



**Case Study**

# **Social-ecological typologies to climate variability among pastoralists in Namwala District - Zambia**

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Agriculture in Zambia has the potential to enhance economic growth and reduce poverty. Despite its huge potential, the development of the livestock sector has been stifled by a number of barriers, among them climate variability. The case of Namwala District in Southern Zambia illustrates how pastoralists have developed multiple resilience strategies to climate variability, livestock diseases and altered flooding of the Kafue River between two dams. The study was exploratory in nature and used both qualitative and quantitative data to allow for descriptions of given geographical phenomena. Results showed that population in cattle have increased resulting into reduced area available for grazing per cow with respect to access to water and pasture regimes. This implies that the Kafue Flats is prone to overgrazing in view of combined increased floodplain agriculture, successive droughts and increase in the number of cattle. Thus, climate variability and ecological dynamics have continued to threaten the resilience of pastoralists. However, despite vulnerability to climatic variability (droughts and floods) and cattle diseases, poor nutrition and husbandry practices, the pastoral typologies in Namwala have survived, demonstrating resilience, dynamic and self-organizing adaptive behaviour in a rural society. It was concluded that pastoralists have built up sufficient adaptive capacity to live with change and uncertainties. Therefore, resilience building in pastoral social-ecological typology and management of common property resources like the Kafue Flood Plain in Namwala, demands preserving and nurturing existing social, economic and ecological components that enable pastoralists to renew and reorganize livelihoods.

**Keywords:** Climate variability, Namwala, Pastoralists, Resilience, Social-ecological typologies, Vulnerability

## **INTRODUCTION**

Socio-ecological typologies are rooted in observation that similar climate 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 change impacts (Malone, 2009). In this respect, solving rural poverty entails overcoming many problems: assuring food security, improving agricultural production and maintaining a sustainable natural resource base. But other issues and threats 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," (Jazairy *et al.*, 1992: 106).

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In Africa, more than 2.3 billion people live with less than USD\$1.25 a day and depend on agriculture for their livelihoods (United Nations, 2009). 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. 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 use change and have least capacity to adapt. In that regard, Africa is cited to be hit severely by these impacts because of sensitivity of its core economies; crop cultivation, livestock keeping and tourism, to mention but a few. 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 common manifestations of climate variability. In many African pastoral societies such as Masai and Fulani, deterioration of pastures during droughts in particular has resulted into poor health and death of livestock impacting on food and livelihood of herders (Kirsten *et al.*, 2002).

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). 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 (Government of the Republic of Zambia [GRZ], 2010). It also accounts for about 35 percent of national output and animal herding is the only livelihood activity for some traditional farmers in remote areas. 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.

The Ila people of Namwala District in Southern Province, engage mostly in cattle keeping, fishing, hunting and subsistence farming. The main livestock reared are cattle, goats, pigs, sheep and poultry and more recently (2013) donkeys. Livestock serve many roles in pastoral society: as means 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 fulfill a number of roles in social functions such as traditional ceremonies and payment for bribe price (Jaspan, 1953). They also contribute to production through draught power for ploughing, transport and manure (Fielder, 1973). It is 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) show that a family needs a minimum of 30 to 50 heads of cattle to fulfill their social obligations and livelihoods.

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 1.8mm/month, whereas rainfall seasons have become less predictable and shorter, with rainfall occurring in fewer but more intense events. Both average annual temperature and rainfall are projected to increase by 3.6°C and 3% respectively by 2100. From 2000 to 2009, the intensity and frequency of droughts and floods and the number of people affected have 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 (worst drought in the century), 1997/98, and partial droughts from 2001-2005 and 2011-2015 left nearly two thirds of the district with little or no rainfall while the 2006/07, 2009/10 and recently 2016/17 has flooded most communities. Furthermore, weather shocks and cattle diseases such as corridor disease and many others, have reduced livestock numbers. These social-ecological typologies have negatively affected the way of life of the people of Namwala which they have enjoyed for decades. The socio-economic situation has changed and indeed food security situation is threatened. "The recurrence of droughts has depleted animal grazing resources and drinking water, thus negatively affecting the productivity of the livestock sector," (GRZ, 2006: 47). Thus, pastoralists within similar agro-pastoral communities and households are likely to respond differently to constraints and opportunities resulting from climate variability and Kafue river regulation.

Previous studies on Namwala concentrated on the role of cattle in traditional society and related constraints such as inadequate staffing levels and cattle diseases, in addition to governance issues of common property resources (CPR). Further, studies have emphasized 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), Kafue River governance and management of CPR (Foster, 1953; FAO /UNDP, 1968; Chabwela, 1994; Chabwela and Haller, 2007) and studies on efforts to introduce environmental Kafue River flows (Churchill, 2010; Casarotto, 2013; Kunz *et al.*, 2013). The definitions and impact of climate variability and change of these studies on pastoralism are poorly established and require some in-depth locale 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 on local pastoralism in the management of CPR.

## Problem statement

Southern is one of the worst drought prone Province in Zambia with most of the people depending on agriculture for their livelihoods. In Namwala, the roots of ecological vulnerability are linked to social-ecological systems and unfavorable 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 the animals throughout the year. 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 pans and ponds needed for livestock watering. Despite the ecological importance, rich natural resource base, economic significance of and functional values of the Kafue Flats ecotone ecosystem, the area is reported to be the most ecologically disturbed wetland in Zambia. Thus, vulnerability to drought and floods has increased in Namwala. Despite pastoralists having adapted very well to climate variability and change in the past, they have become vulnerable to climate variability in large part because their strategies for coping with climate variability have become constrained. Therefore, as climate variations occur ranging from short term to long-term climate shifts, the ability of pastoralists to maintain their livelihoods in their traditional lands using traditional pastoral systems has been altered, particularly when these fluctuations are layered with other typological stresses. Hence, compounded by droughts and increase in cattle numbers (standing at approximately 147,000 in 2017), the hectareage 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. Hence, the objectives of the study were to assess vulnerability and resilience status of pastoral systems to climate variability and change.

