culture and society (Berkes, 2008). Whereas western education is based on a whole system of classification and representation of ideas that determine the wider rules of practice (Hall, 1996). Hall (1996) stated that the West established its own sense of itself by creating "western identity" and western form of education to relate to "the other" or the rest of the west. Agrawal (1995) discussed fundamental distinctions and relationship between traditional science and Western science. He describes that the two types of education systems could be distinguished by substantive, methodological, epistemological and contextual matters. In terms of substantive matters, western science has greater intellectual content by being systematic, objective and analytical and it gets advanced on the achievements of previous research, whereas indigenous education could be equated to common sense, as it doesn't need to be rigorously objective, systematic and conceptual (Agrawal, 1995, p. 126). Berkes (2008) highlighted that in traditional systems, morality and ethics are explicitly a part of the management system; in Western scientific systems they are merely implicit. Local knowledge has memory that spans over space and time (Berkes, 2008) that makes it overstretched temporally and spatially and without perfect match with the timeframe and units of analysis of scientific research. It could be assumed that scientific research provides insights from a selected scale of a local knowledge and therefore it has to refer to a broader indigenous education system that has larger spatial and temporal scales of existence.

Methodological and epistemological distinction is very particular, because western science has more objective and deductive logic, whereas indigenous education is based on subjective and inductive logic. Indigenous education is orally communicated, largely functional and is embedded in the culture of the people (Ellen and Harris, 2000). Western science is a systematically documented and peer-reviewed education derived from the application of predetermined design and methods. This contrasts with indigenous education as it is considered "closed, non-systematic, and holistic rather than analytical, advances on the basis of new experiences, not on the basis of a deductive logic," (Agrawal, 1995:4).

In terms of context, TEK systems have greater moral and ethical context by being attached to a particular social group in certain time and space, whereas Western education, on the other hand, has been divorced from an epistemic framework in the search for universal validity (Berkes, 2008). Sillitoe (1998) argues that indigenous education is kept and maintained by local people to manage their resources and, therefore, it has localized relevance. In contrast to scientific knowledge, indigenous education is empirical rather than theoretical that makes it more localized, repetitive and fluid (Berkes, 2008; Ellen and Hariss, 2000). Sillitoe (1998) asserts that it is risky to compare and contrast scientific information with the local people's interpretation of their activities and livelihood practices. Ellen and Hariss (2000, p. 65) reports that the traditional/folk education and instituted scientific education can be modelled as "two interacting and mutually reinforcing streams: hybridizing through mutual borrowing while maintaining permeable boundaries for social and professional reasons." All these characteristics of indigenous knowledge make it almost impossible to epitomize it as being part of a dominant Western scientific knowledge (Baival, 2012; Berkes, 2008; Ellen and Hariss, 2000).

From the local people's perspective, debate about comparing and contrasting scientific information with the local people's interpretation of their activities and livelihood practices is quite sensitive (Sillitoe, 1998, p. 34), because local education is a *knowledge of how* and it is orally and cross-generationally preserved in "living memories of individuals but also within the textures of local songs, stories and other performance traditions". It is also important to recognizing geographic scales that determine the way local communities learn. As for small scale places stakeholders have particularistic approach of knowing and they depend on personal experiences and features in the surrounding place, whereas stakeholders in large scale have approach of learning that is aesthetic and rely other secondary experiences and information.

Potentials to combine scientific education with local education are demonstrated in a process of adaptive co-management (Gadgil *et al*., 2003), a process of sharing management power and responsibility between government and local resource users (Pinkerton, 1989). Fernandez-Gimenez *et al*., (2003) discussed how traditional ecological knowledge can be combined with science and applied in co-management of natural resources by doing cooperative research that draws on local skills and knowledge. For example, the Canadian Arctic co-management cases inform that a long-term co-management institution building, a favourable policy environment and

diverse forms of communication, deliberation and social interaction are highlighted as important for knowledge coproduction, social learning and adaptation (Gadgil *et al*., 2003).

The continual engagement model was proposed by Reid *et al*., (2009) to better integrate education from diverse stakeholders with the goal to improve impact of science on local and national decision making. The continual engagement model has a core team of diverse stakeholders committed to cross-scale linking a wide range of actors from local to national and to global levels. Authors call this team as a core boundary spanning team. Ross *et al*. (2011, p. 112) examined epistemological and institutional barriers to the integration of indigenous education into western construction of education. They argue that although many barriers are related to the epistemological difference between these two knowledge systems, "the practical manifestation of the barrier is often institutional". Despite numerous attempts and practices involving indigenous people in resource management, bureaucracy of modern institutions still remain as obstacles to cooperative management of natural resources (Ross *et al*., 2011).

Novak's (1998) theory of education could be an important reference and application tool in creating and combining knowledge types. Union of our actions, feelings, and conscious thought constructs a knowledge that we have learned meaningfully and thus makes human empowered to make commitments and accept responsibilities (Novak, 1998). Meaningful learning facilitates integration of new knowledge into knowledge the learner already knows in some no-trivial way (Novak, 1998). Armitage and Plummer (2010) emphasized that meaningful ways of knowledge co-production in co-management institutional arrangement can trigger learning and adaptation. On the basis of pastoral communities in Kenya, Robinson and Berkes (2011) illustrated mechanisms how meaningful participation at multi-level scales may lead to increasing adaptive capacity in the face of social-ecological changes. Thus, this thesis explored potential ways to operationalise resilience thinking, indigenous knowledge and education in the management of coupled human-natural pastoral systems in Namwala amidst climate variability and change.

2.18 Institutional role to climate variability and environmental awareness

In Southern Africa Development Community (SADC) region, Zambia is one of the countries highly impacted on by severe weather and extreme climate events. Studies in the Sub-region suggest that losses due to flooding and drought have increased in frequency over the past two

decades and have adverse effect on Communities and the economy of the Sub-region. In fact, in Zambia it is estimated that 75 percent of all disasters are attributed to weather conditions. The following are concrete actions taken and progress made in implementation in Zambia:

i. The setting up of the Disaster Management Technical committee (DMTC) and Vulnerability Assessment Committee (VAC) of the DMMU under the Office of the Vice – President. The role of DMMU is to coordinate pre and post disaster related activities.
ii. Development of effective drought and flood warning system to maximize the opportunity for the implementation of response strategies aimed at enhancing the safety of life and property and reducing avoidable flood damage.
iii. The operation of the *in situ* monitoring and measuring instruments, for both rainfall and river level that use the current and forecast information of future flood levels.
iv. The provision of accurate weather and climate forecasts by Zambia Meteorological Department (ZMD) to DMMU, policy makers, the media and public has reduced significantly the impact of these events.
v. The lead-time of alerting these events resulting in quick mitigation and responses to disasters has improved. The development of the national early warning flood and drought system will allow for the generation of and dissemination of real-time data and products at national, provincial and district levels.
vi. Cross-training of meteorologists, hydrologists and disaster managers in the science of hydrometeorology that forms the basis of flood detection and prediction is being undertaken and identification of flood and drought prone areas.

In addition, increased frequency to climate change has since 1980 given impetus to the government, donor agencies and individuals to the construction of small dams in Zambia as drought mitigation measures. Between 1988 and 1994 about 300 small dams were planned to be constructed in Southern province (Morris, 1991). Today there are over 800 dams in the province. To address the water scarcity problems the Zambian government adopted its National Water Policy in November, 1994 to recognize the importance of managing water resources in a holistic way. To facilitate this approach the Ministry of Energy and Water Development has put in place plans and programmes to promote the IWRM in the framework of the National Water Policy. It is envisaged that the above programmes will contribute to the realization of the SNDP and SDG number thirteen aimed at achieving sustainable agriculture and combating climate change and its impacts through effective environmental education awareness. The aim of the government programmes is to promote environmental variability and change education in rural areas to control and manage their water resources and the accompanying facilities on a sustainable basis. The government envisages a situation where communities will be mobilized and trained in water and land awareness in line with the water policy ecosystems to cope with the changing rainfall patterns and other extreme weather events. Improved water resources and land awareness are definitely a critical part towards improving environmental education and solution to climate variability.

2.19 Research gaps

In Zambia, there is considerable amount of research work related to climate change, land tenure and management of wetlands (for example, Sichingabula, 1994; Jain, 2007; Kajoba, 2008; Ngoma, 2008; Bwalya, 2010; Kalinda, 2011; Sianungu, 2015; Chabwela 1994; Kalunga, 1996; Kunz *et al*., 2013), Government reports and policy documents (Disaster Management Operations Manual (2015); Department of Veterinary and Livestock Development Report (2014); Zambia: Atlas of our Changing Environment (2013); Ministry of Agriculture and Livestock annual report, (2010); Namwala District Annual Report, (2009); Strategy for flood management for Kafue river basin (2007); Seventh National Development Plan 2017-2021 (2017); Animal Production and Health Programme for Namwala District (2005); Poverty Reduction Strategy Paper 2002-2004, [2002]), non-governmental organisations (Strengthening climate resilience in the Kafue sub-basin, Appraisal Report (2013) by African Development Bank (AfDB); Mainstreaming climate change into rural development policy (2009) by United Nations; Climate Change and Food Security framework document (2006) by Food and Agriculture Organisation (FAO); Agriculture, Water and Environment in the Kafue River Basin (2006) by World Wide Fund for Nature [WWF]) and grassroots Community Based Organisations (Community Led Disaster Risk Reduction Report (2011) by HODI; Namwala Livestock annual Development Report (2010) by Namwala Farmers Association) to mention but a few. However, there is no ample environmental education information available on the effects that climate variability and change has had in proposing viable adaptation strategies on rural pastoralism. This study attempted to fill in this knowledge gap and help implement effective and acceptable EE related to SETs to climate variability and change.

From time immemorial, and since maize is Zambia's staple food, many scholars have concentrated on impacts related to cropping neglecting a viable livestock sub-sector. More specifically, most climate studies in Zambia have concentrated on the impact of climate change on crop production while other studies have assessed perceptions and adaptation (for instance, Kalinda *et al*, 2011; Jain, 2007). Besides, these studies have concentrated on the national level and have not taken the variability and climate environmental education and adaptation to locale levels. Hence, no study thus far has been conducted in Namwala on rural social-ecological linkages and environmental education in particular and related effects and resilience of pastoral systems in general. There is therefore a dearth of literature on linkages between climate variability, environmental education and rural CPRs management among pastoralists in Namwala. The study addresses this gap.

Further, many studies have been done on the Kafue Flats and environmental education. On the Kafue Flats, selected studies have concentrated on the drought and flood management, fisheries and wildlife, Kafue River basin management and riverine agriculture (for example Casarotto, 2013; Kunz *et al*., 2013; Chabwela, 1994; Foster, 1953). On traditional ecological knowledge, environmental education and climate change education, Namafe (2004) and Namafe and Chileshe (2010) focused on the flooding in the Upper Zambezi wetlands and contextualising the curriculum through local floodplain while Mweemba (2014) and Mweemba and Wu (2010) studied risk perception of climate change and variability in Zambia and environmental self-efficacy, attitude and behaviour among small scale farmers in Zambia respectively. In addition, Namafe (2006) and Muchanga (2013) focused on environmental education and learning for climate change adaptation in Zambia respectively. All these studies neglected pastoral EE and TEK as key factors to climate variability local adaptation mechanisms. The chief stress has been on climate variations and change to the extent that very little environmental education has been given to the contemporary effects of pastoral practices and cultural assumptions to cope with these changes. Hence, a built in study of this nature was necessary to understand locale social-ecological typologies to climate variability among pastoralists in Namwala.

2.20 Summary

Literature has pointed out that land and water management are important resources available to rural pastoralists. Maize production, and livestock especially cattle, play an important role in realising family goals through provision of manure and draught power. The available literature, however, does not provide social-ecological typologies on changes in production goals and rationale among different categories of pastoralists as a result of climate variability. There is no data on the changes in goals and adaptive strategies under different social, ecological, political and economic circumstances on the effect of climate variability on pastoral systems. In addition, there is a lacuna on flooding, flow and flux of the Kafue River, carrying capacity per cow in the Kafue Flats, and overall contemporary effects of the newly completed hydroelectric power station at Itezhi-tezhi dam on pastoral water and grass regimes. This study addressed critical facets of livelihoods on social-ecological typologies and application of indigenous knowledge (environmental education) to climate variability among pastoralists, at a locale level and insitu, in Namwala District. The next chapter gives a brief description of the study area.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.1 Introduction

Namwala is a rural district located on the southern bank of the Kafue River in the Southern Province of Zambia, with a total surface area of 21,751 km^2 and is described as a rural District (Figure 3.1). Namwala District has a human population estimated to be slightly above 101,000 people according to the 2010 Census of Population and Housing with 59% being females. The total households in Namwala were found to be 12,072 of which 86 percent were male-headed and 14 percent female-headed (CSO, 2003). The annual population growth is pegged at 4%. The district is composed of four chiefdoms namely: Muchila, Mungaila, Mukobela and Nalubamba. The predominant tribe is Ila, though other tribes have also settled in Namwala. The Ila people of Namwala are cattle herders, and their livelihood is dependent on cattle and Kafue Flood Plain.

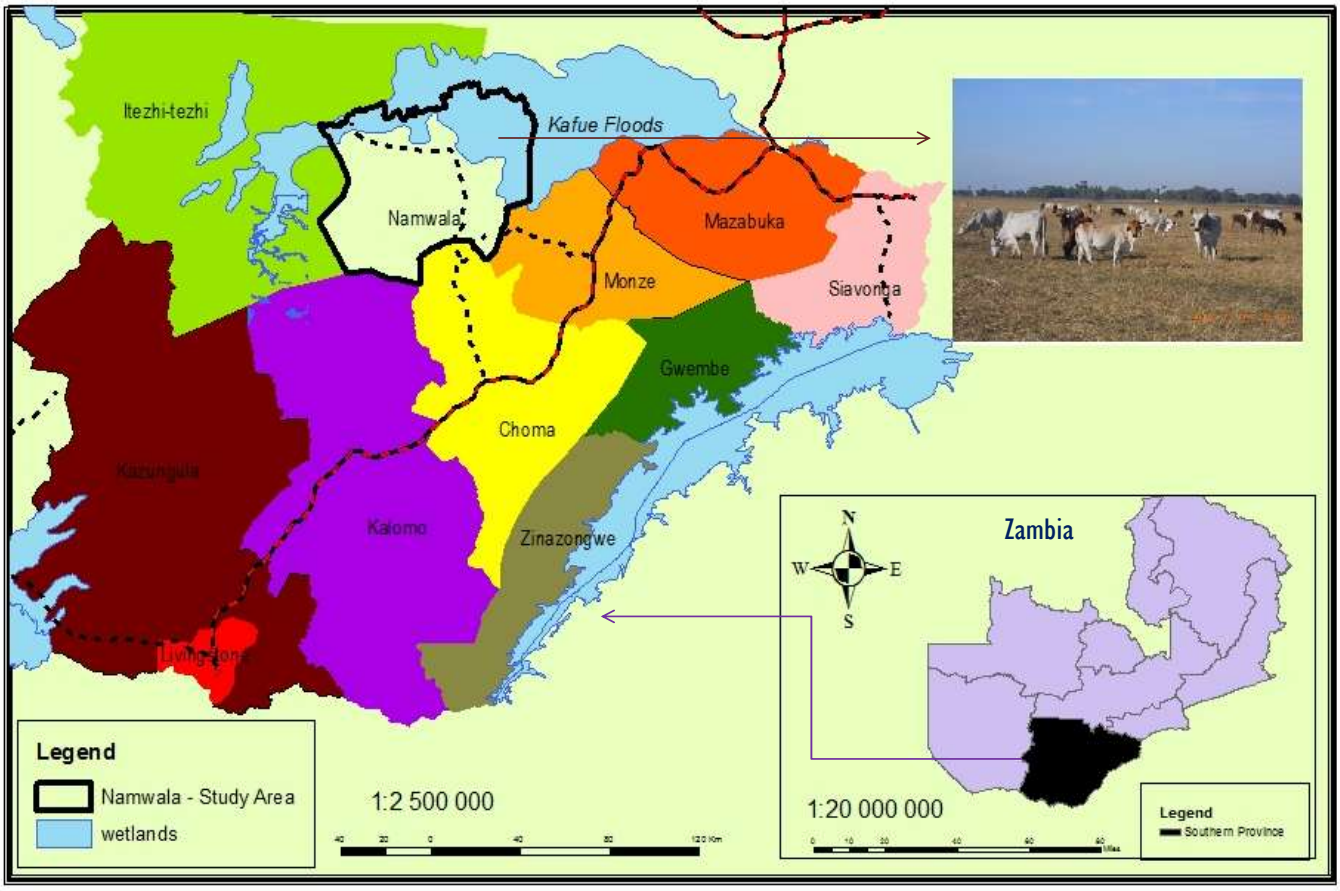

Figure 3.1: Location of Namwala in Southern Province and along the Kafue Flats

Source: Rusangu University – Department of Geography and Environmental Studies

3.2 Location

Namwala also called *Buila* or *Bwila*, home of the Ila, is situated South Central Kafue. The Ila people (*Ba-Ila*) were also called *Ba Shikulumbwe* by the Lozi People. It is generally a rural district situated in the northwest of the Southern Province of Zambia. It is bordered by Monze District in the east, Kalomo District in the south, Choma District in the southeast, and Itezhi-tezhi in the southwest. It is located 170 km North West of Choma town and 158 km from Monze town and 350 km from Lusaka City. Most parts of the study area lie in the Kafue Flats with seasonal flooding prevalent (Figure 3.1).

3.3 Climate

The climate in Namwala, like much of Zambia, is marked by seasonally. There are three distinct seasons; (1) the cool-dry season from (April) May to August; (2) the hot dry season from September to October; and, (3) the wet-warm season extending for five (5) months from November to March. Due to the generally level surface and uniform latitude in the district, the climate prevailing is generally uniform. The average annual rainfall is 800mm, much of it falling in December, January and February. The rainfall totals in between years varies between 700-900 mm, and unreliable within one rainy season. In general, the Inter-tropical Convergence Zone (ITCZ), a low-pressure zone, which prevails over the area in November-March, controls the rainfall pattern. Where the soils are bare, these rains cause high run-off, soil erosion and flooding in the Flats. As from April to October, the ITCZ shifts to the north, and a high-pressure zone prevails in Namwala, which does not produce rain. In recent years, due to a combination of the effects El Niño and deforestation, the rainfall pattern has changed. It is unreliable, producing drought conditions almost every year since 1991/2 rainy season (Kunz *et al*., 2013).

Like other Zambia, the temperatures prevailing in the Namwala are generally warm, but cooler than in the rift valley areas. "The variation is due to differences in altitude, the Flats are on higher (plateau) elevation than the low-lying valley areas. On the Flats, mean monthly temperature range from 14°C in June/July to 27.5°C in October; the mean maximum and minimum temperature range from 16^{o} C to 34°C in October; and, 7°C to 24°C in July respectively," (FAO, 1968: 34).

The rate of evaporation, except in the peak rainfall months of January, February and March, is higher than rainfall. Potential evaporation is in the region of 1,700 – 2,200 mm. This indicates that

there are only three months of water surplus in the year; and, there is generally water deficit in 9 months of the year for plant growth. Factors influencing this high rate of evaporation include the following: vast extent of shallow floodwaters across the flats; presence of plants especially the Water Hyacinth weed, which increases the surface area exposed to the loss of water through transpiration; solar radiation and wind (Simfukwe *et al.,* 2012). High water losses have implication on water availability in the River for the various uses (hydropower generation, irrigation, industry, pasture, etc.). As for sunshine, it is in the vicinity of 3,000 hours per year and wind at their greatest speed reaches the velocities of 100-115 km per hour. Much of the winds and sunshine hours occur in the seven dry months (April-October) of the year. As for winds, these speeds are an important factor in the ecology of the area, i.e., distributing small seeds, spores, and nutrients over the Flats.

3.4 Soils

According to FAO (1968), the soils of the Kafue flats as very heavy-cracking clays, sticky when wet and hard, cloddy when dry. According to Trapnell and Clothier (1996), they listed the Kafue flats soils under the general heading of 'Valley' and 'Flood Plain Grasslands'. The types of soils that have developed in the Flats have been due to the function of interacting factors: parent material, geomorphology, and rate of weathering. The parent Karoo or Katanga rocks have, however, not affected the soils that have developed in the meander-flood plain zone, but are mainly from recent alluvial deposits or sediments from seasonal run-off flood water. The soils are deep dark clays, called montimorillonite, and are capable of holding large quantities of water. They are rich in carbon, thereby giving the characteristic dark colour. These soils are poorly drained and hydrate when wet, but dehydrate when dry. This activity of expanding and shrinking produce a gilgai relief, characterized by big and deep cracks and 'swelling' of the areas between the cracks, creating a rough area in the midst of a generally level terrain. The heavy-cracking soils in the plains of these areas are difficult to cultivate except with special skill, care and timing according to their condition. These support a wide variety of grass used for grazing cattle. In some places, the landscape is associated with rock outcrops. On the plateau, the soils are heavily leached, tend to be acidic, poorly to well drained, sandy-clay-loams (Simfukwe *et al.,* 2012).

3.5 Vegetation

The main vegetation type in Namwala is generally woodland savannah. This vegetation is characterised by *Brachystegia* and *Combretum species* and open grasslands. Typical riverine trees

including some evergreen bush species which occur in places along the river banks. The woodlands are protected as reserves on the plateau. In addition, a wide range of vegetation types consists of many species of natural vegetation. Trapnell and Clothier (1996), points out that the range reflects the different soil types and the various climatic and flooding conditions. The effects of grazing by cattle and those burning are also reflected. The common hyparrhenia grasses are palatable when young, but are coarse and less nourishing as they ripen. This results in cattle gaining weight during rainy season and losing weight in dry season. There is no forage for off-season consumption other than stalks of maize available after harvesting in April. Topographically, the district is characterised by outstanding features of Flood Plains which give support to the high number of cattle.

3.6 The Kafue River and floods

The Kafue River is a major tributary of the Zambezi River which joins it 70 km below the Kariba Dam. With a total length of almost 1,600 Km from the source to the mouth, the Kafue River is the biggest and longest river wholly confined within Zambia. According to Foster (1986), there are three sources of flood water in Namwala; Local rainfall (drainage area 6,000 Km^2); Tributary streams (39,000 Km^2); and the Kafue River (105, 700 Km^2). These three types of flooding come at different times of the year supporting a rigorous growth of aquatic species such as wild rice (*Oryza Barthii*) ideal for grazing purposes (Mclean, 1961). The vast flood plain gives them great potential for grazing purposes. Every year, the Kafue River floods a broad level area to a depth of up to 235km long and up to 40km wide. The floods have been used for cattle rearing and limited cultivation. Cattle herders drive their herds of cattle on the Kafue Flats for their respective cattle outposts (*kumantanga*) as the waters recede, at the time when forage on the uplands becomes scarce. Most farmers prefer to cultivate along the edges of the Kafue flood plain where the soils are more fertile than on the plateau (FAO, 1968).

3.7 Socio-economic activities

Despite more emphasis on cattle rearing among the Ila people, they also grow crops both on the plateau and flats. Jaspan (1953) indicated that the main crop is maize, which together with sorghum, pumpkins, beans, millet and other lesser crops are grown during the single wet season (November to April). In periods of drought, cattle in the study areas are always exchanged for grain with people who had good harvest. According to Trapnell and Clothier (1996: 53), "the

rotation employed varies according to the soil, which was judged by its trees and tallness of grass cover." In essence, among the Ila and Tonga people, cattle are the best possible investments used in crop production. On the plain margins along the Kafue Flats, there are fertile pockets of land in addition to cattle manure that enable these people grow enough crops (Mclean, 1961).

The Ila rarely fish. Instead, immigrants specialize in fishing (Sheppe and Osborne, 1971). Although fishing is a year-round economic activity in Namwala, some people only engage actively in this venture at the height of the annual flooding in February and March. Large numbers of fish take advantage of this flooding for spawning purposes (Haller and Merten, 2008). In turn, the inhabitants over many years have timed this unfailing habit of the fish called *ikuwo,* and kill large amounts of fish particularly barbell fish locally known as *babondo*. The Ila people rarely fish. Instead immigrants such as Lozi, Bemba, Tonga, Luvale and Kaonde are involved in this activity.

3.8 Socio-cultural traditions: A synthesis

The Ila, living on land that is relatively fertile for farming, are agricultural and cattle rearing people. The traditional way of life of the Ila consisted of hunting and herding cattle. In the olden days, the Ila used to take out their front teeth to show that they owned cattle and '*looked like their cattle'*. The Ila traditionally lived in dispersed homesteads and did not have chiefs. The structure of chieftaincy was introduced by colonial administration. Today, when a chief dies there is a group of people, outside the succession line, called *bakwashi*, who choose the next chief, although everyone must agree to the chosen candidate. The Ila hold bravery as one of the highest virtues. Young boys practiced their warrior skills by taking sticks with them so that they could fight during the long hours when herded cattle. Usually, during herding, when bulls fight, boys herding cattle also fight! Boys were allowed to fight with anyone, even their fathers. They were warriors! Those who encountered the Ila in years gone by, noted the elaborate headdress, the *isusu*, worn by men. The *isusu* was constructed out of grass and hair, rising four feet above the head. This elaborate headdress was originally used in hunting trips so that the hunters could locate each other in the long grass (Guhrs and Kapwepwe, 2008). As to where they originated from, the Ila say they dropped from the sky with their cattle wealth. The district practices the Shimunenga and Shikaumpa ceremonies (*ikubi*) in Maala and Baambwe respectively which are cultural march pasts in traditional attire and songs chanted in honour and praise of the ancestral spirits. Most significantly, cattle are displayed in the traditional manner to show off as a symbol of wealth

(Mapani, 2008). Politically, the district has one parliamentary constituency, Namwala constituency. The constituency is divided into 12 wards namely: Baambwe, Maala, Ngabo, Kabulamwanda, Chitongo, Kantengwa, Mbeza, Moobola, Nakamboma, Namakube, Namwala Central and Ndema with democratically elected councillors representing each ward.

3.9 Land tenure

It has been established that the main cause of land-use problems is land tenure (Chabwela, 1994). In Zambia, there are three forms of tenure: state land, private lands and reserve (tribal) land. In Namwala, land ownership is acquired through allocation by a headman or the chief, and by clearing the land for settlement and agriculture despite individuals not having entitlement (Kajoba, 2003). In the absence of entitlement and full ownership, resources have to open access by community members, and these resources are subject to over-use and abuse i.e. overgrazing. Some of the land-use conflicts that exist include are that caused by the multiple use of the flood plain for hydropower, water supply, cattle grazing, wildlife, agriculture and industries. These uses at times have produced conflicts with fisheries interest. The hydropower development in particular has produced changes in the hydrological status of the Kafue Flats. The major changes in particular are the reduction in the area flooded during the rainy season, increase in permanently flooded areas, and reduction in the amplitude of water level fluctuation and velocity of flow (Mclean, 1961).

3.10 Summary

This chapter described Namwala as a rural pastoral district located in the Western part of Southern Province of Zambia. Topographically, the district is characterised by outstanding features of floodplains (Kafue Flats) which give support to the highest traditionally owned number of cattle in Zambia. Therefore, livestock production is the main occupation of the local majority Ila people in the district with most households rearing cattle. Thus, pastoralism constitutes a vital source of livelihood for the people, based on the annual cycle flooding. Despite this scenario, the majority of pastoralists still lack modern EE practices on climate variability and change which has impacted negatively on their traditional pastoral typologies. It is also worth mentioning that there are no commercial farms in Namwala. Cattle are reared traditionally with almost every pastoralist practicing transhumance. Other livestock types include goats, sheep, pigs and donkeys. The district is divided into four chiefdoms namely: Mukobela, Mungaila, Nalubamba and Muchila. In the next chapter, methods which were used in data collection and sampling procedure are presented.

CHAPTER FOUR

METHODOLOGY AND RESEARCH PROCEDURES

4.1 Introduction

This chapter describes the research design and the methods that were used to collect data to achieve the objectives of the study. It explains how pastoralists in the study area were selected. The chapter also highlights the sampling approach and describes how qualitative and quantitative data were collected and analysed. The relevance of participatory methods for this thesis are also explored. The strengths and limitations of various research methods used for data collection are discussed later. Finally, issues relating to positionality and ethical considerations are explored in this chapter. Because of the interplay of multiple processes of social-ecological changes, which manifest themselves at different spatial scales, this study used multi-scale local perspectives. The author employed a combination of quantitative, i.e., surveys, knowledge elicitation tools, participatory tools, and qualitative approaches, i.e., focus groups, individual interviews, participatory techniques, in helping to provide a more holistic picture of the human-environmental (social-ecological) and social-economic processes (Mettrick, 1993). Such approaches are more successful than a single method in assessing social-ecological typologies in a rural setting.

4.2 Research design

This study applied a mixed methods approach (Bryman, 2008), which is a procedure for collecting and analysing data. It used an integrated range of methods including quantitative and qualitative assessments on pastoral vulnerabilities with respect to water and pasture; participatory methods evaluated indicators of adaptive capacity; expert interviews investigated institutional capabilities; and ecological surveys examined environmental effects related to Kafue River alterations on pastoral communities. The rationale for mixing methods was that neither qualitative nor quantitative methods were sufficient by themselves to capture the complex phenomena of social-ecological linkages in livestock-dependent livelihoods. When both methods were used in combination, they tended to complement each other and allowed for more complete analysis (Tashakkori and Teddlie, 1998) and provided a more enhanced understanding of typologies at hand rather than as competing camps. Thus, data collection was divided into three interlinked phases throughout the two (2) years of data collection and analysis. Figure 4.1 shows research design and how various methods were linked to research objectives.

i. The first phase involved using a reconnaissance survey of chiefdoms using Rapid Rural Appraisal (RRA) method through expert and stakeholder interviews.
ii. The second phase (i.e. main fieldwork) was carried out in three stages. Stage 2a) involved the use of participatory and quantitative methods and ecological surveys to characterise and explain the nature of vulnerable and resilient pastoral communities identified in phase 1 based on (i) farm (agro-ecosystems); (ii) livelihoods; (iii) socioeconomic; and (iv) institutional factors. Stage 2b) used Photovoice and other methods to determine adaptation among pastoralists to altered flood, flow and flux of the Kafue River. Stage 2c) also used mixed methods to examine land tenure governance in the utilisation of CPRs (Figure 4.1).
iii. The third phase (combined all stages) involved the use of expert and stakeholder interviews, as well as policy document analysis, to establish institutional and policy arrangements at local levels (i.e. supplementary fieldwork) on climate variability, Kafue River irregularities and land tenure. This phase also involved the use of oral history narratives to explore temporal dynamics of pastoral regimes and helped in devising rural pastoral EE linkages.

In addition to mixed methods, the other philosophical basis of study was based on Bhaskar's (1978) critical realism where reality and nature of knowledge (ontology) is dynamic. Knowledge is viewed as tentative and changing from time to time. Hence generating knowledge (epistemology) was based on the use of different methods to understand this study. This is because no system can be understood or managed by focusing on it at a single scale. All systems exist and function at multiple scales of space, time and social organization, and the interactions across systems are fundamentally important in determining the dynamics of typologies at any particular focal scale (The Resilience Alliance, 2007). Further, although qualitative and quantitative methods have different epistemological and ontological backgrounds, they can be combined and this allowed deepening of understanding through cross-validation of data (Bryman and Bell, 2007). Qualitative methods are flexible and allow a deeper and better understanding of the extent of vulnerability of households and communities to climate variability and change, but it may be difficult to generalise from the findings gained through such methods. Though not quite flexible as qualitative approaches, quantitative methods tend to allow generalisation of results and predictions (Nightingale, 2003). Nevertheless, Bryman and Bell (2007) argued that mixed-method inquiry are like combining two different and separate paradigms of research methods which may have epistemological implications and should not be seen as complementary.

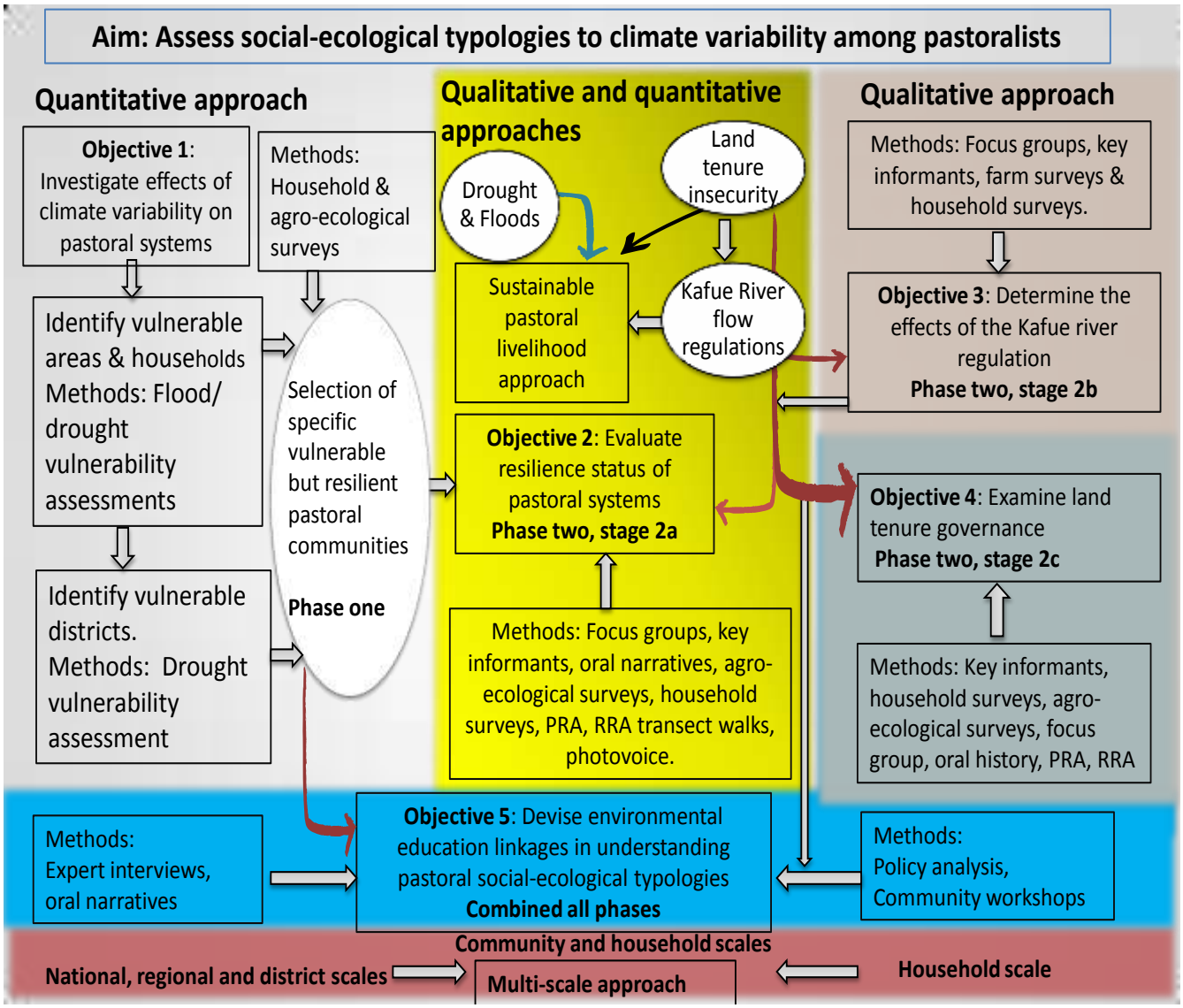

Figure 4.1: Research design and linkages between different methods and research objectives

Source: Field survey, 2017

The methods employed in this study included questionnaire surveys, semi structured interviews, oral histories, guided transect walks, observations and FGDs. Quantitative methods were used mainly for collecting data on exposure, vulnerability and sensitivity, whereas qualitative methods were used to obtain detailed and contextually grounded data (Nightingale, 2003) on pastoralists' perceptions on the concept of climate variability, TEK warning signs and pastoral regimes and practices, coping and adaptation strategies, pastoralists' perceptions, priorities, preferences, attitudes and opinions about climate variability and its effect on livestock-dependent livelihoods. Thus, climate variability and change remains a complex problem and the use of different approaches helped to understand how pastoralists were living with change and uncertainties.

4.3 Selection of the study area

Namwala is a rural district located in drought prone and water scarce of Southern Province (Figure 3.1 on page 61), whose people's occupation is cattle rearing and had the highest herds of cattle in Zambia. The district had repeatedly been hit by droughts in recent years leading to loss of large number of livestock due to pasture and water scarcity. To countercheck this, pastoralists usually resorted to transhumance which involves moving their herd to cattle outposts on the Kafue Flats with promising pasture and water availability, by following receding waters, at the time when forage on the uplands becomes scarce. The district covers the largest area along the Kafue Floodplain, making it the most representative in Zambia in general and Southern Province in particular. Cattle remain the mainstay of large numbers of subsistence peasant farmers from time immemorial as the Kafue Floodplain provides year-round naturally irrigated pasture. The prosperity of the cattle economy therefore is based on the flooding patterns of the Flats that are now significantly altered (regulated between the Itezhi-tezhi Dam and Kafue Gorge Dam). The main characteristic of these areas is an expanse common property plain ideal for rearing cattle hence harbours the highest concentration of livestock in mixed herds. This was necessary to examine the complexities of social-ecological typologies among pastoralists. Thus, undertaking the study in Namwala provided a clearer picture on how pastoralists were using environmental education to adapt to the ongoing effects of climate variability in this rural part of Zambia.

4.4 Training of research assistants and pre-testing of questionnaire

Climate variability and change is a complex problem in which different terminologies are used to describe it in different parts of Zambia. Hence, it was necessary to run a training programme for research assistants who were recruited to help with data collection. Four research assistants were recruited based on their technical competencies including their communication and writing skills, as well as their ability to act objectively within interview situations. The research assistants were thoroughly briefed by the principal investigator on the nature and significance of the study. These assistants were indigenes of the study area and spoke the local language (Ila/Tonga) of the pastoralists. Two of the research assistants were unemployed graduates in agricultural science from the University of Zambia (UNZA) and the other two completed from Zambia College of Agriculture (ZCA) in Monze with diplomas. Two days were used in training the research assistants to ensure that all interviewers asked questions in similar fashion to reduce any ambiguity.

The questionnaire for the household survey (Appendix 1) and the Interview guides for the key informants (Appendices II, III, IV and V) were pre-tested in the second week of October, 2016 at Maala in Mungaila area, the richest pastoral chiefdom in Namwala. Ten randomly selected household heads participated in the pilot testing in order to gauge the kind of responses that could be anticipated in the field. Two FGDs were also held to reflect on the applicability of using focus groups and PRA for a study of this nature. After the pilot of the household survey, the questionnaire was modified by deleting irrelevant and ambiguous questions. Features of research instrument in Appendix 1 include; socio-economic situation among pastoralists; Patterns and cycles of climate variability and change; effects of climate variability and change on pastoral systems; resilience of pastoral systems to climate variability and change; Kafue river regulation and its effects on pastoral land use; and land tenure governance in managing common property resources. These features, presented as sections, followed the objectives of the study. Unstructured interviews using the same questionnaire were relied heavily during data collection.

4.5 Sampling methods

Large scale district spatial zoning were used to allow more pastoralists discern a variety of different social-ecological typologies affecting them across all chiefdoms. Zoning is a geographical delineation of spatial units representing an acceptable degree of homogeneity, and according to some relevant criteria and to some scale of analysis (Lhopitallier *et al*., 1999). But zoning goes beyond data collection and representation, it leads to data management and modelling. It relies on the principle that it is possible to commit all spatial phenomena, their state, their dynamic and their functioning, to a smaller number of units (Kirsten *et al*., 2002; Perret, 1999). Zoning enabled the researcher to arrive at different cooperatives to which farmers belong.

Within Zones representing Chiefdoms, the study used typical case sampling using a questionnaire survey in the selection of pastoral household heads while purposive sampling was used to identify key informants. This ensured specific and spatial coverage of the district and helped in capturing all major social-ecological disturbances from 1990s to 2017. Since most pastoralists belong to cooperatives under the government sponsored Farmer Input Support Programme (FISP), complete checklists of all the farmers, who were also cattle keepers, was utilised from each chiefdom/zone. This technique was based on the selection of elements (names) with the help of veterinary extension officers, and arrived at six randomly selected cases or household names for each of the

five cooperatives. These were household heads; wife or husband. In an event where both were absent, the eldest member of the family was interviewed. Each chiefdom had more than ten cooperatives but only five cooperatives were chosen and six respondents purposively sampled to give a spatial proportionate sample of thirty respondents from each chiefdom/zone. It was easy to comprehend this because the population in the study area is clustered with many farmers having their fields on the outskirts of the villages and cattle in the flood plain. For this reason, carrying out research was timely during rainy/planting season from January to April to capture flood/drought situations and dry season from August to November to capture the water scarcity situation. Yamane (1967:886) provides a simplified formula to calculate proportionate sample sizes. This formula was used to calculate the sample size with proportionate sizes across four chiefdoms. A 95% confidence level and P = .5 were assumed for equation below:

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

$$n = \frac{172}{1+172 \times (0.05)^2}$$

$$n = \frac{172}{1.43}$$

n = 120 Pastoralists

Where:

n = the sample size
N = the population size
e = the acceptable sampling error or level of precision
1 = constant unit
* *95% confidence level and p = 0.5 are assumed*

Thus, the study engaged a total of 120 household heads; in which out of 43 identified pastoralists, 30 were typically sampled from each of the four chiefdoms. Key informants were determined by the nature of their work related to the study. Ideally, these included government line Ministries/Departments, Community Based Organisations (CBOs), Non-governmental Organisations (NGOs) working with pastoral societies and chiefs representing each chiefdom.

4.6 Research methods

The first phase of the study was a reconnaissance survey of chiefdoms using Rapid Rural Appraisal (RRA) method from August to September, 2016. Freundenberger (1994:7) defined the methodology of RRA as "a family of methods designed to get practical information on development issues in local communities quickly." This methodology has been improved upon through the years by allowing local people to actively participate in the collection and analysis of data. The improved version of RRA is referred to as participatory rural appraisal (PRA)

(Chambers, 1992), a form of Focus Group Discussions (FGDs), was used in the main fieldwork phase from October 2016 to November 2017 together with other methods outlined in Table 4.1. Chambers (1992) has however cautioned that there is likelihood that PRA may be misused to describe RRA that is extractive rather than participatory. He points out that it is important to:

> … separate out definitions of RRA as a form of data collection by outsiders who then take it away and analyse it; and PRA as more participatory, meaning that outsiders are convenors, catalysts and facilitators to enable people to undertake and share their own investigations and analysis. There is, then, a distinction between 'a RRA' and 'a PRA'. A RRA is intended for learning by outsiders. A PRA is intended to enable local people to conduct their own analysis to plan and take action (Chambers, 1992: 12-13).

Table 4.1: Research tools/methods and their relationship with research objectives

		Research objectives			
Research tool or method	Focus of research tool/method	Investigate the effects & resilience of pastoral systems	Determine effects of altered Kafue River flow	Examine land tenure governance among pastoralists	Devise EE linkages in understanding social-ecological typologies
Focus group discussions	Small group of pastoralists discussing a topical issue. Helped to validate secondary information.	X	X	X	
Key informants	Solicit information from technocrats in government and NGOs.	X	X	X	
Transect walk	Understanding biophysical resource as research team walked to village periphery under escort by villagers.	X		X	X
Participatory Rural Appraisal	Local pastoralists participated in the collection and analysis of data.	X	X		
Ecological survey	Provided insights into the drivers of vulnerability to climate variability. Helped in triangulating information from other methods such as FGDs.	X	X	X	X
Photovoice	Pastoralists took photos about a given issue, and then had a lengthy interview about the context and motivation in each picture.	X	X		
Seasonal calendars/timeline	Understanding the relationships between natural resources-based livelihoods, climate and disasters.	X	X		X
Questionnaire survey	Solicited information from pastoralists in four chiefdoms.	X	X	X	X
Expert interviews	Elicited policy implications on pastoralism e.g. experts from government ministries, donor agencies, NGOs & district directors	X	X	X	
Oral history/poetic	Past experience and events, allowed the understanding of livelihoods	X	X	X	
Policy analysis	Allowed targeting of policies to enhance relevance of research.	X	X	X	

Source: Field Data collection tools, 2017

Key: X indicates that the particular method was used to collect data to achieve a specific objective

In practice a continuum exists between RRA and PRA and some basic principles of PRA are fully shared with RRA and others are not (Chambers, 1992). During fieldwork for this study, emphasis was placed on local knowledge by allowing for the active participation of local people through expressing ideas and perceptions during the appraisal process. However the intention was for the researcher to learn from the local people. For this reason the process was rather interactive and thus the label PRA, a form of FGD. The reliability of results from these mixed methods (Table 4.1) were provided for by "triangulation." Triangulation is the use of various techniques and sources to investigate the same issues and to verify the results (Chambers, 1992).

4.6.1 Relevance of participatory methods to this research

Participatory methods are research methods that allow local people the opportunity to participate by sharing their experiences and knowledge in an effort to find solutions to local issues (Chambers, 1997). Participatory methods involve sharing knowledge and expertise between scientists and non-scientists (local people) in a collaborative manner (Ballard and Belsky, 2010). In this regard, researchers act as facilitators and learners and seek to assist local people in choice and use of appropriate participatory methods (Chambers, 1994). This allowed local communities to own the information generated.

Participatory methods have certain advantages that can be derived if well executed. First, the active involvement of local people or social actors in the research process can stimulate social action or change (Ziervogel and Calder, 2003). Second, by using participatory methods such as PRA/FGDs, marginalised and underprivileged communities or groups may be empowered, helping to build local capacity to manage problems such as climate variability (Kothari, 2001). This has the potential to increase their self-belief and confidence in their own capabilities (Chambers, 1994). In the case of Namwala, the more powerful and rich pastoralists were, the more they tried to hijack discussions in focus groups. In this regard, efforts were made by the researcher to encourage all participants to share their experiences during focus group discussions. Farmers who appeared intimidated by the presence of certain individuals were later approached for one-to-one discussions. Such one-to-one discussions with the less powerful members of the communities provided valuable insights into the power relations to land and pasture. Serious methodological concerns are usually raised in relation to the extent to which findings generated from context–specific participatory approaches such as focus group discussions and transect walks can be generalised (Martin and Sherington, 1997). To address such shortcomings, participatory approaches were complemented with quantitative approaches such as drought/flood pastoral assessment and time series analysis.

In this study, participatory methods were used because they allowed the researcher to gain local insights into the complexity of social-ecological typologies to climate variability and how it affected pastoral production systems and rural livelihoods in rural areas. For instance, using participatory methods provided valuable insights into how pastoral activities of households in the study communities had been adversely affected by climate variability. Pastoralists have been using indigenous knowledge to develop innovative strategies to cope with climate variability and change. It was therefore necessary that this knowledge was recorded and synthesised so as to explore the nature and extent of vulnerability and coping measures used by pastoralists in their quest to live with change and uncertainties. Thus, the study provided time-tested and robust coping and adaptation strategies that were used to reduce the effects of climate variability and change on livestock-dependent communities. Several other writers have used participatory methods including PRA and FGDs and in climate change studies (see Chileshe, 2005; Antwi-Agyei, 2012; Baival, 2012; Casarotto, 2013; Mngumi, 2016).

4.7 Data collection techniques

The research collected both secondary and primary data. It should be noted that the researcher did not collect data directly from the ecological sub-system of the social-ecological system through direct measurements of vegetation (grass or fodder) or soils or water. Instead, questionnaire interviews, oral histories, surveys, photovoice, FGDs, etc. were used to understand environmental education of the ecological systems through the eyes of local herders' experiences and observations.

4.7.1 Secondary Data

Several types of documents were reviewed as part of data collection, including local government documents, donor project reports, brochures and leaflets including second hand accounts of the people and accounts written by others (Kirsten *et al*., 2002). In addition, secondary information was obtained through reading of different literature from libraries and Internet. From both sources, the major materials were books and articles that had information for Zambia (particularly Southern Province) on climate change and associated effects, climatic conditions and how these affected pastoral agriculture in Namwala District. In addition, different theories on adaptation measures were used to identify pastoralists and stakeholders such as non-governmental sectors active in agriculture. In addition, precipitation and runoff data, amount of rainfall, for Namwala in

particular was obtained from Meteorological Department and Water Resources Department for the available records on drought and flood related effects in the Kafue Flats.

Content analysis of various documents from District Council, District Veterinary Office (DVO), District Agriculture Office (DAO), archival sources and other relevant literature on floods and droughts and their related effects in Zambia were utilized to obtain information on the nature of animal husbandry in Namwala. Documentation on cattle keeping was analyzed and supplemented with pre-interviews with key informants.

Policy documents from pre and post-independence periods from both government and private sector were analyzed to develop an outline of major policies which hindered the growth and development of animal husbandry and how it revolved around the flood and drought situations (Documents from relevant departments like Central Statistical Office, Ministry of Finance and National Planning, Ministry of Livestock and Fisheries (MLF), Zambia Meteorological Department, Disaster Management and Mitigation Unit (DMMU), and other related government policy documents and local government documents related to programmes in the framework of the National Water Policy and in the context of Integrated Water Resource Management [IWRM] for Kafue River Basin; The Water Resources Action Programme [WRAP]; The Partnership for Africa‘s Water Development [PAWD]; The Kafue Dialogue on Flood, Water and Environment; The Poverty Reduction Strategy Programme (PRSP); including the Sustainable Development Goals (SDGs) and land tenure policies.

Census statistics from the Ministry of Livestock and Fisheries on cattle numbers, changes in river regulation and flow, farming seasonal changes and their effect on crops and animal husbandry from 1991 to 2017 farming seasons were analyzed to examine vulnerability and resilience indicators. These were compared with various policy documents to show the extent to which some polices caused vulnerability and/or resilience among pastoralists. Maps and aerial photographs were particularly used to understand the extent of floods, nature of agriculture, water management, fishing and land tenure.

4.7.2 Primary Data

Primary data collection techniques varied according to objectives and their respective requirements. In particular, the research used typical case sampling and purposive sampling

methods which are non-probability sampling techniques in the selection of household head respondents and key informants respectively. Therefore, the study was highly specific, exploratory and participatory. The purpose of PRA was to engage community members in the social-ecological analysis, rather than it being driven by the facilitator.

Four field trips were made with the first in August 2016 to test the instruments. The second fieldwork was intermittently between September to December 2006 to capture dry season in both upland and social-ecological conditions at the onset of rainy season in the Kafue Flats. The third one was between January to April 2017 to capture flooding, flow and flux of the Kafue River. The fourth filedwork was in July 2017 to cover policy and institutional capabilities. These represented all critical months in social-ecological memory and decision making among pastoralists.

In addition to interviews and focus group discussions, one workshop was organized by World Vision with representatives from pastoral communities and local government at Corner Point Lodge in Namwala. This allowed the researcher to introduce the topic, and rapportured during group discussions. From this, preliminary conclusions and interpretations of the data were made. Having community people actively participating in the workshop allowed the researcher to use some elements of participatory research, which has an advantage in constructing a more detailed and accurate knowledge base about the social and cultural contexts of the study area (Arnold and Fernandez- Gimenez, 2007).

While collecting qualitative data, preliminary analysis and interpretation of the data was done. Preliminary data analysis was an ongoing process which could be undertaken every time data are collected (Grbich, 2007). Almost after each interview, focus group or observation exercise, some distinctive meaning of environmental education were noticed, but the researcher held these kinds of conclusions light until data collection was over. From interviews, Focus Group Discussions (FGDs), workshops and field journals, a substantial number of pages were generated. After transcribing interviews and focus group discussions, data was reduced by coding. Coding is often the first step in organizing the data in a meaningful way that condenses the bulk of data into analyzable units by creating categories and trends (Coffey and Atkinson, 1996).

In parallel to coding, a number of data analysis methods were used such as research memos, content analysis, domain and taxonomic analysis, constant comparative analysis and poetic

analysis. Having multiple data analysis techniques provided the researcher with flexibility in choosing right approaches in analyzing various types of data and led to greater level of description, interpretation and elicitation throughout the research process (Creswell, 2003). In addition, oral history/poetic and photovoice analysis approaches were used to analyze some of the interviews taken from pastoralists. To generate meanings out of these data, patterns, themes, wealth ranking, comparisons, contrasts and relationships to build a coherent understanding were formed (Miles and Hiberman, 1998). Hence, each objective had its own methodology as follows;

4.7.2.1 Activity: Investigate the effects of climate variability and change on pastoral system

Methods: The study proposed to look at two key effects of climate variability namely floods and drought that influenced the availability of pasture and water for livestock in the pastoral systems from 1990 to 2017; to capture all major social-ecological disturbances. To determine the trend of such variables, data of the same from 1990 was obtained from the ZMD and District Agriculture Office and subjected it to trend analyses using Microsoft Excel software. Additionally, a historical transect of time trend (time line) targeted the elderly who had the knowledge on their villages and rural areas to provide historical accounts of the areas' social-ecological conditions. This was done separately with males and females to bring out the differences in perspectives. It helped the researcher in knowing the major events and changes in conditions which had taken place in the past, e.g. changes in cropping patterns, famines, floods and droughts. With this, the researcher directly or indirectly saw the increase or decrease of hardship in the lives of pastoralists.

The thrust of the study was that social-ecological typologies undergo change over time. Those changes can be slow and predictable, or they may be fast and unforeseen. These changes can result from external sources of variation interacting with internal vulnerabilities. Therefore, environmental crises can signal or accompany the loss of ecological resilience. They can also serve as windows of opportunity for change. Historical profiles revealed how human interventions and actions, values, perceptions and priorities of the system have changed over time. Thus, the development of a timeline helped to reveal the longer-term dynamics of the system. It helped to reveal the main social or ecological drivers in the system, and how change occurred (such as episodic change through perturbations, or slow linear changes). It also helped to identify the types of disturbances or shocks among pastoralists that have occurred since 1990.

Thus, long term trend analysis was used to explore the historical patterns of issues relating to floods and droughts and explore different sources of information relating to climate variability and change or other trends (for example medium term climate predictions, expected trends in floods and droughts which have an effect on pastures and water, technologies for climate adaptation, etc.) using Seasonal calendars. Seasonal calendars are useful tools in rural areas in identifying different activities and typologies throughout the year(s), for example production activities, hazards and stresses, periods of hunger, landuse, erosion, rainfall, population, tree cover, income, opportunities, management of common property resources etc. (Kirsten *et al*., 2002; Matata *et al.*, 1999; Mettrick, 1993). In this study, seasonal calendars were drawn to foster understanding of local pastoral systems and trace changes in grazing patterns as a result of floods and droughts. Respondents illustrated patterns month by month, cropping patterns, water use, livestock population and fodder, transhumance, pests and cattle diseases. Seasonal calendars stimulated further discussions and generated information about significant events (e.g. flood, droughts, fishing, wild game, new technology and so on) in the history of the community and their effects. A calendar was also useful to identify patterns of change, for example effects and whether floods or droughts were more frequent or severe or whether there were other changing weather patterns. This helped pastoralists in asserting their knowledge about the flood/drought cycles and resources use, recalling and enriching their own understanding of the effects on their livelihoods. By understanding climate variability as agents of change of their rich cultural landscape in which livelihoods were closely intertwined, pastoralist's environmental education were assessed.

Specifically, in addressing this objective, the study employed a combination of participatory approaches (Kirsten *et al.*, 2002) that include Focus Group Discussions (FGDs), transect walks and in depth interviews. FISP e-voucher cooperative members formed FGDs which are said to build up, collective and creative enthusiasm, and usually lead to sharing new and old social-ecological ideas and concepts with an outsider by familiarizing them (Chambers, 1992).

Group discussions were supplemented with transect walks. A transect walk is a simple technique used in rural typological studies to ensure that the researcher, together with cooperative members in zones, explore the spatial differences fully in the area under study (Matata *et al*., 1999; Mettrick, 1993). These formed a Focused Group or team which walked, at times drove to the periphery of villages, observing vegetation, livestock, landuse, water points (wells, boreholes, dams, pans,

ponds etc.) and related them to the effects of droughts and flood situations. In this study, the importance of transects lied not only in knowing the agro-ecological zones in Namwala, but also in getting an in-depth input from the participating villagers on the extent of vulnerability of climate variability, livelihoods, their problems and opportunities. Therefore, participant observation was an important approach which integrated environmental education into the study, and provided the researcher with first-hand data against which observed phenomena may be interpreted.

In addition, participatory mapping was used to produce local agro-ecological maps, populations or resources and discover effects of new constraints such as floods, droughts and cattle diseases. Further, discussions revealed the reasons for exposure, and opportunities for reducing exposure. Maps were be used to explore where those with most fragile livelihoods live, physical constraints to their livelihoods, and accessibility of community services. Participatory mapping dealt with different typologies of rural life, such as social issues, resources, livestock, economic, social stratification, historical and contemporary forms of livelihood etc. Further, respondents portrayed the dwellings in the village, of farms, grazing grounds, ecosystem, forests, soils and many other aspects. In this regard, maps were especially valuable in rural development and to this study in particular for exploring changes of spatial patterns of rural livelihoods (Kirsten *et al.,* 2002). The thrust of the study therefore was that people who knew most about the effects of climate variability on pastoral systems and/or catchment areas in Namwala were those who lived and farmed there. Maps were thus used not only to learn quickly from rural people by using their collective local environmental education, but also to make them share ideas and representation in the management of CPRs. In addition, a questionnaire survey was undertaken with purposively selected pastoral household heads to obtain climate variability data from pastoralists with long term experience.

*4.7.2.2 **Activity:** Evaluate resilience status of pastoral systems to weather shocks that build up the ability to live with change and uncertainties*

Methods: In addressing this objective, the study employed The Resilience Alliance (2007) social-ecological systems (SESs) assessment guidelines in determining the dynamic, differential, and spatial patterns of household and community level coping and adaptive strategies (resilience) to climate-related crises related to pastoral systems. SESs is step by step guide that can be applied in different contexts while examining resilience, mapping of early warning signs and use of local knowledge among pastoralists in Namwala related to droughts and floods. Three key aspects were

considered to attain this, namely the study resources, herds of cattle, and the environment related to drought and flood preparedness and mitigation. Based on the Resilience Alliance guidelines, specific questions/items to drawing formation on this objective were incorporated into the household questionnaire as well as FGDs and in depth interview guides. Respondents shared their experiences of how their livelihoods have been impacted by patterns and cycles of floods and droughts and how they are attempting to cope or adapt. In addition, two aspects were considered when examining resilience including: (1) a micro investigation of the pastoral system (livestock, pasture, water) in study zones in order to determine the pastoralist's ability to maintain productivity and/or rebound following climatic variability perturbation; and (2) evaluation of livelihoods among surveyed households to determine their vulnerability to climate variability.

4.7.2.3 Activity: Determine the effects of the Kafue river regulation on pastoral land use

Methods: An essential component in determining effects of Kafue river flow was Photo Voice Process (Cunningham *et al.*, 2009), in which community members took photos of what they thought was important about a given social-ecological typology issue, and then the researcher had a lengthy discussion and interview about the context and motivation in taking each picture. These interviews were extensive conversations followed by transect walks to map locations using Global Positioning System (GPS) found in the photos (e.g. water points, gardens, farm etc.). These were planned walks through the community to observe sources of water and any preservation methods, available water harvesting and storage practices/techniques in dams, pans and ponds. In addition, field observations on water points (wells, boreholes, dams, etc.) were made in order to gather data on land use in form of cultivated area, grazing lands, plant species and related these to climate variability. This helped in gaining an in-depth assessment of local surface water availability for livestock watering during dry season and rainy season and how the Kafue River impacted on the availability of both water and pasture during different times of the year.

