

# Assessing the Effects of Drought on the Livelihoods of Rural Households Due To Climate Change in Zambia: A Case Study of Monze District

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## **1.0 ABSTRACT**

Drought is a natural hazard with often significant societal, economic, and environmental consequences. Owing to the drought effects, loss of livelihood and assets during successive droughts, has been experienced in many parts of Zambia rendering her food security status, fragile. Monze District can be regarded as one of the areas that are seriously hit by drought in Southern Province resulting in massive crop failures and livestock losses. Thus, the study assessed the effects of drought on the rural livelihoods in Monze District.

The objectives of the study were to investigate the effect of drought on household income levels, to establish the effects of drought on food security and to assess the role of government and other stakeholders in mitigating the effects of drought. The study was conducted in Monze District located in the southern part of Zambia.

The design of this research was a descriptive research design. The study used simple random sampling to select a sample of 115 respondents, who provided the relevant data for the study as

they have experienced drought and famine in the area and have seen the resilience measures adopted to curb the impact of drought and famine. The quantitative data was collected from households and analyzed using a Statistical Package for Social Sciences (SPSS) while qualitative was by use of focus group discussions and key informant interviews and was analyzed using content analysis.

The study concluded that drought significantly affects the household income of the households in Monze District because their source of income is heavily dependent on farming. The study also concluded that there is less food security as a result of drought among the households in Monze District and last but not the least, NGOs were found to be more involved in mitigating the drought effects followed by the government.

**Keywords:** *Climate Change, Drought, Livelihood*

## 1.1 CHAPTER ONE: INTRODUCTION

### 1.2 OVERVIEW

Climate change refers to change in the longer term pattern of behavior of the atmosphere over millennia or, more recently, as a result of natural processes or human activity. It is argued that of all the climate changes Drought affected more than one billion people between 1994 and 2013, or 25% of the global total. This is despite the fact that droughts accounted for just 5% of disaster events in this period (CRED, 2015). Drought is not a permanent phenomenon of the climate, but is a phenomenon which regularly occurs. The onset of drought is not instantaneous but is characterized by a progressive deterioration of conditions. This chapter introduces the topic of this study by presenting the background and subsequently the statement of the problem.

### 1.3 BACKGROUND OF THE STUDY

Drought is a weather-related natural hazard which may affect vast regions for months or years with protracted impacts on food production reducing life expectancy and the economic performance of large regions or entire countries (ISDR, 2009). Keddy (2007) elaborates drought as a recurrent feature of the climate occurring virtually in all climatic zones whose characteristics vary significantly among regions differing from aridity in that it is temporary whereas aridity is a permanent characteristic of regions with low rainfall. Drought is more than a physical phenomenon or natural event whose impact results from the relation between a natural event and demands on water supply and often exacerbated by human activities. Significant environmental, agricultural, health, economic and social consequences signify drought periods.

Even though there is no universally accepted definition of drought, it is defined as a period of

unusual dryness experienced in both wet or cold areas and semi-arid areas of the tropics (Borton & Nicholds, 1994). A generally accepted definition of drought was given as “*a temporary reduction in water or moisture availability significantly below the normal or expected amount for a specified period*” (Reed, 1997, p. 98). This explains the physical nature of a drought which encompasses meteorological drought and hydrological drought. The way these two types of drought affect agriculture and the entire economy leads to agricultural drought and economic drought. The definition is supported by the argument that the reduction is temporary, significant, in relation to the norm of the area and the period for the basis of the norm is specified (Borton & Nicholds, 1994).

Drought can be classified into four categories namely meteorological, agricultural, hydrological drought and Socio-economic drought (Wilhite, 2000). This is also supported by The American Red Cross Society (Ditoro, 2016). All type of drought emanate from a deficiency in precipitation (Sivakumar, et al., 2010).

Meteorological Drought: “*Drought is a prolonged period of dry weather caused by a lack of precipitation that results in a serious water shortage for some activity, population, or ecological system*” (EPA, 2014). This shows that it is a natural event caused by climatic conditions which vary according to location. It is normally caused by low precipitation than the normal average rainfall expected. The extent of dryness compared to the normal and the period of dry conditions makes the type of drought to be meteorologically determined.

“*Drought can be considered to be strictly meteorological phenomenon. It can be evaluated as a meteorological anomaly characterized by a prolonged and abnormal moisture deficiency*” (Palmer, 1965, p. 1). The American

Meteorological Society defines drought as a prolonged and abnormal moisture deficiency (Palmer, 1965). It is also argued that meteorological drought is determined by the threshold of precipitation deficiency over a predetermined period of time and the precipitation threshold chosen (e.g. 75% of normal precipitation) and duration period (of about 6 months) which can vary according to location and the needs associated with the location or users (Sivakumar, et al., 2005).

**Hydrological Drought:** Hydrological drought can be defined as a declining amount of water resources such as land and underground water, lakes and reservoirs (Dracup et al. 1980, Klemeš 1987 in (Wilhite, 2000). There is need to bear in mind that, in the same manner the agricultural drought, the underground and surface waters have no direct relationship with precipitation since hydrological storages are exposed to variety of uses such as irrigation, recreation, tourism, flood controls, transportation, power generation, domestic, ecosystem and environmental preservation.

In general, it is viewed as reduced stream flow as compared to normal conditions (Gornall, et al., 2010). Drought is fundamentally distinguished from aridity, which is a long term phenomenon of climatic conditions whilst a drought is a temporary phenomenon that constitutes water deficit (Maliva & Missimer, 2012). This means an arid region can experience drought if the water levels are below the expected normal.

**Agricultural Drought:** An agricultural drought is identified as the effects of meteorological and hydrological droughts on crops and livestock. Agricultural drought is perceived as, “*lake of availability of soil water to support crop and*

*forage growth.....*” (UNISDR, 2007, p. 5). A famine drought is a form of extreme agricultural drought where severe food shortages cause substantial numbers of people to be malnourished or to die. “*It is defined more commonly by the availability of soil water to support crop and forage growth than by the departure of normal precipitation over some specific period of time*” (Sivakumar, et al., 2010). This suggests the reason being absence of direct relationship between precipitation and infiltration of precipitation into the soil.

There is cohesion of ideas from different authors where agricultural drought is understood as deficiency in soil moisture and the increased plant stress (NDMC, 2006) in (Maliva & Missimer, 2012) and (Gornall, et al., 2010). In general, agricultural drought occurs when there is not enough moisture to support average crop production on farms or any agricultural activity that primarily depends on availability of moisture in the soil. This is evident in the various definitions of different authors.

It is also clear that agricultural drought is not solely linked to dry, hot periods of low precipitation but can still take place even when average precipitation is achieved. This is mainly caused by the conditions of the soil and agricultural techniques that which maybe requiring more water to produce meaningful harvest.

**Socio-economic Drought:** Socio-economic drought is different from the other three in the sense that it looks at the link between supply and demand of commodities or economic goods such as water, livestock forage, or hydro-electric power which highly depend on the levels of precipitation in the area. Socio-economic drought

is also viewed as the imbalance between supply and demand of water to society which ends up affecting social and economic activities (Gornall, et al., 2010). This also touches on the relationship between human activities and drought such as poor land-use which impacts on vulnerability to future droughts.

The idea is supported by the definition which views socio-economic drought as a situation where there is high demand for an economic good exceeding supply because of weather related shortage of water (Maliva & Missimer, 2012). This happens in most Southern African countries where maize grain is on high demand during drought spells. This is because of the fact that it is a staple food for most of the countries in the sub-Saharan African region. In most cases, this is caused by shortages or shortfalls in precipitation and water in the reservoirs to produce maize.

Drought impacts on people or communities as a result of water deficiency or and the imbalance of water demand and its availability. Drought occurs anywhere regardless of the climatic conditions since it is relative to the normal rainfall of the area. Droughts can occur in areas which receive low rainfall, semi-arid areas or even those areas which receive high rainfall. UNISDR concurs with Reed (1997) when it says drought is a deficiency of precipitation over an extended period of time, usually a season or more, which results in water shortage of some activity, group or environmental sectors (UNISDR, 2009).

Preventing climate change-induced human rights violations requires intensive international cooperation. In particular, it requires that inequities between developed and developing countries and their peoples are addressed in accordance with the legal principle of affirmative action. This principle, which is incorporated in

international human rights law, is an expression of an exception to the general principle that all states are sovereign equals, which means that generally all states have the same legal obligations. It provides that a state may have to treat right holders differently, if by treating right holders similarly when they are in unequal positions, inequalities are maintained. As climate change increases the frequency and intensity of these shocks, the challenges faced by food insecure pastoralists 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 gas emissions, land use change and have least capacity to adapt.

This study was conducted in Monze district, Southern Zambia. The District is 6,687 square kilometres, and is in region II of the Zambia agro-ecological zones. The average annual rainfall is 801 mm, which about 120 growing days. Furthermore, the district population: 195,921 (49% are male and 51% are female) and has approximately 32,653 households. Monze district also comprises of famers: 19,034 households of which 99% or 18,932 are small scale. Another aspect of Monze district is that it predominantly rural district coupled with agricultural activity is major livelihood and that the major droughts took place in the following years as follows: 1992/93; 1995/96; 2003/04. On the other hand, major floods experienced in the district were: 1997/8; 2007/08 season. As regards animal diseases, the major livestock diseases' outbreaks: corridor bovine disease. First experienced 1981-82 followed by second wave outbreak 1990 to 1997 (Banda and Jordan, 2014).

According to Eucress (2006), Monze district has a history of recurred drought on account of a detailed examination of the effects of droughts in the study wards indicates that the economic

sectors affected is agriculture, particularly subsistence crop and livestock production. Adversely, an analysis of time series demonstrated that livestock sales of (1980-2003) reduced while cattle mortality increased during years of drought.

Most importantly, the positive effects of the recent drought in Monze district were Food for Work projects which were based on self-help schemes that benefitted entire communities. In this respect, droughts have had long-term effects on Monze district because of vital long-term agriculture. For this reason, Monze district can be regarded as one of the areas that is seriously hit by drought in Southern Province resulting in massive crop failures and livestock losses.

## **1.4 STATEMENT OF THE PROBLEM**

Droughts have become more frequent and severe over the recent years. Owing to the drought effects, loss of livelihood and assets during successive droughts, has been experienced in many parts of Zambia rendering her food security status, fragile. The human and financial costs to countries of coping with extreme weather events, crop failures and other emergencies related to climate are growing and will continue to grow higher.

Further, Banda and Jordan (2014) observe that there is still high social vulnerability to food insecurity among the poor and vulnerable in disaster prone areas, despite recorded bumper maize harvests in Zambia. In this context Monze district is not spared in that it is characterized as rainfed maize production area which is a major indicator of food security performance in Zambia. Consequently, Monze district is among the Agric based livelihoods that are highly dependent on rain fed maize for rural sustenance. Therefore, Monze (rural) district is just an example of food insecure districts in Zambia agro-ecological II.

Additionally, climate change poses a risk to the economic development of thousands of people in Monze district such as their rights to life, health, food and water. The district also experiences where extreme weather events, crop failures and other emergencies related to climate change are projected to occur with greater frequency thus affecting the livelihoods of the citizenry in Monze District. It is for this reason that the researcher was seeking to assess the effects of drought on the rural livelihoods in Monze District.