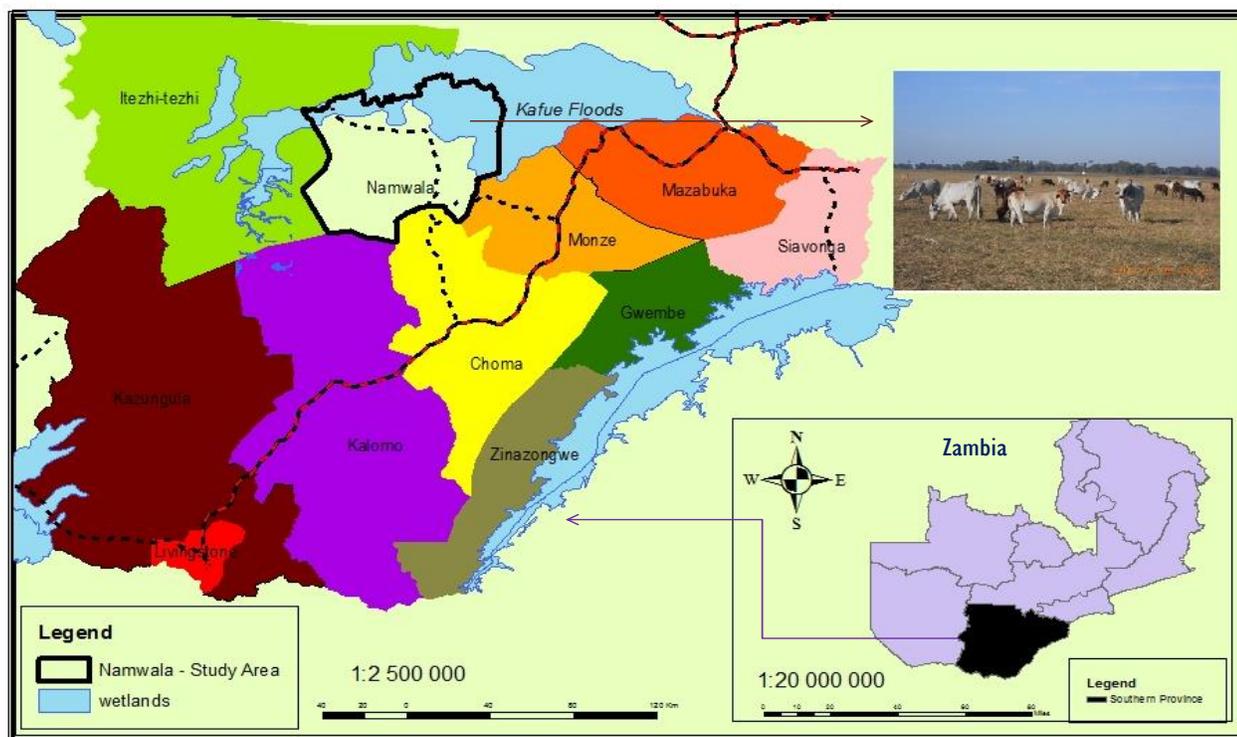
## MATERIALS AND METHODS

Namwala District is about 2,175,064 hectares in extent and located 170 km North West of Choma town, 158 km from Monze and 350 km from Lusaka. It lies along the Kafue flood plain (Figure 1) with seasonal flooding being prevalent (Sheppe and Osborne, 1971). Following acquisitions of village population registers, typical sampling technique was used to identify respondents for household survey while purposive sampling was used to determine in-depth interviews from key informants. Thus, large scale District Spatial Zoning was used to allow more pastoralists discern a variety of different social-ecological typologies affecting them. 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 (Lhopitalier *et al.*, (1999)..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). Hence, zoning enabled the researcher to arrive at different cooperatives to which pastoralists belong. Within Zones, the study used systematic sampling technique in the selection of household heads to ensure spatial coverage of the district. Since most pastoralists belong to cooperatives under the Zambian government sponsored e-voucher Farmer Input Support Programme (FISP), complete checklists of all the farmers, who are also pastoralists, were utilised. This technique was based on the selection of elements (names) at equal intervals, to arrive at six randomly selected household names for each of the five cooperatives in each chiefdom giving a spatial proportionate sample of thirty respondents from each chiefdom. Thus, the study engaged a total of 120 household heads; 30 respondents from each of the four chiefdoms namely: Mukobela, Mungaila, Nalubamba and Muchila.

The thrust of the study was that social-ecological typologies undergo change over time. These changes can be slow and predictable, or they may be fast and unforeseen. Thus, the use of a timeline helped to reveal the longer-term disturbances or shocks that have occurred since 1990. Thus, long term trend analysis was used to explore historical patterns from 1990 to 2016 to capture all major social-ecological disturbances using seasonal calendars. Seasonal calendars are useful tools in rural areas in identifying different activities and issues 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. (Kirsrtten *et al.*, 2002; Matata *et al.*, 1999). In this study, seasonal calendars were drawn to foster understanding of local pastoral systems and trace changes in grazing/water patterns. Respondents illustrated patterns month by month, cropping patterns, water use, livestock population, transhumance, pests and cattle diseases.

Further, group discussions supplemented seasonal calendars by using transect walks and photo voice process. A transect walk is a simple technique used in rural typological studies to ensure that the researcher, together with local pastoralists, explore the spatial differences fully in the area under study (Matata *et al.*, 1999; Mettrick, 1993). In addition, an essential component was Photo Voice Process (Cunningham *et al.*, 2009), in which pastoralists took photos of what they thought was important about a given social-ecological issue, and then had lengthy interview about the context and motivation in taking each picture, followed by transect walks to map locations found in the photos (e.g. water points, gardens, cultivated area, grazing lands, plant species etc.) and related these to climate variability. In addition, ethical considerations are crucial for studies that involve human participants, hence written and verbal consent was obtained from respondents.



**Figure 1: Location of Namwala in Southern Province and along the Kafue Flood Plain**

**Source:** Rusangu University - Department of Geography and Environmental Studies

These methods introduce new approaches in understanding pastoralist's resilience to climate variability and weather shocks, including related effects of a highly regulated Kafue River. Hence, the study was exploratory in nature and used both qualitative and quantitative data to allow for descriptions of given geographical phenomena. Thus, the study used Statistical Package for Social Sciences (SPSS), Quantum Geographic Information System (QGIS) and Excel for statistical data analysis and social network photographs to accompany the interpretations of survey data while Arc GIS was used to generate maps.

## RESULTS AND DISCUSSION

### *Sociodemographic data*

Majority 76.7% of the respondents interviewed 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. More males and females between 41 and 50 age groups accounted for 52.1 percent of those owning cattle because these are at their prime of 'cattle keeping career'. This was followed by those between 31 and 40 age groups who accounted for 30.6 percent. There are fewer people below the age of 30 who own cattle. These own 10.2 percent since they are often starting their families and settling down. In addition, those above 60 represented 7.1 percent as there are few surviving household heads considering

the low lifespan in Zambia.. About 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. In addition, the majority of the people (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 many 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. Thus, Namwala has the highest concentration of traditionally owned cattle in Zambia standing at 139,945 in 2015. 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-*llas* and young people are turning to pastoralism especially in lesser cattle-keeping areas of Muchila and Nalubamba.

An expression given in local language by many respondents signifying the socio-economic importance of cattle in Namwala is that '*ing'ombe mbubumi bwamuntu kono kubwiila*', meaning; 'cattle are our livelihood here in Ila land'. Hence, financial security was ranked the first and most important primary objective with 43.7 percent of the sample due to an increase in the use of money in the rural economy. Social status represented 17.5 percent of the total farmers. Provision of draught power accounted for 15.3 percent of the total respondents and this remains an

**Table 1: Prevalence of cattle diseases in Namwala District**

<b>Disease</b>	<b>Prevalence</b>	<b>Mortality (%)</b>	<b>Treatments (%)</b>
<i>East Cost Fever (Theileriosis)</i>	633	25	81
<i>Anaplasmosis</i>	198	32	70
<i>Babesiosis</i>	11	0	100
<i>Heart water (Cowdriosis)</i>	121	37	139
<i>Blackleg (BQ)</i>	123	39	87
<i>Lumpy Skin Disease (LSD)</i>	49	0	100
<i>Streptothricosis (Senkobo)</i>	94	0	100
<i>Haemorrhagic Septicaemia (HS)</i>	6	50	50
<i>Bovine Tuberculosis</i>	4	100	0
<i>Brucellosis</i>	21	0	0

important objective for keeping cattle. Milk production was cited as an increasingly important primary objective with 12.3 percent for keeping cattle for both home consumption and sale as a source of 'small' income. This is because unlike selling the entire *ing'ombe* (cow), milk (*mukupa*) or sour milk (*mabishi*) can easily be sold to five Parmalat centres and Namwala town and thus, constitutes a fast and ready source of income among pastoralists. This explains why pastoralists are now buying dairy bulls and cows for crossbreeding and milk reduction respectively. Other secondary objectives that were cited were the need to slaughter cattle during funerals, marriages, traditional and initiation ceremonies and these accounted only 6.1 percent pastoralists. The use of manure represented 5.1 percent of the sampled pastoralists who cited that it is no longer an important primary objective for keeping cattle due to higher number of pastoralists under FISP and less emphasis on crop production.