In addition, records on quantities of surface water pathways and reservoirs were collected to establish the water regimes on pastoral related effects of the regulated Kafue River from Itezhi-tezhi dam to the Kafue Gorge dam. This was important because it helped to generate hydrological dam/river inflows and patterns while balancing complex competing water demands over a long planned period (Casarotto, 2013; Wamulume *et al*., 2011). This provided statistical distributions of

allocation decisions (withdrawals, reservoir releases, spills, storage volumes) by Zambia Electricity Supply Corporation (ZESCO) usually without taking into account other water users. This data on Kafue river regulation and its related effects on altered river flow and ecology, landuse, particularly grazing regimes and land tenure conflicts were supplemented with precipitation and runoff data from ZMD at district level.

4.7.2.4 Activity: Examine land tenure governance in the utilisation and management of common property resources

Methods: In this study, an institution was perceived at different levels starting from a family (household) through local authorities to national governing bodies both public and private**.** To address this objective, the study adopted a Social Network Analysis (SNA) approach. A network approach involved a formal observation of social networks both individually and collectively as a set of actors connected through a single or multiple relationships. It was these actors and their network ties that defined network data to be analysed using SNA (Borgatti *et al.,* 2009). SNA also offered a particular opportunity to mix qualitative methods with quantitative techniques. Networks are both structure and process at the same time, and therefore involved simple categorisation as either quantitative or qualitative phenomena. Moreover, how people perceived the network, and the content and meaning of ties, was essential in understanding network patterns and measures (Borgatti et al., 2009). In addition, land tenure policy documents from government line Ministries and Departments, Community Based Organisation (CBOs) and Non-Governmental Organizations (NGOs) and traditional knowledge and institutions on land issues from four district chiefs were analysed. Generation of land tenure data was complimented with in-depth interviews, group discussions and transect surveys (Stein *et al.,* 2011).

4.7.2.5 Activity: Devise environmental education linkages in understanding pastoral social-ecological typologies

Methods: This objective also employed the Social Network Analysis (SNA) approach because of its ability to illustrate multiple environmental education linkages between socio-economic and ecological components that together made up the state of pastoral social-ecological typologies. Each component within both natural and social systems interrelates with others across space added to the complexity of social-ecological typologies (Berkes *et al*., 2003).

The following gap in literature was identified: ‘Many studies have neglected pastoral environmental awareness and TEK as key factors to climate variability local adaptation mechanisms. The chief stress has been on development to the extent that very little environmental education has been given to the contemporary effects of climate variability and change on pastoral systems. Hence, a built in study of this nature was necessary to understand social-ecological typologies to climate variability among pastoralists in Namwala.’ For this reason, objectives one, two and five were used to bridge the gaps in available literature related to effects, resilience and environmental education linkages respectively in understanding pastoral social-ecological typologies from climate variability and change stressors.

To conclude, these primary methodologies were crucial in this study as they helped in understanding the effects of climate variability on the livelihoods of the people of Namwala. They empowered respondents by being approached as experts in their community and shared their knowledge and concerns with a larger audience in the rural setting. These methods were collaborative and not controlled by the researcher, allowing the participant’s true ideas about environmental education to surface. Thus, they generated a ripple effect as participants explained their livelihoods, and their interrelations with ecology and socio-economic factors. This provided a wealthy of details about their everyday life, cultural assumptions, and environmental education adaptive strategies. The above resource-based tools and data created a new understanding of a cultural and social-ecological landscape that was shaped by multiple physical, economic, political and social forces.

The key informants from government line Departments included; Zambia Meteorological Department (ZMD), ZESCO in Itezhi-tezhi, District Council Chairperson, District Water Affairs Officer, District Veterinary Officer, District Agriculture Officer, Disaster Management and Mitigation Unit (DMMU) at District level, Itezhi-tezhi and Kafue gorge Dam and hydroelectric power station managers, and agriculture extension officers and veterinary extension officers in each Zone. Non-Governmental Organizations such as HODI, World Vision and Namwala Farmers Association (NFA) were targeted. In addition, private entities such as Zambeef and Starbeef managers and four district chiefs (Mukobela, Mungaila, Nalubamba and Muchila) were also purposively drawn. The questions asked all focused on identifying disturbances and historical events, their characteristics and effects of climate variability and change on pastoral systems.

4.8 Ethical considerations

Ethical considerations are crucial for studies that involve human participants because of the need to safeguard the research participants, the research process and the credibility of research results (Flick, 2009). Ethical dilemmas focused on confidentiality and participants' consent. Photovoice and verbal consent were obtained from participants who could not sign their names or read the information sheets (in which cases, the sheets were read out to them). Participants were made aware that their involvement in the research was voluntary, and that they would not be compensated. They were also given an opportunity to ask questions that might be bothering them. Thus, before fieldwork, the researcher got clearance and ethical approval from the Ethics Committee of the University of Zambia. Further, informed consent was obtained from key informants and management in charge of institutions where research was carried out and full consent on ethics for use of pictures (photovoice) from specific respondents was sought.

Respondents in this study were approached as experts in their community and shared their knowledge and concerns with a larger audience in the rural setting. In order to protect the rights of respondents, participation in the study was voluntary. Respondents were not coerced into participating in the study and were free to withdraw at their own will. From the beginning, the nature and purpose of the study was made known to the respondents. The identity of respondents was kept confidential, instead identity numbers and abbreviated letters (pseudonyms) were used and respondents were assured that their data was going to be used for academic purposes only. In situations where recording was done, it was done with permission from those involved.

4.9 Methodological implication of the theory to the study

This subsection highlights how Holling's theory affected data collection. There are four elements in Holling's Adaptive Renewal Cycles (*exploitation, conservation, release* and *reorganization).* These are used in building resilience and adaptive capacity in social-ecological typologies and were used as theoretical lens in this study. As such the proposed methods were an attempt to explore climate variability on pastoralism in a commonly held resource (Kafue Flood Plain) that demonstrated dynamic and resilience to disturbances.

Memory and novelty were the main features that made up adaptive capacity of social-ecological typologies (Folke *et al.,* 2003). This entails that this study relied heavily on the memory of the

previous disturbances from 1990 to 2017 to capture all major social-ecological perturbations (cattle diseases, drought or flood or any other social-ecological shocks or stresses) among pastoralists. Failure by pastoralists to recall climatic experiences or environmental education and wisdom could have rendered data collection difficult. This is because, social-ecological studies of this nature depended heavily on the number and types of pastoralists found during data collection and experienced some form of climatic related disturbances. Gunderson *et al.,* (2002) described this as collective social-ecological memory of experiences with resource and ecosystem management. This is supported by Folke *et al.,* (2003:375) who stressed that combining and recalling different types of knowledge/disturbances was about "creating platforms and involving user groups and interest groups for knowledge sharing about complex ecosystem management and for relating to uncertainty and surprise." Hence, the success of this study relied upon learning local skills, knowledge, livelihoods and coping strategies of current and previous stresses. This was because traditional environmental education offered understanding and insights that helped to develop research and interpret results that led to improved understanding of different typologies.

In addition to memory, novelty was another essential element of resilience, defined as the ability to innovate. For the local farmers to be resilient, it is important the system be exposed to disturbances that play a constructive role in resource management by creating the opportunity for renewal (Folke *et al.,* 2003). However, the resilience of many social-ecological typologies had been eroded. We cannot take for granted any longer the capacity of the ecosystems to regenerate after disasters and continue to produce resources and services for human livelihoods. Thus, the assumption in Holling's Adaptive Renewal Cycles implied that pastoralists in Namwala were facing climate variability effects and had adopted and adapting to multiple coping strategies to live with change and uncertainties. In the absence of perturbations or the capacity of the ecosystems to regenerate after a disturbance or continued to produce resources and services for human livelihoods, it was difficult to measure indigenous environmental education and collect data on social-ecological typologies.

4.10 Data presentation and analysis

Descriptive statistical methods were used to organize and summarize quantitative data on the impact and resilience attributes while qualitative data were analysed and presented based on themes, categories, and patterns. In order to compare the relations among variables, hazard trend

analysis was used to develop time linkages to better understand patterns and cycles of hazard frequency, severity, or predictability over time. This helped to form patterns, themes, clustering, making comparisons, looking at the contrasts, quantify the relations among variables, clarifying relationships, and building a coherent understanding (Miles and Hiberman, 1994). Further, the use of flood and drought analytical techniques such as magnitude frequency characteristics and photovoice determined water demands. They also showed the extent to which the altered Kafue River flooding, flow and flux had impacted on pastoral systems. The study also used Quantum Geographic Information System (QGIS Valmiera) and Excel for statistical and ecological photographics which accompanied the interpretations of survey data while ArcGIS was used to generate maps.

4.11 Summary

This chapter has shown that the research approach adopted for this study was eclectic. It combined some elements from the positivist and critical realism approaches to constitute a methodology that embraced both qualitative and quantitative methods of research. The combination of participatory methods, sample surveys and traditional anthropological methods were meant to serve different but complementary purposes. Thus, this chapter described how pastoralists participated in this study. The research design as well as the use of participatory methods in this study has been justified. This chapter also contributes to wider academic debate in relation to how different methods (i.e. quantitative and qualitative approaches) at different scales can be integrated to investigate social-ecological typologies among pastoralists in rural settings. The Chapter highlighted that climate variability and change is a complex problem interacting with different processes at different scales (Cash and Moser, 2000). The use of a mixed-method approach allowed validation and deepening understanding of many typologies involved in pastoral systems and livelihoods related to climate variability through triangulation, thereby providing a significantly richer environmental education among pastoralists to climate variability and change. The Chapter further showed that combining different methods with valuable insights from local pastoralists provided local insights that enhanced learning by the researcher and members of the study communities. Having described how the various data were collected and analysed, the next chapter (Chapters 5) presents the results from this study.

CHAPTER FIVE

PRESENTATION OF RESULTS AND FINDINGS

5.1 Introduction

This chapter presents the results that were obtained in Namwala District. Data were mainly analysed qualitatively and quantitatively and presented using tables, graphs, charts, percentages, photovoice and maps. One hundred and twenty respondents comprised the sample. Firstly, the chapter reveals demographic characteristics of cattle keepers with respect to sex, age, educational attainment and ethnic origin. This is followed by the pastoralists' perceptions to climate variability and contemporary agro-pastoral production goals; socio-economic transformations and change in the value of cattle; impact of climate variability and change on pastoral system; resilience status of pastoral system to weather shocks that build up the ability to live with change and uncertainties; the effects of the Kafue river regulation on pastoral land use; land tenure in the utilisation and management of common property resources; and lastly, a developed local pastoral social-ecological education model capable of application in other rural herding communities.

Important demographic characteristics in the study included gender, age and education level of the head of household as important attributes in livestock management. The study involved households which had experience in pastoral farming activities of not less than fifteen years, hence the minimum age in this study was 25 years. The study assumed that a pastoralist who has been involved in pastoral activities for the past 10 years could have gained sufficient knowledge and experiences in farming activities and the environment and thus could demonstrate possible changes and impacts that have taken place in the area and in livestock farming activities. Thus, heads of households whose age was below 25 were considered to have less knowledge and experiences in farming activities as well as fewer relevant observations in climate variability. Out of 120 respondents in the study area, 92 respondents (76.7 percent) were males while 28 (23.3 percent) were females. A lesser number of women were interviewed because there are fewer female-headed households as compared to male-headed ones. This was because men rather than women inherit cattle, and owned land in the traditional set up. Results showed that more males and females between 41 and 60 age groups accounted for 52.1 percent of those owning cattle (these are at their prime of 'cattle keeping career'), followed by those in the 31 and 40 age groups who

accounted for 30.6 percent. There were fewer respondents below the age of 30 who owned cattle. These owned 10.2 percent of the total since they are often just starting their families and are therefore still settling down. In addition, those above 60 years represented 7.1 percent only as there were fewer surviving household heads; considering the low lifespan in Zambia in general and Namwala in particular.

Further, a question was asked on their level of education attainment. Sixty nine [69] (57.6 percent) attended primary school, 16 (13.3 percent) attended secondary school, 7 (5.8 percent) attended tertiary education and 28 (23.3 percent) never attended formal education. From 13.3 percent who attended secondary education, 70 percent were males and 30 percent were females. With 5.8 percent who attended tertiary education, 80 percent were males while 20 percent were females and out of the 23.3 percent who never attended formal school, 40.9 percent were males while 59 percent were females.

In addition, the majority of the respondents (70.8 percent) interviewed were natives in the study area and owned more cattle. Tribal cousins (*Lozi*, *Luvale*, *Mbunda*, and Luchazi) constituted 23.4 percent of the sample and other tribes such as the *Bembas, Tumbukas, Ndebeles* accounted for 5.8 percent and these settled in the study area after retiring from formal employment. In addition, more than 80 percent of respondents agreed that they have non-Ilas owning cattle in their communities resulting into increased population in cattle. To confirm this, the District Veterinary Officer (DVO) 01 observed that Namwala has the highest concentration of traditionally owned cattle in Zambia standing at 145,445 in 2016 (Figure 5.1), increasing steadily over the years. This increase is attributed to improved management practices among pastoralists as a result of proceeds from cattle sales enabling them to plough back into the herd and government disease control and vaccination programmes. In addition, more non-Ilas from outside the district and young people are turning to pastoralism especially in lesser cattle-keeping areas of Muchila and Nalubamba.

Results in Figure 5.1 shows that in Namwala, rural household's income is primarily based on cattle production. The DVO 01 observed that across all chiefdoms, the total number of cattle and livestock in general is gradually growing from year to year especially after 2001 when the government in power prescribed sound economic policies.

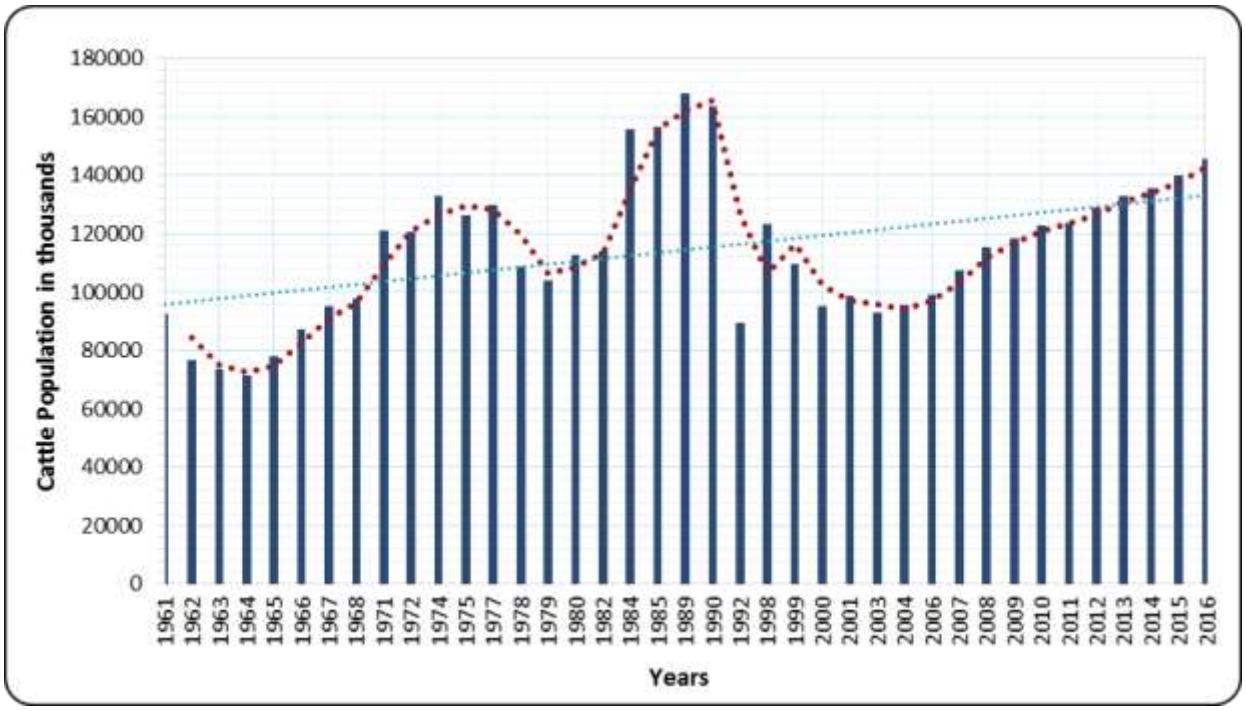

Figure 5.1: Trends in traditional cattle numbers from 1961-2016 in Namwala

Source: Namwala District Veterinary Office, 2017

5.2 Pastoralists' views of climate variability and climatic induced risks

Climate variability and change adaptation literature suggests that expectations of the impacts associated with climate variability are an important determinant of adaptive responses. To examine pastoralists' perceptions of climate variability and climatic induced risks, information was gathered on their views about the impacts of climate variability and change on pastoralism particularly on water and grass, and their views on managing weather/climatic risks on their farms (Figure 5.2). The majority of pastoralists (85%) in this study indicated that they had heard, read, or seen information related to climate variability and change on a daily basis or several times a week. Figure 5.2 shows that the main sources of information about climate variability and change came from a combination of sources including radio (45%), relatives, friends and neighbours (32%), agriculture and veterinary extension officers (25%), television (8%), internet through mobile phones (5%) and a combination of all sources (65%).

Overall, the results indicated that while 80 percent of the pastoralists perceived that climate variability had negative effects on pastoralism in Namwala, no responses were recorded to indicate that climate variability and change would result into positive effects on pastoralists. On the other hand, only 5 percent of respondents did not respond to this question.

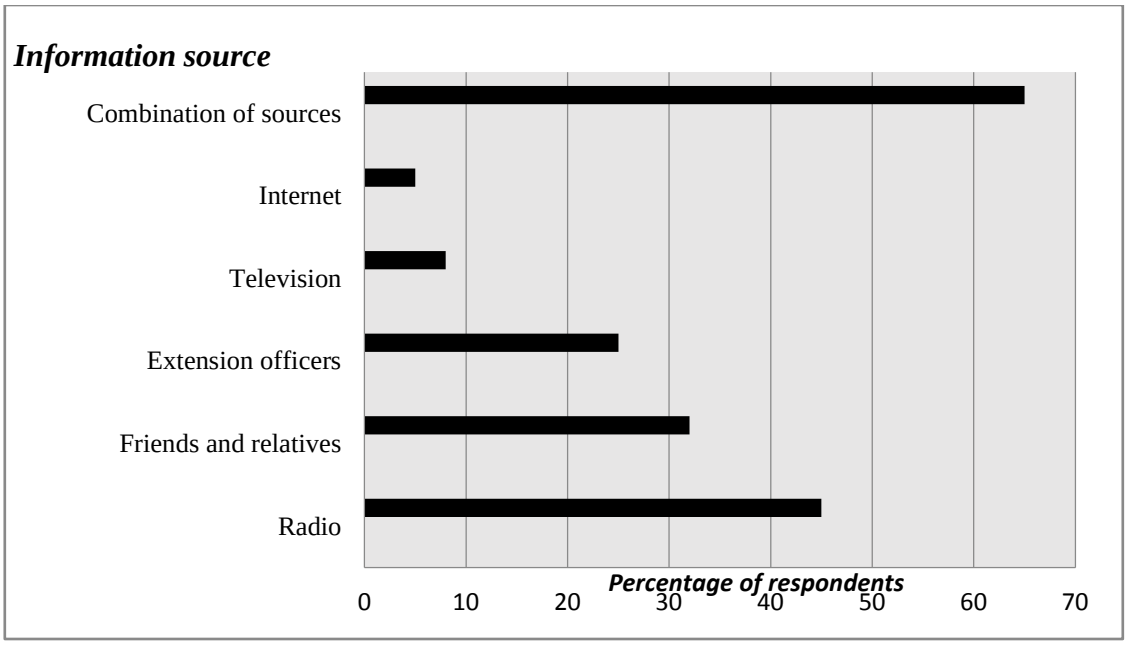

Figure 5.2: Sources of climate variability and change information
Source: Field data, 2017

In addition, the questionnaire presented pastoralists with various statements about potential effects of climate variability on various aspects of agricultural production. They were asked to indicate the level with which they agreed or disagreed with the statements using Likert Scale (e.g., 5 point Likert scale) responses. With regard to the potential negative impacts of climate variability and change on pastoralism, 82 percent of respondents indicated that there were more cattle diseases associated with climate variability, while 78 percent believed that there were more extreme weather events resulted into water and grass shortages. Further, 67 percent of respondents indicated that there were increased deaths of cattle (and money) due to perceived increased variations in climate.

However, pastoralists were generally not in agreement about the potential positive effects of climate variability on pastoralism in Namwala. In addition, 88 percent pointed out that more floods during rainy season benefit their cattle as lagoons get filled up. They explained that lagoons and pans served as dry season '*oasis*' for grazing and livestock watering for their cattle, particularly in the Kafue Flats. The results also show that 85 percent of pastoralists agreed with the statement that crop growing season is now shorter, with the majority of respondents indicating that there were strange crop diseases they suspect of having come as a result of climate variability.

5.2.1 Local perceptions and indicators of climate variability and change

Table 5.1 shows that there was a growing understanding among pastoralists that climate variability and change were happening and are continuously affecting their livelihoods which depended on agriculture in general and pastoralism in particular. Although climate variability was not physically measured, it was quantified based on changes in forms of livelihoods, values, customs, perceptions and world views. The study shows that households understood the indicators of climate variability as increase in drought (n=117; 97.5%), changes in floods, flow and flux of Kafue River (n=116; 96.7%), increased temperatures (n=112; 93.3%), weather variability/ unpredictability (n=111; 92.5%), increase in livestock diseases (n=92; 76.7%), increase in flooding of *ibanda* (n=75; 62.5%), decrease in *ibanda* (floodplain) grasses (n=73; 60.8%), had the highest responses from the majority of the respondents. On the other hand, short planting season (n=68; 56.7%), food shortages (n=64; 53.3%), decrease in crop productivity (n=63; 52.5%), decline in amount of rainfall (n=54; 45%), drying of wells and boreholes (n=41; 34.2%), increase in pests (n=38; 31.7%) and increase in wind conditions (n=19; 15.8%), had lowest responses (Table 5.1).

Table 5.1: Percentage responses on local indicators of climate variability by chiefdom

S/N	**Local indicators of climate variability**	**Overall Percent**	Maala (n=30)		Baambwe (n=30)		Muchila (n=30)		Mbeza (n=30)	
			Number	%	Number	%	Number	%	Number	%
1	Increase in drought	97.5	30	100	29	96.7	28	93.3	30	100
2	Changes in floods, flow and flux of Kafue River	96.7	30	100	30	100	28	93.3	28	93.3
3	Increase in temperature	93.3	30	100	30	100	28	93.3	24	80
4	Weather variability/ unpredictability	92.5	27	90	28	93	30	100	26	86.7
5	Increase in livestock diseases	76.7	27	90	25	83.3	21	70	19	63.3
6	Increase in flooding of *ibanda* (floodplain)	62.5	26	86.7	19	63.3	13	43.3	17	56.7
7	Decrease in *ibanda* grasses	60.8	23	76.7	25	83.3	12	40	13	43.3
8	Short planting season	56.7	11	36.7	16	53.3	18	60	23	76.7
9	Food shortages	53.3	23	76.7	17	5.7	13	43.3	11	36.7
10	Decrease in crops	52.5	23	76.7	17	56.7	12	40	11	36.7
11	Decline in amount of rainfall leading to drying of lagoons and streams	45	9	30	10	33.3	17	56.7	18	60
12	Drying of wells/boreholes	34.2	8	26.7	9	30	13	43.3	11	36.7
13	Increase in pests	31.7	7	23.3	6	20	11	36.7	14	46.7
14	Increase in wind conditions	15.8	5		3		6		5	
15	*Others	38.3	12	40	9	30	13	43.3	12	40

Source: Field data, 2017

NB: Others*: Seasonal changes, disappearance of morning dew and disappearance of rare bird species

5.2.2 Changes in production goals for keeping cattle

Respondents were asked to give the primary goals for keeping cattle. Although other types of domestic animals are found in Namwala, cattle are by far the most important and commonly kept. The social and cultural attachments are still important but the economic value of cattle has taken a centre stage. This has led to change in production goals, for example, being financially fit to purchase crops when there is crop failure as compared to keeping cattle for prestige. An expression given in local language by many respondents signifying the socio-economic importance of cattle in Namwala was that "*ing'ombe mbubumi bwamuntu kono kubwiila"*, meaning "cattle are our livelihood here in Ila land" (Table 5.2). In addition, 95 percent of the sample own cattle. Those who do not own cattle were viewed as inferior. This was so because cattle play various roles in Ila (or *Mashukulumbwe* as called by Lozi tribal cousins) society. Hence, pastoralists gave the following responses in order of importance as reasons they kept cattle: financial security (Mean = 42; SD = 35.35) social status (Mean = 30; SD = 23.63), draught power (Mean = 22.5; SD = 15.6), milk production (Mean = 16; SD = 6.57), manure (Mean = 15; SD = 4.28) and others such as slaughter during funerals and ceremonies, and bride price or *lobola* (Mean = 18; SD = 9.88).

Table 5.2: Frequency table showing changes in production goals among pastoralists

S/N	Objective	x-scores	x^2	Frequency	Mean	SD
1	Financial security	64	4096	84	42.0	35.35
2	Social status	18	324	60	30.0	23.63
3	Draught power	15	225	45	22.5	15.6
4	Milk	12	144	32	16.0	6.57
5	Manure	5	25	30	15.0	4.28
6	Others	6	36	36	18.0	9.88
		N=120				
			Mean (M) = 40.42 Standard deviation (SD) = 52.0			

Source: Field data, 2017

Financial security (M = 42; SD = 35.35) was ranked the first and most important primary objective for keeping cattle by the sample. This is due to the changing economic environment resulting in an increase in the demand for money in the rural economy, in addition to commercial cattle buyers such as Zambeef and Starbeef that provided a ready market. Sixty respondents (60) stated that owning cattle avoids the negative effects or risks such as crop failure. It was found that owning cattle enabled farmers to plant early during rainy season and often cultivated larger hectares of land. In the case of failure due to factors such as drought and flooding, pastoralists noted that cattle provided a source of income either in the form of cattle or milk sales.

Field data shows that the number of cattle sold was increasing every year than what was slaughtered for funerals and other ceremonies. Respondents observed that on average, 1-3 animals were slaughtered on these occasions as compared to 7-15 in the 1980s and 1990s although this depended on the status of the deceased. However, cattle did not form the major source of protein in the traditional diet, except in the provision of milk or if an animal died or during ceremonies.

Cattle still confer social status (M = 30; SD = 23.63) to individuals. Still common and very important, the more the number of cattle one has, the wealthier and respected the individual was. There is change in the cultural value attached to cattle. Although pastoralists kept cattle for prestige, they did it more for economic reasons. This was due to the growth of markets for livestock, especially cattle that provided opportunities for them to acquire different universally accepted items/properties such as shops, vehicles, iron-roofed houses, dip tanks and fencing.

Provision of draught power (M = 22.5; SD = 15.6) remains an important objective for keeping cattle. Respondents indicated that oxen remain key in food production and transport. Milk production (M = 16; SD = 6.57) was cited as an increasingly important primary objective for keeping cattle for both home consumption and sale as a source of 'small' income. Respondents were of the view that unlike selling the whole *ing'ombe* (cow), milk (*mukupa)* or sour milk (*mabishi)* could easily be sold to Parmalat centres and Namwala town and thus, constituted a fast and ready source of income ('target income selling') among pastoralists. Pastoralists explained that they were buying dairy bulls and cows for crossbreeding and milk production respectively.

The use of manure (M = 15; SD = 4.28) among pastoralists is still an important primary objective despite less emphasis on crop production. Pastoralists pointed out that the use of cattle manure was gaining importance given the high cost of organic fertiliser and less packages under FISP. They stated that the soil, unless in small pockets, was not ideal for growing crops unless with cattle manure which allowed them to use the same piece of land for a longer period of time. More than 30 percent farmers stated that an area could be used for a minimum of seven years and maximum of 15 years without diminishing soil fertility. It has to be emphasised here that farmers had more than one objective for keeping cattle and these objectives re-enforce each other.

Furthermore, the secondary reasons (other objectives) that were cited for keeping cattle were the need to slaughter cattle for *masuntu* (cattle slaughtered during funerals), traditional and initiation

ceremonies and payment of *lobola* (M = 18; SD = 9.88). Respondents indicated that instead of slaughtering many cattle, for example during a funeral, farmers preferred reserving them to buy items such as agricultural inputs. Although bride price is a customary practice, only fewer households (6%) stated that they paid bride price in form of cattle. However, this form of payment was increasingly being replaced by money especially among non-Ila speaking people. In case where a non-Ila married an Ila girl, the family demanded that the groom bought cattle to pay as *lobola*, locally known as *chiko*. It was reported that money was paid according to the value of the number of cattle charged (although there was a tendency of undervaluing the worth of cattle). Pastoralists further indicated that the number of cattle charged as *lobola* decreased so as those slaughtered during funerals and ceremonies due to effects of climate variability and change.

5.3 Effects of climate variability and change on pastoral systems

The first objective for the study was to examine the effects of climate variability and change on pastoral systems which usually led to vulnerability. Vulnerability is a characteristic that describes the capacity of a person, community or society to anticipate, cope with, resist and recover from the effects of a natural or human induced hazard. It involves a combination of factors that determine the extent to which people's lives and their livelihoods have been put at risk by the hazardous event (DMMU, 2015). Typologies are the pieces of the system that include phenomena such as human actors, particular ecosystem or habitat types, resources, goods and materials, and abiotic variables (Cumming *et al.,* 2005). Respondents were asked to identify factors that have led to the effects or vulnerability of pastoral systems, particularly those related to climate variability. To highlight climate variations and change, the District Agriculture Officer 01 indicated that:

> *"...in Namwala, droughts and floods, as common manifestations of climatic variations have intensified and increased in recent years. An increase in mean annual temperature of 1.2°C and decreased mean rainfall of 1.8mm/month has been recorded in which rainfall seasons have become less predictable and shorter, with rainfall occurring in fewer but more intense events. Generally, there is a net trend towards more floods and droughts. Mean temperature has increased by 1.3^{o}C since 1990s with a recorded increase in the number of hot days and nights. At the same time, the average precipitation is not projected to change significantly with mean rainfall having been decreasing by 2.3% per decade. However, precipitation variability is expected to increase with early rainy season to become drier, peak rainy season with heavier rainfall periods. This has resulted into climate variation extremes to accentuate with more intense floods; more frequent droughts. This climatic unpredictability has often depleted cattle grazing grounds and disrupted livestock watering points due to rise and fall of the Kafue River..."*

Further, the results show that households in the study area were aware that climate variability and change were happening. Specifically, households were asked about their observation of changes in rainfall and temperature patterns over the past three decades (since the 1990s). This length of time was considered adequate to explore how pastoral livelihoods had been affected by climate variability. Table 5.3 shows that 79 percent of sampled households observed increasing temperatures and that the weather level became hotter compared with their childhood days. In addition, 7 percent of respondents indicated that they had observed considerable decrease in temperature while 17 percent indicated that temperature had not changed.

In terms of rainfall, whilst 83% of the sampled households perceived decreased rains, 18% reported increased rainfall over the study period. Results in Table 5.3 show that 90% of respondents indicated that they had observed considerable changes in the onset of rainfall over the past 30 years. Most respondents (85%) were of the view that the rainy season in these communities was characterised by high intra-annual variability and torrential rainfall, which may not be that useful for rain-fed agriculture and growth of certain grass species. Generally, it was agreed across chiefdoms that there was a decreasing trend in the amount of rainfall as well as delay in the onset of rainfall compared with their childhood days. Therefore, it was essential that these traditional ecological typologies were assessed among pastoralists to explore how climate variability and change had impacted on pastoral livelihoods.

Table 5.3: Proportion of households who identified climate variability and change

Variable	Percentage (%) of respondents who identified climatic variability & changes		
	Impact (n = 120)	Resilience (n = 120)	Average
Rainfall			
Changes in onset	86.7	93.3	90
Increasing rainfall	14.2	21.7	18
Deceasing rainfall	87.5	77.5	82.5
Temperature			
Increasing temperature	81.7	75.8	78.8
Decreasing temperature	5.8	8.3	7.1
Temperature unchanged	15.8	18.3	17.1

Source: Field data, 2017

Respondents identified several climatic related constraints that hinder livestock production: livestock deaths and diseases; poor nutrition and husbandry practices; drought and floods; shorter rainfall season and growth of grass; weather variability and unpredictability; decline in water level and drying of surface streams and lagoons and non-climatic factors associated with environmental

variability. Although the constraints that pastoralists faced were presented here as discrete factors limiting increased cattle production, they re-enforce each other.

5.3.1 Effects on livestock - deaths and diseases

The DVO 01 confirmed that major diseases and their vectors in Zambia are Theileriosis, which is transmitted by *Rhipicephalus appendiculatus, and R. zambeziensis*; *Babesiosis* and Anaplasmosis transmitted by *Boophilus microplus* and *B. decolaratus* and *Cowdriosis* transmitted by *Amblyomma variegatum* and *A. hebraeum.* He observed that climate variability and change were attributed to these tick species' multiplication, resistance and difficult to control through mismanagement of chemical acaricides in their application by pastoralists. In addition to climate variability and change, health challenges were identified as contributing factors to already low livestock productivity prevailing in the traditional sector.

Results show that the prevalence of diseases for cattle was one of the greatest challenges pastoralists face in Namwala. This had contributed to low growth and restricted access to local and international markets. The DVO 02 confirmed that in 2017, there were more deaths of cattle as a result of corridor disease with 159 deaths out of 633 cases due to differences in management practices. Other deaths were recorded from Anaplasmosis with 63 deaths, Heartwater and Blackleg with 45 and 58 deaths respectively (Table 5.4). The key informant emphasised that these were reported cases only, unreported cases were believed be more. Respondents observed that the district had a number of serious endemic diseases, parasites, pests and vectors that affect livestock. They further confirmed that cattle diseases had continued to pose a challenge to the development of the livestock industry from the early 1990s in addition to poor state of feeder roads for drug delivery. Although pastoralists were faced with more than one cattle disease, major diseases include: East Coast Fever/Corridor Disease were accounted by 115 respondents (95.8%), Heart water by 86 respondents (71.7%, as more cattle were treated than those diagnosed with the disease), Foot and Mouth Disease [FMD] by 75 respondents (62.5%), while Lumpy skin disease was attributed by 68 respondents (56.7%) and 55 pastoralists (45.8) mentioned Bovine Tuberculosis (TB) as cause of livestock deaths. Minor diseases (*Haemorrhagic Septicaemia, Blackleg, Anaplasmosis* and *Brucellosis*) were accounted for by 27 pastoralists (22.5%).

Table 5.4: Prevalence of cattle diseases in Namwala District

Disease	*Prevalence*	*Mortality*	*Treatments*	*Households*	
				N = 120	(%)
East Cost Fever/Corridor disease (Theileriosis)	633	365	81	115	95.8
Anaplasmosis	198	32	70	4	3.3
*Foot & Mouth Disease (*Aphthae epizooticae*)*	195	31	122	75	62.5
Babesiosis	11	0	100	3	2.5
Heart water (Cowdriosis)	121	37	139	86	71.7
Blackleg (BQ)	123	39	87	10	8.3
Lumpy Skin Disease (LSD)	49	0	100	68	56.7
*Streptothricosis (*Senkobo*)*	94	0	100	8	6.7
Haemorrhagic Septicaemia (HS)	6	50	50	38	31.7
Bovine Tuberculosis (TB)	4	100	0	55	45.8
Brucellosis	21	0	0	2	1.7
Other	23	13	0	31	25.8

Sources: Namwala District Veterinary Office/Field data, 2016

In addition, DVO 01 indicated that:

> "*…there is greater risk of CBPP and other diseases due to illegal movements of cattle either to the local abattoirs or for rearing to and from other districts and provinces...*"

Results further show that 75 percent of the respondents linked livestock deaths to effects of climate variability and change. The occurrence of drought conditions in recent years had caused more livestock deaths due to insufficient and low quality of fodder, making livestock highly vulnerable to diseases which accelerate more livestock deaths. Such conditions have resulted in the majority of pastoralists reducing their stocks to a manageable size, while others have reallocated/redistributed their herds to relatives and friends. However, keeping fewer livestock was considered to be uneconomical because one could not earn sufficient money from the sale of both livestock and livestock products. The majority of the farmers focused more on quantity than quality. One of the participants in the FGDs reported that:

> "*….by keeping less livestock means increasing the price of the livestock products as well as the selling price of the livestock, which the majority of the consumers in the area cannot afford. In addition, although some farmers have continued with transhumance, it is expensive especially during drought conditions where cattle are stuck in mud and lost to predators such crocodiles, hyenas and cattle rustling*."

Similarly, results also show that frequent and different cattle diseases were associated with climate variability and change. Sixty-eight percent of the participants, the majority from Maala and Baambwe, reported an increase of livestock diseases such as East Coast Fever, lung diseases and cattle miscarriage than in the past. Although there was no statistical evidence to prove such claims, Veterinarian Camp Officers indicated that such cases were reported to occur in chiefdoms

although there was no direct link to climate variability and change. The failure among pastoralists to control cattle diseases emanated from poor nutrition and husbandry practices.

5.3.2 Effects due to poor nutrition and husbandry practices

Poor nutrition associated with poor husbandry practices were cited as another source of vulnerability among pastoralists. The causes of poor nutritional status in the traditional herds were shortage of both feed and water during the dry season. In Table 5.5, results indicated that the ability to feed cattle adequately throughout the year was perhaps one of the most widespread technical constraints limiting increased cattle productivity among pastoralists in Namwala. Nutrition as a constraint involves lack of provision of quality indigenous pastures, crop residues and feed. Since Zambia has a uni-modal rainfall pattern, major problems facing the pastoralists in Namwala was feeding cattle during the dry season, which normally lasts for six months. In addition, poor nutrition led to susceptibility to diseases and parasitism. Thus results show that shortage of water due to drying of streams, ponds, pans, lagoons and reaches (n=114; 95%) comprised a major serious constraint contributing to various diseases affecting cattle. Cattle keepers pointed out that the shortage of water due to drying of dams and absence of boreholes (n=84; 69%), lack of improved pasture to feed cattle on farms (n=56; 48%) and lack of feed supplementation (n=45; 38%) were identified as constraints contributing to poor nutritional status of cattle in the dry season.

Table 5.5: Factors contributing to poor nutritional status and livestock health

S/N	Contributing social, institutional and ecological causes	No. of responses*	Percent (%)	Effects
1	Drying of streams, lagoons and pans	114	95	*Poor nutrition status resulting into shortage of water and feed*
2	Lack of adequate boreholes and dams	83	69.2	
3	Lack of improved pasture on-site of farms	56	46.7	
4	Lack of feed supplementation	45	37.5	
5	Long distances from sources of drugs	113	94.2	*High cost of drugs*
6	Few drug outlets	70	58.3	
7	Inadequate news about drug availability	65	54.2	
8	Non- availability of drugs at DVO	30	25	
9	Insufficient extension support system	116	96.7	*Inadequate coverage by the DVO*
10	Long distance to veterinary stations, poor staff houses and vastness of camps	80	66.7	
11	Lack of dipping and vaccination facilities	78	65	
12	Poor disease monitoring and surveillance	60	50	

Source: Field data, 2017

**Note: The number of responses was more for each effect giving more than the total of 120 respondents*

Table 5.5 further shows that 113 respondents (94%) were of the view that long distances to sources of chemical for dipping and drugs led to high cost of chemicals and drugs while 70 respondents (58%) observed there are fewer drug outlets in the district. In addition, inadequate information about drug availability (n=65; 52%) was also noted in addition to non-availability of drug (n=30; 25%) outlets in the district.

Apart from having fewer Veterinary Extension Officers [VEO] (n=116; 97%) manning nine out of twelve veterinary camps, their vastness and lack of transport (n=80; 67%) had contributed to poor husbandry practices. Further, 78 percent of respondents pointed out that the district office lacked adequate dipping and vaccination facilities while 60 percent stated that there was poor disease monitoring and surveillance among veterinary officers in the district. Thus, livestock health was affected by poor husbandry practices resulting from poor extension system. In addition, results show that pastoralists lack sufficient knowledge about modern husbandry practices such as good housing practices, feed supplementation, and breeding which improves the vigour of calves. Instead, cattle were grazed in big mixed herds on the flats and on the upland during dry and rainy seasons respectively. Results also established that traditional practices among pastoralists did not seem to favour stock improvement because too many bulls were allowed to run with the herds. Furthermore, it was still common to castrate the best bulls so that they would become large oxen for showing off at traditional ceremonies such as *Shimunenga* and *Shikaumpa* ceremonies in Maala and Baambwe areas respectively, despite a ready rural market following the establishment of commercial abattoir facilities.

5.3.3 Effects of drought on livestock husbandry practices

Virtually all respondents identified an increase in drought conditions as one of the indicators of climate variability and change with 97.5 percent of the responses.

5.3.3.1 Effects of drought on water for livestock watering

Results revealed that water scarcity was a serious problem depressing cattle especially during dry season (Figure 5.3). Pastoralists across all chiefdoms observed that high frequency of dry spells contributed to shortening of growing season and crop damage. Respondents generally observed that even in years of relatively ‘normal’ rainfall, evaporation rates was high and in many reservoirs the losses from evaporation exceeded contributions from rainfall and river flow.

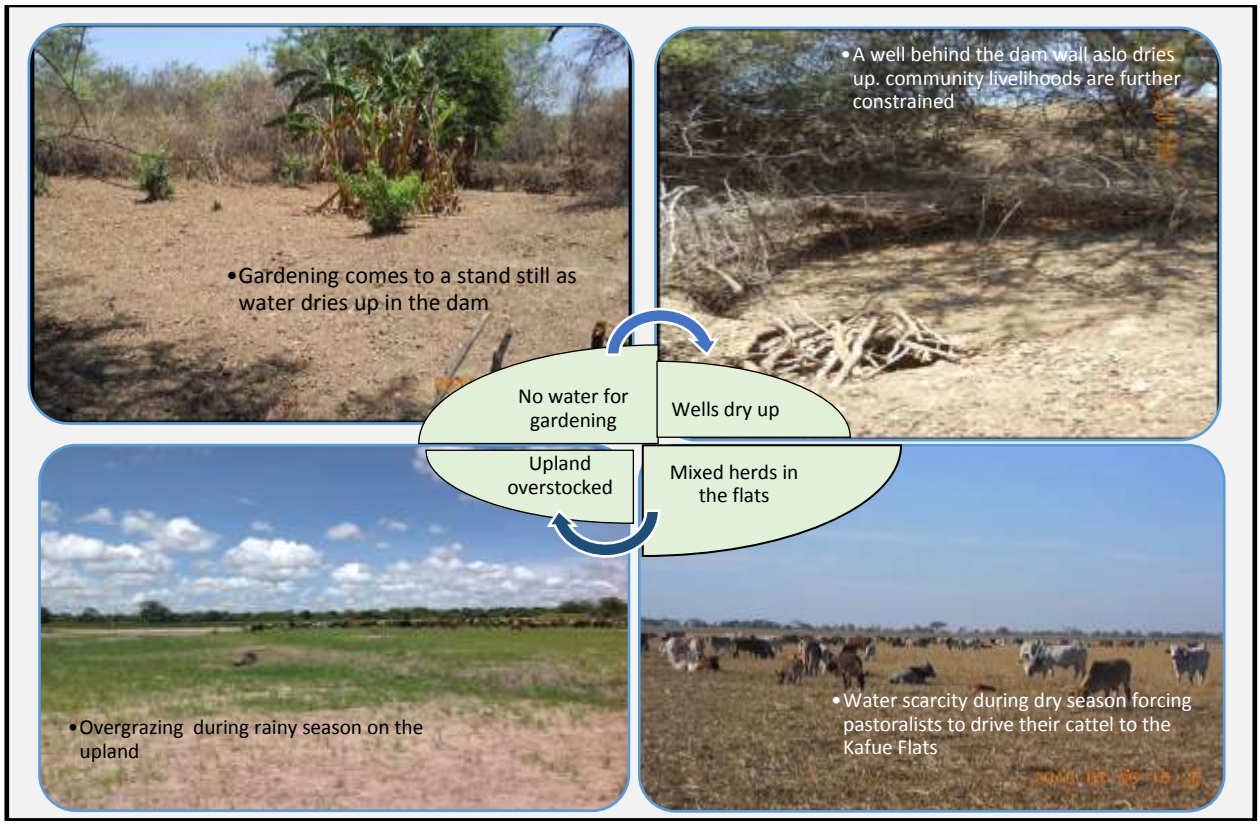

Figure 5.3: Effects of water scarcity during dry season

Source: Field data, 2017

The results indicated that water for domestic use was mainly from surface water sources such as rivers, lakes, small dams, pans and ponds. During dry season, however, groundwater was the most reliable source of water in communities. The worst affected areas were those in Muchila and Nalubamba chiefdoms due to their long distance from the Kafue River. Key informant 04 from Muchila observed that water supply covered by groundwater was mostly provided by hand-pumps and wells. Borehole installations, mostly with the help of government and NGOs such as World Vision, were helping the local rural communities to gradually replace the hand-dug wells that easily dried up. From this situation, an elderly female pastoralist recalled that:

> "*...the rains we had when Kaunda was President are no more, our cattle die due to lack of pasture and scarcity of water. In 1992 and 1993, we sold less number of cattle than those that died from lack of water and denkete (corridor disease)...*"

5.3.3.2 Effects of drought on grazing lands

Results showed that pastoralism was well adapted to coping with a single rain failure in Namwala. But when successive rainy seasons fail, there was simply insufficient regeneration of grazing land and pasture reduced. Additional results from the DVO revealed that cattle numbers were

increasing in the district from 123,016 in 2010 to 123,738 in 2011, 128,898 in 2012 to 132,797 in 2013, and 135,306 in 2014 to 139,945 in 2015 (see Figure 5.4). The VEO 08 added that this put pressure on water provision especially during dry season in which more than 80 percent respondents lamented that dams, ponds, pans and dug-out wells dried up. When this happens, water supply is provided by hand-pumps and largely by the Kafue River. Thus, water scarcity forced pastoralists to drive their cattle to various outposts along the Kafue Flats where more problems were faced due to high concentration of cattle to access water and pasture [both in reduced quantity and quality] (Figure 5.4).

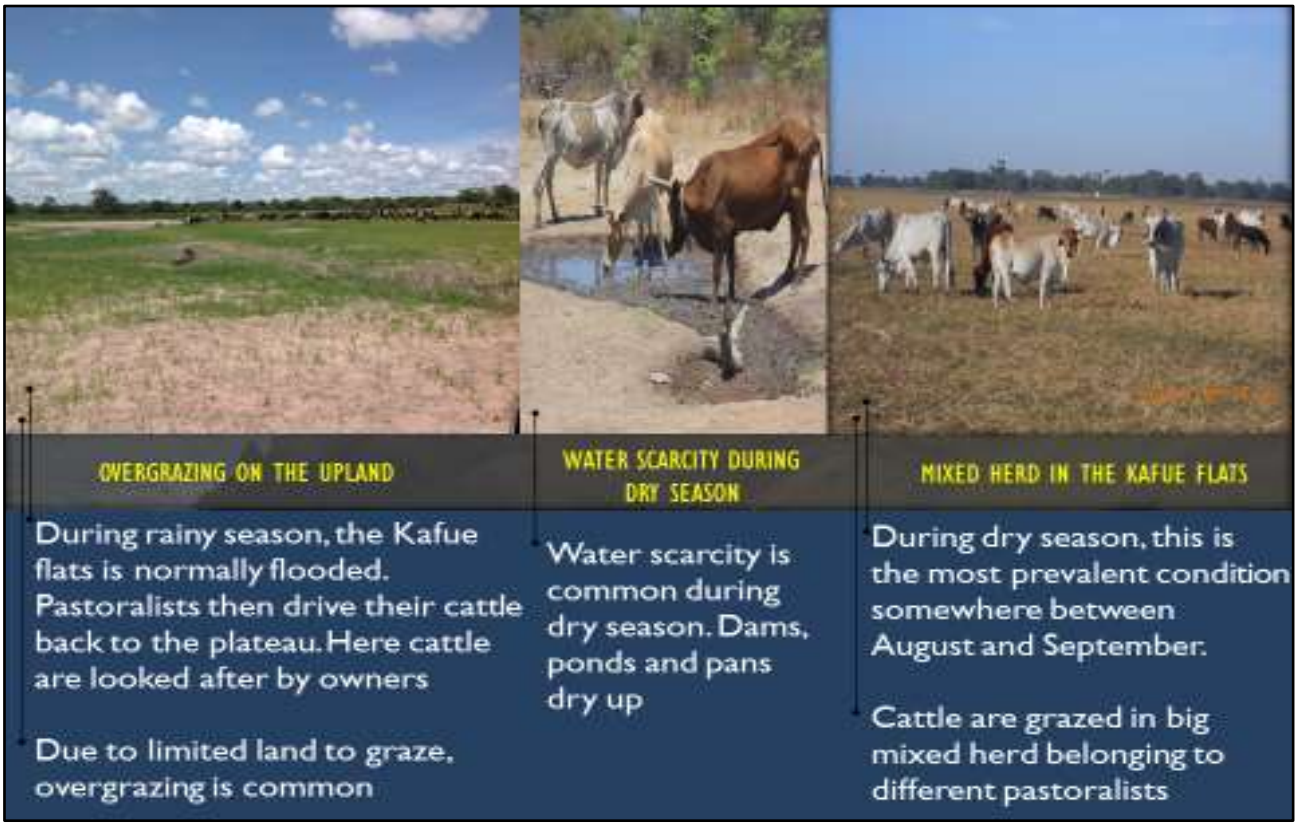

Figure 5.4: Seasonal changes in grazing regimes on the upland and the flats
Source: Field data, 2017

Transect walks through observations revealed that plant growth and grass species had decreased significantly in the Kafue flats. Such changes had enormous effects on the livelihoods of pastoralists who depend on these ecosystems. One of the most evident and important effects of climate variability on livestock production was mediated through changes in water and grass resources. Respondents observed that although indirect, effects on grass species had significant impact on livestock productivity, the carrying capacity of rangelands, the buffering ability of

ecosystems and their sustainability, prices of stovers and grains, trade in feeds, changes in feeding options and grazing management.

Results further revealed that grass species composition had also been altered resulting in loss of weight of cattle. This had further led to reduced nutrient availability for animals and ultimately to a reduction in livestock production, which affected food security and incomes through reductions in the production of milk and loss of weight of cattle. On this, one senior headman in Kabulamwaanda observed that:

> "*...for the past four years, our plain had not been flooded and so we did not bring our animals to the upland. This resulted into lack of grass to thatch our houses. Look at the dilapidated state of our houses! But this year (in reference to 2017), we were blessed; the plain was flooded from February to April. So nankokwe (brachiaria sp) really grew and we are rebuilding our houses...*"

Despite social status that cattle confer, pastoralists shared similar opinions that increase in livestock numbers caused pasture degradation. A senior headman in Ngabo area of Baambwe chiefdom lamented that:

> "*...after 1991, privatization coupled with environmental catastrophies decimated cattle population. However, the New Deal administration policies in 2001 increased livestock numbers and the pasture are diminishing as they are sensitive to overgrazing…"*

Another older pastoralist from Mbeza observed that:

> "*...nowadays pasture carrying capacity is decreasing a lot due to large size of herds..."*

In this case, results revealed that pastoralists are concerned with diminishing productivity of the pasture, resulting from associated effects of climate variability. This was because they trust their wealth in cattle than anything else as one rich pastoralist from Maala observed:

> "*...wabula mukowa koombe kokwete' meaning 'when you have cattle you have relatives.' Pastoralists have more trust in their livestock than anything else, because they believe that nobody can help you, but you can rely on your livestock and extend patronage beyond relatives..."*

5.3.3.3 Effects of drought return rate on crops and cattle mortality

Drought and food shortages were mentioned by all participants (100%) in all chiefdoms. Drought return rate is the average number of years within which a given drought is expected to be equalled

or exceeded. Frequent droughts in recent years have meant that households have had no opportunity to rebuild their assets, including livestock, with many becoming locked into a spiral of chronic food insecurity and poverty. The majority of the respondents (80%) expressed concern on the increase in the frequency of droughts on grazing lands, livestock, and people have less time to recover between droughts. Thus crop failure is frequent in Namwala. The length of growing period has reduced with maize as the most common grown crop. Pastoralists pointed out that despite government efforts to diversify; they have failed to substitute it with drought tolerant crops such as cassava, sorghum and millet.

A decrease in crop productivity was mentioned by 53 percent of the respondents, 81% of the responses were from Baambwe and Maala. Results revealed that the amount of crops harvested were low, making these areas experience food shortages. In addition, drought conditions in Baambwe and Maala did not only affect the productivity of annual crops (maize and beans) but also the productivity of other staple crops such as banana, sugarcane, sweet potatoes, pumpkins and cassava; which were the major food crops that supplemented food shortages when there was a poor maize harvest. These crops were also sold directly to the market to earn money for household use. The productivity of these crops was reported to be very low and mostly of poor quality. However, current droughts and rainfall variability were reported to affect even the productivity of these less preferred food crops. The majority of the participants (78%) reported insufficient food harvests for the past 30 years. However, observations revealed that not only do drought conditions affect crop productivity in the area, but also poor soil fertility, use of untreated seeds, limited application of chemicals and pesticides.

During the interview, District Agriculture Officer 02 lamented that:

> "*…it is now over 10 to 15 years that the harvests in the district have been below the average target due to frequent droughts, making the district depend mostly on food aid from organisations such World Vision and Southern Partners Organisation. In most cases, food is provided in the form of "food for work", where healthy members of households volunteer for public work, such as contributing labour in the road maintenance, building school or a hospital, dam reconstruction, and after work they receive food…"*

Results also revealed that the years 2011-2015 were characterized by inadequate rains, which adversely affected the availability of water and pasture for livestock. As a result, most pastoralists could not bring back their animals from the Kafue Flats to the upland as per tradition. Also,

animals that were on the upland moved into the Kafue Flats as early as March. According to DVO, lack of flooding of the Kafue Flats usually led to a build-up of ticks on livestock. This scenario, coupled with irregular dipping when animals are in the Kafue Flats, results into higher prevalence of tick-borne diseases. Frequent droughts in recent years meant that households have had no opportunity to rebuild their assets, including livestock, with many becoming locked into a spiral of chronic food insecurity and poverty. Reports from FGDs show that drought-related shocks used to occur every ten years, but were now occurring every three years or less. A village headman in Mandondo in Chief Nalubamba's area pointed out that:

> "*...our cattle do not have time to recover physically from drought and can no longer withstand the dry spells. Cattle begin dying after just two months of a dry spell and are continuously being lost every dry period; whether there is a drought or not, considering the distance we have to cover to drive them to the Kafue flats. The frequency of droughts means grazing lands, crops and livestock have less time to recover between droughts and this increases our vulnerability to maintain livelihoods in the same traditional lands and traditional ways of life…*"

5.3.4 Effects of floods as a source of livelihood flux

The results showed that 63 percent of the respondents associated the occurrence of floods as an indicator of climate variability and change, with the majority from Baambwe and Maala. However, perceptions about the frequency of floods showed that 96 percent of the participants in the district viewed flooding as a result of altered flow and flux of the Kafue River. Flood is high hydrologic extreme resulting from natural or human activities that disturb the hydrological cycle over a period of time resulting into excessive occurrence of water. Namwala is not exceptional to flooding. Namwala District Agriculture officer 01 stated that the year 1994 saw severe floods in the Flats when grazing grounds and some settlements along the Kafue River were inundated and people were displaced. He observed that the effects of the 1994 floods were compounded by the fact that the district had not yet recovered from the impact of the preceding 1991, 1992 and 1993 droughts. The most recent floods were associated with flash floods and occurred in various places during 2000/01, 2005/06, 2006/07, 2009/10 and 2016/17 rainy seasons.

Results further shows that the Kafue River was by far the most responsible for flooding situations in Namwala than rainfall induced flooding. A summary of results in Table 5.1 showed that flooding was induced by changes in flow and flux of Kafue River as a result of altered river regulation (n=116, 96.7%) while increase in flooding of *ibanda* (floodplain) was noted by 75

(63%) of the respondents. One female photovoice participant observed that the floods that came as a result of water flux from Itezhi-tezhi dam caused untold misery among pastoralists:

> "*…these floods, a lot of water, especially this year (2017), just like those that came last year (2008), destroyed our crops, grazing lands and brought lumpy skin disease…*"

In Namwala, pastoralists believe that humans can never manage nature, but rather are dependent on how well land will produce for them as observed by one pastoralist (Figure 5.5) in Baambwe:

> "*…we pastoralists are happy when land is giving and when it is not we can not do much. We live by and follow the mood of the sky, and herd our livestock in accordance with its mood." For us pastoralists, it is more important to consider weather variability and climatic conditions before thinking about the management of the pasture and water as key aspects in managing our ibanda (floodplain)…*"

Figure 5.5: Vulnerability to floods with tangible consequences
Source: Field data - photovoice participant from Baambwe, 2017

The farming and cattle grazing livelihoods that characterize Namwala are dependent on a rich ecosystem nourished by the seasonal rise and flow of the Kafue River. Thus, in the Kafue Flood Plain, the cattle economy is linked to flooding which has positive impact of provision of sufficient

grazing grounds throughout the year. Results showed that the herding of cattle therefore followed the pattern of flooding and recession of flood waters. One of the Chiefs observed that apart from grazing, flooding and recession of floods allow pastoralists to practice recession agriculture allowing them to grow more than one crop in a year due to availability of residue soil moisture. However, respondents observed that floods can be destructive to newly adopted agricultural activities. They identified the negative effects of floods on premature crops particularly during dry season. Respondents reported that floods submerged gardens which often led to crop damage in various ways. Crops were sometimes washed away by fast flowing flood waters. Tuber crops such as potatoes and cassava ended up rotting. Even okra, which is water tolerant, was reported to be destroyed if it was submerged for more than one week. In addition, floods have also resulted into higher incidences of livestock diseases:

> "*…Fascioliasis disease (caused by liver flukes) is a problem, whenever we have floods, our cattle die from this disease during dry season…"* explained one respondent in Maala.

Information obtained from the DVO emphasized that cyclical flood changes were important attributes for pastoral social-ecological typologies. The majority of the respondents (90%) stated that the 2016/17 season flooded and reduced grazing areas and forced cattle to move to higher grounds at once. About 61 respondents pointed out that the concentration of cattle on the upland often led to overcrowding in the few available grazing areas. The DVO confirmed that this created an opportunity for cross infection of diseases and overgrazing because land was generally under customary regulation of open access. During this time, pastoralists lamented that food insecurity was exacerbated because stray cattle destroyed maize stock. It was also reported that floods created mud and weak animals could not move freely. This often led to high mortality rate for weak and young animals.

