

The effects of drought on small scale beef cattle farmers in Ba-Phalaborwa
Municipality, Limpopo Province

By

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Mini-Dissertation

Submitted in partial fulfilment of the requirements for the degree

Of

MASTERS

In

BUSINESS ADMINISTRATION

In the

Faculty of Management & Law
Turfloop Graduate School of Leadership
University of Limpopo
South Africa

Supervisor: Professor M Kanjere
2018

DECLARATION

I declare that this dissertation is my own work, unaided work and that all the sources that I have cited have been acknowledged by means of complete references. It is being submitted for the Degree in Master of Business Administration in the University of Limpopo TGSL. It has not been submitted before for any degree or examination in any other University.

Gudluza Shalati Rebecca

Date

Dedication

To my guardian angels my late mother Alona Metse, my late father Mphakati Silas Gudluza and my late brother Walter John Gudluza who taught me that an investment in knowledge pays the best interest, however they never lived to see my work.

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation and thanks to the Lord Almighty, the God of Abraham, Isaac, Jacob and the God of my spiritual father Prophet Shepherd Bushiri for the wisdom, strength, courage, opportunity and provision to complete this study. I fully understand and accept that without Him this responsibility would have never been a success. Surely those who walk with the Lord will reach their destination. Proverbs 16:3 “commit to the Lord whatever you do and your plans will succeed”. Recognition and acknowledgement should also be directed to the following people and organisations that assisted and walked with me the path towards completion. It was not easy, but with your constant support and encouragement I persevered and worked to the best of my abilities:

- I wish to express my sincere gratitude to my supervisor Prof M Kanjere for the motivation, guidance, support, patience, advice, and contribution throughout my study period.
- The study would not have been successful without the support of the municipal Deputy Director Mr Vincent Machaba, the assistant director Mrs Fanisa Mushwana, the animal scientist Mr Musa Kabini and the Animal Health technician Mr Dominic Rikhotso.
- This work wouldn't have been possible without the participation of Lulekani A and B livestock farmers, without you this study wouldn't have been possible.
- Mr Ishmael Baloyi who was instrumental in analysing my research data, thank you.
- Honestly, the acknowledgement will be incomplete without featuring my lovely fiancé Vonani and our children Nkuriso and Ndzalo who endured long days and hours without their Mother who was trying to compile this work into a readable piece, I love you and you're my greatest inspiration.
- I want to acknowledge the support and encouragement from the Gudluza's my special mom, my brothers and my sister and everyone who supported me in this journey.
- Lastly, to our new born baby Ngalava “the Ark of Gods glory” I love you in a great way, may follow my footsteps and outdo me.

ABSTRACT

This article investigates the effects of drought on small scale beef cattle farmers of Ba-Phalaborwa Municipality in Limpopo Province. Drought and its financial implications have caused critical problems to small scale farmers especially beef cattle farmers in the municipality. Most rural households depend on agriculture as their source of food and income. Agriculture thus plays a prominent role in the stability of rural communities. Drought is a factor that affects farmers not only during the drought season, but also the following season as the previous year's reduced profits influence the next seasons spending. The changes in price of input commodities the season after drought also affect farmer's decisions.

The main objective of the study was to investigate the effects of drought on small scale beef cattle farmers in Ba-Phalaborwa municipality in Limpopo province. 25 Small scale livestock farmers from Lulekani A and B village in Ba-Phalaborwa municipality were randomly selected to participate in the study. The quantitative study applied a survey design and primary data were collected using open and close ended questionnaires.

The findings of the study revealed that drought is a major concern for livestock farmers and the agricultural sector at large, resulting in high loss of livestock due to mortality and enforced sales. Furthermore, due to the devastating effects of drought farmers responses were characterized by the increased reliance on the Department of agriculture and rural development in the form of drought relief.

It is therefore recommended that the country needs to prepare for this natural phenomenon and the key to drought preparedness and readiness is about knowing the what, how and when of the drought. To achieve this goal the scientific expertise to monitor and predict, the capability of the observation networks, information systems for drought early warning have to be improved. Furthermore, the provision of financial assistance to address long-term developmental needs (such as investment in water infrastructure and water-harvesting techniques) of the farming community, thereby improving their resilience, may prove more beneficial in the long run than short-term drought relief assistance in the form of fodder supply.

Key words: Ba-Phalaborwa, drought, small scale livestock farmers,

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ACRONYMS

BPM	Ba-Phalaborwa Municipality
CODESA	Conference for a Democratic South Africa
DAFF	Department of Agriculture, Forestry and Fisheries
DMP	Disaster Management Policy
FAO	Food and Agriculture Organization
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
HMNDP	High level Meeting on National Drought Policy
IPCC	Intergovernmental Panel on Climate Change
ITK	Indigenous Technical Knowledge
LDARD	Limpopo Department of Agriculture and Rural Development
MDMC	Municipal Drought Management Centre
NDPC	National Drought Policy Commission
NDMC	National Disaster Management Centre
PDMC	Provincial Disaster Management Centre
SADC	Southern African Development Community
UNCCD	United Nation Convention to Combat Desertification
WMO	World Meteorological Organization

Chapter 1: Contextual background of the study

1.1 Introduction

In this chapter the definition, overview and effects of drought on small scale beef cattle farmers in Ba-Phalaborwa municipality is outlined. The problem statement is formulated and objectives of the study are stated. The justification of the work is discussed while the research questions, objectives and limitations are outlined.

Droughts are a frequent occurrence in South Africa's arid and semi-arid rangelands and can have severe economic consequences (Vogel, 1994). Limpopo province is in a semi -arid with low, unreliable rainfall (LDARD, 2015). The impact of lower rainfall has negative effects on the agricultural sector, low rainfall resulting in decreases in agricultural activities, loss of cattles and shortage of drinking water. Limpopo province is one of South Africa's richest agricultural sector.

Drought is emerging as one of the main challenges Limpopo province cattle farmers will have to face for many years to come. There are different types of drought meteorological, agricultural, hydrological and socio-economic drought. According to South African Weather Services any amount of rain less than 75% of annual rainfall constitutes a meteorological drought (SAWS, 2016).

In farming the impact of drought eventually reflects in death of cattles and this leads to decline in food production, increase in food prices and higher cost for food importation. Agriculture is an important sector for South Africa's economy as it has major implications on job creation, rural development, food security and foreign exchange.

Droughts also have a major negative influence on the agricultural share of the country's GDP due to the effects on rain-fed agricultural production (Vogel, Laing and Monnik, 2000). Ba-Phalaborwa municipality has been declared a foot and mouth zone and beef cattle's from this area are not allowed to areas that are Foot and mouth disease free. Cattle farmers around Lulekani village in BPM can only sell their animals as live animals in infected areas and as carcass in FMD free areas.

1.2 Problem Statement

Drought and its economic impact have been causing critical problems to small scale cattle farmers in BPM Lulekani village. Most rural households depend on agriculture as their source of food and income. Agriculture thus plays a prominent role in the stability of rural communities.

Drought is a factor that affects farmers not only during the drought season, but also the following season as the previous year's reduced profits influence the next seasons spending. The changes in price of input commodities the season after drought also affect farmer's decisions. Improving the economic stability and reducing the effects of drought can lessen the concern of farmers over diminished profits.

Drought causes an increase in debt and an incapacity to gain further credit as subsidies to farmers in debt have also decreased. Emergency measures for farmers during drought have changed and the potential for self-employment among rural farmers has decreased (Benson and Clay, 1998). However, beef cattle farming industry is becoming more concentrated as large commercial farmers dominate, and small scale farmers are succumbing to their vulnerability to drought. Beef cattle farmers in Lulekani village have been forced to reconsider their options about beef production because of drought.

1.3 Research Questions/Hypothesis

Research questions of the study among others include the following:

- What are the effects of drought on small scale beef cattle farmers in Ba-Phalaborwa Municipality in Limpopo province?
- What are the financial implications of drought on small scale beef cattle farmers?
- How can the mitigation strategies of drought be developed?

1.4 Objectives

Objectives of the study among others include the following:

- To investigate the effects of drought on small scale beef cattle farmers in Ba-Phalaborwa municipality in Limpopo province
- To assess the financial implications of drought on small scale beef cattle farmers
- To develop mitigation strategies for drought

1.5 The aim of the study

To mitigate the economic harm affecting small scale farmers in beef cattle production during drought period in BPM.

1.6 Motivation/Rationale of the study

Global warming is becoming serious economic consequences and poses an increasing challenge to small scale beef cattle farmers. Limpopo province is a drought prone province which faces challenges of drought from time to time. As a result of severe drought, the province especially Mopani district experienced reduced grazing and water for livestock which negatively impacted the agricultural sector, farmers and their economic status.

The study will close knowledge gap on how small scale beef cattle farmers can mitigate the effects of drought and its economic impact. Therefore there is a need for this study to evaluate the contribution of drought in small scale beef cattle farming to the income of small scale beef cattle farmers in Lulekani village of BPM.

1.7 Significance of the study

This study intended to investigate the effects of drought and its economic impacts on small scale beef cattle farmers of Lulekani village in BPM. Furthermore, the study will make a significant contribution on how Ba-Phalaborwa farmers can prepare themselves economically before drought and mitigate the effects of drought thereafter.

The study will be of great efforts making recommendations which will assist cattle farmers to deal with the loss associated with drought. The trial will contribute in reducing the economic detrimental effects, poverty alleviation and improving beef production for the small scale farmers in South Africa.

Based on the outcome of the study farmers will be able to make informed decisions economically and before drought. Lastly, this research is of outmost importance because it can form part of educational significance as it can be utilized to form a journal which can be used for academic purposes and recommendations made at the end of the study can prompt other researchers to further extend on this research to investigate other effects of drought.

1.8 Definition of concepts

Some of the concepts used in this study include the following:

Drought is a period of abnormally dry weather sufficiently prolonged for the lack of precipitation relative to what is expected that, when extended over a season or a longer period of time, results in the inability to meet the demands of human activities and the environment (Hayes et al., 2011).

Beef cattle are cattle raised for meat production (LDARD, 2015).

Mitigation refers to the measures taken well in advance of a hazard to minimize the severity or impacts of disasters as well as vulnerability to an expected event.

Small scale farmers are often equated with a backward, non-productive, non-commercial, subsistence agriculture that we find in parts of the former homeland areas (Johann, 1998).

1.9 Ethical considerations

Since the study will investigate the effects of drought and its financial implications on small scale beef cattle farmers in Ba-Phalaborwa Municipality, the researcher intends getting consent from the tribal authority and livestock farmers committee to carry out the study. It is also the intention of the researcher to assure all participants in the study that the information obtained from them shall be treated with confidentiality and that their names shall not be mentioned and that they have every right to withhold their identities.

1.10 Research limitations and delimitations

No study can be so perfect without shortcomings. Every study has its own limitations. According to Pajares (2006), a limitation identifies potential weaknesses of the study. The possible limitation to my study is that most farm owners are not always available in the farms, they have herd men or farm workers whom take care of the cattle's, and they may not be available during the survey.

1.11 Organisation of the report

Outline of the dissertation:

The research will comprise of 5 chapters outlined as follows:

Chapter 1

This chapter shall include Introduction and background of the study. It will also contain aim, objectives and methodology followed to conduct this research.

Chapter 2

This chapter shall include Literature Review. The review shall cover all the contextual definitions related to effects of drought and its financial impacts. It will further review internal and national experiences in effects of drought and its financial impact.

Chapter 3

This chapter shall comprise of Research Methodologies. This chapter gives a detailed approach on how data was collected and methods used to analyse these data.

Chapter 4

This chapter shall contain the research data analysis, results and discussion of such results. This chapter will show details of interpretation of the results and its discussion.

Chapter 5

This chapter shall include conclusion of the research and recommendations made thereof. It will also provide the way forward of the entire study.