## **1.5 OBJECTIVES OF THE STUDY**

### **1.3.1 General objective**

The main objective of the study was to examine the effects of drought on the rural livelihoods due to climate change in Zambia.

### **1.3.2 Specific Objectives**

- 1) To investigate effect of drought on household income of households in Monze district
- 2) To establish the effects of drought on food security in Monze district
- 3) To assess the role of government, and other stakeholders in mitigating the effects of drought in Monze District.

## **1.6 RESEARCH QUESTIONS**

- 1) How does drought household income of households in Monze district?
- 2) What are the effects of drought on food security in Monze district?

## **1.7 SIGNIFICANCE OF THE STUDY**

The study helped in identifying the effects of drought on the rural livelihoods of the people of Monze district. The study also focused on the role played by NGOs and the government in counteracting the effects of drought and famine in Monze. On the other hand, the topic was chosen because drought is one of the leading disasters in the country. The study generated suggestions, which were significant to formulation of policy statements through its recommendations. The study made recommendations on the diversification of income generating activities, planting of drought resistant crops and adaptation efforts in farming practices and such recommendations could inform policy formulation and professional practice in the country at large.

Furthermore, the purpose of this study was to address the effects of climate change on economic development and develop curriculum that uses the topic of climate change as a context for teaching standards-based research skills to the communities. Communities are better able to reduce the behaviors leading to climate change if they understand scientific issues developed by research skills on the effects of climate change.

## **1.8 LIMITATIONS**

The area under study was not easily accessible due to the poor infrastructure; Time factor was also a limitation factor as the researcher was based in the urban area and the study was conducted in the rural area which meant a lot of time was spared for the study; Financial resources also posed a challenge to the researcher in carrying out the study; Language barrier and illiteracy of the respondents was also as a big challenge to the researcher and therefore, an interpreter had to be sought and finally long bureaucratic procedures from government officers and NGOs, who were the key informants,

caused delays in approval of authority to collect data. Nevertheless, the findings may be useful within current public policies debates and may be useful for educational purposes.

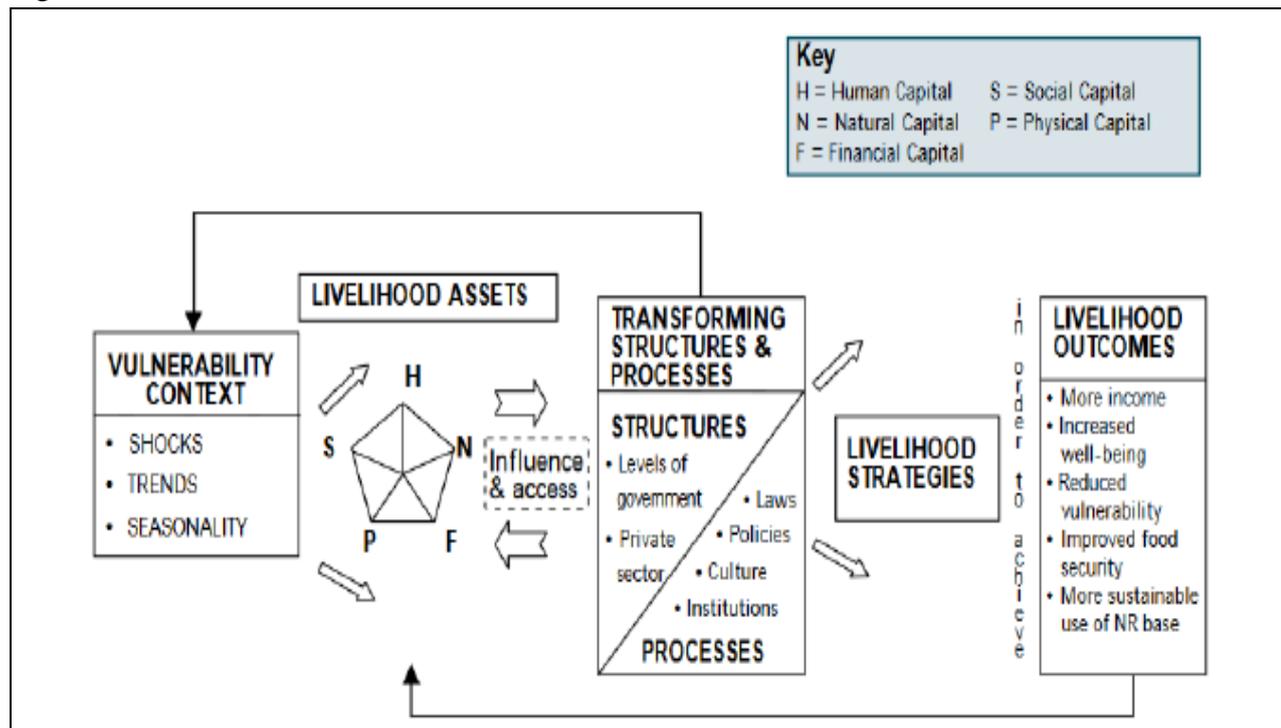
## **1.9 CONCEPTUAL FRAMEWORK**

### **Sustainable Livelihoods Framework**

This study was informed by the Sustainable Rural Livelihood framework as articulated by Department for International Development (DFID) Sustainable Livelihoods programme which aimed to apply the framework in particular cases, with the use of specific examples. The concept of 'sustainable rural livelihoods' is increasingly central to the debate about rural development, poverty reduction and environmental management.

Besides economic activities, livelihoods include the political and cultural context of rural household sustenance as well as natural, human and social resources of households. According to (DFID, 1999) *"A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base."*

Figure 1.1: Sustainable Livelihood Framework



Source: DFID, 1999

The Sustainable Livelihoods Framework (Scoones, 1998; DFID, 1999; Ellis, 2000; GLOPP, 2008) highlights the multiple dimensions of livelihoods and the inherently complex systems of human–environmental interactions. According to DFID (1999), the Sustainable Livelihoods Framework (SLF) summarizes the main components of and influences on livelihoods. It presents the main factors that affect people’s livelihoods and relationships between them. The main components of the SLF are *vulnerability context*, *livelihoods assets*, *transforming structures and processes* (cf. policies, institutions and processes – PIPs – in other framework versions), *livelihoods strategies* and *livelihoods outcomes* (Figure 1.1). Livelihoods are shaped by different factors and forces that are themselves constantly shifting. There are also important feedback loops between the SLF components (e.g. PIPs - vulnerability context; livelihood outcomes - livelihood assets).

Based on the sustainable livelihoods framework outlined above, a conceptual framework was constructed to demonstrate how established variables under livelihood are affected by rough. Conceptual framework is an analytical tool with several variations and contexts. It is used to make conceptual distinctions and organize ideas. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply. Apart from identifying the boundaries of the study, conceptual framework is also the means of selling out an explanation set that might be used to define and make sense of the data flow from the research question.

According to DFID (1999) the issue of vulnerability context includes drought which may affect the livelihood outcomes. The livelihood outcomes that have been adopted as variables for this study are household income and food security. Therefore, the relationship of the variables are illustrated below.

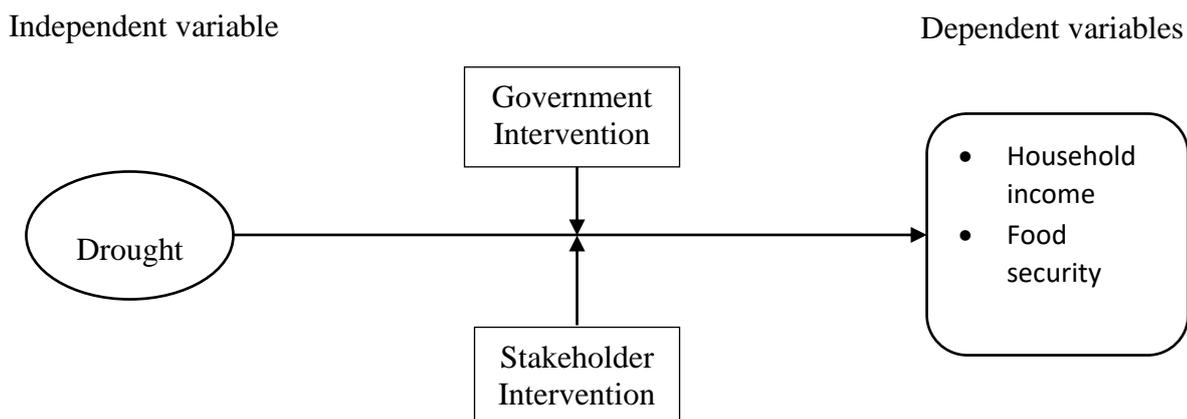


Figure 1.2: Conceptual Framework

## 1.10 1.8 OPERATIONAL DEFINITION OF TERMS

### **Drought**

A drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in its waters supply, whether atmospheric, surface or ground water. A drought can last for months or years, or may be declared after as few as 15 days.

### **Famine**

A famine is a widespread scarcity of food, caused by several factors including crop failure, population unbalance, or government policies. This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality.

### **Climate Change**

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

### **Disaster**

A disaster is a serious disruption of the functioning of a community or society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community and society to cope using its own resource

## 1.11 CHAPTER TWO: LITERATURE REVIEW.

### 2.0 OVERVIEW

This chapter reviewed some studies that have been conducted on the topic both theoretical and empirical literature. It looked at the overview of drought risk reduction and published literature on the role of community participation. It further considered what has been learnt on community participation in various settings for comparison purposes so as to elicit how community participation could be enhanced in effective disaster preparedness and resilience efforts and ultimately disaster risk management.