4.3.5 Shorter rainfall season and growth of grass

Decline in rainfall and annual rainfall variability were also said to have resulted into a shorter rainfall season and growing season. Fifty seven percent of the respondents understood and linked climate change with shorter growing season. Pastoralists perceived that the growing season had become shorter when compared to the past 30 years. The statement ranked eighth among responses in Table 5.1. Results also revealed that rainfall seasons have changed, where sometimes rainfall starts at the onset or in the middle of the season and ends when crops were still at the

growth stage or had just started producing flowers. Citing examples from the farming calendar, one respondent in Muchila area pointed out that over the past 30 years, rainy seasons had been commencing in late October or even mid-November, with light or heavy downpours which could last for two or three days, with no more rain for the rest of the season. Pastoralists in all other chiefdoms also revealed that the trends in rainfall had changed; where one season could receive sufficient rainfall and the other received poor rain or a season could receive one year with good rain then followed by three to four, or even five, years with poor rains which were highly variable and did not fully support cropping and pastoral activities. They further observed that rains for planting begun in December instead of Late October and Early November. This affected the growth of grass for cattle. One of the participants in Mbeza chiefdom reported that in the past, rainy season had four years of good rain then followed by one year of poor rain or drought:

> *"…the situation in rainfall has changed a lot, until now drought and crop failures have become part of our life, and many years have passed now since we had sufficient harvest. We struggle working to earn money for the purchase of seeds and fertilizer through e-voucher and as soon as it rains we plant somewhere in December, and do weeding early enough but to our surprise there is no further rain after planting and weeding in January. Crops survive under limited moisture conditions while others wilt and die due to prolonged variations in rain days and increase in drought…"*

Another respondent from Kabulamwanda in Mungaila chiefdom said:

> *"…nowadays pastoralism is no longer a certain activity that one can depend on for survival and livelihood as it was in the past years. The rains come late in December by which time most our cattle lose condition due to lack of pasture…"*

The decline in rainfall and increases in variability, affect the livelihoods of the pastoralists who depend on natural rain to graze their cattle. Pastoralists reported that rainy seasons no longer follow known trends from the past, hence affecting the normal routine of grass shooting making cattle lose weight, miscarriages and stunted growth. One respondent in Ngabo stated that sometimes their cattle die due to prolonged non-availability of grass. Others got trapped in the mud as they attempted to drink water in the Kafue River, as most lagoons, pans and streams were dry most of the year. A senior headman in Maala added that most of their cattle lost weight during dry season and late rains means their cattle did not give them maximum earnings at slaughter. From the observations and discussions with pastoralists it was evident that, despite the variability

and unpredictability of rainfall, farmers still kept large herds of cattle and grazed them in mixed herds in the Kafue Flats.

4.3.6 Decline in water level and drying of surface streams and lagoons

Climate variability was also associated with increased decline in the amount of water in the Kafue River, streams and drying up of lagoons, dams and pans. Results showed that 45 percent of the pastoralists associated climate variability with decreases in overall Kafue River water volume and the drying of streams, lagoons and pans. However, perceptions from participants suggested that the area had experienced a steady decline in the amount of water in local streams and lagoons over the past 30 years. They attributed this to rises in temperature and declines in rainfall, and increased rainfall variability. Some of the perennial rivers and streams have become seasonal, and others had dried out altogether. In Muchila area, pastoralists reported that streams had become seasonal, as they only flow during and shortly after the rainy season. From field observations, most lagoons, dams (i.e. Baambwe dam) and streams in the district had low volumes and some have since dried.

5.4 Rebuilding the resilience status of pastoral system to weather shocks and contemporary changes in the value of cattle

This sub-theme addresses the second objective on the resilience status of pastoral systems to climate variability. “A resilient system has the capacity to change as climate varies while still maintaining its functionality,” (Walker and Salt, 2006: 144). The study established that since 1990s, pastoralists had been facing various problems pertaining to cattle diseases and climatic variability. These affected people’s livelihoods that they had enjoyed for decades. The social-economic situation of the farmers changed and indeed food security had been threatened. However, pastoralists were learning to live with change and uncertainties. Hence, to understand contemporary resilient status of pastoral systems, respondents were first asked a question on various forms of cattle acquisition and accumulation in the traditional set up.

Results in Figure 5.6 show that 81 percent (*n*=98) of households interviewed received their cattle through inheritance. Inheritance was the most important way of transmitting animal wealth from one person to another. Two types of inheritance were established; the first involved the sharing of a deceased person’s assets among relatives while the second involved the alienation and transfer of stock from parent to off-spring, while the parent was still alive. Such transfers may be effected

immediately a child was born and cattle multiply by the time they were grown up. Hence, respondents stated that they took precautions by moving animals allocated to younger children out of the main kraal. These animals were then entrusted to relatives or friends who were given specific instructions to keep the cattle on behalf of a specific child and be given when the parent dies.

A focus group participant gave a characteristic response that illustrated the timing of giving out cattle:

> *"...parents are always concerned about how their estate is going to be shared amongst their children when they die. There is always a possibility that the younger children may get a raw deal when the estate is divided..."*

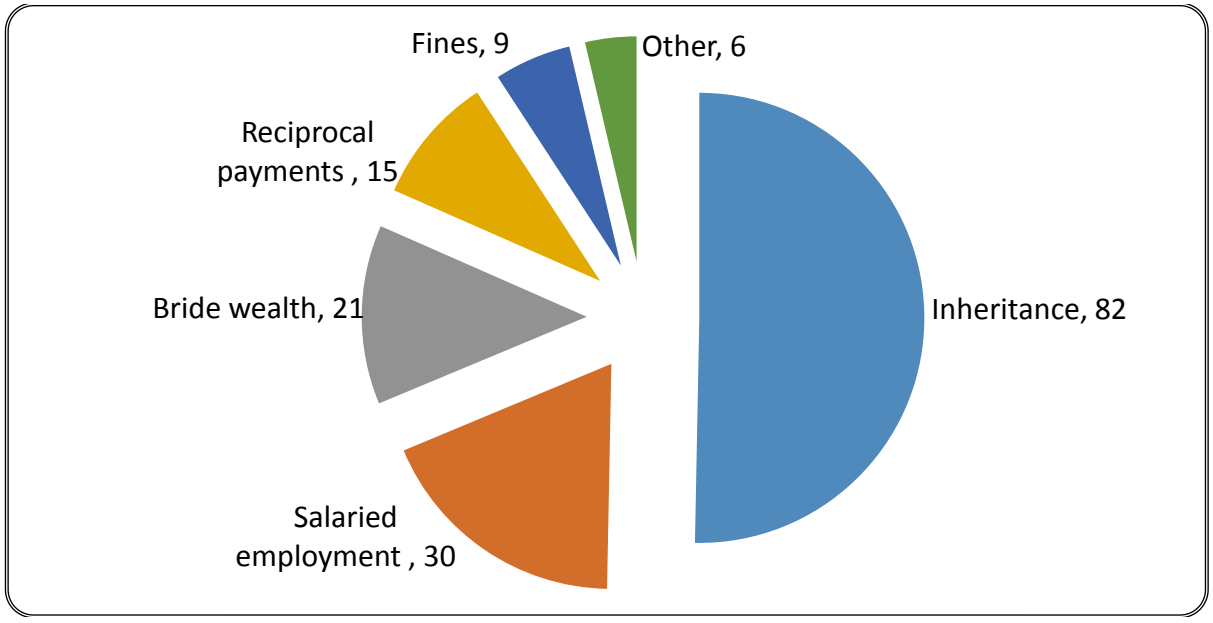

Figure 5.6: Forms of cattle acquisition and accumulation
Source: Field data, 2017

Respondents ranked salaried employment as the second form of cattle acquisition and accumulation (n=36, 30%). The role of wage employment as a means to acquire cattle had been very important in the past and continues to be very important today. The results show that people in salaried employment were able to accumulate animal surpluses by investing their wages in cattle and used un-remunerated kinship labour to herd their cattle while they were away. In return, the salaried employees had reciprocal kinship obligations to their relatives in the village, such as buying dip chemical and vaccines, paying school fees for relative's children or providing lodging to relatives visiting urban areas. Respondents further showed that the absence of these salaried

employees from the village and their access to an alternative source of income enabled them to refrain from eating into their capital, unlike their kin who remained in the village (see sub-section 5.4.8 on the role and increasing dependence on salaried employees in Namwala).

Households reported that bride wealth *(lobola* or *chiko*) was a non-commercial way of acquiring cattle with 15 percent of the respondents (n=25). Pastoralists observed that this was an old tradition and cattle had been strictly used in bride wealth transactions. One chief observed that marriages in Namwala still attracted alot of cattle and were momentous occasions characterised by song and dance, including slaughter of cattle.

Further, 15 percent (*n*=18) of households received their first cattle through reciprocal stock payments which involved taking care of someone else's cattle either through *kushisha*. *Kushisha* involves the temporary transfer of stock to close associates for a number of reasons; for example to balance labour and stock, to avoid drought and epidemics, or, as pointed out above, to simply 'hide' inheritance cattle for younger members of the family. The other common situation of *kushisha* was where a formal agreement between two parties, such as between a salaried employee and a village-based caretaker. In both cases, the temporary care-taker was given an animal after an agreed period of time, as a token of appreciation for looking after the animals.

Court fines constituted 7.5 percent (n=9) while 'other' such as cattle rustling received 5 percent (n=6) responses. These were cited as minor mechanisms through which cattle were accumulated in Ila society. Local villagers usually paid cattle for any offences committed as these were easily available. For example, in Mbeza area, one pastoralist stated that his son was fined K2, 400 or three heifers as equivalent. The cash equivalent for heifer in 2017 was pegged at K800 each, while the real market value of a heifer was typically above K2, 500 each. So it was only prudent to sell cattle and pay the 'little fees' demanded.

One key respondent had this to say:

> *"...although these non-commercial methods of stock animals are circulated, they rarely constitute a basis for successful cattle accumulation, especially in the present era of the cash economy, in which the pressure to sell livestock assets is ever greater. This is because the number of cattle involved in these traditional transactions is often small. In instances where more than one animal is to be transferred, such as in marriage transactions, payment can stagger over a number of years without much pressure being applied to the livestock giving party, as long as the latter has given a pledge to eventually pay up.*

> *Furthermore, the livestock giving party is also at liberty to pay a cash equivalent instead of an actual animal. In such instances, the cash equivalent is often pegged at a much lower value than the actual market value of a live animal...*"

These various forms of cattle acquisition and accumulation were important attributes towards increasing cattle numbers in the traditional set up and helped in understanding contemporary resilient strategies of pastoral systems, a second objective. Although resilience may be prompted by climate events such as droughts and floods, it should be acknowledged that these adaptation strategies were taken in response to the complex interplay of both climatic and non-climatic conditions including political, economic and socio-environmental changes (Mertz *et al.*, 2010). Therefore, it was difficult to attribute specific adaptation strategies to climate variability and change. Hence, the resilience strategies that pastoralists identified in Namwala to withstand climate variability were seen as critical in coping with other non-climatic stressors: presence of commercial livestock buyers; herd mobility and management; pastoralists embarking on capital projects; increased cash investment into the herd; withdrawal of cattle from internal redistribution to individual accumulation; net flow of cattle from poor to richer pastoralists; changes in milking strategies and breeding; role and increasing dependence on salaried employees; locals '*turn*' to the Kafue river; social differentiation and improved marketing behaviour; changes in the cultural value of cattle; diversification with mixed crops/animals; management of diseases through treatment and spraying; intervention by the government; and role of NGOs in promoting livestock.

5.4.1 Presence of commercial livestock buyers

This was the first resilient strategy identified by pastoralists. Rural markets are vital for opening up an area for business and other social-economic activities in the face of climate related stressors. A great milestone in the history and transformation of Namwala in general and cattle husbandry in particular was set with the establishment of commercial buyers: Zambeef and Starbeef in 2005 and 2008 respectively. This was followed by Chitongo and Maala Abattoirs in 2012 and 2014 respectively. Thus, Namwala District had four operational abattoirs namely: Zambeef, Starbeef, Chitongo and Maala Abattoirs. In addition, a new abattoir, called Aukwata, was under construction and will have the slaughter capacity like that of Zambeef. Respondents identified new livestock commercial buyers as an important resilient catalyst in the face of climate variability with the majority respondents selling their cattle to Zambeef (n=86; 72%) and Starbeef (n=61; 51%), Chitongo (n=39; 33%) and Maala (n=26; 22%) as shown in Table 5.6. Despite a significant

decline in '*briefcase*' livestock buyers (n=5; 4.2%) [those who used to buy cattle from pastoralists at cheaper prices to re-sale at higher prices in urban centres such as Kembe Cold Storage in Lusaka and Kitwe on the Copperbelt Province], results show that briefcase buyers were cited as 'other' and remain important in far flung areas such as Muchila (n=19; 63%) and Nalubamba (n=12; 40%). In addition, selling breeding bulls was also cited as 'other' resilient strategy. This number was higher in Mungaila (n=11; 37%) as people in Maala were chief breeders and supplied breeding bulls within and outside the district. All abattoirs were operational throughout the year and mostly slaughtered cattle from within the district. Respondents observed that this trend had significantly transformed the livelihoods of pastoralists as an important resilient strategy from merely accumulating cattle stock for prestige to entering into the money market. Further, pastoralists identified a new niche market in which they were selling steers at Zambeef feedlot in Sinazongwe (n=43; 36%) and Mazabuka (n=20; 17%) at live weight grading system.

Table 5.6: Livestock markets available to pastoralists as an important resilient strategy

S/N	Where they sell cattle	Overall n = 120		Mungaila n = 30		Mukobela n = 30		Muchila n = 30		Nalubamba n = 30	
1		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
2	Zambeef	86	71.7	21	70	28	93.3	21	70	16	53.3
3	Starbeef	61	50.8	14	46.7	19	63.3	17	56.7	11	36.7
4	Maala	26	21.7	26	86.7	0	0	0	0	0	0
5	Chitongo	39	32.5	0	0	0	0	14	46.7	25	83.3
6	Sinazongwe	43	35.8	18	60	11	37.7	6	20	8	26.7
7	Mazabuka	20	16.7	9	30	4	13.3	5	16.7	2	6.7
8	Kembe	3	2.5	2	6.7	0	0	1	3.3	0	0
9	Kitwe	2	1.7	1	3.3	1	3.3	0	0	0	0
10	Other	51	42.5	11	36.7	9	30	19	63.3	12	40

Source: Field data, 2017

Key informant 08 stated that there were three slaughter days in a week namely; Monday, Wednesday and Friday. Pastoralists chose where to take their cattle for slaughter. Zambeef slaughtered over 100 cattle per day but had the capacity of slaughtering 120 animals with 22 local people employed. Starbeef slaughtered 80 animals per day and employed 15 local people as illustrated in Figure 5.7. Chitongo and Maala slaughtered less than 50 each per week due to limited storage. This forced the majority to take their cattle to either Zambeef or Starbeef. Most respondents expressed gratitude that the coming of Starbeef raised the price per kilogramme to at least K19 as of August 2016 but this price fluctuated depending on supply and demand. The price could be as low as K15 per kilogram between January and March owing to many people selling their cattle due to hunger and was time at which schools open. This led to a glut on the market

since most farmers by this time had diminished their maize stock. Thus, pastoralists resorted to selling their cattle to briefcase buyers in view of crop failure and cattle deaths.

Company	Average slaughtered daily	Local people Employed	Price per Kg - beef	Price per set - offal
Zambeef	100	30	K19	K150
Starbeef	80	25	K19	K1[illegible]
Chitongo	20	12	K16	K150
Maala	15	8	K17	K1[illegible]

Figure 5.7: Comparison in abattoir operations as a source of livelihood for pastoralists

Source: Field data, 2017

5.4.2 Herd mobility and management practices

Herd mobility and management was the second cited resilience strategy among pastoralists. Respondents were asked a question on how they managed their herd during years of drought or floods. One respondent in Maala explained that they moved livestock depending on availability of rangeland resources including water and pasture and the duration of receding flood water between the upland and the Flats. Mobility was an inherent part of pastoralist's existence. Results showed that the distance trekked to livestock water sources were almost tripled during drought years. Key resource areas that were set aside during the rainy season were called upon during drought years.

Pastoralists identified five resilient strategies which averted the effects of climate variability on herd management including: herd sizes, transhumance, herd splitting, maintenance of female-dominated herds and herd diversity. Herd size was identified as the most important strategy in building up the herd size in recovery periods between droughts and protects against total loss of

the herd during drought. Results in Figure 5.8 shows that 86 respondents (72%) overall gave it as strategy with highest herd sizes in Mungaila (n=26; 87%) and Mukobela (n=24; 80%) while Muchila (n=19; 63%) and Nalubamba (n=17; 58%) had lower herd sizes.

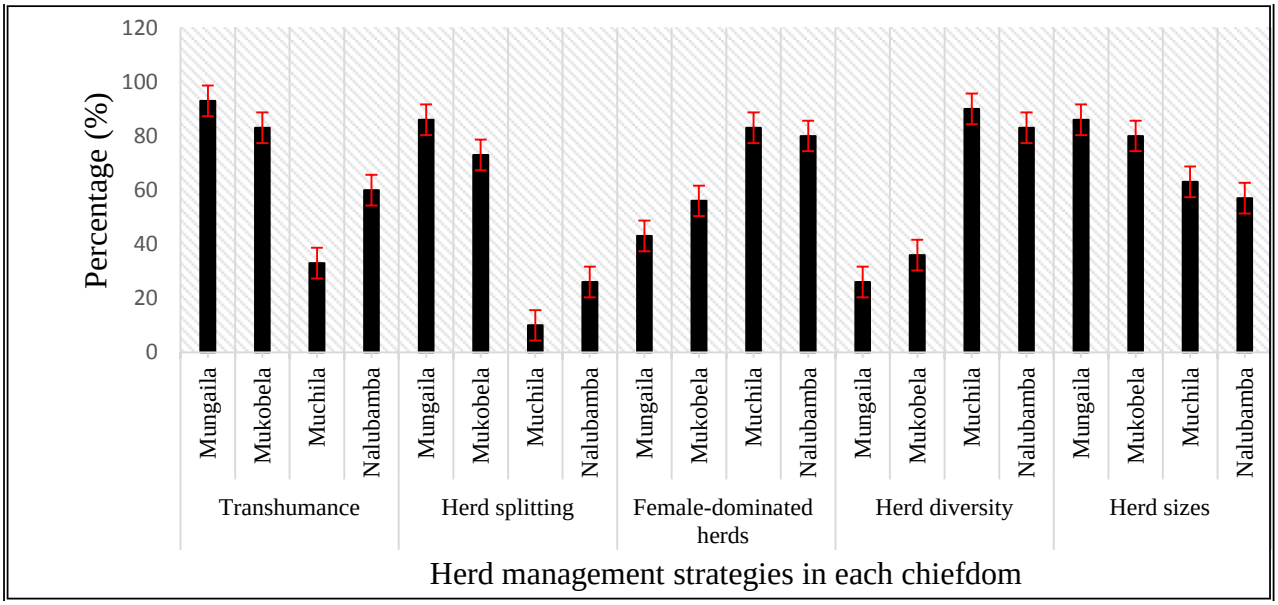

Figure 5.8: Forms of resilient herd management strategies

Source: Field data, 2017

Transhumance was cited by 81 respondents (68%) as the second most important herd resilient strategy overall with specific responses from Mungaila (n=28; 93%), Mukobela (n=25; 83%), Nalubamba (n=18; 60%) and Muchila (n=10; 33%). Pastoralists across chiefdoms stated that they trekked their cattle to the Kafue Flats particularly during dry season in search of green pastures (Figure 5.9). The lesser number was recorded in Muchila due to long distance respondents had to trek their cattle to the Kafue Flats. Results further showed that maintenance of female-dominated herds (n=79; 66%) was another important resilient strategy. Results from chiefdoms showed that Muchila (n=25; 83%) and Nalubamba (n=24; 80%) had higher number of female herds than Mungaila (n=13; 43%) and Mukobela (n=17; 58%). Respondents stated that a female-dominated herd structure was used to stabilize the herd in an event that some died from climate stressors.

Further, herd diversity (n=71; 59%) was another resilient strategy which was mostly cited by those who owned less than one hundred (100) heads of cattle with higher responses from Muchila (n=27; 90%) and Nalubamba (n=25; 83%) while Mukobela (n=11; 37%) and Mungaila (n=8; 27%) had fewer responses. On this, pastoralists pointed out that they managed both grazing and

browsing livestock species to optimise different range resources and ensure the conservation of rangeland ecosystems. At the same time, pastoralists stocked their herd with a mixture of cattle, goats, donkeys and sheep (this is explored fully under diversification). Herd splitting was cited as another important resilient strategy and way of redistributing wealth particularly in drought years. Results showed that 59 respondents (49%) overall with higher responses from Mungaila (n=26; 88%) and Mukobela (n=22; 73%) while Nalubamba (n=8; 27%) and Muchila (n=3; 10%) chiefdoms recorded fewer responses. Splitting the herd into smaller groups and moving them to different locations and outposts was reported as an important resilient strategy enshrined in Ila traditions from time immemorial and continued to prevent overgrazing and maintained long-term productivity of the CPRs, particularly the Kafue Flats (Figure 5.9).

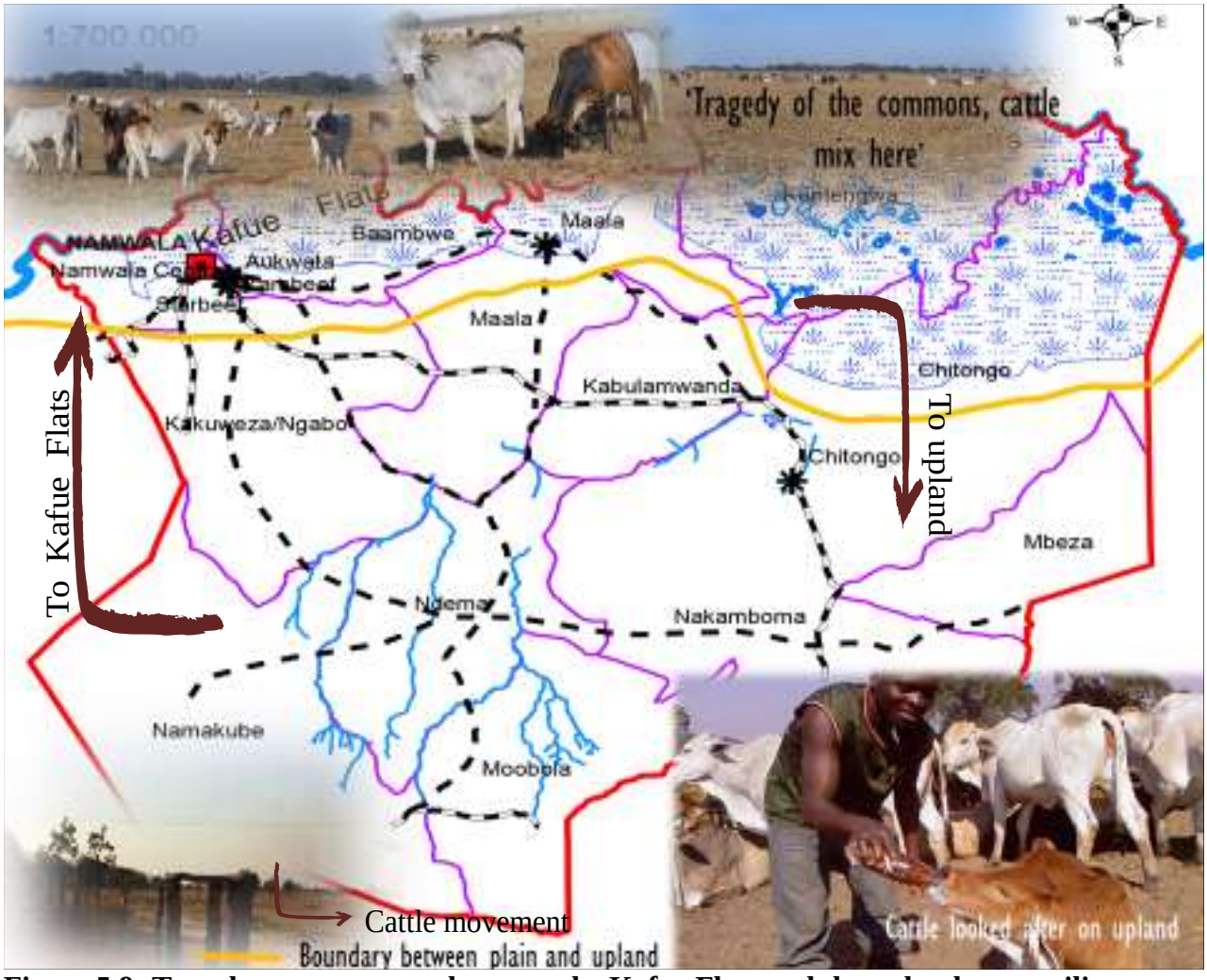

Figure 5.9: Transhumance system between the Kafue Flats and the upland as a resilient Strategy

Source: Field data, 2017

5.4.3 Pastoralists embarking on capital projects

Respondents identified various capital projects as important resilience strategies in the face of climate variability and change. The results show that 83 percent (n=106) of households had bought radios, 73 percent (n=88) had solar panels whereas 38 percent (n=45) had television sets from proceeds of cattle sales. Those that had bought vehicles constituted 36 percent (n=43) and 33 percent (n=40) constructed dip tanks/spray races. The majority among 36 percent had bought utility vehicles such as pick-ups and canters. These were believed to be dependable to use on the rough plain and sandy plateau. Increasingly, some people who had sizeable herds bought motorbikes before purchasing a vehicle since their fuel consumption was minimal. The demand and need to build houses had equally spread to rural towns like Namwala with 33 percent (n=40) of the respondents having built houses in Namwala town and put them on rent while those fencing their paddocks accounted for 28 percent (n=33). Those pastoralists that had opened shops/guesthouses constituted 26 percent (n=31). Other projects such as hammer-mills, wood misers and borehole drilling were accounted for by 19 percent (n=23) of the farmers (Table 5.7).

Table 5.7: Capital projects by households in Namwala

S/N	Item bought / project	No. of households				Frequency	Percentage (%)
		Mukobela	Mungaila	Muchila	Nalubamba		
1	Radio	29	28	23	26	106	83.3
2	Solar panels	24	22	18	24	88	73.3
3	Television (TV)	12	18	6	9	45	37.5
4	Vehicles/motorbikes	11	13	10	9	43	35.8
5	Built houses	8	17	7	8	40	33.3
6	Dip tanks/spray race	6	20	7	6	39	32.5
7	Fences	8	14	6	5	33	27.5
8	Shop/ Restaurants	7	9	11	4	31	25.8
9	Other	4	9	5	5	23	19.2

Source: Field data, 2017

Results further revealed that a few wealthy individuals (other; n=23; 19.2%) had established wood misers (timber processing machines) and fleet of trucks in addition to having digital satellite television in their homes. These lamented that their businesses enabled them to maximise on huge profits and helped them meet financial needs as opposed to selling cattle. Results also showed that due to recurrent diseases and droughts/floods, cattle were now increasingly seen as commodities, avenues of other investments, and this reconceptualisation had led to a gradual shift in production goals, to a reworking of production relationships between different households, and to a redefinition of economic ideologies and cultural beliefs. Respondents insisted that apart from

direct conversion of livestock wealth into commercial assets, proceeds from cattle sales had helped to prop up non-livestock commercial sector by bringing large amounts of cash into local circulation. Hence, respondents concluded that the strategic importance of the traditional livestock sector and pastoral changes to the overall development of the district cannot be over-emphasised.

A further examination of the results suggested that for successful pastoralists, cattle accumulation had opened unprecedented opportunities to facilitate their participation in regularised rural market transactions. The study established that due to the expansion of market opportunities, richer pastoralists had redefined their production goals and orientations to take advantage of the opportunity to convert their stock wealth into monetary value, and to transform this value into other forms of economic and social investments such as schools and shops (Figure 5.10). This was the reason why most pastoralists in Namwala, in the contexts of recurrent cattle diseases and droughts, tended to sell more cattle to abattoirs. This enabled them to acquire universally acceptable items such as radios, vehicles, shopping centres, dip tanks and fencing among others.

Figure 5.10: Chief Mukobela's statue at '*his*' school and new shops from cattle sales
Source: Field data, 2017

Pastoralists were further asked to provide reasons on the importance of capital projects. About 31 responses identified major developments in Maala, Moobola, Itapa, Niko, Mandondo, Mbeza and Namwala Central with growth of vibrant commercial centres that included several modern shops such as butcher shops, restaurants, bakery and lodges. This situation was similar to what was happening in other areas in Namwala such as Itapa in Muchila area and Niko in Nalubamba chiefdom. Most of these commercial enterprises were started with proceeds from cattle sales after 2005 when Zambeef established an abattoir in that year and later Starbeef and others as observed by one respondent:

> *"...Chief Mukobela Lubanga Shabongwe Kakombo Suta Namaluba built a school after selling more that 300 heads of cattle. For him, Ilas did not need formal education because they were pastoralists and born 'rich' hence constructed it in Namwala Central, 8 kilometers from Baambwe chiefdom. This shows that the strategic importance of cattle cannot be overemphasised..."*

Emanating from these observations is the fact that similar situations prevailed in all chiefdoms in which pastoralists were running retail shops with capital obtained from cattle sales or had expanded their businesses by investing proceeds from shops into cattle and then ploughing the income from cattle sales back into other businesses. All shop owners (31 respondents) that were interviewed confirmed that they run a dual livestock and retail enterprises as an important resilient strategy in the face of climate variability in which crop failure and cattle diseases were high.

5.4.4 Increased cash investment into the herd

Increased cash investment into the herd was identified as another resilience strategy in the face of climate variability and change. This was another aspect of cattle typology which had changed with increased commercialisation and threat from climate variability and recurrent diseases. Results showed that 115 households (96%) invested into their herd in form of dip tanks/spray races (n=39; 33%), fencing (n=33; 28%) [Table 5.9], drugs and supplementary feed. Results further revealed that rich cattle owners (n=27; 22.5% owned more than 200 and less than 1000 cattle) tended to buy more drugs than small or poor cattle owners who constituted 60 percent (n=72) and had less than 200 cattle. In addition, very rich herd owners (17.5% [n=21] owned more than 1000 cattle) stated that they sold more than two hundred cattle on average annually for vaccines and dip chemicals as a disease control measure and had embarked on various capital projects (see Table 5.9). These rich cattle owners pointed out that they managed to minimise the effects of flood and

drought by using several hired herders who trekked their animals over long distances in different outposts, in search of grass and water.

The results further showed that more that 83 percent (n=99) of the 120 households sampled have made substantial investments into their herd in form of dip tanks, spray races (which are increasingly becoming common than dip tanks), bore-holes, breeding bulls (such as Angoni and Boran known for their drought resistance, Dairy and Bonsumara for milk and beef respectively, as opposed to Brahman which was believed to be less resistance to drought and had long calving intervals) and fencing of their traditional farmlands forming paddocks. Further, respondents stated that an increase in local communication through Namwala radio and high number of mobile phone ownership and relationships had encouraged pastoralists to travel to nearby chiefdoms such as Maala and buy quality breeding bulls in the quest to improve their herd. Local bulls were reported to fetch about K7,000 on average as compared to bulls from outside the district that fetched as high as K18,000. However respondents stressed that they did not buy supplementary feed except for newly purchased bulls.

5.4.5 Withdrawal of cattle from internal redistribution to individual accumulation

Withdrawal of cattle from internal redistribution to individual accumulation was identified by respondents as another resilience strategy in learning to live with climate variability and change, and as a component of herd splitting (n=59; 49%). Results demonstrated that sharing, loaning, and gift-giving among pastoralists was a year-round activity, forming an integral part of the communal way of life. However, sharing of assets intensified during and after drought when families hit hardest ran short of food for consumption. Climate variability and recurrent cattle diseases led to the reconceptualisation and gradual shift in objectives and production goals among pastoralists. When cattle assume a high market value, traditional networks of cattle redistribution (*kushisha)* and stock gifts tended to decline. New forms of reciprocity which did not involve the transfer of live cattle had become more important and common, for example, between absentee urban-based livestock owners and their rural based caretakers. Poor pastoralists expressed that it was hard to receive cattle from rich relatives due to breakdown in extended family system and changes in the value of cattle.

In view of unpredicted and eventual mortalities resulting from cattle diseases and drought, 72 percent (n=86) stressed that they had taken full advantage of available rural markets instead of engaging in cattle redistribution practices and consulting later as the case in the traditional reciprocity. Results established that small herd owners tended to belong to resident clusters of a number of close relatives and friends, while big herds typically belong to one family. For example, despite the fact that one interviewed pastoralist in Kabulamwaanda owned more than one thousand heads of cattle, he stated that all of them belong to him and that not even his grown-up sons had any cattle in the herd:

> "*...all these are my animals even if they have different brand marks for my children from my four wives; they consult me and do not sell them anyhow as I have the final say...*"

The results show that 60 percent (n=72) of the respondents identified reasons why rich pastoralists refrained from traditional institution of *kushisha* system and joint ownership of herd units. Firstly, by not receiving *ing'ombe shakushishiwa* (temporary cattle), richer pastoralists freed themselves from the obligations of traditional reciprocity of having to give out their animals as well. Secondly, since they have sufficient stock of their own, rich pastoralists had sufficient access to milk, manure and draft power, the three replenishable products which lured poor pastoralists to accept *ing'ombe shakushishiwa.* Thirdly, richer pastoralists often made investments in the herd in form of veterinary drugs, wages for herdsmen, fencing, boreholes, spray races, modern houses and supplementary feed. Accepting *ing'ombe shakushishiwa* would therefore increase these costs. Respondents also identified another reason that individual ownership of cattle simplified cattle management and cattle marketing decisions, as no one else needed to be consulted.

5.4.6 Net flow of cattle from poor to richer pastoralists

In the face of climate variability and change, net flow of cattle from poor to richer pastoralists was identified by respondents as another resilience strategy. Ninety-three percent of the participants strongly agreed with the statement that richer pastoralists were becoming richer while poor continued to have fewer cattle. The study quantified 'very rich/bigger/richer' pastoralists to refer to those who owned more than 1,000 herds of cattle and these constituted 17.5 percent (n=21); 'big/rich' pastoralists represented 22.5 percent (n=27) with more than 200 but less than 1,000 animals and; 'small or poor' pastoralists were those with less than 200 animals and these constituted 60 percent (n=72) of the sample. Results showed that since 1990s, marketing strategies of bigger and small herd owners had been markedly different due to drought and flood situations,

and this resulted into a net flow of livestock from the latter to the former. They noted that under normal circumstances, one would expect that poor pastoralists sold fewer animals while very rich pastoralists were expected to sell more. On the contrary, they reported that poor pastoralists tended to sell more cattle during the drought years, not as a deliberate economic strategy but as a coping strategy to meet their staple requirements. As such, during months of January and March, irrespective of harvest, the market value of cattle considerably drops in relation to the market value of grain. Thus, poor pastoralists fall prey to local speculators and long-distance grain traders who took advantage of their situation by dictating the terms of exchange unfavourable to them. From several first-hand accounts during this study, it was established that some poor pastoralists had exchanged the whole 'cow' for three 90 kilogramme bags of maize.

On the other hand, responses from very rich pastoralists (n=21; 18%) were separated from poor pastoralists to compare their resilience. The following observations were made as responses to the question on how they dealt with drought situations in relation to marketing of their cattle:

i. They withdrew their cattle from the depressed local livestock market especially between January and March when cattle prices considerably dropped;
ii. They transported their cattle with their own transport or hired trucks to the line of rail (usually Sinazongwe or Mazabuka) where they fetched higher prices at live weight;
iii. They also dominated on the local livestock market by buying cattle at very cheap prices from poor pastoralists who were usually desperate for cash.

5.4.7 Changes in milking strategies and breeding

Another adaptation strategy used by households especially poor pastoralists in the face of climate variability and change was selling milk. The study established that poor pastoralists who constituted about 60 percent (n=72) of the sample tended to milk all their lactating animals while at the same time stripped more milk than very rich herd owners. During rainy season, a cow could be milked three times per day, while allowing the calf to suckle intermittently to stimulated further milk let-down. The three stages identified by respondents were *chifumofumo, muunza* and *mangolezha* (morning, noon and late afternoon) respectively. For example, some poor pastoralists in Muchila and Nalubamba chiefdoms, women in particular, had direct sources of income from milk sales, and tended to milk *chifumo-fumo* and *muunza* while the poorest milked *mangolezha* due to fewer lactating cows. On the other hand, 18 percent (n=21) who were categorised as 'very

rich' only milked a proportion of their lactating cows. This was normally done *chifumo-fumo* and preferred to maximise calf growth and weight gain for the market. For this reason, dairy cows had been recently bought to take advantage of the new niche milk market in the district.

Respondents identified five Parmalat sales centres (Namwala Central, Nchole, Kabulamwanda, Chitongo and Niko) shown in Figure 5.11. For this, 10 percent of those interviewed stated that they bought dairy bulls to take advantage of a newly introduced milk market in view of crop failure and cattle losses. Although the sales centres were fewer, 40 percent of those interviewed expressed gratitude and were maximising the new niche market in view of droughts and floods.

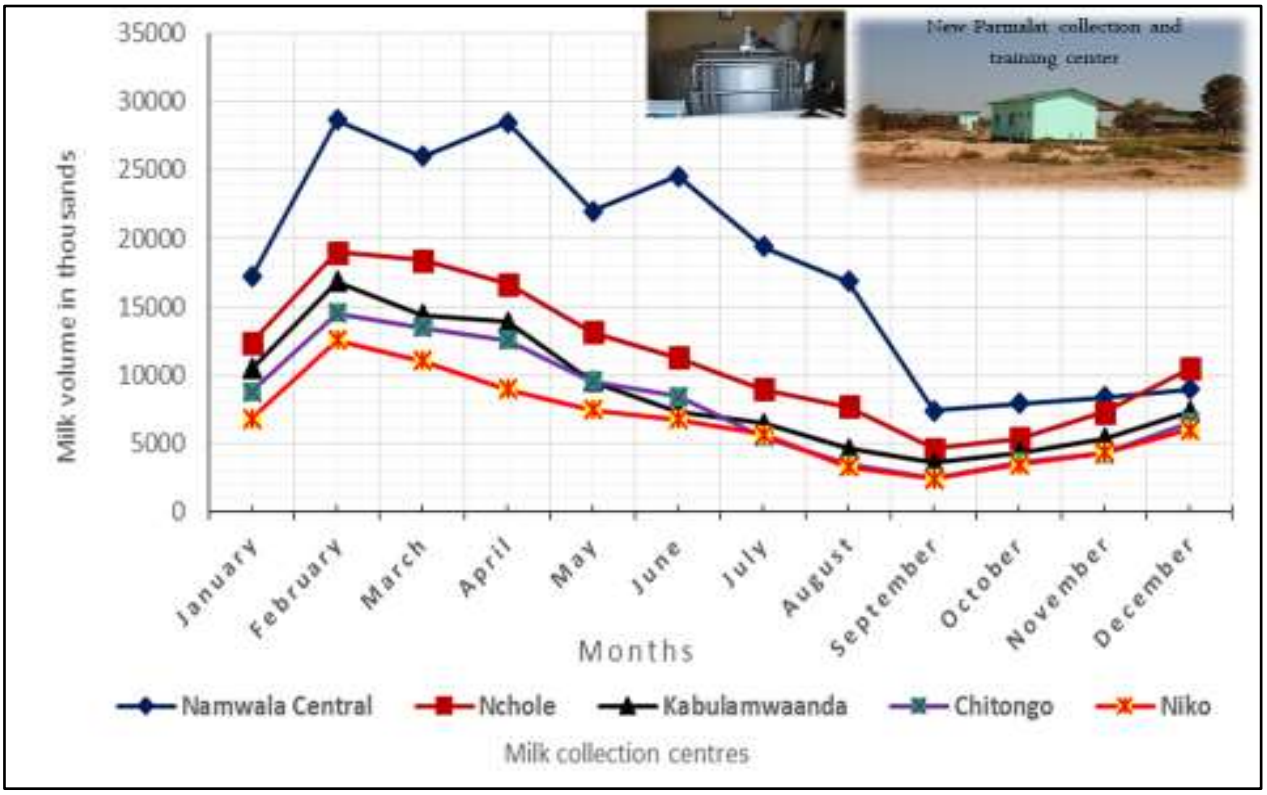

Figure 5.11: Milk volumes at five collection centres

Source: Field survey data from milk collection centres, 2017

Figure 5.11 shows that Namwala central had the highest milk volumes with production ranging from 10,000 and above for most of 2016. Milk volumes only picked in January due to delays in onset of rainy season. All other centres attributed limited supply of less than 20,000 volume of milk throughout the year due to farmers having fewer diary animals and poor husbandry practices. Nchole is second highest producer and located closer to town centre, followed by Kabulamwanda, Chitongo and Niko in that order. Respondents observed that the closer one moved to the town

centre/Kafue flats, the higher the concentration of cattle with better pastures and water which were contributing factors to higher milk let down. Pastoralists also lamented that during dry season, pastures were scarce. Seventy percent of the sample stated that they did not give supplementary feed to their cattle. Therefore, there was a close correlation between grass availability and milk let down, an increasingly important resilient strategy in the face of climate variability in Namwala.

5.4.8 Increased reliance on salaried employees in the face of climate variability

Increased reliance on salaried relatives was identified as an imminent resilience strategy in the face of climate variability and change. Salaried employment was cited as a second major form of cattle acquisition and accumulation (n=36; 30%). Respondents attested that most of their cattle in the herd belonged to their urban-based relatives who purchased cattle from wages and kept them in the home village under the care by close kin. Although there was a significant decline in internal redistribution and other reciprocal stock exchange from urban based cattle owners for example to village-based caretakers, the latter group still derived significant social and economic benefits from the cattle of their urban-based kin. Pastoralists pointed out that urban-based employees were made to feel a greater obligation to make regular cash remittances to their rural-based kin, and this enhanced the redistribution of income from urban to rural areas which were often at risk of crop failure and hunger. At the same time, rural based care-takers extracted use value from the cattle entrusted to them, in form of milk, manure and draft power. In Namwala, manure and draft power were the two major variables determining the scale of production and the quantity of harvest. To amplify on the role and increasing dependence on salaried employees by their village relatives due to many ecological related problems, was illustrated by a case example of one successful pastoralist, we shall call Respondent SX who gave a brief oral history of his cattle keeping career:

> "*...I started cattle enterprise in the 1990s when I was employed as a planner in the Ministry of Local government. I acquired my first cattle by investing my wages into buying dip chemicals and took them to Baambwe village where I exchanged them for cattle. I left cattle in the village under the care of my elder brother. He looked after the animals without any monetary remuneration, apart from the use value he extracted in the form of milk and manure, and the prestige which was conferred on him for being the 'owner' of a large herd (i.e. most people were not aware that my brother was only a caretaker). In addition, he also received an accassional animal in appreciation of the herding services rendered. I retired in 1999, by which time my herd expanded to well over two hundred. When I settled back in the village, I took all my cattle from my brother, in order to manage them myself as a fully-fledged economic enterprise. After settling, my herd continued to grow and my sons took more than 10 steers at a time, to the sales yard of Zambeef in Chisamba. After a decade, I managed to build a house in 2005 complete with electricity. In addition, I*

acquired a grinding-mill in 2009, fenced my farm, and later bought a Land-cruiser in 2011 in addition to a lodge in Namwala town. I sell most of my cattle in Sinazongwe at live weight..."

Respondent SX's case was not isolated. Participants recognized the value of investing in cattle. Cattle were seen as the only possession which could congeal, store and increase value, holding it in the stable form in an environment of inflationary pressures. A High school teacher recounted his cattle keeping career and had this to say:

"*...unlike money which is associated with dark and distant forces over which an individual has no control, cattle are a vehicle towards economic self-sufficiency and freedom from want. I have more than two hundred heads of cattle and earn more income than my salary..."*

This argument was supported by an explanation made by another respondent from Baambwe in line with a local world view that money '*has no owner'* because '*it runs through your pocket*' and left you destitute and hungry. In addition, respondents observed that it was a common sight along the edges of the Kafue Flats to find dotted holdings, most of which belonged to salaried employees and proximity to Namwala town centre for easy monitoring as noted by another respondent:

"*...I bought a small holding along the fringes of the Kafue flats and employed two caretakers. They do not have problems looking after them because they just take them out and watch them graze lazily in the vast flood plain...*"

5.4.9 Locals '*turn*' to the Kafue River

While new comer tribes such as *Lozis* and *Bembas* were traditionally involved in fishing, the *Ilas* used the plain for grazing purposes from time immemorial. In view of climate stressors, eleven (11) respondents stated that they had become fishermen while six (6) and four (4) respondents were involved in basket weaving and gardening respectively as a response to changing ecological situations. Figure 5.13 show new realities among most Ila men. Results revealed that children as young as 12 years had dropped out of school to help in fetching '*new forms of livelihood*'. Respondents identified recurrent cattle diseases and droughts/floods to have decimated livestock numbers. Thus, pastoralists identified the Kafue River as an answer. They had turned to the Kafue River and sold either fresh fish within Namwala town or dried it to fetch for higher returns in urban centres such as Choma, Lusaka and even as far as Kasumbalesa. The arrows in Figure 5.12 show an influx of pastoralists from the upland the Kafue flats in search of new livelihood options. They argued that the money realised was used for meeting various demands and for purchasing steers and heifers in an effort to re-establish themselves in the Ila way of life. They stated that they

had not completely embraced fishing as a permanent way of life. In addition, apart from fishing, timber (with some farmers owning wood misers) was processed and sold to urban centres such as Choma, Mazabuka and Lusaka where it fetched higher prices. However, these strategies remained unpopular as compared to keeping cattle as explained by one pastoralist shown in Figure 5.12 pulling the seine net with his sons:

> "*…as a resilient strategy to drought, fishing is our new way of life; I have no cattle or any other form of livestock. My late father lost all the cattle to corridor disease (denkete). So the oxen I use belong to my uncle. As a way of survival, and because I cannot afford to take my children to school, we have become fishermen because yields are extremely low to sustain my family to the next season due to droughts and poor soils. This is also important because it is a 'cost measure' for us. We keep and leave the little harvest intact on the upland. We survive here by exchanging fish with maize meal to those coming from both outside and within the district. We only use what we harvested when we go back in November or December at the onset of rainy season. Even if it is my 'new' life now, I have not permanently embraced it. It is the only way for me to get re-established in the Ila way of life (keeping cattle) from which I have bought two oxen so far...," explained one pastoralist tuned fisherman shown in Figure 5.12.*

Figure 5.12: Pulling for survival: An Ila man pulling a seine net with his sons

Source: Field data, 2017

5.4.10 Social differentiation, marketing behaviour and resilience during drought

Oral narratives and biographies were used to reconstruct livelihood histories and explore temporal dimensions of resilience among pastoralists. Drought was cited by 98 percent of respondents as the most serious local indicator of climate variability with specific responses from chiefdoms: Mungaila (n=30; 100%), Mukobela (n=29; 98%), Nalubamba (n=30; 100%) and Muchila (n=29; 93%). Pastoralists recalled and lamented that the 1991/92 was the worst drought of the century and their memories were still fresh. To investigate the impact of drought on cattle marketing decisions, household-level information was collected which reflected how different categories of producers dealt with the problem. To facilitate comparison of shifting and different marketing strategies, partial drought year's period between 2011 and 2015 were compared with pre-drought period between 2009 and 2010 and post drought years between 2016 and 2017 (Table 5.8). Because the study is based on memory and novelty, similar partial drought years from 2011 and 2015 were analysed as opposed to the worst period between 1991 and 1994. When this information was compiled, results showed that the resilient strategies and marketing behaviour of very rich (n=21; 18%) and poor pastoralists (n=72; 60%) markedly differed during drought. To illustrate this, household-lever data was obtained from four very rich pastoralists (owned above 1000 cattle) and four poor pastoralists (owned less than 20) is presented in Table 5.8. Figures for 2017 reflected cattle sold during the first half of the year. Names given in case studies were pseudonyms.

Table 5.8: Marketing behaviour of rich and poor pastoralists during drought

Name	*Status*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
SX	Rich	60	70	25	20	25	20	35	55	26
SN	Rich	500	1500	1000	850	750	880	1220	2200	1350
SZ	Rich	400	900	820	800	550	350	450	1050	610
RM	Rich	450	570	430	350	300	230	450	600	420
MUW	Poor	2	3	3	4	4	2	2	0	1
NAL	Poor	0	1	2	2	3	2	3	1	0
CHIB	Poor	1	1	0	2	1	3	2	1	1
CHU	Poor	0	0	1	2	2	2	1	0	0

Source: Field data, 2017

Case 1: Respondent SX:

The case of SX was explored in detail under sub-section 5.4.8 on the role and increasing dependence on salaried employees. SX was the fourth richest pastoralist in the sample. In 2015, he had not sold any of his cattle to private commercial buyers because of low prices. Instead he sold steers to Sinazongwe at live weight. This was necessitated because he had a lodge project and steers sold at live weight at Zambeef abattoir in Sinazongwe where he fetched higher returns; something not offered at any of the abattoirs in the district. He

explained that the proceeds realized were used for different projects, including fencing and spray race construction as important resilience aspects among others.

Case 2: Respondent SN:

Nawa was the richest traditional pastoralist in Namwala with more than 10,000 heads of cattle. He is Lozi and came as an immigrant and settled in *Chibunze*, a fishing camp located about 10 km from Namwala town. He grew up a fisherman. In early 1980s, he bought a seine net (locally known as *ituwa*). The catch was good as a result of the moderate rainfall and promising flow regime of the Itezhi-tezhi dam. He hired several fishermen and bought three more seine nets or *matuwa* (more than one *ituwa*) in one year. He made his fortune as a fisherman. In late 1980s, he diversified and ran a chain of rural-based grocery shops. At that time he had no cattle. He gradually built his herd with proceeds from his shops and fishing. He also invested heavily in agriculture using ox-drawn ploughs before buying a tractor with all his fields located in the Kafue Flats thereby maximising harvest especially with less floods experienced in the last three decades. In years of favourable rainfall, he would harvest up to 15000 x 50 kilogram bags of maize. During the worst drought in the 1990s, he accumulated a large number of animals by exchanging grains with cattle, and this marked his peak in cattle accumulation. He has now shifted his home base to Namwala town. He had also split his cattle into several herding units because they were too many to be combined into a single herding unit (he conservatively estimated his total herd at 10,500 and hired five herd managers each managing approximately 2000 heads).

In 2010, SN was contracted by Zambeef as a key supplier. Thus, every year, the company allocated two weeks between October and December (presumably when the price per kilogram was higher) for him to slaughter. From 2011, he had been supplying more than 1000 cattle annually all drawn from his herd (Table 5.8). Because of his good marketing networks, he had several investments, including the newly completed shopping complex in Namwala central; several houses on rent dotted in Namwala, Choma and Lusaka; fleet of trucks, wood misers; grinding-mills; shops etc. He had also invested heavily in his herds with more than 5 dip tanks, 3 spray races and several farms all of which were fenced with 'game wire'. SN did not sell any of his cattle to '*briefcase*' buyers except those buying breeding bulls. All the cattle reflected in Table 5.8 were sold to embark on capital projects and achieve resilience diversity in projects not directly related to agriculture.

Case 3: Respondent SZ:

SZ was one of the richest pastoralists and owned one of the flourishing chains of shops in Kabulamwaanda, Niko, Itapa and Namwala town. He would not disclose the actual number of cattle he had, although he admited they were well over 7000 heads. In addition, he was one of the bus operators with two buses. In addition, he owned a fleet of trucks. He stated that other pastoralists hired his trucks to take their cattle to markets along the line of rail and for transporting building bricks, sand and stones. Although he owned buses and trucks, including shops, respondent SZ regarded cattle as '*wealth par excellence'* because according to him, '*vehicles and shops could evaporate like dew.*' For example, in 2000, he narrated that he became very ill and all his vehicles and shops were immobile and closed respectively. When he recovered, he had to sell some of his cattle to resuscitate the businesses. Results in Table 5.8 shows why he sold most of his animals among the rich pastoralists, despite the drought-induced depression of local cattle prices. Thus,

irrespective of drought, most rich pastoralists sold their cattle to embark on capital projects and avoided cattle deaths associated with climate stresses. Respondent RM had similar attributes with respondent SZ although he had no shops (Table 5.8).

Case 4: Poor pastoralists:

It would be a bit too long-winding to give accounts of individual cases in this category (n=72, 60%). Field data showed that these pastoralists owned less than 15 animals. They mainly managed those belonging to relatives and friends. These belong to the category of pastoralists commonly referred to as '*target income sellers'*. The one thing they had in common, which was evident was that they all seemed to have sold comparatively more cattle during drought years. For example, whereas they sold only 14 cattle between 2009 and 2011, they sold almost twice that number between 2012 and 2015. The increased off-take among poor pastoralists was attributed to the grinding scarcity of cereal staples resulting from drought. For example, in 2011, respondent CHIB, one of the poorest pastoralists in the sample, had completely run out of maize by August because of exceptionally poor yields. In good years, most pastoralists managed to retain some maize up to January of the following year but this was no longer the case especially that most recent years were drought prone. The shortage of starch staples forced CHIB to sell two cows between August 2012 and January 2013, both at give away prices. By that time, CHIB had already sold one cow earlier in the year to meet medical bills and transport expenses for his daughter travelling to Lusaka for medical attention. This brought the number of animals sold in 2012 to three, which was a big number to a small herd. Although the 2013 yields were equally bad, the respondent was lucky to have sold only one steer the following season. This was because he received substantial cash remittances from one of his daughters working as a teacher in Lusaka. Respondent NAL added that cattle saved a lot of lives during the drought. Those without cattle survived by eating *imbula* fruits (*paripari curatelifolia*) or '*fighting*' for relief sorghum distributed by NGOs.

5.4.11 Diversification with mixed crops/livestock

Pastoralists identified diversification as another resilience strategy. One hundred and fourteen (114) respondents strongly agreed that they were engaged in mixed crop-livestock production in view of climate variability and change. The statement about keeping different species to survive diseases and drought ranked highest from all responses. Traditionally, rural communities believed that there was no home without food, thus sufficient food in the household was considered to be a sign of material wealth and prosperity, as diversification enabled them to derive different benefits from different species (Table 5.9). Among responses, 98 respondents strongly agreed that advantages were taken from different reproductive rates of different species to rebuild livestock numbers after a hazard. Results further showed that small ruminants such as sheep and goats had greater fecundity and multiplied quicker than cattle. Further, 88 respondents strongly agreed that an outbreak of disease could affect certain species, for example, sheep and goats, as these species or breeds were able to survive droughts and thus helped carry a family over such difficult periods.

Table 5.9: Outline of resilience responses in a mixed crop-livestock system

S/N	Statement	5	4	3	2	1	Score	Score as % of the max
1	You keep different species to survive diseases and drought	114	6	0	0	0	594	99
2	You derive different reproductive rates from different services	98	22	0	0	0	578	96
3	You view it as a risk minimizing strategy	88	24	6	2	0	558	93
4	You use other forms of livestock to rebuild number of cattle	78	34	5	3	0	547	91
5	You benefit from different products	4	61	21	11	23	372	62
6	You use small ruminants for target income selling	2	16	23	34	45	256	43
7	You slaughter small ruminants at ceremonies	4	4	15	21	78	201	34
8	You derive manure from different species	0	2	6	23	89	161	27
9	You use crop residue as feed	0	0	7	8	105	142	24
10	You derive milk from different species	0	0	0	6	114	126	21
11	You only keep cattle	0	0	1	3	116	125	21

Source: Field data, 2017

Note: Strongly agree = 5; Agree = 4; Not sure = 3; Disagree = 2; Strongly disagree = 1
N = 120
*Maximum score (120*5)* = 600 *Scores as % were determined by specific score/maximum score* x *100*

In addition, more than 70 percent of the respondents kept mixed types of livestock as indicated in Figure 5.13. Chickens (85%) were the most popular form of livestock kept by households followed by cattle (72%) while the majority kept a mixture of cattle and chickens (96%). Chickens were commonly kept by women because of their small size which made them easy to handle and their easy convertibility into '*target income cash*' as compared to large livestock such as cattle.

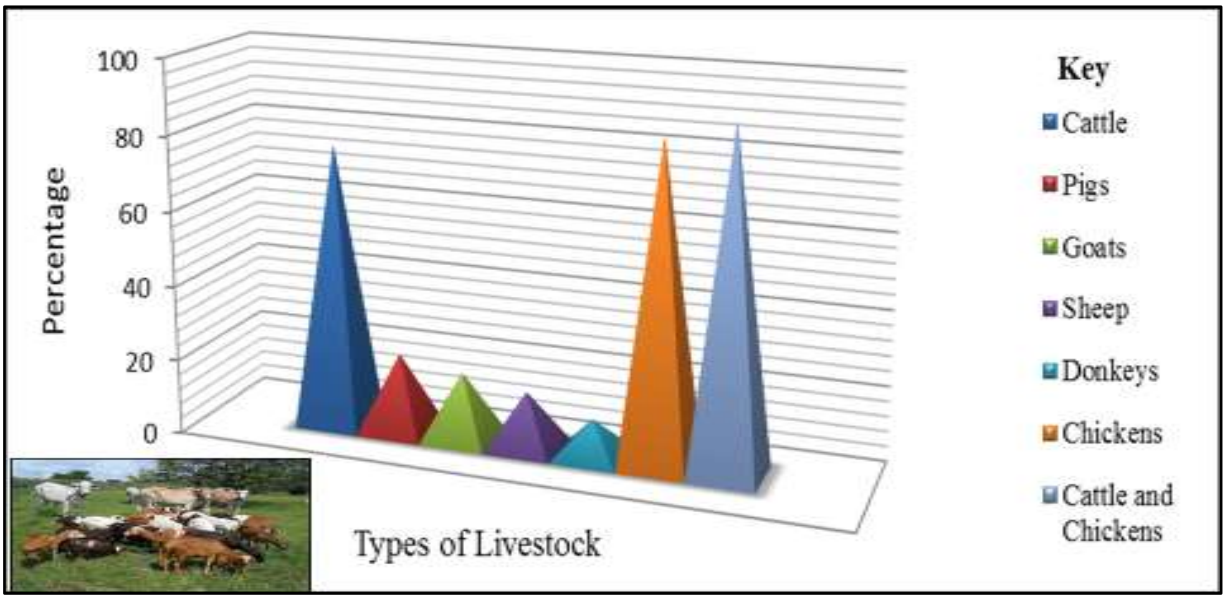

Figure 5.13: Types of livestock kept by households in Namwala

Source: Field data, 2017

5.4.12 Management of diseases through treatment, dipping and vaccinations

Treating cattle was one of the most important resilience strategies that pastoralists had assumed in order to prevent cattle deaths. Pastoralists confirmed that livestock diseases tended to increase during periods of climate stressors. Results in Table 5.10 indicate that 36 pastoralists dip or spray their animals weekly or regularly. Fifty four percent of the sample stated that they sprayed their cattle fortnightly with the highest number of 21 households from Muchila. Less number of pastoralists dipped/sprayed their cattle monthly and after three months.

Table 5.10: Frequency of dipping/spraying among pastoralists

Frequency	Number of households				Total	Percentage (%)
	Baambwe	Maala	Muchila	Nalubamba		
Weekly	11	16	6	3	36	30
Fortnightly	14	12	21	18	65	54
Monthly	4	2	4	4	14	12
After 3 months	1	0	1	2	4	3
Yearly	0	0	2	1	1	1
None	0	0	0	0	0	0

Source: Field data, 2017

Meanwhile, the yearly and none responses were obtained from pastoralists who mostly owned *ing'ombe shakushishiwa* (entrusted cattle by a relative or close friend) and these responses came from poorer households. The weekly, fortnightly and monthly dipping were usually done throughout the year but mostly in the months of December to March when tick infestation was high. These measures were important for building cattle stock for survival. In addition, routine control measures of major diseases were intermittently timed by the DVO (Table 5.11).