1.12 Conclusion

Drought is a natural hazard of South Africa's climate, and it is expected to worsen with climate change projections. Therefore, the country needs to prepare for this natural

phenomenon. Drought is considered by many to be the most complex, but least understood of all natural hazards, affecting more people than any other hazard. It is a normal recurring feature of climate and occurs in virtually all climatic regions.

Drought is the consequence of a natural reduction in the amount of precipitation received over an extended period of time, but other climatic factors such as high temperature and wind can significantly aggravate the severity of the event. It has adverse social, economic and environmental impact that can lead to overall reduction in GDP, food security and water sources.

Small holder farmers and all farmers at large are giving up farming or diversifying their sources of income in the face of economic and climatic uncertainty, reducing the diversity of livelihood options among poorer and emerging farmers reduces their ability to cope with drought (Shackleton, Shackleton and Cousins, 2000).

Small holder farmers should master the key to drought preparedness and readiness by knowing the what, how and when of drought. These will mitigate some of the effects that come with the drought disaster. However, for them to master these the scientific expertise must ensure that the observation networks and information systems for drought early warning are improved.

Chapter 2: Literature review

2.1 Introduction

This chapter reviews the concepts of drought, drought characteristics, global perspectives of drought and its causes. It further unpacks the government legislations and policies on drought in South Africa. Moreover, the drought declared areas in the country are revealed and finally the Government drought management and mitigation strategies in SA are outlined.

Droughts have major and long lasting effects on the agricultural sector of South Africa. Agriculture is an important sector for the South African economy as it has major implications for job creation, rural development, food security and foreign exchange (National treasury, 2014). Commercial farming is the dominant performer in the agricultural sector, but small and emerging farmers also play a crucial role. These farmers have a robust impact on poverty alleviation, job creation and food security in rural areas (National treasury, 2014).

The management and mitigation of drought in South Africa has become a main concern for the government (DAFF, 2015). The Government has a crucial role in the management and mitigation of drought as the policies they implement have great consequences for the agricultural community. Managing drought effectively is key in the process of reducing the harmful effects of drought on vulnerable communities (Washington and Downing, 1999). Most rural communities depend on farming as their only source of income and thus when drought occurs these communities suffers the most. Early warning systems need to be improved as a valuable means of preparing for drought (Clay et al., 2003). The white paper on Agriculture began the change to improving the way droughts are managed in the country as the focus shifted from relief to prevention and mitigation (Van Zyl, 2006).

Drought management can improve the monitoring of water quality and veld condition to assist in the preparation and control of future droughts. Measures that could be considered to manage drought include a better understanding of the nature of drought and the improvement and use of existing agricultural and development structures to

maintain a drought plan. Engaging farmers and rural communities to organise themselves in times of droughts by means of farmers days, capacity building, public awareness campaigns, information provision and agricultural extension and advisory services are also effective drought management measures (Vogel, 1994).

Drought is the most important natural disaster in southern African in economic terms (Buckland, Eele and Mugwara, 2000). The effect that an event, policy change or market trend will have an economic factor such as interest rates, consumer confidence, stock market activity or unemployment. Natural disasters such as drought can have a significant economic impact due to the way that they affect business activities (Clay, Bohn, Blanco de Armas, Kabambe and Tchale, 2003).

South Africa has been overwhelmed recently by extended periods of severe droughts resulting in extensive economic consequences (Wilhite, 2012). Drought has primary and secondary effects on domestic or national economy. Primary impacts include decrease in agricultural production, hydroelectric power generation, water intensive non-agricultural production (processing), and domestic availability of water, which has health implications, whereas secondary impacts are those that affect GDP e.g. decrease in industrial output may lead to inflation and lay-off of labour, which increases unemployment. These factors reduce demand, expenditure, savings and GDP.

The economic impacts faced by livestock farmers are increased prices for farming commodities, increased transport costs, sale of livestock at reduced market price, expensive imports, loss of jobs, deepening poverty, reduction of livestock quality, reduction of economic development, increased capital shortfall, increased debt and bad credit record (Vogel, Laing and Monnik, 1999).

2.2 Concept of Drought

Most definitions of drought indicate that it should be observed with regional bias, since water supply is largely a function of climatic regimes, and drought impacts should be perceived as dynamic effects resulting from the interaction between supply and demand for water.

Drought has numerous definitions, however the simple may be the shortage of rainfall over an extended period of time, usually a season or more. Drought is usually considered relative to some long-term average condition, or balance, between precipitation, evaporation, and transpiration by plants. An inequity could result from a decrease in precipitation, an increase in evapotranspiration or both.

According to the NDMC (2011), drought is an economically important hazard for many countries. Agriculture, livestock, forestry, energy, industry and water sectors are mostly at risk from drought.

Furthermore, Wilhite (2005) defines drought as a weather-related phenomenon that reveals the natural variability of the climate system. Drought is prospective in almost all regions of the world, regardless of precipitation or temperature regimes. Droughts are slow onset, spatially widespread, events that can affect regions for weeks, months or years. Due to these characteristics droughts are often considered the most complex of all natural hazards to understand and analyse (Wilhite et al., 2007).

There is no single, universal definition of drought as definitions can vary depending on the subjective views of the user and the particular regions, impacts and sectors being assessed (Wilhite, 2005). The Intergovernmental Panel on Climate Change define drought as a prolonged absence or noticeable deficiency of precipitation, a deficiency that results in water shortage for some activity or for some group, or a period of abnormally dry weather sufficiently prolonged for the lack of precipitation to cause a serious hydrological imbalance (IPCC, 2007, P261).

Moreover, the International for Disaster Reduction (ISDR, 2010) defined drought as a normal, recurring feature of the climate that occurs almost in all climatic regimes in high as well as low rainfall areas. It is a temporary deviation, in contrast to aridity, which is a permanent feature of the climate restricted to low rainfall areas (Wilhite, Hays and Knutson, 2005).

Drought is commonly defined as a lack of rainfall over an extended period, usually a season or more, relative to some long-term average condition. History suggests that severe and extended droughts are predictable and part of natural climate cycles.

While forecast technology and science have improved, regional predictions remain limited to a few months in advance.

Kurnaz (2014) further define drought as a natural event that occurs when the amount of rainfall is significantly less than normal, causing severe hydrological imbalances that negatively affect land resources and production systems. Alston and Kent (2004) argue that various definitions point to meteorological (problematic weather patterns), hydrological (lack of rain), agricultural (low commodity production) and / or socioeconomic (low incomes and social consequences) explanations. They suggest that it is drought's impact on people and their activities that is the important feature and therefore they define drought as a deviation between demand and supply for water. Furthermore, they suggest that the increase in the break-even positions for farmers and therefore the demand for higher yields and the spread of farming to more marginal country results in the mistaken impression that droughts are increasing.

Drought is an unescapable natural hazard and the adverse effects penetrate many areas of society such as land quality, area planted both for local consumption and for export purposes, food imports, labour supply and rural poverty (Glantz et al., 1997). Interdependent socio-economic conditions such as price increases are then revealed as the drought gradually deteriorates. Drought can thus be defined as an exogenous supply-side shock that generally causes sharp declines in agricultural output, export earnings, employment and income levels (Glantz et al., 1997). Figure 2.2 shows how these impacts spread throughout the economy by means of sectoral linkages and multiplier effects. The drought impacts stem from a combination of factors, as illustrated in Figure 2.2. An increase in rainfall variability is one aspect, but how this affects communities and nations depends upon how well people, the economy and the environment can cope.

Impacts of drought

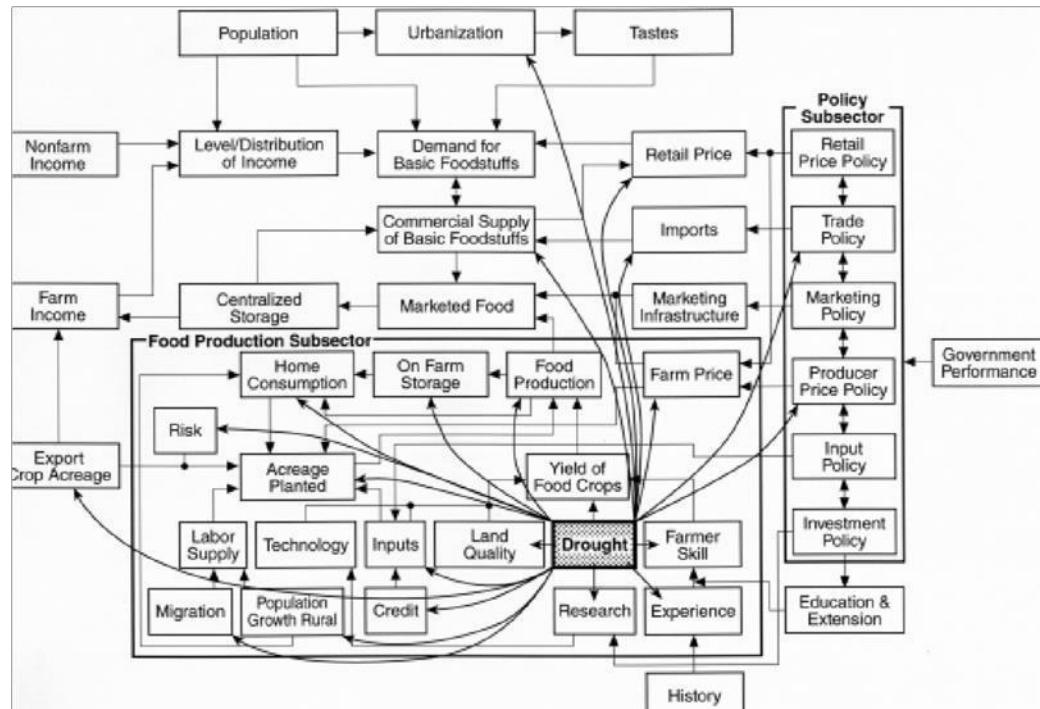


Figure 2.2 The impacts of drought spread through all facets of the economy due to the close sectoral linkages (Glantz et al., 1997, P89).

2.3 Characteristics of drought

There are four perspectives on drought: meteorological, agricultural, hydrological and socioeconomic. Meteorological drought is usually defined by the measure of the departure of precipitation from the normal and the duration of the dry period. Agricultural definitions refer to situations in which the moisture in the soil is no longer sufficient to meet the needs of the crops growing in the area. Hydrological drought deals with surface and subsurface water supplies (such as stream flow, reservoir/lake levels, ground water). Lastly socio-economic drought refers to the situation that occurs when economic goods associated with the elements of meteorological, agricultural and hydrological drought fail to meet the demand (Bang and Sitango, 2003).

Furthermore, according to Wilhite (2000) there are four basic approaches to measuring drought namely: meteorological, hydrological, agricultural, and socioeconomic. The first three approaches deal with ways to measure drought as a physical phenomenon, however the last measure deals with drought in terms of supply

and demand, tracking the effects of water shortfall as it ripples through socioeconomic systems.

Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. Definitions of meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.