### **Vulnerabilities among pastoralists**

#### ***Vulnerability to cattle diseases***

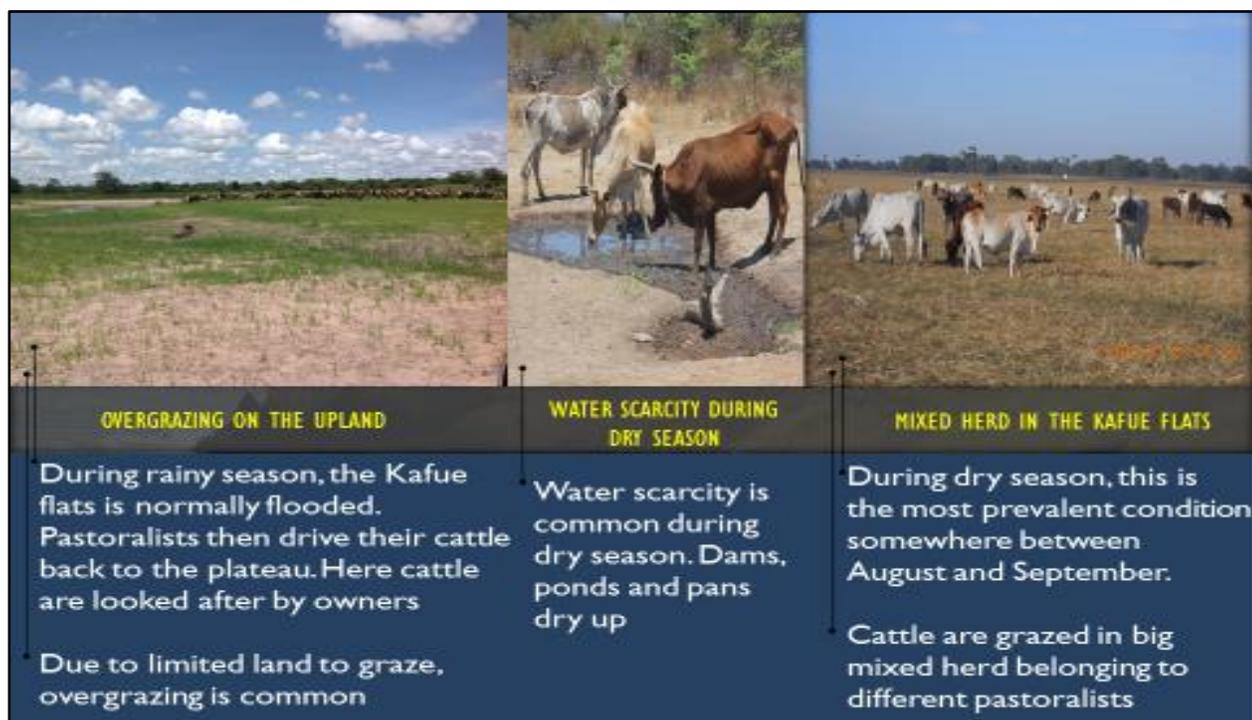
Vulnerability is the characteristic that describes the capacity of a person, community or society to anticipate, cope with, resist and recover from the impact of a natural or human induced hazard. It involves a combination of factors that determine the extent to which people's lives and their livelihoods have been put at risk by the hazardous event (Disaster Management and Mitigation Unit [DMMU], 2015). The prevalence of diseases for cattle is one of the greatest challenges pastoralists face in Namwala (Table 1). This has contributed to low growth and restricted access to local and international markets. The area has a number of serious endemic diseases, parasites, pests and vectors that affect livestock. For this, respondents confirmed that cattle diseases have 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 are faced with more than one cattle disease, 56 respondents attributed their loss of cattle mainly to Corridor Disease, Heart water with 46 respondents (more cattle were treated than those diagnosed with the disease), Foot and Mouth Disease (FMD) with 43 respondents, while Lumpy skin disease with 26

respondents and others were 28 pastoralists. On other diseases, loss of cattle was mainly attributed to Anthrax and Bovine Tuberculosis (TB). Other sources of loss of cattle were attributed to predators such as crocodiles, hyenas and cattle rustling.

Of particular interest among the responses was social-ecological cause of death - '*mud*' (31 respondents) along the Kafue River as a result of successive droughts and Kafue river flow. This is increasingly becoming a threat to their cattle. Compounded with successive partial droughts from 2012-2015 and high demand for electricity, generation of hydro-electric power at the Kafue Gorge requires more water from Itezhi-tezhi dam. This confines water to a narrow strip along the Kafue river leaving vast areas of mud responsible for trapping cattle; at the time during dry season when most reservoirs such as dams, ponds and pans on the upland dry up. This situation has deprived particularly those that have not accumulated more cattle a source of income, since cattle can be sold to raise money to purchase available drugs, grain and other requirements on rural markets. The effect of diseases for cattle are depressing productivity and results into low milk yields, poor animal weight gains, high mortality rates, low animal conception rates and long inter-calving intervals. The failure by pastoralists to control cattle diseases result from two factors namely poor nutrition and husbandry practices.

#### ***Poor nutrition and husbandry practices***

The causes of poor nutritional status in the traditional herds are shortage of both feed and water during the dry season (CSO, 2001). The ability to feed cattle adequately throughout the year is 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 supplementary feeding. Since Zambia has a uni-modal rainfall pattern, major problems facing pastoralists in Namwala is feeding cattle during the dry season, which normally lasts for six months. In addition, poor nutrition leads to susceptibility to diseases and parasitism. Shortage of water due to drying of streams, ponds and pans comprise a serious constraint contributing to poor nutritional status of cattle. Further, respondents