Table 5.11: Routine control measures of major diseases

Month	Blackleg (BQ)	Haemorrhagic Septicaemia (HS)	Corridor (ECF)	Foot and Mouth Disease (FMD)	Deworming	Dipping/ spraying
January	2,071	5,602	0	0	1,767	42,430
February	2,235	2,511	0	0	2,365	38,020
March	4,402	4,587	0	0	2,107	28,204
April	5,813	7,498	0	0	1,522	23,595
May	1,068	1,068	0	105,212	4,679	21,790
June	6,743	1,425	0	34,730	368	19,057
July	2,741	0	6,000	0	1,492	17,755
August	400	775	0	0	12,419	14,201
September	2,500	4,000	0	0	335	12,016
October	2,948	1,911	0	0	670	16,500
November	5,126	5,027	0	0	2,038	28,786
December	3,854	4,054	1,980	136,306	1,407	33,392
TOTAL	**39,901**	**38,458**	**7,980**	**276,248**	**26,490**	**318,746**

Source: Namwala District Veterinary Office, 2016

In addition, DVO 02 explained that six (6) GRZ dip tanks were earmarked for rehabilitation while thirteen (13) dip tanks were expected to be constructed in 2017 in the district (Figure 5.14). Further, 80 percent of the privately owned dip tanks were operational and serving the community from diseases as opposed to government owned ones. Resilience was achieved by more cattle.

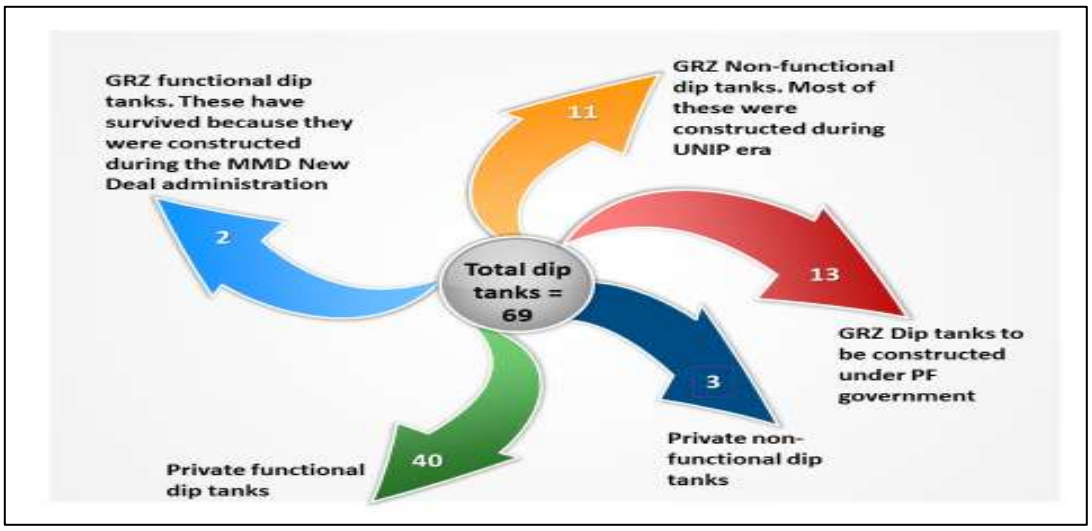

Figure 5.14: Dip tank status in Namwala district

Source: Namwala District Veterinary Office, 2016

In addition, the DVO confirmed that the East Cost Fever (ECF) immunisation under Smallholder Livestock Investment Project (SLIP) immunised 13, 315 calves against corridor disease in 2015. To achieve resilience against diseases, the District had also been the beneficiary of avian influenza and a total number of 4,732 calves were immunised in 2009. Furthermore, the DVO 01 indicated that more than 39,901 were vaccinated against BQ, 38,458 against HS, 7,980 against ECF, and 276,248 against FMD. In addition, 26,490 cattle were dewormed while 318,746 households were involved in dipping and spraying throughout 2016. In 2006, the District was given 800 heifers for restocking and more than 500 households benefited although this number was small considering the number of cattle lost to diseases such as corridor. Apart from cattle, other forms of livestock were promoted by Heifer International (HI) which gave out 600 goats in 2009. However, the DVO noted that the district recorded a decline in donkeys from 657 in 2015 to 536 in 2016. This decline of 121 donkeys was attributed to the Chinese buyers who provided a market for donkeys.

> "*...they came here, the Chinese, and I sold two notorious male donkeys that took refuge in another village. Infact, I did not know where to take them but these Chinese buyers came from nowhere and bought them at K600 each...*," explained one pastoralist in Baambwe.

Further analysis of data from the DVO revealed that, as a result of cattle restocking and vaccination programmes, there had been a significant increase in the number of cattle in the district. For example, Maala had the highest number of cattle in the district in all years followed by Baambwe. Thus, an increase in cattle in Namwala District as a whole was as a result of disease control measures undertaken by the DVO and management initiatives by pastoralists amidst climate variability and change - believed to have brought strange diseases and pests. Figure 5.15 shows the spatial distribution of population in cattle in the district. Better treatment, dipping and vaccination mechanisms led to higher disease control measures and subsequent increase in cattle. An increase in cattle meant improved livelihoods and resilience among pastoralists despite having nine out of twelve manned veterinary camps. Note from Figure 5.15 that a higher proportion of cattle were concentrated near and along the edges of the Kafue Flats where resilience to climate variability was higher than areas such as Muchila chiefdom, which is further from the floodplain.

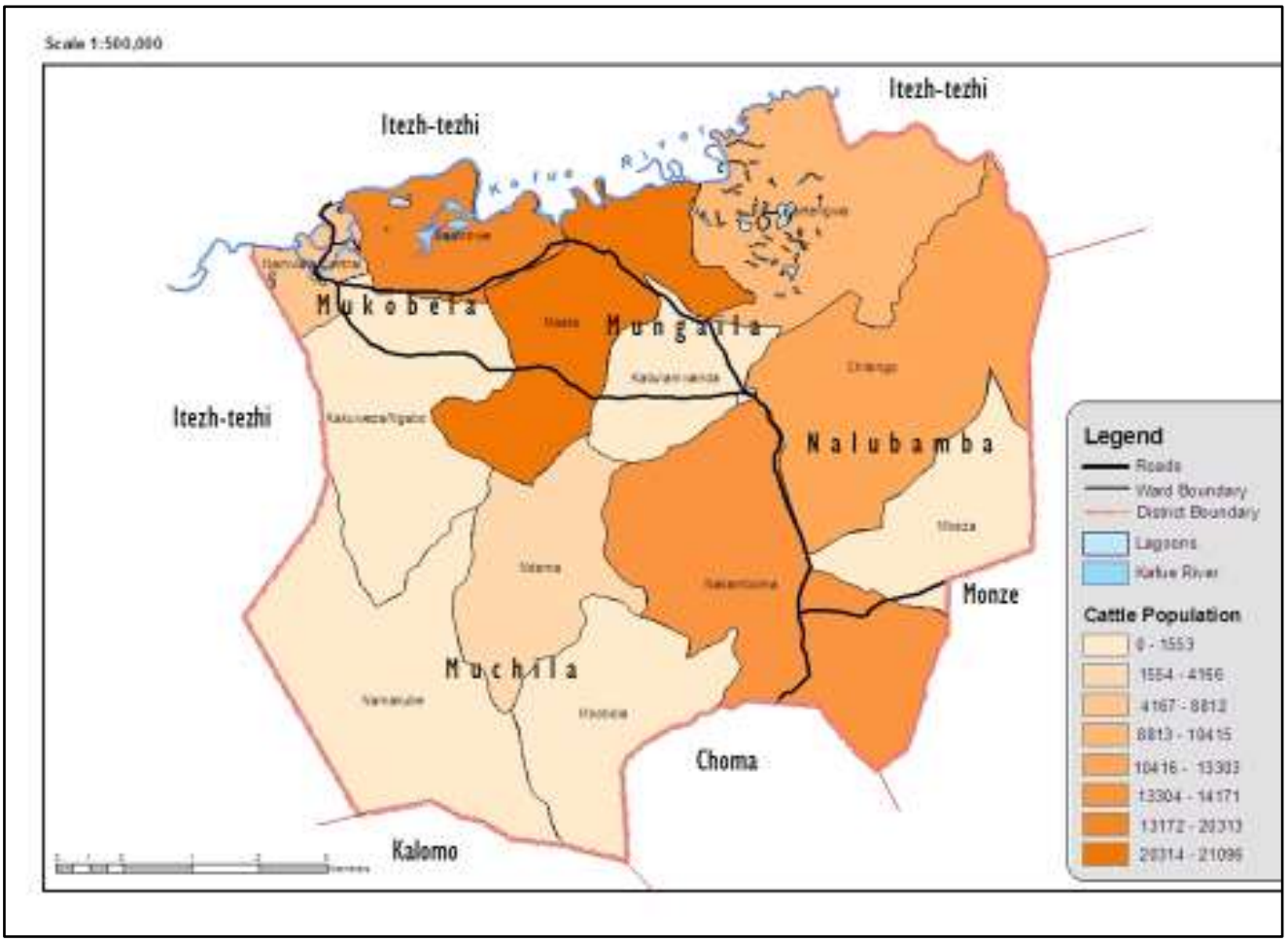

Figure 5.15: Spatial distribution of cattle in Namwala District

Source: Field data, 2017

5.5 Effects of the Kafue river regulation on pastoral land use

This sub-topic addresses the third objective. The daily lives and livelihoods of an estimated 500 million people worldwide are affected by the alteration of river flows downstream of large dams. The fishing, farming and cattle grazing typologies that characterize Namwala are dependent on a rich ecosystem nourished by the seasonal flood cycles of the Kafue River. However, the flooding patterns of the Kafue Flats have significantly been altered by the Itezhi-tezhi Dam (constructed in 1978) which regulates water flow for the downstream Kafue Gorge Dam (constructed in 1972). Seasonal flooding was often unpredictable and flood-dependent livelihoods are threatened. This section expands the discourse about dam management, environmental river flows, and the consequences of hydropower projects on water and grazing patterns.

The Kafue Flats is the second biggest flood plain in Zambia after the Barotse flood plains, extending for about 353km long and covering an area of 6,500 km^2, comprising the Kafue main river channel, lagoons and swampy areas. For most of this river reach, the Kafue meanders through a large flat grassland flood plain, with a minimum elevation of 1,065 meters and the height difference between Itezhi-tezhi dam and Kafue Gorge being only 15 m over a distance of 353km (Figure 5.16). The Kafue Flats is a very critical sub-basin as it supports economic activities of the country such as hydropower generation, and livestock. However, with the passage of time, the livestock sector has been performing badly with fluctuating water levels and grass availability.

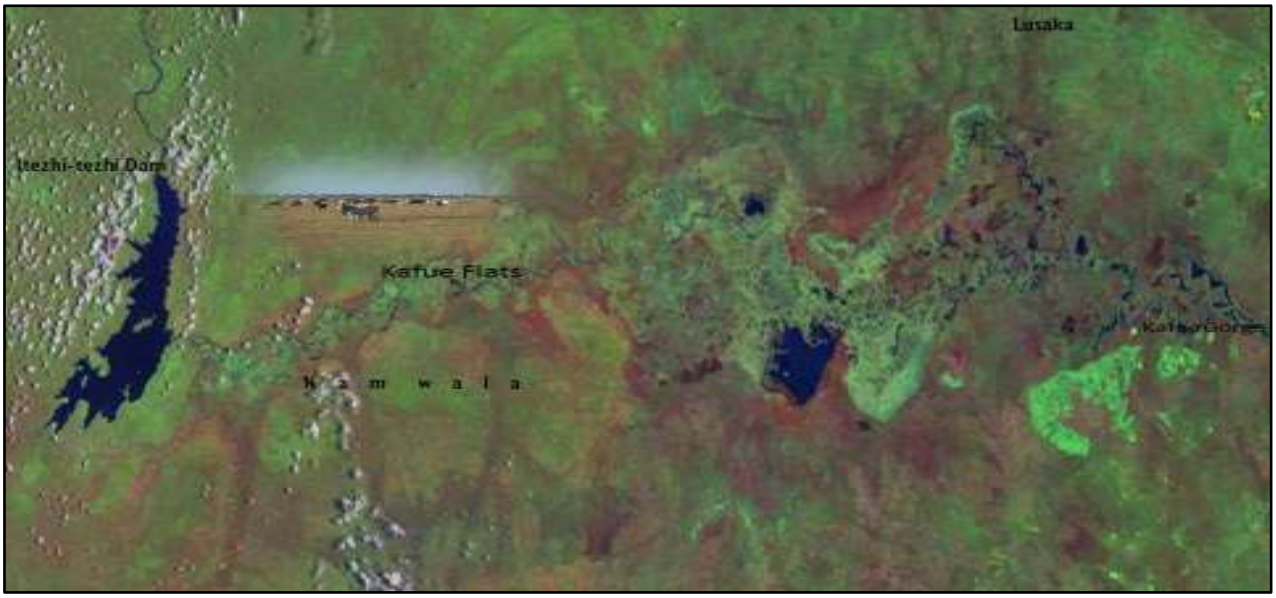

Figure 5.16: Satellite image of the Kafue Flats

Source: Adapted and modified from Casarotto (2013)

In this study, *flood* was defined as a high hydrologic extreme resulting from natural or human activities that disturb the hydrological cycle over a period of time resulting into excessive occurrence of water. *Flow* relates to the natural Kafue River downward movement from upstream ITT dam to the downstream Kafue Gorge dam. *Flux* is the condition of continuous change resulting from anthropogenic and man-made change on the quantity of water discharged from the ITT reservoir. In order to understand the Kafue River alterations with respect to the flooding, flow and flux of the Kafue River, the researcher travelled to ZESCO's Itezhi-tezhi dam to understand the dam's operation rules which had resulted into changes in flooding, flow and flux of the river.

5.5.1 Itezhi-tezhi and Kafue Gorge operation rules and their implication on water flow

The key informant 11 noted that the operations of the ITT and Kafue Gorge dams had evolved with time through three sets of rules. These are: (i) Swedish Engineering Consultants (SWECO) Rules; (ii) Southern African Development Community (SADC) Rules; and (iii) Integrated Operating Rules. The first sets of Rules were designed by SWECO and were in operation from 1977 to 1994. Explaining this, a key informant noted that a provision was required for a minimum release of 55 cumecs and a freshet release of 300 cumecs every March from ITT dam. The second set of rules came as a result of the severe drought of the 1991/92 season and they were in effect from 1994 to 2004. Shawinigan Engineering under the SADC project developed the Lower Rule Curves for the two reservoirs. These were to act as a safeguard for hydropower production from severe drought and for dam safety from severe floods coming from upstream **(**Figure 5.17).

Results showed that all these rules aimed at improving the timing of the release of excess water from ITT dam for flooding and increasing the recession area during the dry season by drawing down the Kafue Gorge dam in addition to meeting ecological requirements for the ITT and Kafue Gorge dam "flatline" river flow differences. Yet another key informant added that ZESCO's water rights on the Kafue River land never changed since it was originally obtained despite the evolution of the operation rules. Results show that improving dam operation rules in order to mimic the natural flooding pattern was important. A freshet that mimics the natural rising and declining curve was found to be best suited to hydropower generation against ecological requirements and pastoralism. It was observed that rainfall to a larger extent influenced the timing of the freshet release. In a wet year the freshet could start in January or February, in an average year the freshet could start in February or March and in a dry year the freshet could only start in March. Freshet is

a process of water release to meet the environmental requirement for flooding, flow, flux and recession of the Kafue Flats **(**Figure 5.17).

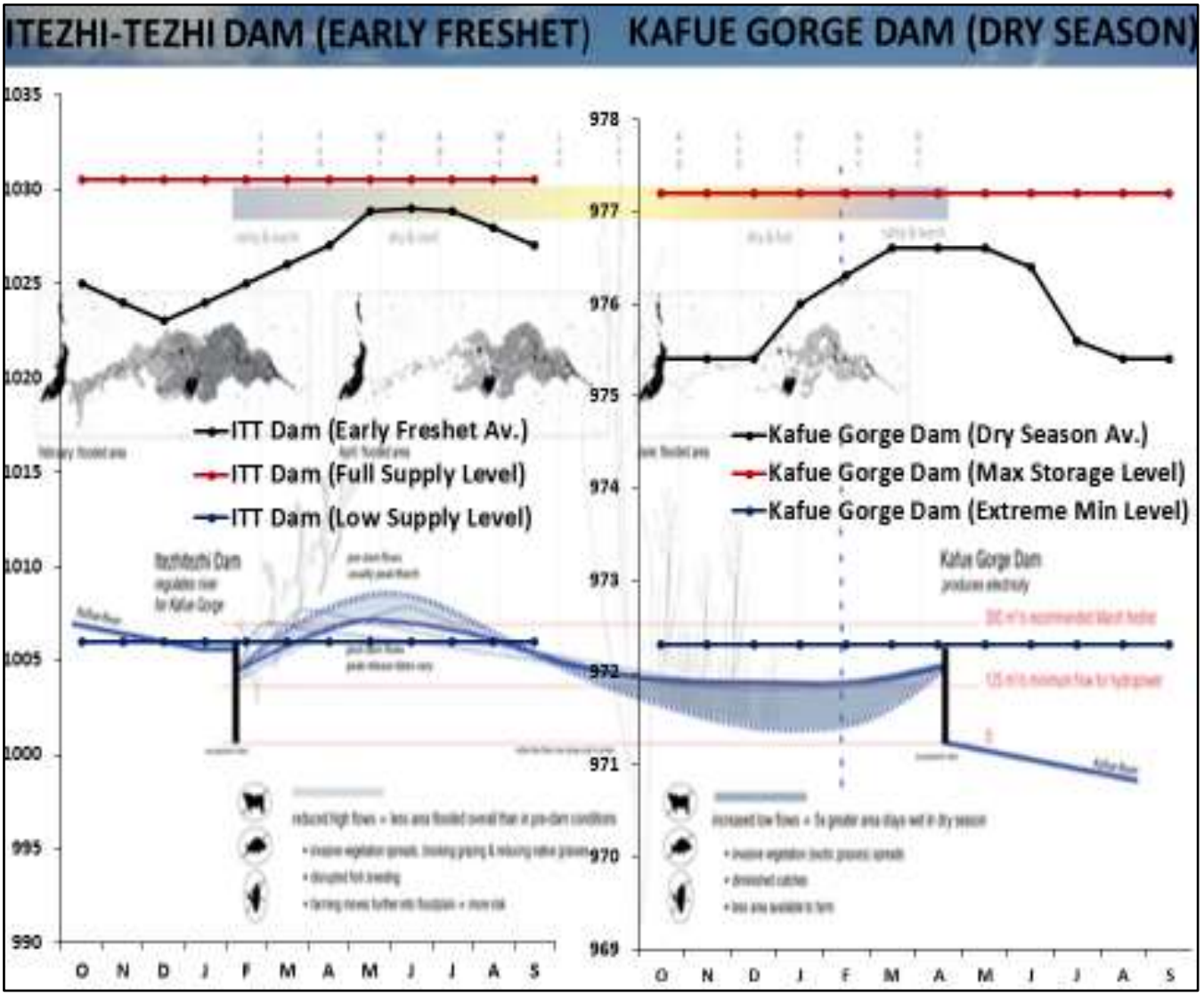

Figure 5.17: Itezhi-tezhi and Kafue Gorge dam "flatlines" of the Kafue River flow

Source: ITT dam - ZESCO, 2017

Emphasising on changes in flow and flux, key informants noted that records still showed that there was usually a delay in releasing of seasonal flood water from ITT reservoir and Kafue Gorge for much of the year (Figure 5.18). Respondents attributed this to the fact that there was still no full coverage of data collection on rainfall, water levels and discharge; therefore, it was not possible to arrive at an effective assessment of the actual hydraulic and hydrological situation throughout the Kafue Flats. Thus, it was concluded that this led to reservoirs being operated on the safe side in terms of hydropower production only, neglecting other sectors.

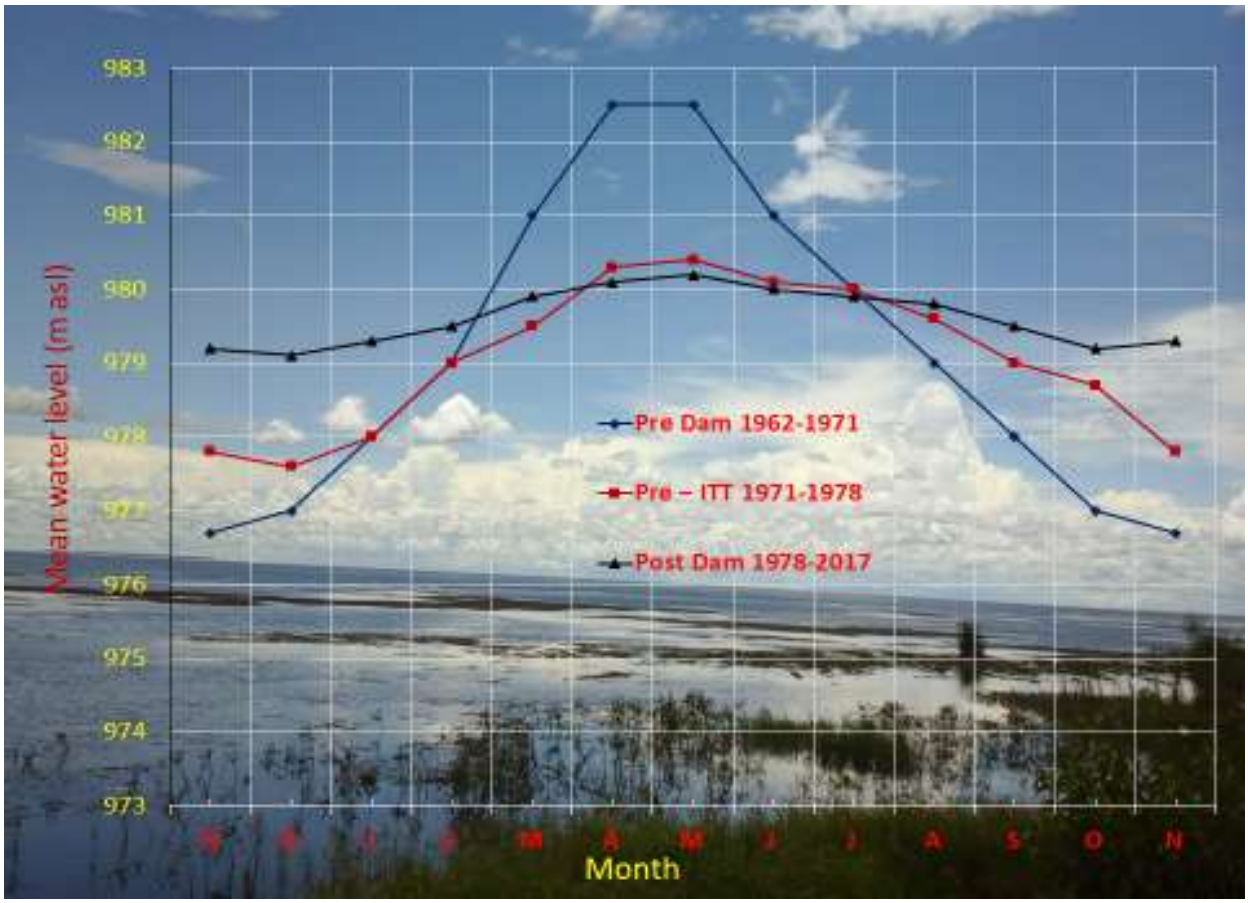

Figure 5.18: Mean hydrograph at Namwala gauging station for pre-dam and post dams

Source: Field data, 2017

A critical examination from key informants suggested that, irrespective of the above rules and regulations, the flow regime of the Kafue River at ITT directly affected and altered the timing and extent of the seasonal flooding in the Kafue Flats downstream, thereby affecting pastoralist's transhumance practice. In addition, key informants at Namwala Water Resources Department observed that alterations included lower maximum and higher minimum water levels (Figure 5.18), and hence a reduced seasonal amplitude throughout the year (from 5 meters pre-dam to 1.3 meters post-dam). As a consequence, seasonally flooded areas in the floodplain had been reduced, while the permanently flooded as well as the permanently non-flooded areas were increased. They added that these changes in hydrological regime induced vegetation shifts, as different vegetation types were strongly linked to the prevailing hydrological regime of the Kafue River. They further gave an example, at Namwala Pontoon, where the river usually remained above 6.7m level from 56 to 190 days. The flood, however, rose more rapidly than it fell. The mean rate of rise was 0.04m/day and the mean rate of fall was established to be 0.02m/day.

5.5.2 Reduction in the available surface area for grazing

Reduction in the available surface area for grazing lands was cited as an immediate effect of altered Kafue River flow. Respondents were asked to state their views about altered Kafue River flow and how it had disrupted grazing patterns. The findings in Table 5.12 show that there were growing concerns among pastoralists that climate variability and change were happening and was continuously affecting their pastoral livelihoods through changes in grass and water availability. Results indicated that the Kafue hydroelectric dam development was not of local and ecological nature to include other economic activities that could grow based on its development. Respondents stated that both Kafue Gorge and Itezhi-tezhi schemes were purely for such development for generating electricity. They did not address local needs such as cropping and grass availability.

Table 5.12: Disrupted grazing patterns: General views of altered Kafue River flow

Statement	5	4	3	2	1	Score	Score as % of the max
Reduction in the available surface area for grazing	99	18	3	0	0	576	96
Changes in flooding, flow and flux of the Kafue River	92	22	6	0	0	566	94
Impact of Kafue River regulation on ecotone ecosystem typologies	88	20	12	0	0	556	93
Lack of rainy season flooding	84	24	10	2	0	550	92
Increased dry season flooding	71	34	12	3	0	533	89
Reduction in floodplain grasses	2	63	19	13	23	368	61
Decrease in water and drying of streams and lagoons	8	10	46	34	22	256	51
Conflicts in the management of pastures	5	3	22	58	32	251	42
Reduction in arable land	6	6	2	53	53	219	37
Deaths of the livestock	7	4	3	45	61	211	35
Increase in cattle diseases	5	5	9	33	68	206	34
Declining and loss of wetlands	3	6	7	31	73	195	33
Floods seem to be more frequent	0	0	8	19	93	155	26
Loss of human lives	0	2	1	3	114	131	22
Itezhi-tezhi dam flood, flow and flux is normal	0	0	0	0	120	120	20

Source: Field data, 2017

Note: Strongly agree = 5; Agree = 4; Not sure = 3; Disagree = 2; Strongly disagree = 1
N = 120
*Maximum score (120*5) = 600* *Scores as % were determined by specific score/maximum score* x *100*

For the Ila, the main activity and source of identity has always been cattle herding. They developed transhumance system that was adapted to the seasonal changes in the ecosystem of the

Kafue Flats. A total of 99 and 18 respondents strongly agreed and agreed respectively that there was a reduction in the available surface area for grazing. In general, DVO 01 outlined that the vegetation in the Kafue Flats was largely composed of *Vossia cuspidata, Leersia hexandra, Oryza barthi, Cyperus esculentus, Eleocharis fistulosa,* and *Acroceras macrum*. He added that abandoned water channels, lagoons and oxbow lakes were commonly covered by *Aegchynomene fluitans peter, Nyamphaea capensis* and *Nymphoides indica*, but sedges such as *Cyperus papyrus* and *Typha capensis Rohrb* were frequent. However, the common plant species on levees, banks and sand bars were *Phragmites mauritanus, Echinochloa stagnina, Echinochloa pyramidalis, Sacciolepis Panicum africana, Vossia cuspidate, Oryza barthi, Leersia denudate, Acroceras macrum, Panicum repens, Paspalum commersonii* and *Sorghum verticilliflorum* in association with *Hyphaen ventricosa. Piliostigma thonningii, Lonchocarpus capassa* dominated the upland. Pastures covered nearly 4000 Km^2 but their quality varied with topography within the flood plain.

Pastoralists indicated that a good pasture refers to a grazing area with;

a) Good palatable and nutritive grass/plant species
b) Accessible to grazing for a very long period of the year
c) Has a highly productive and high biomass

Further analysis of grasses in the Kafue Flats showed a high productivity values and biomass production of the flood plain grasses for cattle husbandry. Explaining this, one key informant noted that the standing biomass of these grasses may go to 1,747.6g/m^2 and was highest from January to April depending on the amount of available moisture. Plant species such as *Setaria sp, Brachiaria sp,* and *Hyperrhenia sp* were available for grazing during the onset of the rainy season. Further, these grasses had drastically changed due to changes in the hydrological regime caused by climate variability, burning and general changes in wetland geo-morphology. For this, 53 percent (n=63) pastoralists agreed that *Brachiaria sp (nankokwe)* and *Oryza barthii* (Figure 5.19) were identified as the most nutritious grasses at the onset of the rainy season, covering wider areas.

> "*..kalya kezu kasubila u nankokwe shalya kale yatanga ati kwamana shaina - meaning the red grass (Oryza barthii) and Brachiaria sp (nankokwe) were responsible for sudden weight gain at the onset of rainy season. During the dry season, cattle heavily rely on Hyperrhenia sp (locally known as masale) found in lagoons, tributatries and water reaches. Several grasses and vegetation have changed in the floodplain. We have observed that some plant and grass species, which were historically growing above the high flood line shifted to lower elevations. We have also seen that permanent flooding now support submerged mats of aquatic vegetation where floodplain grasses had been growing before ITT dam operations..,*" observed Chief X.

Figure 5.19: Cattle browsing on *Oryza barthii* and *Brachiaria* during dry season
Source: Field data, 2017

A total of 63 respondents agreed that the carrying capacity of the Kafue Flats differed depending on the locality and general reduction in floodplain grasses. The carrying capacity averages about five (5) hectares per cow. McLean (1961) calculated the number of hectares of different types of available land for grazing (before the construction of the ITT dam) per animal in Namwala District in 1961 and 1969. Table 5.13 provides the summary with current approximations of carrying capacity of the Kafue Flats (with an area of 2145km^2 in Namwala District) while comparing with cattle numbers presented in Figure 5.1. Before and after the construction of Kafue Gorge and ITT dams in 1961 and 1975, the carrying capacity was found to be higher at 5.2, 0.8 and 3.6 and reduced to 3.62, 0.5 and 2.4 hectares per cow in the Flats, lagoons and dry land respectively.

The results revealed that the construction of the ITT dam in 1972 altered the flooding, flow and flux of the Kafue River with increased dry season flooding and reduced rainy season flooding thereby reducing area available for grazing per cow. Compounded by droughts and increase in cattle numbers (standing at 150,072 in 2017), ecological survey estimates showed that the hectarage per cow had continued to decline from 3.8, 2.6 to 1.9 and 3.7, 2.4 to 1.7 in 2015 and

2017 in the Flats, lagoons and dry land respectively (Table 5.13). This revealed that the Kafue Flats which depended on heavily regulated Kafue River, was prone to overgrazing in view of combined successive droughts and increase in cattle numbers.

Table 5.13: Hectares per animal from pre-dams to 2017 in the Kafue Flats

Type of grazing land and when used	Hectares per Animal								Observations by DVO 01
	1961	1969	1975	1985	1995	2005	2015	2017	
Flats (Jun/Aug to Nov/Dec)	5.2	3.84	3.62	3.45	3.02	4.56	3.88	3.73	Limited use due to droughts, irregular Kafue river flow and flux
Lagoon grazing (Aug to Dec)	0.8	0.6	0.5	2.3	0.4	2.8	2.6	2.4	Capable of carrying higher density as a result of increased incidences of dry season flooding
Dry land grazing (Dec/Jan)	3.6	2.6	2.4	2.9	1.9	2.1	1.9	1.7	Danger of overgrazing due to competition with agriculture and flooding in Kafue flats and fencing

Source: McLean (1961) and Field data, 2017

Results also show that grasses of the Kafue Flats were mainly wild rice (*Oryza Barthii*). Respondents stated that these grasses were usually coarse and covered with mud and silt after the receding flood waters. This made them very unpalatable to cattle. Other grasses, *Vossia Cuspidata* and *Echinochloa Stagnina* were found along the shores of the river branches and lagoons. Pastoralists also noted that these grasses remained green, nutritious and palatable throughout the dry season. They further observed that when the grass was sufficiently dry, the entire floodplain was burnt somewhere in August. The new growth was very nutritious to cattle although it normally came with first rains. They observed that this situation forced cattle to graze deep in lagoons, putting them at risk from crocodile attacks and *Fascioliasis* disease.

Respondents further noted that from March/April to July/August, they grazed their cattle along the margins of the floodplain and slowly on the entire flats area depending on receding water. They remained here until the rains begun in November/December. Pastoralists were of the view that from 2011 to 2015, they did not take their cattle to the upland due to lack of flooding. But in January 2017, cattle were moved at once due higher rising floods, which killed cattle as news about flooding was not heard by some pastoralists.

5.5.3 Disrupted livelihoods and changes in flooding, flow and flux of the Kafue River

Results in Table 5.12 shows that 92 (77%) and 22 (18%) respondents strongly agreed and agreed respectively that the current changes in flooding alterations had negative effects on grazing. Timeline and seasonal calendars revealed that several flooding situations affected inundated

grazing areas and settlements along the Kafue River. Pastoralists observed that the effects of the 1994 floods were compounded by the fact that the district had not yet recovered from the preceding 1991, 1992 and 1993 droughts. They noted that Namwala also experienced floods in 2000/01, 2005/2006, 2007/2008 and 2009/2010 rainy seasons. In Namwala, the cattle economy was linked to flooding which had positive impact of provision of sufficient grazing grounds throughout the year, despite frequent droughts. The herding of cattle therefore followed the pattern of flooding and recession of flood waters. The flooding and recession of floods also allowed the local people to practice recession agriculture allowing them to grow more than one crop in a year due to availability of residue soil moisture. However altered flooding was generally viewed as destructive to their agricultural activities with cyclical floods and drought situations (Figure 5.20).

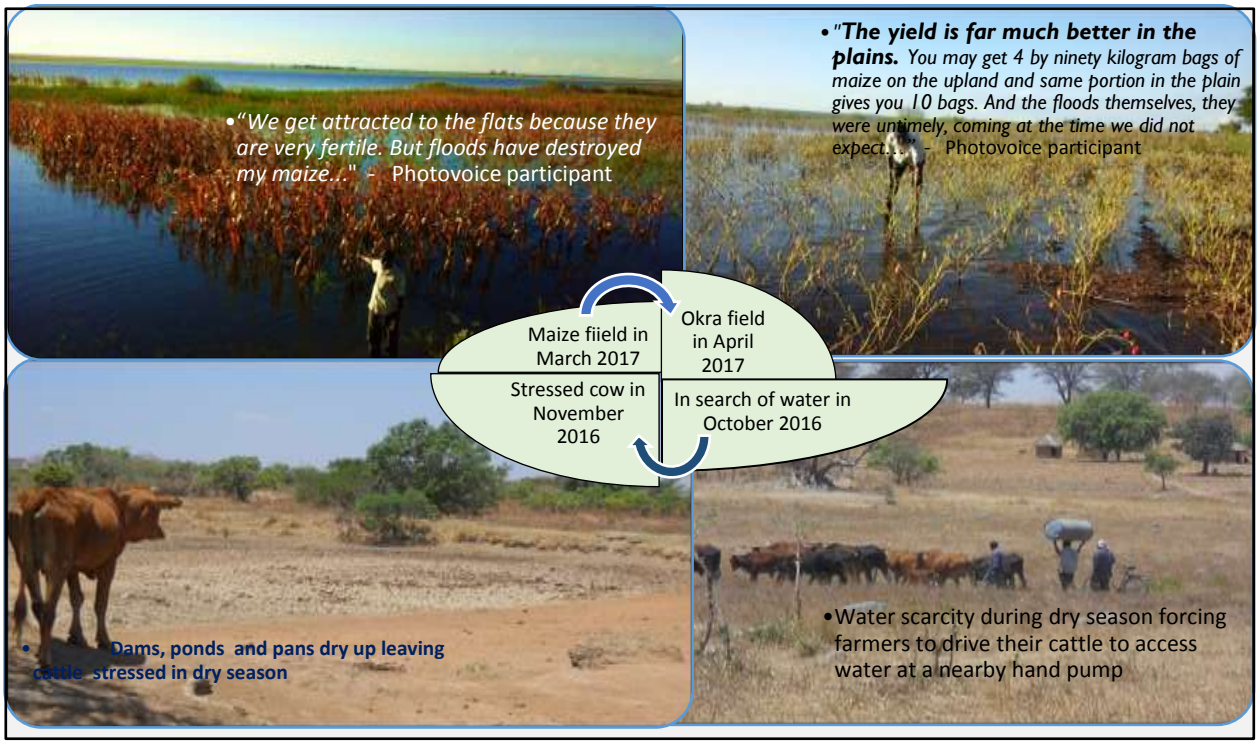

Figure 5.20: Livelihoods in flux: Cyclical floods and drought in Namwala

Source: Field data, 2017

A lesser number of respondents (n=6) strongly agreed and asserted that their crops were sometimes washed away by fast flowing flood waters. They pointed out that the negative effects of floods affected premature crops and grazing grounds. Maize, potatoes, '*golden eggs*' (*solanum melongena*) and cassava crops ended up rotting. They further noted that even okra, which was water tolerant, was destroyed if it was submerged for more than one week (Figure 5.20). An extract

from one photovoice participant turned seasonal gardener, found at his garden during an ecological survey near Namwala embankment at the height of 2017 floods had this to say:

> *"…the yield is far much better in the floodplain. You may get four by ninety kilograms bags of maize on the upland and the same portion in the plain gives you ten bags but floods usually come at the time we do not expect and destroy our crops...*"

Photovoice about variability and adaptation among pastoralists revealed tangible experiences of living in a dynamic environment, revealing not only reliance on the seasonal productivity of the Kafue Flats but also concern at the unpredictability of dam releases and rainfall, which created real consequences for pastoralists' new sources of livelihoods such as gardening. Despite these ecological 'upheavals', photovoice results showed that pastoralists had adapted their livelihoods to the changing seasons, climatic patterns and dam operations. However, uncertainty of rainfall inflows and dam operations continued to affect pastoralists every year as a result of altered flood, flow and flux timings that varied widely from year to year.

> "*…the timing is disastrous as these people who operate the Itezhi-tezhi dam do not care about our cattle. These floods bring untold misery in dry season as our cattle have nowhere to graze*," explained one pastoralist in Kantengwa in Maala Chiefdom.

Results further illustrated that the flood plain and upland influenced the flux of activities with respect to seasonality (flooded and dry). For this, majority respondents (94%) asserted their knowledge about the floodplain cycles and resources, recalling and enriching their own and their neighbours' understanding of the value of *ibanda*. By understanding the Kafue Flats as a rich cultural landscape in which cattle husbandry was closely intertwined with a specific season, respondents illustrated seasonal calendars and timeline of the Kafue floodplain changes in different seasons and how this influenced activities related to cattle rearing, crop production and fishing (Figure 5.21).

Figure 5.21 shows a pictorial environmental seasonal calendar of the Kafue Flats, as illustrated by pastoralists. It was based on their transhumance observation with seasonality. Note that seasonal flux was productive. The farming and cattle grazing livelihoods that characterize the Ila people were dependent on a rich ecosystem nourished by the seasonal rise and flow of the river. However, untimely seasonal release of water at Itezhi-tezhi Dam and storage at Kafue Gorge Dam had affected herdsmen who grazed their cattle in the Kafue flood plain. Thus, pastoralists across all zones shared assertions that natural water sources from the Kafue Flats were part of their key

social-ecological typologies, as it determined the transhumant, seasonal movements and livestock management strategies. The ability of complex social-ecological typologies to withstand changes partly depended on diversity that supports creativity and adaptive capacity. Environmental education increased diversity and capacity among pastoralists to overcome disturbance, learn and change. For pastoralists, it was more important to consider weather variability and climatic variations before thinking about management of the pasture and water as key aspects in managing the CPRs. They pointed out that all these adversaries came as a result of the construction of Kafue Gorge Dam in 1972 and ITT Dam in 1978 which altered the flow regime and extent of flooding within the Kafue Flats with varying rules. As a result of flow regulation, a number of hydrological changes had taken place in the Kafue Flats affecting both grass and water availability.

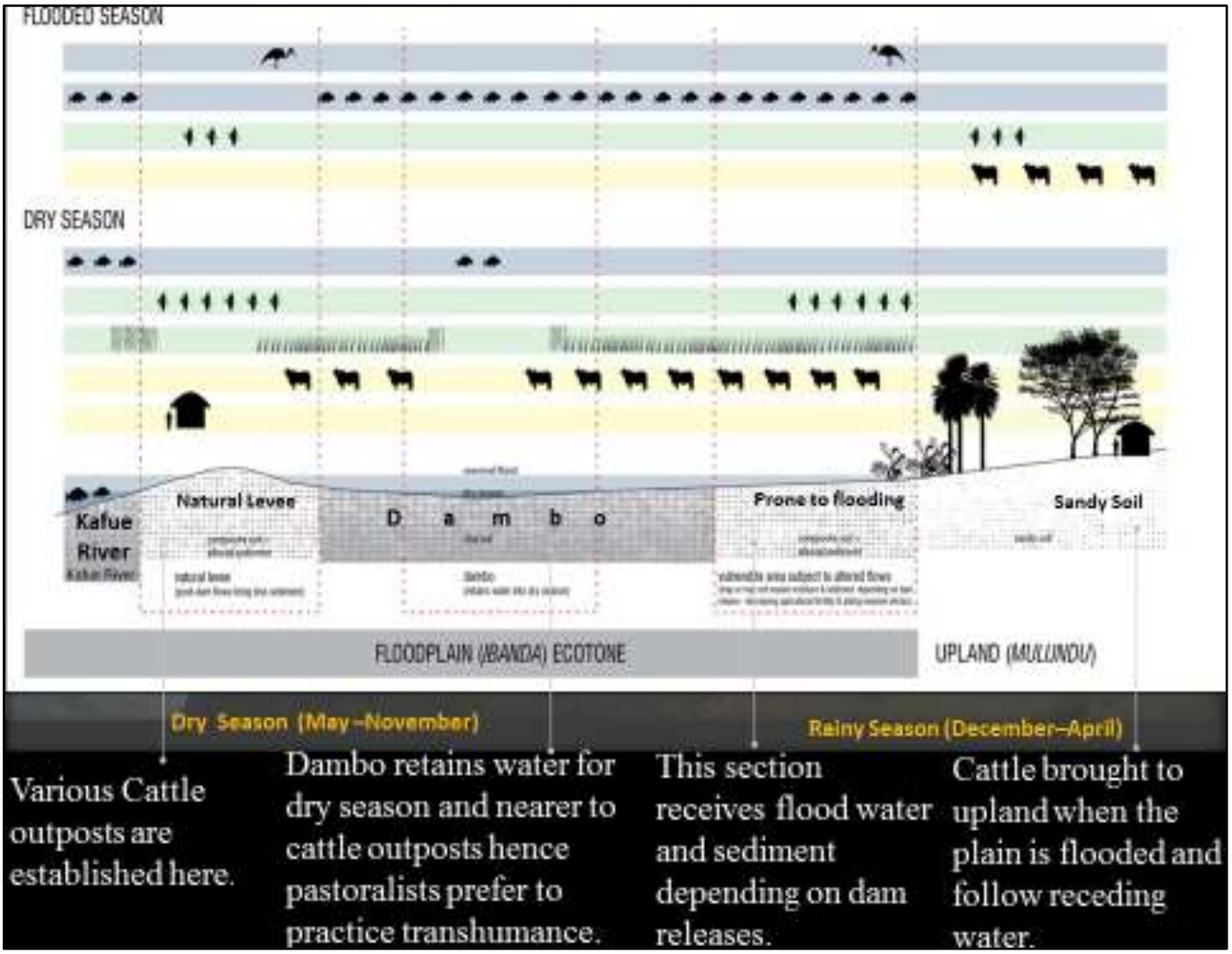

Figure 5.21: Pictorial seasonal calendar showing rich ecotones nourished by flooding

Source: Field data, 2017

5.5.4 Lack of rainy season flooding

Results showed that 84 (70%) and 24 (20%) respondents strongly agreed and agreed respectively to the statement of lack of rainy season flooding as another effect of altered natural flow of the Kafue River. They observed that the normal annual flooding in the Kafue flats started in December and ended in May with peak period between February and April. Pastoralists were of the view that flooding related closely to the condition of river flows. The average annual flooding in the period before the dam was constructed at Itezhi-tezhi was much higher than the flooding as a result of the operating rules by ZESCO. For this, a key respondent at ITT dam stated that there was a difference of about 35 percent, which means that 25 percent of the Kafue Flats did not flood any more, or 1625 km^2 of land remained unflooded. From different accounts among pastoralists, they observed that lack of rainy season flooding had been one of the major problems in the Kafue Flats. Under the flood plain conditions, a flood plain was required to be flooded at least for some time during the flooding period (Welcomme, 1979). This condition was important for the flood plain ecology for fish, wildlife and vegetation and flood recession for cropping and livestock grazing. The DVO 01 observed that this condition had promoted the growth of woody weeds in the area where flooding did not occur. He added that due to vegetation changes (immigration of an Australian weed called *Mimosa pigra*), the endemic Kafue lechwe (*Kobus Lechwe Kafuensis*) and Zebras (*Equus bruchelli*) left the Kafue National and Lochnivar parks and grazed on CPR pasture. This created competition between cattle and wildlife and consequently led to a decline in grazing land for cattle, in addition to cross-infection of diseases.

5.5.5 Increased dry season flooding

Increased dry season flooding was another effect of regulated Kafue River at ITT dam. Seventy one (n=71; 59%) and 34 (28%) respondents strongly agreed and agreed respectively that dry season flooding intermittently occurred mainly between July and November. This was as a result of the operating rules at Itezhi-tezhi which allowed a flow of 300 m^3 per second to feed the lower dam at the Kafue Gorge. Results revealed that during dry season, the upland *hyparrhenia* grasses were palatable when young, but became coarse and less nutritious as they ripen. This resulted into cattle losing condition. There was no forage for off-season consumption other than stalks available after harvesting on the upland. It was not until about April that the rainy season stopped. After this time the floods begun to recede and cattle begun to follow the receding floods to the Flats. Pastoralists asserted that before the construction of ITT dam, water flow was generally confined to

the main channel and lagoons, and operated according to the flood plain conditions. Hence, it was also required that the flood plain dried up during the dry season (Welcomme, 1979). However, respondents observed that this did not occur any longer in the Kafue Flats due to ZESCO's operating rules. As a result, a larger part of the land (75 percent) was covered with the dry season flooding, rendering nearly 5000 km^2 of grazing land lost to floods during the dry season. Pastoralists observed that the dry season flooding had been the most critical as cattle were expected to be in the Kafue Flats during this time of the year.

One pastoralist from Maala had this to say:

> "*…the Kafue flats water regime has changed and the floodplain does not dry up as it used to be particularly between July and October. This has reduced the area for grazing as we have been using ibanda as an 'oasis' for during dry season grazing and watering..."*

5.5.6 Conflicts in the management of pastures

Results indicated that 42 percent of the pastoralists attributed that the altered Kafue River flooding flow and flux had led to conflicts in the available surface area for grazing. Pastoralists asserted that floods destroyed grazing land, reduced grazing areas and forced livestock to move to higher grounds. Once flooding occurred, cattle were moved to the upland where it was reported that overgrazing occurs in the available land which had been further reduced by fencing. This increased conflicts and food insecurity was exacerbated due to cattle 'feasting' on maize stock of unfenced fields. Respondents also lamented that those that risked their cattle to graze in the floods usually had their cattle stuck in the mud, leading to high mortality rate for weak and young animals. A closer look at results showed that pasture areas diminished due to man-made ecological changes at ITT dam, in addition to less amount of rainfall the study area had been receiving.

An extract from a key informant outlined a brief pasture conflict in Nalubamba chiefdom:

> "*…the main line of conflict broke out during the period of food crises in Mbeza in 2002. In order to mitigate the food crisis, Chief Nalubamba reintroduced the idea of an irrigation project in Mbeza territory that he had already proposed earlier without success by foreign developers. On 3,600 hectares of land, rice, wheat and other crops were to be grown in the pasture area of Kafue Flats and water from Kafue River. The project could have benefited 3,500 households. However, there was very strong opposition against the irrigation project by pastoralists during the consultative meeting. If this project was allowed, they argued, they could have lost access to the flats to graze their cattle. They stated that they could have remained with smaller portions of the flat's pasture, which was already reduced by altered Kafue River flow and fencing in the flats and upland respectively…"*

5.5.7 Reduction in arable land

Reduction in arable land was another effect cited by pastoralists as a result of altered flow of the Kafue River. According to Trapnell and Clothier (1996), the soils of the Kafue Flats were alluvial in nature and of sedimentary origin. They were very heavy-cracking clays, sticky when wet and hard, cloddy when dry. The heavy-cracking soils were difficult to cultivate except with special skill, care and timing according to their condition. Workability was a severe problem due to heavy top soils, which tended to be slippery in the wet season. In addition, pastoralists (37%) pointed out that water released from the ITT dam affected riverbank and floodplain crop cultivation. A key informant pointed out that the flood plain soils were also ideal for rice cultivation, provided a system of bunded fields and organized supply and drainage of irrigation water were made. He further noted that receding floodwaters left silt sediments that supported a wide variety of crops and grass. In few flood years, an increase in the recurrence of above normal rainfall conditions was recorded and this resulted into rising of the groundwater table in the flood plains. Pastoralists observed that this created conditions for flooding when peak flow releases were made from ITT dam. This often led to inundation of crops cultivated in the flood plains and grazing grounds.

In 2008, respondents noted that flooding took place in February which was in the middle of the growing season and therefore most crops were not yet mature. Furthermore, in 2010, flooding occurred towards the end of the growing season when most crops were already fully mature. Results showed that in 2017, pastoralists reported that floods caused extensive damage to their crops, especially those who entirely grew crops in the wetland areas of Mungaila Chiefdom. They noted that floods submerged fields which led to crop damage. Crops such as maize were either submerged or washed away by fast flowing floodwaters while tuber crops such as potatoes ended up rotting (Figure 5.21). From many first hand accounts, food security seemed to be a primary concern among respondents. However, pastoralists continued to risk it all by planting in the floodplain because yields were far better as alluvial soils supported crops particularly maize. Thus, the temporality of farming livelihoods dependent on seasonal flooding was both a productive asset and vulnerability.

5.5.8 Increase in cattle diseases related to Kafue River irregularities

Results showed that 34 percent of the respondents attributed an increase in cattle diseases to unstable Kafue River flooding, flow and climate variability. They observed and linked the Kafue

River flux to increased presence of ticks, as they were no longer washed away during floods on a yearly basis. Pastoralists asserted that most years in the district were characterized by late arrival of rains which usually came in late November or December. The persistent dry years were linked to various diseases such as corridor disease, which had attracted an annual cattle vaccination called *Chitongo vaccine*. Ticks were responsible for the spread of many cattle diseases as indicated by the DVO 02:

> "*The lack of flooding of the Kafue Flats has led to a build-up of ticks leading to high cattle mortality. This scenario, coupled with irregular dipping among pastoralists, when animals are in the Kafue Flats has led to high prevalence of tick-borne diseases.*"

From various accounts during this study, it was observed that 80 percent of the pastoralists who lost two thirds of their cattle between 1989 and 1993 due to corridor disease (also called east-coast fever, *Theilerosis parva*) partly attributed their loss to altered Kafue River flooding, flow and flux. One Chief recalled that:

> "*…corridor disease is transmitted by ticks, which were less common in the Kafue Flats before the construction of the Itezhi-tezhi dam because the ticks were drowned by the floods during the rainy season. After the ITT dam was built, there has been less flooding in the Flats especially in drier years. Due to less flooding, ticks do not get killed in the same manner as before 1978. Additionally, there are more trees now and less pasture in the floodplain than before the construction of the ITT dam…"*

The results further revealed that there were more flooding in the dry season due to untimely water releases. This led to a situation whereby the lagoons in the Flats had more water in the dry season now than before the dam was build. Respondents noted that in earlier times, cattle used to feed on the grass in shallow water and swamps that had healthy looking *hyperrhenia sp* (*masale*). But in recent years, in order to get access to *masale*, cattle stood deep in the water in dry season (Figure 5.19). However, water in most floodplain lagoons in the dry season was sometimes too deep and had less grass and therefore cattle fed on the higher grounds, where they were attacked by ticks and could not lose them in water. This was one of the indigenous explanations why corridor disease spread in the 1990s, and supported by DVO.

5.5.9 Other problems related to Kafue River regulation

Altered Kafue River flooding, flow and flux also brought more negative effects to downstream communities who depended on the Kafue Flats for their livelihoods than benefits. Thus, climate

variability and change, together with anthropogenic governance of the ITT, have resulted into differential flood, flow and flux related problems of the Kafue River among pastoralists. Pastoralists cited waterborne diseases, flood related plagues and human encounters with predators such as crocodiles and hippos. These were cited as other problems related to Kafue River alterations. For example, in the flood prone levees along the Kafue Flats such as *Chibunze* and *Kakuzu* in Mukobela chiefdom, *Chilala*, *Chitumbi* and *Busangu* areas in Mungaila chiefdom, one key informant observed that people were vulnerable to diseases associated with floods such as cholera, dysentery, malaria and bubonic plague which claimed fifteen lives in Chibunze in 2008. Further, timeline extract from respondents revealed that Namwala district had a major incidence of bubonic plague in 2008 due to rats that moved from the flooded areas to the residential areas during peak floods. Respondents were of the view that these diseases were less prevalent on the upland but attacked those on the levees in the Flats (Figure 5.22). In addition, pastoralists highlighted that heavy floods sometimes destroyed economic infrastructure such as roads and bridges; as the usual case whenever the district is in flood, was always completely cut off from Itezhi-tezhi district. Furthermore, respondents were concerned that despite new and old rehabilitated hydroelectric power generated at Itezhi-tezhi and Kafue Gorge power plants respectively, less than five (5) percent of households in Namwala had electricity, while 60% of Zambia's electricity went to Lusaka for residential and industrial use and the Copperbelt mines.

> "*…maybe people in urban centers can be proud because they get electricity but alterations of the Kafue River due to Itezhi-tezhi dam have brought misery here,*" complained one headman from Kawilizhi area in Mukobela Chiefdom.

5.6 Land tenure governance in the management of common property resources (CPR)

This sub-theme addresses the fourth objective; to examine land tenure governance in the utilisation and management of common property resources. The focus was on how pastoral/arable land was accessed, acquired, used, and contested by individuals and households. In this study, land tenure was defined as "the rights of individuals or groups over arable, grazing and residential land, how such rights are acquired, what they consist of, how they operate in the holding, transfer and inheritance of land and how they may be extinguished," (White, 1957, p.172). It refers to legal rules recognized and applied in any given country for the acquisition or allocation of land rights, substantive content of those rights, and their protection in the law, their disposal as well as their regulation. Tenure is a system of rights regulating the ownership or use of land.

Land tenure rights refer to the relationship of one person to another with respect to land resources. These rights motivate production effort. Rukuni (1998) highlighted that land tenure rights were becoming burning issues on top of the political agenda in every country. Land tenure also refers to basket of rights governing access to land with respect to:

1) User rights; which are rights to grow crops, graze, and make permanent improvements;
2) Transfer rights; which are rights to transfer land or use rights, i.e., rights to sell, give, mortgage, lease, rent or bequeath;
3) Exclusion and inclusion rights; which are rights by an individual, group or community to exclude others from the rights discussed above; and
4) Enforcement rights; which refer to the legal, institutional and administrative provisions to guarantee rights.

Thus, a tenurial system is constituted by these bundles of rights and duties a person has to acquire, to hold, to occupy and to use land and all its products subject to such regulation and limits as the state may impose in relation to planning, land use, conservation, disposal and transfer. In order to safeguard long-term, equitable and sustainable environmental management and governance, a clear and transparent relationship to land (whether an individual's, a community's, a government's or a private investor's) is essential. Sound environmental governance, which builds on equitable and sustainable management of CPRs (used in this study to refer to water and land), play a key role in supporting sustainable livelihoods and building pastoral resilience. For sound environmental governance of CPRs to persist in the longer term, a clear, fair, and protected relationship to land and water is needed. It is also important to consider the socio-ecological context influence on how livelihoods and the property regimes underpinning them have evolved. These regimes allow flexibility, negotiation and reciprocity in terms of who has access to land and water, when and where, which accommodates the uncertainty that comes with variability in climate. It is against this background that this study assessed land tenure governance in the management of CPRs among pastoralists by first focusing on methods of acquiring land.

5.6.1 Methods of acquiring land in Namwala

For the Ila people in Namwala, the term 'land' (*inshi*) means many things. It refers to the ground, rivers, trees, grasslands, forests, bush land and soils. Some people in Namwala also understood 'land' to mean 'the world' (*chishi*). Land was also looked upon as the means of life or livelihood

(*buponi*). To whom did land in Namwala belong? The local view to this question was that no one owned the land. Land belonged to the villagers as a group and the chief (*mwami*), village headman (*shibbuku*) or village elders (*bakando*) who represented the village communities and usufruction guaranteed land access and ownership. In Namwala, residence of an individual in a village confered usufruct rights to graze, cultivate and to exploit other natural resources within the village territory. Only accepted residents in the village (*bamukamwini chishi*) had the right to acquire land in the village territory. New comers (*beenzu*) accepted as village residents had to seek permission from the chiefs or headmen. In this way, the possibility of conflicts between land seekers and possible landholders was reduced. There were different methods of land acquisition (Table 5.14) in which villagers gained access to land. Access to land was based on the traditional principles that all residents in chiefdoms were entitled to land for their personal or household use. This meant that as far as virgin land was concerned, any member of the related community could select a site for grazing, homestead construction and crop fields within the village or chiefdom territory.

Table 5.14: Methods of acquiring land in Namwala

Land acquisition method	**Overall %**	**Mungaila (n=30)**		**Mukobela(n=30)**		**Muchila(n=30)**		**Nalubamba (n=30)**	
		Number	%	Number	%	Number	%	Number	%
Inheritance	62.5	19	63.3	18	60	23	76.7	15	50
Construct homestead	61.7	15	50	19	63.3	21	70	19	63.3
Showing vacant land	54.2	12	40	23	76.7	17	56.7	13	43.3
Gift of land	50.8	23	76.7	14	46.7	13	43.3	11	36.7
Allocate to strangers	47.5	9	30	8	26.7	21	70	19	63.3
Buying of land	30	11	36.7	12	40	7	23.3	6	20
Renting land	10.8	3	10	8	26.7	2	6.7	0	0
*Other	4.2	3	40	2	6.7	0	0	0	0

Source: Field data, 2017

NB: Others*: Loans and leasing and land obtained after wrangles and court order

Results show that 30 heads of households in each chiefdom (Mungaila, Mukobela, Muchila and Nalubamba) were asked to indicate how the land they were grazing and cultivating was acquired. Table 5.14 shows the results aggregate for the each chiefdom. The study revealed that land in Namwala was acquired in seven basic ways. These were inheritance and succession (*ukona*) with 63% (n=75); homesteads construction[2] (n=74; 61% - direct acquisition here meant a villager went out in the village territory bush and without the guidance or permission of the village headman or

[2] Chiefs, headmen and village elders assumed control of the power to allocate land within areas of their jurisdiction. Footpaths, streams, anthills and big trees are often used as general boundary marks (*inyinza*) of adjacent parcels of land, usually marking two chiefdoms or neighbours within the same cheifdom.

local chief, cleared land for cultivation. This method of land acquisition was associated with the relative abundance of land in Namwala). The other methods were showing of vacant land by headman (n=65; 54% - village headmen identified vacant pieces of land and granted permission where to graze, cultivate or build a homestead); and gift of land by a relative or friend (n=61; 51% - involved transfer of land rights by an individual to another without receiving any payment. Such transfers were usually between relatives (*bamukowa*), friends and in-laws living in the same village. The consideration in this case was mere goodwill between the person giving the gift of land and the recipient. Allocating land to strangers (n=57; 48%); buying of land (n=36; 30%); renting (n=13; 11%) and 'other' included reciprocals such as loaning and land obtained after wrangles and court orders (n=5; 4%). Except buying and renting of land, the chiefs and their headmen were heavily involved in 'other' methods of land acquisition.