Characteristics of drought

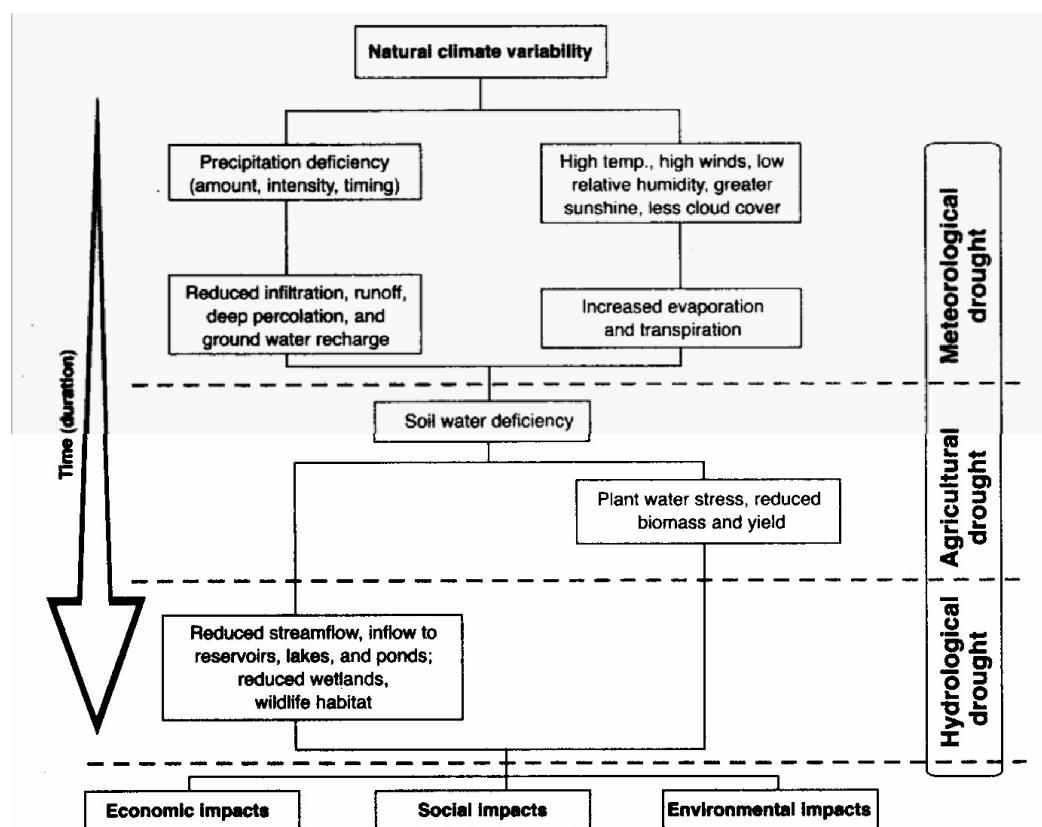


Figure 2.3The characteristics of the various drought types and how they are related to each other, as well as the different impacts of drought, over time (Wilhite, 2000, P10).

For example, some definitions of meteorological drought identify periods of drought on the basis of the number of days with rainfall less than some specified threshold. This measure is only appropriate for regions characterized by a year-round precipitation

regime such as a tropical rainforest, humid subtropical climate, or humid mid-latitude climate. Examples are locations such as Manaus, Brazil; New Orleans, Louisiana (U.S.A.); and London, England. Other climatic regimes are characterized by a seasonal rainfall pattern, such as the central United States, northeast Brazil, West Africa, and northern Australia. Lengthy periods without rainfall are common in Omaha, Nebraska (U.S.A.); Fortaleza, Ceará (Brazil); and Darwin, Northwest Territory (Australia), and a definition based on the number of days with precipitation less than some specified threshold is unrealistic in these cases. Other definitions may relate actual precipitation withdrawals to average amounts on monthly, seasonal, or annual time scales.

Agricultural drought is associated with various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on rainfall shortages, differences between actual and potential evapotranspiration, soil water shortages, reduced groundwater or reservoir levels, and so forth. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought should be able to describe the variable vulnerability of crops during different stages of crop development, from emergence to maturity. Poor topsoil moisture at planting may hinder germination, leading to low plant populations per hectare and a reduction of final yield. However, if topsoil moisture is adequate for early growth requirements, shortages in subsoil moisture at this early stage may not affect final yield if subsoil moisture is filled as the growing season progresses or if rainfall meets plant water needs.

Hydrological drought is associated with the effects of periods of rainfall (including snowfall) shortages on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, groundwater). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a shortage of rainfall, hydrologists are more concerned with how these shortages perform through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes long for rainfall shortages to show up in components of the hydrological system such as soil moisture, streamflow, and groundwater and reservoir levels. As a result, these impacts

are out of phase with impacts in other economic sectors. Moreover, a rainfall shortage may result in a rapid reduction of soil moisture that is immediately evident to agriculturalists, but the impact of this shortage on reservoir levels may not affect hydroelectric power production or recreational uses for many months. Also, water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, wildlife habitat), further complicating the sequence and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly.

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is plenty in some years but unable to meet human and environmental needs in other years. Furthermore, socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortage in water supply. For example, in Uruguay in 1988–89, drought resulted in significantly reduced hydroelectric power production because power plants were dependent on streamflow rather than storage for power generation. Reducing hydroelectric power production required the government to convert to more expensive (imported) petroleum and implement stringent energy conservation measures to meet the nation's power needs.

In most instances, the demand for economic goods is increasing as a result of increasing population and per capita consumption. Supply may also increase because of improved production efficiency, technology, or the construction of reservoirs that increase surface water storage capacity. If both supply and demand are increasing, the critical factor is the relative rate of change. Is demand increasing more rapidly than supply? If so, vulnerability and the incidence of drought may increase in the future as supply and demand trends converge.

While drought is widely considered a natural and physical event, it has some social component. The risk associated with drought for any region is a product of both the exposure to the event and the vulnerability of the society to the event (Wisner et al., 2004; Wilhite, Hays and Knutson, 2005). Exposure to drought varies spatially and there is little, if anything, that can be done to alter the probability of its occurrence yet vulnerability on the other hand, is determined by social factors such as population size, demographic characteristics, policy, technology, social behaviour and coping strategies (Wilhite et al., 2000). Thus vulnerability to drought is likely to change, either increase or decrease in response to changes in these social factors. It is therefore logical to assume that subsequent droughts will have different effects, even if they are identical in intensity, duration and spatial characteristics, because societal characteristics will have changed. However, much can be done to reduce the societal vulnerability component to drought.

2.4 Global perspective of drought and its causes

2.4.1 Introduction

Drought is global, but most prevalent in semi-arid lands. Developing countries are particularly vulnerable to drought because of their geography and strong dependence on subsistence agriculture. The highly diversified economies of developed countries mitigate its effects, but do not eliminate human stress and major economic loss. Drought results from an abnormal water deficiency.

Its onset and intensity are usually measured in terms of a water deficiency, but its manifestations are often poor plant-growth, dust storms, deficient and polluted water supplies, and distressed economies and ecosystems. The water deficiencies are generally due to natural causes, but they are exacerbated by the steadily growing demand for and dependence on this limited resource. The effects of drought differ with each drought and among crops, water resources, forests, different economies and other entities.

Since each drought is different and there may be long time-spans between droughts, there is a need for systems to make known and available the many available technologies. Above all there is a continuing need, in all vulnerable countries and internationally, for short- and long-term planning based on the pooled wisdom of many

disciplines. That planning must consider more than simple projections of the water-demand. It must examine possible increases in vulnerability posed by industrial development, urbanization, water transfers, land-use change and other major water-related activities.

Despite significant drought research, studies that deal with the global picture of drought patterns and impacts are limited. Even fewer studies deal with global mapping of drought-related indicators. Peel et al., (2004, 2005) conducted an analysis of precipitation and runoff periods (runs) of consecutive years below the median for 3,863 precipitation and 1,236 runoff stations worldwide. Run lengths were found to be similar across all continents and climates except North Africa, which showed a tendency towards longer run lengths.

2.4.1.1 Indian perspective

Drought affects all parts of our environment as well as our communities. Different droughts have variable economic, environmental and social impacts. Approximately 16 % of India's geographic areas are drought prone. Droughts occur in varying intensities almost every year regardless of a good monsoon (Gol, 2013). While it is difficult to determine the onset and end of drought, the impacts can be severe affecting the poorest and most deprived sections of the society.

India is primarily an agrarian economy and while the sectors contribution to the national Gross Domestic Products is gradually declining. The agricultural sector is the immediate victim of drought disaster impacting crop area, crop production, grazing land, animal livestock production, farm employment and the country's Gross Domestic Product. Droughts severely impacts economies of a large section of population in the rain-fed regions. Agricultural losses impacts the income and purchasing power of farmers converting small and medium farmers into agricultural labourers resulting in an increase in unemployment. Farmers and farm workers relocate to urban areas in search of employment opportunities Das et al., (2007).

In 2009, India launched its National Policy on Disaster Management with a vision to build a safe and disaster resilient India. The policy aims to develop a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response. The major government

programmes help to mitigate the severe impacts of drought and build resilience of people by encouraging efficient water management practices, ensuring livelihoods, guaranteeing economic access to food and supplying fodder among other measures (Gol, 2009).

India is endowed with a skilled source of knowledge relating to cloud formation, lightning, wind direction, rains and drought which has evolved over centuries to observe and manage natural disasters and extreme events by disaster predictions, response, mitigation and effects of weather on crops (Gupta and Singh, 2011). Hence there is a massive potential for binding the indigenous technical Knowledge (ITK) for alleviating drought impacts. This massive and time-tested ITK on natural resource management can be inferred to understand the modern concepts of disaster risk management in terms of early warning, preparedness, mitigation, response and relief.

India has a strong drought assessment capabilities but there's a need to enhance capacity for early warning and impact monitoring, particularly in the light of climate change impacts, which can further compound the challenge of drought monitoring for early warnings because of wide variability in rainfall pattern even at local levels. Prabhakar et al., (2007) highlights that effective and timely coordination among various organisations can enhance the drought management results.

2.4.1.2 Australian perspective

Australia is the driest inhabited continent on Earth and drought is an important feature of Australia's climate. Whilst Australians have always lived with drought and its consequences, it is likely that climate change is making drought worse in the southeast and southwest, some of our most populous regions. Drought affects agriculture, tourism, employment and livelihoods in Australia, with severe economic repercussions. Between 2002 and 2003 decreases in agricultural production due to drought resulted in a 1% reduction in the Gross Domestic Product (GDP) and a 28.5% fall in the gross value added for the agricultural industry compared to the preceding year (ABS 2004). This is a significant hit to the economy, considering that the global financial crisis caused a reduction of 2 percent in Australia's annual GDP from 2008 to 2009 (World Bank 2015). Several important agricultural areas, including southwest Western Australia, parts of central Queensland and northern New South Wales,

Victoria and southern South Australia, and most of Tasmania, received below-average annual rainfall for 2014 (BoM 2015a). Significantly reduced rainfall in winter and spring across eastern Australia affects the intensive cropping and livestock breeding that is commonly practiced in the region, with potentially serious economic repercussions (ABARES, 2012).

More recently the Millennium Drought in southeast Australia, which lasted from 1996 to 2010, was one of the worst on record for the region van Dijk et al., (2013). Southeast Australia experienced its lowest 13-year rainfall record since 1865 (CSIRO, 2012). The Millennium Drought had wide-ranging repercussions. For example agricultural production fell from 2.9 percent to 2.4 percent of Gross Domestic Product (GDP) between 2002 to 2009, with drought playing a significant role in these observed declines in GDP (van Dijk et al., 2013). It is estimated that between 2006 and 2009 the drought reduced national GDP by roughly 0.75 percent. Between 2007-2008 regional GDP in the southern Murray-Darling Basin fell 5.7 percent below forecast and was accompanied by the temporary loss of 6000 jobs (IPCC, 2014).

Drought can also be costly due to drought relief packages provided by the federal government. By mid-2010 the Australian government had paid \$4.4 billion in direct drought assistance to farmers (ABARES, 2012). Drought also has economic repercussions for Australia's tourism industry.

Climate change is exacerbating drought conditions in Australia through changes in rainfall patterns and increasing heat. In the future severe droughts are expected to happen more often.