**Figure 2: Seasonal changes in grazing regimes on the upland and the flats**

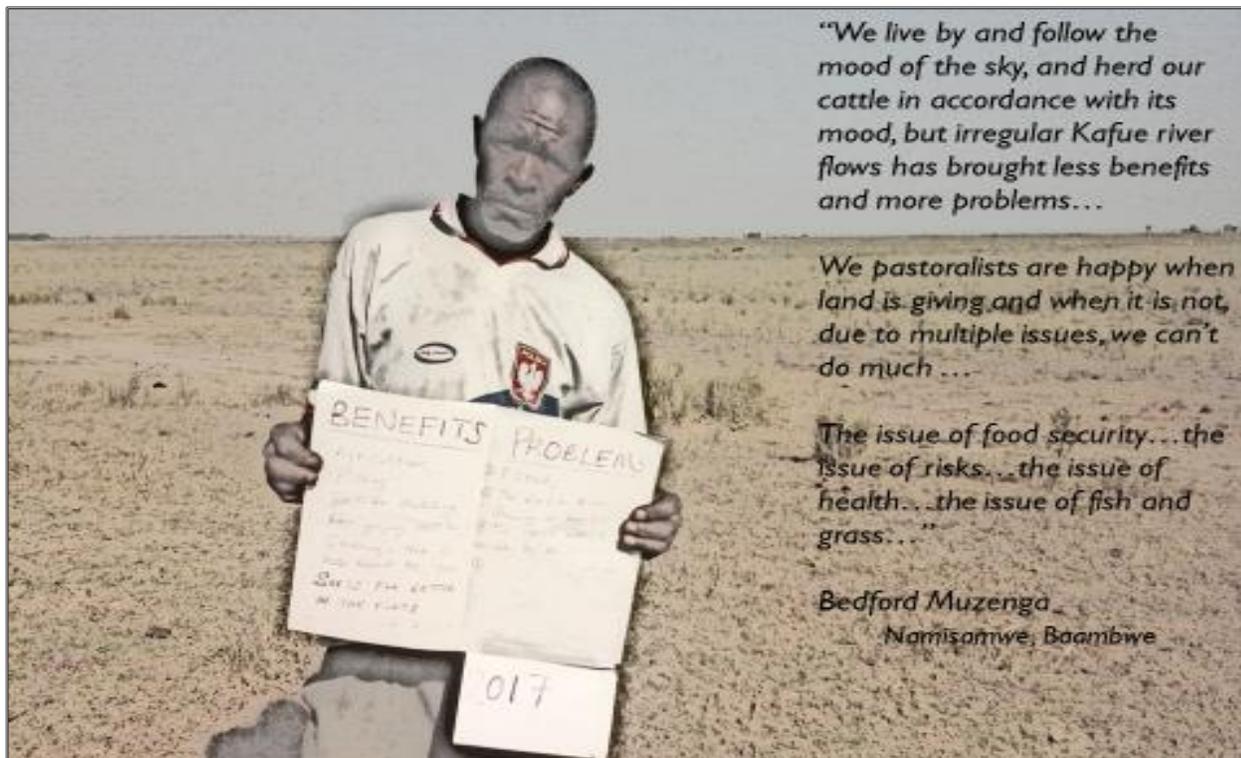
pointed out that despite having nine out of twelve veterinary camps that are manned, their vastness and lack of transport has contributed to poor husbandry practices. Thus, livestock health is also affected by poor husbandry practices resulting from poor extension system and insufficient modern husbandry practices. Pastoralists lack sufficient knowledge about modern husbandry practices such as good housing practices, feed supplementation, and breeding which improves the vigour of calves to diseases and internal parasite control (de-worming). Instead, cattle are grazed in big mixed herds on the Kafue Flats and on the plateau during dry and rainy seasons respectively (Figure 2). In addition, observed established traditional practices do not seem to favour stock improvement because too many bulls are still allowed to run with the herds. It is also 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*.

### Vulnerability to droughts

Drought is low hydrologic extreme resulting from disturbances in the hydrological cycle over a sufficiently long time resulting into significant water deficiency. Respondents pointed out that pastoral vulnerability has been exacerbated by unfavorable government policies and natural forces. When the Movement for Multiparty Democracy (MMD) government of Dr. Fredrick Chiluba came to power in 1991, it introduced neo-liberal policies of privatization and agricultural market liberalization, removed subsidies on fertilizers, maize marketing, transportation, storage, and state controlled pricing of

agricultural commodities (Kajoba, 2008). This subsequently led to the collapse of marketing boards and credit institutions. The economic policies that were introduced by the MMD government under Structural Adjustment Programmes (SAPs), led to the vulnerability of rural society and bred food insecurity and widespread rural poverty in Namwala. These difficult changes that pastoralists 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. Other dry seasons were experienced in 1994/95, 1997/98, and partial droughts from 2001-2006, leaving the district with little or no rainfall.

These droughts impacted negatively on pastoralists, making rural society more vulnerable with widespread crop failure, loss of income and increase in livestock diseases, grass and water shortages since 1990. Thus, pastoralists observed that high frequency of dry spells have contributed to shortening of growing season and crop damage. Even in years of relatively “normal” rainfall, evaporation rates are high and in many reservoirs, the losses from evaporation exceed contributions from rainfall and river flow. Thus, water for livestock watering is still to a large extent tapped from surface water sources such as dams, ponds, lagoons, pans, rivers and streams. Accordingly, cattle numbers are 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 and 145, 445 in 2016. This puts pressure on the provision of water especially during dry season in which



**Figure 3: Kafue River flooding as a source of livelihood flux**

more than 80 percent of the sample lamented that dams, ponds, pans and dug-out wells dry up. This water scarcity forces pastoralists to drive their cattle to various cattle outposts along the Kafue Flats (Figure 2) to access water and pasture; both in reduced quantity and quality.

Grass species composition has also been altered resulting in loss of weight of cattle and low milk production. Therefore, frequent droughts in recent years means 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. Also, an increase in the frequency of droughts means grazing lands, livestock, and people have less time to recover between droughts. 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 (Figure 2). In addition, cattle that were on the upland moved into the Kafue Flats as early as March. Thus, lack of flooding of the Kafue Flats has led to a build up of ticks leading to high tick challenge on livestock. This scenario, coupled with irregular dipping when cattle are in the Kafue Flats, usually lead to high prevalence of tick-borne diseases and this increases pastoralists' vulnerability to maintain their livelihoods in the same traditional lands and ways of life.

### Vulnerability to floods

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. The year 1994 saw severe floods in the Flats when grazing grounds and settlements along the river were inundated and people were displaced. 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 (Figure 3).

The Kafue River is by far the most responsible for flooding situations in Namwala than rainfall induced flooding. Hence, all recounts in the study area are based on floods induced by the Kafue River irregularities. In Namwala, pastoralists believe that humans can never manage and change nature, but rather are dependent on how well land will produce for them as lamented by one pastoralist: "We pastoralists are happy when land is giving and when it is not we can't do much. We live by and follow the mood of the sky, and herd our livestock in accordance with its mood." For pastoralists, it is more important to consider weather variability before thinking about the management of the pasture and water as key aspects in managing common property resources.

The carrying capacity differs depending on the locality and natural vegetation but averages about five (5) hectares per cow. In his 1961 survey, McLean (1961), calculated the number of hectares of different types of available grazing (before the construction of the ITT dam) per animal in Namwala District in 1961 and 1969. Table 2 provides the summary with latest carrying capacity of the Kafue Flats (with a floodplain area of 2,145km<sup>2</sup> in Namwala District). Before and after the construction of Kafue Gorge and ITT

**Table 2: Hectares per animal from pre-dams to 2017 in the Kafue Flats**

Type of grazing land and when used	Hectares per animal								Remarks
	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 and irregular Kafue river flow
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 rains grazing (Dec/Jan)	3.6	2.6	2.4	2.9	1.9	2.1	1.9	1.7	Danger of overgrazing especially in competition with agriculture due to fertile alluvial soils on the Flats

dams in 1961 and 1975, the carrying capacity was 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 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 approximately 147,000 in 2017), the hectareage 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.

The grasses of the Kafue Flats are mainly the wild rice (*Oryza Barthii*). They are coarse and are covered with mud and silt following the floods. This makes them very unpalatable to cattle. Other grasses, *Vossia Cuspidata* and *Echinochloa Stagnina* occur along the shores of the river branches and lagoons. They remain green, nutritious and palatable throughout the dry season. When the grass is sufficiently dry, the entire flats zone is burned. The new growth is very nutritious to cattle although comes with first rains. This forces cattle to graze deep in lagoons, putting them at risk from crocodile attacks and liver fluke disease.

Thus, 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. 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. The herding of cattle therefore follows the pattern of flooding and recession of flood waters. The flooding and recession of floods also allow 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, floods can be quite destructive to newly adopted agricultural activities. Pastoralists observed a number of negative impacts on crops and grazing grounds. These impacts are mainly enhanced by Itezhi-tezhi dam regulation that causes what is partly known as “dry season flooding.” Flooding submerges gardens which often lead to crop damage in various ways. Crops are sometimes washed

away by fast flowing flood waters. Tuber crops such as potatoes and cassava end up rotting. Even okra, which is water tolerant, is destroyed if it is submerged for more than one week as flood peaks between February and April. Floods have also resulted into higher incidences of livestock diseases such as lumpy skin and liver flukes.