**Map: Position of Monze in Zambia**

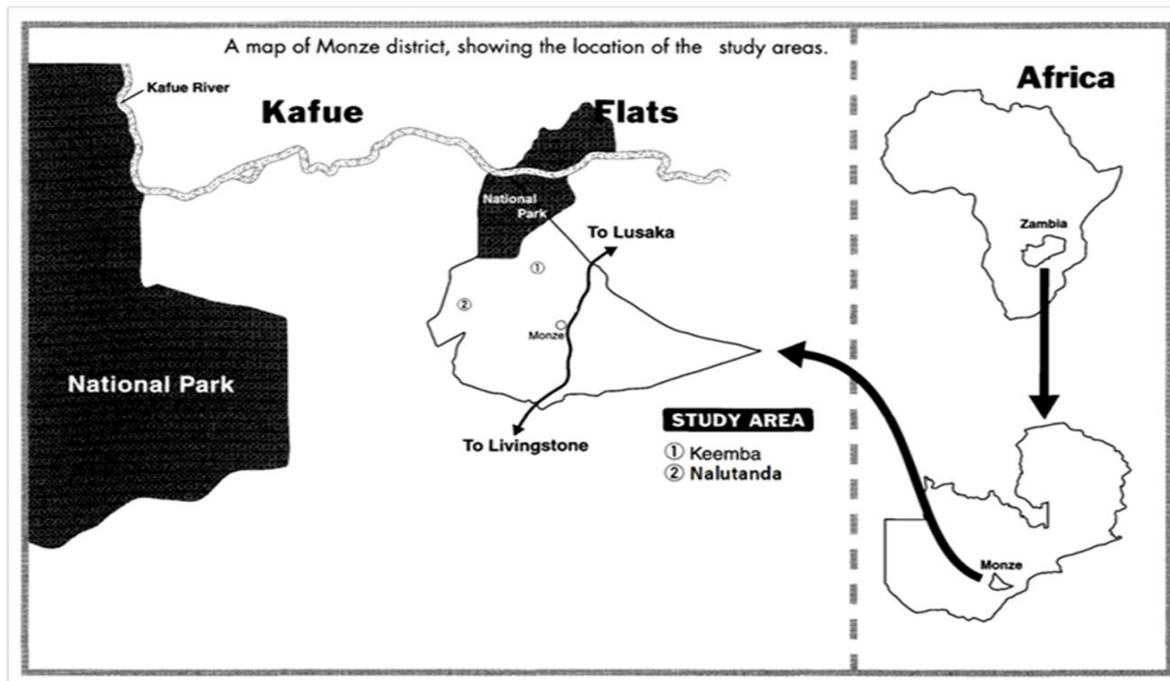


Figure 2.1: Position of Monze in Zambia

## **2.1 DROUGHT EFFECTS ON HOUSEHOLD INCOME**

Even though agriculture is the main impact channel for climate variability, it affects poverty reduction in both rural and urban areas for two reasons. First, a third of Zambia's urban population engages in agricultural production (Thurlow et al., 2008). Thus, while agricultural revenues are not especially important in urban areas, changes in rainfall patterns still affect urban incomes. Secondly, food consumption is a large share of urban households' consumption baskets and so real urban incomes are influenced by changes in agricultural production and prices. As a result, declining agricultural production increases food prices and reduces real urban incomes. Ultimately, two fifths of the poverty caused by climate variability occurs in urban areas (i.e., 133,000 people out of 300,000 at the national level). This result underlines the importance of measuring the economy wide or indirect effects of climate variability, especially when estimating welfare implications, which, in

the case of Zambia, are pronounced.

The direct effects of drought are also perceived to contribute to reductions in output and loss in revenues for agricultural producers. Indirect effects are deemed to be the lost revenues from upstream and downstream entities on the supply chain mainly because of reduction in output which is experienced by the directly impacted producers (Bauman, et al., 2013). Rural dwellers are more often times than not both producers and consumers, thus, drought affecting them directly as producers and indirectly as consumers.

Ichhikwawa and Ishidaira (2015) carried out a study on the effects of drought in vulnerable areas and found that crop failure subsequently affected livestock rearing and rural employment activities, resulting high reductions in on-farm unskilled employment opportunities and an increase in unskilled labor in off-farm rural employment activities. Drought caused severe decreases in the annual income of respondent households and

resulted in financial hardship, forcing them to seek alternative source of income (off-farm employment) or loans with high interest rates. On average, a respondent household reported a decrease of 85.4% in annual income from crop production and livestock and was found to be availing loan amounts approximately equal to the respondent's normal annual income (INR107,000). This explains the severity of drought impacts on farmers' income and the financial hardships faced by farmers due to the drought in 2012. This situation could have been worsened by a second consecutive year of severe drought. The study concludes that the respondents with large family size, low to marginal land holding size, low income, and rain fed farming systems were found to be severely affected by drought.

Livestock production is also largely dependents on rainfall. The country's high rainfall variability and limited irrigation capacity make the sector vulnerable to climate change. The rising frequency of drought and shorter rainy seasons as well as high temperatures may also degrade grazing land and lead to loss of livestock, with negative consequences for food security, loss of income and loss of livestock.

It is noted that drought usually causes economic and financial challenges for agricultural production and also that if it persists for some years it can cause huge and devastating agro-economic problems as well as serious economic hardships for agricultural production and businesses that are agriculturally-based in rural communities (Johnson & Smith, 2003). Economic impacts are referred to as impacts of drought which cost people (or businesses) money (NDMC, 2016). To support this, drought is seen to be historically causing direct and indirect economic, social, and environmental problems throughout the world (Glantz, et al., 2007).

The effects that a drought may have on macro-economic variables, such as the economic growth rate, investment, the current account of the balance of payments, inflation and employment all seem to have financial implications for farmers and the government (Pretorious & Smal, Undated). The authors went on to argue that the South African Reserve Bank's macro-econometric model was used to estimate the extent of the damage caused by the previous drought in 1992.

Drought-induced economic losses include those resulting from impaired dairy and beef, crop, timber, and fishery production; lack of power for industrial use; decline in agriculture-dependent industries; increased unemployment in agriculture and other drought-affected industries; strain on financial institutions (capital shortfalls, credit risks); loss of revenue to state and local governments (from reduced tax base); reduced navigability of waterways; and increased costs for transport of water and development of new sources (Wilhite and Glantz, 1985). Such effects are felt by municipalities, business and industry, agricultural enterprises, households and individuals, and governments" (Glantz, et al., 2007).

It is also relevant in terms of EU Common Agricultural Policy (CAP, 2nd Pillar) and it is closely related to ecosystem conservation at the same time – through decoupling subsidies and developing agro-environmental programmes, which also affect forest area, that has significantly increased in Spain in the last decade as a result of land abandonment, with implications for conservation policies, forest landscape connectivity, etc. (Martín-Martín et al., 2013). Crop yield changes, as a response to climate change projections, have been estimated in many relevant studies dealing with climate change impacts (Rosenzweig et al., 2004; González-Zeas et al., 2014; Lobell et al., 2014), and the Mediterranean region in particular has been

identified as a major hotspot due to the expected increase in drought risk (Garrote et al., 2007). As for the Spanish case, climate change will probably increase water conflicts among sectors, as well as an improvement in the efficiency of water use, which will be essential to maintain environmental flows and therefore ecosystem sustainability. In this context Quiroga and Suárez (2016) analyzed the response of rain-fed crops to climate conditions including extreme events such as drought. Here we have selected crops best representing Mediterranean crop systems. Cereals, grapes, and olives are the three basic products of Mediterranean agriculture, the ones representing a higher proportion of harvested area, but also with an important cultural heritage in the region. Table 1 shows the percentage of total agricultural rain-fed area dedicated to the selected crops. We can see that they account for more than 50 % of the rain-fed crop systems. Although agriculture does not represent a high proportion of gross domestic product (GDP) in Spain (less than 3 %), more than 3000 farms highly depend on these crops as their main activity. Due to the significant agricultural land abandonment in Spain (Beilin et al., 2014) the economic effects on these three crops are also important for the wider analysis of rural development.

With regard to income distribution Quiroga and Suárez (2016) estimated the marginal effects of drought on the Gini coefficient and we have observed that the effects are not large but they are negative for all the crops analyzed whatever the river basin considered. The Tagus river basin is the one that shows the most important effects in both production loss and income inequality, and with respect to the sectors analyzed, the olive sector is where the greatest impacts are noted. The results are policy-relevant since adaptation policy for agricultural systems and water resource

distribution could consider prioritizing the most affected basins and sectors.

The effect of drought on small business is an important aspect of this study. Levantis (2001) examined the links between farms and communities by analyzing the impact of farmers' expenditure on employment and population. The key findings of the study were that small towns are highly reliant on surrounding broad acre farming for their economic survival. The study also revealed that the larger the town, the lower the importance of farm expenditure to the town's economy. It is therefore anticipated that the impact of drought will be greater in smaller towns.

On the contrary, the preceding study found that the differences in terms of income distribution are not as severe as those reported in studies that analyze solely physical impacts (Iglesias et al., 2010), which suggests an important role of market prices in stabilizing farmers' outcomes. Although most of the studies project important crop production to be reduced due to climate change in Spain (Iglesias et al., 2012a; López-Gunn et al., 2012), Quiroga and Suárez (2016) results could imply rural incomes not suffering the most through agriculture losses but consumers' welfare being the most greatly affected.

A research done in Ebo River Basin in Spain estimated a total employment loss due to drought of 11 275 jobs, and losses directly linked to agriculture, forestry and fisheries of 8094 jobs (Pérez y Pérez and Barreiro-Hurlé, 2009) (Gil, et al., 2013, p. 2691). This indicates a relationship between drought and agricultural employment. Agricultural production is a primary industry which in turn affects the processing companies since there will be short supply of raw materials. Secondary industry factories will have no option except to have skeletal workforce.

Loss of income for financial institutions due to unpaid loans by farmers because the farmers could not get a harvest to sell so as to pay the money owed to banks. Farmers also may lose their properties which they attached as collateral for the loan towards inputs and equipment for the farm. *“Drought impacts the marketing assistance loan program. If there is no production, there is no loan collateral”* (Johnson & Smith, 2003).

Many farmers now are faced with increasing indebtedness due to the loans borrowed to overcome agricultural losses. It is difficult to convert other assets (such as land and livestock) into cash because no one would buy them during the drought. Some expressed the hope that the government would order waiver on bank interest, as a form of drought relief.

A study carried out in Ethiopia by Behe et al (2017) found that found that pastoralists and semi-pastorals in the Afar region widely practiced livestock mobility as their most important strategy to cope with drought effects. However, the income of households from sales of firewood and charcoal needs to be replaced by providing them with accessible and sustainable options like honey production, salt mining, commercial tree plantation, livestock rearing and trading. Extensive intervention on promulgating water harvesting schemes would largely help communities in the Afar region. This would enable households to produce animal feed (hay and straw) and create a better chance to use diversified livestock rearing. Depending on the types of livelihood sources, innovative advisory services are highly required to each community member. Mainly, the existing pastorals ways of livestock mobility have to be improved by educating livestock herders via provision of improved veterinary services, livestock management and continuous training.

## **2.2 DROUGHT EFFECTS ON FOOD SECURITY**

The effects of drought on food availability and accessibility depend on levels of vulnerability and the capacity of the households and communities to respond (Filho and Mannke, 2012). Drought coping strategies are likely to be more limited for resource-constrained people, for example, those whose livelihoods are heavily dependent on natural resources (Fleshman, 2007; Mfitumukiza et al., 2017a, b). Coping response varies depending on the prevailing ecological and socio-economic conditions: these may include local agro-ecology, levels of education, gender, income, availability of support systems and services (Deressa et al., 2008; Mfitumukiza et al., 2017a). These and other capabilities play a key role in determining how individuals and communities are able to cope with the impacts of drought and maintain the functioning of their socio-economic systems (Robeyns, 2005).

Attempts have been made to investigate the general primary effects of climate related hazards (e.g. Adhikari et al., 2015 and Sabiiti et al., 2018). However, there is a very limited number of studies that have focused attention on the direct relationship between drought and food security. Even where attempts have been made, they are too generalized to provide effective location specific drought adaptation response actions for agricultural productivity and food security (e.g. Phalkey et al., 2015 and Rahn et al., 2018). Effective planning and decision making for improved food availability and accessibility related to the effects of climate variability and change requires new, location and time-specific information. Moreover, such information is needed for lesson sharing across regional, national and international levels to facilitate learning processes that can lead to global context support and partnerships (STOTT, 2014).