5.6.2 Land tenure governance on the upland *(mulundu)* and role of Chiefs

In Namwala, Chiefs (*bami*) were introduced by the European colonialists in the whole area of the Ila and Tonga County in order to establish so called Native Authorities, who were collecting taxes and dealing with local conflict resolution at Native Authority Courts. At the next lower level there were the village headmen who were responsible for all communal activities and conflict resolutions. These structures remained after colonial times although the powers of the Chiefs were considerably limited after introducing government local courts. Locally, the Ila and Tonga Chiefs were still important and powerful, although their powers were always contested and challenged in allocating land on the upland.

Chiefs had to show that they were able to distribute resources and if they failed their political legitimacy was undermined. An Ila or Tonga Chief's power was not always as respected as it is with other ethnic groups in Zambia such as the Lozi. If a Chief decided on a matter, it was not automatic that all community members would accept his decisions. Power and access to water and land, for example, were embedded in religious believes. One Chief added that the Ila were traditionally monotheists but believed in the existence of spirits especially ancestors who gave them the right to give access to land, pasture and water resources. The ancestral spirits were very important for making rain and were worshipped at shrines (*malende*). Included in these rights were common property regimes regulating access to water and pasture in close vicinity. Chief X observed that:

> "*...traditionally, every male head of a household has usufruct right to land for his homestead, cultivation and grazing...*"

Results showed that control over these resources (land and water) were in the hands of headmen, who were giving not only access to their community but also reciprocal rights to resources for residential, cultivation and grazing for local people within and even for groups outside the neighbourhood territory (*chishi*), with the full knowledge of the chief (*mwami*). All headmen and women reported to the chief on all land allocations on the upland. Respondents were asked to rank the importance of land and related it to their socio-ecological and economic trends. Table 5.15 shows that land tenure regimes on the upland in Namwala had evolved around five themes in their order of importance.

Table 5.15: Local land tenure indicators

Land tenure typology	Frequency (n = 120)	Percentage (%)
LT markets and allocative efficiency	81	67.5
LT security and willingness to invest	73	60.8
LT and equity	63	52.5
LT and gender	23	19.2
LT and access to credit	15	12.5

Source: Field data, 2017 LT = Land tenure

5.6.2.1 Land tenure, land markets and allocative efficiency

Results show that 68 percent (n=81) of respondents observed high transaction costs and multiple ownership as a major problem in creating a conducive land market and allocative efficiency (Table 5.15). They noted that outright land sales had generally resulted into conflicts with multiple ownership and rules governing customary tenure systems. In Namwala, land is not regarded as just any commodity. To the extent that such were upheld, somehow customary tenure systems constrained the creation of a land market. It was observed that economic factors limited the creation of land market. To most pastoralists, it hardly made sense to sell their land.

> "*...we need our land to live from, graze our cattle and grow crops. A person who does not have chilawo (land) is nobody...*," explained one respondent from Mbeza.

Alternatives outside land husbandry did not simply exist. With droughts, floods and cattle diseases that decimated their cattle, the likelihood among pastoralists to sell land was high. Anyone could sell land using usufruct rights. Under normal circumstances, only those headmen and women with clan lineages could sell land with full knowledge of the chief. Thus, 81 respondents pointed out

that land was increasingly offered on the market, diminishing grazing areas especially in Ngabo that recorded deadly land conflicts as individuals came with different interests (Figure 5.22).

> "*…some rich people from urban areas are here; they have come to Namwala to get huge pieces of land especially along the Naminwe lagoon, from Ngabo to the flats, and from Namwala town to Kantengwa, all that area has immigrants. It seems our Kafue flats are attracting people from towns as the place is increasingly viewed as a place for retirement. It is land of choice and hope for people as there is no paper work involved and no unnecessary hustle of title deed procedure (although rich individuals obtain for their farms); and one does not have to be confined to one piece of land..,"* observed one pastoralist in Ngabo in Baambwe Chiefdom.

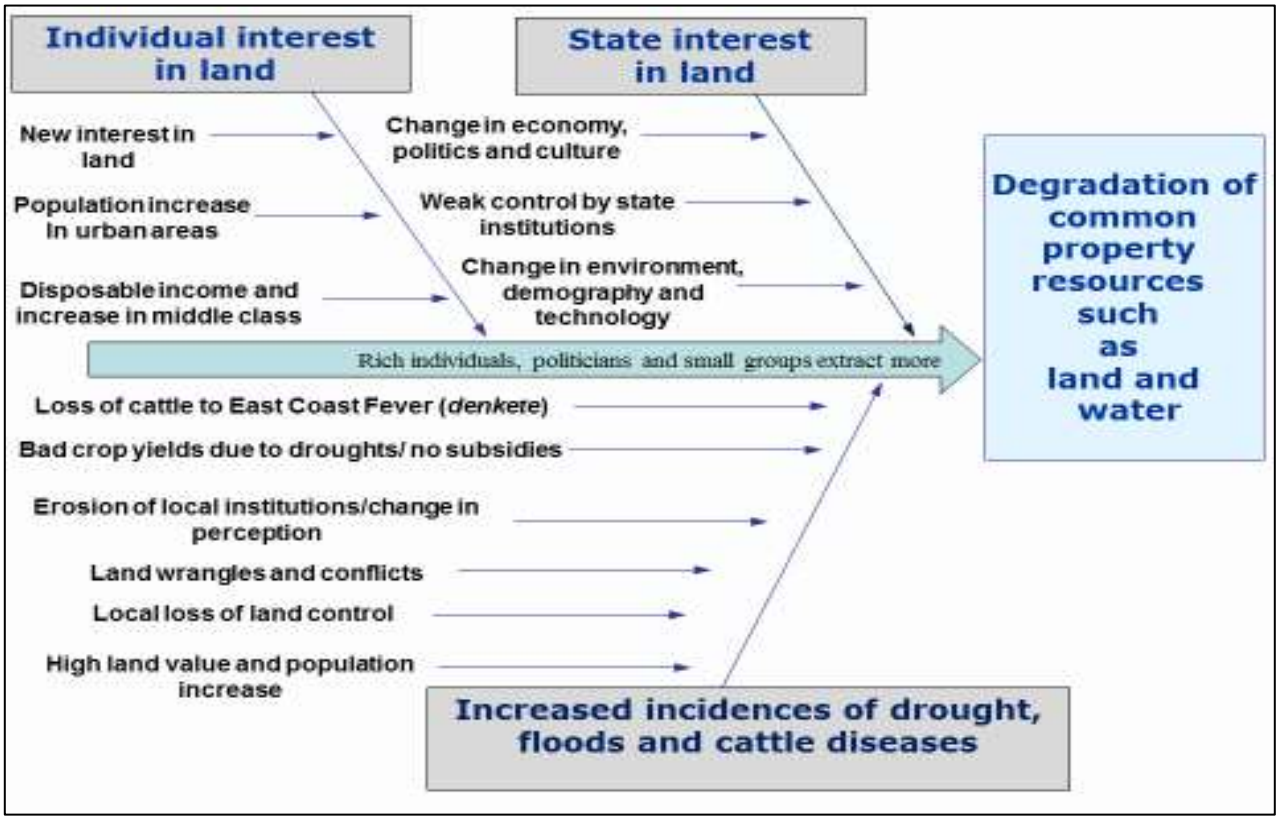

Figure 5.22: Individualisation and state interest in customary land amidst climate variability
Source: Field data, 2017

Several accounts from respondents confirmed that the chiefs, through their headmen were actively involved in selling huge pieces of land to outsiders who gave them '*bags*' of money. Closer observations pointed to the fact that individuals who purchased newly fenced areas had little farming knowledge with limited intentions of putting land to productive use. Thus, land was often bought for speculative purposes. When grass was exhausted in common grounds, they took their cattle inside the fenced areas. Therefore, this outplayed speculative to economic reasons in which land was primarily purchased as a reserve asset in case other options were closed. Further

observations established that land was bought to get access to credit, with money used outside the agriculture sector and outside the district. Respondents identified these buyers as politicians, civil servants, and rich pastoralists outside and a few very rich cattle owners within Namwala. For this, FGDs identified two forms of interest in customary land in view of increased incidences of drought, floods and cattle diseases as individual and state interest in land (Figure 5.22).

Results further showed that once the above categories of buyers gained access to land, the market often played a subordinate role. With superior information about how the 'system' worked, influence, personal contacts, capacity to bribe and manipulate, these buyers managed to outmanoeuvre less well placed poor pastoralists in a way which had little to do with the functioning of a market. Almost all farms belonging to rich pastoralists were fenced off excluding villagers from communal grazing land and water; as the case in Ngabo where several urban-based bourgeoisies demonstrated this.

5.6.2.1.1 ***Case study: Land wrangles and market in Ngabo - Mukobela chiefdom***

Ngabo area in chief Mukobela's chiefdom was *'shielding and brandishing'* with spears and deeply rooted in land conflicts. Increase in land market and value had spread to rural areas particularly Namwala which attracted people from outside and civil servants in particular to buy land for arable and pastoral purposes. It all started when the senior headman sold land on the either side of the main road in Ngabo (Figure 5.23). The 'urban based' former civil servant quickly fenced off the land with game wire leaving a narrow road in between. The senior headman sold approximately more than 600 hectares for K30, 000 cash, including four crop fields for his relatives whom he coerced with K1, 000 each. This amount was less considering the value of land at that time. As if this was not enough, the senior headman again sold part of the 'open' grazing area which harbours the biggest lagoon in the area; *mulonga wa Lwanfuli (Lwanfuli* lagoon*).* The named politician bought this piece of land and fenced part of the CPR. The community was totally excluded from their usufruct rights to access perennial livestock watering and grazing. Information obtained in the field emerged that he bagged approximately K60, 000, with the chief getting almost half the amount in all land transactions. From this, the named senior headman bought cattle in an effort to re-establish himself in the Ila culture of keeping livestock. He also bought a motor bike and a hummer mill.

The above situation was a Pandora's Box for other headmen and ordinary people. They realised selling part of 'their' land as the senior headman did would earn them some cash. Reports in the field showed that land wrangles emerged on ownership and boundaries. It was reported that two members of the same family died after being attacked by unknown people. Police investigations concluded a foul play in their deaths. In 2017, it took the District Commissioner to visit the area and convened a meeting with villagers in an effort to resolve conflicts. This situation was not only restricted to Ngabo but a common sight to the rest of the district.

Figure 5.23: New look, common sight: Fencing on the upland

Source: Field data, 2017

5.6.2.2 Land tenure security and willingness to invest

There was a general agreement that tenure security was one of the important determinants for pastoralists to make investments in fencing, cropping, housing and equipments at their farms. It should be noted that a number of other factors were often equally important in influencing investments. In Namwala, prices for inputs and produce, the market infrastructure and services, agro-climatic conditions, technological options, level of farm technology and productivity and political interference played a major role in investment decisions among pastoralists. Thus, indigenous tenure systems had often been criticized for not providing the security needed to stimulate investment. For this, 61 percent (n=73) of the pastoralists pointed out that by their usufruct rights, they had full control of their land, with its improvements, and could be bequeathed on to their sons, although 15 out of 120 respondents had title deeds to their farmlands. Irrespective of titling, pastoralists argued that they made different and substantial investments on their land in form of fences, houses, dip tanks and spray races among others. Therefore there was no significant difference between title ownership and the level of investment among pastoralists. Those with titles confirmed that they did not provide a much added security towards investment because even others without title deeds were making similar investments on their farms.

Results further showed that despite the above scenario, urban-based absentee land owners, cash crop development programmes, polarization of political and economic power on ethnic lines, social and economic stratification, climate variability and change and government interference were cited as powerful sources of tenure insecurity. They noted that they faced the risk of losing their cropping and pastoral land to potential large scale crop schemes. Respondents also identified land grabbing and conflicts as sources of tenure insecurity. In addition, pastoralists identified civil servants, politicians and rich local pastoralists as far too often used their positions and influence to secure customary land for themselves thereby fuelling conflicts. One pastoralist had this to say:

> "*...formal titling and beauracratic registration systems are often used to legalize the robbery, for us farmers who have used the land for many years are technically denied...*"

5.6.2.3 Land tenure and equity

For the majority of pastoralists (n=63; 53%) in Namwala, land tenure and equity determined their economic and social position in life as well as where to graze their cattle. Respondents were of the view that cropping was secondary to cattle husbandry. Hence, much land meant wealth, status and power. Based on usufruct rights, all pastoralists are given broad access to both arable and grazing land. However, increase in fencing, whether buyers had title or not, resulted into a higher degree of land fragmentation. Both arable and best grazing land had been lost as demarcations and bounds between fields increased. Pastoralists noted that fragmentation also led to more disputes, as extension service became more difficult and inefficient. More prosperous pastoralists were taking up huge pieces of customary land than poor pastoralists. One key informant observed that this led to poor pastoralists' feeling excluded hence their willingness to pave way for large scale government and donor projects such as cropping as in the case of Mbeza. He added that the phenomenon was likely to widen the gap between the rich and poor.

The results further show that poor pastoralists were often losers over land issues. Being a politically marginalized group with weak institutions to defend their tenurial rights, local poor pastoralists were generally losing to outsiders, who were often powerful and well connected to the system. With increase in population and disposable income, there was an increase in the likelihood of breakdown of old traditions in favour of increase in land commercialization and individualization. Individualization of tenure was on an increase as a hallmark of both informal and formal fencing and titling respectively that characterised indigenous tenure of CPRs in

Namwala. For this, 53 percent of respondents agreed that this would in the long run exacerbate conflicts due to increase in cattle and would result into lack of grazing areas and landlessness.

5.6.2.4 Land tenure and gender

In Namwala, the customary tenure system ascribed women with inferior tenure rights to men. Accordingly, whereas men got access to land through their lineage or clan, women got access to land through their husbands. A total of 19 percent (n=23) respondents still believed that women had secondary rights as compared to primary rights for men. At the same time, men were under the obligation to allocate land to their wives, which the women could use at their discretion. For few respondents in Namwala (23 responses), this was a strongly held rule. Commercialization and individualization of customary tenure systems, both informal and formal fencing and titling of land were further eroding women's rights. At the same time, women's labour was demanded to expand cash crop production and food security in the traditional set up. Increase in land scarcity was working in the same direction as commercialization, both reduced land available to women. Male heads of households tended to satisfy what they saw as their need for land before they allocated it to their wives. For them land was often used for primary production and market. Respondents further noted that although there were exceptions, when a man died, his male children inherited his land. Thus, in the traditional set up, women, regardless of their marital status or age, could never acquire or inherit land even in the midst of human rights.

> "*…women do not inherit land, they are likely to get married any time and join their husbands; so how can they inherit land…*?" Chief Y wondered.

5.6.2.5 Land tenure and access to credit

A major point of criticism of indigenous tenure systems was that it prevented pastoralists from access to formal credit. The absence of a registered title increased the risk and the transaction cost for lending institutions. As previously pointed out, a range of factors influenced the pastoralist's investment decision. Tenure security was one important factor. However, 68 percent pastoralists observed that tenure security in Namwala was not a constraint to investment. In this case, one would not expect demand for credit to increase as a result of titling.

Results in Table 5.20 shows that about 105 respondents (88%) stressed that they did not need credit or loans from the bank as compared to only 15 (n=13%) who had opened bank accounts. Common connotations shared during the study were that:

"*…uswe tubaila ing'ombe ndii bank lyesu ubumi bwesu*," meaning "*cattle is our bank and source of security and livelihoods here in Ila land..."*

Respondents observed that the only time when a bank became necessary was during payments after slaughter but even this did not require pastoralists to open bank accounts. From 2016, payments for cattle were done at respective abattoirs on the same day of slaughter. This was a further alienation of pastoralists from the banking services. Furthermore, one key informant noted that the demand for loans did not exist for most pastoralists in Namwala. In addition, the district only had one bank, ZANACO. Some respondents pointed out that the district was far for them to trek to make deposits and withdrawals, in addition to delays and bureaucratic lending procedures.

5.6.3 Land tenure governance on the Kafue flood plain (*Ibanda*)

Pastoralists were of the view that in the Kafue Flats (also known as Kafue floodplain), customary rights of the floodplain and related resources were controlled by first occupants called the *Kazoka* clan in Mbeza and *bana Shimulonga* (*Shimulonga clan*) in Baambwe, as a kind of incipient right. No group controlled access to the plain in Maala but the chief directly gave permission to those wishing to have cattle outposts. At the same time, all these were CPRs for the whole *chishi*. Respondents pointed out that access to pasture was given to any individual or group who wanted to own a cattle outpost by a symbolic payment of one cow, and consented by *mwami*. These groups controlled but not privately own the Kafue Flats. On the other hand, the chief's council served as the community's land management structure on the upland where such clan groups were absent (Figure 5.24). Using a participatory process, the chief's council oversaw all activities on land and guided the implementation of the village constitution. The committee also enforced the village's by-laws, which defined the usufruct rights available to all villagers.

Results further showed that the district was mainly designated into two zones; the upland where permanent residential areas and major agricultural activities were and the Kafue flats/ Kafue flood plain mainly for grazing purposes (Figure 5.24). Further, ecological surveys revealed that there were clear boundaries and membership was restricted to members of the village in the Kafue Flats. Respondents were of the view that the chief through the headmen gave permission to access pasture in the flats and establish *lutanga* upon payment of a cow (Figure 5.24). This applied to 'foreigners' who were usually allowed after seeking permission. The chief's council was the supreme customary law making body which only heard who had allocated access to Kafue

floodplain during *lubeta* (meeting). Respondents concluded that although this was the case, the final decision was in hands of the chief. They added that there was monitoring and graduated sanctions to outsiders who accessed the flats without permission.

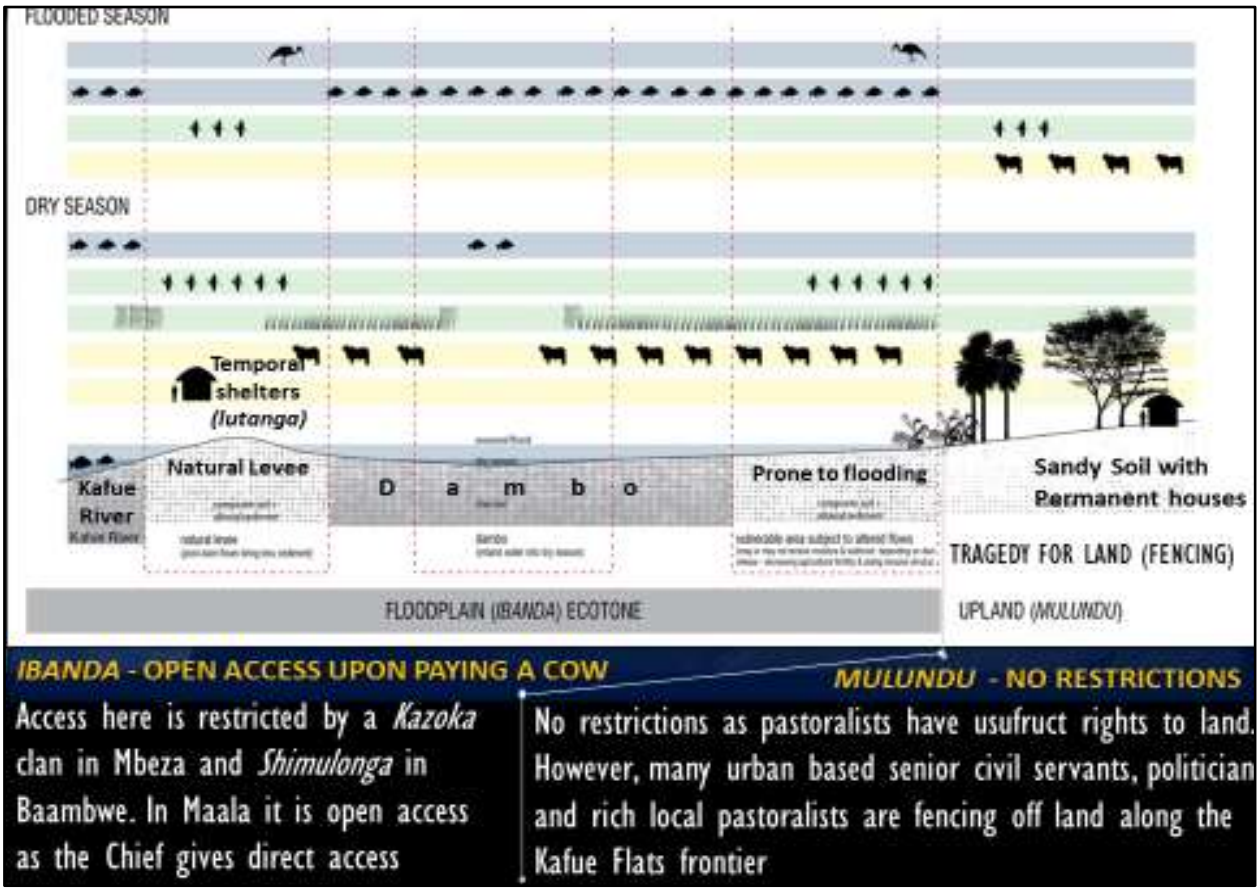

Figure 5.24: Cross-section showing land restrictions between Kafue Flats and upland
Source: Field data, 2017

There were no rules governing the utilisation and management of grazing patterns of CPR except time for *kuboola* (taking cattle back to upland). On this, there were stringent rules and fines on individuals who did not take heed. On the upland, ownership and control of land was vested in the community and supervised by complex governance mechanisms with a hierarchy of customary institutions, with the chief at the centre of all land matters. On the other hand, the Kafue Flats were highly depended as the largest recognizable geographic area for grazing, watering, and fishing livelihoods. Respondents claimed that headmen managed water, pasture, and livestock mobility whereas chief's councils had established community institutions, including a council of elders, to manage land and water resources. Table 5.16 provides a summary of synopsis concerns and lessons learned from pastoralists' and host reflections concerning land tenure in Namwala.

Table 5.16: Synopsis of land tenure lessons learned from pastoralists and host reflections

S/N	Land tenure lessons	Obstacles pointed out by respondents	Priority by key informants
1	Put legislations and policies in place that clarify the state of land and recognise the community's central role in natural resource management (based on principles of co-management).	*"..still unclear on how the constitution and policies are to be applied in practice especially that upon buying land, rich people quickly fence their land…"*	*"Clearly identify and map customary land and its uses. This should be community driven, either formal or informal, and supported/recognised by government"*
2	Though tenure systems have been put in place in a top-down manner, there is now space for real community participation from the bottom up approach through decentralization.	*"…poor local knowledge of the legal context in land matters. Rich people from outside informally fence off communal land with the chief's consent. This has increased wrangles on the upland…"*	*"Document customary law as well as governance institutions and systems and promote their recognition and inclusion in formal legislation. This will facilitate inclusion of pastoralists in owning land formally"*
3	Clear, effective and respected natural resource management systems in place (formal or informal) related to land and water including fisheries and forests as alternatives among pastoralists	*"…even if the chief's councils are supreme customary law making bodies, the chiefs and headmen rarely consult their subjects in matters related to land…"*	*"Allow real decision-making power at the community level in terms of managing natural resources (e.g., grazing and water). Poor pastoralist's voices should be heard"*
4	Communities know the boundaries of their CPRs and also the membership within those boundaries.	*"…meaningful local political representation on behalf of communities still weak. Chiefs often overrule the will of the people…"* This was observed e.g. case of Ngabo	*"Communities are capable rangeland resource managers. There is a need to encourage and strengthen existing management and institutional local mechanisms and knowledge"*
5	There are clear and functional institutional structures in place with defined roles and responsibilities in each chiefdom.	*"…government does not recognize community structures. Particularly, women's participation in all local matters still weak though growing…"*	*Pay attention to pastoral communities and their specific needs, and focus on their education and other services. This empowers communities, reduces grievances, builds resilience and decreases dependence"*
6	Communities have the authority to manage their own resources. There are strict community rules for resource use, which are enforced and respected, either through community action (e.g., taking cattle as fines through local courts).	*"…increase in land market has led to loss of usufruct rights to land by pastoralists. No consultations take place. As long as there is land, the chiefs and their headmen sell without mutually engaging local people…"*	*"Identify diversification opportunities building on peoples' existing adaptive mechanisms and their own priorities related to land and water management"*
7	Community knowledge and capacity to manage and allocate land, and plan land use recognised; communities conduct land use planning on their own behalf.	*"…signs of changing lifestyle among pastoralists. 'Thirsty' for land ownership increasingly creeping in. Some rich pastoralists are fencing their farms with or without title…"*	*"Raise awareness on key environment and common property resources use and access. 'Foreigners' should be integrated well into local land and water management practices"*
8	Government engages with and/or recognizes customary systems.	*"…less trust in government by most pastoralists as we feel the offer of title deeds is 'selective' in favour of urban-based politicians and civil servants..."*	*"Provide basic services along with other land interventions; need for equitable rules and policies; prioritize funding for land interventions and alienation in favour of locals"*
9	Support community resource co-management systems to allow flexibility to accommodate variable and unpredictable climate (reciprocal arrangements between neighbours, negotiated access,)	*"…there are no co-management practices here in Namwala. The rules to land and water management are very weak…"*	*"Review policies and legislations with a view to better mainstreaming common property resource concerns and strengthen, educate and localize"*
10	Improve land tenure and local land management and ownership.	*"…land ownership still strongly held in by clans/lineages (for example, Kazoka in Mbeza and Shimulonga in Baambwe). Locals have usufruct rights…"*	*"Improve tenurial governance which restricts uncustomary and unlawful land transactions"*

Source: Field data, 2017

5.7 Environmental education linkages in understanding pastoral social-ecological typologies

This sub-theme addresses the fifth objective which was to devise environmental education linkages in understanding pastoral social-ecological typologies. To understand the dynamics of a complex pastoral socio-ecological system and division of linkages, an understanding of resilience perspective that focused on the complex relationships between ecosystem development and social dynamics was important. Resilience learning and knowledge include systems thinking, and it provides a framework for viewing social-ecological typologies as one system continually adapting through cycles of change (Walker and Salt, 2006). Resilience has been defined as:

- The amount of change/stress a system can undergo and still be in the same domain of attraction (e.g. still have capacity to provide goods and services to humans);
- The degree to which the system is able to self-organize (it requires little human interventions to maintain its functions and structure by withstanding various management errors and disturbances); and
- The degree to which the system express capacity to learn and adapt [e.g. have adaptive capacity for social-ecological systems] (Holling, 2001; Walker *et al*., 2002).

Walker and Salt (2006) described nine attributes for a resilient social-ecological system, including diversity, ecological variability, indigenous knowledge (IK), acknowledging slow variables, tight feedbacks, social capital, innovation, overlap in governance and ecosystem services. Thus, results revealed that the Kafue floodplain behaved as complex adaptive systems that demonstrated resilience dynamics, a nested hierarchical structure, cross-scale interactions, non-linear processes and components that adapted to disturbances. This section therefore combined all four objectives to describe important social, ecological and economic components and attributes, and their relationships and feedbacks, which influenced the state of pastoral social-ecological typologies in the utilisation and management of CPRs. In this concluding synthesis section, a brief review of results were given in form of mapping of early warning signs and use of indigenous knowledge (environmental education) in devising rural pastoral social-ecological education in observing natural environmental indicators to foretell the amount of rainfall. Further, the processes and strategies of reorganization and renewal, from an environmental education perspective (indigenous knowledge) among pastoralists were also discussed while identifying types and cycles of change (critical disturbances and historical events) and their characteristics and effects on pastoralism. Finally, an attempt was made to describe indigenous knowledge and socio-cultural commonalities among pastoralists in building their adaptive capacity to the realm of typologies that captured dynamics, complexity and cultural values of the Kafue floodplain, where pastoralists depended.

5.7.1 Mapping of early warning and use of local knowledge in Namwala

Local environmental weather predictions involves the use of observations of the natural environmental and space indicators, supported by experience of the past to foretell the start of the rainfall in the following season in order to plan farming activities in advance (Senanayake, 2006)). A successful weather prediction could lead to increased food production because farmers were able to implement informed decisions on when, where and what to plant, and hence ensured quality food production. Wrong predictions, on the other hand, may result in an inappropriate implementation of agronomic practices and adaptation strategies which may lead to poor quality of agricultural produce. Current observed climate changes and variability posed challenges in the provision of accurate and reliable weather predictions and forecast information. However, effective coping and adaptation strategies for the management of the effects of climate change and variability could be attained through accurate weather and climate predictions which helped pastoralists in making informed decisions on their farming activities leading to increased food productivity (Norberg *et al*., 2008). For this, results among local pastoralists in Namwala show that they still depended on monitoring local environmental weather indicators (Table 5.17).

Table 5.17: Local indigenous knowledge and environmental weather indicators

Indicator	Frequency (n = 120)	Percentage (%)
Tree leaves sprout and flowering	78	65
Clouds and weather conditions	67	55.8
Insects and animal behaviour	61	50.8
Astronomical celestial bodies	48	40
Bird chirping	41	34

Source: Field data, 2017

The findings in Table 5.17 shows that weather forecasts and indicators in form of tree leaves sprout and flowering (n=78; 65%), clouds and weather conditions (n=67; 56%) and insects and animal behaviour (n=61; 51%) were the best known weather forecast indicators for the majority of the respondents, followed by astronomical celestial bodies (n=48; 40%) and bird chirping (n=41; 34%). The majority of respondents aged 60 years and above mentioned tree flowering, tree leaves sprout and astronomy as important local weather indicators than any of the other age groups. However, results showed that participants in all chiefdoms shared the view that most of the trees which were used in the predictions for the imminent rainfall, had been cut for making charcoal, burning bricks, firewood and building poles. In addition, it was noted that increase in drought conditions affected birds' and insects' habitats and populations, also made them migrate to other

areas in search of food and suitable habitats and breeding sites. For instance, participants mentioned the disappearance of the *African ground hornbill birds* (*ba moomba*), which had predicted imminent rainfall through chirping.

Respondents also highlighted that some of these '*environmental songs'* appeared as usual, indicating the imminence of rainfall, but it did not rain. These were regarded as factors which contributed to the decline in awareness of local environmental weather indicators and predictions among pastoralists. This left precious IK among the elders. Similarly, an increase in drought conditions, which affected agricultural activities, resulted into less involvement of people (especially youth) in farming activities which was the only way of passing over the knowledge through observing and sharing of the past experiences. In addition, an increase in levels of illiteracy and heterogeneity in the community made people more dependent on their local knowledge through various signs of droughts (*chiyumayuma*) and floods (*chilobe*). Figure 5.25 show various drought and flood early warning signs that were identified by pastoralists.

Figure 5.25: Drought and flood early warning signs

Source: Field data, 2017

Figure 5.25 shows a variety of signs such as wild fruit availability and wind direction as among key signs to predicting how the season would pan out, although high male births and a year ending with a digit 8 may not be accurate signs of flood due to previous occurrences. Pastoralists talked about how God balanced between wild fruits availability and crop production thereby ensuring that there was always a constant supply of food in years of plenty and in dry seasons. They pointed out that detecting whether there was going to be a season of shortage or a season of plenty at an early stage helped in carrying out activities to mitigate hazards and survived even the severest of drought effects. Furthermore, respondents stressed that the important component of preparedness and mitigation lied in the capacity to obtain and use early warnings signs of impending hazards. However, there were limitations and obstacles to the timely forecast of extreme events as the perception of risk was not universally the same. For example, pastoralists who lived in the Kafue Flats perceived the balance of benefits to risks as favourable. In many cases, pastoralists may be aware of risks, but believed that they had no alternatives to their present location and behaviour.

Pastoralists further indicated that they talked to each other about weather conditions and continued discussion on this topic helped them to assess the current weather conditions for herd movements and grazing. The information that pastoralists shared about local changes happening in their communities was related to long-term trends, descriptive and specific. For example, pastoralists recounted that they shared information about *ibanda* (floodplain) conditions, where they grazed cattle during dry season, but for the past few years lost their grass and water supply due to irregular alterations. Pastoralists' knowledge about upcoming weather events were generated on the basis of consultation with each other. For example, in the face of upcoming drought/flood, pastoralists got mutual perspectives about making distant movements and splitting their herds:

> "*…last year (2016) cattle became so weak that once they went to the river, they would get stuck in the mud and we helped them to stand, but others would die in the process. We share this information to save our cattle*," explained one respondent from Baambwe.

Pastoralists also shared their concerns related to changes in vegetation and how this affected herd composition. One older pastoralist said that their pasture was becoming less suitable for raising cattle as *nankokwe* (*Brachiaria sp)* was diminishing due to consecutive recent droughts. In other words, pastoralists liked to share their knowledge in a familiar way, orally and face to face, from parents to children, pastoralist to pastoralist and community to community.

"*...I became a herder thanks to my uncle who was a very experienced pastoralist. It is important to follow these 'golden rules', as they have a great impact and leave behind a lot of knowledge with you. Now I nag my sons and tell them to do this or don't do that. My sons are becoming good pastoralists too. In addition, I discuss with friends and neighbours where to graze the herd, what the weather would be like today and we remind each other about good herding practices*," shared an older pastoralist from Mbeza.

5.7.2 Indigenous knowledge and rural pastoral social-ecological typologies

To explore the state of the social-ecological indigenous knowledge (IK), important social, ecological and economic components were identified and synthesized. Typological system components included pieces of IK such as human actors, particular ecosystem or habitat types, resources, goods and materials, and abiotic variables to create the linkages between social and ecological attributes among pastoralists. Having identified the above components and relationships among pastoralists, the information was then used to develop a systems diagram to depict SETs of these components as shown in Figure 5.26.

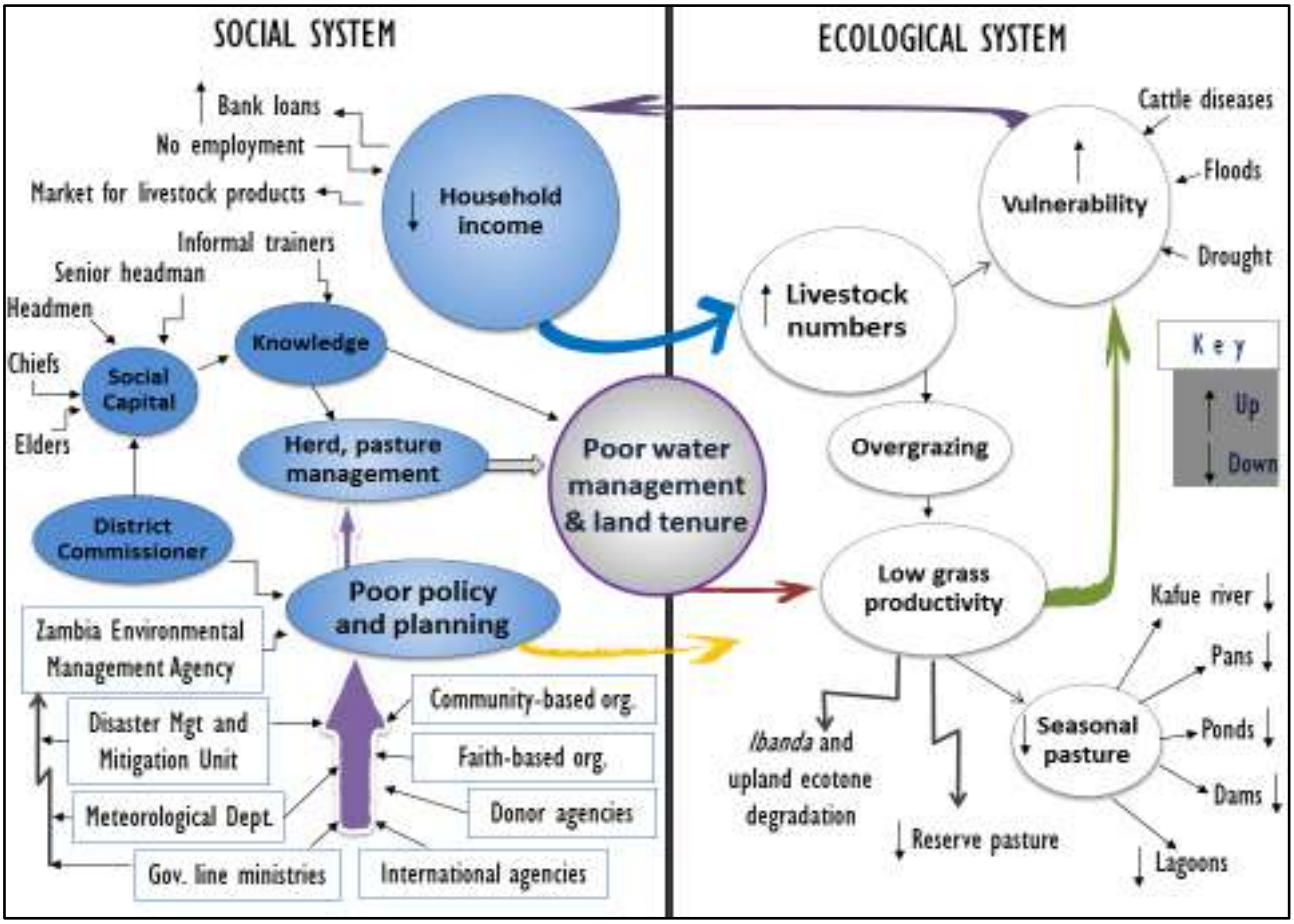

Figure 5.26: Rural pastoral social-ecological learning framework

Source: Field data, 2017

Figure 5.26 illustrates the relationships between the socio-economic and ecological components that together made up the state of pastoral social-ecological IK in Namwala. Each component within both natural and social systems interrelated with others across space adding to the complexity of pastoral environmental education. For example, a key few variables were identified by respondents in the field such as household income, livestock numbers, herding and pasture management capacity and productivity of pastureland. These provided a general illustration of complex interactions and feedbacks that facilitated reciprocal linkages between nature and pastoralism. The interactions of these variables illustrated that distant events and decisions made by pastoralists two decades earlier could have a powerful influence on ecological functions and processes today. With cattle population on an increase and increase in fencing, new forms of interactions among pastoralists were likely to occur.

In addition, the above learning framework (Figure 5.26) examined the extent to which pastoralists reorganized or renewed themselves in response to changing social-ecological environments. It revealed social and ecological practices and strategies that pastoralists had developed to build resilience and developed significant environmental education, uncertainty and variability as well as a greater wealth of socio-economic upheavals in creating linkages between household income, livestock numbers, herd and pasture management. This framework also shows innovative and adaptive behaviour and practices to explore how herders reorganized and adapted to different external and internal factors that affected their social, ecological and economic realms.

Thus, there was a closer link between social and ecological components in managing CPRs among pastoralists. In view of recurrent cattle diseases, drought and floods responsible for increased vulnerability, results showed that the area available for grazing had been reducing over the years. In addition, land commercialization and individualization which resulted into fencing of land particularly by urban-based politicians and civil servants, and dry season flooding in the Kafue flats, led to communal land to diminish further. Field data also revealed that social-ecological typologies among pastoralists demonstrated its capacity to respond to crisis and disturbance was not only embedded in social capital, practices and social networks, but also in significant environmental education or IK among pastoralists. The environmental education that pastoralists employed in the face of climate variability and change were not simple, but rather complex, demanding greater human labour, local networking, mutual support, mobility, innovative skills of

herding, reserve pasture, availability of support system, learning attitude and access to knowledge and networks. These contributed to the resilience of the rural pastoral social-ecological linkages in the utilization and management of CPRs such as the Kafue floodplain (Figure 5.27).

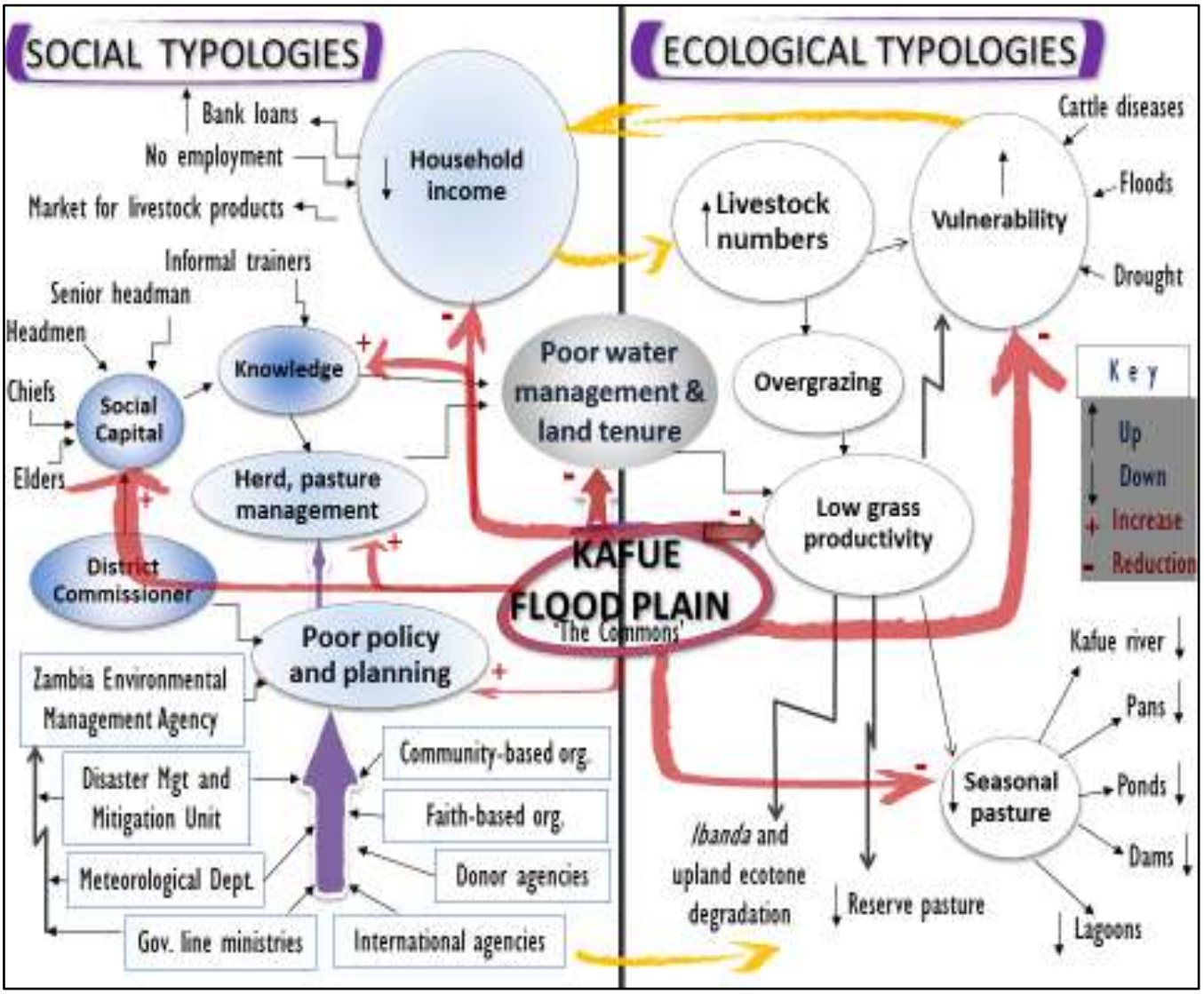

Figure 5.27: Rural pastoral social-ecological complex educational linkages
Source: Field data, 2017

Figure 5.27 shows that pastoralists have built up sufficient memory to live with and adapt to negative effects of drought and floods as well as major socio-economic and political transitions. Results further show that the combined effects of novel and cyclical disturbances over the past two decades had hit hard on the resilience of the pastoral communities in Namwala, overwhelming their adaptive capacity. Hence, pastoralists were learning to live with change and uncertainty. The

findings indicated that pastoralists had common strategies to cope with climate change and variability processes and these strategies were rooted and embedded in the pastoral traditions and customs such *kuwila* (transhumance mobility), flexibility, reserve, diversity and reciprocity (Figure 5.27). These strategies also served as cornerstones for the resilience of pastoral social-ecological local educational linkages that seemed to have demonstrated dynamic and self-organizing adaptive behaviour.

A critical examination of the results suggested that observed resilience building practices among pastoralists were capitalizing and developing pastoralist's environmental education and livestock management practices in combination with innovative practices. They established local level institutions that served as an improved and renewed form of regulating access and use of seasonal pastures. Closer observation also reviewed that actors such as local government, NGOs, development agencies and policy makers often devalued the intellectual and social capital existing among pastoralists, which resulted into marginalization of pastoralists and their knowledge associated with pastoralism. Such perceptions somewhat undermined the competitiveness of pastoral culture and indigenous knowledge and prevented the shaping and adaptive modification of rural transformation in the face of climate stressors.

Results also revealed a new TEK on the effects of dams on downstream human settlements was important (Figure 5.28). Thus pastoralists demonstrated that the Kafue Flats had high habitat value and productivity, with its strategic location between two dams on the Kafue River. As shown earlier in this report, field data showed that every year, several large floods and irregular releases resulted into widespread destruction of crops, livestock and homes, while drought years and dam operating procedures led to widespread ecological changes. However, the ways in which a dam could cause subtler effects on downstream economic and social patterns had only been secondarily documented in the area (with exception of Beilfuss, 2002 on the Zambezi), as scientists have focused on quantitative hydrological and ecological measures, neglecting the pastoralists' social-ecological linkages and climatic implications.

Thus, a new generation, new paradigm on fine-grained, qualitative observations about the relationship of communities to the seasonal fluctuations of the river could be used in concert with a wider array of environmental and social science data to form a case study useful in implementing

environmental flows on the Kafue flats and elsewhere. Results show that a new generation and a new paradigm of this study had the capacity to provide linkages of environmental river flows and new partnerships to regenerate the Kafue Flats in ways that were more economically, ecologically and energetically sustainable. Results show that in order to achieve an economically, ecologically and energetically sustainable Kafue river flow, it was important to involve all users in restoring the Kafue floodplain. The findings also pointed to entrenched Ila attitudes, traditions and institutions regarding land tenure, fishing, crop production and water governance, as important factors in environmental education paradigm shift for behaviour and attitude change in understanding social-ecological typologies to climate variations and changes (Figure 5.28).

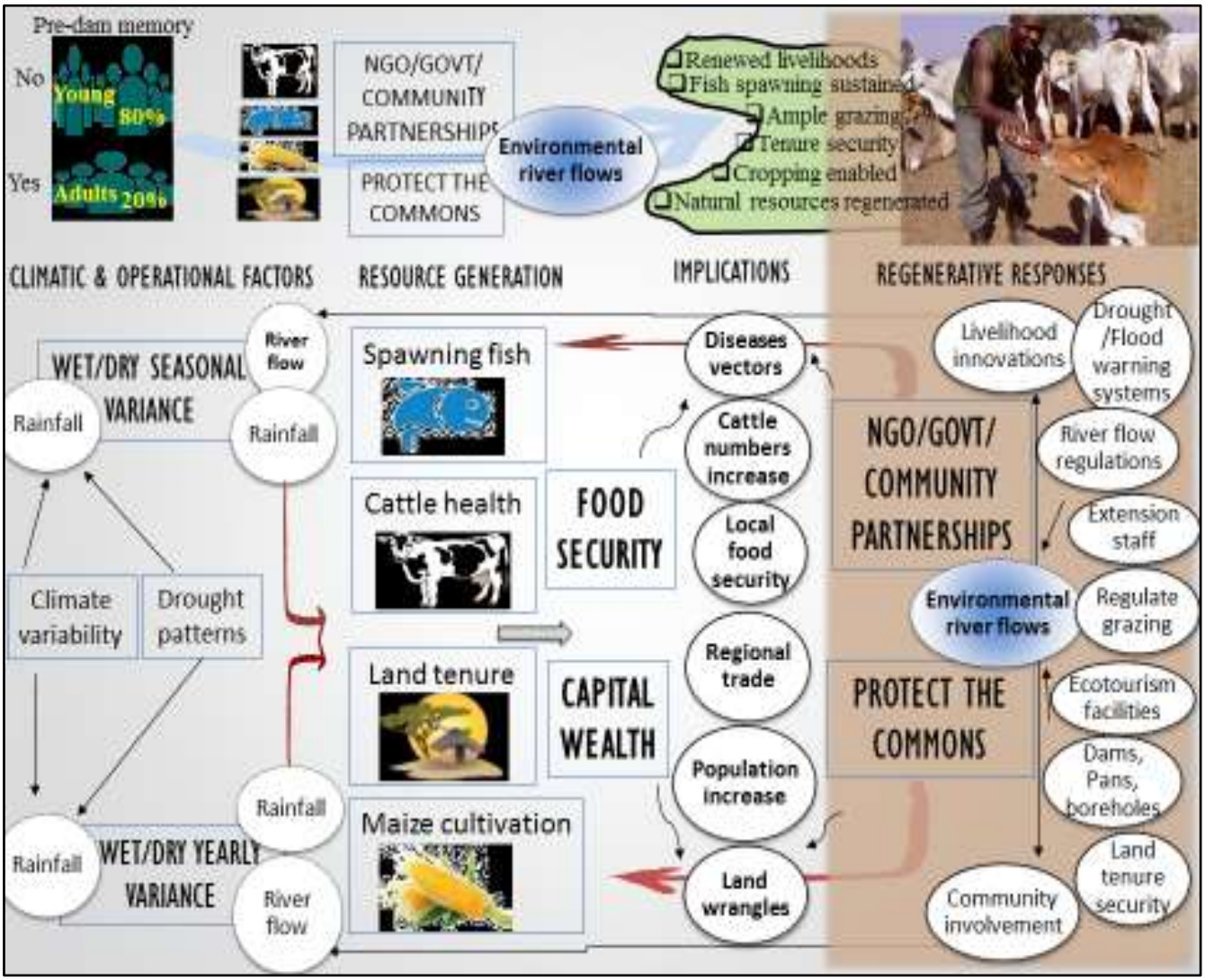

Figure 5.28: Relationship among people, environment and resource factors

Source: Field data, 2017

5.7.3 Reorganization and theoretical application to the study: Environmental education, socio-economic and political cyclic phases of pastoralism in Namwala

An attempt was made using Holling's (2001) Adaptive Renewal Cycles to analyse the resilience of pastoralists' IK by reconstructing historic major climatic events that occurred from 1964 to date. This focused on the surprises and crises and political regimes. Results demonstrated that changes faced by pastoral social-ecological typologies in Namwala were both novel and cyclical. Novel and cyclical events such as water scarcity and climate-driven vegetation dynamics were part of the environmental experience of the pastoralists. From independence, political policies under different regimes had a greater impact on pastoralist's ability to adapt to climate variability and change. Thus, a sequence of adaptive cycles for the pastoral SETs from 1964 until the present (2017) is illustrated in Figure 5.29. This was based on combining environmental surprises and different policies by different political regimes.

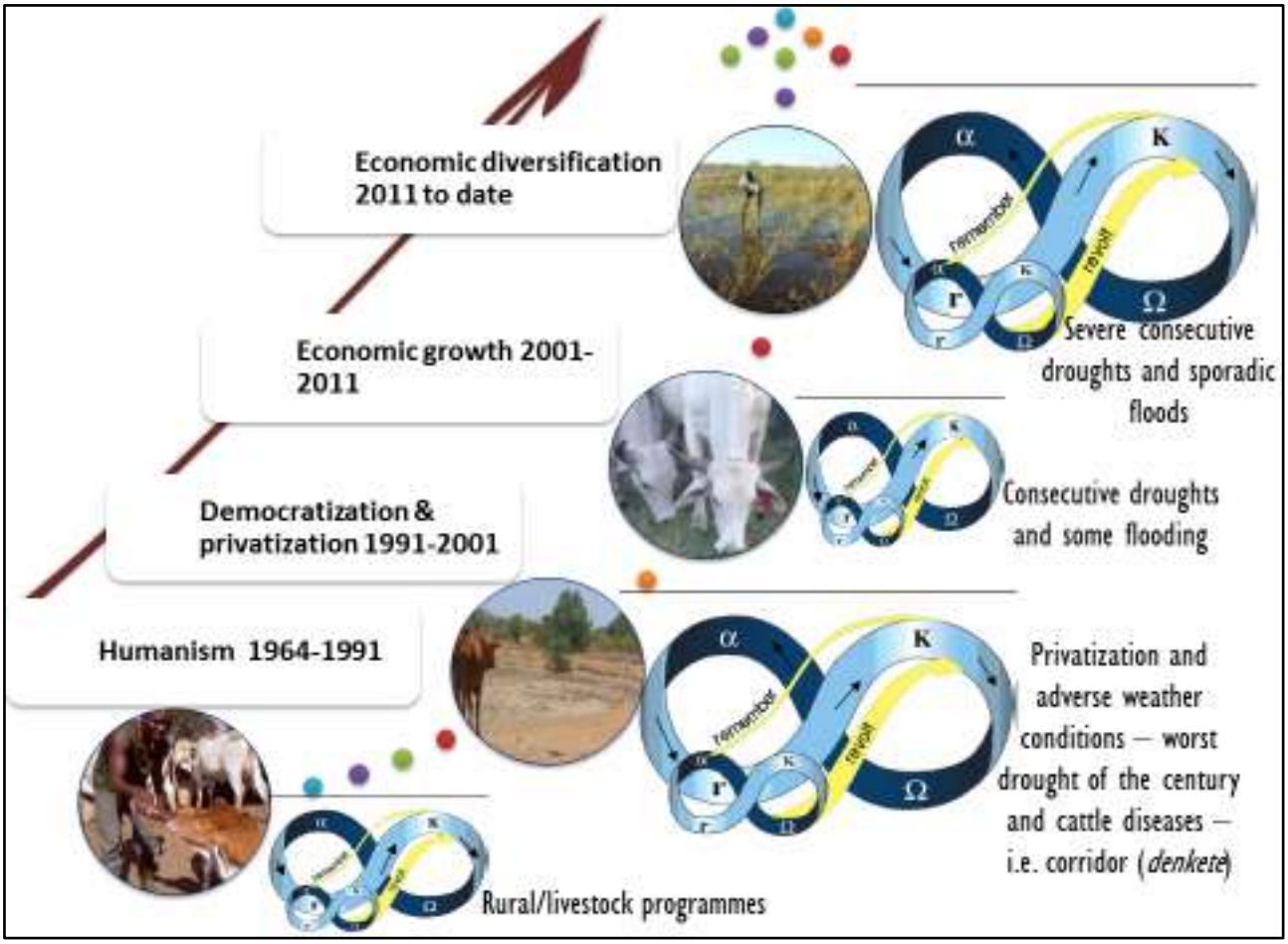

Figure 5.29: A sequence of adaptive circles to climate variability in Namwala from 1964 to date

Source: Field data, 2017

In a resilient ecosystem, these four phases of the adaptive cycles in Figure 5.29 repeated themselves again and again. Changes anywhere in the lower scale of the social-ecological system affected the stability of the system at a larger scale and caused some changes to it. Ecosystems and social-ecological systems across scales were basically comprised of hierarchies and adaptive cycles. In this case, some circles were small and fast (1964-1990 and 2001-2011) whereas others were large and slow (1991-2001 and 2011 to date). The rule in this case was that the smaller and faster the adaptive circles pertaining to each period, the more resilient and more vigorous the policies to tackle climate variability and change or other social-ecological surprises were. It also showed that the period in question had fewer calamities to the extent of making pastoralists vulnerable. On the other hand, the larger and slower the circle was, the higher the degree of vulnerability and the weaker the policies that were/are tailored towards pastoralism. Based on results of circles in Figure 5.29, Table 5.18 provides characteristics of memory and novelty to climate variability for each adaptive cycle and the adaptive responses from respondents that affected resilience for each of the subsequent cycles using political periods from 1964 to date.