It should be emphasized that cyclical flood changes are important attributes associated with the pastoral rural social-ecological typologies in Namwala. However, the 2016/17 flooding had flooded and reduced grazing areas and forced cattle to move to higher grounds at once. Concentration on the upland often leads to overcrowding of cattle in the few available grazing areas due to individualisation and commercialisation which has resulted into fencing of customary land. This creates an opportunity for cross infection of diseases and overgrazing because land is still generally under customary regulation of open access leading to what Hardin (1968) termed ‘*tragedy of the commons*’. During this time, pastoralists lamented that food insecurity is exacerbated because stray cattle destroy maize stock. It was also reported that floods created mud and weak animals could not move freely. This often lead to high mortality rate for weak and young animals.

It can therefore be said that seasonal releases of water at Itezhi-tezhi Dam and storage at Kafue Gorge Dam continued to affect pastoralists who graze their cattle in the common property resource – the Kafue Flats. Many studies have classified the Kafue Flats as a highly sensitive environment which requires major flood management interventions for sustainability of all sectors including pastoralism (Haller, 2004; Casarotto, 2013). The construction of Kafue Gorge Upper Dam in 1972 and Itezhi-tezhi Dam in 1978 altered the flow regime and extent of flooding within the Kafue Flats. Operation of Itezhi-tezhi reservoir has reduced the inflow to the Kafue Flats during the wet season but increased flow during the dry season. As a result of flow regulation, a number of hydrological changes have taken place in the Kafue Flats affected spawning nature of fish, grass availability and cattle mortality rose due to ‘mud’ and other deprivations such as crocodiles and reduced pasture. Despite these flood-related problems, pastoralists shared that natural water sources from the Kafue Flats are part of their key social-ecological resources, as they determine the transhumant,



**Figure 4: Comparison in abattoir operations in Namwala**

seasonal movements and livestock management strategies from time immemorial. Thus, the ability of complex social-ecological typologies to withstand changes partly depends on diversity that supports creativity and adaptive capacity (Folke *et al.*, 2003). Diversity increases the capacity of social-ecological systems to overcome disturbance, learn and change (Norberg *et al.*, 2008).

#### **Resilience and contemporary changes in the value of cattle**

The major causes of vulnerability among pastoralists are many, complex and interrelated. "A resilient system has the capacity to change as climate varies while still maintaining its functionality," (Walker and Salt, 2006: 144). Since 1990, pastoralists have been facing various problems pertaining to recurrent cattle diseases and climatic variability. These have affected people's livelihoods that they have enjoyed for decades. The socio-economic situation among pastoralists has changed and indeed food security has been threatened, but pastoralists are learning to live with change and uncertainties. The following are some of the various resilient strategies assumed by pastoralists;

#### **Presence of commercial livestock buyers**

Rural markets are vital for opening up an area for business and other social-economic activities. In recent years, there has been a significant decline in 'briefcase' livestock traders who used to buy cattle from pastoralists at cheaper prices to re-sale at higher prices in urban centres such as Choma, Mazabuka, Lusaka and the Copperbelt. However, 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 has four operational abattoirs namely: Zambeef, Star beef, Chitongo and Maala Abattoir. In addition, a new abattoir, called Aukwata, is under construction and will have the slaughter capacity like that of Zambeef (Figure 4). These abattoirs are operational throughout the year and mostly slaughter cattle from within the district. This trend has significantly transformed the livelihoods of pastoralists from merely accumulating cattle stock for prestige to entering into the money market.

There are three slaughter days in a week namely; Monday, Wednesday and Friday. Pastoralists choose where to take their cattle for slaughter. Zambeef slaughters over 100 cattle per day but has the capacity of slaughtering 120 animals with 22 local people employed. Starbeef slaughters 80 beasts per day with 15 local people employed as illustrated. On the other hand, Chitongo and Maala each slaughter less than 50 each per week due to limited storage. This forces the majority to take their cattle to either Zambeef or Starbeef. Most pastoralists expressed gratitude that the coming of Starbeef has raised the price of beef per kilogram to at least K18 as of October 2017 but this price fluctuates depending on supply and demand. For this reason, about 645 animals are slaughtered per week, 2,580 per month and over 30,960 per year. As opposed to accumulating cattle for socio-cultural and symbolic value, this study established that cattle keepers are in fact rational economic actors, with objectives and strategies for keeping cattle enable them to sell their cattle. With

**Table 3: Capital projects by households in Namwala**

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

established commercial cattle buyers, there is an increased opportunity to engage in the rural livestock markets, especially with the continued cattle husbandry threats emanating from recurrent diseases and climate variability (floods and droughts).

#### **Pastoralists embarking on capital projects**

Out of the total 120 pastoralists, 83.3 percent have bought radios, 73.3 percent have solar panels whereas 37.5 percent have television sets from proceeds of cattle sales. Those that have bought vehicles constituted 35.8 percent and 33.3 percent constructed dip tanks/spray races. The 36 percent have bought utility vehicles such as pick-ups and canters. These are believed to be dependable to use on the rough plain and sandy plateau. Increasingly, some people who have sizeable herds have bought motorbikes before purchasing a vehicle since their fuel consumption is minimal. The demand and need to build houses has equally spread to rural towns like Namwala with 32.5 percent of the respondents having built houses in Namwala town and put them on rent while those fencing their paddocks accounted for 27.5 percent. Those pastoralists that have opened shops/guesthouses constituted 25.8 percent. Other projects such as hammer-mills, wood misers, bore-holes etc were accounted for by 19.2 percent of the farmers (Table 3).

A few wealthy individuals (other 19.2 percent) have 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 enable them to maximise on huge profits and help them meet financial needs as opposed to selling cattle. Due to recurrent diseases and droughts/floods, cattle are now increasingly seen as commodities, avenues of other investments, and this reconceptualisation has 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. Apart from direct conversion of livestock wealth into commercial assets, proceeds from cattle sales has helped to prop up non-livestock commercial sector by

bringing large amounts of cash into local circulation. Hence, the strategic importance of the traditional livestock sector and pastoral changes to the overall development of the district cannot be over-emphasised. For successful pastoralists, cattle accumulation has opened unprecedented opportunities to facilitate their participation in regularised rural market transactions. Most pastoralists have 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. This has enabled them to acquire universally acceptable items such as houses, vehicles, dip tanks and fencing among others.

#### **Increased cash investment into the herd**

The other aspect of cattle typology which has changed with increased commercialisation and threat from climate variability and recurrent diseases is the degree to which pastoralists invest into their herd. Rich or 'big' cattle owners (22.5 percent and own more than 200 and less than 1000 cattle) tend to buy more drugs than small or poor cattle owners who constituted 61.2 percent with less than 200 cattle. In addition, very rich, 'bigger/richer' pastoralists (constituted 16.3 percent and own more than 1000 cattle) stated that they sell more than two hundred beasts on average annually for vaccines and dip chemicals as a disease control measure and embark on various capital projects. Such rich cattle owners manage to minimise the impact of flood and drought by using several hired herders who trek their animals over long distances in different outposts, in search of grass and water. In addition such pastoralists 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 is believed to be less resistance to drought and has long calving intervals) and fencing of their traditional farmlands forming paddocks which are increasingly becoming a common sight especially in Maala and Baambwe chiefdoms (Table 4).