The evidence for the influence of climate change on observed drought patterns is strongest for southwest Western Australia and the far southeast of the continent - Victoria and southern parts of South Australia (CSIRO, 2012). The link is related to the southward shift of the fronts from the Southern Ocean that bring rain across southern Australia during the cool months of the year (winter and spring) (CSIRO and BoM 2015). This shift, which is consistent with the changes in patterns of atmospheric circulation expected in a warming climate system, has led to the observed declines in rainfall in the southwest and southeast of the continent and the resulting drought conditions (Timbal and Drowdowsky, 2012; Climate Commission, 2013).

As part of the changes in atmospheric circulation, the subtropical ridge (STR), an area of high pressure that commonly lies over the Australian continent, has intensified as global air temperatures have increased as a result of increasing greenhouse gas concentrations (Timbal and Drosdowsky, 2012; CSIRO, 2012). The intensification of the STR is estimated to account for roughly 80 percent of the recent rainfall decline in southeast Australia (Murphy and Timbal, 2008; Climate Commission, 2013).

The observed drying trends during the cooler months in the southwest and southeast of the continent, which are likely influenced by climate change already, are expected to continue. Average rainfall in southern Australia during the cool season is expected to decline further, and the time spent in drought conditions is projected to increase with a greater frequency of severe droughts in the region (CSIRO and BoM, 2015).

The ongoing drying trend and projected increase in severe droughts could lead to decreases in production in Australia's most important agricultural regions, including the largest catchment and most productive agricultural area in the country, the Murray-Darling basin, and southwest wheat belt (IPCC, 2014). The projected drying trend across southern Australia could also threaten urban water supplies, as nearly 13 million of Australia's population is concentrated in the southern cities of Perth, Adelaide, Melbourne, Canberra and Sydney (ABS, 2014).

2.4.1.3 American perspective

Drought is a normal part of the climate for virtually all portions of the United States; it is a recurring, inevitable feature of climate that results in serious economic, environmental and social impacts (WMO, 2014). Drought will occur at some time every year in the United States. It can and does extend over long periods and large areas, and it brings hardship. Each time drought occurs, many of the same issues are raised. Principally, how much damage was inflicted, on whom, and where? Who is going to pay for it? How can we prevent or at least reduce damages and their costs in the future?

Drought is perhaps the most obstinate and pernicious of the dramatic events that Nature conjures up. It can last longer and extend across larger areas than hurricanes, tornadoes, floods, and earthquakes. At its most severe, drought creates vast, windblown dust bowls—eroding the landscape, damaging terrestrial and aquatic

wildlife habitat, contributing to widespread wildfire, causing hundreds of millions of dollars in losses, and dashing hopes and dreams.

Furthermore, drought may be the last straw in driving farm and ranch families off their land and livestock producers out of business. It brings hardship to water-dependent enterprises such as commercial fishing, marinas, river outfitters and guides, landscapers, golf courses, and water theme parks. In many small communities, downturns in farming, ranching, and recreation have a rippling effect, causing loss of income for seed and implement retailers, recreation equipment suppliers, and Main Street businesses from grocery stores to clothing outlets, entertainment Operations, restaurants, and banks. This in turn creates revenue shortfalls for local governments. Drought can have devastating impacts on the lives of migrant agricultural workers and people employed in seasonal, recreation-dependent jobs.

Moreover, drought can lead to tough decisions regarding allocation of water and result in stringent water-use limitations. Drought can also cause problems in ensuring safe drinking water as well as adequate water supplies for municipal, county, and rural fire-fighting efforts and for the dilution of wastewater effluent. In large managed river basins and water systems such as the Columbia, Missouri, the state and federal California reservoir systems, the Colorado River, the Apalachicola-Chattahoochee-Flint, and others, drought creates or exacerbates conflicts about who should get water. The most common conflicts pit older, established uses such as agriculture and navigation against newer uses such as recreation and water for growing municipal populations, and water for direct human use against water for ecosystems.

However, the US has not developed a national drought policy, there has been considerable pressure from states for the federal government to move towards a risk-based national drought policy (WMO, 2014). This pressure has been quite effective and led to the introduction of legislation in the US Congress directed at improved preparedness and early warning. The National Drought Policy Act of 1998 created a National Drought Policy Commission (NDPC) charged with making recommendations to the US Congress on future approaches to drought management. The final report of the Commission was submitted to Congress in 2000 and included a recommendation that the US move forward with the development of a national drought policy based on the principles of risk management (NDPC, 2000).

2.5 Government legislations and policies on drought in South Africa

2.5.1 Introduction

In this chapter the constitutional, legislative, regulatory and policy obligations of South African Government in respect of drought are described and discussed.

Drought is a severe problem for agriculture and vulnerable communities and most often the best way to cope with a drought lies with the decision-makers of a country. The legislations and policies that the South African Government employs to deal with drought have serious effects for the population of the county as well as on operations at a local level (Vogel, 1998).

In this chapter some of these government legislations and policies on drought at national and local levels in South Africa are described and discussed. Drought events in South Africa have thus seen many policy changes as agriculture and vulnerable communities have been affected in various ways, prompting government to reassess their drought policies.

2.5.2. South African Constitution on Disaster

With the signing of the Constitution (Act 108 of 1996) into law on the 10 December 1996, a constitutional democracy came into effect in South Africa on 4 February 1997. This had been preceded by the Conference for a Democratic South Africa (CODESA), which was responsible for drafting the interim Constitution, which included a set of 34 binding Constitutional principles (Schedule 4 of the Interim Constitution Act 200 of 1993) on 20 December 1991. Principles were adopted by the Tricameral Parliament on 22 December 1993, and remained in force until the final constitution was adopted by the Constitutional Assembly (parliament elected in 1994) and certified by the Constitutional Court on 11 October 1996. This was after

33 the first certification process failed in September 1996 (Currie and De Waal, 2005:P39). The purpose of the certification process was to ensure that the final constitution conformed to the 34 Constitutional Principles (Schedule 4 Interim Constitution of South Africa Act 200 of 1993) agreed upon by the Tricameral Parliament. The significance of the certification process is that a court should

approach the relevant meaning of the relevant provision on the basis of the meaning assigned to it by the Constitutional Court in the certification process as its correct interpretation, and should not depart from it except in the most compelling circumstance. The Constitution is based on significant principles that define the new constitutional order; that influence the interpretation of many of the provisions of the Constitution and Bill of Rights; that inform the way the legislation is drafted by the legislature and interpreted by the courts and the way the courts develop common law. These basic principles are constitutionalism, the rule of law, democracy and accountability, separation of power, check and balances, co-operative governance and devolution of power (Currie and De Waal, 2005:P7). As South Africa is a constitutional democracy and all spheres of Government and People in South Africa function within this constitutional democracy, a concise description of the most important principles of a constitutional democracy is provided below.

The Constitution (Act 108 of 1996) in the Republic of South Africa is the Supreme Law (Section 2 Act 108 of 1996). This implies that any law or conduct that is inconsistent with it is invalid, and any obligation imposed by the Constitution must be fulfilled, and its obligations are binding on all the branches of the state, and all policy, laws, and regulations. Therefore, Section 172.1 of Act 108 of 1996 provides that any court deciding on a constitutional matter that is within its power must declare any law or conduct that is inconsistent with the Constitution invalid to the extent of the inconsistency. Section 165.5 (Act 108 of 1996) provides that any order or decision issued by a court binds all persons and organs of states to which it applies

2.5.3. The National Disaster Management Act No. 57 of 2002

One major development that may accelerate a more risk management approach to drought is the Disaster Management Act of 2002. After the transformation of agricultural markets, the preparation of a Green Paper on disaster management for South Africa began in 1997 and outlined an improved disaster risk management strategy (Vogel, 1998). At the time reactive policies to disasters prevailed, exacerbated by a lack of awareness and communication about structures and plans at higher levels for local authorities. Rural areas were also having difficulties with limited resources and personnel during disasters (Vogel, 1998). There was definitely the need to redraft

legislation from the reactive disaster management perspective to a more proactive, risk-reduction, risk management and migratory approach.

Disasters were viewed by many as events that occur as a result of poorly managed risk. The Green Paper therefore identified the evaluation of risk environments and vulnerability assessments as a key initiative (Vogel, 1998). The Paper examined how risk was managed at the time and suggested how this could be improved. A lack of funding for emergency preparedness and disaster prevention and mitigation, as well as limited funding for emergency response, was one of the problems. There was also the need to ensure that risk reduction strategies complemented development in the country, as this was essential for successful disaster management (Vogel, 1998).

The Disaster Management Bill was introduced in the National Assembly late in 2001. The aim of the Bill is “To provide for an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery; for the establishment of national, provincial and municipal disaster management centres; and for matters incidental thereto.” (Disaster Management Bill, 2001, P2).

The Bill appeared to include all the various applications necessary for improved disaster management in South Africa. The Bill called for the President to establish an Inter-governmental Committee on Disaster Management. The Committee would consist of Cabinet members involved in disaster management, MECs of each province involved in disaster management and representatives of organized local government (Disaster Management Bill, 2001). The Committee in turn must establish a national disaster management framework that should outline a coherent and inclusive policy on disaster management appropriate for South Africa. The framework must also establish prevention and mitigation as the main theme of the policy; facilitate the involvement of the private sector and communities in disaster management; and provide a framework within which the state may fund disaster management and post-disaster recovery (Disaster Management Bill, 2001).

A National Disaster Management Centre will be established to promote an integrated and co-ordinated system of disaster management, with special emphasis on prevention and mitigation. The National Centre must give guidance to all players on

ways and means to determine risk and to assess vulnerability (Disaster Management Bill, 2001). Methodologies must also be created and applied concerning appropriate prevention and mitigation and also integrated with development plans and initiatives. The National Centre should also establish communication links with foreign disaster management agencies to exchange information and assistance. Efforts must also be initiated and facilitated to make funds available for disaster management (Disaster Management Bill, 2001).

The National Centre must also act as a repository and conduit for information concerning disasters, impending disasters and disaster management. An electronic database developed by the National Centre must contain extensive information about disasters that do or may occur in southern Africa (Disaster Management Act, 2002). Information must also be included on aggravations of disasters; risk factors and ways to reduce such risk; prevention and mitigation; early warning systems; vulnerable areas and communities; and research and training facilities for disaster management. The National Centre must also ensure that the electronic database is accessible by any person free of charge (Disaster Management Act, 2002). Each province in South Africa must also prepare a disaster management plan for the whole province.

The disaster management plan for the province must form an integral part of development planning for the province (Disaster Management Act, 2002). The plan should also anticipate the types of disasters that could occur as well as their effects and provide appropriate prevention and mitigation strategies. The plan must also have emergency procedures to be applied in the event of a disaster (Disaster Management Act, 2002). The procedures should provide for the allocation and co-ordination of responsibilities to various role players; rapid disaster response and relief; and the acquisition of essential goods and services. The province must submit a copy of its disaster management plan to the National Centre and to each municipal or local disaster management centre in the province (Disaster Management Act, 2002).

The Disaster Management Act is a vast improvement on previous disaster management initiatives in South Africa and takes into account past concerns and recommendations. The issue of reducing risk is of high importance and the theme of prevention and mitigation runs central through the entire Act. Risk reduction strategies

are put in place to complement development in various areas of the country. Structures and plans at higher levels are clearly evident for local authorities so as to aid in the reduction of risk. The various levels of government are also formulating plans in conjunction with one another thereby creating a more effective environment to manage disasters in South Africa.

2.5.4. The national drought management Policy

These National Drought Management Policy Guidelines are an initiative of the Integrated Drought Management Programme and were developed by Donald A. Wilhite, founding director of the National Drought Mitigation Centre, and currently a professor of Applied Climate Science in the School of Natural Resources at the University of Nebraska-Lincoln.