Understanding the relationship between drought and food availability and associated perceptions and responses is critical in managing food insecurity across scale (Knowler and Bradshaw, 2007; Mertz et al., 2009). It is with such information that plausible, context specific adaptation strategies in communities could be identified for the desired social change (Rosegrant and Cline, 2003; Sen, 2004; Robeyns, 2005; Smit and Wandel 2006).

Oxfam (2011) elaborates that climate in the Horn is experiencing an increase in the rates of drought and that drought-related shocks used to occur every ten years, and they are now occurring every five years or less. Among Borana communities of Ethiopia, whereas droughts were recorded every 6-8 years in the past, they now occur every 1-2 years which is now the case over the entire East Africa region (Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda) and come with inevitable uncertainties associated with localized impacts. They nonetheless show that even with moderate increases in the length of crop growing period in some patches of the region, agricultural productivity could decline dramatically due to climate change in the decades ahead as temperatures increase and rain patterns change. On top of these projections, any incidence of extreme weather events like droughts would further be hit food production in the region. These reductions in food production would have severe consequences most directly for smallholder farmers and agro-pastoralists, who rely on farming for income, and for all those who purchase such crops.

El Nino induced drought episodes are increasingly common in Southern Africa. For Zambia, based on historical records of El Nino events, the southern half of the country is usually prone to drier conditions (NCCRS, 2010). The negative impacts of droughts are felt most by

those dependent on climate sensitive economic activities, such as rain-fed agriculture, for their sustenance. Erratic rainfall also has significant impacts on Zambia, especially on farming and human settlements. Floods and droughts have increased in frequency over the past three decades, costing the nation an estimated 0.4% in annual economic growth. Climate change impacts will have negative impacts on different sectors and increase vulnerability of the categories of the population who are already vulnerable. A major drought can reduce crop yields and crop hectares because less water and soil moisture are available for crop growth. During a drought, farmers may consider reducing their cropping hectares and only plant drought-tolerant crops. However, it is important to understand the spatiotemporal variability of drought impact on crop yield and cropping areas to plan and mitigate its potential negative impact on agriculture (Zipper et al., 2016).

Drought, flooding, extreme temperatures and prolonged dry spells are threatening rural livelihoods through crop failures and degraded food and water security systems. In the last two decades, yields for crops such as maize have been severely affected by extreme drought, flooding and rainfall deficits (NAPA 2007). Climate variability undermines attempts to reduce poverty and food insecurity, since most of Zambia's poor population consists of rural small scale farmers who rely on agricultural incomes.

Impacts of climate change are also affecting the health of vulnerable populations in Zambia. Climate changes are predicted to increase mortality levels associated with climate-sensitive diseases. Health in general will also be affected by climate hazards in terms of heat stress caused by the rising temperatures, increase in water borne diseases and malnutrition due to insufficient food. Malaria, being the number one killer disease in Zambia, requires a constant assessment of its

status. Floods are expected to have effects as water recedes and stagnates, causing favorable environments for mosquitoes, which will in turn transmit more diseases.

In terms of water resources, Zambia has a relatively abundant supply of surface water and groundwater. However, surface water is unevenly distributed throughout the country, and the southern region often experiences water shortages. During drought periods and following declines in precipitation, there have been reductions in the flow and volume of rivers, streams, and lakes, which have affected the accessibility and availability of surface water and groundwater for drinking, agriculture, livestock rearing, other human activities, and fisheries. Reduced access and availability of water resources also impact hydroelectric power in Zambia.

According to FAO/WFP, (2006) Farmers in southern province of Zambia including Monze farmers reportedly engaged in petty trade more intensely because of the effect of drought on their farm produce. Consumption of perceived inferior crop like cassava was common in the southern province. When household food supply dwindled, farmers attempted to extend their food stock by skipping meals from three to one or two a day. As household food stock ran out, people in many parts of both provinces were reportedly surviving by eating green mangos, and toxic root. Farmers who live near a forest made frequent visit to the forest to look for wild foods and, in the process, competed with wild animals for dwindling food sources. School children reportedly went to school in the morning without having breakfast and brought home their left over rations. Some distressed farmers resorted to desperate coping behavior such as stealing and prostitutions.

Volumes of food imports increase as the drought worsens and this may increase debt for the country in the region and internationally. This is illustrated in the case of Malawi where droughts also have macroeconomic implications evidenced by tobacco which accounts for a third of the country's export earnings. Thus, if demand for maize imports goes up whilst tobacco production and exports decline, it makes Malawi's exchange rate to depreciate (Pauw & Thurlow, 2009). The 2015/2016 drought has seen Zimbabwe importing grain from South Africa and Zambia in the SADC region thereby straining the economy which is already in an unpleasant situation because of lack of production industries and poor production on farms even in years of good rains.

As the yield from traditional crops is sluggish, because of water deficit commercial crops and more recently, hi-tech agriculture are promising sources of growth. However Hi-tech agriculture is confined to small enclaves. While it would contribute handsomely to value of agricultural output, it is doubtful whether it would have a beneficial impact on the income and employment of masses of poor. This change in the cropping pattern bears impact on food security and is far from favorable because it diverts the land from coarse cereals which are the staple food grains in drought-prone areas. Commercial crops although result in the increase of the incomes of farmers, make them more vulnerable to vagaries of market fluctuations. This puts the farmers in flux – neither meeting food security nor certainty in the returns from the commercial crops.

In most of the Mandals of Anantapur, though the rainfall in the year 2002-03 was not up to the expectations of the farmers, they did not change the cropping pattern for the Kharif season. Out of normal acreage of 8, 06,224 hectares for the whole district, the area under crops sown was 8, 37,942 hectares (Table 1) of which the area under groundnut was more than 90 per cent in the

district. However, due to severity of drought conditions this crop was totally dried up. For example, in Obuladeva Cheruvu Mandal, the area under groundnut was sown in 11,985 hectares, most of which was dried up and became useless for harvesting and also involves an additional cost to use it as a dry fodder. Some of the farmers followed alternative cropping methods during the drought seasons as a part of their coping strategies. For example, In Nallamada Mandal, the area under groundnut was 35,000 acres while the area under alternative cropping system was 15,000 acres. The yield rates of alternative-cropping patterns were very high when compared to groundnut.

Some large landholding farmers report more reliance on irrigation. However, even irrigated groundnut crop yielded less (reduced by 2/3<sup>rd</sup> to 4/5<sup>th</sup> of normal) due to erratic power supplies to well pumps and greater incidence of diseases. Even those who reported no problems as yet, expect problems in the near future if the drought continues. In some cases, there was scaled back or discontinued cultivation of water-intensive crops such as paddy, and increased cultivation of sunflower. However, problems rose regarding the increasing costs and decreasing quality of sunflower seeds, and they lost paddy straw as a source of fodder for livestock.

Backyard plantations of coconuts reduced yield due to drought related problems. Farmers were selling less produce in major town markets, and more in nearby village markets, as the quality and quantity of their goods considerably decreased.

Droughts affect soil quality in the sense that soil moisture is essential for the breakdown of organic matter. Droughts reduce the quality of soils, by lessening organic activity, increasing wind erosion, and as a result soil insects or organisms perish (eSchool Today, 2006-2014; Owen, 2008).

## **2.3 ROLE OF GOVERNMENT AND OTHER STAKEHOLDERS IN MITIGATING DROUGHT EFFECTS**

Government mobilization of community participation into drought management dates back to the times of Epic of Gilgamesh and biblical times of Joseph. The Bible presents a scenario where the government authoritatively commanded community participation in drought management and drought risk reduction in Egypt where it worked efficiently (ABS, 2004). Effective drought risk reduction involves the participation of communities for maximizing the opportunities, knowledge, and synergies in interventions considering appropriateness of needs, perceptions, and existing capacities. Community knowledge on drought disaster patterns forms a rudimentary part of early warning system where forecasting of drought disaster through traditional and scientific methods is very vital.

In most cases, assistance from outside the communities is in the form of Government assistance through programmes like food for work, public works projects, supplementary feeding schemes, food aid (Masendeke & Shoko, 2014). NGOs are also important stakeholders in the household external coping capacities. For example, food aid has been a very popular drought mitigation strategy across the world where the majority of the households receive food hand-outs during times of drought due to serious food shortages (Mushore, et al., 2013). In rural communities, most households that are vulnerable benefitted from food aid in Zimbabwe and food aid programmes have been there for years (Mushore, et al., 2013).

Gono (2005) indicates that reliable supply of electricity is necessary for agriculture and electricity is not only required for direct agricultural activities, but also for consistent supply of inputs which include coal, fertilizer,

pesticides and herbicides which depend on electricity for smooth running of production in industries. Kaseke (2013) also explains that Power outages have been high and are still affecting firms (industry), farms, mines and households. This entails that regular load shedding which characterized Zambia since early 2000 to date have significant impact on production in farms.

Agriculture contributes 20% of GDP and accounts for more than 60% of the labor force. In the rural areas, agriculture is the main employer responsible for almost 87-90% of employment. The majority of farmers, almost 98%, can be classified as small scale farmers whose agricultural activities are almost 100% dependent on rainfall. Therefore, the agriculture sector in Zambia is extremely vulnerable to rain fall patterns which have become more unpredictable under climate change (NAPA 2007; Phiri et al 2013). Agriculture annual GDP growth rate has been reduced by at least 1 percentage point, and by over 2 percentage points during the worst rainfall scenario. This will greatly reduce Zambia's chances of achieving the national development goal of strengthening agricultural and rural income growth (IFPRI, 2009). In the absence of adaptation, rainfall variability alone could keep an additional 300,000 people below the poverty line over the next decade.

Many studies on the effects of climate change on forests have focused on the ability of species to withstand variations in temperature and moisture. But, depending on the geographical location, climate change also has the potential to affect forest ecosystems by altering the frequency, intensity, duration, and timing of fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, or landslides. All these dimensions (besides moisture and temperature) have huge implications on forest ecosystems and subsequently on

humans too, and therefore require research attention. Both natural and human-induced disturbances change forest ecosystems by influencing their composition, structure, and functional processes.

In Zambia, natural disturbances with the greatest effects on forests include wildfires, drought, suppression by invasive species (*introduced plant species*), excessive rainfall, and attacks by insects and pathogens. Each forest is affected differently; some disturbance may cause serious and large-scale tree mortality, whereas others may only affect a small community without causing massive damage. All these natural disturbances interact with human-induced effects on the environment, such as air pollution and land-use changes arising from resource extraction, agriculture, urban and peri-urban expansion, and recreation. Lasting solutions are possible through policy interventions that promote adaptation-mitigation approaches.

## 2.4 Disaster theories

On a global scale, the frequency, duration and severity of droughts have increased substantially in recent decades (Dai, 2011), especially in arid and semi-arid regions (Solomon, 2007). In fact, as earlier mentioned, drought is a global phenomenon that occurs virtually in all landscapes causing significant damage both in natural environment and in human lives (Lambers *et al.*, 2008, Mishra and Desai, 2009). Drought has major ecological effects on population and structure of both fauna and flora. Loss of habitat, poor water and land quality, weak biotic interactions, changes in nutrient cycling, and reduction of primary productivity have major effects on the ecosystem functionality and are associated with social and economic implications (Keshavarz and Karami, 2016). However, due to changing spatial and temporal characteristics of drought and complex ecosystem attributes, it is

difficult to monitor and assess the potential effects of droughts (Wang *et al.*, 2014). Several drought indices, typically based on a combination of precipitation, temperature and soil moisture, have been derived in recent decades to assess the effects of droughts and define different drought parameters, which include intensity, duration, severity and spatial extent (Carrao *et al.*, 2016).