Table 5.18 Characteristics of adaptive cycles and adaptive responses that affect resilience building

Period	Year	Phase		Change processes	Supporting quotes from respondents and key informants
UNIP under Dr Kenneth Kaunda (Excessive interventions in order to promote agriculture and rural development)	1964-1991	Exploitation & conservation with sudden small and fast cycles of events	r, K	'*Fruits of independence'* as government promoted agriculture and rural development through agricultural subsidies	"*We had a lot of incentives during Kaunda era, dip tanks and dip chemicals were free. Dams, veterinary laboratory, veterinary camp officers, management and grazing systems were promoted."* *"Veterinarians made physical visits to farmers, made timely vaccinations for free. There were no such requirements as payments for vaccinations and dipping."* *"There was limited market for cattle. Most times, we would give the 'buyer' our cattle, and then pay us when he comes back from mine (market) after selling them.*"
		Release	Ω	Technical and managerial problems	*"Impact of drought, technical and managerial problems together with cattle diseases and critical shortage of markets posed a challenge to cattle husbandry."*
		Re-organization	α	Livestock marketing	*"There was generally improved animal health and reduced mortality rate, calving, and management. We had a lot of cattle and but poor markets were provided by Agricultural Finance Company and Cold Storage Board."*
Democratization & privatization under the late President Dr Frederick Chiluba **(**Introduced SAPs	1991-2001	Exploitation	r	▪ Removal of subsidies ▪ Restructuring of local and national government institutions ▪ Collapse of state	*"After privatization, all extension services to livestock collapsed, including reduction in vet extension officers."* *"Livestock production became much disorganized because many technocrats and educated people left this rural area."*

and neo-liberal policies of privatization and agricultural market liberalization)				vet and breeding services ▪ Collapse of communal vet dip tanks	*"Livestock management became difficult as no one was there to visit and check on them, as it was the case during Kaunda era."*
		Conservation with larger and slow cycles of events	K	Market liberalization, decontrolled prices of commodities	*"We started looking for markets outside the district to urban centres such as Lusaka, Chisamba and Kitwe. It was a bit profitable for us although prices remained low and exploitative."*
		Release	Ω	▪ Consecutive severe drought ▪ Prevalence of cattle diseases especially corridor disease ▪ Increase in poverty and school drop-outs ▪ Shortage of food ▪ Increase in consumer prices	*"We will never forget the drought of 1991 to 1993. It was bad, sad. We lost thousands of cattle to denkete. There was total negligence by govt. towards treating cattle, dipping and vaccinations by government."* *"We will never forget and forgive those who were in power; because some of our colleagues who had thousands of cattle remained with nothing (no cattle), others committed suicide."* *"Lack of markets forced us to trek our cattle to Monze, then load them in trucks to Lusaka, Chisamba and as far as Kitwe. Our animals lost weight and could not make profit. This increased vulnerability."* *"We lost cattle because we were weak and vulnerable. Every family had shortage of cash, no income, no jobs. Many of us just could not do fishing, and don't have a specialization or profession to get a job, so we endured the suffering."* *"It was hard especially that consumer goods were in short supply, i.e. maize meal. We lived on yellow maize meal, something we never grew, ate or knew"*
		Re-organization	α	▪ Herd recovery from the remaining stock ▪ Livestock and donor relief, rehabilitation, restocking projects (World Vision, Heifer international, etc. ▪ Diversification to other forms of livelihood	*"Drought and denkete were a curse. We watched our cattle dying and couldn't do much about it. We got lessons and now will not let the livestock perish easily."* *"After drought and denkete, some pastoralists left to urban areas, leaving few surviving livestock with their family. They later used their earned cash remittances to buy livestock, and rebuild stock."* *"Without cattle, we are nothing. We turned to other means of survival such as fishing. Ilas are not fishers; previously we would call a kama (meeting) to find out the problem when we find an Ila fishing. But it is normal nowadays. Some poach, lumber, and keep other forms of livestock such as goats, sheep and pigs."*
Economic Growth under the New Deal administration of late President Dr Levy Mwanawasa (term completed by Mr Rupiah Banda) (Deliberate and targeted	2001-2011	Exploitation	r	▪ Reintroduction of subsidies and restocking programme ▪ Disease control and disease free zones ▪ Strengthen the early warning system ▪ Promote and establish of	*"Before President Mwanawasa came into power, everyone was thinking of working somewhere, earning some money elsewhere. But this changed with the reintroduction of subsidies and restocking programme. Early warning, disease control measures and frequent vaccinations improved animal health and production in addition to diversification and promotion of other forms of livestock such as goats, sheep and donkeys."* *"Our livelihoods were on course again, we no longer took our cattle to Kitwe, the markets (abattoirs) were on our door steps despite their low prices. However, we did*

interventions towards agriculture, with the support of the international community)				▪ abattoirs in livestock production areas ▪ Land tenure security ▪ Change in herders' mentality ▪ Improved market value for cattle	*not come up with prices per kilogram, they dictate. But they were better than previous regimes."* *"Most of the pastoralists' livestock got replenished from droughts and floods despite state intervention."* *"Pastoralists invested in other forms of wealth and their inability increased to live in accordance with poor market system and social-ecological dictates"*
		Conservation with sudden small and fast cycles of events	K	Rebuilding the resilience of small-scale farmers who had experienced both policy (SAPs) and environmental shocks (droughts, cattle diseases and floods)	*"Despite favourable government intervention to improving livestock production, climate related disasters such as floods and drought were a problem."* *"Due to effective and efficient government programs, the prevalence of livestock diseases reduced and our cattle begun to increase. With readily available rural livestock markets, we would easily sell and buy other essential commodities and send our children to school."*
		Release	Ω	Consecutive droughts and floods affecting livestock sector	*"Government provided help in terms of other forms of livestock which would withstand drought such as goats. These are diseases resistant and multiply quickly than cattle."*
		Re-organization	α	Herd recovery	*"Cattle increased leading to overgrazing in the Kafue flood plain where they converge during dry season"*
Economic diversification under the Patriotic Front government of late President Michael Sata and current President Edgar Lungu (Economic and agriculture diversification)	2011-date-2017	Exploitation	r	▪ Removal of subsidies on agricultural inputs and fuel ▪ Strengthen disease control and prevention measures ▪ Rehabilitate all dip tanks and establish new ones	*"Under this current government, we are in the state of shock as farmers; fertilizer is expensive, livestock vaccines are expensive and we are now asked to pay for our livestock to be vaccinated; something we never experienced during UNIP's Kaunda and MMD's Mwanawasa regimes. With more droughts and sporadic floods, our lives and our cattle are at risk again."* *"The whole district only has 2 functional government dip tanks, both located in Namwala central. There are 11 non-functional dip tanks despite the government promising to construct 13 new ones. Most pastoralists now depend on private spray races as they are believed to be efficient and economical."*
		Conservation with larger and slow cycles of events	K	▪ Public-Private Partnerships in the construction and operation of dip tanks and other animal services ▪ Livestock breeding centres ▪ Promote diversification in livestock production ▪ Promote range management practices ▪ Increased livestock extension and vet. coverage All supported by Seventh National Development Plan (7NDP), & Vision 2030	*"Year after year, climatic conditions are getting worse, it actually doesn't improve. Drought situations and irregular flooding especially from Itezhi-tezhi dam has continued posing challenges to our cattle."* *"Pastoralists are growing herd sizes, because it is productive venture. When household income grows, pastoralists' consumption grows as they buy cars and motorcycles. They also cover school expenses for their children, clothes and school supplies as costs for these are getting higher."* *"Each pastoralist has a thought to educate children. They aim to send them to any school, college or university as a host of cattle management problems continue. Actually, it is a new form of prestige among pastoralists."* *"Pastoralists now view pastoralism as a business. NGOs, donor agencies and government through workshops are changing the perception among farmers."*

		Release	Ω	Severe consecutive drought and sporadic floods leading to a host of pastoral problems	*"Our pastoralists suffer from poor supply of pasture, water, breeding stocks, poor markets, high energy costs, poor infrastructure such as feeder roads, and a lack of competitive processing facilities in the form of abattoirs and milk collection centres, among others."*
		Re-organization	α	Herd recovery, land tenure and management of common property resources (CPR)	*"We are not respected here; our herds are growing because we are hard working. Water from Itezhi-tezhi dam is released anyhow without considering our cattle. We also have difficulties in acquiring title deeds for our land, but 'foreigners' easily get titles."*

Source: Field data, 2017

Note: Vet stands for veterinary

5.7.4 Indigenous knowledge and socio-cultural commonalities among pastoralists

Results also revealed some environmental education commonalities based on context, practices and behaviours. Pastoralists experienced and lived with the sense of embeddedness, as they shared the same pastoral culture and faced the same stressors affecting their social-ecological education. They also underwent same processes that were novel and cyclical (Figure 5.30). They identified cooperatives among others as a new form of local cooperation but such relationships were old among pastoralists and primarily existed as traditional neighbourhoods and honouring extended family system obligations.

> "*...even before the government/NGOs supported cooperatives, we are people from one 'mukowa' (big family) and we live with support from each other. We communicate to each other if one sees the neighbour's cow*," explained one respondent from Maala.

> "*...people from the same chiefdom or those that speak similar language are like relatives; they look after each other's herd, openly talk to each other and share their daily observations and thoughts on impending drought or flood situations..*," noted another pastoralist from Muchila.

Results established that there were common environmental and socio-economic stresses that brought pastoralists as well as local officials closer and embedded within one '*mukowa*' or sense of belonging to share such problems. In addition, pastoralists shared the same administrative structure and governance at local levels. They identified headmen and women, together with chiefs as performing similar environmental education governance systems related to the utilization and management of CPRs.

Furthermore, exposure to novel and cyclical events was a common experience in the district. Pastoralists experienced same stressors, some of which were familiar while others were new and strange. They also shared common concerns such as decline in pasture productivity, new

challenges in the governance of the Kafue flats as a CPRs, water scarcity, reduction in grass and overstocking, including improving livelihoods, improving herd quality and having secure access to seasonal pasture and other key resources available in the Kafue flood plain - regarded as an '*oasis*' for dry season pasture (Figure 5.30). When asked what they meant by '*oasis*', one respondent from Muchila described *ibanda* as:

> "*...ibanda is a gift from God, it is our all weather lifeblood, a place where we were born, and where our livestock are raised. If my ancestors lived there from far old times, this inevitably becomes my inheritance and homeland. When there is good rain and grass grows, we say our ibanda is healthy and giving us life*."

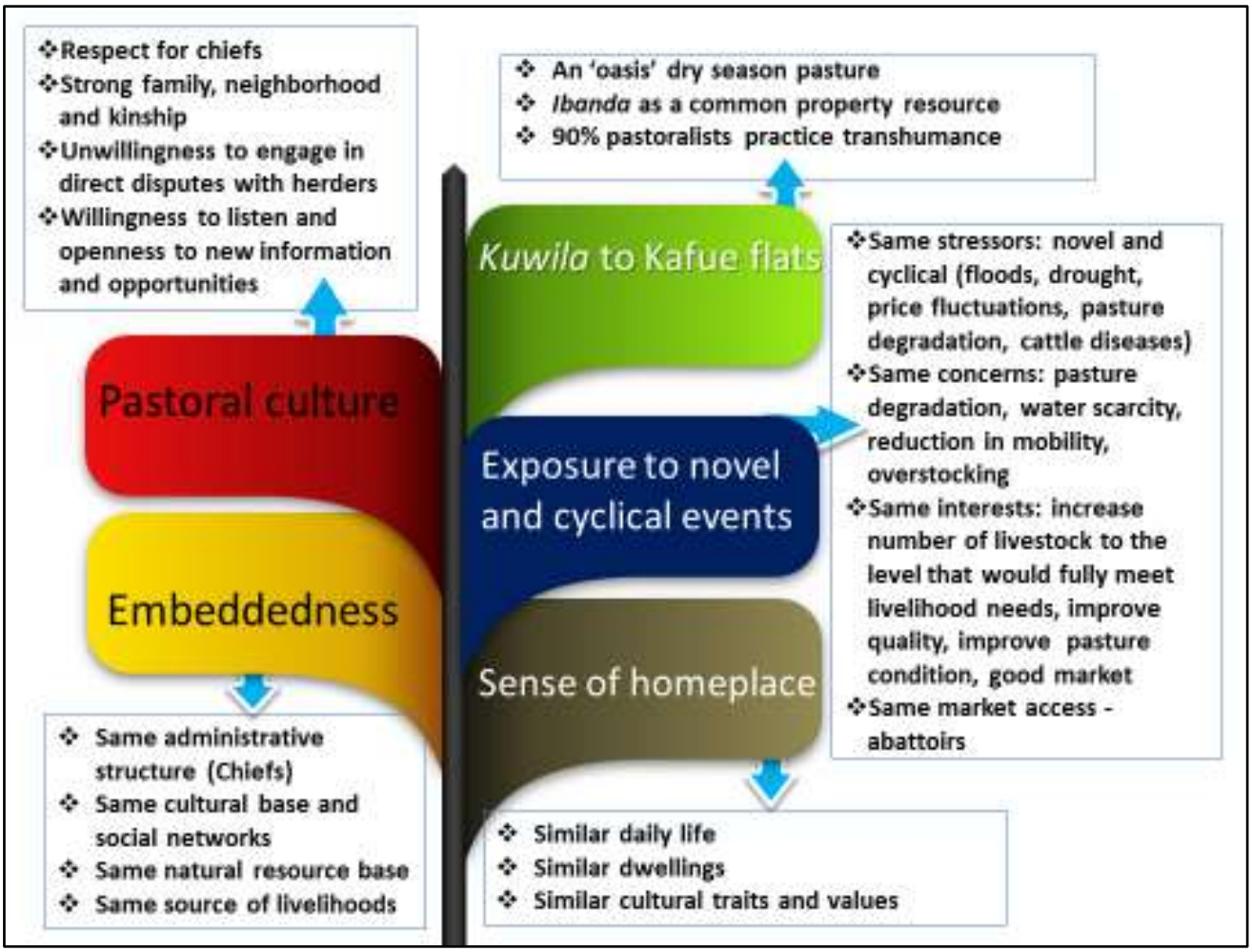

Figure 5.30: Social-ecological commonalities among pastoralists

Source: Field data, 2017

The findings showed that pastoralists had common strategies to cope with climate variability and change and these strategies were rooted in pastoral traditions and customs such as mobility,

flexibility, reserves, diversity and reciprocity. They also lived with a sense of embeddedness in their communities that helped them cope with and absorbed climatic effects of novel and cyclical changes (Figure 5.30). These strategies were cornerstones for the resilience of pastoral social-ecological environmental education that demonstrated dynamic and self-organizing adaptive behaviour over the long history of pastoralism among the Ila people. In addition, results showed that in the face of combined effects of novel and cyclical changes, pastoralists experienced a gradual loss of resilience from one adaptive cycle to another.

Further, results showed that pastoralists demonstrated greater diversity in communication networks, information sources, and some management practices; specifically mobility, without reserves of pastures and fodder on the upland. Despite numerous problems facing pastoralists, they followed the same customary pastoral strategies of having access not only to the key Kafue floodplain, but also environmental education to make distant movements to different lagoons during the time of emergencies. Ever-changing socio-economic and ecological conditions required building adaptive capacity by not only capitalizing on traditional institutional structures and management practices, but also adopting new principles and institutions for reorganization and renewal. In this case, social capital and social memory of pastoralists could be expanded if herders were frequently exposed to different experiences, concerns and interests without being limited to local perspectives and local practices. In many situations, pastoralists were disadvantaged not only by their geographic location, influenced by chiefs and headmen, but also by lack of access to relevant information and networks, self-organized institutions and community-based organizations that served as mechanisms or structures to promote diversity of local solutions and practices of specific environmental education in utilizing and managing CPRs.

5.8 Summary

The findings highlighted that climate variability and change were happening in Namwala and affected pastoral activities and the lives of agriculture-dependent communities. However, these agriculture-dependent societies had survived within these changing environmental conditions over decades. The study revealed that pastoralists were aware of climate variability and change. Generally, respondents associated and perceived climate variability effects as an increase in drought, increase in temperature, decline in rainfall, water shortage, increase in pests, shortened growing period, weather variability, changes in windy conditions, and increase in cattle diseases.

Nevertheless, pastoralists have adapted to these changes over generations, thus increasing their resilience to coping and adapting through: presence of commercial livestock buyers, herd mobility and management, capital projects, increased cash investment into the herd, withdrawal of cattle from internal redistribution to individual accumulation, net flow of cattle from poor to richer pastoralists, changes in milking strategies and breeding, role and increasing dependence on salaried employees, locals '*turning*' to the Kafue River and diversification with mixed crops/animals among others.

Similarly the results also revealed that governing common property resources for pastoralism in floodplains was a challenge. The case of the Kafue Flats illustrated how pastoralists developed multiple resilience strategies to climate variability and altered flooding, flow and flux of the Kafue River between two dams. It was found that population in cattle increased. This increase led to a reduction in the area available for grazing per cow with respect to access to water and pasture. Compounded by droughts and increase in cattle numbers, the hectarage per cow continued to decline. The findings also showed that the Kafue Flats was prone to overgrazing in view of combined increased floodplain agriculture, successive droughts and increase in cattle numbers. Thus, grazing and cropping patterns had changed dramatically and flood-dependent livelihoods were threatened.

This chapter also showed how land was accessed, used, and contested by individuals and households in Namwala. Results revealed that the district was mainly designated into two zones; the upland where permanent residential areas and major agricultural activities were found and the Kafue flats/Kafue flood plain mainly for grazing purposes. Access to land on the plateau was sought through headmen and chiefs who gave consent while clans, with the knowledge of the chiefs, gave permission to access pasture in the flats and subsequent establishment of *lutanga* upon payment of a cow. Unlike in the past where tenure system was part of subsistence economy, the land tenure system in Namwala was operating in a liberalised national market economy. Thus, monetary investments in land appeared to hasten individual interest in land and its preservation by converting customary tenure into statutory tenure. This increased individualisation and commercialization of land particularly along the edges of the Kafue Flats. Further, social difference or inequalities based on gender, wealth and descent had an influence on an individual's or household's access to tenure of land. These differences influenced the power and authority of

individuals in households and in villages with regard to access and control over pasture and crop fields.

In sum, the findings also indicated that TEK was effective in heightening environmental education in relation to the effects of climate variability and change. For this reason, to contextualize social-ecological typologies linked to Hollings (2001) adaptive cycles and pastoralist's worldview, local environmental education perceptions and forms of livelihoods were identified as meaningful knowledge in which native terms were used as a lens and foundation for assessing social-ecological typologies to climate variability among pastoral communities in Namwala. The linkages developed in this study provided stewardship elements that recognized and promoted indigenous social-ecological practices and values as culturally appropriate alternative to resilience building and management of land and water as CPRs in the context of climate variability and change. Thus, findings from objectives one, two and five were envisioned to bridge the gaps in literature on the effects, resilience and environmental education linkages respectively in understanding pastoral SETs from climate variability and change stressors. Hence, the social-ecological complex education linkages provided a framework capable of application at locale, district, national and international levels. This was important as it showed locally owned and resilient approaches in the utilization and management of CPRs such as the Kafue Flats and promotion of rural development through appropriate agricultural policies in general and livestock in particular. Thus, this study re-conceptualized the Kafue Flats as a dynamic ecotone ecosystem, one in which new rules for Kafue River governance could sustain pastoralism into a vital economic, ecological and energetic sector. The next chapter discusses the major results.

CHAPTER SIX

DISCUSSION OF RESULTS AND FINDINGS

6.1 Introduction

Several assessment reports published over the years by the United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) have not only confirmed the reality of climate change, but have also underscored the importance of incorporating traditional ecological knowledge (TEK) into climate action (Boko et al., 2007). The incorporation of TEK into climate action is said to be useful in developing 'effective adaptation strategies that are cost-effective, participatory and sustainable' (Boko *et al*., 2007: 456). For African countries, the need to combat climate change is particularly urgent given the peculiarity of Africa's climate change situation. Though the least contributor to the anthropogenic causes of global climatic changes, Africa bears the harshest brunt of climate change (IPCC, 2014) and is poorly represented in global efforts to combat climate change as evidenced for example in the small number of African scientists on the IPCC. Climate change poses a serious threat to Africa's sustainable economic development and if not combated, risks derailing the socio-economic gains already made by African countries (Senanayake, 2006).

Climate change policies and programmes are mostly framed as mitigation and adaptation strategies (Boko *et al*., 2007), with some as educational strategies that aim to change 'lifestyle, economies and social structures' that contribute to excessive production of greenhouse gases, and also equip people and communities with the appropriate knowledge and skills to adapt their lifestyles and livelihoods to the impact of climate change. Human activities have been found to contribute significantly to climate change (IPCC, 2014), and education as a tool for social change has a vital role to play in not only changing behaviours that contribute to climate change, but also in instilling adaptive knowledge and skills towards the accommodation of climate change impacts. The IPCC (2014) for example cites indigenous food security practices amongst women in Africa, who are able to use EE to select drought and pest resistant crop seedlings for planting to protect their families against food insecurity during droughts and famine. The development of EE discourse around TEK or IK holds the prospect of exposing these global economic and political interests for what they are, whilst paving the way for the utilization of IK to promote sustainable development in African states (Liu *et al*., 2007).

Combating climate variability and change is part of a broader global sustainable development agenda (Senanayake (2006), as can be seen in the inclusion of a climate change goal in the proposed UN Sustainable Development Goals (SDGs). For climate-related education programmes to be successful in creating a climate-aware citizenry in any society, the indigenous forms of knowledge based on the lived experiences and local ecological conditions of such a society must be incorporated into such programmes. This important indigenous perspective to environmental education (EE) is notably missing in most African countries, due to the de-contextualised nature of educational policies and programmes, traceable to Africa's past experience with colonial domination (Senanayake (2006), the result of which has been the marginalisation of African TEK in contemporary educational policies and programmes (Boko *et al.*, 2007).

Addressing the risks of climate variability requires global as well as local action to reduce greenhouse gases and to reduce vulnerabilities to climate change impacts. The relationship between the local and the global - and how they shape each other in mutually interdependent ways - is one of the central organising principles of EE. When climate change is framed as a local issue, it enhances local peoples' sense of connection to and understanding of climate variability and change; allows for engagement with practical, concrete issues and initiatives; promotes the development of local and regional solutions that could be applied to the national and global arenas.

Despite the severity of an existing climate crisis, as well as the establishment of a consensus on the reality of human-induced climate change (Liu *et al*., 2007), climate change is often treated as a low policy priority, relative to other national and environmental issues, particularly in areas where the effects of climate change are not directly felt, or with sufficient frequency to cause alarm. However, the scale and urgency of the crisis calls for radical changes in how individuals, communities, governments, corporations, the energy industry, and international agencies think and act in relation to climate change (Senanayake, 2006). Mainstream educational efforts to address worsening environmental conditions have been criticised for their preoccupation with individual behavioural change, to the detriment of a consideration of wider institutional concerns.

Even at the personal level, however, environmental educational efforts to promote more sustainable practices among individuals have met with limited success. As IPCC (2014) puts it, human beings appear to be 'fundamentally ambivalent about going green'. Psychologically

speaking, human beings have the capacity for disavowal, i.e., the capacity to know and deny something at the same time. As Liu *et al*., (2007) remarks, 'many of us hold that climate change is a reality, and yet, in our driving and consuming habits, we act as if we did not take it seriously'. Moreover, since many of the behaviours and practices that contribute to climate-related harm are rooted in social and cultural norms, and make life more convenient, manageable, and pleasurable for people, they are difficult to change. In other words, complex social-psychological as well as cultural-economic realities make it extremely challenging to bring about the radical reduction in emissions that climate variability and change demands.

While individuals might appreciate the importance of ecologically sustainable modes of living, the way that societies within emissions-intensive economies are currently organised makes it is very difficult for them to radically reduce their emissions (Senanayake, 2006). The discrepancy between a relatively high level of awareness of the ecological crisis on the one hand, and insufficient political and social change on the other are at the heart of the problem. Environmentally educational speaking, this implies the need to foster a very different set of social norms and practices and to engage local communities with opportunities to reflect on the broader social-cultural contexts which shape their lives and their relationship to the environment, so that collectively they can explore possibilities for how human and ecological systems can be structured differently (Liu *et al*., 2007).

This chapter therefore discusses five themes based on research questions presented in Chapter one sub-section 1.5.3. The categories include: reducing vulnerability and strengthening resilience status of pastoral system to climate variability (combined research questions 1 and 2); re-organisation and renewal in the regulation of the Kafue River on pastoral land use (research question 3); land tenure governance in the utilisation and management of CPRs (research question 4); and application of rural pastoral social-ecological linkages (research question 5).

6.2 Reducing vulnerability and strengthening resilience in the face of climate variability among pastoralists: transformative analysis and the value of cattle

Whenever traditional cattle farming are discussed in Zambia, one of the names that come to mind for many people is Namwala District of Southern Province. This is so because even with the decapitating cattle diseases that have ravaged the area in the last decade, Namwala still boasts of being the district with the largest number of traditionally owned cattle that stood at 145,445 in

2016. Cattle rearing in Namwala had taken a centre stage from time immemorial. It remained the mainstay of traditional peasant farmers. The prosperity of the cattle economy was based on the cycle of flooding on the Kafue flood plain, which provided year-round naturally irrigated pasture. Pastoralists' views and perceptions of the changing environmental conditions were confirmed by evidence from rainfall and temperature data obtained from local weather stations in the study area and regional rainfall and temperature data obtained from Zambia Meteorological Department (ZMD), which all indicated that Namwala was experiencing increased fluctuations of both rainfall and temperature in the past 30 years. The IPCC (2007a) reported an increase of 0.74°C of the global temperature near the surface of the earth from 1906 to 2005 and also estimated the likely increase of about 6.4°C on average during the 21st century. Similarly, the findings on the perceptions of the farmers on the changes in rainfall and temperature, and the associated physical effects of climate change, were similar to the other findings in climate change literature (Parry, 2007; Collier *et al*., 2008). Similarly, the study area fell within the region of sub-Saharan Africa where climatic models project that climate change will have major effects on the livelihoods of the people and ecosystem goods and services on which they depend (Thornton *et al*., 2006).

Results showed that cattle were an important symbol of prestige and social standing in traditional Ila society. Cattle also conferred status to individuals. There was a common assertion that the more the number of cattle one has, the wealthier and respected the individual was without considering their health. Further, pastoralists rarely slaughtered their cattle for food or sold them for commercial gain. In addition, cattle fulfilled a number of roles in social functions such as traditional ceremonies and marriage payments. They also contributed to production through draught power for ploughing, transport and manure (Fielder, 1973). It was further noted that cattle were seen as the main form of security in the Ila society and in a way fulfilling the accumulation of more cattle (Rootselaar and Bwalya, 1990). Thus, pastoralists strived to accumulate cattle in an effort to enhance their status in the community by honouring social relationships and extending patronage over others. This agreed with findings from studies conducted by Beerling (1986) among the Lozi in Western Province who showed that a family needed a minimum of thirty to fifty heads of cattle to live reasonably and to fulfil their social obligations in the community.

The findings revealed that cattle were important for political purposes and for storage of wealth. This fact had often been misunderstood in literature and by officials in the past. It was not only for

political reasons that owning a lot of cattle was the goal for most Ila. Large herds were important for security reasons as cattle were seen as a security bank in times of need. Cattle could be exchanged with maize or sold. In olden days milk was often consumed in the households on a daily basis while cattle were only slaughtered for meat at funerals. In the colonial and the first part of the post-colonial times, the slaughtering of many animals at funerals was criticised by colonial officials as they did to late Chief Mukobela. They saw cultural reasons as inhibiting the Ila selling cattle to urbanised centres such as Lusaka, the Copperbelt and the so-called line of rail (rail connecting the Copperbelt with Livingstone and today's Zimbabwe). According to Fielder (1973), the Ila were reluctant to sell cattle but this 'habit' had more economic reasons than political or cultural ones. Fielder (1973) argued that the security level for a household in order to sell cattle was at least 40 animals. Before this number was reached, the Ila were reluctant to sell cattle. Another aspect was that cattle were not really private property but they belonged to a group of relatives and was traditionally not easy to sell a cow without various consultations among family members where the owner had extended patronage (Tuden, 1968).

Following the introduction of abattoirs in 2005 and 2008 by Zambeef and Starbeef respectively, Maala and Chitongo later, production goals for keeping cattle had changed. This was due to socio-economic changes among pastoralists from keeping cattle for prestige and as a symbol of wealth to redefinition of goals. In this study, financial security was ranked the first and most important primary objective of those interviewed. This was due to the changing economic environment resulting in an increase in the demand for money in the rural economy. Many pastoralists were market oriented and money acquired was used to purchase necessities ranging from social needs to agricultural inputs. The reliability on cattle among farmers as a source of income was found to be very significant. This suggested that cattle were perceived to be more important than their actual contribution to household cash income. This position agreed with the study undertaken by Hermitte (1974) in Western Province, which revealed that when new trade was monetarised, goods could be obtained by converting surplus animals into cash with which to buy prestigious European goods, especially by the Lozi aristocracy. This became the most important objective for keeping cattle since surpluses were used for financial gain to purchase other items as opposed to using cattle to forge political and social networks. Furthermore, the study in Manicaland Province in Zimbabwe by Zindi and Stack (1992) indicated that fifty percent of households owning cattle ranked livestock among the two most reliable sources of income. About 40 percent of the

households owning cattle ranked them among the two most reliable sources of income compared to 16.3 percent of the households owning only small stock. While 25 percent of the non-livestock owning households ranked livestock among the top two most reliable sources; suggested that poultry enterprises was important for households with cattle or other types of livestock. This was in line with results from Namwala that livestock particularly cattle were ranked highly as a form of insurance by households owning cattle in terms of cash.

Scoones (1995) pointed out that the key issue underlying African livestock marketing was not supply but rather strategic public sector interventions to competitive, efficient and flexible markets. Jaspan (1953), in a study Namwala in the early 20th century showed that between 1922 and 1933, cattle sales were low due to trypanosomiasis and FMD causing prices to drop and fluctuate and marketing became unreliable. Prices dropped from £10 per animal in 1934 to £1in 1936. In 1940s, cattle prices were still low averaging £2 or £3 for cows and £3 to £6 for oxen. However, Fielder (1973) in 1960s indicated that due to various diseases, the District was excluded from selling cattle because of the fear of spreading diseases to other districts. Consequently, off-take rates from the traditional sector were low ranging from two to seven percent per annum. These figures, however, varied with accessibility to markets for cattle traders and the economic circumstances in a particular year (Rootselaar and Bwalya, 1990). Marketing problems coupled with livestock diseases continued in the 1980s and 1990s with 'briefcase buyers' dominating the livestock markets for cattle. Although the livestock industry had been growing over the years, the sub-sector faced various challenges that had restricted its growth and access to local and international markets. It was characterized by low production and productivity.

The socio-economic transformation among pastoralists in Namwala was as a result of the rise of rural-livestock markets, with the operations of commercial buyers which resulted into significant decline in 'briefcase' traders. These commercial entities opened new opportunities for pastoralists to sell their animals owing to recurrent livestock diseases and droughts/floods. The situation changed the perception of farmers and the value attached to cattle from accumulation to entering into the money economy. For example, off-take rates from 1991 commercial sales were 1,700 outside the district and 205 within the district. The number slightly rose to 1,920 in 2001 and 2,642 in 2004. The establishment of Zambeef saw the number rising sharply to 14,400 in 2005 and almost doubled to 26,330 in 2009 following the coming of Starbeef. This was because an average

of about 645 animals was slaughtered per week, 2,580 per month and over 30,960 per year. This proved the point that the availability of markets had the potential to increase off-take rates from the traditional sector. Hence, there was a relationship between regular markets for cattle and off-take rates in the face of climate variability.

For successful pastoralists, especially in Maala, cattle accumulation opened unprecedented opportunities to engage in regularised livestock markets. The findings established that with the expansion of markets, cattle keepers took advantage of the opportunity to convert stock wealth into monetary value, and transformed this value into other economic investments. The propensity for successful cattle owners to be regularly involved in cattle markets was in line with information presented by Lutke-Entrup (1971), in his study in Western Province of Zambia. He concluded that traditional off-take rates were linked to the sizes of the herd among different categories of cattle keepers in Western Province, particularly in Mongu and Senanga where first abattoirs were established. The bigger the herd, the more surplus the number of cattle sold. Hence, for successful cattle owners in Namwala, cattle were increasingly seen as commodities that could congeal with increase in value holding it in a stable social, economic and ecological environment.

There were more pastoralists who indicated that they sold their animals to acquire universally accepted and prestigious items such as radios, solar panels, television sets, and vehicles. For example, 36 percent of the pastoralists bought vehicles from proceeds of cattle sales and 33 percent constructed dip tanks/spray races for dipping their animals. In addition, pastoralists made other improvements such as building modern housing structures, fencing, and opening up of retail shops. All the chiefdoms (Maala, Baambwe and Mbeza, except Muchila), were among few rural outposts in Zambia connected to the National grid, with 38 percent of the sample owning television sets, hammer mills and running other small businesses requiring electricity. Even if this was so, only chief's palaces, clinics, schools and a few richer pastoralists had electricity in their homes. They used solar instead. To support the acquisition of material assets by pastoralists with increased markets, Zindi and Stack (1992) in their study on communal areas in Zimbabwe, stressed that although 70.3 percent of the households experienced cattle marketing constraints, 76.9 percent indicated that a ready cattle market was the reason for selling their animals to acquire items such as fire arms, hammer-mills and vehicles. The Namwala case agreed with this assertion that price incentives from Zambeef and Starbeef, including Maala and Chitongo abattoirs, were a

strong driving force that resulted into farmers disposing off surplus cattle with earned income used to purchase various items.

Another observation made was that depending on the status of the pastoralist, surplus animals by different categories of pastoralists in Namwala were deployed to serve different socio-economic functions which secured material advantages for the owners. The situation was changing in that instead of using cattle surpluses to forge for social networks, prestige in society and patronage over others, successful pastoralists tended to withdraw their cattle from internal redistribution to acquiring universally accepted items. Under the free market economy prevailing in Zambia, increased opportunity to engage in rural markets by private commercial buyers, led to some rich pastoralists to withdraw animals from traditional internal redistribution to individual accumulation in order to participate in the rural markets without consulting anyone. This phenomenon was also observed in a wide diversity of other African cattle keeping societies such as the Fulani of Nigeria (Sutter, 1987), the Masai of Kenya (Hedlund, 1971; Grandin, 1988), the Somali of central Somalia (Abdullahi, 1990). Closer to home, Solway (1986) and Behnke (1987), demonstrated this in the case of Botswana among the Tswana that the use of live animals for *kushisha* tended to decrease with the level of increased market opportunities in local rural areas.

Furthermore, the ability to build sufficient herd was partly determined by the extent to which a particular cattle owner could refrain from liquidating the reproductive element of the herd. Thus, access to other forms of income and means of subsistence, such as shops were found to be advantagious for pastoralists who were still attempting to expand their cattle holdings. Once a sufficient herd of cattle was achieved, it became feasible to sell the surplus animals without undermining the reproductive capacity of the herd. In addition, the role of wage employment as a means to acquire animals had been very important in the past and continues to be important today, and was on an increase in Namwala. It was indicated that people in salaried employment, both Ilas and non-Ilas and those who hailed from other districts and provinces, were able to accumulate animal surpluses by investing their wages in cattle and used un-remunerated kinship labour to herd their animals while they were away in employment. In return, the salaried employees had reciprocal kinship obligations to their relatives in the village, such as paying school fees for a relative's child or providing lodging to relatives visiting urban areas. The absence of these salaried employees from the village and their access to an alternative source of income enabled them to

refrain from eating into their herd capital. These observations in Namwala agreed with findings from studies by Beerling (1991) and Wood (1989) on studies in Western Province of Zambia.

There were no limitations upon the number of cattle that an individual or family could keep. In the past, the chief owned more heads of cattle in the village than any other person and subjects offered herding services. For instance, Chief Mukobela[3] of Baambwe who died in 1958 owned more than eight thousand (8000) heads of cattle and more than half were redistributed among his subjects. This was to ensure loyalty, power and prestige among his subjects. This is referred to as 'cattle complex' argument where cattle accumulation among successful cattle keepers were used as a vehicle through which they strived to enhance their status. This enabled them to extend social patronage and relationships over others. This custom had continued and facilitated the circulation and redistribution of animals in the Ila society. Thus, a corollary of the concept of cattle complex is 'target selling income' which was used to contend that because of their cultural attachment to cattle, traditional cattle keepers were unwilling to sell their animals unless there were specific income targets to be met. For various interpretations see Fielder (1973) and Jaspan, (1953).

Lutke-Entrup's (1971) study indicated that almost half of the respondents stated that they acquired their first animals through purchase of cattle after earning money from employment. This situation could have been more pronounced in Namwala if parents encouraged their children to attend formal education, instead of the current situation where only 20.4 percent of the respondents stated that their salaried relatives had entrusted them with their cattle. In this study, more males were far more educated because a reasonable number of males attended secondary and tertiary education with 70 and 80 percent respectively whereas the bulk of females attended only primary (62.3 percent) and most of them never attended formal school (59.9 percent) due to cultural arrangements favouring boys. Boys have always been viewed as future family heirs. This collorary was attached to an old tradition, i.e where Chief Mukobela Lubanga Shabongwe Kakombo Suta

[3] Chief Mukobela (Lubanga Shabongwe Kakombo) helped in the political struggle for independence by donating cattle to freedom fighters to eat and sell. In 1950, in order to encourage education, and because he disapproved the wasteful of *masuntu* (cattle slaughtered at a funeral) ceremonies, at which large quantities of cattle were slaughtered on the death of every prominent citizen to provide the spirit a herd of cattle for him in the spirit world, he arranged with his people to save 200 of the cattle that would have been slaughtered at his funeral and donated them to the project - Lubanga Shabongwe Basic building project after his death (although 300 cattle were slaughtered when he died). Chief Mukobela also stipulated that a statue of him similar to that of Livingstone at Victoria Falls should be erected on the site in front of the school. The statue was made by a Cape Town sculptor, Mr. Mitford Barberton, from photographs the Chief had in his prime considering he never saw Mukobela either then or now is a remarkably fine likeness. The school was opened at the end of August, 1952 and the statue unveiled by His Excellence the Governor of Northern Rhodesia, Sir Gilbert Rennie.In Baambwe where he hailed from, there was (is) no such infrastructure. He built it to help the 'vulnerable'. According to him, the Ilas where rich and did not need such infrastructure.

built a school far from his chiefdom for the education of *balumbu* (non-Ilas) he regarded as 'vulnerable'. For him, the *Ilas* did not need formal education because they were pastoralists and born 'rich'. This was proved by the fact that the chief completely handed over the school to the federal government without any strings attached or shares to the royal family. This situation and status quo, it was learnt, had persisted up to date. But in recent years, due to diseases that reduced cattle numbers and unpredicted harsh climate, many pastoralists realised the importance of sending their children to school as a form of investment. It was a newly established form of 'social' prestige that a pastoralists 'child was in 'town', at a prestigious school, college, university or even abroad. They were willing to sell cattle to raise school fees for their children just like they sold their cattle to acquire other assets. Hence, social-ecological stresses were found to be compelling forces on the level of investment in education for their children.

Furthermore, due to prevalent of cattle diseases and recurrent droughts, 62 percent of the respondents did not accumulate sufficient cattle. This group just managed to maintain a foot-hold in agro-pastoral production mainly given to them by rich relatives. Because of their weaker economic base and their lack of access to alternative sources of livelihood, they were more dependent on their cattle for survival and more likely to liquidate the reproductive element of the herd to meet short-term income needs. This depleted their stock and diminished their chances to successfully accumulate and participate in available markets as compared to very rich pastoralists. In situations where they had no immediate need to dispose off their animals, this category of herd owners showed a greater degree of 'attachment' to their animals, and for this reason their behaviour was attributed to 'cultural irrationality' and less participation in regularised markets.

In addition, livestock health in Namwala had been affected by poor husbandry practices resulting from poor extension system and certain traditional practices. Pastoralists lacked sufficient knowledge about modern husbandry practices such as good housing practices, feed supplementation, and breeding which improved the vigour of calves to be resilient to diseases in addition to internal parasite control (de-worming). In most cases, the sizes of herds often led to overgrazing particularly in drought years on the upland and now increasingly on the Kafue flats. Big cattle herds were also difficult to control and very often left to wander freely, becoming easy prey for lions, hyenas and even crocodiles. Studies among the Ila by Jaspan (1953) and later by Fielder (1973) found that losses due to the depredations of these carnivores were frequent, and

sometimes described as large. Some established traditional practices did not seem to favour stock improvement because too many bulls were allowed in the herds. It was also common to castrate the best bulls so that they could become large oxen for showing off at traditional ceremonies such as *Shimunenga* and *Shikaumpa* in Maala and Baambwe respectively. In lesser instances, methods of castration often led to deaths as bad methods and dirty knives were used.

The above situation is different today. Selling cattle expanded pastoralists' production opportunities by ploughing capital into modern forms of investments such as retail shops with money realised ploughed back to buy more cattle stock. Increased commercialisation and the degree to which cattle owners tended to invest into the herd in form of drugs, vaccines, supplementary feeding and fencing controlled and protected the spread of diseases and pasture. Apart from direct conversion of livestock wealth into commercial assets, proceeds from cattle trade also helped owners to purchase breeding bulls such as Brahman from neighbours along the line of rail such as Kalomo, Choma, Mazabuka and Mkushi. Improvements in management also occurred through the use of rubber bands (instead of using a burdizzo and knives), de-horning, de-worming, and cattle treatment with frequent dipping and spraying and fencing (grazing control). These were regarded as socio-economic resilience building strategies in the pastoral society.

Information that described the community and its environment was gathered in a number of ways, which included dynamic, differential, and spatial patterns of household and community level vulnerability and to identify associated coping and adaptive strategies (resilience) to climate-related crises. It was also observed that direct and indirect effects of these and other distress coping strategies could send vulnerable households into a downward spiral that undermined their livelihoods for years to come. Evidence suggested that climate-related threats to livelihoods were of greater concern to poor communities than 'one-off' disasters. It was also noted that the critical ingredient for reducing vulnerability to disasters was through increased EE. These were not only means to a more secure environment, but they were also means to social-ecological livelihoods.

Thus, pastoralists in Namwala were facing various problems pertaining to recurrent cattle diseases and climatic variability resulting into cattle losses, frequent droughts and floods, and consequently crop failure. This resulted into assuming coping strategies that included among other things the following; fishing, poaching/ bee keeping/lumbering, treating cattle with vaccines and

dipping/spraying, diversifying with mixed crop/animal production and keeping different animal species. Yambayamba (2006) explored fishing and keeping different livestock species as the most visible and viable coping strategies common in recent years in the wake of livestock diseases.

For a long time, the *Ilas* had little to do with the river. All they used the river for was mainly livestock watering, and even going near the river was a taboo. But because of the prevalence of diseases like corridor (*denkete*) which killed thousands of cattle in the 1990s, some of those who were heavily hit turned to the river for survival. However, this was not received by the local people. Some years before, if an Ila was found fishing, they would have a *kama* (small meeting) to find out why, because those who fished were normally *balumbu* (foreigners or non-Ilas) especially the Yao, Lozis and Bembas. Fishing was mainly done for them to re-establish themselves in the Ila way of life. Many people had not adopted it as a permanent activity but to re-establish themselves in the Ila way of life - cattle keeping. Sikana (1997) found out that the situation was similar in Western Province in Zambia in which cattle keepers who lost their animals to corridor disease turned to the Zambezi River for survival and re-established themselves after.

In addition, the study by Yambayamba (2006), in other Provinces of Zambia namely: Eastern, Northern and Central Provinces established that other than cattle that were classified as 'very important', other species such as goats, sheep, pigs, poultry and rabbits were generally classified as 'important'. In all the Provinces, livestock species were ranked in order of their socio-economic importance as follows: cattle, goats, poultry, pigs, sheep, and rabbits. Small livestock such as poultry and goats had a high turnover rate and could easily be converted into cash. Yambayamba (2006) further stated that experience on the ground showed that with more improved management, local chickens could be raised to market weights within two months. Goats on the other hand, had a higher thinning rate and could multiply in a short period, helping families to survive.

Many of these diverse species kept were found to be similar to those assumed in Namwala although they had not yet embraced rabbit keeping as a viable coping strategy; maybe it is time to introduce them, for women! On the whole, diversifying with mixed crop-livestock production was vital in addition to keeping different livestock species such as pigs, poultry and goats and now increasingly sheep which were slaughtered more often on weddings and traditional ceremonies rather than cattle. In situations of drought, especially the 1991-93, worst of the century, pastoralists

realized that the crises came suddenly and keeping cattle only was not a secure source of livelihood. Today, most of them diversified to keeping other forms of livestock such as goats, sheep and donkeys. They had also embraced non-traditional livelihoods among them fishing, lumbering and poaching. 'Target income' household expenditures were met by these small ruminants. In addition, donkeys were also introduced for transport and draught power. Like other farmers elsewhere in Zambia, pastoralists in Namwala District had taken advantages from different reproductive rates of different species mainly not as a survival strategy, but to rebuild their livestock numbers. Thus, a call for support to the diversified livestock sector that had mainly been marginalised cannot be overemphasized.

Pastoralists had also realized that the traditional system of extensive grazing in the Kafue flood plain they maintained for years was no longer sustainable under severe conditions of climate variability and change. Thus, the need to improve livestock and pasture management both on the upland and flood plain, and adopt a more diversified food production and income generation strategy cannot be overemphasized. An immediate need to this was to support more effective dry season preparation to enable pastoralists cope with the prevailing extreme weather conditions.

Furthermore, transhumance was a common practice in Namwala. Mobility was an inherent part of the pastoralists' new existence in Namwala in which they spent rainy season on the upland and dry season on the Flats. An analysis by Cull and Vincent (2004) showed that South African pastoralists had similar movements of livestock depending on availability of water and pasture. While, Deressa and Hassan (2009) research on pastoral movements as a coping mechanism in the Horn of Africa showed that the distance trekked to livestock water sources was almost tripled during drought. Key resource areas that were set aside during the rainy season were called upon during drought. This was already and will become a major source of conflicts in Namwala with continuous uncertainities in the utilization and management of the Kafue Flats, and increase in individualization of land which had resulted into informal fencing of customary land.

For this reason, herd management was at the centre of pastoral improvement in Nawmala. This involved herd diversity in which pastoralists managed both grazing and browsing livestock species to optimise different range of resources and ensured the conservation of rangeland ecosystems. Grandin (1992) made similar observations in Kenya and Tanzania that pastoralists stocked their

herd with a mixture of cattle, camels, goats, and sheep. This level of mixture was also visible in Namwala, although at a small sacle. The other aspect was herd splitting. Splitting the herd into smaller groups and moving them to different areas was used to prevent overgrazing and maintain the long-term productivity of the range. This was a normal and an old practice among rich pastoralists, not only in Namwala, but also in other cattle keeping societies. It was not feasible to keep 10,000 cattle in one place, so splitting was an economical alternative.

Although livestock feed supplementation was a common strategy in most African countries during dry years (Galvin, 1992) and neighbouring districts outside Namwala (Sianungu, (2015), it was not practiced in Namwala. Even in driest years, pastoralists in Namwala did not give supplementary feeding to their cattle except, and only breeding bulls. They still largely depended on the Kafue flats as an answer even when climate variations were threatening cattle survival. It was therefore important to transform local perceptions and methods by introducing supplementary feeding to increase livestock strength and productivity in years of floods or drought. Other strategies were management of diseases which tended to increase during periods of stress, particularly floods; and sharing, loaning, and giving of livestock as gifts which formed an integral part of the communal way of life, although these were no longer popular. The tendency by pastoralists to liquidate some of their livestock during times of drought had been recorded as an important resilient strategy in many pastoral and agro-pastoral societies (see for example, Little and Brokensha (1987) for Masaai; Sutter (1982), for the WoDaBe in Niger; McCabe (1988) for the Turkana; Hogg (2001) for the Borana and Baival (2012) among Mongolian herders).

6.3 Reorganization and revaluing the Kafue River flow and flux for pastoralism

The farming and cattle grazing livelihoods that characterize Namwala were dependent on a rich ecotone ecosystem nourished by the seasonal rise and flow of the river. The Kafue Flats is a dynamic and seasonally flooded landscape of oxbows, verdant grasslands and wooded levees in central Zambia. The Itezhi-tezhi Dam (1978) regulates the Kafue River as it flows through the Flats to the Kafue Gorge Dam (1972). Food security was a primary concern in Namwala and seasonal flux was productive as rich ecotones were nourished by flooding. The temporality of pastoralist's depending on seasonal flooding which were both ecologically productive and vulnerability. Accordingly, weather and climate information should be used as integral components for risk management in implementing flood management programmes. ITT dam was

designed for managing seasonal flooding to mimic pre-dam flooding patterns but implementation faltered. Trade networks, centred on fish, also cannot be underestimated for their impact on the health, economy and culture of the commonly owned Flats, which needed to be nurtured and protected. Thus, improved technology and operating procedures could allow river flows to be managed with more nuance and sensitivity to both ecological and pastoral needs thereby protecting the Kafue Flats as an 'oasis' for dry season grazing. The major problems pastoralists were faced with were irregularities and timing of releasing water from the Itezhi-tezhi dam.

Altered flooding patterns changed the ecosystem and the flow regime was severely changed to provide consistent levels for downstream hydropower production as noted by other scholars (Handlos, 1998; Chabwela and Siwela, 1986; Chabwela and Ellenbroek, 1990). Compared with the Kafue River's natural flow regime, the post-dam flow exhibited a reduced flood peak, higher minimum flows, and reduced flows overall. However, pastoralists pointed out that there was inequity of the hydropower transaction as authorities did not care for cattle husbandry but for urban populations and mining in Lusaka and Copperbelt. Only 5% of households in the Namwala had electricity, while 60% of Zambia's electricity went to the Copperbelt mines. Hence, the Kafue Flat activities were the consequences to satisfy urbanites by altering river flows. It was therefore vital to reconceptualise and revalue the Flats as a complex cultural landscape rather than a utilitarian resource. Altered flows were also connected to corridor disease which decimated cattle and continued to be a major cause of poor management practices among pastoralists.

Most pastoralists lost two thirds of their cattle between 1991 and 1994 due to outbreak of corridor disease (also called east-coast fever, *theilerosis parva*). This sickness is transmitted by ticks, which were less common in the Kafue Flats before the construction of the Itezhi-tezhi dam because the ticks were drowned by the floods during the rainy season. After the dam was build, there was less flooding in the Flats especially in dry years (see Marchand and Drijver, 1985; Drijver and Chooye 1995) and as a result there were more trees and less pasture. Additionally, the ticks did not get killed in the same amount as before 1978. On the other hand there was more flooding in the dry season due to untimely water releases. This led to the situation whereby the pans and lagoons in the Flats had more water in the dry season now than before the dam was build. In earlier times, cattle used to feed on the grass in shallow water and swamps that had nice fodder. In order to get access to this green grass, the animals stood deep in the water and by this lost the ticks that got

drowned. But now paradoxically, the water in these lagoons in the dry season was too deep and had less grass and therefore cattle fed on the higher grounds, where they were attacked by ticks and could not lose them.

The causes of flooding in the Kafue Flats were identified as both natural and human induced. In some years, the recurrence of above normal rainfall created conditions for flooding as natural occurrence. It was also indicated that the operations of the Itezhi-tezhi Dam upstream the Kafue Flats caused sudden floods when peak flow releases were made from Itezhi-tezhi reservoir and led to altered livelihoods as human induced. The two types of flooding call for different approaches for their management. For instance, early planting of crops in the plains and evacuation to higher grounds for those living on islands such as *Namisamwe* and *Kakuzu* in Baambwe, *Chitumbi, Chilala* and *Busangu* and some parts of *Kantengwa* in Maala was imminent. The main complaint, as learnt from these interactions, was that in recent years people were not given enough notice by the dam operators (ZESCO) when the flood gates were to be opened at Itezhi-tezhi Dam.

Information about floods, flow and flux was critical in the Kafue Flats. Prior to the commencement of each rainy season, the ZMD issued a seasonal rainfall forecast in order to provide some indication of the likelihood (timing and nature of the rains) of the coming season. These forecasts enabled pastoralists to make informed decisions and plan appropriately for their activities (i.e. supplementary feeding). But this information did not reach all pastoralists. Limited climate information and early warnings was received by pastoralists due to absence of transmission signals for radio and television reception. Instead climate information and early warnings were disseminated through community based radio stations working under the radio-internet (RANET) system of which local ones such as Itezhi-tezhi and Namwala radio stations are not included. In terms of effective early warnings for disaster preparedness, pastoralists recommended the use of public speaker systems on 4x4 vans and speed boats; and/or helicopters and low flying aircrafts to distribute flyers written in local languages. This information was useful in planning their activities. It was further established that the transhumant movement of cattle from the plains to upland areas were sometimes deadly when news about floods is delayed or not heard.

The Kafue Flats, being suitable for livestock farming, its abundant water resources should also be utilized for irrigated crops such as rice and diversification to keeping small ruminants such as

goats, pigs and donkeys to ensure food security and gardening for diversified income generation. The Namwala Farmers Association was implementing some small scale irrigation initiatives using treadle pumps to grow vegetables for sale. The Zambia Prison Services in Namwala was also producing winter maize and vegetables under irrigation. These initiatives should be copied and strengthened so that local pastoralists diversify. In view of the entrenched TEK attitudes and traditions among pastoralists, EE for behaviour and attitude change for other economic activities should be encouraged.

Increased dialogue among stakeholders about responsive dam operations and a range of strategies for increasing food security and protecting the commons were critical for regenerating the Flats. Adjudicating common resources should also be a priority. The floodplain itself is a zone of vulnerability but also of great natural wealth, would become an even greater source of uncertainty for local residents' livelihoods and regional trade networks if its role as a common resource was further threatened. As such food insecurity was a primary concern in the flood plain. Churchill (2010) argued that the temporality of livelihoods dependent on seasonal flooding was both a productive asset and vulnerability. Pastoralist's livelihoods were likely to continue to be in flux thereby increasing vulnerability and shift changes in values about new paradigms and social-ecological typologies. Farmers were now adapting their livelihoods to the changing seasons, climatic patterns and irregular dam operations in managing the 'commons'.

This study re-conceptualized the Kafue flats as a dynamic system, one in which environmental river flows, new partnerships and re-valued resources could sustain healthy communities. Increasingly, stable economies were predicated on well-managed ecologies which supported development within reasonable bounds. If the Kafue flats became overgrazed, overfished and overdeveloped, or if flows were not restored, it would not support the pastoralists who depended on it. However, if the natural flow of the Flats was restored through more sustainable dam operations, it could continue to be a wealth of natural resources such as farming and fishing. Therefore, living with variability, change and uncertainty entails networking with other relevant partners in gathering, processing and forecasting of meteorological and early warning information. Hence, learning to live with change and uncertainty entails production adjustment, improved breeding, policies, technology and management practices among pastoralists to accept disturbance, surprise and crisis as part of the transformation process of SETs.

6.4 Empowering and improving livelihoods through land tenure security

All land in Zambia is vested in the President who holds it in perpetuity for and on behalf of the people of Zambia. This indicates that customary land just like state land is also controlled by the President. However, customary tenure was not expressly defined in the Lands Act of 1995 but it provided for the recognition of customary tenure as a form of landholding in the country. Land under customary tenure has been hailed to be the greatest resource and at the same time the backbone for wealth in many local communities whether urban or rural. Nonetheless, it had not fully been utilized by the local communities to enhance its development. This has been necessitated by various shortcomings in both the legal and institutional frameworks. Kajoba (2003) observed that the main legal framework for the administration of land which was the Lands Act of 1995 which lacked collaboration with other statutes. On the other hand, the institutions that were involved in customary land administration lacked coordination and this adversely contributed to the ineffective of customary land administration in Zambia. According to the GRZ (2006, p.55), the overall goal in rural diversification and development is "to have an efficient and effective land administration system that promotes security of tenure, equitable access and control of land for the sustainable socio-economic development of the people of Zambia." In addition, the Land Policy states that in order to advance the advantages of customary tenure, government would "recognize the rights of land users by defining these rights through registration so that everyone irrespective of social status, gender or origin can have similar rights to land," (GRZ, 2006, p.14).

Some background may be helpful in explaining the sensitivity and complexity of customary tenure arrangements and the long-running resistance to change by pastoralists. Allan (1965) in his classic study, '*The African Husbandman'* provided a synopsis of land tenure arrangements prevailing in customary areas in Zambia in the first half of the last century. His explanation drew on the findings by Gluckman (1941) on the customary land-holding systems of the Bantu-speaking peoples of Central and Southern Africa. Gluckman (1941) explained that chiefs did not allot the land directly to their subjects who used it. Rather, land was allocated to sub-chiefs who in turn allotted shares to village headmen. At the village level, the headman allotted land to heads of subsections or heads of families and they distributed land to their dependants. "Each of the persons granted land in this way was secure in his rights and could not be expropriated without fault. He could transmit his rights to heirs, but could not transfer them to anyone else without the permission of his seniors. If rights were vacated they rested in the next senior in the hierarchy," (Allan, 1965,

p. 361). Gluckman (1941) referred to this nested system of customary rights and responsibilities to control, administer and distribute land as 'estates of administration'. In Zambia, this provides the basic framework of customary land law for the majority of tribes. Variations occur in some land-scarce areas, where 'estates of administration' or 'control' were vested in segments of clans or lineages presently responsible for land administration in Namwala and other parts in Zambia.

An important feature of customary land tenure system was the right to avail it as a shared resource by all people belonging to a particular tribe. This right did not depend on the discretion of the chief or headman. He was required to provide residential, arable and grazing land for all his subjects. "A tribesman was entitled to land without giving anything for it, but he had a duty to protect and conserve it," (Kajoba, 2008, p.14). Although the concept of individual ownership was unknown, the usufruct rights to residential land were exclusive and permanent. The holder could protect his rights by civil action against any person, even the chief, except when land needed to be acquired in the public interest. In this case the chief would allocate an equivalent piece of land in compensation. Allan (1965) observed that customary law permitted tribesmen to transfer interests in residential land among themselves, but only with the consent of the chief. Although the concept of land sales was unknown, there was no rule forbidding payment for improvements. The free transfer of unimproved land was taken for granted. It was received free and was given free. It was not viewed as a commercial asset. But this scenario had somehow changed tremendously with value attached to land as outlined in the Lands Act of 1995. Successive governments have 'blown hot and cold' over the role of the chiefs in land administration and a great deal of ambiguity surrounding its current status. However, in rural areas, especially in Western Province, the role of chiefs in administering customary land has probably not changed greatly for the majority of people. According to Beerling (1986), the chiefs continued to grant rights to occupy and use land, imposed restrictions on the use of customary areas (e.g. prohibiting cultivation or the grazing of animals in a certain area) and resolved disputes with the help of groups of elders.

Thus, developing countries throughout the world were experiencing unprecedented pressure on land and natural resources; a host of factors has prompted sharp increases in demand for land, water, grassland and forested areas in developing and emerging countries. Fraser *et al.*, (2011) observed that these drivers, combined with climate variability and change and population growth, led to increased investments and speculation in agricultural and rangelands. While data seemed to

indicate that millions of hectares of land in developing countries were being newly leased or sold, an accurate picture regarding scale and impact had been difficult to obtain, due to a widespread lack of transparency involved in such transactions.

While Africa's predominantly customary land management systems were under pressure, formal and statutory land tenure and management systems introduced in the colonial period were generally very limited in coverage. In practice, land rights claimed and allocated by the modern state often conflict with the land tenure practices of ordinary people and, as a result, land tenure and shelter were insecure for many Africans. Birgegard (1993) stressed the fact that land and property rights were frequently weak or unclear creating a major obstacle to investment, both large and small. In Zambia, most national land policy reforms undertaken in the last decade recognized the legitimacy of customary land rights and provided for some form of registration or recognition (Kajoba, 2008), and a role for community institutions in land management, alongside the state.

For the Ila the main activity and source of identity has always been cattle herding. For this, Fielder (1973) and Bingham (1982) stated that the Ila people have developed a transhumance system that is adapted to the seasonal changes in the ecosystem of the Kafue Flats and land especially the flood plain is critical in these movements and access to pasture. However, there have already been intentions to privatise the communal property of the pasture area indicating that a more intensive use could take place in the future but with the wrong idea in mind that there was still plenty of pasture available, with fences extending in the CPRs. There was also another change taking place. Rich politicians and civil servants owning cattle from outside Namwala were acquiring and informally fencing off huge pieces of land. They employed cattle herders in local chiefdoms. Haller (2004) noted that this clearly contradicted the old institutions that only members of a *chishi* or in special circumstances from neighbouring chiefdoms could gain access to the pastures. In this respect, the district was already open for market purposes by making reference to a traditional but transformed rule. These then claimed to have reciprocal access to the land and pasture of the Ila because they had 'relatives' in Namwala. This increased land wrangles as the case in Ngabo area of chief Mukobela. The local people felt deprived of their usufruct access to land which was diminishing at a faster rate. From interviews and observations made in this study, two sources of concern were leading factors to land becoming scarcity in Namwala. The first factor was where

rich urban politicians and civil servants informally fenced land without title deeds. Secondly, an increase in cattle numbers and dry season flooding were also contributing to land scarcity.

In addition, the pasture area in the district had been diminishing due to the man-made ecological changes in flooding. Chabwela and Haller (2007) added that due to the increase in areas cultivated, former wet season pastures close to the villages had been reduced. This study found that the problem was exacerbated with the growth in cattle population now (2017) standing at approximately 150,000, with an influx of 'new tribes' and 'new pastoralists' from outside Namwala district following greener pastures in the Kafue Flats. Thus, the traditional institution regulating access to pasture was severely put into question and two contradicting constellations were observed in a typical case of Mbeza: one leading to attempts of privatization the Flats, while the other upholding old open access to the floodplain. An elaborate example of land tenure contestation in the management of CPRs broke out in Mbeza in 2002. According to Haller (2004), in order to mitigate the food crisis, the local Chief Nalubamba reintroduced the idea of an irrigation project in the Mbeza territory that he had already proposed earlier without success. Haller (2004) argued that the new project showed an approach of modernisation, which was common in the 1960s. The counter argument to this was that this was not a small-scale project adapted to the local needs but a large-scale irrigation project in which environmental and socio-cultural impacts were not studied and the ownership issue was not clear. Additionally, it was envisioned that the project would have taken a huge portion of the pasture, which had already been reduced by irregular flooding. In this situation, strong opposition and wrangles were expected as observed by Chabwela and Haller (2007, p.11): "There was strong opposition against the irrigation project led by an ex-major of the Zambian army. He and his followers, especially the lineage of the *Kazoka* claimed that under customary law, control of CPRs area was under the *Kazoka* group lineage. They were supported by the people owning a lot of cattle, and not the poor pastoralists." In any situation where the rich and the poor disagree, the rich always win, and so they did.