**Table 4: Pastoral livestock typologies and adaptation strategies**

Typology	Strategy
Production adjustments	<ul style="list-style-type: none"> <li>Diversification intensification and/or integration of pasture management, livestock and crop production</li> <li>Promoting mixed livestock farming systems to enable farmers live with change and uncertainties</li> </ul>
Breeding strategies	<ul style="list-style-type: none"> <li>Identifying and strengthening local breeds: Dairy, Angoni and Boran breeds are preferred due to high resistance to drought and disease as compared to Brahman and local <i>Ila</i> breeds</li> </ul>
Market responses	<ul style="list-style-type: none"> <li>Transformation among pastoralists has occurred accumulating both cash and assets that are universally accepted in view of drought and diseases</li> </ul>
Institutional and policy changes	<ul style="list-style-type: none"> <li>Improved management practices among pastoralists and government programmes in vaccinations and diseases control</li> <li>Livestock early warning systems to droughts and floods including Kafue River flows</li> </ul>
Science and technology development	<ul style="list-style-type: none"> <li>Understanding of the impacts of climate variability on livestock, grass and water</li> <li>Enhancing soil and water management including rain harvesting techniques and sustaining water storage from dams, ponds and pans</li> </ul>
Capacity building	<ul style="list-style-type: none"> <li>Understanding and awareness of climate variability and change patterns</li> <li>Training in agro-ecological technologies and practices</li> </ul>
Livestock management systems among pastoralists	<ul style="list-style-type: none"> <li>Provision of title deeds and water to reduce spread of diseases</li> <li>Diversification from cattle to other forms of livestock such as goats and pigs</li> <li>Changes in livestock/herd composition to include dairy cattle for milk production to supply to three newly introduced Parmalat sales centers</li> <li>Improved management of common resources (Kafue river, land, dams and pans)</li> </ul>

#### **Withdrawal of cattle from internal redistribution to individual accumulation**

Climate variability and recurrent cattle diseases have led to reconceptualisation and gradual shift in objectives and production goals among pastoralists. When cattle assume a higher market value, traditional networks of cattle redistribution (*kushisha*) and stock gifts tend to decline. Today, new forms of reciprocity which do not involve the transfer of live cattle have become more important and common, for example, between absentee urban-based livestock owners and their rural based caretakers. In view of unpredicted and eventual mortalities resulting from cattle diseases and drought, most pastoralists stressed that they have taken full advantage of available rural markets instead of engaging in cattle redistribution practice and make several consultations in the case of traditional reciprocity. Thus, poor pastoralists expressed concern that it is now hard to receive cattle from richer relatives due to breakdown in extended family system and changes in the value of cattle.

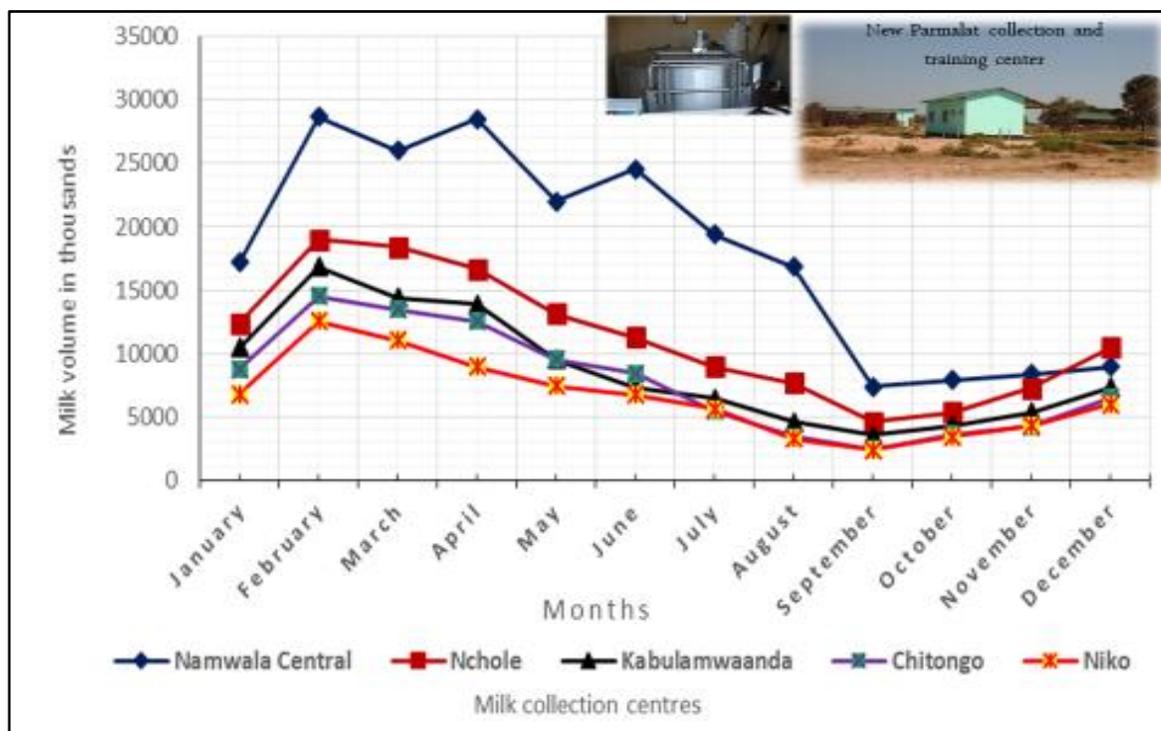
#### **Net flow of cattle from poor to richer pastoralists**

The study quantified 'very rich' pastoralists to refer to those who own more than 1,000 herds of cattle and these constituted 16.3 percent; 'rich' pastoralists represented 22.5 percent 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 61.2 percent of the sample. Since 1990, marketing strategies of bigger and small herd owners have been markedly different due to drought and flood situations, and this has resulted into

a net flow of livestock from the latter to the former. Under normal circumstances, one would expect small pastoralists to sell fewer animals while bigger pastoralists are expected to sell more. On the contrary, it was established in Namwala that small pastoralists have 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. During months of January and February, irrespective of harvest, the market value of cattle considerably drops in relation to the market value of grain. Thus, small pastoralists fall prey to local speculators and long-distance grain traders who take advantage of the situation by dictating the terms of exchange unfavourable to them. From several first-hand accounts during this study, it was established that some small pastoralists had exchanged the whole 'cow' for three 90 kilogramme bags of maize. However, bigger herd owners pointed out that they have responded to the drought situation in the following ways; withdraw their animals from the depressed local livestock market; transport their animals either with their own transport or with hired trucks to the line of rail where they fetch higher prices; and they also dominate on the local livestock market by buying cattle at very cheap prices from poor pastoralists who are usually desperate for cash.