In spite of this fact, as yet, there is no unified framework to assess drought effects compared to different assessment criteria. In this regard, Lei *et al.*, (2015) presented a new framework of a quantitative evaluation on the effects of drought on ecosystems and used it to evaluate the damage to ecosystem function and serve under different drought situations. Based on the framework, the assessment of the effects of droughts on ecosystems includes a series of important steps: 1) clearly defining drought scenarios, such as moderate, severe and extreme drought; 2) selecting an appropriate indicator of drought impact; 3) selecting an appropriate ecosystem model and verifying its capabilities, calibrating the bias and assessing the uncertainty; 4) assigning a level of unacceptable impact of drought on the indicator; 5) determining the response of the indicator to drought and normal weather state under global change; and 6) investigating the unacceptable impact of drought at different spatial scales. The framework is comprehensive and scientific, allows rapid assessment of the unacceptable effects of the single factor drought, and can find wide application in decision-making. Not only it can be used to assess the effects of drought on ecosystems such as forests, grasslands, wetlands, and croplands, but it also can be extended to estimate the influence of drought on economics and societal functions by using appropriate models (Lei *et al.*, 2015).

This has been a new development over the “dominant paradigm” and brings better conceptualization of disaster through connecting hazards and vulnerability where their interaction leads to disaster. This relation is portrayed by the formula of risk = hazard X vulnerability (Blaikie *et al.*, 2004). The scrutiny’s of the approaches and further empirical work have inspired the development of subsequent perspectives which give attention to environmental processes and impacts of anthropogenic activities. Therefore, an alternative view, described as “social vulnerability approach” has got space in different disciplines and policy communities.

## Famine theories

Famine, the most damaging of all disaster types, has a long record in human history. It can be stated that no aspects of social, economic and political lives are untouched, when a famine occurs (Blaikie *et al.*, 2004). Apart from death tolls, it brings livelihood insecurity, impoverishment of natural-resource base, destitution, displacement, trauma, social disorganization, political instability, which may endure for post-famine periods (Davies, 1996; Blaikie *et al.*, 2004). The nature, degree or severity and causes of specific famine disasters vary over time and from one context to another.

The current literatures show that famines persist, and affect severely some regions of the world, particularly the African countries. Location of famines has shifted, and in fact the supposed causes have changed overtime, and famines have become more complex (Devereux, 2000; Devereux *et al.*, 2002; Blaikie *et al.*, 2004). Traditionally famines have been attributed to drought, and sometimes to flood or epidemics. But as it is stated earlier attributing famines to natural factors has been challenged since the 1980s claiming that drought and sudden-onset

„natural causes“ are less capable of acting as causes of famines. This notion has stimulated more academic debates on famine causation and led to development of various disciplinary perspectives to explain famine causes. There are four main famine theories which have been developed in the past four decades and are discussed below.

## METHODOLOGY

### 3.0 OVERVIEW

This chapter presents the methodology that was used in the study. It begun with the description of the research design that was used, target population, sample size & sampling procedure, data collection instruments & procedures, data analysis and further describes the ethical considerations that were made during data collection.

### 3.1 RESEARCH DESIGN

This is a case study which used descriptive research design. Descriptive design helped in investigating the impact of drought in Monze district and the resilience measures adopted to counteract the effects of drought. Descriptive research design provides deep understanding of the events been studied and its instruments are helpful in getting first-hand experience as well as in depth coverage of the study (Kothari, 2004). This research design is a present oriented methodology that the researcher used to investigate disaster preparedness and resilience amongst communities in Monze southern province of Zambia by selecting a sample population. The design helped the researcher to establish conditions that exist, practices that prevail, beliefs and attitudes that are held, processes that are ongoing and trends that are developing. The research design provided numeric descriptions of the sample population by describing the role of the community, government

and NGOs in the management of drought in Monze southern province of Zambia also notes that this method has the ability to allow collection of large amount of data quickly and at minimal costs. The researcher opted for a descriptive survey design to cater for the large population that will be involved in the study through a sample for the purpose of data collection and analysis.

### Case Study

The type of mixed method design that was used in this study was a Case Study Design. This method enables the researcher to answer *how* and *why* questions while taking into consideration how the phenomenon is influenced by the context in which it is situated. It opens the possibility of giving voice to voiceless people (Stake, 2008). According to Creswell (2007) a Case Study involves an exploration of ‘bounded systems’ (bounded by time, context, and place). It may be a single study or multiple studies over a period of time through detailed, in-depth data collection that involve multiple sources of information. This study used a single Case Study because it involved an intensive, holistic description and analysis of a single instance, phenomenon (or a social unit) within a limited time scale (Feagin, Orum, & Sjoberg, 1991). The implication of this is that the researcher is not necessarily looking for findings that can be generalized to wider populations although the findings may be applied usefully to similar context.

In case studies a variety of study methods may be employed. These include in-depth interviews that produce narrative data and is achieved by speaking with the participants on a one-on-one setting; participant and non-participant (e.g. direct and indirect) observation, focus group interviews (e.g.in-depth interviews) and ethnographic fieldwork that involves spending a year or more in a society, living with the local people and learning about their ways of life. By doing this,

the researcher attempts to see events and experiences from the viewpoint of those studied in order to develop an in-depth and long-term account of the community, events, or trends under observation (Creswell 2007). In this study focus group interviews and one-on-one interview was used to collect data. Henning, Van Rensburg and Smit (2004), indicated that in case studies, the main assumption is that the phenomenon being investigated is a "bounded system." The system may be the group of people or single entity. Any social entity that can be bounded by parameters and dynamic, relevant, and reveals information that can be captured within these boundaries may be a case study (Nieuwenhuis, 2007; Pope and Mays, 2006). The case study area of this research is Monze District.

## **3.2 TARGET POPULATION**

The study targeted Southern province of Zambia residents in Monze district. Monze District has a total population of 191,872. 93,958 are males and 97,914 are females. 149,982 are in the rural areas of which 73,485 are males and 76,497 are females. The urban area has a population of 41,890 of which 20,473 are males and 21,417 are females (Census of Population and Housing, 2010).

The group of respondents included 115 farmers who provided relevant data for the study as they have experienced drought and famine in the area and have seen the resilience measures adopted to curb the impact of drought and famine. The study was aimed at establishing the effects agricultural production has on the living standards and household welfare of the farmers of Monze district and therefore some of the household characteristics studied included; age, education level, gender of the head of the household, family size, years of farming experience, and wealth.

The targeted population of interest in this study was the residents of Monze district of the

Southern province of Zambia. The age distribution started from 10 years up to 80 years plus. The population of interest also included residents who were single, married, divorced or separated and the widowed ones.

## **3.3 SAMPLE SIZE AND SAMPLING PROCEDURE**

### *3.3.1 Sample size*

According to Bryman (2008), sampling is the process of selecting a number of individuals for a study in such a way that the individual represents a larger group from which they are selected. The major criterion used when deciding on the sample size is the extent to which the sample size represents the population. The researcher used random sampling technique to gather data from the target population. According to Mugenda and Mugenda (2005) a third of the population is an ideal sample. The sampling technique is the process of selecting a specific number of respondents for a study (Ngulube, 2003). Hence, the sample size used was 115 respondents.

### *3.3.2 Sampling technique*

Sampling cannot be avoided in a research because it is impracticable to survey the entire targeted population due to budget and time constraints (Saunders, 2007). The study employed simple random sampling technique to collect data from 115 households. Simple random sampling was conducted to ensure that each member of the target population had equal and independent chance of being included to produce unbiased sample of study (Saunders, 2007).

The researcher did not possess a list of households in the area under study. Therefore, the researcher used population estimates from the last census report of 2010. The researcher also did not possess the number of households in each sub area and therefore she identified the midpoint (market, school or church) in each district and then proceeded to divide the area into 4 sub areas

(North, South, East, West). The number of households to be included in each sub area was obtained by dividing the sample size in each district by 4. Once, the researcher had the number of households from each sub-area, then used a distance of 500m between households to select the intended number of households. The researcher used a path from the midpoint which is frequented used by many residents to go to their homes. The path assisted the research in calculating distance between households and also helped in identifying boundaries.

### **3.4 DATA COLLECTION METHODS AND PROCEDURES**

#### **3.4.1 Data collection instruments**

Data was collected through interviews with key informants, focus group discussions (FGDs) and

household questionnaire survey (McMillan and Schumacher, 2000). Key informant interviews were conducted with a broad variety of stakeholders comprising of; government officials, local and international NGOs and CBOs. The interviews were aimed at getting insights into the impact of drought in the district and their efforts to assist the communities in coping with the disaster. During the field study, ten key informants were interviewed and focus group discussions held comprising of eight farmers. Data was also collected through household survey using semi-structured questionnaires that provided the basis for a quantitative characterization of household's socio-economic characteristics, perceptions of climate change and coping mechanisms of the household heads.

Figure 3.1 below shows methods of data collection;

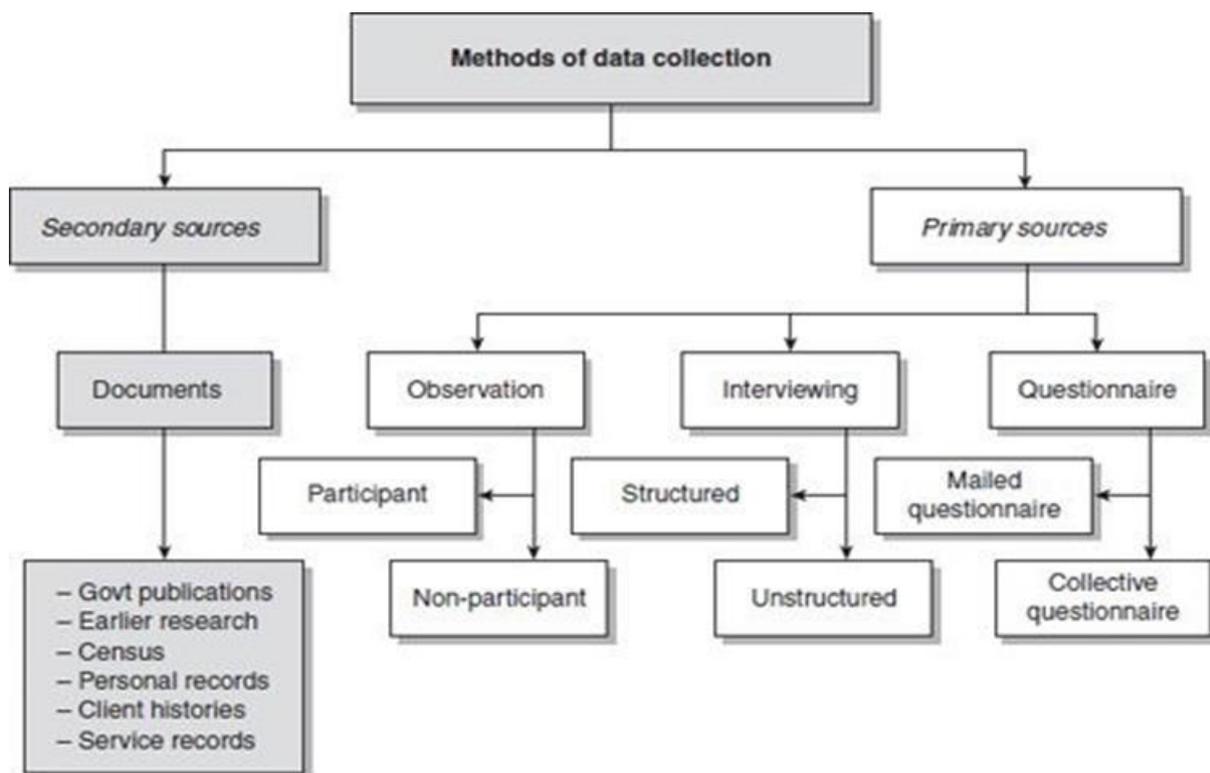


Figure 3.1, Source; adopted from Kumar (2011)

## Collection of quantitative data

The study used semi-structured questionnaires to collect data from the households. Mugenda and Mugenda (2003) observed that, the pre-requisite to questionnaire design is definition of the problem and the specific study objectives. Kothari (2004) observed that questionnaires are very economical in terms of time, energy and finances. Questionnaires yielded quantitative data which was easy to collect and analyze.