The main argument surrounding land tenure governance in Namwala was that the Ila had always been cattle herders and that it was this traditional economy, which made the Ila different and rich (Jaspan, 1953). They argued that with a better treatment of the cattle and *Ibanda*, their livelihoods were secure. Haller (2004) added a strong argument that the feelings of being '*Ila'* and love for cattle and the pasture areas of the Kafue Flats led to violently reject the project in Mbeza with

strong opposition. Therefore, a closer analysis from the failed irrigation project was that part of the project laid in the area of informally fenced land belonging to powerful urban-based politicians and civil servants who had since fenced most areas along the edges of the Kafue flats. This irrigation project would have put in jeopardy their plans to get leasehold titles in the areas along the edges of the Kafue Flats. It was therefore clear that the opposition against the irrigation project was not only about Ila tradition or 'ethnic identity' but also about individual land interests. As a drawback to local land governance and administration, the land tenure reform legal framework of 1995 permitted the possibility for individuals to own multiple customary leaseholds irrespective of the size or sizes in different places. In addition, Adams (2003, 21) pointed out that "the new draft National Land Policy of 1995, is oriented towards more individualization of land by further facilitating individualized leasehold." Therefore, all these changes in the Lands act of 1995 still favour the local rich pastoralists, politicians and foreigners. "Traditional land administration was highlighted as one of the major challenges. The traditional leaders submitted that potential investors acquire land only to resell it at exorbitant prices, sometimes without developing it," (GRZ, 2017:17).

Thomas (1996) and Brown (2003) observed that, when land value rose, there were usually conflicts between local communities and the new users. With 'corrupt' chiefs, commercialization and individualization put the land conversion in question as many of these rich politicians and civil servants were attempting to privatise part of the commons and possibly obtain a rent in near future, thereby enriching themselves and leaving the locals vulnerable and poorer. These attempts were creeping in and soon, just like what was happening in Kenya, Uganda and Tanzania (Grandin, 1992), would soon materialize in Namwala. It was therefore important that the future of the Kafue floodplain be contested on an ideological arena with new local land tenure security in the ongoing (2017) new draft land policy which would shape the social, economic and cultural interests of all stakeholders, particularly taking into account local pastoral usufruct rights.

Communal usufruct rights represented the best arrangement for situations in which the opportunities to invest in the quality of the land were limited and the community was small to bear some more additional costs to exclude outsiders from using it (Mulolwa, 2002; Adams, 2003). But with market liberalization and technology development, there might potentially be large benefits produced and in this case communal rights may no longer provide sufficient incentives for herders

to land efficiently (Mulimbwa, 1998; Mvunga, 1993). However, most common pastoral ecosystems in Namwala were faced with prolonged droughts, high variability in rainfall patterns, spatial and temporal variability that led to diminishing resource quality and production. Such uncertainty and unpredictable character of climate variability and change led to what Hardin (1968) called 'tragedy of the commons' as the potential and capacity of the Kafue flood plain and the upland were faced with irregular water releases and fencing/drought respectively. Bureaucratic land tenure security to acquiring title deeds and low levels of education had also led to local pastoralists reluctant and unwilling to transform customary into leasehold as compared to urban-based politicians and civil servants. For them, usufruction to land was enough but sooner than later, with examples of herders in East Africa (Thomson, 2004) and elsewhere where CPR were communal (Grandin, 1992), may lead into fierce and bloody conflicts as already happening in Mbeza and Ngabo areas. In light of this, it was unlikely that herders would invest in rangeland, but rather they preferred to maintain their flexibility and rights to move to other areas when climate dictated this necessity (Fernandez-Gimenez *et al*., 2008). Haller (2004, p. 19) concluded that "regulation of seasonal movement represents a vitalization of Ila historical institution and when coupled with customary institutions would allow for a high degree of local involvement and preserved the social and ecological flexibility essential to the success of a nomadic lifestyle in a highly variable natural and ever-shifting social, political and economic environment."

The Zambian situation is not isolated, disconnect between formal and customary land tenure remained the prevailing property rights theme and constituted one of the primary development dilemmas in Africa. Lack of appropriate legislation dealing with property rights did not prevent a land market from operating, however informally. But without a legal framework, the informal nature of the market could breed tenure insecurity particularly in rural areas, and discourage sustainable management of CPRs. Ostrom and Schlager (1996) pointed out that these informal markets had the potential to become conflictive later if subsequent property rights legislation were unable to adequately embrace market transactions that took place during the informal period.

In order to reduce vulnerability of rural society in Zambia and improve or rebuild resilience of food production or livelihood systems through secure tenure, there was need to embrace and implement the above stated intentions of empowering pastoralists by registering their land rights. These intentions were similar to the strategy being followed in Uganda on how to integrate

statutory and customary tenure. Birgegard (1993) described these as legal provision that all citizens owning land under customary tenure acquired a certificate of customary ownership. These certificates could be leased, mortgaged, and pledged where the customs of the community allowed. Such certificates of customary title empowered the cultivators with a strong sense of ownership and control over their land, and used it more productively even by obtaining agricultural credit, while using the land as collateral. In Namwala, this kind of empowerment could be greatly appreciated by poor pastoralists, particularly women farmers, including those who were widowed, divorced, single or even married. These categories of women tended to be marginalized over land in most communities since customary law supersedes any other provisions intended to mitigate the plight of such women (ECA, 2003; Gender in Development Division [GIDD], 2005). This could end unnecessary and common land wrangles currently going on not only in Namwala, but also across Zambia as they sideline women, who were major producers in rural areas.

It may be argued that registration and issuance of certificates of customary title, which recognized the place of CPRs, was a transitional step towards a gradual or evolutionary individualization of land tenure in Uganda (Mwebaza, 1999). Such a gradual approach was necessary in Zambia in order to avoid alienating the traditionalists and other interest groups. Furthermore, a gradualist approach as part of a long term vision that hoped to achieve a transformation of rural society from being agrarian based to a modern market based industrial state, was necessary. Industrialization should absorbed the surplus population from rural areas, to avoid landlessness, although this was still slow in Zambia as established by other studies on the main causes of land-use problems related land tenure (Chabwela, 1994; Mudenda, 2007; Adams, 2003).

Individualisation of land in CPR was an impediment factor in which government should play a part. Farmers could be provided with technical assistance to improve the quality of grazing areas and calculate the carrying capacity for their cattle. Studies by Solway (1986) in Botswana and Zindi and Stack (1992), on communal areas in Zimbabwe, indicated that leasehold tenure was the only way farmers could be made to match their cattle numbers to grazing resources, as communal tenure always encourages individuals to increase their herds. Rootselaar and Bwalya (1990) further observed that in the Eastern Province of Zambia, cattle obtained the bulk of their feed from the crop residues produced by the arable land, while the introduction of legumes helped the increase of crop and fodder production. In Namwala, land tenure was complex in the Kafue

floodplain as a CPR with interest from multiple stakeholders. From first hand accounts among respondents, they put it clear that the Kafue floodplain *nchipo kwa leza* (gift from God) and could not be leased. What needed to be enhanced were management practices with respect to regular dipping, vaccination and climate variability and flow regimes. Furthermore, the studies by Casarotto (2013) and Kunz *et al*., (2013) pointed out that it was difficult to take account of local variations in grazing conditions and seasonal changes in grazing sites in Namwala due to vastness of the flood plain. Unless pastoralists in Namwala realised the importance of a strong mixed crop and livestock strategy for the production of more fodder and individualisation of land, such efforts would be in vain and bred more conflicts.

The other land-use problem in the Kafue Flats was caused by the multiple use of the flood plain for hydropower, water supply, cattle grazing, wildlife, agriculture and industries. Subramaniam (1992) noted that these multiple uses produced conflicts with different stakeholders. The hydropower development in particular produced changes in the hydrological status of the Kafue Flats. The major changes were the reduction in the area flooded during the rainy season, delayed and prolonged flood period, increase in permanently flooded areas, and reduction in the amplitude of water level fluctuation and velocity of flow. On a bigger picture, these land-use conflicts (Brown, 2003) undermined conservation and integration of land-use planning crucial for CPRs.

The other problem identified by the study surrounding land tenure in the utilization and management of CPRs in Namwala was that they were 'too open' for other users who were not recognising locally developed institutions. It was not the argument that in 'olden days everything had been better' but focusing on the current problem that the influx of newcomers was premised under very unequal bargaining power situations. Under these circumstances, it was very difficult or nearly impossible to continue upholding the old rules (Brown, 2003; Mudenda, 2007). In this vain, Haller (2004) added that the major problem was that newcomers usually came with different ideological philosophies, which prevented them from coming to terms with the local pastoralists. Their common argument went like: "*we are citizens of Zambia so we are allowed to come into the area and use the resources without the need for co-ordination and consultation on local rules and regulations governing CPRs*." This attitude generated conflicts where there had never been such conflicts of this intensity before especially with fencing that excluded many locals from accessing formerly commonly owned water and land resources.

In order to provide an effective administration for land under customary tenure (Mulolwa, 2002), the institutional framework should be well established (Mudenda, 2007). The institutions responsible to customary administration should provide adequate information to land seekers in order to promote transparency. It is the view of the researcher that availability of land information was key to enhance an effective customary land administration, utilization and management. Once the institutions involved in the administration of customary and draft land policy were equipped with land information and disseminated to the public, conflicts would be lessened. This would then ensure transparency in land governance that everyone would embrace and give support to the chiefs who were the regulators of customary land. However, this could only be made possible if customary land administration was not left to start with the chiefs and ended with the Commissioner of Lands at the Ministry of Lands only.

6.5 Rural pastoral social-ecological linkages: From the view point of environmental education

Social systems are structures where humans live and operate, and these systems are embedded in ecological systems, allowing humans to exist within coupled social-ecological linkages (Walker and Salt, 2006). In coupled social and ecological systems, there are reciprocal linkages between people and nature, characterized by complex feedback loops (Coughenour, 1991). Therefore, linkages provided complex social-ecological systems, an ability to withstand shocks and disturbances (Berkes *et al.*, 2003). Folke *et al*., (2003) identified a framework of four principles of linkages in building to enhance the adaptive capacity of social-ecological systems. They suggested that these factors interacted across temporal and spatial scales to deal with nature's dynamics in social-ecological systems: 1) learning to live with change and uncertainty, 2) nurturing diversity for reorganization and renewal, 3) combining different types of knowledge for learning and 4) creating opportunity for self-organization toward social-ecological sustainability.

The linkages developed in this study had several key attributes vital for building resilience and adaptive capacity, including social and institutional learning, knowledge integration, diversity and redundancy among pastoralists. Some scholars discussed how these characteristics could be part of the CPRs benefits and outcomes. For example, community-based management allowed resource users to cooperate and define their own governance structure to manage their resources (Ostrom and Schlager, 1996). Communities that practiced community-based management were thought to

possess a diversity of educational practices that developed through continuous trial-and-error experiences (Colding *et al*., 2003) and which influenced social-ecological linkages, promoting and sustaining ecosystem processes and services (Tengo and Hammer, 2003). For example, in arid and semi-arid ecosystems with highly variable climates, herders needed to move frequently to avoid recurrent droughts that caused major die-offs of livestock (Ellis and Swift, 1993). Frequent movements and livestock die-offs allowed vegetation in grazing lands to recover (Ellis and Swift, 1988). However, reduction of mobility and concentrated grazing in these ecosystems changed the composition of vegetation, increasing the risk of losing productivity in both grazed as well as in remote less frequently utilized areas (Coughenour, 1991; Fernandez-Gimenez and Swift, 2003). Such a strong feedback between the resource users and the ecosystem occurred because rangeland management practices of the users may alter the vegetation in grazing lands in equilibrium rangelands and key resource sites in drier non-equilibrium rangelands (Ellis and Swift, 1988). Due to the strong feedback, the resource users continuously adapted their knowledge practices to the characteristics and dynamics of the ecosystem and accumulated more local practices and traditional ecological knowledge (TEK) than centralized resource management agencies (Davidson-Hunt and Berkes, 2003). In addition, Namafe and Chileshe (2010) explored that the type of environmental and sustainability issues associated with floodplain artifacts could be used for creating a localised curriculum for teaching and learning through 'learning as connection'.

These scenarios had been applied in Namwala in which pastoralists were learning to live with climatic variations and environmental changes based on environmental education of their ecosystems. Results showed that 80 percent of the pastoralists depended on grazing their cattle in the Kafue flats regarded as an '*oasis*' of dry season pasture. The dynamics in adaptation and utilization of CPRs was visible and twofold. Firstly, these dynamics were dependent upon anthropogenic activities such as irregular releases of water from Itezhi-tezhi dam to the Kafue Gorge and increase in environmental timing and novelty by pastoralists in following receding waters played an important role. This knowledge was vital in protecting their cattle from getting stuck in the mud. Secondly, natural climatic variations resulted into droughts and floods which had impacted and altered grazing patterns and livelihoods. For this, older members of the family guided young herders where to graze their cattle from based on their social and ecological memories and novelty.

Social and ecological memories are important components in social-ecological linkages (Baival, 2012). When social-ecological systems were disturbed and underwent change, the systems would be renewed and reorganized by capitalizing on their social and ecological memories. The social memory of diverse practices in pasture and livestock management as well as lessons of drought, cattle diseases, floods and other disturbances were retained among pastoralists. However, donors and the government did not consistently harmonise, recognize, appreciate and learn from pastoralist's collective social-ecological memory and knowledge. This perception prevents mobilization of diverse pastoral knowledge and tradition that persisted from historic times in demonstrating dynamic and self-organizing adaptive behavior. Folke *et al.,* (2003) and Norberg *et al.,* (2008) in their studies stressed that diversity and redundancy in social-ecological systems built up greater ecological and social memory, thus increasing a system's ability to cope with change and reduced the system's sensitivity to loss of components. Ecosystems undergoing change needed to have a diversity of functional groups, diversity within species and populations, and a diversity of species in functional groups to be resilient and continue generating ecosystem services (Folke *et al*., 2003). This reasoning was applicable in Namwala, a perfect pastoral typology in which water, pasture and diverse herd composition in terms of species, breeds and ages of animals played a significant role in overcoming harsh climatic conditions and frequent weather disasters.

Thus the ability of ecosystems to sustain their multi-functionality was determined by species' diversity at a local scale and community diversity and redundancy at a larger scale of the landscape (Berkes *et al.,* 2003; Coughenour, 1991). Ecological memory was fostered by social and institutional structures that made necessary adjustments to environmental dynamics and ecological feedbacks (Folke *et al.,* 2003). Social memory is the "institution of knowledge, which frames individual remembering, creativity, and learning within a social-ecological environment," (Davidson-Hunt and Berkes, 2003, p.45). Social memory therefore was collectively produced and consisted of a diversity of individuals, institutions, organizations, and other players with different, but overlapping roles of knowledge carriers and retainers, networkers and facilitators, stewards and leaders, visionaries and inspirers (Folke *at al*., 2003). With limited social-ecological memory, the system would unable to create the necessary net of overlapping and mutually reinforcing components that buffered the system from uncertainties and disturbances (Folke *et al*., 2003).

This study aimed at understanding the environmental education linkages between community-based natural resource management and linkages of coupled social-ecological typologies in the utilization and management of CPRs, especially the Kafue flats. Hollings (2012) Adaptive Cycles were used as theoretical lens to analyze rural pastoral systems of Namwala. Hence, different political regimes were tied with different perturbations and policies that affected the degree of vulnerability and resilience. For example, during UNIP under the government of Dr. Kaunda, it made excessive interventions in order to promote agriculture and rural development. This heavy intervention promoted resilience and led to food security, control of cattle diseases, and good marketing for agricultural products. Hence, pastoral adaptive cycles were faster and smaller, meaning policies were adequate to address the social-ecological perturbations faced by rural farmers. With introduced neo-liberal policies of privatization and agricultural market liberalization when the MMD government under Dr. Chiluba came to power in 1991, introduced policies (SAPs) coupled with environmental shocks particularly drought, led to the vulnerability of rural society and bred food insecurity and wide spread rural poverty. However, Kajoba (2008) observed that the New Deal administration of President Mwanawasa, made deliberate and targeted interventions towards agriculture through the reintroduction of partial subsidies on fertilizers, provision of fertilizers and maize seeds, cattle restocking and vaccinations. The MMD also reintroduction a minimum floor price for maize and provided a market for maize and other crops through the Food Reserve Agency (FRA), giving rise to adaptive cycles that were smaller and faster. Some of the policies apart from cattle restocking, and provision of subsidies, have continued under the PF administration although many they felt that the current government was not doing enough to empower rural pastoralists and cultivators. Agricultural policies were poor with poor marketing for their agricultural products putting rural livelihoods and food security at risk. Hence the current (2017) rural adaptive capabilities were found to be weak and vulnerable to climate variability.

Pastoralists' adaptive behaviour and resource-use knowledge about local natural systems is characterized as knowledge-practice-belief systems (Berkes, 1999), as it is place-based knowledge and belief that drives local people's practices and decisions (Ostrom and Schlager, 1996). CPR user groups and interest groups have different perspectives about learning and doing, however, the ability to build on each other's knowledge is part of adaptive capacity and resilience (Folke *et al*., 2003). Both natural systems and social systems are considered complex systems in themselves, and their interactions contribute further to making these typologies more complex (Berkes, 2008).

Hence, bringing different kinds of environmental education together and complemented with scientific knowledge helped in increasing the capacity to learn. In this study, local knowledge and signs generated by pastoralists were the most important resources they had and this knowledge system was often ignored by firstly; knowledge-holders themselves and secondly; the NGOs and donor agencies. Therefore, linkages of coupled rural pastoral social-ecological typologies were determined by the ability to get relevant information from diverse sources for meaningful learning and practice. Integration of different types of pastoralist's environmental education encouraged the evolution of renewed local or community-based forms of cooperation and institutions that were sensitive to the building of social-ecological linkages of pastoral rural societies, threatened by climate change and variability. This was in line with the study by Baival (2012) among Mongolian herders who developed multiple resilience in their quest to respond to climate change.

Hence the establishment of the community-based TEK linkages created some formal space to combine multiple knowledge systems at smaller social scales to manage local rangeland resources (Marin, 2009). Indigenous knowledge on herd and rangeland management was the common knowledge pastoralists in communities relied on daily basis (Fernandez-Gimenez, 2000). The norms of reciprocity and flexibility were common strategies to exchange pastoral knowledge and other resources with each other (Fernandez-Gimenez *et al.*, 2008). In Namwala as many other pastoral societies, environmental mechanisms for enhancing social and ecological linkages were often inherent in the traditional forms of cooperation as a basis for novel and traditional knowledge blended in the utilization and management of CPRs. Since traditional knowledge was not static, but in continuous development (Menzies and Butler, 2006), innovative knowledge of pastoralists to climate variability and change contributed to renewal of local knowledge who shared CPRs, creating new types of local linkages within the wider environmental education context.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

The purpose of this chapter is twofold. Firstly, it gives a conclusion to the findings of this study and secondly, provides some recommendations for policies and future research related to this subject matter.

7.2 Conclusion

One of the socio-economic sectors that have beared the heaviest burden of climate variability and change footprint is pastoralism, given its sensitivity to variations and extreme weather and inabilities by pastoralists to put up resilience. The findings of this study agreed with the general literature on climate change, which suggested that changes in climatic conditions were affecting agriculture-dependent livelihoods. The IPCC (2007) reported an increase of 0.74°C of the global temperature near the surface of the earth and also estimated the likely increase of about 6.4°C on average during the 21st century. However, the IPCC (2014) report shows that the global average land and sea surface temperature data combined has increased by 0.85°C making the previous three decades the warmest period in the last 1,400 years. The warming effects were projected to affect agriculture activities, ecosystems and biological behaviours (Chaudhary and Aryal, 2009). Similarly, the study area fell within sub-Saharan Africa where climatic models projected that climate variability and change would impact negatively on the livelihoods of the people and ecosystem goods and services on which they depend (Thornton *et al*., 2006). The findings showed that the changes in climatic and environmental conditions were happening in the study area and affecting agricultural livelihoods. Respondents showed extensive knowledge and understanding of their local environmental conditions, and were able to attest to environmental changes that they perceived to have occurred over the past three decades.

Most pastoralists understood and associated the effects of climate variability with increases in drought conditions, rise in temperatures, decline in rainfall, occurrence of floods, increased rainfall variability, greater weather unpredictability, increases in pests and deaths of livestock caused by diseases and shortages of fodder. Participants perceived the local effects of climate variability as shortened growing seasons, changes in the duration and commencement of the rainfall season,

increased crop failures, food shortages and increase in the occurrence of extreme weather events, such as droughts and floods. Most respondents in the study area perceived that temperature increased and rainfall decreased over the past two decades. They observed an increase in day temperatures, reflected by an increase in the intensity of sunshine and higher night temperatures, decline in rainfall and increased rainfall variability, accompanied by changes in the seasons. These impacts helped in bridging the gap in literature related to effects of climate variability and change.

The study showed that social-ecological typologies of pastoral systems in Namwala were sustainable and resilient to prevailing environmental conditions, and were therefore able to ensure relative food security inspite of land tenure insecurity and Kafue river irregularities. Namwala is a predominantly cattle rearing area and pastoralists in the area begun to realise that livestock rearing was business and not a matter of prestige. However, pastoralists in the area faced many challenges that required urgent attention from the government, which appeared to be giving more prominence to crop farmers. Generally, the agricultural sector is mainly directed at the crop sub-sector as opposed to the livestock sub-sector. Pastoralists observed that in order to increase the sector's contribution to the national economy, there was an urgent need to redirect resources towards livestock and offer pastoralists incentives similar to their crop counterparts.

The central premise reached in this study was that pastoralists were in fact rational economic actors, whose production goals and strategies were determined not solely by cultural and ideological considerations, but by constraints and opportunities imposed by the wider socio-economic environment. The shift among pastoralists in Namwala District became apparent in 2005 and 2008 when Zambeef and Starbeef respectively established abattoirs there, with Maala and Chitongo abattoirs joining later. These provided regular markets for pastoralists. One of the most important aspects was the differential ability of different categories of pastoralists to successfully accumulate sufficient number of cattle and took advantage of opportunities presented by regularised markets amidist different social, economic, political and ecological vulnerabilities. Despite these vulnerabilities, it was generally observed that pastoralists had accumulated enough cattle stocks enabling them to participate in regularised markets.

Against this background, poor pastoralists, who had not yet managed to accumulate enough stock were more likely to exhibit what many commentators referred to as 'target income selling'

syndrome; the tendency to hold on to animals and only sell them when there are specific and short-term income targets to be met. However, the apparent cultural irrationality among traditional pastoralists should be seen as a prudent economic behaviour to safeguard the reproductive elements of the cattle in order to meet the longer term goal of stock accumulation. Once sufficient animals were accumulated, it then became feasible to regularly participate in the ready rural cattle markets currently provided by commercial buyers. This had also changed the production goals among traditional pastoralists from mere accumulation for prestige and social standing in society to entering into the money market economy.

The findings also showed constraints that hindered rearing of livestock. These included presence of cattle diseases and parasites, poor nutrition and poor husbandry practices together with droughts and floods. These constraints led to cattle losses and some individuals had resorted to fishing, poaching, honey collecting and lumbering, diversification with mixed crop-livestock and keeping various livestock species. It must be emphasized that the traditional livestock sector is a dynamic enterprise which responds to opportunities and constraints imposed by the wider social, political and economic environment. This study demonstrated that pastoralists who managed to accumulate sufficient cattle stock, especially in Maala and Baambwe areas, where farmers were found to have relatively more cattle numbers and much improved breeds than in Muchila and Mbeza areas, were more likely to have better herd management practices in terms of maintenance of herd sizes, transhumance, herd splitting, maintenance of female-dominated herds and herd diversity. Thus, increased cattle marketing had encouraged change in objectives for keeping cattle from accumulation for prestige to embarking on acquiring universally accepted and prestigious assets such as solar panels, television sets, spray races, utility vehicles, dip tanks, iron-roofed houses, fencing and retail shops among others. The study established that due to the expansion of market opportunities, richer pastoralists redefined their production goals and orientations to take advantage of the opportunity to convert their stock wealth into monetary value, and to transform this value into other forms of economic and social investments. These adaptive strategies were envisaged as bridging gaps in literature related to resilience among pastoralists to climate variability and change stressors.

In addition, most pastoralists bemoaned high outbreaks of cattle diseases, especially tick-borne diseases, as having posed a serious threat. They further stated that government needed to come up

with a system to assist livestock farmers to access vaccines through a programme similar to the Farmer Input Support Programme (FISP) for crop farmers. They stated that pasture seed could be included in the FISP package as increase in the number of cattle often led to overgrazing and degradation of the floodplain. In this case, the study suggested that government should devise some form of subsidy, such as waiving of taxes that would bring down veterinary related costs. Pastoralists also lacked pasture for grazing due to consecutive droughts and sporadic floods especially during dry season. It is important for local government officials to begin educating pastoralists on the need to grow pastures in order to reduce distances that animals traveled to graze on the Kafue flats, particularly those from Muchila area. Further, the study concluded that although government veterinary officers were available to diagnose animal diseases, there was no provision of vaccines and basic training to pastoralists to improve management of their cattle.

Another aspect drawn from this study was that farming and cattle grazing typologies that characterized the Kafue Flats in Namwala were dependent on a rich ecosystem nourished by the seasonal flood cycles of the Kafue River. However, the flooding patterns of the Flats were significantly altered by the construction of Itezhi-tezhi Dam in 1978 which regulates water flow for the downstream Kafue Gorge Dam (constructed in 1972). The study revealed that the Kafue seasonal flooding was often unpredictable in its timing and duration. Thus, grazing and cropping patterns had changed dramatically and flood-dependent livelihoods were threatened. This study focused on fine-grained and elicited pastoralist's own photovoice by communicating their concerns about a given issue; in this case their relationship to the altered floodplain ecosystem. What emerged most clearly was that ecological changes brought by the dam manifested as real consequences for pastoralists' livelihoods. Thus, this study expanded the discourse about climate variability, dam management, environmental river flows, and the consequences of hydropower projects on pastoralism. Hence, the study re-conceptualized the Kafue Flats as a dynamic system, one in which Kafue River flooding, flow and flux together with new partnerships and grazing patterns could sustain local livelihoods. Further, the study establishesd that if the Kafue Flats became overgrazed, overfished and overdeveloped, or if natural flooding, flow and flux were not restored, it would not support the populations that depended on it, including pastoralism.

The study further established that resilience building in pastoral social-ecological typologies and management of common property resources like the Kafue Flood Plain in Namwala demanded

preserving and nurturing existing social, economic and ecological components and their interactions that enabled pastoralists to renew and reorganize pastoral livelihoods. The study showed that pastoralists had built up sufficient strategies to live with and adapt to negative effects of drought and floods as well as major socio-economic and political transitions over the past three decades. Thus pastoral SETs were multiple, varied and were transforming into a more resilient system.

Although there was an indication that CPRs were degraded due to alterations of river flows, increase in cattle population and commercialisation of land, the mimic of the natural flow of the flats could be built back provided there was sufficient, organised and effective management of local institutions governing access and grazing. Already, there were plans to decentralise Kafue Flats as a Water Catchment Management Authority (WWF, 2006). Under this category, existing policies and legislation would be harmonised into a single institution with authority for all the resources in the Kafue Flats. Nevertheless, should such efforts remain lacking, emerging issues such as water scarcity, increased livestock population, expansion in agriculture and settlements, the utilisation and management of the Kafue Flats as a CPR will have been irreversibly destroyed.

Furthermore, land was one of the most available resources to pastoralists with multiple methods of acquiring it through: inheritance, construct a homestead, showing of vacant land, giving out land, allocate land to strangers, buying and renting of land among others. Results also showed that land tenure on the upland in Namwala had evolved and bred several conflicts. On the other hand, results revealed that much of the Kafue Flats was a CPR and local pastoralists were unhappy with the influx of many non-natives acquiring huge portions of land along the edges of the Kafue flats. This agreed with results from ZEMA/UNEP (2013) that the Kafue Flats should be preserved as a local pastoral system for continuous local community adaptation to environmental conditions and protect pastoralists from losing their traditional adaptive values.

In addition, the institution of chiefs should be enhanced in order for them, with their headmen, to handle customary land administration effectively. This can be done by ensuring that each zonal area formed a tribal committee to look into the issue of customary land alienation. Results pointed out that this would do away with the shortcomings that currently exist where the chiefs make unilateral decisions and sometimes at the expense of local people. It was further observed that one

of the problems associated with chiefs was that some of them were corrupted by urban-based politicians and civil servants. Instead of consulting their subjects before granting approvals, it was alleged that some chiefs discharged this responsibility alone and corruptly. This study showed that some chiefs sold most of their subjects' land to outsiders, particularly politicians, civil servants and local rich pastoralists, who tended to fence it upon buying but without title deeds. In this regard, the 7NDP proposes that "standard guidelines be developed on acquiring land from traditional leaders across the country, to improve land administration," (GRZ, 2017, p.14). In this regard, information should flow to the chiefs so that they are aware of what happens at every stage of land acquisition and administration. Currently the chiefs are not adequately informed on the alienation of land under customary tenure, and as such their main concern is the monetary value of the land. As a result of these challenges, endogenous factors in Ila society are altered and bred widespread clan wrangles. Thus good traditional land tenure governance was key in the in the provision of an effective customary land security for pastoralists.

Thus, pastoralists in Namwala were learning to live with change and uncertainty. Learning to live with change and uncertainty entails knowledge, practices, and social mechanisms to accept disturbance, surprise and crisis as part of the development and process of social ecological systems (Folke *et al.,* 2003). Frequent disturbances, for example ecological surprises, that happen in social-ecological realms should be accepted as the rule, not the exception (Gunderson *et al.*, 2002). This is because, commonly managed ecosystems are characterized by high inter annual variation in rainfall, grazing intensity and altered flooding that determine dynamics of livestock production and movement (Walker *et al.,* 2002). For this, the study concluded that disturbances that affected ecotone ecosystems in Namwala were not only predictable in terms of severity and magnitude, but also by herd management and mobility techniques practiced by pastoralists to cope with such variability and unpredictability nature of droughts and floods. The Namwala case demonstrated that the transhumant herding strategies, perceptions, spatial and temporal variability in their environment played a vital role in making their seasonal movements and utilization of the commons viable. Thus, pastoralists were closely connected to resource ecotone systems and were in a better position to understand and adapt to signals from the ecosystem and to successfully manage it over an extended period of time. Such adaptive capacity of the resource users determined success of their institutional arrangements and served as a vital component in building linkages (Carpenter *et al*., 2001; Colding *et al.,* (2003).

Furthermore, pastoralists have built up sufficient memory to live with and adapt to negative effects of drought and floods as well as major socio-economic and political transitions and policies affecting cattle husbandry. The combined effects of novel and cyclical disturbances over the past three decades had hit hard on the resilience of the pastoral communities in Namwala overwhelming their adaptive capacity. The findings showed that pastoralists had common strategies to cope with the change processes and these strategies were embedded in the pastoral traditions and customs such mobility, flexibility, reserve, diversity and reciprocity. These strategies served as cornerstones for the resilience of pastoralists coupled with their TEK that demonstrated dynamic linkages and self-organizing adaptive behaviour. In addition, pastoralists mobilized internal as well as external inputs, skills and knowledge to respond to disturbances. Most importantly, pastoralists had alternative and innovative ways to cope with combined effects of climate variability and change.

The social-ecological complex system linkages developed in this study demonstrated that given the sensitivity of pastoralism to climate variations, its capacity to respond to crisis and disturbance was not only embedded in environmental education, practices and social networks, but also influenced by combining novel and traditional practices and TEK. The methods pastoralists were employing in the face of climate variability and change were not simple, but rather complex, demanding greater human labour, local networking, mutual support, mobility, innovative skills of herding, presence of reserve pasture, availability of support system, learning attitude and access to scientific knowledge and networks that contributed to the resilience linkages of the rural pastoral social-ecological typologies in Namwala.

Therefore, actors such as local government, development agencies, policy and NGOs usually devalue and did not appreciate environmental education existing among pastoralists, which resulted into marginalization of farmer's TEK and strategies associated with pastoralism. Such perceptions somewhat undermined the competitiveness of pastoral culture and TEK and prevented the shaping and adaptive modification of rural development policies in the face of social-ecological changes. Adaptive traditional practices, knowledge and skills were implicitly surviving within the realm of changes and transition. Therefore, linkages of the coupled social-ecological typologies were determined by the ability to get relevant environmental education from diverse sources for meaningful learning. Integration of environmental education encouraged the evolution

of renewed local or community-based forms of cooperation and institutions that were sensitive to the building of social-ecological resilience. However, traditional knowledge must be renewed and reorganized to survive, transformed and developed as a basis of community resilience building. Thus, community-based land tenure security and utilization and management of CPRs offered structures and linkages that could support pastoral needs to stimulate new learning for constructive change. The above findings were envisioned as vital bridging gaps in literature on environmental education linkages to weather-related shocks among pastoralists.

The study demonstrated that EE pertains to the fact that TEK or IK evolves from a people's interaction with their environment over time, and gets embedded in their ways of living to become part of their cultural traditions and beliefs, whilst serving as a guide in discouraging lifestyles that may be injurious to the environment. TEK is often identified with various features, among which have been outlined by Senanayake (2006) as locally-based, orally-transmitted, inter-generationally transmitted, fragmented in distribution, sustained by repetition, and a product of practical engagement with the environment in everyday life. The study showed that the processes and benefits of adaptation to climate change were local, and could not be meaningfully pursued without considering the local socio-cultural context within which EE was produced for use in such adaptation practices. Thus, TEK is labeled as local and traditional because it is produced in a local context for solving local problems of the environment, and this explains why the usefulness of EE in climate change adaptation practices is popular (Boko *et al*., 2007). Further, the study demonstrated that in Namwala, indigenous methods of weather forecasting are particularly useful owing to the inadequacy or non-availability of scientific weather forecasting instruments and weather data, and reliance on TEK for weather forecasting, farming and food storage practices in such contexts was locally useful. There exists among pastoralists social-ecological knowledge systems, the wealth patterns of EE and warning signs, crop varieties, planting seasons, vegetation patterns and changes, which are useful for climate variability and change adaptation practices.

From all the above typologies, the researcher takes the pastoralist's world view and protectionist stance, and an environmental education point of view, rather than that of a scientist, to suggest framing a rural pastoral social-ecological resilience building definition as: "*learning to live with change and uncertainty with peace of mind about change and renewal of a livelihood system within a dynamic realm that integrates both the opportunities and assets available to a group of*

people for achieving their goals and aspirations, as well as interactions with, and exposure to, a range of beneficial or harmful ecological, social, economic and political perturbations that may help or hinder a group's capacity to make a living in the utilisation and management of common property resources." Thus the proposed rural pastoral social-ecological education linkages in this study could serve as a foundation for community resilience building and as a basis for adaptation in the complex rural pastoral social-ecological typologies in Namwala and elsewhere.

This thesis explored that climate variability and change effects and environmental education in pastoral SETs in Namwala demanded preserving and nurturing existing social, economic and ecological components and their interactions that enabled ecotone ecology to renew and reorganize itself following unprecedented changes caused by climate variations. Resilience thinking asks environmental education researchers to talk to the local communities not in the language of scientific concepts, methods and results, but in local common language (Colding *et al*., 2003) using meaningful frameworks (Malone, 2009) that transcends boundaries of different worldviews. While environmental education and resilience framework are all about creating local awareness and space (Walker and Salt, 2006), rural social-ecological environmental education typologies should be understood as peace of mind about change to varying climate. Peace of mind about change is possible when local rural pastoral communities are self-aware; remember principles gleaned through past experiences to apply them to new situations, gain sufficient confidence to ask new questions to guide further learning and adaptation to the ongoing climate variability and change processes happening in their communities. Otherwise, climate variability and change are likely to continue bringing new weather patterns that pastoralists are unfamiliar with in many pastoral societies in general and Namwala in particular, in the absence of sensitive adaptive EE capacities for climate-resilience and climate-smart livelihoods.

7.3 Recommendations

Arising from the study findings, the following recommendations are made;

1) Government should assist livestock farmers by providing subsidies and incentives to the livestock sub-sector, as is the case in the crop sub-sector. Subsidies should be on drugs, dipping chemicals, dip tanks/spray races, bulls and pasture seed among others as this would help curb diseases and improve animal nutrition. This is due to the finding arising from deaths of cattle as a result of diseases such as corridor with 159 deaths out of 633 cases in 2016;
2) Pastoralists should focus on interventions which can accelerate the accumulation process of cattle to an extent where the break-even point is reached. Such interventions should include

disease control, cross-breeding and animal nutrition. These should be accompanied by sensitisations which would prevent poor pastoralists from eating into the reproductive element of the herd. This arises from the finding that pastoralists identified several climatic related constraints that hinder livestock production such as livestock deaths and diseases; poor nutrition and husbandry practices; drought and floods; shorter rainfall season among others;

3) There is need to place emphasis on expanding and strengthening other alternative income earning opportunities such as bee keeping, lumbering and fishing and change '*cattle complex'* imbedded in Ila society. In addition, pastoralists should be encouraged to venture into other livestock species such as donkeys, chickens, pigs, goats and sheep. These are particularly useful for meeting '*target income'* requirements needed to purchase various goods and services on rural markets. This is as a result of the finding that 70 percent of the respondents kept mixed types of livestock due to different reproductive rates and resilience to diseases of different species to rebuild livestock numbers after a hazard;
4) As an immediate measure, pastoralists should adopt technologies to broaden income sources by adding value to milk and transforming it into different end products such as yoghurt, butter, cream and cheese. This could be done by encouraging partnerships with companies such as Parmalat and others to establish milk and tannery processing plants in strategic camps. One way is to frequently maintain feeder roads and come up with a tax-free policy to those wishing to establish livestock-related industries. This can consequently attract more players in agro related industries so that pastoralists have maximum value for their livestock. This is linked to the finding that pastoralists identified five Parmalat milk sales centres (Namwala Central, Nchole, Kabulamwanda, Chitongo and Niko) as an intervention in maximising the new niche market in view of droughts and floods;
5) Although Zambeef, Starbeef and other abattoirs have played a major role in transforming the rural economy in Namwala, prices remain unattractive. Pastoralists should be encouraged to form pastoral cooperatives and associations aimed at improving the pricing mechanism to stimulate further off-take rates. This arises from the finding that pricing of cattle is still solely determined by livestock commercial buyers;
6) The District Veterinary Office (DVO) should create a local livestock fund directed towards maintenance of loading bays, purchasing of vaccines and other related costs. This would help increase government coffers so that whenever there is a disease outbreak, there is no rushing to central government. The findings indicated that the district council collects K110 per animal meant for slaughter and this money is not used in any livestock related services;
7) The government should allocate significant human resources to ensure all 12 wards in the District are manned with extension officers to provide quick veterinary and other agro-related services to cattle diseases/pests and other problems pastoralists are facing as compared to only 9 which are manned;
8) The DVO in conjunction with pastoral cooperatives should ensure that disease outbreaks are controlled and other infrastructure such as dipping tanks are revamped to ensure total disease control and eradication. One way to do this is through the encouragement of the formation of cooperatives in all the wards in the District. The findings show a free range grazing system on the Kafue floodplain. This measure would compel most pastoralists to dip and vaccinate their livestock regularly thereby lessening the outbreaks and transmission of preventable diseases;
9) The District agriculture training centre in Namwala should be strengthened to provide basic training to local pastoralists through innovations such as cross-breeding programmes, veterinary care, research, supplementary feeding and climate change initiatives. These should be accompanied by improvements in the marketing arrangements for agricultural products in

general, and for livestock and cattle products in particular, and access to credit by all categories of pastoralists. This is linked to the finding that smallholder farmers only receive piecemeal training in workshops in fodder management and strategic feeding that addresses dry season feeding challenges as a result of climate variability and change;

10) The DVO and NGOs should carry out mass environmental education on the need for good nutrition for livestock to ever changing grass species and composition. This arises from the finding that pastoralists lack environmental education on how to plant pastures and its importance, including land tenure governance and overcrowding and over utilisation of common resources such as the Kafue flats;
11) Establish a district breeding centre and promote artificial insemination to improve herd size and resilience to diseases and drought. This arises from the finding that the district lacks infrastructure in which only one public dip tank was operational;
12) Address weather and climate variability and change through timely environmental education (EE) and climate change education (CCE), weather forecasts and early warning information tailored towards pastoral communities. This would ensure the development of sustainable and appropriate programmes for both crops and livestock in the face of climate variability and change and apply GIS/ remote sensing in mapping of drought and flood prone areas of the district. This is linked to the finding over pastoralist's overdependence on observations of the natural environmental and space indicators using their environmental education through various signs of droughts (*chiyumayuma*) and floods (*chilobe*) to predicting how the season would pan out;
13) Decentralize and localize forecast predictions of climatic information in an effort to mitigate the effects of drought by ensuring that information reaches pastoral communities through various media such as Community Radio Stations. There is need to ensure that appropriate mechanisms are in place to manage conflict between pastoral groups and others, and enable practical early warning of droughts/floods and rapid response through the provision of adequate funding. This is due to the finding arising from limitations and obstacles to the timely forecast of extreme events as environmental perceptions and conditions were not universally the same;
14) Train and equip extension and veterinary camp officers with skills to translate traditional ecological knowledge (TEK) strategies into modern climate action at the community level where the effects of climate variability and change are the greatest. This would equip and empower local pastoralists with appropriate environmental education to deal with new threats and risks and develop best practices of what constitute to be adaptation to climate change education as opposed to the finding that indicated that local pastoralists in Namwala still depended heavily on monitoring local environmental weather indicators using TEK;
15) Put in place appropriate measures to respond to climate variability and changes such as public environmental education and climate change education/information programmes in order to increase awareness, resilience and adaptation by connecting all levels; National Disaster Management Technical Committee (NDMTC), Provincial Disaster Management Committee (PDMC), District Disaster Management Committee (DDMC) and Satellite Disaster Management Committee (SDMC) with DMMU. This could be achieved by developing capacity for remote sensing, geographic information systems, hazard modelling, forecasting and early warning at community level. This is due to the finding arising from lack of deliberate local environmental education in schools and communities related to local climate variability and change dynamics;

16) Non-governmental Organizations (NGOs) and community based organizations (CBOs) should be encouraged to motivate and facilitate community participation at various stages including relief and rescue operations and capacity building at community level. This would lead to appropriate communication strategy in preparing conducive atmosphere for developing trust and confidence of pastoralists through sharing environmental education data, developing linkages for decision making, building formal mechanisms to enable participation and capacity building. This arises from the finding that Itezhi-tezhi dam and the Kafue River reservoirs are operated on one side in terms of hydropower production only, neglecting other sectors;
17) Improve linkages between various Ministries and agencies through an effective and evolving inter-sectoral mechanism established at various levels to plan and implement pre-disaster and post-disaster flood/drought prevention and mitigation measures through appropriate coordination between the Department of Water Resources, ZMD and ZESCO for timely localized forecasts as findings showed that the Itezhi-tezhi dam and the Kafue River were operated solely for hydropower production only, without consulting local communities;
18) In Namwala, findings show that some areas like Muchila only experience floods when there is above normal rain, otherwise the area is dry for much of the year. The people in this area travel long distances to drive their cattle to the Kafue River for grazing and watering. To enhance their animal production, it is recommended that dams be constructed in such far flung areas to harvest rain water;
19) There is also need to reduce the existing land insecurity by finding affordable title to pastoralists whose areas have already been affected by market based land reforms and buyers from outside the district. Customary areas especially the Kafue flats should be maintained as a CPR and/or allowed to evolve with minimal government intervention. This is due to the finding that farms belonging to rich pastoralists were fenced off excluding villagers from communal grazing rights and livestock watering, with increasing fear that some portions of the Kafue Flats could be sold to outsiders and rich individuals or foreigners soon; and
20) The allocation of customary land in all relevant institutions and authorities should be consulted. This can only be made possible if all these institutions fall under one ministry or board which in turn be guided by the statute. For the customary land sector in particular, consultation should be extended to the traditional authorities. Land allocation boards should be set up at provincial and district levels to advise on allocation and acquisition of land. Generally, the research found that chiefs and councils continued with land allocation function. However, they lacked capacity to prepare and plan the land including titling to make it ready for alienation. On the other hand, the problem remains that the Commissioner of Lands has not decentralised land administration to councils more especially rural councils where the vast portions of land fall under customary tenure.

7.4 Reflections on the research process

The following were some of the reflections of the study:

i. It was not possible to discern all social-ecological components among pastoralists in the face of climate variability and change in Namwala let alone the Kafue Flats. The study was not intended as an overall assessment of the climate-smart development process, but as a means to bring out the close relationship between ecology, adaptation and local

environmental education (EE)/traditional ecological knowledge (TEK) in the face of climate variability.

ii. The solution to rigorous and wider EE and TEK of contemporary climatic variability lies in the integration of scientific with local knowledge. It required the specialised knowledge of physicists, chemists, hydrologists, meteorologists, pedologists, geologists, environmentalists and geographers. To evaluate all these SETs and environmental impacts on grazing, on agriculture etc., one cannot but generalise. The author however did not lose sight of the fact that general environmental education could sometimes fail to solve general ecological problems, hence the study was localised.

7.5 Suggestions for future research

Environmental education is an important process in building community resilience to, and coping strategies for, climate variability and change. In order to adapt to the multifaceted nature of climate variability among pastoralists through local practices, the focus should be on how to respond to local societal challenges and needs. This study re-conceptualizes the Kafue Flats as a dynamic social-ecological realm, one in which EE, new partnerships and re-valued resources can sustain healthy communities in the face of climate variability and change. Pastoralists asserted their TEK about climate variability and related it to the floodplain cycles and resources, recalling and enriching their own and their neighbours' understanding of the value of those resources. By using EE to understand climate variability, in general, and TEK in the Kafue Flats dynamics, specifically, as a rich cultural landscape in which livelihoods are closely intertwined with a particular environment, both the people and the environment can begin to be valued more highly. In this regard, this study highlights the continual need for close-grained, contextualized further studies that will illuminate the complexities and ambiguities of larger issues such as education for sustainable development (ESD), environmental education (EE) and climate change education (CCE) while incorporating TEK or IK and relate them with more rigorous quantitative social science data of hydropower production, climate change, Kafue River management, land tenure and small-scale agricultural production methods and other social, economic, cultural and environmental activities surrounding all wetland-dependant livelihoods.

REFERENCES

Abdullahi, A.M., (1990), "Pastoral Production Systems in Africa: A study of Nomadic Household Economy and Livestock Marketing in Central Somalia", in **Farming Systems and Resource Economics in the Tropics,** vol no. 8, pp. 23-38.

Adams, M., (2003), **Land tenure policy and practice in Zambia: issues relating to the development of the Agriculture sector**, Draft 2003, mokoro Ltd, oxford.

Adger, W. N, (2006), "Social and Ecological: resilience: are they related?" in **Progress in Human Geography,** 24, 3 pp 347-364.

African Development Bank [AfDB] (2013), **Strengthening climate resilience in the Kafue sub-basin, Appraisal Report,** October 2013, Lusaka: Osan Department.

Agrawal, A. (1995), "Dismantling the divide between indigenous and scientific knowledge," in **Indigenous Knowledge and Development Monitor**, 3(3), 3-6.

Allan, W., (1965), **The African Husbandman**, London: Oliver and Boyd.

Allan, W., Baylies, C., and Foster, E., (1945), **Land Holding and Land Usage among the Plateau Tonga of Mozabuka District; A reconnaissance Survey**, Rhodes, Livingstone Institute NO.14. Manchester: Manchester University Press.

Antwi-Agyei, P., (2012), **Vulnerability and adaptation of Ghana's food production systems and rural livelihoods to climate variability,** The University of Leeds, School of Earth and Environment, PhD Thesis.

Archer, M., Bhaskar, R., Collier, A., Lawson, T., and Norrie, A. [Eds.]. (1998), **Critical Realism: Essential Readings**, London: Routledge.

Armitage, D. and Plummer, R., [Eds.], (2010), **Adaptive Capacity and Environmental Governance**, Berlin Heidelberg: Springer-Verlag.

Arnold, J.S. and Fernandez-Gimenez, M, E., (2007), "Building social capital through participatory research: An analysis of collaboration on Tohono O'odham tribal rangelands in Arizona," in **Society and Natural Resources**, *20*, 481–495.

Associated Programme Flood Management [APFM] (2007), **Strategy for Flood Management for Kafue River Basin, Zambia**, APFM/ MEWD/ WMO, Lusaka

Babbie, E., (2010), **The Practice of Social Research**, (12th ed.) USA, Wadsworth: Cengage Learning.

Ballard, H.L. and Belsky, J.M., (2010), "Participatory action research and environmental learning: Implications for resilient forests and communities," in **Environmental Education Research**, 16(5-6): 611-627.

Baival, B., (2012), **Community-based rangeland management and social-ecological resilience of rural Mongolian communities**, Colorado State University, Fort Collins, Colorado, PhD Thesis.

Barret, J., (1999), **The Economic role of Cattle in Communal farming Systems in Zimbabwe: Pastoral Development Network Paper**, London: Overseas Dev. Institute.

Bauman, P., (2002), **Improving Access to Natural Resources for the Rural Poor: A Critical Analysis of Central Concepts and Emerging Trends from a Sustainable Livelihoods Perspective.** Food and Agricultural Organization of the U.N., Livelihood Support Programme, LSP Working Paper 1, July 2002.

Baylies, C., (1979), "The Emergence of Indigenous Capitalist Agriculture" The case of Southern Province: Zambia, in **Rural Africana,** vol. 5, pp. 65-81.

Beerling, M.E.J., (1986), **Acquisition and Alienation of Cattle in Western Province,** Ministry of Agriculture and Cooperatives, Lusaka: Department of Veterinary and Tsetse Control.

Behnke, R., (1987), "Cattle accumulation and commercialisation of traditional livestock industry in Botswana," in **Agriculture systems**, vol. 24, pp. 1-29.

Behnke, R.H., Kerven, C., and Grandin, B.E., (2006), "Cattle Accumulation and the Commercialisation of the traditional Livestock industry in Botswana," in **Agricultural Systems,** vol. 25, pp. 25-41.

Berkes, F., (2008*),* **Sacred Ecology,** (2nd edition) New York and London: Routledge.

Berkes, F., Colding, J. and Folke, C., (2003), Introduction in Berkes *et al*., (Ed.) **Navigating socialecological systems** (pp. 1-29). Cambridge: University Press.

Bhadwal, S. (2006), **Indicators of Adaptive Capacity. Mapping climate vulnerability and poverty in Africa: Where are the hot spots of climate change and household vulnerability?** *International livestock research institute*.http://www.ilri.org/ILRIPubAware/ShowDetail.asp?CategoryID=TS&ProductReferenceNo=TS%5F060906%5F002. Accessed date: 4th May, 2017.

Bhaskar, R., (1978), **A Realist Theory of Science**, Hemel Hempstead: Harvester.

Bingham, M.G., (1982), **The livestock potential of the Kafue Flats** in Howard G.W and Williams G.J Proceedings of the National seminar on Environment and Change: Consequences of hydroelectric power development on the utilization of the kafue flats, Lusaka, April 1978, Kafue River Research Basin, University of Zambia.

Birgegard, L.E., (1993), **Natural Resources Tenure: A Review of Issues and Experiences with Emphasis On Sub-Saharan Africa**, Sweden: Swedish University of Agricultural Sciences, International Rural Development Centre.

Boko, M, Niang, I, Nyong, A, Vogel, C, Githeko, A, Medany, M, Osman-Elasha, B, Tabo, R and Yanda, R (2007) 'Africa: Climate Change 2007: Impacts, Adaptation and Vulnerability', Contribution of Working Group II, in M L Parry, O F Canziani, J P Palutikof, P J van der Linden and C E Hanson (eds.) **Fourth Assessment Report of the Intergovernmental Panel on Climate Change**, Cambridge: Cambridge University Press, available: https://www.ipcc.ch/pdf/assessment-report/ar4/.../ar4-wg2-chapter9.pdf (accessed 19 August 2019).

Bonanno, G.A., (2005), "Resilience in the face of potential trauma," In **Current Directions in Psychological Science**, 14: 135-8.

Borgatti, S.P., Mehra, A., Brass, D.J., and Labianca, G., (2009), **Network Analysis in the Social Sciences**, Science 232.

Breen, C.M., Quinn, N.W. and Mander, J.J., (1997), **Wetlands Conservation and Management in Southern Africa: Challenges and Opportunities**, Summary of the SADC Wetlands Conservation Survey Reports, Harare: IUCN.

Brooks, N., (2003), **Vulnerability, risk and adaptation: a conceptual framework** *(Tyndall Centre Working Paper No. 38)*, New York: University of East Anglia.

Brown, T., (2003), **Contestations, confusion and corruption: Market-based land reform and local politics in Zambia**,Wisconsin Wisconsin: University of Wisconsin.

Bryman, A., (2008), **Social Research Methods**, Oxford: Oxford University Press.

Bryman, A., and Bell, E., (2007), **Business research methods**, Oxford: Oxford University Press.

Casarotto, C., (2013), **Water economics and governance in the Kafue River Basin**, PhD Thesis.

Casarotto, C., and Kappel R., (2013), "A half empty bucket: woman's role in the governance of water resources in Zambia" in **The Journal of Gender and Water**, Iss 3.

Carpenter, S., Walker, B., Anderies, M.J. and Abel, N., (2001), "From metaphor to measurement: resilience of what to what?" **Ecosystems**, 4, 765-781.

Central Statistical Office [CSO], (2007), **Economic Census on Agriculture Production in Zambia: A Survey on the Performance of the Sector**, Lusaka: CSO.

CSO., (2005), **Agricultural and Pastoral Production: 2003/04 Post Harvest Report for Small-scale Agricultural Holdings**, Lusaka: CSO.

CSO., (2003), **2000 Census of Population and Housing: Agriculture Analytical Report**, Lusaka: CSO.
CSO., (2002), **Namwala District Census of Population and Housing**, Lusaka: CSO.

CSO., (2001), **Agricultural and Pastoral Production (Small -and Medium Holdings) 1999/2000 Report**, Lusaka: CSO.

Chabwela, H.N., (1994), **Status of wetlands of Zambia: Management and conservation issues**, ECZ, Zambia.

Chabwela, H.N and Ellenbroek, G.A., (1990), "The Impact of hydroelectric development on the Lechwe and its feeding grounds at Kafue Flats, Zambia," In Whigham D.F, Good, R.E. and Kvet, J., (eds) **Wetlands ecology and management: Case studies**, London: Kluwer Academic Publishers.

Chabwela, H.H and Haller, T., (2007), **Governance issues, potentials and failures of participative collection action in the Kafue Flats, Zambia,** ECZ, Zambia.

Chabwela, H.N and Siwela, A.A., (1986), **The vegetative structure of the Kafue Flats North Bank after construction of the dams.** In Proceeding of EWWS/AAB 7th Symposium on Aquatic weeds, Loughborough: Loughborough University.

Chambers, R., (1997), **Whose reality counts? Putting the first last**. London: Intermediate Technology Publications Ltd.

Chambers, R., (1994), **The Origins and practice of Participatory Rural Appraisal,** *World Development*, 22(7): 953-969.

Chambers, R., (1992), **Rural Appraisal: Rapid, Relaxed and Participatory**, Brighton: Institute of Development Studies (IDS), Discussion paper No. 311.

Chambers, R., (1992), **Participatory Rural Appraisal,** Institute of Development Studies, UK: University of Sussex.

Chaudhary, P. and Aryal, K. P., (2009), "Global Warming in Nepal: Challenges and Policy Imperatives," in **Journal of Forest and Livelihood**, 8**,** 5-14.

Chileshe, A.R., (2005), **Land Tenure and Rural Livelihoods in Zambia: Case Studies of Kamena and St. Joseph,** PhD. Thesis University of Western Cape, Southern Africa.

Chizyuka, C., and Mangani, L., (1987), "Cattle Diseases", in Mimba, D.C (ed) (1991) **Corridor Disease,** Lusaka: ZAMIC, Agricultural Division.

Churchill, Allegra, (2010), **Flood, Flow, Flux: Livelihoods on the Kafue Flats, Zambia**,American Society of Landscape Architects (ASLA), Virginia: University of Virginia.

Coffey, A. and Atkinson, P., (1996), **Making Sense of Qualitative Data**, Thousand Oaks: Sage, CA.

Colding, J., Elmqvist, T. and Olsson, P. (2003), "Living with disturbance: Building resilience insocial-ecological systems," in Berkes et al, (Ed.) **Navigating social-ecological systems** (pp. 132-162), Cambridge: Cambridge University Press.

Collier, P., Conway, G., and Venables, T., (2008), "Climate Change in Africa", in **Oxford Review of Economic Policy** Vol. 24 No. 2, London, Oxford Univ. Press, pp 337-353.

Coughenour, M. B., (1991), "Spatial components of plant-herbivore interactions in pastoral, ranching, and native ungulate ecosystems," **Journal of Range Management**, 44(6), 530-554.

Creswell, J. W., (2003), **Research Design: Qualitative, Quantitative, and Mixed Methods Approaches**, (2nd. ed.). Thousand Oaks, London: Sage Publications.

Cull, T., and Vincent K., (2004), **Climate change and food security in Southern Africa. Implications of theoretical development for promotion of sustainable equitable development**, Johannesburg: Kulima Integrated Development Solutions.

Cunningham, F., Feder, G and Ellsasser, K., (2009), **Contemporary methodologies in social science research,** London: Longman Group Limited.

Dasgupta, P., (2005), "Common Property Resources: Economic Analytics", in **Economic and Political Weekly,** 40: 1610-1622.

Davidson-Hunt, I. J. and Berkes, F., (2003), "Learning as you journey: Anishinaabe perception of social-ecological environments and adaptive learning", in **Conservation Ecology**, 8(1): 5.

Deressa, T.T., and Hassan, R.M., (2009), "Economic Impact of Climatic Change on Crop Production in Ethiopia: Evidence from Cross-Section Measures" in **Journal of African Economics**, Vol. 18, No. 4, London, Oxford University Press, pp 524-554

De Haan, C., (1999), **Determinants of Success in Livestock Development projects in Developing countries: A review of the World Bank Experience.** Paper presented at the occasional symposium of the British society of Animal Production, May, 12-15, 1999, Wye: Wye College.

Disaster Management and Mitigation Unit [DMMU], (2015), **Disaster Management Operations Manual**, GRZ, Office of the Vice President, Lusaka.

Dodge, J.D., (1977), **Agriculture Policy and Performance in Zambia: History, Prospects and Proposals for Change**, Berkeley: Institute of International studies.

Drijver, C. A and Chooye, P. M., (1995), "Changing Views on the Development of the Kafue Flats in Zambia," in **Tropical Freshwater Wetlands**, ed. H. Roggeri. Dordrecht, Netherlands: Kluver Academic Publishers.

Eakin, H. and Lynd, A.M., (2006), "Assessing Vulnerability of Social-Ecological Systems," in **Annual Review of Environment and Resources**, Vol.31, July 18. pp 365-394.

Easterling W.E., Crosson P.R., Roseberg N.J., Mckenney M.S., Katz L.A., and Lemon K.M., (2000), "Agricultural impact of and response to climate change in the Missouri – Iowa-Nebraska", in **Region Climate Change,** 24(1-2): 23-62.

Economic Commission for Africa [ECA] (2003), **Land Tenure Systems and Sustainable Development in Southern Africa**, Lusaka: Southern Africa ECA Office.

Ellen, R. and Harris, H., (2000), "Introduction," in Ellen et al. (Ed.) **Indigenous Environmental Knowledge and its Transformations: Critical Anthropological Perspectives** (pp. 1-35). Overseas Publisher Association.

Ellenbroek, G.A., (1987), **Ecology and Productivity of an African Wetland System: The Kafue Flats, Zambia,** Dordrecht: Dr. W. Junk Publishers.

Ellis, J.E, and Swift, D.M., (1993), **Climate Variability, Ecosystem Stability and the implication for Range and Livestock Developmen**t, London: Overseas Development Institute.