#### **Differences in milking strategies and breeding**

The study established that poor pastoralists tend to milk all their lactating animals while at the same time stripping more milk than very rich pastoralists. During the rainy season, a cow can be milked three times per day, while allowing the calf to suckle intermittently to stimulate further



**Figure 5: Milk volumes at five collection centres**

milk let-down. The three stages are *chifumofumo*, *muunza* and *mangolezha* (morning, noon and late afternoon respectively). For example, poor pastoralists in Muchila and Nalubamba chiefdoms and women in particular, have direct sources of income from milk sales, and tend to milk *chifumo-fumo* and *muunza* while the poorest may even milk *mangolezha* due to fewer lactating cows. On the other hand, very rich pastoralists who constituted 16.3 percent only milk a proportion of their lactating cows normally done *chifumo-fumo* and prefer to maximise calf growth and weight gain for the market. In addition, most pastoralists cross-breed and fetch pure breeding bulls such as Brahman, Boran, Bonsumara and Dairy from places along the line of rail such as Choma, Mazabuka, Lusaka, Chisamba and as far as Mkushi from commercial farmers. With five Parmalat sales centres (Namwala Central, Nchole, Kabulamwanda, Chitongo and Niko), pastoralists are increasingly buying dairy bulls to take advantage of a newly introduced niche milk market (Figure 5). Although the sales centres a fewer, more than 40 percent of those interviewed expressed gratitude and are ready to maximise the new niche market in view of food insecurity and dwindling income from growing crops resulting from droughts and floods; which are also increasingly viewed as not favouring large herds of cattle. This has greatly increased income at household level and improved local traditional breeds at the same time.

#### **Role and increasing dependence on salaried employees**

In Zambia's high inflationary environment, civil servants and other salaried employees have invested their money

in agriculture in general and cattle keeping in particular rather than keeping it in the bank. The animals purchased from wages are often kept in the home village of the absentee worker by his/her close kin. In Namwala, people never attached importance to send their children to school. But after the 1991/92 tragedy of corridor disease, most pastoralists realized the importance of taking their children to school (as far as Lusaka and Copperbelt in various private schools, colleges and universities) and later get employed and provide cash remittances in view of increased droughts and other ecological events disturbing agricultural patterns. Some salaried employees have recognized the value of investing in cattle. Cattle are seen to be the only possession which can congeal, store and increase value, holding it in the stable form, in an environment of inflationary pressures. It is now a common sight along the upland edges of the Kafue Flats to find dotted holdings, most of which belong to salaried employees and proximity to Namwala town centre for easy monitoring. Although there is 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 derive significant social and economic benefits from the cattle of their urban-based kin. In the first place, urban-based employees are made to feel a greater obligation to make regular cash remittances to their rural-based kin, and this enhances the redistribution of income from urban to rural areas; often at risk of crop failure. The money sent is used to cushion food insecurity, buy vaccines and other essentials. Secondly, rural based care-takers extract use value from the animals entrusted to them, in the form of milk, manure and draft power.

### Deflating the bride price

Bride price or *Lobola*, locally known as *Chiko* accounted for a significant number of cattle transfers in Namwala. *Lobola* is a non-commercial way of acquiring cattle. It was found that transfer of cattle for *lobola* purposes accounted for over 10 percent of all cattle movements in the District per annum. At present, there is a significant reduction in the number of cattle demanded in marriage transactions owing to droughts and dilution in cultural norms and practices. The number of cattle being demanded as bride wealth has steadily reduced between the 1980s and in recent years. Two reasons were advanced by pastoralists for this decline: (1) increase in the value of cattle due to available ready market from commercial buyers and (2) reduction in the number of people contributing to bride price in form of cattle due to economic changes (hardships and cattle ravaged by diseases and droughts) and changes in cultural traits (breakup in the extended family system).

### Locals 'turn' to the Kafue River

While new comer tribes outside the district such as *Lozis* and *Bembas* are traditionally involved in fishing, the *llas* used the plain for grazing purposes from time immemorial. Eleven (11) respondents stated that they have become fishermen while six (6) and four (4) respondents are involved in lumbering and gardening respectively as a response to the ever changing social, economic and ecological situations. Fishing in the Kafue River is now a new reality and way of life among most *Ila* men. What is sad is that even their children as young as 12 years have dropped out of school to help in fetching 'a new form of livelihood'. Recurrent cattle diseases and droughts/floods have continued to decimate cattle numbers. This has forced pastoralists to turn to the Kafue River and sell either fresh fish within Namwala town or dry it to fetch for higher returns in urban centres such as Choma, Lusaka and even as far as Kasumbalesa. The money realised is used for meeting various local rural demands and for purchasing steers and heifers in an effort to re-establish themselves in the *Ila* way of life. Pastoralists further stated that they have not completely embraced fishing as a permanent way of life. However, fishing remains unpopular as compared to keeping cattle.

### Diversification with mixed crops/animals

Diversification with mixed crops/animals is another strategy that is used as a coping measure to recurrent cattle diseases and droughts/floods. More than 80 percent of the respondents are engaged in mixed crop-livestock production. Donkeys have also been introduced as beasts of burden, particularly for transport and draught power. This form of livestock farming is seen by many respondents as a risk-minimising strategy. Farmers have also praised NGOs such as Heifer International for coming to their aid in form of goats. Thus, keeping different livestock species help them with the supply of different

products. Pigs, goats, and increasingly sheep tend to be slaughtered more often on weddings and traditional ceremonies rather than cattle. Major household expenditures are met by income raised from cattle sales, while medium and small expenditures are met by sheep, pigs, goats and chicken sales. Pastoralists stated that an outbreak of disease may affect certain species and spare others, for example, sheep and goats, as these species or breeds are better able to survive droughts and thus help carry a family over such difficult periods. Advantages can also be taken from prolific rates of different species to rebuild livestock numbers after a hazard. Thus, more than 70 percent keep mixed types of livestock with chickens (85 percent) as the most popular form of livestock, followed by cattle (72 percent) while the majority keep a mixture of cattle and chickens (96 percent). Chickens are commonly kept by women because of their small size which makes them easy to handle and their simple convertibility into 'target income cash' as compared to large livestock such as cattle which require consultation from husbands or relatives.

### Reorganization and adjudicating climate variability and change for pastoralism

In Zambia, climate variability and change are affecting agriculture and natural resource productivity, thereby exacerbating poverty and contributing to decline in economic growth (African Development Bank [AfDB], 2013). Floods and droughts have increased in frequency over the past three decades, costing Zambia an estimated 0.4% in annual economic growth. Projected temperatures are expected to increase by 3-5°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 Gross Domestic Product (GDP) growth by 0.9%. In Namwala, respondents pointed out that 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 with mean temperature increased by 1.3°C while mean rainfall 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 and more frequent droughts. This climatic unpredictability has often depleted cattle grazing grounds and disrupted livestock watering due to rise and fall of the Kafue River. 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 on pastoralism.