## Collection of qualitative data

Qualitative research data collection methods are time consuming, therefore data is usually collected from a smaller sample than would be the case for quantitative approaches - therefore this makes qualitative research more expensive. The benefits of the qualitative approach are that the information is richer and has a deeper insight into the phenomenon under study. The two types of qualitative techniques used in the study included:

### a) Key informants

The term “key informant” in this study refers to a person who disposes specific competence/knowledge of drought and famine, its impacts and response mechanisms due to academic qualifications or/and many years of work experience. The interviews were aimed at getting insights into the impact of drought in the district and their efforts to assist the communities in coping with drought and famine. During the field study, ten key informants were interviewed using an interview guide. They were selected using purposive selection. The key informants included; government officials, local and international NGOs and community based organizations.

### b) Focus Group Discussions

A focus group discussion is an interview with a small group of people usually eight to twelve people participate in the interview for about one

to two hours. The interviews are expected to yield higher response rates by using probing questions (Patton, 1990). Patton argues that focus group discussion is the highly efficient qualitative data collection technique, which provides some quality controls on data collection. Participants tend to provide checks and balances on each other and it is fairly easy to assess the extent to which there is a relatively consistently shared view among the participants. During the study, the researcher held focus group discussions with eight farmers who experienced drought and famine in the region. The discussions were on the following topics; community participation, coping mechanisms, impact of drought and famine on the lives of the community and their understanding of drought and famine. The researcher used snowballing sampling as a means of identifying the group participants. The researcher encouraged the respondents to participate without holding back the information they might be having as the research instruments would not bear their names (McMillan and Schumacher, 2000).

## 3.5 DATA ANALYSIS

Mugenda and Mugenda (2003) assert that data obtained from the field in raw form is difficult to interpret unless it is cleaned, coded and analyzed. The collected data was analyzed using both quantitative and qualitative data analysis methods. Quantitative method involved descriptive analysis. Descriptive analysis such as frequencies, percentages were used to present quantitative data in form of tables. Data from questionnaire was coded and logged into the computer using Statistical Package for Social Science (SPSS). The graphs and charts will also be generated with SPSS. (Jennings, 2001:303).

Qualitative data was collected and analyzed using content analysis. According to Creswell (2003), content analysis is a research technique used to

determine the presence of certain words or concepts within texts or set of texts. The researcher quantified and analyzed the presence, meanings and relationships of such words and concepts then make inferences about the messages within the text. To conduct a content analysis on any such text, the text was broken down into manageable categories on a variety of levels; word, word sense, phrase, sentence or theme and then examined using content analysis.

### **Validity**

Kumar (2011:216) citing (Smith 1991:106 and Kerlinger 1973:457) defines validity as the degree to which the researcher has measured what he/she has set out to measure. The commonest definition of validity is epitomized by the question: Are we measuring what we think we are measuring?

Therefore, data validity determines the degree to which the research is measuring what it claims to be measuring. The data that will be obtained will be analyzed and revised for the main study so that the internal validity and reliability is maximized; if there will be any ambiguity it will be uncovered (Kumar 2011:215). Moreover, there are two perspectives on validity:

Data validity of the results from the tools employed in the study were measured by content validity through the extent to which the test items represent research questions (research being measured).

### **Reliability**

The data reliability is the extent when the research findings would be the same, if the research was repeated. However, it is very rare that the results would be exactly the same in social sciences because human beings change and differ in social situations (Veal 2006:41).

### **3.6 ETHICAL CONSIDERATIONS**

According to Kerridge, Lowe and McPhee (2005), ethic involves making a judgment about right and wrong behavior. Ethics as noted by Minja (2009) is referred to, as norms governing human conduct which have a significant impact on human welfare. Indeed, as observed by Devettere (2000), ethics is about choice between good and bad. In this study, the researcher followed ethical considerations in the course of the data collection process. Respondents participated on their own will without pressure from either the researcher or their supervisors. The researcher protected the privacy and confidentiality of the respondents' identities. Voluntary participation; each participant was informed that participation is voluntary (with no incentives), and their refusal would not affect any relationship that is there.

Evaluating the risks to participants; to the best knowledge of the researcher, this study did not evoke any emotional or psychological harm.

Conflicts of interest; to the best knowledge of the researcher there are no conflicts of interest involved in this study.

## **RESULTS AND FINDINGS**

### **1.12 4.0 OVERVIEW**

The collected data from the field was analyzed based on the codes assigned to responses on questionnaire as discussed in the previous chapter. This chapter discussed the interpretation and presentation of the findings obtained from the field. The chapter presents the background information of the respondents; findings of the analysis based on the objectives of the study. The objectives of this study were; to investigate effect of drought on household income in Monze district, to establish the effects of drought on food security in Monze district and to assess the role of government, and other stakeholders in mitigating the effects of drought in Monze District. The

researcher was able to get back 115 responses of the sampled households giving a 100% response rate.

### 4.1 CHARACTERISTICS OF RESPONDENTS

The response rate determines the statistical power of a research and a higher rate is considered better. In this study, a total of 115 questionnaires were distributed and all 115 were filled and returned. This response rate was excellent and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. This represents a response rate of 100 % and this was sufficient as shown in table 4.1.

#### 4.2 Table 4.1: Response Rate

Response	Frequency	Percentage (%)
Responded	115	100%
Not responded	0	0%
<b>Total</b>	<b>60</b>	<b>100%</b>

### 4.3 DROUGHT EFFECT ON HOUSEHOLD INCOME

#### The main assets Found in Monze district

Table 4.5 shows the main assets found in Monze district, the study found that the main assets found in Monze District include houses, farm equipment, livestock, land businesses and bicycles. Generally, most people in Monze District had houses as represented by 84% the rest had rental houses. 76% of the households owned at least some land where 69% practiced some farming and 58% reared livestock. Finally, 18% household heads had business and 7% had bicycles.

The study also revealed that the main assets found in Monze include houses, farm equipment, livestock, land, businesses and bicycles. Generally, most people in Monze District had

houses as represented by 73% the rest had rental houses. 67% of the households owned at least some land where 62% practiced some farming and 51% reared livestock. Finally, 32% household heads had business and 14% had bicycles.

**Table 4.5:** The main assets found in Monze

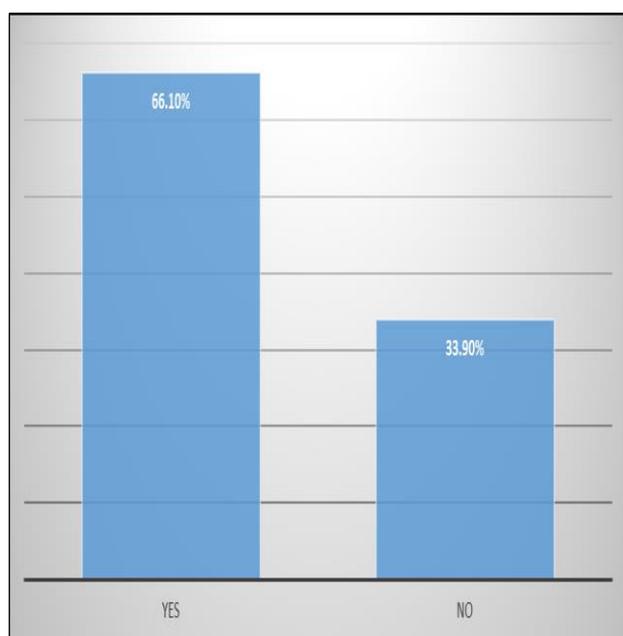
	Urban area	Rural areas near town	Remote rural areas
<b>Assets</b>	<b>Percentage</b>		
Houses	84.00%	73.00%	77.00%
Land	76.00%	67.00%	71.00%
Farm equipment	69.00%	62.00%	66.00%
Businesses	18.00%	32.00%	25.00%
Livestock	58.00%	51.00%	55.00%
Bicycles	7.00%	14.00%	9.00%

#### Dependency on Crop Farming in Monze

Figure 4.3 shows the dependency of crop farming in Monze district. The study found 66.1% (76) of the respondents depended on crop farming compared to 33.9% (39) that didn't depend on crop farming. The key informants stated that most people depend on crop farming due to poverty in the region since they cannot be able to access financial services such as loans from banks to start a business in the district. The key informants further stated that the high dependency of the household heads on crop farming is the cause of famine and poverty in Monze district since the district is prone to drought and when drought strikes it leads to famine and poverty since the residents have no other source of income.

Zambia being an agricultural based rural community, the available options in crop farming

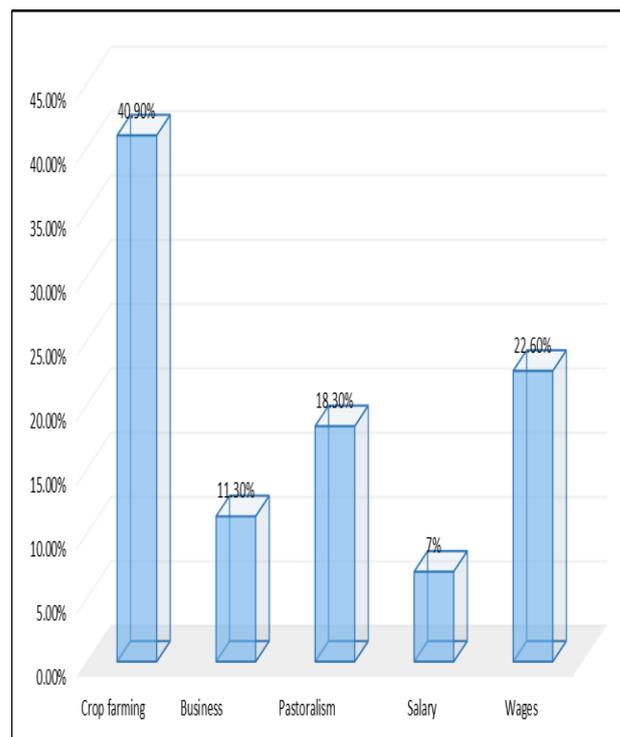
are adversely affected by a changing climate; small scale businesses and labor opportunities are the most probable alternative livelihood opportunities to reduce their vulnerability and enhance their resilience, though this is dependent on other socio-economic factors that might reduce on the opportunities that they would like to diversify.