The implementation of a drought policy based on the philosophy of risk reduction can alter a nation's approach to drought management by reducing the associated impacts. This was the idea that motivated the World Meteorological Organization (WMO), the Secretariat of the United Nations Convention to Combat Desertification (UNCCD), and the Food and Agriculture Organization of the United Nations (FAO), in collaboration with a number of UN agencies, international and regional organizations, and key national agencies, to organize the High level Meeting on National Drought Policy (HMNDP), which was held in Geneva from 11 to 15 March 2013. The theme of the HMNDP was Reducing Societal Vulnerability – Helping Society (Communities and Sectors).

The spiralling impacts of drought on a growing number of sectors is cause for significant concern. No longer is drought primarily associated with the loss or reduction of agricultural production. Today, the occurrence of drought is also associated with significant impacts in the energy, transportation, health, recreation/tourism and other sectors.

The policy should provide a framework for shifting the paradigm from one traditionally focused on reactive crisis management to one that is focused on a proactive risk-

based approach that is intended to increase the coping capacity of the country and thus create greater resilience to future episodes of drought.

The formulation of a national drought policy, while providing the framework for a paradigm shift, is only the first step in vulnerability reduction. The development of a national drought policy must be intrinsically linked to the development and implementation of preparedness and mitigation plans at the sub-national level. These plans will be the instruments through which a national drought policy is executed.

For the most part, previous responses to drought in all parts of the world have been reactive, reflecting what is commonly referred to as the crisis management approach. This approach has been ineffective (i.e. assistance poorly targeted to specific impacts or population groups), poorly coordinated and untimely; more importantly, it has done little to reduce the risks associated with drought. In fact, the economic, social and environmental impacts of drought have increased significantly in recent decades. A similar trend exists for all natural hazards.

The intent of the policy development and planning process described in this report is to provide a set of generic steps or guidelines that nations can use to develop the overarching principles of a national drought policy aimed at risk reduction. This policy would be implemented at the sub-national (i.e. provincial or state) level through the development and implementation of drought preparedness plans that follow the framework or principles of the national drought policy.

These plans are the instruments for implementing a national drought policy based on the principles of risk reduction. Following these guidelines, a nation can significantly change the way they prepare for and respond to drought by placing greater emphasis on proactively addressing the risks associated with drought through the adoption of appropriate mitigation actions. The guidelines presented here are generic in order to enable governments to choose the steps and components that are most applicable to their situation. The risk assessment methodology embedded in this process is designed to guide governments through the process of evaluating and prioritizing impacts and identifying mitigation actions and tools that can be used to reduce the impacts of future drought episodes. Both the policy development process and the planning process must be viewed as ongoing, continuously evaluating the nation's

changing exposure and vulnerabilities and the ways in which governments and stakeholders can work in partnership to lessen risk.

2.5.5 Limpopo Province Agricultural Disaster Management Policy

The MEC of the province who is responsible for disaster risk management must establish institutional capacity for disaster risk management in the province. Such arrangements must be consistent with national arrangements and must provide the appropriate mechanisms to allow for the application of co-operative governance to facilitate both intergovernmental and provincial interdepartmental relations for the purposes of disaster risk management.

The Provincial disaster management centre is the primary functional unit for disaster risk management in each province. A key responsibility of the PDMC is to provide support to the NDMC and the metropolitan and district disaster management centres in the province. It must provide the link between national objectives and provincial and municipal disaster risk management activities and priorities.

In the event of a significant event or disaster occurring or threatening to occur, the PDMC must provide support and guidance to the relevant MDMCs. In addition, it must mobilise provincial infrastructure and resources to support municipal disaster risk management resources

The Limpopo Province Agricultural Disaster Management Policy originates from the disaster Management act, No. 57 of 2002. Its aim is to encourage primary producers within the province to adopt self-reliance approaches in managing climate variability, to maintain and protect the Limpopo province agricultural and environmental resource base during periods of extreme climate stress, and to ensure early recovery of agricultural and rural industries, consistent with long-term sustainable levels.

This agricultural Disaster Management policy sees climate variability and agricultural disasters as normal features of the Limpopo province environment in which agriculture must operate. The main focus is on farm management and takes into account the risk associated with a variable climate and adhere to the principles of sustainable

agriculture. These are aided through research, extension and education though providing economic instruments to reduce fluctuations in income from year to year, at achieving more sustainable agriculture.

Based on this policy document direct financial assistance should be provided when agricultural disasters are deemed to be exceptional.

2.6 Drought declared areas in South Africa

2.6.1 Introduction

Drought continues in many provinces. The Department of Agriculture, forestry and fisheries has reported that veld and livestock conditions remain poor in the majority of the areas. It is further reported that irrigated crops are under stress due to lack of sufficient water and high temperatures. The levels of major dams are generally low with restrictions being imposed on irrigation in a number of areas (Agri SA, 2016).

Many dry land farmers could not begin in the normal planting window in most areas due to lack of soil moisture. An increase in the number of veld fires has also been reported in the Free State, Limpopo, Northern Cape, North West, Mpumalanga and Western Cape. Severe thunderstorms caused extensive damage in Gauteng, Limpopo and Free State.

Furthermore, significant livestock mortalities have been reported in a number of provinces.

South Africa is particularly vulnerable to the effects of drought as a result of the importance of dry land agricultural production.

2.6.2 Limpopo province as a drought declared area

Limpopo province is one of the poorest province in the country, characterized by high unemployment rate, poverty and lack of access to a range of resources that frustrate majority of people's ability to secure their livelihoods.

Limpopo is the food basket and agricultural engine of South Africa, accounting for nearly 60% of all fruit, vegetables, maize, wheat, and cotton (LDARD, 2015). Livestock farming is also a significant contributor to the province's agriculture sector. It is the

source of 65% of the country's papayas, 36% of its tea, 25% of its citrus fruit, bananas, and litchis, 60% of its avocados, 60% of its tomatoes (40% by one company alone), and 35% of its oranges. It produces 285,000 tons of potatoes annually (GoLimpopo, 2016). An estimated 33% of households in Limpopo are considered agricultural households, and the province is home to 16% of South Africa's agricultural households (Steyn and Associate, 2014). Despite this, the agriculture sector contributed only three percent to the province's annual average Gross Domestic Product (GDP) in 2012.

Drought is a serious problem in the province considering that it is in a semi-arid area with low, unreliable rainfall. As a result of the severe drought, the province experienced reduced grazing land and water for livestock and irrigation. The province was worst affected by drought in the past eight years when dams were only 50% full, compared with 84% in late nineties (LDARD, 2015).

Farming is an important source of livelihood for the Limpopo province especially those in rural areas, but with natural hazards like drought, it is very difficult for farmers to survive. During the dry season, livestock farmers are forced to sell their livestock because of lack of grazing pasture and water. According to Makhura (2001), a sharp decline in agricultural production would not only have implications for a province or country but also for the region as a whole.

2.6.3 Drought status in Ba-phalaborwa municipality

Drought has emerged one of the main challenges to Ba-phalaborwa farmers. It has become a major threat to food security, as it has a strong impact on food production, access and distribution. Furthermore, given an estimate of 3 million farmers in South Africa who produce food primarily to meet their family needs, rural poverty in Ba-phalaborwa could be worsening with drought (Stats SA, 2007). Indeed, due to their low income, lower technological and capital stocks, households are predicted to have limited options to adapt to changing weather patterns like drought.

Drought is a serious problem in the municipality considering that it is in a semi-arid area with low, unreliable rainfall (LDARD, 2015). As a result of the severe drought, the

municipality experienced reduced grazing land and water for livestock and irrigation. The municipality was worst affected by drought in the past eight years when dams were only 50% full, compared with 84% in late nineties.

In Ba-Phalaborwa municipality drought is not just a crisis for the agricultural sector on a national scale, all South Africans are affected and the poor and most vulnerable members of our society unfortunately bear most of the brunt (Agri-SA, 2016).

Farming plays a great role in the livelihood of many people, but with extreme weather like drought, it is very difficult for them to cope. It is quite disturbing that in some parts of the municipality, farmers are forced to sell their livestock because of drought.

2.6.4 The effect of drought on small scale farmers

Varying degrees of vulnerability to drought conditions occur within the agricultural sector according to the size and nature of one's farming operation. The case of small scale farmers have proven to be more vulnerable to droughts given their concentration in less favourable climatic regions their lack of resources and their reliance on own production for household food security.

In drought conditions newly established small holder farmers are likely to face a much greater loss of assets and household savings.

Drought has the potential to cause severe direct and indirect impacts to society, the economy and the environment. For example, drought can directly cause loss of life, loss of livestock/animals, destroy crops and reduce water supply and quality. Direct impacts on food and water supply can indirectly affect quality of life, lead to malnutrition, starvation, disease, and risk of conflict, all triggering humanitarian and human development concerns.

Drought is an economically important hazard for many farmers. Agriculture, livestock, forestry, energy, industry, and water sectors are all particularly at risk from drought (NDMC, 2007). Direct economic impacts can indirectly affect business production affecting the flow of goods and services through extensive and complex sectoral linkages. Secondary macroeconomic impacts comprise both the indirect losses and the impacts of government reallocation of resources for reconstruction and relief efforts.

Agriculture is an exception as Ding et al. (2010) notes that it is highly sensitive to weather variability and so drought impacts can be immediate and physically observable. Data and statistics for the agricultural sector are easier to gain than for other sectors, and monetary estimates of drought losses are often collected for regions that seek disaster aid with most relief programs available for agriculture only. Consequently, economic impacts of drought are not usually considered as severe as from other extreme weather types like floods or hurricanes. Yet drought is commonly associated with large indirect economic losses due to the dependence of many industrial sectors on water for production, and the importance of water for providing services and recreation. These indirect damages can propagate rapidly through the economic system affecting regions far from the original event Wilhite et al., (2007).

A study done by Ndlovu (2010) in Bulilima and Mangwe districts of Zimbabwe observes that asset disposal has increased over the years with the selling of cattle as the most popular coping strategy of drought in the two districts. Selling cattle during drought is of paramount importance whereby the herd size is reduced and the money is used to purchase supplements for the remaining cattle. However, if farmers rely more on selling their cattle it can increase the drought risk in the long run as farmers will not have enough cattle to prepare for future droughts. Furthermore, due to drought farmers suffer distress sales where they have to sell their cattle at low prices and this tends to reduce cattle and profit loss Scoones et al., (1996:P285). This indicates that farmers sustain a severe financial loss as compared to normal sales without drought-induced effects Scoones et al., (1996:P285).

According to the FAO (2010:P26), during drought crops are severely affected by drought which leads to reduced fodder production and a decline in fodder production may accumulate. Scoones et al., (1996:P284) maintain that in some contexts farmers prefer to move their livestock to other areas that have sufficient pastures as a result of reduced fodder production. However, this is not a viable activity for all farmers (i.e. farmers under the redline).

These effects of drought have serious implications on farmers for several decades. However, through historical experiences in different regions and communities, coping mechanisms have been developed to mitigate the situation.

2.7 Government drought management and mitigations in South Africa

2.7.1 Management of drought

Historically, drought management in South Africa has had significant weaknesses: Governmental structures have responded slowly and ineffectively to drought, especially in farming communities with poor resources, and clear definitions of the roles and responsibilities of the state and the farming communities have been absent. These weaknesses can be ascribed to the absence of a comprehensive drought management plan, including an effective and accessible early warning system. South Africa, with its developed commercial farming sector functioning alongside its large subsistence farming sector, needs a much more comprehensive plan to protect its rural communities and their economy against the ravages of drought. Therefore the Department of Agriculture together with key stakeholders pledges to work together to root out the uncertainties with regard to drought management by means of the DMP.

Drought management is a shared responsibility of all levels of government, the farming community, the private sector and civil society. In addition, the effect of drought on SADC countries must be taken into consideration, since drought has no respect for borders.