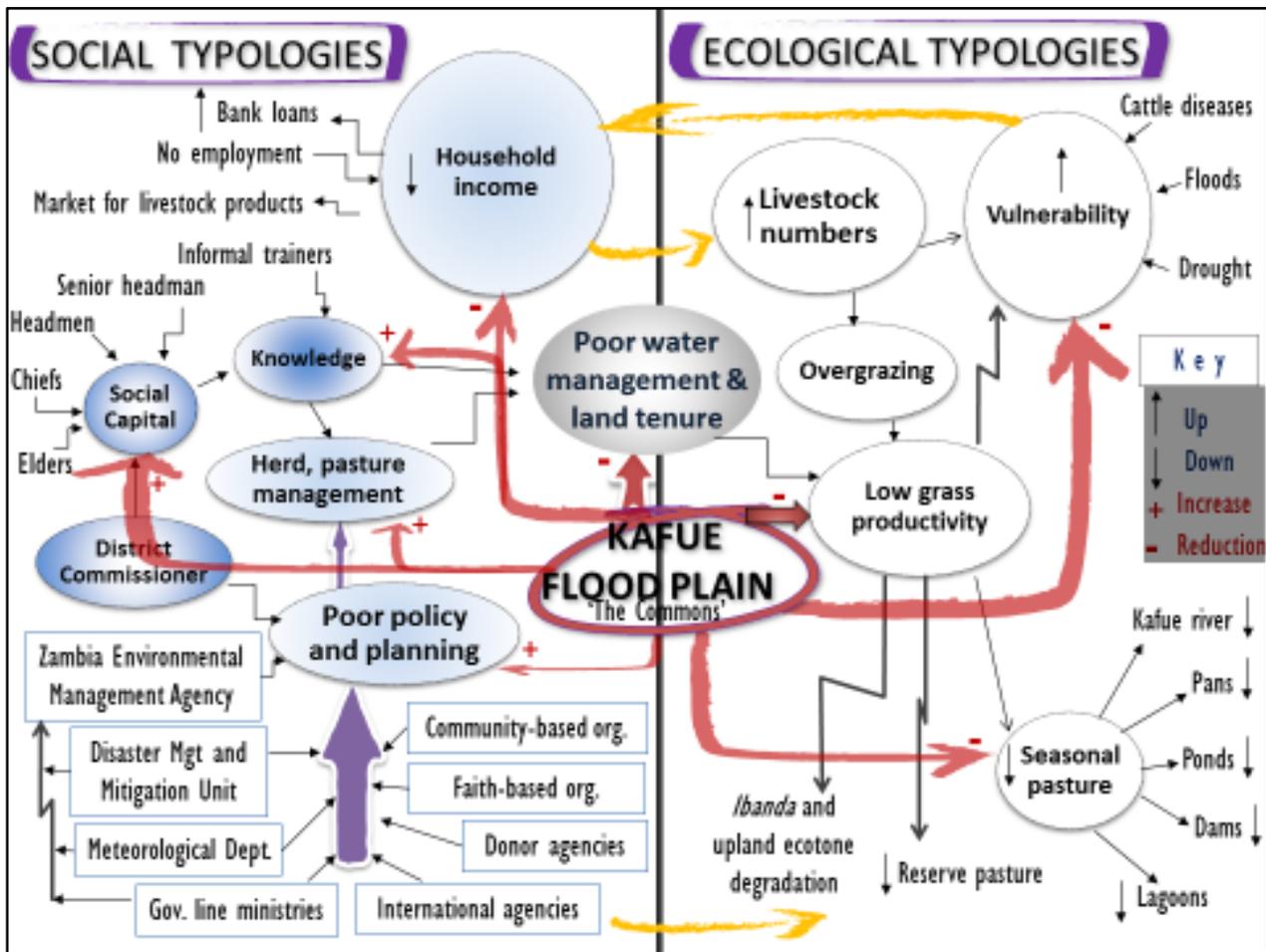


Figure 6: Namwala rural pastoral social-ecological complex systems model

Therefore, pastoralists’ activities are within the governance of altered Kafue River flooding, flow and flux. For this reason, it is vital to reconceptualise and revalue the Flats as a complex cultural landscape rather than a utilitarian resource (Figure 6). This study reconceptualizes the Kafue Floodplain as a dynamic system, one in which environmental river flows, new partnerships and re-valued resources can sustain healthy social-ecological typologies in order to achieve an economically, ecologically and energetically sustainable Kafue River flooding, flow and flux; necessary to involve all users in restoring the Flats. Increased dialogue among stakeholders about responsive dam operations and climate variability are vital strategies for increasing food security and protecting the commons, the Kafue Flats (Chabwela and Haller, 2007). Adjudicating climate variability and change in the context of CPR will also be increasingly important. As the floodplain is a zone of vulnerability, it is also of great natural wealth and likely to become an even greater source of uncertainty for local pastoralists’ livelihoods and trade networks if its role as a CPR is further threatened. As such, pastoralist’s livelihoods are likely to continue to be in flux thereby increasing vulnerability and shift changes in values about new paradigms, changing seasons and climatic patterns (Figure 6).

Thus, Figure 6 demonstrates that social-ecological typologies among pastoralists have the capacity to respond to crises and disturbances, not only embedded in local knowledge, practices and social networks, but also influenced by combining novel and traditional practices. The methods pastoralists employ in the face of climate variability and change are not simple, but rather complex, demanding greater human labour, local networking, mutual support, mobility, innovative skills of herding, presence of reserve pasture (supplementary feeding), availability of support system, learning attitude and access to knowledge and networks. This would contribute to the resilience of the pastoral social-ecological complex system in the utilization and management of CPR such as the Kafue Floodplain, regarded as an ‘oasis’ of dry season grazing.

Therefore, 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. The combined effects of novel and cyclical disturbances over the past two decades have hit hard on the resilience of the pastoral communities in Namwala, overwhelming their adaptive capacity. The Veterinary Department and other government line ministries under the struggling economy have appropriate policy framework

and experiences but lack financial capacity and implementation to realize and address evolving effects of climate variability and change on livestock. Hence, pastoralists are now learning to live with change and uncertainty. They have common strategies to cope with climate variability and change processes and these strategies are rooted and embedded in their pastoral traditions and customs such mobility, flexibility, reserve, diversity and reciprocity. These strategies also serve as cornerstones for the resilience of pastoral social-ecological coupled systems that seem to have demonstrated dynamic and self-organizing adaptive behaviour among pastoralists.

## CONCLUSION

It was concluded from the study that different categories of pastoralists within similar agro-pastoral communities and households respond differently to opportunities and constraints resulting from climate variability and change and recurrent cattle diseases (an increase in mean annual temperature of 1.2°C and decreased mean rainfall of 1.8mm/month and higher prevalence of cattle diseases). 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 change in physical environment. Resilience building in pastoral social-ecological typologies and management of common property resources like the Kafue Flats in Namwala demands preserving and nurturing existing social, economic and ecological components and their interactions that enable pastoralists to renew and reorganize livelihoods. Pastoralists have 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. Hence, the combined effects of droughts, floods and cattle disease disturbances over the past two and half decades have hit hard on the resilience of pastoralists. Therefore, pastoral vulnerabilities are multiple, varied and are transforming pastoral ways into a more resilient system. For successful pastoralists, cattle accumulation has opened unprecedented opportunities to facilitate their participation in regularised rural market transactions in the district. The study established that due to the expansion of market opportunities, richer pastoralists have 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. This has enabled them to acquire universally accepted assets such as television sets, solar panels, vehicles, modern houses and dip tanks/spray races for dipping their animals among others.

Thus, pastoralists in Namwala are 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 typologies should be accepted as the rule, not the exception (Gunderson, 2003). This is because, commonly managed ecotone ecosystems are characterized by high inter annual variation in rainfall, grazing intensity and flood that determine dynamics of livestock movement (Walker, 2002).

Hence, disturbances that affect pastoralists in Namwala are not predictable in terms of severity and magnitude, but by herd management and micro-mobility techniques practiced by pastoralists to cope with such variability and unpredictability to droughts and floods. However, transhumant herding strategies demonstrate how pastoralists' perceptions of spatial and temporal variability in a varied environment play a vital role in making their seasonal movements and utilization of the commons. Thus, pastoralists are closely connected to Kafue Flats' ecotone typologies and are in a better position to understand and adapt to stresses from the ecosystem and to successfully manage it over an extended period of time. Such adaptive capacity of the resource users determines success of their institutional arrangements and serves as a vital component of resilience building. Hence, learning to live with change and uncertainty entails production adjustment, improved breeding, policies, and technology and management practices among pastoralists to accept disturbance, surprise and crises as part of the transformation process of social-ecological typologies. Otherwise, climate variability and change are likely to continue bringing new weather patterns that pastoralists are unfamiliar with.

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