**Figure 4.3:** Dependency on Crop Farming in Monze District

### Main Source of Household Income in the District

According to figure 4.4 on the main source of household income, the study requested the respondents to indicate the main source of household income, from the findings, it is clear that most of the respondents as shown by 40.9% (47) indicated the main source of income is crop farming, 22.6% (26) indicated the main source was wages which is also earning on farm lands, 18.3% (21) indicated pastoralism, 11.3% (21) indicated business while 7% (8) indicated the main source was salary.



**Figure 4.4:** Main Source of Household Income in the District

The key informants who were government officials, local and international NGOs and community based organizations stated that most people depend on crop farming due to poverty in the region since they cannot be able to access financial services such as loans from banks to start business in the district. Also most people in rural areas of Monze lack education and hence formal employment are skills to start a business. Zambia being an agricultural based rural community, the available options in crop farming are adversely affected by a changing climate; small scale businesses and labor opportunities are the most probable alternative livelihood opportunities to reduce their vulnerability and enhance their resilience, though this is dependent on other socio-economic factors that might reduce on the opportunities that they would like to diversify.

Besides farming being the main source of livelihoods, the data also shows that 98% of the households are into farming for family

consumption and or sale whilst only 8% indicated that they are doing farming for other reasons which may include the fact that others are doing it for traditional attachments. There is lack of diversity since 93.1% of the district rely on farming for both family consumption and for sale and also 81.3% depend on farming as a source of livelihood. The data for percentages of households depending on farming for consumption and or sale are shown in the table 4.6 below.

**Table 4.6:** The purpose of farming

Farming Purposes	Percentage
Farming for Consumption/sale	93.1%
Farming for other use	6.9%
<b>Total</b>	<b>100%</b>

#### 4.4 DROUGHT EFFECT ON FOOD SECURITY

##### Household Food Shortage Experience

From the table 4.7 below on whether the household experience food shortage, it was established that most of the respondents as shown by 66.1% (76) faced food shortage while only 33.9% (39) indicated they didn't face food shortage. This is an indication that the poverty level was high as most people faced food shortage and hunger this could be due to drought and infertility of the land. The key informants who were government officials, local and international NGOs and community based organizations indicated access to sufficient food is critical for households to hold together, lack of sufficient food at the household level eventually moves to the community and other higher levels of the society, which eventually leaves majority of the people without enough food to eat. As a consequence, the affected populations eventually resort to negative ways to cope, and this has a negative impact on the livelihoods of a

community, as more resources previously not meant for food are redirected to purchase food and leaving other equally important needs unmet.

**Table 4.7:** Household Food Shortage Experience

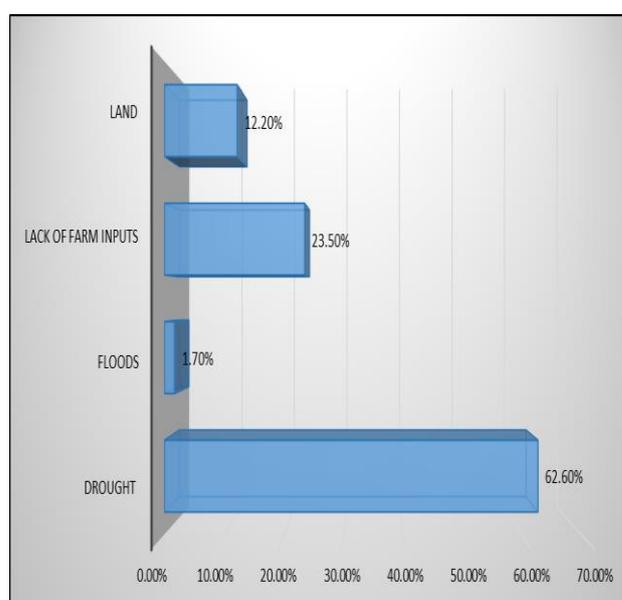
Response	Frequency(n)	Percentage (%)
Yes	76	66.1
No	39	33.9
<b>Total</b>	<b>115</b>	<b>100.0</b>

Source: Author, 2019

##### Reasons for Food Shortage in the District

From the figure 4.7 below on the reasons for food shortage, the study requested the respondents to indicate the reasons for food shortage, from the findings, it is clear that most of the respondents as shown by 62.6% (72) indicated it was due to drought, 23.5% (27) indicated lack of farm inputs, 12.2% (14) indicated shortage of land while 1.7% (2) indicated floods.

**Figure 4.7:** Reasons for Food Shortage in the District



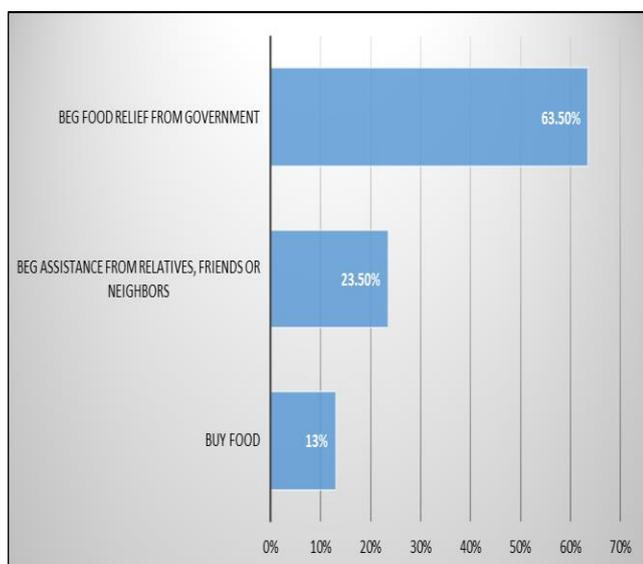
Source: Author, 2019

This is an indication that drought was the main cause of the food shortage hence there should be measures to conserve the environment hence

reduce drought and famine. The key informants who were government officials, local and international NGOs and community based organizations indicated that drought and famine has been the talk in the last decade in Zambia where the residents have suffered a lot from the disaster, there has been in reduction in food production leading which makes the lives of the residents difficult.

### Action taken in times of Food Shortage

Figure 4.8 below shows the action taken in times of food shortage, the study requested the respondents to indicate the action taken in times of food shortage, from the findings, it is clear that most of the respondents as shown by 63.5% (73) indicated they beg food relief from government, 23.5% (27) indicated they begged assistance from relatives, friends or neighbors, while 13% (15) indicated they bought food. This is an indication that most residents begged food in times of shortage hence there should be measures to conserve the environment hence reduce drought and famine.



**Figure 4.8:** Action taken in times of Food Shortage

## CONCLUSIONS

## AND

## RECOMMENDATIONS

### 5.0 OVERVIEW

This chapter consolidates all the arguments from chapter one to chapter four and shows the connection between the objectives in chapter one, the study of literature presented in chapter two and the results of data analysis in chapter four of the research. The extent to which the objectives were achieved will be outlined and concluded. Recommendations will suffice based on the conclusions guided by the findings or results.

### 5.1 DISCUSSION OF FINDINGS

#### Drought Effects on Household Income

The objective was to investigate the effect of drought on household income in Monze District. On the main source of household income, the study requested the respondents to indicate the main source of household income, from the findings, it is clear that most of the households responded that the main source of income is crop farming. The study also found that the majority of households have an average income of less than K500 per month. Research results above are justification for intervention during drought as they show that the community had too little to fall back on during drought. It is argued that farmers from rural communities who live from hand to mouth are likely to be the worst affected during droughts (Maphosa, 1994).

Furthermore, the majority practice farming for consumption and sale. This is an indication that the district depends heavily on farming as a source of income. Therefore, an overwhelming agreement to the statement that drought causes their income to reduce was expected, except for a few respondents who were either civil servants or working for NGOs. This supports Oxfam's (2011) report that the reductions in food production would have severe consequences most

directly for smallholder farmers and agropastoralists, who rely on farming for income, and for all those who purchase such crops.

The key informants who were government officials, local and international NGOs and community based organizations stated that most people depend on crop farming due to poverty in the region since they cannot be able to access financial services such as loans from banks to start business in the district.

Monze being an agricultural based rural community, the available options in crop farming are adversely affected by a changing climate; small scale businesses and labor opportunities are the most probable alternative livelihood opportunities to reduce their vulnerability and enhance their resilience, though this is dependent on other socio-economic factors that might reduce on the opportunities that they would like to diversify. This is in line with the research done by Tongyirwe et al (2019) who found that household income levels and land area of tenured farmers are key determinants to drought coping strategies and food security. But the result differs with Quiroga and Suárez (2016) whose results found that rural incomes could not suffer the most through agriculture losses but consumers' welfare being the most greatly affected by drought.

## **Drought Effect on Food Security**

The objective was to establish the effect of drought on food security in Monze. The study found that the majority of the households have experience food shortages with over 60% of the respondents. This is in line with the World Development Report (2010) which revealed that the overall impacts of climate change on agriculture are expected to be negative threatening global food security. Drought was the highest among the reasons given for having

experienced food shortages and followed by lack of farm inputs. In support of this, Huho (2010) study on severity of drought in Kenya concluded that droughts were the major threats to farming activities disrupting the inhabitants' livelihood sources. The alternative sources of livelihood sought by the farmers exacerbated drought severity due to environmental degradation they caused leading to a vicious cycle of endless poverty and food insecurity in the study area.

Majority of the households who experience food shortages look to the government for food relief. The key informants who were government officials, local and international NGOs and community based organizations indicated access to sufficient food is critical for households to hold together, lack of sufficient food at the household level eventually moves to the community and other higher levels of the society, which eventually leaves majority of the people without enough food to eat. As a consequence, the affected populations eventually resort to negative ways to cope, and this has a negative impact on the livelihoods of a community, as more resources previously not meant for food are redirected to purchase food and leaving other equally important needs unmet.

## **Role of government and NGOs in mitigating Drought effects on rural livelihood in Monze**

The objective was to assess the role of government and other stakeholders in mitigating the effects of drought in Monze District. The study found that there are organizations who have worked in the district to address the climate challenge which include drought. This concurs Masendeke & Shoko (2014) who indicated that assistance from outside the communities is in the form of Government assistance through programmes like food for work, public works projects, supplementary feeding schemes, food aid

The study found that both the government and NGOs address the climate change and a few private companies and individuals. It is also discovered that majority of the households have benefited from the service provided by the government. The results indicate that education and training is most benefited service by households in Monze District followed by Agricultural inputs. This is in line with Mushore, et al., (2013) who state that food aid has been a very popular drought mitigation strategy across the world where the majority of the households receive food hand-outs during times of drought due to serious food shortages.