Ellis, F., and Allison, E., (2004), **Livelihood Diversification and Natural Resource Access**, Food and Agricultural Organization of the U.N., Livelihood Support Programme, LSP Working Paper 9, January 2004.

Environmental Partnership for Africa [EPA], (2004), **Climate Change Indicators**. Available From: http://www.epa.gov/climatechange/indicators.html. [Assessed on August 30, 2016].

Feeny, D., Berkes, F., McCay, B. and Acheson, J., (1990), "The tragedy of the commons: Twenty two years later," in **Human Ecology**, 18, pp. 1-19.

Fenton M., Kelly G., Vella K., and Innes, J., (2007), "Climate change and the Great Barrier Reef: Industries and communities," In: Johnson, JE & PA Marshall (Eds.) in **Climate Change and the Great Barrier Reef: A Vulnerability Assessment.**Australia. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office.

Fernandez-Gimenez, M.E., (2000), "The role of Mongolian nomadic pastoralists' ecological knowledge in rangeland management," in **Ecological Applications**, *10*(5), 1318-132.

Fernandez-Gimenez, M.E., Swift, D. M. and Le Febre, S., (2008), Mobility in pastoral systems: Dynamic flux or downward trend? **International Journal of Sustainable Development & World Ecology**,*13*, 1–22.

Fernandez-Gimenez, M.E. and Swift, D. M., (2003), **Strategies for sustainable grazing management in the developing world**. *Proceedings of the VIIth International Rangelands Congress*, 821-831.

Fielder, R.J., (1973), "The Role of Cattle in the Ila Economy: A Conflict of Views on the uses of Cattle by the Ila of Namwala", in **African Social Research**, No. 15, pp. 327-361.

Fraser, E. D. G., Dougill, A. J., Hubacek, K., Quinn, C. H Sendzimir, J., and Termansen M., (2011), **Assessing Vulnerability to Climate Change In dry Land Livelihood Systems: Conceptual Challenges and Interdisciplinary Solutions, Ecology and Society** 16(3):3

Fratkin, E., (1997), "Pastoralism: Governance and Development Issues," in **Annual Review Anthropology,** 26:235–261.

Freudenberger, K. S., (1994), **Tree and land tenure: Rapid Appraisal Tools**, Rome: Food and Agriculture Organisation of the United Nations (FAO).

Folke, C., (2006), "Resilience: The emergence of a perspective for social-ecological systems analyses," in **Global Environmental Change**, *16*, 253-267.

Folke, C., Colding, J. and Berkes, F. (2003), "Synthesis: Building resilience and adaptive capacity in social-ecological systems," in Berkes et al, (Ed.) **Navigating social-ecological systems** (pp. 328-352), Cambridge: University Press.

Food and Agriculture Organisation [FAO], (2006), **Climate Change and Food Security: A framework document,** Summary on Interdepartmental working group on climate change: 1-107. Food and Agriculture organization, (2012). *FAO statistical Yearbook, 2012.*

FAO/United Nations Development Programme [UNDP], (1968), **Multipurpose Survey of the Kafue River Basin: Zambia**, vol. 1, Rome: FAO/UNDP.

Foster, E.E., (1953), "Potential utilization of the Kafue Flats of Northern Rhodesia", **The Geographical Review**, vol. 43, pp. 366-379.

Foster, L.J., (1986), **Agricultural Development in Drought-Prone Africa**, Nottingham: Russell Press Ltd.

Gadgil, M., Olsson, P., Berkers, F. and Folke, C., (2003), "The role of local ecological knowledge in ecosystem management," in Berkes et al, (Ed.), **Navigating social-ecological systems** (pp. 189-209). Cambridge: University Press.

Gallopin, G.C., (2006), "Linkages between vulnerability, resilience, and adaptive capacity," in **Global Environmental Change**, 16: 293-303.

Galvin, K.A., Coppock, D.L., and Leslie, P.W., (1994), "Diet, nutrition and the pastoral strategy," In: Fratkin E, Galvin KA, Roth EA (eds), **African pastoralist systems: an integrated approach,** Lynne Rienner, Boulder, p 113–132.

Galvin, K.A., (1992), "Nutritional Ecology of Pastoralists in Dry Tropical Africa," in **Human Biology** 4:209–221.

Gender in Development Division [GIDD], (2005), **Baseline Survey on Women's Access to Agricultural Land in Zambia, Research Report**, Gender in Development Division (GIDD), Cabinet Office, Lusaka.

Gluckman, M., (1941), **Economy of the Central Barotse Plain**, London, Rhodes-Livingstone Institute: Rhodes-Livingstone Papers.

Government of the Republic of Zambia [GRZ], (2017), **Seventh National Development Plan (7NDP) 2017-2021**, Ministry of National Development Planning, Lusaka.

GRZ, (2011), **Department of Veterinary and Livestock Development Report**, Lusaka: Ministry of Agriculture and Livestock.

GRZ, (2010), **Ministry of Agriculture and Livestock annual report,** GRZ, Lusaka: Ministry of Agriculture and Livestock.

GRZ, (2009), **Namwala District Annual Report**, Ministry of Livestock and Fisheries, Department of Veterinary and Livestock Development, Namwala: DVO.

GRZ, (2008), **Annual Cattle Vaccination and Surveillance in Namwala District**, Lusaka: Ministry of Agriculture and Co-operatives [MACO].

GRZ, (2007), **Strategy for flood management for Kafue river basin**, Zambia, Associated Programme Flood Management (APFM), August 2007, Lusaka.

GRZ, (2006), **Fifth National Development Plan 2006-2010**, Lusaka: Ministry of Finance and National Planning.

GRZ, (2005), **Animal Production and Health Sub-Programme,** Namwala District Annual Report, Lusaka: Ministry of Agriculture and Cooperatives [MACO].

GRZ, (2002), **Poverty Reduction Strategy Paper 2002-2004**, Ministry of Finance and National Planning, Lusaka: GRZ.

GRZ, (2001), **Zambia's Economic Performance,** Ministry of Finance and National Planning, Lusaka: GRZ.

GRZ, (2000), **Livestock Development Plan 2000-2004**, Ministry of Agriculture Food and Fisheries: Background and Justification, Lusaka.

GRZ, (1998), **Agricultural Sector Investment ProgrammeAppraisal**, Lusaka: MAFF.

GRZ/PRSP, (2004), **Zambia First Poverty Reduction Strategy Paper Implementation Progress Report, January 2002-June2003**, Ministry of Finance and National Planning, Lusaka, March.

Grandin, B.E., (1992), "Wealth and Pastoral Dairy Production: A case study from Maasai land," in **Human Ecology** 16(1):1–21.

Grbich, C., (2007), **Qualitative Data Analysis: An Introduction**, London: Sage Publications Ltd.

Grandin, B.E., (1988), **Wealth Ranking in Smallholder Communities: A Field Manual**, London: Intermediate Publications.

Gunderson, L.H., Holling, C.S., Pritchard, Jr. L. and Peterson, G.D., (2002), Resilience of largescale resource systems in Gunderson & Pritchard Jr., (Ed.) **Resilience and the behavior of large-scale systems** (3-20). Washington, Covelo, London: Island Press.

Guhrs, T. and Kapwepwe M. (2008), **Ceremony! Celebrating Zambia's Cultural Heritage**, Lusaka, Celtel Zambia Plc and Sensitisation and Education through Kunda Arts (SEKA).

Hall, S., (1996), "The West and the Rest: discourse and power," in Hall *et al*., (Ed.) **Modernity: Introduction to Modern Societies** (pp. 184-224). Blackwell Publishers Inc.

Haller, T., (2007), **The contested Flood plain institutional change of common pool resources management and conflicts among the Ila, Tonga and Batwa. Kafue flats (Southern Province) Zambia.** Department of Social Anthropology, University of Zurich, Switzerland.

Haller, T., (2004), **Open Access and the State: Change of Institutions Governing Floodplain Common Pool Resources (CPRs) and conflicts in the Kafue Flats, Zambia**, The Tenth Biennial Conference of the International Association for the Study of Common Property (IASCP).

Haller, T. and Merten, S., (2008), "**We are Zambians - Don't Tell Us How to Fish**!" **Institutional change, power relations and conflicts in the Kafue Flats fisheries in Zambia**. Department of Social Anthropology, University of Zurich, Switzerland.

Hans, E., (1982), **Livestock Production System and Livestock Development in Tropical Africa**, Kiel: Novelle Press.

Hardin, G., (1968), "The tragedy of the commons" in **Science**, *162,* 1243-1248.

Hedlund, H., (1971), **The impact of Group Ranches on Pastoral Society,** Nairobi:Nairobi Institute for Development Studies.

Hermitte, E., (1974), '**An Economic History of Barotseland 1800-1940**' Unpublished PhD Thesis, Michigan, USA, Ann Arbor: North Western University.

Herreria, E., Byron I., Kancans, R., and Stenekes, N., (2006), **Assessing dependence on water for agriculture and social resilience,** Canberra: Bureau of Rural Sciences.

HODI, (2009), **Traditional Livestock Keeping in Namwala: Transformation and Goals towards Cattle Marketing**, Lusaka: Hodi Reports.

Hogg, R., (2001), **An Institutional Approach to Pastoral Development: An example from Ethiopia,** Pastoral Development Network Paper, London: Overseas Development Institute.

Holling, C. S., (2003), "Resilience and Stability of Ecological Systems," **Annual Review of Ecology and Systematics** 4: 1–23.

Holling, C.S., (2001), "Understanding the complexity of economic, ecological, and social systems," in **Ecosystems**, 4, 390-405.

Holling, C.S., (1973), "Resilience and stability of ecological systems," in **Annual Review of Ecology and Systematics**, 4: 1-23.

Hulme, M., Doherty, R., Ngara, T., New. M., and Lister, D., (2005), **African Climate Change: 1900 – 2100**, Climate Research 17: 145-168.

Ingram, J.S, Ericksen, P., and Liverman, D., (2010), **Food security and global environmental change**, Earthscan.

International Fund for Agricultural Development [IFAD] (1995), **Common Property Resources and the rural Poor in Sub-Saharan Africa,** IFAD), Amsterdam. July, R. 1975, *Pre Colonial Africa*, New York: Charles Scribner's Sons.

Intergovernmental Panel on Climate Change [IPCC] (2014), **Climate Change 2014: Synthesis Report**. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], IPCC, Geneva, Switzerland.

IPCC), (2007a), 'Summary for Policymakers,' in S. Solomon, (ed). **Climate Change 2007: The Physical Science Basis.** Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK: Cambridge University Press: 1-18.

IPCC, (2007b), **Climate Change 2007: Impacts, Adaptation and Vulnerability**, Contribution of Working Group II to the Fourth Assessment Report of theIntergovernmental Panel on Climate Change M.L. Parry, O.F. Canziani, J.P. Palutikof,P.J. van der Linden and C.E. Hanson, Eds. Cambridge University Press, Cambridge,UK, pp 976.

IPCC, (2001), **Synthesis of the Third Assessment Report, Intergovernmental Panel on Climate Change (IPCC)**, Cambridge: Cambridge University Press.

IPCC, (2000), **Emissions Scenarios. Special Report of the Intergovernmental Panel on Climate Change**, Cambridge: Cambridge University Press.

Jain, S., (2007), **An empirical economic assessment of impacts of climate change on agriculture in Zambia**, Policy research working paper, World Bank Research Group.

Janssen, M.A and Ostrom, E., (2006), "Editorial: Resilience, vulnerability, and adaptation: a cross-cutting theme of the International Human Dimensions Programme on Global Environmental Change," in **Global Environmental Change,**16: 237-9.

Jaspan, M.A., (1953), **The Ila-Tonga Peoples of Northern Rhodesia**, London: International African Institute.

Jazairy, I, Alamgir, M., and Panuccio, T., (1992), **The State of World Rural Poverty: An Inquiry into its causes and consequences,** International Fund for Agricultural Development (IFAD), New York: New York University Press.

Jodha, N.S., (1986), "Common property resources and rural poor in dry regions of India," in **Economic and Political Weekly** 21, 1169-1181.

Kajoba, G.M., (2008), **Vulnerability and resilience of rural society in Zambia: From the view point of land tenure and food security**, Resilience project report, Working paper on Social-Ecological Resilience Series No. 2008-003, Tokyo, Japan: Research Institute for Humanity and Nature (RIHN).

Kajoba, G.M, (2003), "Land and Natural Resources Tenure Reform in Developing Countries: Lessons for Zambia", in V.C. Jha (ed.) **Land Degradation and Desertification,** Rawat Publishers, Jaipur and New Dehli, pp291-319.

Kajoba, G. M, (1998), "The Impact of the 1991/92 Drought in Zambia in Ahmed, A.G.M. and Mlay, W. (eds)," in **Environment and Sustainable Development in Eastern and Southern Africa: Some Critical Issues**, MacMillan Press Ltd. in Association with OSSREA, pp. 190-206.

Kalapula, E.S., (1984), **Back to the Land: Youth- Based Agricultural Land Settlement Centres for Economic and Social Development in Southern Zambia**, PhD Thesis, Clark University, U.S.A.

Kalapula, E.S., (1979), "**Rural development and rural industrialisation in Zambia**," Paper presented at the Eastern African Social Science consultative Group Workshop on Industrialisation and Rural Development, Tanzania, Arusha, 4-6 April, 1979.

Kalapula, E.S., (1976), **Kafue River Basin Development: Its Effects on Ecology and Landuse**, Master of Arts Dissertation, Arizona State University, U.S.A.

Kalapula, S.C., (2012), "Socio-economic transformation among traditional cattle keepers in Kafue Flood Plain in Namwala District, Zambia," in **Journal of Agricultural and Biomedical Sciences** (JABS), Volume 1(3): pp. 25-30.

Kalapula, S.C., (2007), **The Socio-Economic Impact of Theileriosis (East Coast Fever) or Corridor Disease on the Livelihood of People of Namwala District: A Case Study of Baambwe Area**, Unpublished Project Report, Department of Geography, The University of Zambia, Lusaka.

Kalibaba, N.P., (2000), **Livestock Marketing and Trade in the Central Corridor of West Africa,** Agricultural marketing Improvement Strategies Project, Sahel West Africa Office, Washington DC: USAID.

Kalinda, T.H., (2011), "Small holder farmers' perception of climate change and conservation agriculture: Evidence from Zambia", in **Journal of sustainable development**, Vol. 4, No. 4. August 2011.

Kalunga, Willie, (1996), **An Assessment of the Water Hyancith (Eichhorinia Crassipes control options in Kafue River, as influenced by industrial activities at Kafue Town**, Zambia. Msc. Thesis, Agricultural University of Norway

Kanyanga, K., (2008), **Precipitation and Temperature variations in Zambia: Evidence of Climate Change.**A paper presented at Media Workshop on Climate Change and Global Warming held in Chipata, Zambia.

Kirsten, J, Perret, S, and d'Haese, M, (2002) **Rural Development: Focusing on small scale agiculture in Southern Afirca,** University of Pretoria, Pretoria.

Kodamaya, S., (2007), "Vulnerability and Coping Strategies in Africa: Literature Review for Research in Zambia", in Umetsu, C. (ed) **Vulnerability and Resilience of Social-Ecological Systems Project Report**, No.3, Research Institute for Humanity and Nature, March, pp. 35-43.

Kothari, U., (2001), "Power, knowledge and social control in participatory development," in Cooke, B. & Kothari, U. (eds.), **Participation the new tyranny**, London: Zed Books, 139-152.

Kruger, A.C., and Shongwe S., (2004), "Temperature trends in South Africa: 1960–2003," in **International Journal of Climatology,** 24 (15): 1929–1945.

Kunz, M.J., Senn, D.B., Wehrli, B., Mwelwa, E.M. and Wüest, A., (2013), "Optimising turbine withdrawal from a tropical reservoir for improved water quality in downstream wetlands," in **Water Resources**, 49 (3) 181-203.

Lhophitallier, G, Ellis, C.K., and Gillis, M., (1999), **Assessment of Landuse patterns and agrarian systems: Principles of Zoning,** Pretoria: University of Pretoria Press.

Little, P.D., and Brokensha, D.W., (1987), Local Institutions, Tenure and Resource Management in East Africa, In: P. Anderson and R., Grove, (eds), **Conservation in Africa: people, policies and practice,** Cambridge: Cambridge University Press, p 193 – 209.

Lutke-Entrup, J., (1971), **Limitations and Possibilities of Increased Market Production of Peasant African Cattle Holders in Western Province**, Lusaka: Institute for African Studies.

Maguire, B., and Hagan, P., (2007), "Disasters and communities: understanding social resilience", in **The Australian Journal of Emergency Management**, 22: 16-20.

Liu, J., Dietz, T., Carpenter, S.R., Alberti, M., Folke, C., Moran, E., and Pell, A.N., (2007), "Complexity of coupled human and natural systems," in **Science**, *317*, pp. 1513-1516.

Malone, E.L., (2009), **Vulnerability and Resilience in the Face of Climate Change: Current Research and Needs for Population Information**, Battelle; Pacific Northwest Division Richland, Washington DC.

Mapani, W., (2008), "The Shimunenga Cattle drive of the Ila People in Namwala District: Changes in value attached to Cattle" in the **Zambia Daily Mail** 14/10/2008, pp. 5-7.

Marchand, M. and Drijver, C.A., (1985), **Land use possibilities on the Kafue Flats**, Zambia, Centre for Environmental Studies, Leiden: State University of Leiden.

Marin, A., (2009), "Riders under storms: Contributions of nomadic herders' observations to analyzing climate change in Mongolia, **Global Environmental Change**, *20*, 162-176.

Matata, D., Botha, G., and Bhala, S.S., (1999), **Rural development in Rural Africa: Towards inclusive participatory development,** Cape Town: Oxford University Press.

Martin, A. and Sherington, J., (1997), "Participatory research methods-implementation, effectiveness and institutional context," in **Agricultural Systems**, 55(2): pp. 195-216.

McKeen, M.A., (2000), "Common property: What is it, what is it good for, and what makes it work?" in Gibson et al, (Ed.) **People and Forests: Communities, Institutions, and Governance**, (pp. 27-55). The MIT Press.

McCabe, T.J., (1988), **Labour and pastoral production**, London: Chatto and Windus.

McCay, B., (2002), "Community and the commons: Romantic and other views," in Agrawal and Gibson (Ed.) **Communities and the Environment: Ethnicity, Gender and the State in Community-Based Conservation** (pp. 180-193). Rutgers University Press.

McLean, H.A., (1961), "Agriculture Reconnaissance Survey of Namwala District", in **Northern Rhodesia Department of African Agriculture**, Lusaka: Mimeographed.

Menzies, C.R. and Butler, C., (2006), "Introduction: Understanding ecological knowledge," inMenzies, (Ed.) **Traditional ecological knowledge and natural resource management**, Nebraska: University of Nebraska Press.

Mertens, J., [ed] (2013), **Center Environment and Sustainability (CCES)/African Dams Project: An Integrated Water Resources Management Study,** CES/ADAPT, Zurich.

Mertz, O., Mbow, C., Nielsen, J.O., Maiga, A., Diallo, D., Reenberg, A., Diouf, A., Barbier, B., Moussa, I.B. and Zorom, M., (2010), "Climate factors play a limited role for past adaptation strategies in West Africa.," in **Ecology and Society**, 15(4): 25.

Mettrick, T., (1993), "Participatory Rural Appraisal techniques: Changing perceptions," **in Rural Africana,** Issue 4, vol. 7 (pp. 32-38).

Miles, M.B. and Huberman, A.M., (1994), **Qualitative data analysis** (2nd ed.). Thousand Oaks, CA: Sage Publications.

Millennium Ecosystem Assessment [MEA], (2005), **Ecosystems and Human Well- Being: Synthesis,** Washington, D.C.: Island Press.

Ministry of Tourism Environment and Natural Resources [MTENR], (2007*)*, **Formulation of the National Adaptation Program of Action on Climate Change,** MTENR, Lusaka.

Mngumi, J., (2016), **Perceptions of climate change, environmental variability and the role of agricultural adaptation strategies by small-scale farmers in Africa: the case of Mwanga district in northern Tanzania**. PhD Thesis, http://theses.gla.ac.uk/7441.

Muchanga, M, (2013), "Learning for Climate Change Adaptation among Selected Communities of Lusaka Province in Zambia," in **Southern African Journal of Environmental Education**, Vol. 29, 2012/2013, pp 94-114.

Mudenda, F., (2007), **Land law in Zambia,** Lusaka: University of Zambia Press.

Mulimbwa, A. C., (1998), "Land Policy and Economic Development in Zambia," In Zambia **Law Journal**, Special Edition, Lusaka: UNZA Press

Mulongo, H.A., (1985), "Ecological and Administrative constraints in the economic development of Namwala 1910-1940" in **Zambian Geographical Journal** No. 35 (19-29).

Mulolwa, A., (2002), **Intergrated Land Delivery towards improving Land Administration in Zambia**, Netherlands: Delft university Press.

Mungaba, F.N., (1988), **Dip Management and East Coast Fever - Corridor disease control**, Lusaka: D De Menegh.

Munyama, J., (1994), "Corridor Disease in Southern Province", in the **Times of Zambia,** p.4, April 29, 2004.

Mvunga, M., (1993), **Land Law Policy in Zambia**, Institute of Zambian studies, University of Zambia.

Mweemba, L., (2014), "Climate Change in the Zambian Mind: Communicating Risk Perception of Climate Change and Variability in Zambia," in **Zambia Social Science Journal**, Vol. 5, No. 1, Article 6, pp. 71-93.

Mweemba L. and Wu H., (2010), "Environmental self-efficacy, attitude and behaviour among small scale farmers in Zambia," in **Environment, Development and Sustainability**, October 2010, Volume 12, Issue 5, pp. 727-744.

Namafe, C.M. (2006), **Environmental Education in Zambia: A Critical Approach to Change and Transformation**. Lusaka: New Horizon Printer.

Namafe C., (2004), "Flooding in the Context of the Barotse People of the Upper Zambezi Wetlands" in **Southern African Journal of Environmental Education**, Vol. 21, pp. 50-60.

Namafe C. and Chileshe B., (2010), "Contextualising the Curriculum through Local Floodplain Artefacts at Lealui Basic School of Western Zambia" in **Southern African Journal of Environmental Education**, Vol. 29, pp. 167-179.

Namafe, C. and Slater F., (2010), Floods, friends or enemies? in **Geographical Education**, Vol. 8, No. 3, pp. 57-62.

Nestel, B., Pratt, D.J., Thome, M. and Tribe, D.E., (1973), **Animal Production and Research in Tropical Africa**, Washington DC: Consultative Group on International Agricultural Research.

Ngoma, J., (2008), **Effect of climate change on maize production in Zambia**, Master of Science Thesis, Environmental Science Programme, Linköpings Universitet, Campus Norrköping, SE-601 74 Sweden, Norrköping.

Nightingale, A., (2003), "A Feminist in the Forest: Situated Knowledges and Mixing Methods," in Natural Resource Management 1, **An International E-Journal for Critical Geographies**, 2**,** pp. 77-90.

Norberg, J., Wilson, J., Walker, B. and Ostrom, E., (2008), Diversity and resilience of socialecological systems in Norberg and Cumming (Ed.) **Complexity Theory for a Sustainable Future** (pp. 46-79), Columbia: Columbia University Press.

Norgaard, R.B., (1994), **Development Betrayed: The End of Progress and a Co-evolutionary Revisioning of the Future**, London and New York: Routledge.

Novak, J. D., (1998), **Learning, creating and using knowledge: concepts maps as facilitative tools in schools and corporations.** London: Lawrence Erlbaum associates, publishers.

Ostrom, E. and Schlager, E., (1996), **Governing the commons,** Cambridge: Cambridge University Press.

O'Brien, K., Sygna L. and Haugen J.E., (2004), "Vulnerable or resilient? A multi-scale assessment of climate impacts and vulnerability in Norway", in **Climatic Change**, 64: 193-225.

Patriotic Front [PF] (2016), **Manifesto** 2016-2021, Lusaka: Patriotic Front Secretariat.

Parry, M. L., (2007), **Climate Change 2007: Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Fourth Assessment Report of the IPCC Intergovernmental Panel on Climate Change**, Cambridge: Cambridge University Press.

Perret, S., (1999), **Typological techniques applied to rural households and farming systems: Principles, procedures and Case studies**, University of Pretoria, CIRAD, Working Paper 99/2, November 1999.

Pimm, S.L., (1984), "The complexity and stability of ecosystems", in **Nature,** 307: 321- 6.

Pinkerton, E., (1989), **Cooperative management of local fisheries: New directions for improved management and community development,** Vancouver: University of British Columbia Press.

Pritchard, J.M., (1979), **Africa: A Study Geography for Advanced Students (**Revised Third Edition), London: Harlow Longman Group.

Ramsar Secretariat (2013), **Ramsar Sites in order of their addition to the Ramsar List of Wetlands of International Importance**, Ramsar Convention, Ramsar, Iran.

Rees, W.A., (1978), The ecology of the Kafue Lechwe as affected the Kafue Gorge Hydroelectric Scheme, **Journal of Applied Ecology**, Volume 15 pp. 205-2017.

Reid, R. S., Nkedianye, D., Saida, M. Y., and Clark, W. C. (2009), **Evolution of models to support community and policy action with science: Balancing pastoral livelihoods and wildlife conservation in savannas of East Africa.** *PNAS*, *w.pnas.org_cgi_doi_10.1073_pnas.0900313106.*

Rennie, J.K., (1985), "Traditional Society and Modern developments in Namwala" **Proceedings of the National Seminar on Environment and Change: The consequences of hydroelectric power development on the utilisation of the Kafue Flats,** Lusaka, April 1985, University of Zambia, Kafue Basin Research Committee.

Roberts, A.D., (1976), **A History of Zambia**, London: Heinemann.

Robinson, L. W. and Berkes, F., (2011), "Multi-level participation for building adaptive capacity: Formal agency-community interactions in northern Kenya," **Global Environmental Change**, 21 (4), 1185-1194.

Roland B., Neukum, C., Nkhoma, C., Silembo, O., (2007), **The Groundwater Resources of Southern Province, Zambia** (Phase 1), Volume 1, Technical Report, Lusaka: Ministry of Energy and Water Development, Department of Water Affairs; and Federal Institute for Geosciences and Natural Resources.

Rootselaar, G.H.V. and Bwalya, G.M., (1990), "Cattle Development Programmes for Small-Scale Farmers" in Woods, A.P, Keane, S.A, Milimo, J.T and Warren, D.M [eds] **The Dynamics of Agricultural Policy and Reform in Zambia**, Ames: Iowa State University Press, pp. 493-513.

Ross, A., Sherman, K. P., Snodgrass, J. G., Delcore, H. D. and Sherman, R., (2011), **Indigenous peoples and the collaborative starship of nature: knowledge binds and institutional conflicts**,New York: Left Coast Press, Inc.

Sahn, D., [ed.] (1989), **Seasonal Variability in Third World Agriculture: the Consequences for Food Security**, Baltimore, MD: Johns Hopkins University Press.

Schoon, M., (2005), **A short historical overview of the concepts of resilience, vulnerability and adaptation** *(Working Paper W05-4).* Workshop in Political Theory and Policy Analysis, Indiana University.

Scoones, I., [ed], (1995), **Living with uncertainty: New directions in pastoral development in Africa,** London: International Institute for Environment and Development.

Senanayake, S. G. J. N., (2006), 'Indigenous Knowledge as a Key to Sustainable Development', **The Journal of Agriculture Sciences**, Vol. 2, No. 1, pp. 87-94.

Sheppe, W. and Osborne, T., (1971), **Patterns of Use of a Flood Plain by Zambian Mammals**, Ecological Monographs, vol 41, No, pp179-205.

Sianungu, P., (2015), **The implications of climate variability and change on rural household food security in Zambia: experiences from Choma district, southern province**, Master of Arts in Environmental Planning and Management in the Department of Geography and Environmental Studies, Faculty of Arts, University of Nairobi.

Sichingabula, H. M., (2004), Occurrence and magnitude of hydrological drought in Zambia: Impacts and implications, in **Hydrological Extremes: Understanding, Predicting, Mitigation**. ***IAHS publication*** no. 255. 297-305.

Sichingabula, H.M., (1997), "Drought research and related activities in Zambia," In: **The Environmental Impact of the 1991-1992 Drought on Zambia: Summary Proceedings of the IUCN Drought Study Follow-up Workshop**, IUCN, Lusaka.

Sichingabula, H. M., (1996), The environmental impact of the 1991-92 drought on Zambia: a review with some analysis, **Proceedings of the IUCN drought study follow-up workshop on the impact of 1991-92 drought on Zambia**. IUCN Lusaka, Zambia, p. 127-133.

Sichingabula, H.M., (1998), **Rainfall Variability, Drought and Implications of its Impacts on Zambia, 1886-1996 in Water Resources Variability in Africa during the XXth Century**. International Association of Hydrological Sciences Publication No. 252: 125-134.

Sikana, P.M., (1997), **Agro-Pastoral and Trade Liberalisation: Transformation of Production Goals and Rationales among Traditional Cattle Keepers of the Bulozi Flood Plains**, Lusaka: The Study Fund, MFNP.

Sillitoe, P. (1998), "The development of indigenous knowledge: A new applied anthropology," in **Current Anthropology**, 39(2), 223-252.

Simfukwe, T., Casarotto, C., Kainda, T., Tembo, G., (2012), **Rural household water use in the Kafue River Basin in Zambia**. World Congress on Water, Climate & Energy, Dublin, May 2012.

Singleton, R.A. Jr. and Strants B.C., (2005), **Approaches to Social Research**, 4th ed., Oxford: Oxford University Press.

Sinha, S., (2010), 'What would it take for Zambia's cattle industry to achieve its potential', in The Post, **The role of cattle industry to the economy of Zambia**, World Bank Consultant - 25-05-2010, p.v Business Post.

Smith, E.W. and Dale, A.M., (1920), **The Ila-Speaking Peoples of Northern Rhodesia**, 2 vol., London: McMillan.

Solway, J., (1986), **Commercialisation and Social Differentiation in a Kalahari Village in Botswana**, Unpublished PhD Thesis, Toronto: University of Toronto.

Staatz, J., (1979), **The Economics of Cattle and Meat Marketing in Ivory Coast,** Centre for Research and Economic Development, Ann Arbor: University of Michigan.

Stein, C., Ernstson, H., and Barron J., (2011), "A Social Network Approach to Analyzing Water Governance: The case of the Mkindo Catchment, Tanzania," in **Physics and Chemistry of the Earth**, Vol 36 (14-15), pp1085-1092.

Stern, N (2006), **The Stern Review: Report on the Economics of Climate Change**, London: HM Treasury.

Strategic Visions Limited (2011), **Diary Value Chain Study in Zambia,** Lusaka: SVL.

Subramaniam, S. P., (1992), "A brief review of the status of the fisheries of the Bangweulu Basin and Kafue flats*,"*In **The wetlands of the Kafue flats and Bangweulu basin: Proceedings of the Wildlife Fund for Nature International-Zambia Wetlands Project Workshop,** eds. R. C. V. Jeffrey, H. N. Chabwela, G. Howard, and P. J. Dugan. Gland, Switzerland: IUCN.

Sutter, N.S., (1987), **Cattle accumulation, Marketing and Commercialisation of Traditional Livestock Sector in Nigeria,** Lagos: International Institute of Social Sciences.

Tashakkori, A. and Teddlie, C., (1998), **Mixed methodology: combining qualitative and quantitative approaches.** Thousand Oaks, Calif.: Sage.

The Resilience Alliance, (2007), **Assessing Resilience in Social-Ecological Systems: A workbook for scientists,** Version 1.2, Draft for testing and evaluation.

Thomas, D.H.L., (1996), "Fisheries Tenure in an African Floodplain Village and the Implication for management," in **Human Ecology**, Vol. 24(3), pp. 286-313.

Thomson, H., (2004), **Livestock Productivity in Sub-Saharan Africa**, London: ITLP.

Thornton, P. K., Jones, P. G., Owiyo, T., Kruska, R., Herrero, M., Kristjanson, P., Notenbaert, A., Bekele, N. and Omolo, A., (2006), **Mapping climate vulnerability and poverty in Africa**, Cambrige: Cambrige University press.

Trapnell, C.G. and Clothier J.N., (1996), **The Soils, Vegetation and Traditional Agriculture of Zambia**, volume 1; Central and Western Zambia (Ecological Survey 1932-1936), Bristol: Redcliff Press Ltd.

Triffen, M.R. and Mulele, M., (1994**)**, **The Environmental Impact of the 1991/92 Drought in Zambia**, Gland Switzerland: The World Conservation Union (IUCN).

Tschakert P., E. Huber-Sannwald, D. S. Ojima, M.R. Raupach., E. Schienke., (2008), Holistic, Adaptive Management of the Terrestrial Carbon Cycle at Local and Regional Scales, **Global Environmental Change,** Vol. 18 128–141.

Tuden, A., (1968), **Ila Property relationships and Political Process in Local-level Politics.** M. Schwartz (ed.) New York: Atherton.

United Nations Development Programme [UNDP], (2007), **Human Development Report 2007/2008: fighting climate change: human solidarity in a divided world**, New York: United Nations Development Programme.

United Nations Framework Convention on Climate Change [UNFCCC], (2012), **Bonn Climate Change Conference Report**, Conference report.

United Nations (2014), **Mainstreaming climate change into rural development policy post 2013,** Final Report, UN New York.

UN/FAO (1968), "**Multipurpose Survey of the Kafue River Basin, Zambia, Final Report**", Volumes 1-6 Rome.

Walker, B., C. S. Holling. C.S., Carpenter, S. R. and Kinzig, A., (2002), "Resilience, adaptability and transformability in social–ecological systems", in **Ecology and Society**, *9*(2): 5.

Walker, B.H. and Salt, D., (2006), **Resilience thinking: sustaining ecosystems and people in a changing world**, London: Island Press.

Wamulume, J., Landert, J., Zurbrügg, R., Nyambe, I., Wehrli, B., and Senn, D. B. (2011), "Exploring the hydrology and biogeochemistry of the dam-impacted Kafue River and Kafue Flats (Zambia)", in **Physics and Chemistry of the Earth**, 36, 775-788.

Welcomme, R.L., (1975), **The Fisheries ecology of African Floodplain**, Longman, London.

White, C.M.N., (1957), "A Survey of African Land Tenure in Northern Rhodesia", in **Journal of African Administration**, vol. II, pp 3-10.

Williams, G.J., (1984), "The Kafue hydroelectric scheme and its environmental setting," In Williams, G.J. and Howard, G.W. (1984), **Development and ecology in the lower Kafue Basin: Papers from the Kafue Basin Research Committee of the University of Zambia**, Lusaka: Department of Biology.

Wood, A.P., (1989), **'Cattle Development in Western Province of Zambia'**, London: ODI Pastoral Development *Network Paper* No. 28c.

World Bank (2011), **What Would it Take for Zambia's Beef and Dairy Industries to achieve their Potential**? World Bank.

World Wide Fund for Nature [WWF], (2006), **Agriculture, Water and Environment in the Kafue River Basin**, Issue No 5, Lusaka: WWF.

WWF, (2004), **Biodiversity on the Kafue Flats: From Poaching to Tourism**, Issue No. 10, Lusaka: WWF.

Yamane, T., (1967), **Statistics: An Introductory Analysis**, 2nd Ed., New York: Harper and Row.

Yambayamba, E.S.K., (2006), "A Survey of Prevailing Traditional Ownership of Livestock by Smallholders in four Provinces of Zambia," in **Zambian Journal of Agricultural Science**, Volume 8 (2): pp. 6-12.

Yanda, P.Z., and C.P. Mubaya., (2011), **Managing a Changing Climate in Africs; Local Level Vunerabilities and Adaptation Eperiences**, Dar es Salaam: Mkuki na Nyota.

Zambia Environmental Management Agency [ZEMA]/GRID-Arendal/GRID-Sioux Falls and United Nations Environment Programme [UNEP] (2013), **Zambia: Atlas of our Changing Environment**, Lusaka: ZEMA, GRID-Arendal, GRID-Sioux Falls and UNEP.

Zambia National Farmers Union [ZNFU], (2012), **A Review of Council Fees and Charges on Livestock Sector**, Lusaka: Zambia National Farmers Union (ZNFU).

Zambia Vulnerability Assessment Committee [ZVAC], (2008), **Multi-Sectoral In-Depth Vulnerability and Needs Assessment,** ZVAC, Lusaka, Zambia.

Ziervogel, G. and Calder, R., (2003), "Climate variability and rural livelihoods: assessing the impact of seasonal climate forecasts in Lesotho," in **Area**, 35(4): 403-417.

Zindi, C., and Stack, J., (1992), **Income versus Insurance: Preliminary findings on the contribution of Livestock to Communal Area Farm Household Food Security**, Harare: University of Zimbabwe Press.

APPENDICES

Appendix 1: Household questionnaire

Serial No:……..... **Chiefdom:**…….**Date:**…….....

Section A: Background information

1. Sex: ..... Male: …..... Female: .....
2. Age…….....Years
3. Marital status: (a) Single ☐ (b) Married ☐ (c) Widow ☐ (d) Separated ☐
4. If married, how many children do you have? ….....
5. What is the size of household ? …….....
6. Have you ever attended formal school? Yes ☐ (b) No ☐
7. If yes to Question 6, what is your highest educational attainment?
   (a) Lower Primary 1-4 ☐
   (b) Upper Primary 5-7 ☐
   (c) Basic school 8-9 ☐
   (d) High school 10-12 ☐
   (c) Tertiary ☐
   (d) Non ☐
8. What is your main occupation?.....
9. What is your religious denomination?
   (a) UCZ ☐ (b) Jehovah's Witness ☐ (c) Catholic ☐
   (d) SDA ☐ (e) New Apostolic ☐ (f) No Religion ☐
10. What tribe are you?
    (a)Ila ☐ (b) Tonga ☐ (c) Lozi ☐ (d) Luvale ☐ (e) Others specify…….....
11. How long have you lived in this area?.....

Section B: Socio-economic situation among pastoralists

12. How much total land (in hectares) do you own?.....
13. How much land did you cultivate last farming season?.....
14. What are the reasons you did not cultivate the total land?.....
    (a) Lack of seed ☐ (b) Lack of fertilise ☐ (c) Inadequate labour ☐
    (d) Land grabbed ☐ (c) Poor rainfall ☐ (d) Others specify…….....
15. Using table below, what crops did you grow last farming season and how much did you harvest for each crop?

Crop grown	Average output (kg)	Quantity consumed	Quantity sold (ZMK)
Hybrid maize			
Local maize			
Sorghum			
Millet			
Cassava			
Groundnuts			
Rice			
Cotton			
Sunflower			
Tobacco			

Soya beans			
Beans			
Sweet potatoes			
Other			

16. Which of the following practices were you involved in the last farming season?
    (a) Crop diversification ☐ (b) Crop rotation ☐ (c) Green/animal manuring ☐
    (d) Grew new crops ☐ (e) Soil conservation ☐ (f) Mixed farming ☐
    (g) Minimum tillage ☐ (h) Improved fallow ☐ (i) Other…….....
17. Which is your most important source of income in your household?
    (a) Sale of livestock ☐ (b) Sale rain crops ☐ (c) Piecework ☐
    (d) Timber/lumbering ☐ (e) Fishing ☐ (f) Poaching ☐
    (g) Trading ☐ (h) Gardening ☐ (i) Sale of fruits ☐
    (j) Sale of Sour/milk ☐ (k) Honey hunting ☐ (l) Other…….....
18. Which of the following livestock in table below do you own and in what numbers?

Type of livestock	How many do you own (number)
Cattle	
Sheep	
Donkey	
Goats	
Pigs	
Chickens	
Rabbits	
Guinea fowls	
Ducks	
Pigeons	
Peacock	
Other specify	

19. Which of the following items do you own and in what quantities?

Item	Quantity	Year bought	Purpose	Where did money to buy item come from?
Hoe				
Ploughs				
Ridgers				
Harrows				
Ox-cart				
Tractors				
Rippers				
Bicycle				
Motorbike				
Car				
Radio				
Television				
Iron roofed house				
Hammer mill				
Hand mill				
Maize Sheller				
Water pump				
Borehole				
Pond/pan				
Others specify				

20. How do you survive in times of floods and droughts?
    a) Fishing ☐

b) Charcoal burning ☐
c) Game poaching ☐
d) Honey hunting ☐
e) Others specify…….....

Section C: Patterns and cycles of climate variability and change

21. When was the village/settlement established?.....
22. List ecological changes that have taken place in the last 10 years…….....
    ……..…..
    ……..…..
23. Have you observed any major changes in the climate/weather patterns in your area (village) over the past years or decades? E.g., has the temperature or rainfall increased, decreased or there has been no change?.....
24. What is the history of droughts and floods in your area?.....
    ……..…..
25. What is the typical frequency and duration of occurrence of droughts and floods? Are they seasonal?.....
26. Have droughts and floods changed over time, for example due to climate change or other trends?.....
27. What is the speed of onset of drought/flood? Are there any warning signs? What are the established early warning signs?.....
28. What are the underlying causes of droughts/floods, do you understand their occurrence?.....
29. Using the timeline table below, what significant trends or changes have you observed in recent decades, and how do they expect them to evolve in the future?

History and cycles of drought/floods		
History of drought/floods	Year (indicate months most affected)	Changes observed
	1990-1995	
	1996-2000	
	2001-2005	
	2006-2010	
	2010-2015	
	2016-2017	

30. Identify types and cycles of change (critical disturbances and historical events), their characteristics and impacts…….....
    ……..…..
31. Outline, using the table below, how you have been affected by different social- ecological disturbances;

Disturbance	Pulse or press	Frequencies of occurrence	Recovery during and after disturbance	System most affected	Magnitude of impact (minor to severe)	Change in the past few years (none, little, less frequent, more intense, etc.)
Droughts						
Floods						
Water scarcity						
Cattle diseases						
Soil erosion						
Cattle rustling						

Kafue river flow						
Crocodiles						
Other						

32. Using the information that you developed in the timeline activity, identify past adaptive cycles for your focal system and length of each domain using the table below;

Domain(Social - Ecological)	Domain features (slow, fast or damaging)	Length of phase	What triggered a release or shift?	What are the system vulnerabilities? Who is affected?	What characteristics changed among pastoralists?
Droughts					
Floods					
Water scarcity					
Cattle diseases					
Soil erosion					
Cattle rustling					
Kafue river flow					
Crocodiles					
Other					

33. How would you describe the effects of these disturbances in your area?.....
……..
34. According to your observation, how would you describe the number of rainy days in your area? Have they increased, decreased or there has been no change?.....
…….....
35. What changes have you observed in your environment that are potentially linked to changes you mentioned above? E.g., in forest cover, pasture, agricultural land, streams/rivers, grass, or any other change…….....
…….....

Section D: Effects of climate variability and change on pastoral systems

36. Do you own any livestock? (a) Yes ☐ (b) No ☐
37. If Yes to Question 36 above, how did you acquire your animals?.....
…….....
38. Are there any salaried employees who own cattle in your kraal? (a) Yes ☐ (b) No ☐
39. If Yes, is the owner (a) Male/ Female……(b) Age……(c) Ethnic origin…….....
40. Tick below the kind of livestock you own;
    (a) Cattle ☐ (b) Pigs ☐ (c) Goats ☐ (d) Sheep ☐ (e) Donkey ☐
    (f) Chickens ☐ (g) Others specify…….....
41. Has the use of cattle/donkey helped in agricultural production? (a) Yes ☐ (b) No ☐
42. What are your objectives for keeping cattle…….....
…….....
43. Tick in the boxes below common diseases in your area;
    (a) Foot and Mouth disease ☐ (d) Lumpy Skin ☐
    (b) Corridor disease ☐ (e) CBPP ☐
    (c) Heart water ☐ (f) Anthrax ☐
    (g) Others please specify…….....
44. Have you lost any livestock (cattle) to disease (s) you have listed in Q. 43 above?
    (a) Yes ☐ (b) No ☐
45. How many cattle or any other livestock have you lost in the last 10 years?.....
46. Would you please list other challenges that are associated with cattle rearing in this

area…….....
……...
47. Climate variability and change has affected animal husbandry on grass and water.
(a) Strongly disagree ☐
(b) Disagree ☐
(c) Neither agree nor disagree ☐
(d) Agree ☐
(e) Strongly agree ☐
48. Do you have a high degree of reliance on one industry (cattle)? (a) Yes ☐ (b) No ☐
49. If Yes to Question 48, how much financial investment is in cattle?.....
50. Outline the impacts and implications of droughts and floods on livestock?.....
……..
51. Describe the shift in pastoral production as caused by either drought or floods…….....
……..
52. For the problems you face, describe how drought/flood caused a dramatic change in pastoral regime. How would you characterize the system (pastoral regimes) before the transition?.....
……..
53. How would you characterize the pastoral regimes after the transition? Give each era a name (try to identify 3-6 eras/farming seasons)…….....
54. For each era concept in table below, cross the scale, description and impact of climate variability and change indicators on livestock;

Climate variability indicator	Cross (X)	Reason
Decrease in *ibanda* (floodplain) grasses		
Short planting season		
Decrease in crop production		
Decline in rainfall amount		
Drying of wells and boreholes		
Increase in pests and crop diseases		
Increase in wind conditions		
Decrease in *ibanda* grasses		
Increase in drought		
Changes in floods, flow and flux of Kafue River		
Increase in temperature		
Weather variability/unpredictability		
Increase in livestock diseases		
Increase in flooding of *ibanda* (floodplain)		
Other		

55. Historically, did you have any problems related to droughts/floods that were caused bysimilar factors we talked about? – one decade ago or more? Please give details if possible.....
……..
56.What are the key constraints and/ or opportunities you face to access water, skills and technologies, drugs, loans for secure livelihoods?.....
……..
57. What problems do you encounter with respect to the Kafue Flood Plain…….....
……..

Section E: Resilience of pastoral systems to climate variability and change
58. What are the most critical ecological disturbances affecting you? (a) Drought ☐

(b) Floods ☐ Others specify …….....

59. Which disturbance is most threatening to the pastoral system?.....
60. Have you faced critical shortage of pasture in the past, when or how long, how bad?.....
.....
61. If answer to 60 is Yes, how has your household dealt with the pasture shortage?.....
…….....
62. What kinds of coping strategies do you currently use when you are affected with water and pasture shortages?.....
…….....
63. Where do you take your cattle in times of water and grass shortage and why?.....
…….....
64. Do you give your cattle supplementary feeding? Yes ☐ No ☐
65. If Yes to Question 64, where do you buy feed and other forms of feed…….....
…….....
66. How do you (pastoralists) respond immediately after the drought/flood occurs (are there contingency plans, safe areas, emergency resources, response organizations, feed, etc.)?
(a) During drought/flood……..…….....
(b) After drought/ flood…..…….....
(c) Long term strategies…….....
67. Based on the issues raised, what opportunities and capacities are available, or could be strengthened to improve on drought/flood preparedness?

Trends, impacts and adaptation options	
Information about trends and impacts	Information about adaptation options (example indicators)
Ability to manage drought	
Ability to manage floods	
Ability to adapt to change	
Ability towards food security	
Other specify	

68. Complete the table below indicating vulnerability and resilience to either drought/floods

Collating the information on hazards and stresses		
Hazards: Drought and floods	Issues and vulnerabilities	Capacities and opportunities for resilience
Frequency, duration, seasonality, trends		
Warning signs and early warning		
Underlying causes		
Groups affected		
Assets and services affected		
Immediate response		
Other specify		

69. How is resilience of pastoral regimes determined by your ability to combine different types of knowledge to adapt to change in climate?.....
…….....
70. What types of local knowledge do you poses and how do you integrated them for building social-ecological resilience?.....
71. Using table below, describe how you have responded to critical disturbances and shocks in the past and whether this built adaptive capacity (identify knowledge, practices and social institutions that build up the ability to live with droughts/floods);

Types of knowledge	Institutions in building	How it is applied to management	Examples of whether and when it is combined with

	resilience	and shared/transferred within and outside the community	other types of knowledge
Local or traditional knowledge of herders			
Knowledge assimilated in times of hazard			
Experts knowledge			
Government knowledge			
Donor innovative knowledge			

72. What technologies do pastoralists have as a result of climate variability?.....
……..
73. Why is access to technologies important for building resilience?.....
……..
74. In what ways do you voice out when faced with climate uncertainty?.....
……..
75. How do you re-organize or renew yourselves in response to changing social-ecological environments (drought/floods?.....
……..
76. Why is access to relevant and timely information important for building resilience to drought/ floods?.....
.....

Section F: Kafue river regulation and its effects on pastoral land use

77. How often do you experience annual floods?
    (a) Every year ☐
    (b) Once in three years ☐
    (c) Once in six months ☐
    (d) None of the above ☐
    (e) Others specify……..
78. What time of the year do you experience floods and why?.....
79. Briefly explain the cycle of floods from 2006 to date……..
……..
80. Outline the uses of the Kafue Flood Plain…….....
81. Using the table below, in what ways has the Kafue river regulation impacted on pastures before, during and after the construction of the Kafue Gorge and the Itezhi-tezhi dams?

Kafue river regulation and its impact on livestock	
Situation before flood	
Situation during flood	
Situation after flood	
Impact on pastures	
Impact on water	
Impact on settlements	
Impact on crops	

82. Explain how floods affect cattle pasture regimes…….....
……..
83. Does ZESCO or dam (Kafue Gorge and Itezhi-tezhi dam) operators inform you timely on the

times or quantity of water released?.....

84. How does the amount of water released affect pastures on the flats?.....
……..

85. What are some of the benefits of floods to cattle…….……..
……..

86. Do you receive early warning prior to flooding? Yes ☐ No ☐

87. What kind of awareness and in what form and platform do you receive before water is released from Itezhi-tezhi dam?.....
……..

88. Using table below, what institutional response has been helping you pertaining to issues of climate change and variability on pastoral regimes?

Collating information on Kafue River Regulation		
Trend: Climate change and variability	Information related to vulnerabilities	Information related to resilience
Data on changes from 1990		
Information on drought		
Information on floods		
Access and source of Information to drought		
Access and source of Information to floods		

Section G: Land tenure governance in managing common property resources

89. Do you own land? (a) Yes ☐ (b) No ☐

90. If Yes to Q. 89, do you have a title deed and how did you acquire it, and from who?
.....

91. Do you cultivate the total land you own? (a) Yes ☐ (b) No ☐

92. If No to question 115, give reasons why…….....
……..

93. Describe customary land utilization, written agreements, access and user rights in your area…….....

94. Describe some of the major land issues which have triggered conflicts (e.g. an influx of farming families, rich people from towns buying traditional land)?.....
……..

95. What are the particular influences which continue to impact how the community functions and responds to land tenure (e.g. relationships between pastoralists within and outsiders)?.....
.....

96. Has there been any history of conflicts over land and relationships between pastoralists within and outside your area? (a) Yes ☐ (b) No ☐

97. If Yes to Question 122, who was involved and how were they resolved?.....
……..

98. Using the table below, what measures is government/NGO(s) putting in place to fight climate effects related to land husbandry?

Area of connectivity	Activities and Achievements in Promoting the Livestock Sector
Climate variability and change	
Droughts	
Floods	
Food security	
Water scarcity	

Livestock diseases	
Water sources	
Land tenure	
Kafue River regulation	
Floodplain economies and ecosystems	
Water storage and abstraction techniques	

99. Do you belong to any cooperative? (a) Yes ☐ No ☐
100. If Yes to Question 99 above, how are you benefiting?.....
……
101. Is there any NGO working in your area to assist mitigate the impact of climate variability?
(a) Yes ☐ (b) No ☐
102. If Yes to Question 101, in what way(s) is it helping you?…….....
……
103. Is there any awareness being made in your area on climate variability and in what media?.....
.....
104. Does climate related information from the Zambia Meteorological Department reach you and in what medium or form?.....
105. What kind of climate related information do you receive from agricultural extension officers?.....
……
106. What are some of the organizations in your area that are responsible in sensitizing you about climate variability?.....
……
107. Do veterinary/agricultural extension officers include climate related lessons during field visits to your area (a) Yes ☐ (b) No ☐
108. If Yes to Question 107, what climate or new pastoral practices do they advise?.....
……
109. In conclusion, what possible solutions or suggestions would you propose for enabling you to cope with climate variability and food insecurity in your homes?.....
……
……
……

THANK YOU FOR YOUR COOPERATION

Appendix II

INTERVIEW GUIDE - THE CHIEF/SENIOR HEADMAN

1. Sex: ..... Male…..... Female…..
2. How long have you been a Chief/ Senior Headman?.....
3. Level of education
   (a) Primary ☐ (b) Secondary ☐ (c) Tertiary ☐ (d) Never been to school ☐
4. What changes have you noticed from your subjects in cattle keeping?.....
   …….....
5. What do you think has brought about these changes?.....
   …….....
6. To which abattoir do your subjects prefer selling their cattle and why?.....
   …….....
7. What are some of the improvements that have been brought by these commercial livestock buyers? …….....
8. In what way(s) has the life of people improved with respect to ready cattle sales? ….....
   …….....
9. What are your subject's other income generating activities apart from cattle sales?.....
   …….....
10. What constraints are the farmers facing in controlling livestock diseases?.....
    …….....
11. How are cattle keepers coping with fluctuations in droughts/ floods?.....
    …….....
12. In what ways do you influence in the regulation of the Kafue river.....
    …….....
13. Where do people get their water for domestic and livestock watering especially during dry season…….....
14. What are some of the traditional means of storing and abstracting water in your area or chiefdom?.....
15. How do people acquire land in your chiefdom…….....
16. Have there been any conflicts in land ownership? If Yes, how did you resolve them…..
    …….....
17. What are some of the village written customary laws…….....
    …….....
18. What is the village council doing to reduce the impact of climate variability and livestock diseases and land conflicts? …….....
19. In your opinion, what lasting solution(s) would you want to see done by the government and other stakeholders to completely combat drought/flood effects on pastoralists?.....
    .....
20. Has there been any private companies or Government Agency that tried to develop the plain for any agricultural development? (a) Yes ☐ (b) No ☐
21. If Yes to Question 20, what were the objectives and crops sought?.....
22. What were the reactions from the villagers? …….....
23. Explain various attempts, failures and reactions among your subjects by the state and other private companies to convert the Kafue Flood Plain into rice plantation.....
    …….....

-END-

Appendix III

INTERVIEW GUIDE - GOVERNMENT DEPARTMENTS

1. Name and position of officer…….....
2. What kind of livestock do people keep in Namwala? .....
3. How many animals (cattle) does an average person own?.....
4. Under what conditions do farmers sale their cattle:
   (a) Drought ☐ (b) Education ☐ (c) Sickness ☐
   (d) Purchase agricultural input ☐ (e) Others specify…….....
5. Of what importance is the Kafue Flood Plain to the people of Namwala?
   (a) Farming ☐ (b) Winter grazing ☐ (c) Fishing ☐ (d) Water transport ☐
   (e) Others specify …….....
6. How many cattle do you clear for slaughter in a day?.....
7. How does the plain serve as a winter grazing area? .....
8. Mention cattle diseases common in Namwala?.....
   …….....
9. What challenges do traditional cattle keepers face due to droughts/floods? …….....
   …….....
10. What is government position on land tenure and how do you resolve land conflicts?.....
    …….....
11. How do traditional cattle keepers cope with droughts and water scarcity?.....
    …….....
12. What is government policy in rural water supply especially livestock watering…….....
13. Do you have enough livestock extension officers in the District? If not, how are you operating with the shortage of staff?.....
    …….....
14. In your opinion, what do you think should be done to improve the use of Kafue Flats?

Kafue river regulation and its effects on livestock	
Situation before the construction of Kafue Gorge HEP	
Situation after construction Kafue Gorge HEP station	
Situation before the construction of Itezhi-tezhi dam	
Situation after construction of Itezhi-tezhi HEP station	
Land tenure/conflicts in the Flood plain	

15. What are the levels of livelihood reliance on water resources by pastoralists?.....
    …….....
16. Are they mainly public lands, private lands, common property lands or a mixture of all three?.....…….....
17. What are the access rights on these lands (water bodies)? Do the different kinds of tenure conflict with or complement each other?.....
18. What is the most principal use of the Kafue Flood Plain…….....
19. Would you sell the Kafue Flood Plain for the cultivation of rice, for example, against the primary livestock use?.....
20. How do different groups within the Kafue Flats hold the value of water, and which sector is more important?.....
21. List the overall benefits of the Kafue Flood Plain to the pastoralists.....
    .....

- END -

Appendix IV

INTERVIEW SCHEDULE - ABATTOIR MANAGERS

1. Name……Sex…….Company……Position…….....
2. When did your company come to Namwala?.....
3. Why did you choose Namwala for your business?.....
   …….....
4. How many local people have you employed in your company? Male…….....Female…..
5. How many cattle do you slaughter in a day?.....
6. Is this number enough and up to your expectations?.....
   …….....
7. Are there other livestock types that you sell apart from cattle? (a) Yes ☐ (b) No ☐
8. If Yes to Question 7, please list them…….....
   …….....
9. If No to Question 7, please explain why…….....
   …….....
10. Are there ways in which you are helping the traditional cattle keepers improve their breeds?
    (a) Yes ☐ (b) No ☐
11. If Yes to Question 10, what are they?.....
    …….....
    …….....
12. If No to Question 10, explain why?.....
    …….....
13. Are you in any way involved in Cooperate Social Responsibility in the District?.....
    …….....
14. In what ways do you teach farmers on climate change and variability to improve animal health?.....
    …….....
15. What time of the year do pastoralists supply more cattle and why?.....
    …….....
16. In what way(s) is the government supporting your operations in this area?.....
    …….....
17. What major challenges do you face in your operations?.....
    …….....
18. What are your future prospects with respect to the operations and expansion of your business here? …….....
    …….....
19. What is the price of beef per kilogram?.....
20. How often does this price change and why…….....
    …….....
21. Is the price competitive enough to benefit the local cattle suppliers?.....
    …….....

- END -

Appendix V

INTERVIEW SCHEDULE – COMMUNITY BASED ORGANISATIONS (CBOs)/ NON-GOVERNMENTAL ORGANISATIONS (NGOs)

1. Name……Sex……Company……..Position…….....
2. When did your organisation come to Namwala?.....
3. Why did you choose Namwala for your operation?.....
   …….....
4. How many people are employed by your organisation in the District? Male….....Female.....
5. What are the aims and objectives of your organisation?
   (a) Aims…….....
   (b) Objectives…….....
6. How has your organisation been welcomed by the local people?.....
   …….....
7. What are some of the objectives among the traditional cattle keepers?.....
   …….....
8. What are some of the objectives on pastoralism and mitigating climate variability?.....
   ……....
9. How have you helped 'cattle complex' and 'target income selling' among the traditional cattle keepers? …….....
   …….....
10. How have you improved the following among the traditional cattle keepers?
    (a) Traditional cattle breeds…….....
    (b) Cattle marketing…….....
    (c) Diseases control…….....
    (d) Climate variability and change…….....
    (e) Water scarcity…….....
11. How does the community organise itself when faced with water scarcity?.....
    …….....
12. What is the community's history of reliance on water (e.g. have there been major changes in the water demand or supply for cattle – such as the building of a dam, or the establishment of a major flood plain user)?.....
    …….....
13. Are there key policies, laws or regulations governing resource use that enhance or constrain pastoralist's livelihoods? …….....
    …….....
14. In what way (s) is the government supporting your operations in the District?.....
    …….....
15. What challenges do you face in your operations?.....
    …….....
16. What are your future prospects with respect to the improvement of livestock disease control and marketing in the next five years?.....
    …….....
17. Describe the role of local groups or community leaders in land ownership, pastoralism, water scarcity etc…….....

- END -