To achieve South Africa's vision for drought management, the following overarching principles must be heeded:

- The objectives of the DMP should be in line with the Disaster Management Act (57 of 2002).
- The DMP must create awareness and preparedness in the South African agricultural sector.
- The DMP should emphasise the joint responsibility of the government and farming sector as well as redefine the role of drought assistance programmes.

- The DMP should clarify the responsibilities of the different levels of government and all other key stakeholders.

The Drought Management Plan represents a marked deviation from the existing approach to drought management. Risk management, and therefore risk reduction, is the core principle of the plan and is aimed at reducing the vulnerability of farming communities. The plan signifies a shift away from the disproportionate emphasis given to rare major disasters and underscores the government's intention to move away from direct financial intervention and improve South Africa's ability to manage drought and its consequences in a coordinated, efficient and effective manner.

The plan acknowledges the premise that the government should only provide assistance where sustainable agricultural management is employed. Partnership between government and farming communities is essential for the latter.

2.7.2. Mitigation of drought

Mitigation is often associated with actions taken after the fact to remedy damage caused by human or natural disturbances. In the context of this report, we use the term "mitigation" to describe actions taken prior to and during drought events to reduce potential impacts and thus reduce the costs of responding to drought. As such, mitigation is an essential, proactive element of drought preparedness. Proactive drought mitigation comprises a broad range of measures from the installation of livestock watering ponds on ranches and technologies and methods for capturing storm water in rural and urban settings to state-of-the-art wastewater treatment that allows reuse of water

Since the primary concern of drought is water shortage, most of the drought mitigation and adaptation activities are aimed at reducing the effect of water shortage through measures that are taken before, during and after drought. The priority of drought mitigation is the protection of the critical resources and systems on which communities depend. Drought mitigation has four basic components: Awareness, avoidance, early warning and rehabilitation.

An integrated public awareness strategy must be developed and implemented nationally to encourage risk-avoidance behaviour by all role players, including all

departments in the three spheres of government, and especially in schools and in communities known to be at risk. Such a strategy is necessary for the promotion of an informed, alert and self-reliant society capable of playing its part in supporting and co-operating with the government in all aspects of disaster risk and vulnerability reduction. To achieve this objective, a disaster risk management public awareness and information service, which takes cognisance of relevant international trends and initiatives as well as indigenous knowledge, must be established by the NDMC.

A culture of risk avoidance must be promoted among stakeholders by capacitating role players through integrated education, training and public awareness programmes informed by scientific research. Sections 15 and 20(2) of the Act specify the encouragement of a broad-based culture of risk avoidance, the promotion of education and training throughout the Republic, and the promotion of research into all aspects of disaster risk management. This enabler addresses the requirements for the development and implementation of a national education, training and research needs and resources analysis and a national disaster risk management education and training framework, the development of an integrated public awareness strategy, including effective use of the media, the development of education and training for disaster risk management and associated professions, and the incorporation of disaster risk management in school curricula. It also outlines mechanisms for the development of a disaster risk research agenda. The development of a user-friendly public-access website with relevant and up-to-date information on disasters, disaster risk and key institutional role players is a critical component of such an information service. The employment of qualified resource personnel to take responsibility for functions, for example, materials development, external consultation processes and liaison with the media (print, radio and television), will be necessary to ensure the success of the service.

Early warnings are designed to alert areas, communities, households and individuals to an impending or imminent significant event or disaster so that they can take the necessary steps to avoid or reduce the risk and prepare for an effective response.

The NDMC is responsible for ensuring the technical identification and monitoring of hazards and facilitating the development of standard early warnings by national organs of state tasked with primary responsibility for a specific hazard.

The NDMC must prepare and issue hazard warnings of national significance in a timely and effective manner and ensure that the warnings are disseminated to those communities known to be most at risk, including those in isolated and/or remote areas. Warnings of impending or imminent significant events and/or disasters must include information and guidance that will enable those at risk to take risk-avoidance measures to reduce losses (SA National Disaster Management Framework, 2005).

In order to ensure a holistic approach to rehabilitation and reconstruction in the aftermath of a significant event or disaster, the organ of state tasked with primary responsibility for a known hazard must facilitate the establishment of project teams for this purpose.

Checks and balances must be effected to ensure that projects and programmes maintain a developmental focus. Project teams established for this purpose must determine their own terms of reference and key performance indicators and must report on progress to the NDMC.

It can be concluded that water storage infrastructure is an indispensable tool for mitigation and adaptation to drought and climate change. South Africa as a water scarce country needs to improve its water storage capacity. Apart from large storage reservoirs, smaller scale storage are needed to benefit small scale farmers in rural and semi urban areas.

2.8 Conclusion

This chapter has provided different concepts and characteristics of drought. The chapter further attempted drought and its causes on a global perspective. Furthermore, the South African Government legislations and policies on drought were unpacked. Moreover, the researcher alluded the drought declared areas and the effects of drought in the country, however more emphasis was on the area of study. Lastly the drought management and mitigation measures in South Africa were employed.

It can be concluded that Limpopo is perhaps the most vulnerable province to climate change in South Africa. The consequences of experienced extreme events between 2014 and 2015 are exposing the lack of preparation of the province to handle climate

variations. Notable efforts have been done by the Province in the development of a framework and strategies to address mitigation and adaptation; however the lack of appropriated changes in governance limits improved resilience.

Chapter 3: Research Methodology

3.1. Introduction

This chapter outlines the choice and rationale of the research and research paradigm. It further unpacks the methodologies employed in this research. The last section of this chapter unpacks the description of the study area that is location, climate and study population. For the purposes of this study the research approach that will be adopted will be quantitative.

3.1.1 Research Paradigm

Research paradigm has been defined by (Collis and Hussey, 2013) as a framework that guides how research should be conducted based on people's philosophies and assumptions about the world and their nature of knowledge. The way in which the researcher chooses to investigate the study question is motivated by the research paradigm. Research paradigm definition has been stated as a meta-physical construct that provides an organizing framework for the philosophical assumptions that guide researchers in their theorizing and practice. Patton (1990): A paradigm is a world view, a general perspective, a way of breaking down the complexity of the real world. Paradigm is an interpretative framework, which is guided by "a set of beliefs and feelings about the world and how it should be understood and studied." (Guba, 1990). Additionally, (Denzin and Lincoln, 2001) listed three categories of those beliefs as follows:

- Ontology: what kind of being is the human being. Ontology deals with the question of what is real.
- Epistemology: what is the relationship between the inquirer and the known: "epistemology is the branch of philosophy that studies the nature of knowledge and the process by which knowledge is acquired and validated" (Gall, Borg and Gall, 1996).

Their further expansion on the topic of the research paradigm has been revealed as the metaphysical frameworks that are made up of four philosophical assumptions, including axiology (ethics), ontology (reality), epistemology (knowledge), and methodology (systematic enquiry). Research paradigm may refer to a researcher's

worldview, belief, or a system of thinking and/or interpretation and thus the behaviour of the research (Wahyuni, 2012).

Dill and Romiszowski (1997) stated the functions of paradigms as follows:

- Define how the world works, how knowledge is extracted from this world, and how one is to think, write, and talk about this knowledge
- Define the types of questions to be asked and the methodologies to be used in answering
- Decide what is published and what is not published
- Structure the world of the academic worker
- Provide its meaning and its significance

However, some researchers use mixed methods paradigmatically wherein the researcher evaluates the findings of the study based on responsiveness to the research question and further requirements without consideration of philosophical assumptions.

Major research paradigms include positivist, anti-positivist or critical theory. However, this study will adopt the positivist paradigm, the reason for using the positivist paradigm is that, this type of research paradigm relies on measurement of linkage or relationship between variable such that associated variables may receive a cautious generalization within a limited environment.

3.1.2 Positivist research paradigm

The research paradigm of this study is positivist since Human beings are seen objectively, and as a result, social scientists look to different avenues to study human society (De Vos et al., 2011). Thus, positivism may be seen as an approach to social research that seeks to apply the natural science model of research as the point of departure for investigations of social phenomena and explanations of the social world (Denscombe, 2008:14; 2010b:P120). Positivism research paradigm entails a belief based on the assumption that patterns, generalisations, methods, procedures, cause-and-effect issues are also applicable to the social sciences. This view of positivism

maintains that the objects of the social sciences, namely people, are suitable for the implementation of scientific methods.

Furthermore, positivism entails a belief that valid knowledge can only be produced on the basis of direct observation by the senses; and this would include the ability to measure and record what would be seen as knowledge. Observation in this sense means accepting only empirical evidence as valid evidence. Valid evidence is thus produced through the senses of sight, smell, touch, taste and hearing. It would clearly mean that there is no place for phenomena which cannot be observed either directly, through experience and observation, or indirectly, with the aid of instruments.

Moreover, positivist research paradigm is also employed to entail a particular position in relation to values. Positivism's position on values is to draw a sharp distinction between issues, statements and norms. While positivists recognize that they can investigate the implications of a particular normative position, they are unable to verify or disprove the position itself.

Positivist paradigm has been summarised according to the observation of the following factors (Gray, 2013):

- basic belief which states that the world is external and objective and also that the observer is independent
- researcher should focus on the facts thus locating causality between variables
- methods must include operationalizing concepts so that they can be measured
- use large samples from which to generalize to the population, and
- this type of the research is best conducted by quantitative method

3.1.3 Quantitative research approach

This research will adopt a quantitative approach because it measures the effect of drought on small scale farmers. In addition, quantitative approach will be used in this study as it is most suitable since this study will be conducted in a short space of time with limited resources. (Creswell, 2013) defines quantitative research as an approach used for testing objective theories by examining the relationship among variable. These variables are further elaborated that they can be measured, typically on

instruments, so that numbered data can be analysed using statistical procedures. Researchers who engage in this type of approach tend to protect the study results against bias, control for alternative explanations and will be able to generalized and replace the findings.

Furthermore, the quantitative section deals with the statistical analysis and numerical data to provide quantitative information. In quantitative approach, the researcher addresses the research questions and therefore designs studies that involve collecting quantitative data and analyse it using statistical methods. Quantitative research requires objectively evaluating the data which consist of numbers, trying to exclude bias from the researcher's point of view. Typically, the quantitative method makes use of a questionnaire. Quantitative research always involves the numerical analysis of data gathered by means of some kind of structured questionnaire. In summary, the quantitative research produces useful data in short time periods with reasonable investment of human resource and materials.

3.1.4 Survey research design

The applicable approach of this research will be a survey design because the research will be focusing on the effects of drought on small scale livestock farmers. The reason for using a survey design is that the phenomenon of the study and that of the variables function on small scale livestock farmers.

Furthermore, survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. It includes cross-sectional and longitudinal studies using questionnaires or structured interviews for data collection—with the intent of generalizing from a sample to a population.

Quantitative research is one of the research approaches used in empirical investigations. It is defined differently by different authors (Leedy, 2011; Bless Higson-Smith, 2011). Unlike qualitative research, quantitative research involves the collection, analysis and interpretation of numeric data, collected through experiments or surveys, or through interviews using structured or unstructured questionnaires (Leedy, 2009). For the purpose of this study, this definition is adopted as a working definition; that is,

the collection, analysis and interpretation of quantitative data using structured farmers questionnaires.

3.1.5 Study area

The study area is Ba-Phalaborwa, which is situated in the northern part of Limpopo Province. Mopani is one of the five district municipalities of Limpopo: Waterberg, Sekhukhune, Capricorn and Vhembe, Parts of the Vhembe district were the former Venda homeland. Mopani District is composed of five local municipalities, namely; Greater Giyani, greater Letaba, Greater Tzaneen, Maruleng and Ba-phalaborwa municipality.

The choice of the study area tended to bridge the gap and the level of awareness of the farmers about drought and its effects as the farmers in the rural communities depend more on farming. Furthermore, the choice of the study will also assist in evaluating how smallholder farmers in the rural area perceive drought season and how they cope with the hazard.