On the success side, the study found that the organizations have supported the community in coping with drought through various measures such as conducting forum and sensitizing the locals on the need of conserving the environment through planting of trees and eliminating deforestation which is a major cause of drought. The organizations have also built boreholes to the locals to increase the water content for the community where the residents can irrigate their lands. This concurs with the report by Shamano, (2010) on which indicated FEWSNET) is one of the initiatives of USAID which covers 17 countries in the Sub-Saharan Africa. FEWSNET provides a range of information products, tools and services intended to strengthen the abilities of the countries and regional organizations to manage threats of food security through the timely provision of information, and analytical early warnings as well as vulnerability status.

The key informants who were government officials, local and international NGOs and community based organizations indicated that in coping with drought the residents have empowered the residents to grow drought resistant crops which can cope under harsh weather conditions. The organizations further strengthen the need for diversification of income generating activities and livelihood strategies for

households and communities living in Monze, in situations with limited income generating opportunities, it is usually a vulnerable households limited productive assets" that are at the greatest risk from the negative impacts of drought.

## **5.2 CONCLUSION**

The study also concludes that most household heads in Monze depend on crop farming as a source of income. The study also concludes that drought was the main cause of food shortage in the district of which the majority of the households depend on crop farming as their main source of income. From the study it was concluded that majority of the households in the district are under a low income bracket which is highly determined by the level of harvest. Many households in rural Monze do not farm for commercial purposes but are able to sell surplus on a good harvest year. According to the first objective on the effect of drought on household income, the study concludes that drought significantly affects the income levels of households.

In terms of food security, the study concludes that drought is the major reason for food shortage in rural Monze with the Majority of households having experienced food shortages recently due to drought. Food shortage leaves majority of households looking to government for food relief. The study also concludes that the presence of NGOs in the district has been felt more by the residents in addressing the issue of climate change than the government of which the majority of the households say has been beneficial.

The study also concludes that the organizations have supported the district in coping with drought through various measures such as conducting forums and sensitizing the locals on the need of conserving the environment through planting of

trees and eliminating deforestation which is a major cause of drought. The organizations have also built boreholes and dams for the locals to increase the water content for the community. In coping with drought the residents have been empowered to grow drought resistant crops which can cope under harsh weather conditions. The institutions have also requested the residents to diversify their income through engaging in other income generating activities. In the same vein the study concludes that the services provided by the government and other stakeholders has been effective.

### **5.3 RECOMMENDATIONS**

The farmers in Monze should be encouraged to diversify their income generating activities since high dependency in crop farming leads to losses and increased poverty in times of drought as majority of the residents have no other source of income for their livelihood. The farmers should be encouraged to grow drought resistance crops such as sorghum and millet which are not prone to drought and this will reduce famine in the region. The government and both the local and international NGOs should put in place various measures to mitigate drought in the region by enhancing opportunities for small scale irrigation, water harvesting and the construction of more boreholes and dams in the region. The community should be educated on the importance of trees to the environment. The community should be discouraged from cutting down trees for firewood and given other options like biogas production or solar power generation. The government should encourage parents on the importance of education. Education will provide opportunities in the future for their children. Parents can enroll in adult education programs that are available in the region. The government of Zambia should promote the formation of local rural institutions and farmer groups. This will help in educating farmers on fertilizers, seed

varieties, crop diversification and also livelihood diversification and the development of community drought early warning systems.

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## 1.13 REFERENCES

- [1] Adhikari, Umesh, Nejadhashemi, A Pouyan, Woznicki, Sean A., (2015). "Climate change and Eastern Africa: a review of impact on major crops. *Food and Energy Security* 4 (2), 110–132. <https://doi.org/10.1002/fes3.61>.
- [2] Bauman, A., Geomans, C., Pritchett, J. & McFadden, D. T., (2013). Estimating the Economic and Social Impacts from the Drought in Southern Colorado. *Journal of Contemporary Water Research & Education*, August, Issue 151, pp. 61-69.
- [3] Chimes, Art. (March, 2007) U. S. Educators Face Challenges in Teaching Climate Change. *Voice of America*.
- [4] Bhandari P. B. (2013). Rural livelihood change? Household capital, community resources and livelihood transition. *Journal of Rural Studies*, Vol. 32, pp.126–136. <https://doi.org/10.1016/j.jrurstud.2013.05.001>
- [5] 7. Deressa, T.R.M.H., Alemu, T., Yesuf, M., Ringler, C., (2008). Analyzing the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia. *Intl Food Policy Res Inst*.
- [6] Dyson, Freeman J. Freeman Dyson. Retrieved from: <http://www.sns.ias.edu/~dyson/> Gore, A. (2006). *An Inconvenient Truth*. New York: Rodale Press. Intergovernmental Negotiating Committee for a Framework Convention on Climate Change. United Nations Framework Convention Climate Change.
- [7] DFID (1999). Sustainable Livelihoods Guidance Sheets. Department for International Development (DFID), UK. Available at <http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf>.
- [8] Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford University Press, Oxford, UK.
- [9] Filho, L., Mannke, F., (2012) Key themes of local adaptation to climate change: results from mapping community-based initiatives in Africa. In: *Experiences of Climate Change Adaptation in Africa*. Springer, Berlin Heidelberg.
- [10] Fleshman, M. (2007). Climate change: Africa gets ready. *Africa Renewal* 21/2.
- [11] Gono, G., (2005). *Drought Mitigation and Resuscitation Policies for the Agricultural Sector in Zimbabwe*, Harare: Reserve Bank of Zimbabwe.
- [12] GLOPP (2008). DFID's Sustainable Livelihoods Approach and its Framework. Globalization and Livelihood Options of People living in Poverty (GLOPP). Available at [www.glopp.ch/B7/en/multimedia/B7\\_1\\_pdf2.pdf](http://www.glopp.ch/B7/en/multimedia/B7_1_pdf2.pdf)
- [13] Gukurume, S., (2013). CLIMATE CHANGE, VARIABILITY AND SUSTAINABLE AGRICULTURE IN ZIMBABWE'S RURAL COMMUNITIES. *Russian Journal of Agricultural and Socio-Economic Sciences*, 2(14), pp. 89-100.
- [14] IFPRI, (2009). *The Impact of Climate Variability and Change on Economic Growth and Poverty in Zambia*
- [15] Kaseke, N., Volume 2, No.10, October (2013). Emergence Of Electricity Crisis In Zimbabwe, Reform Response And Cost Implications. *Journal of Business Management & Social Sciences Research (JBM&SSR)*, October, 2(10), pp. 1-16.
- [16] Kinsey, B., Burger, K. & Gunning, J. W., (1998). Coping with Drought in Zimbabwe: Survey Evidence on Responses of Rural Households to Risk. *World Development*, 26(1), pp. 89-110.
- [17] Knowler, Duncan, Bradshaw, Ben, (2007). "Farmers' adoption of conservation agriculture: a review and synthesis of recent research. *Food Policy* 32, 25–48. <https://doi.org/10.1016/j.foodpol.2006.01.003>.
- [18] Kumar, R., (2011). *Research Methodology: A step-by-step Guide for Beginners*. Third. ed. London: SAGE.
- [19] Masendeke, S. & Shoko, K., (2014). Drought Coping Strategies and Their Effectiveness: The Case of Ward 12 in Mberengwa District Zimbabwe. *International Journal of Social Science Studies*, January, 2(1), pp. 137-152.

- [20] Mertz, Ole, Æ Cheikh Mbow, Æ Anette Reenberg, (2009). "Farmers' perceptions of climate change and agricultural adaptation strategies in rural sahel. *Environmental Management* 43, 804–816. <https://doi.org/10.1007/s00267-008-9197-0>.
- [21] Mfitumukiza, David, Bernard, Barasa, Aringaniza, Ingrid, (2017a). Determinants of agro-forestry adoption as an adaptation means to drought among smallholder farmers in nakasongola DIstrict, Central Uganda. *Afr. J. Agric. Res.* 12 (23), 2024–2035.
- [22] Mfitumukiza, David, Bernard, Barasa, Emmanuel, Ntale, (2017b). Ecosystem-based adaptation to drought among agro-pastoral farmers: opportunities and constraints in nakasongola district, Central Uganda. *Environ. Manag. Sustain. Dev.* 6 (2), 31–50.
- [23] Phalkey, Revati K., Aranda-Jan, Clara, Marx, Sabrina, Hofle, Bernhard, Sauerborn, Rainer, (2015). Systematic Review of Current Efforts to Quantify the Impacts of Climate Change on Under nutrition. PNA, no. July: 4522–29.
- [24] Rahn, Eric, Vaast, Philippe, Läderach, Peter, van Asten, Piet, Jassogne, Laurence, Ghazoul, (2018). Exploring adaptation strategies of coffee production to climate change using a process-based model. *Ecol. Model.* 371, 76–89 ISSN 0304–3800.
- [25] Robeyns, Ingrid, (2005). "The capability Approach: a theoretical survey the capability approach: a theoretical survey. *Hum. Dev.* 6 (1), 93–114. <https://doi.org/10.1080/146498805200034266>.
- [26] Rosegrant, Mark W., Cline, Sarah A., (2003). "Global food Security: challenges and policies. *Science* 302 1917–19. <https://doi.org/10.1126/science.1092958>
- [27] Sabiiti, G., Mwalichi, I.J., Ogallo, L.A., Ouma, J., Artan, G., Basalirwa, C., Opijah, F., Nimusiima, A., Ddumba, S.D., Mwesigwa, J.B., Otieno, G., Nanteza, J., (2018). Adapting agriculture to climate change: suitability of banana crop production to future climate change over Uganda. In: Leal Filho, W., Nalau, J. (Eds.), *Limits to Climate Change Adaptation*. Climate Change Management. Springer, Cham.
- [28] Sen, Amartya, (2004). Capabilities, lists, and public reason: continuing the conversation. *Fem. Econ.* 10 (3), 77–80. <https://doi.org/10.1080/1354570042000315163>.
- [29] Scoones, I. (1998). Sustainable rural livelihoods: A framework for analysis. IDS Working Paper 72. Institute of Development Studies (IDS), Brighton, UK. Available at <http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/3390/Wp72.pdf?sequence=1>
- [30] Sidewinder 77. (2007, April 15) Freeman Dyson on Global Warming 2 of 2 Stratospheric Cooling. Video posted to: <http://ca.youtube.com/watch?v=k69HUuyI5Mk> Singer, S. Fred, and Avery, Dennis T. (2007) Unstoppable Global Warming-Every 1,500
- [31] Smit, B. and Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Glob. Environ. Chang.* 16, 282–292. <https://doi.org/10.1016/j.gloenvcha.2006.03.008>.
- [32] Sneider, C., Golden, R., Gaylen, F. (2007) *Global Systems Science- Climate Change*. Berkeley: The Regents of the University of California.
- [33] Solh, M. & van Ginkel, M., (2014). Drought preparedness and drought mitigation in the developing world's dry lands. *Weather and Climate Extremes*, 5 April, Volume 3, pp. 62-66.
- [34] Soon, W. (2005) Variable Solar Irradiance as a Plausible Agent for Multidecadal Variations in the Arctic-Wide Surface Air Temperatures of the Past 130 Years. *Geophysical Research Letters*, No. 32, American Geophysical Union.
- [35] STOTT, C., (2014). An Examination of the Least Developed Countries in the IPCC AR5 WGII. IIED Issue Paper. IEED, London.