The study area of this research will be Lulekani A and B villages in Ba-Phalaborwa municipality in Mopani district of Limpopo province. The reason of this choice of the study area is that it has been declared a drought area and that most farmers from the area suffer a great loss during drought.

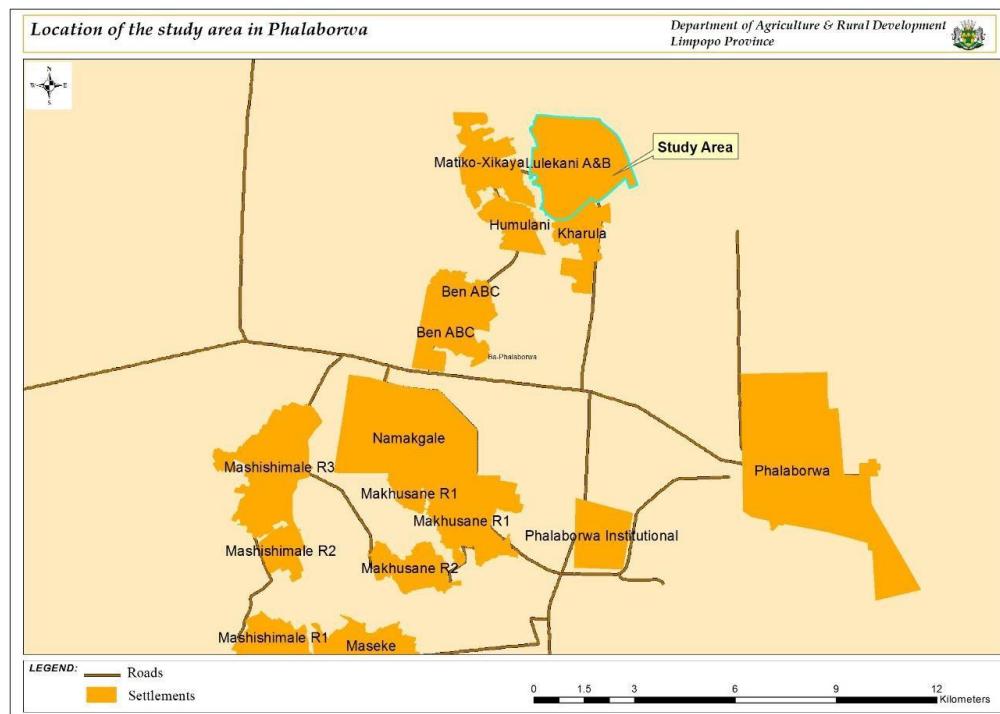


Figure 3.1.5 Geographic location of Ba-Phalaborwa municipality highlighting the study area (LDARD, 2017)

3.1.6 Population

Levy and Lemeshow (2013) has defined the research population as the entire set of individuals or targets in which findings of the survey are to be extrapolated. During research, attempts are made to select a sample population that is considered representative of groups of people or organisations to whom results will be generalised or transferred. The population of this research will be 25 livestock farmers from Lulekani A and B in Ba-Phalaborwa municipality.

3.2 Sample, sampling methods and sample size

3.2.1 Sample

Sample has been defined by (Jonker and Pennink, 2014) as a smaller but hopefully collection of units from a population used to determine certain truths about that population. The list from the list which the potential respondents are drawn is called the sample frame.

Similarly, sample is defined by Levy and Lemeshow (2013) as a subset from the original set of all measurements of interest to the researcher. It is further explained that when the research is conducted, it is the members of the sample who will be interviewed, studied, or measured.

Merriam-Webster's Learner's Dictionary defines a sample as a small amount of something that gives you information about the thing it was taken from, which is a small amount of something that is given to people to try. Further states that a sample is a group of people or things that are taken from a larger group and studied, tested, or questioned to get information. Additionally, stating that a sample is a finite part of a statistical population whose properties are studied to gain information about the whole or group especially when presented for inspection or shown as evidence of quality or specimen.

3.2.2 Sampling methods

Sampling methods has been defined as the strategy that is applied by the researcher in the selection of the study population taking into consideration the results that the study should produce (Jonker and Pennink, 2014).

3.2.2.1 Types of sampling methods

Probability sampling

This is regarded as the most recommended type of sampling because it increases the likelihood of obtaining samples that are representative of the population. Probability samples are selected in such a way as to be representative of the population. They provide the most valid or credible results because they reflect the characteristics of the population from which they are selected such as residents of a particular community, students of a certain school, etc. There are also two types of probability sampling which are random and stratified sampling.

Random sampling

Random sampling means that each individual in the population of interest has an equal likelihood of being selected. This is the type that allows an equal chance of

selection meaning that no bias will be involved in the selection of sample. Any variation between the sample characteristics and the population characteristics will be only a matter of chance.

Stratified sampling

A stratified sample is a mini-reproduction of the population. Before samples are selected the population will be classified into characteristics of importance for the research. For example, they will be divided according to the gender, social class, educational level, religion, etc. Then the population is randomly selected within each category or stratum. Stratified samples are also good or better than random samples, but they require a fairly detailed advance knowledge of the population characteristics and therefore are more difficult to construct.

Nonprobability sampling

Nonprobability sampling methods are less desirable than probability sampling methods. Their validity can be increased by trying to approximate random selection and by eliminating as many sources of bias as possible. Nonprobability samples are limited with regard to generalization. Because they do not truly represent a population, they cannot be used to make valid inferences about the larger group from which they are drawn. Validity can be increased by approximating random selection as much as possible and making every attempt to avoid introducing bias into sample selection. Three common forms of nonprobability samples are convenience or accidental sample, quota sample and purposive sample.

Convenience sampling

This is a matter of taking what the researcher can get such as those who arrive on the scene by mere happenstance. It takes people or other units that are readily available. Although selection may be unguided, it probably is not random, using the correct definition of everyone in the population having an equal chance of being selected. Volunteers would constitute a convenience sample.

Quota sampling

The defining character of quota sampling is that the researcher deliberately sets proportions of levels or strata within the sample. This is done to ensure the inclusion of a particular segment of the population. The researcher sets a quota, independent of population characteristics.

Purposive sampling

A purposive sample is a non-representative subset of some larger population and is constructed to serve a very specific need or purpose. This type of sample may be appropriate for certain research problems. However, the researcher should always provide a rationale explaining why he or she selected the particular sample of participants.

Therefore, a sampling method that will be utilized in this study is purposive or judgemental method. This type of method has been chosen because the researcher will not have enough time to interview all the livestock farmers within the study areas therefore the focus of the study will be conducted only on the randomly selected farmers.

3.2.3 Sampling size

In a very general sense, the larger the sample, the better because larger samples tend to be more similar to the population from which they are drawn. However, if the population of interest is small, then the sample can be relatively small. Large samples require more time for data collection and analysis, and are therefore costlier than smaller ones.

If a treatment is known to have a fairly strong effect, it may show up in an experiment involving a small sample. On the other hand, a small sample for a survey may miss individuals holding a minority point of view. For surveys one has to consider refusal and spoilage rates (incomplete responses, illegible answers, nonsensical replies). In such cases the researcher should aim for a larger sample in order to cover the loss.

Appropriate sample size depends on the population size, availability of resources such as time or money, strength of effect being measured, refusal and spoilage rates and a number of analyses to be performed. The total number of Sixty (60) livestock farmers are listed in the livestock farmer's database and they constitute the sample population of the study. Based on purposive choice of the researcher, the sample size of this study will be formed by the Twenty- five (25) randomly selected farmers.

3.3 Data Collection

The researcher conducted a survey with Lulekani A and B livestock farmers of BPM that are affected by the impact of drought episodes Brynard and Hanekom (2006:P38).

Data is information, usually in the form of facts or statistics that the researcher can analyse, or that one can use to do further calculation such as in this study where data is in the form of survey questions of farmers affected by drought disaster in Lulekani A and B village. Data has been further expanded as recorded observations, recorded in numeric or textual form.

Data collection is defined as the finding and gathering or generating of materials that the researcher will then analyse during the study (Jonker and Pennink, 2014). The data collection instruments used in this study will be a questionnaire; the main focus of this study being the effects of drought on small scale farmers. The data that will be collected from small scale livestock farmers who were affected by drought.

3.3.1 Data collection method

Struwig and Stead (2001:P98) state that there are different ways to collect data from the research setting in the field. However, these data collection tools are elected based on the objective of the research study. More than one data collection tool can be used in one research study. For this study, primary data will be adopted and will be collected using constructed questionnaires. These research tools are most frequently used in a quantitative research design because they allow the researcher to gather first-hand information from respondents.

3.3.2 Data analysis

Data analysis has been defined by (Jonker and Pennink, 2014) as the process of editing and reducing accumulated data to a manageable size, developing summaries,

looking for patterns, and application of statistical technique. It is further outlined as the one that consist of three concurrent flows of activity: data reduction, data display, and conclusion drawing or verification. The analysis is a continuous iterative enterprise. Data reduction refers to the process of selecting, simplifying, abstracting, and transforming the data that appear in the study.

The data that were collected from twenty-five (25) respondents were presented in the form of tables to give a clear picture of the research outcomes. The data were processed using Statistical Package for Social Science (SPSS) version 25 2018 software.

3.4 Validity and reliability

According to Babbie (2004:P143) validity refers to the extent to which an empirical measure accurately reflects the concept it is intended to measure. Babbie and Mouton (2001:P119) contends that reliability is a matter of whether a particular technique applied repeatedly to the same object would yield the same results each time. Creswell (2009:P201) indicates that validity and reliability in research are addressed through trustworthiness, authenticity and credibility.

The researcher used pilot testing to ensure that the study is valid and reliable. The researcher has tried to be as honest as possible with the findings generated from participants. The researcher used the data only for the purposes of this study.

3.5 Ethical considerations

In this study, primary data from small scale livestock farmers will be used. The original data will not be manipulated, hence the data by the researcher, data will be analysed in its original context. According to Newman (2003:P140), before an individual becomes a subject of research he or she shall be notified of the aims, methods, anticipated benefits and potential hazards of the research. Writing about these anticipated ethical issues is required in making an argument for a study. Researchers need to protect their research participants; develop a trust with them; promote the integrity of research; guard against misconduct and impropriety that might reflect on their organizations or institutions; and cope with new, challenging problems (Israel and

Hay, 2006). Ethical questions are apparent today in such issues as personal disclosure, authenticity, and credibility of the research report; the role of researchers in cross-cultural contexts; and issues of personal privacy through forms of Internet data collection (Israel and Hay, 2006).

Ethical issues in research command increased attention today. The ethical considerations that need to be anticipated are extensive, and they are reflected through the research process. These issues apply to qualitative, quantitative, and mixed methods research and to all stages of research. Proposal writers need to anticipate them and actively address them in their research plans.

3.6 Research Limitations

The study results may not be applicable in other parts of Phalaborwa since coping strategies may be area specific. In addition, due to time and financial resources, only a small sample of the population was interviewed. Equally, the results gathered as coping strategies and capacity of the institutions may change from time to time since these are dynamic variables.

3.6 Conclusion

It is important to highlight that the focus of this chapter is on research design, methodology, population, sampling and data collection procedure. The questionnaire was used to collect data from both Lulekani A and B livestock farmers from Ba-Phalaborwa Municipality in the Limpopo Province.

CHAPTER 4: DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter outlines the presentation and analysis of data followed by a discussion of the research findings. The findings relate to the research questions that guided the study. Data were analysed to identify, describe and explore the effects of drought on small scale livestock farmers. Data were obtained from questionnaires, twenty-five (25) randomly selected small scale livestock farmers fully participated in the study hence a total of twenty-five (25) questionnaires were received.

The questionnaire comprised of three sections and data generated will be presented as follows:

- The first section comprises of biographical data such as gender, age, farming experience and educational background.
- The second section comprises of data describing the occurrence of drought, effects of drought, Government interventions during drought, mitigation strategies, farming knowledge, business skills and business skills.
- In the third section comprises of data outlining the strategies in place to mitigate drought effects as well as the effects of drought on the financial resources. The questions on this section are open ended.

4.2 Data Analysis, presentation and Results

Before entering data in the excel 2010, completed questionnaires were checked for errors such as inconsistencies in data filling, data entry and completeness of the data. None of the questionnaires were discarded, all questionnaires statistics, tables and charts were produced, then interpreted and presented. Descriptive statistical analysis was used to identify percentages to answer all of the questions in the questionnaire. All respondents answered all of the questions therefore percentages reported correspond to the total number of farmers answering the individual questions. Note that the discussion of the results has been reserved for the next chapter.

4.3 Section A

4.3.1 Gender of respondents

The gender analysis of respondents shows that 32% was composed of females while 68% comprised of males. These shows that males are still dominant in the farming industry and that most of the women from the 32% inherited the farms from their late husbands as a source of income in the household.

		Gender of respondents			Cumulative Percent
Valid		Frequency	Percent	Valid Percent	
Valid	Male	17	68.0	68.0	68.0
	Female	8	32.0	32.0	100.0
	Total	25	100.0	100.0	

Table 4.3.1 Gender of respondents

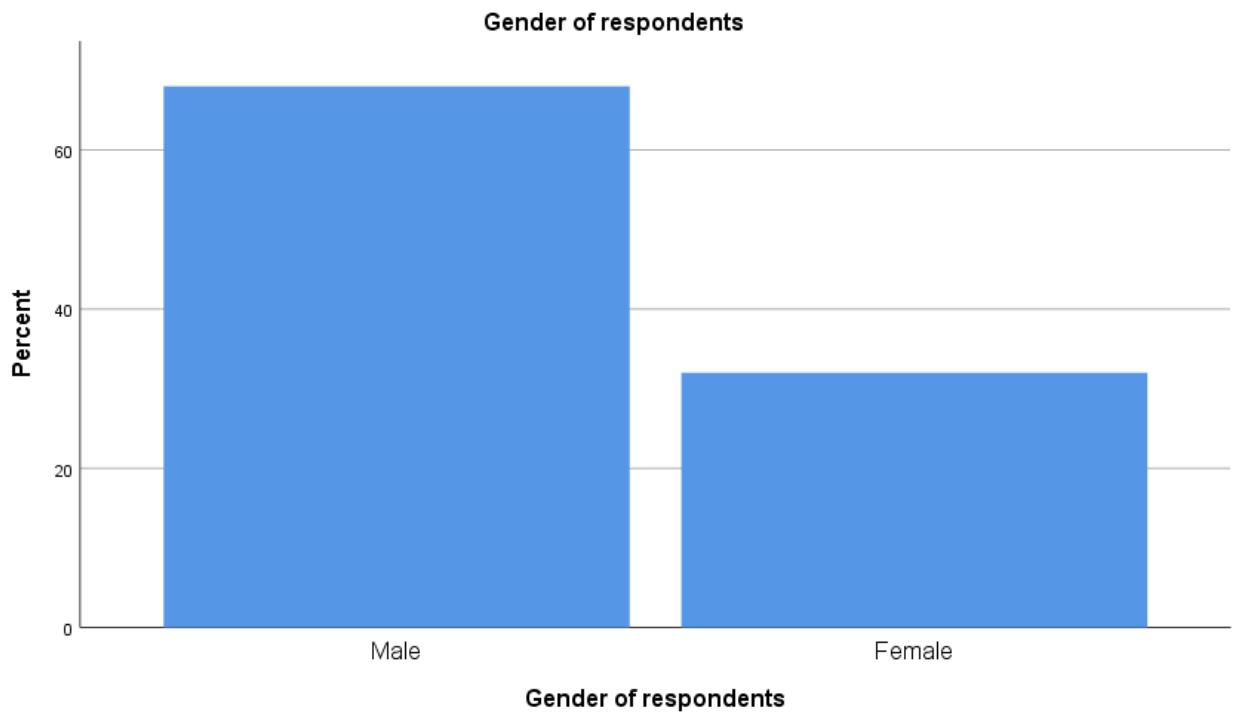


Figure 4.3.1 Gender of respondents (%)

4.3.2 Age category of respondents

The age group of respondents ranged from 29-60+. From the analysis it is revealed that 52% Of the respondents are 60 years and above. This becomes a challenge

because we are living in a technological era and farmers at 60+ years cannot keep up with the technology. This may be one of the reasons why they are likely to be hardly hit by the disaster.

Age of respondents in years

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-39	2	8.0	8.0
	40-50	3	12.0	20.0
	51-60	7	28.0	48.0
	60 above	13	52.0	100.0
	Total	25	100.0	100.0

Table 4.3.2 Age of respondents in years

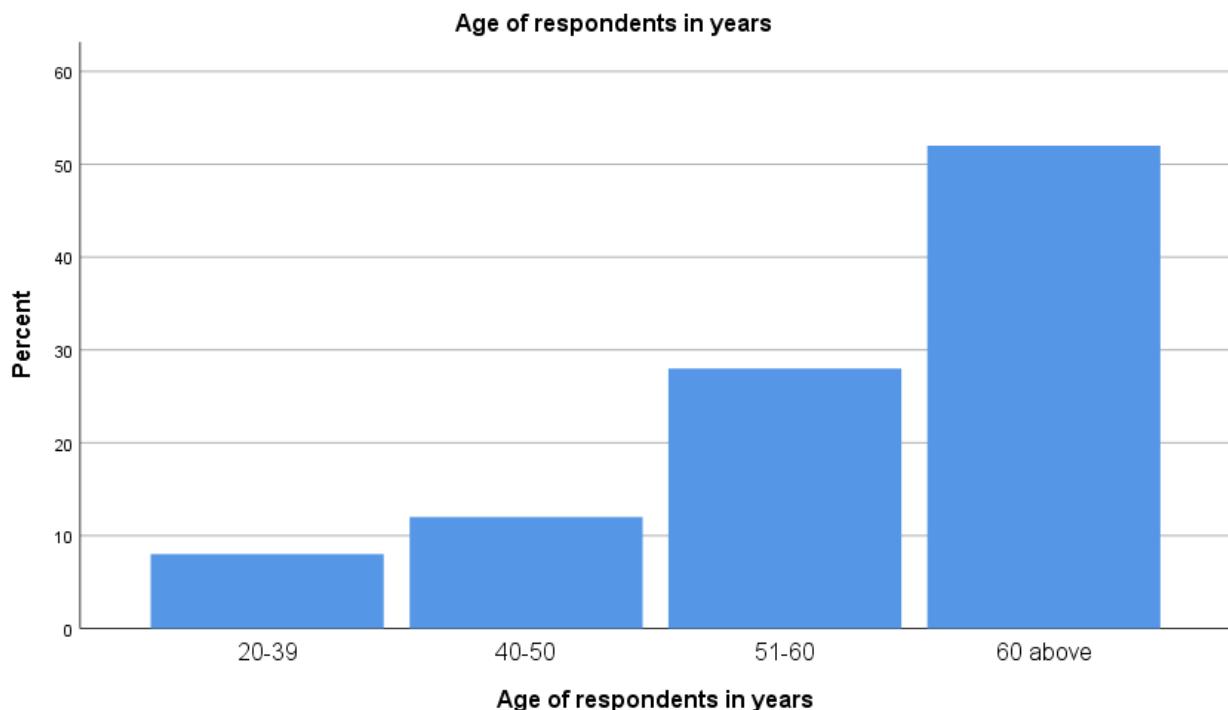


Figure 4.3.2 Age of respondents (%)

4.3.3 Farming experience of respondents

The farming experience of respondents in the study ranged between 1-10+ years. 84% of the respondents had 5-10+ years of farming experience. 12% of respondents had farming experience of 2-5 years. However, only 4% had 1-2 years' experience. This showed that majority of the respondents are experienced and have been farming for years. They have experienced many drought incidents in their farming journey.

Number of farming experience in years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2	1	4.0	4.0	4.0
	2-5	3	12.0	12.0	16.0
	5-10	21	84.0	84.0	100.0
	Total	25	100.0	100.0	

Table 4.3.3 farming experience

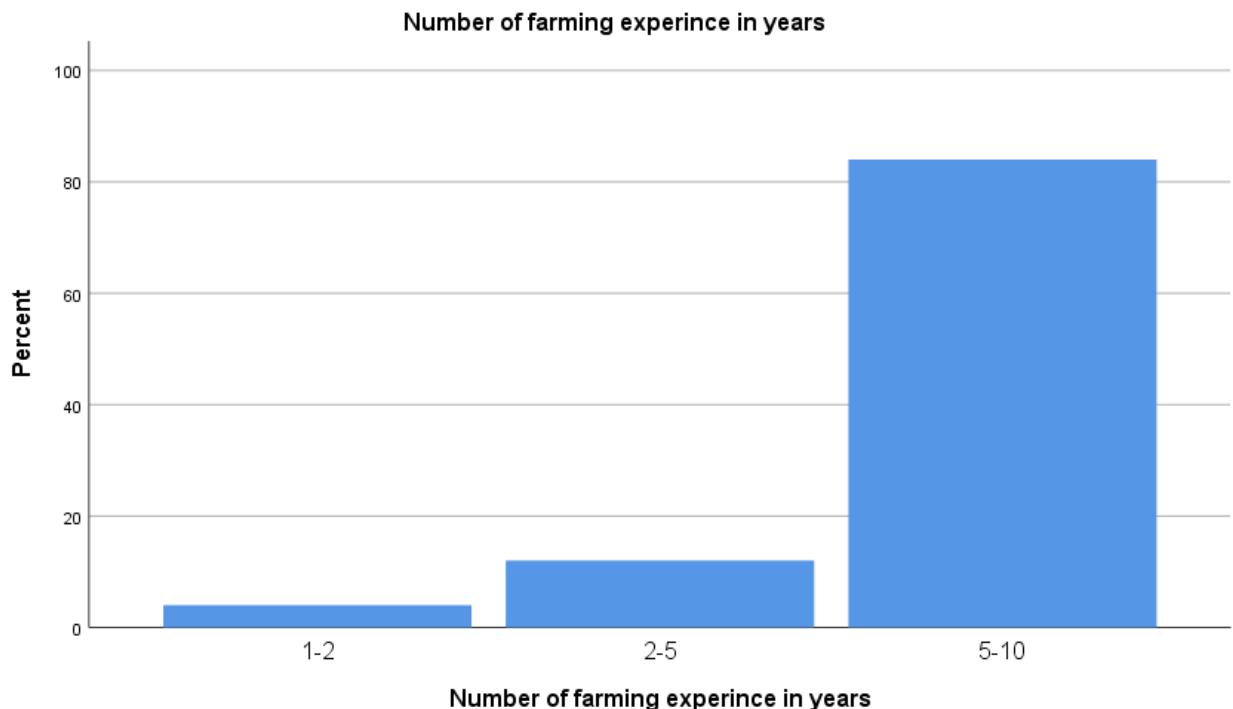


Figure 4.3.3 Farming experience (%)

4.3.4 Educational background of respondents

The educational background of farmers ranged from less than high school to university degree. It was learned from table 4.3.4 that a high % of farmer's education background was less than high school. Furthermore, 28% farmers showed to have high school educational background. Moreover, 20% farmers proved to have college educational background however, only a small fraction of 4% which is equivalent to 1 farmer had a university degree.

Educational background

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	12	48.0	48.0	48.0
	High school	7	28.0	28.0	76.0
	Diploma	5	20.0	20.0	96.0
	University Degree	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Table 4.3.4 Educational background

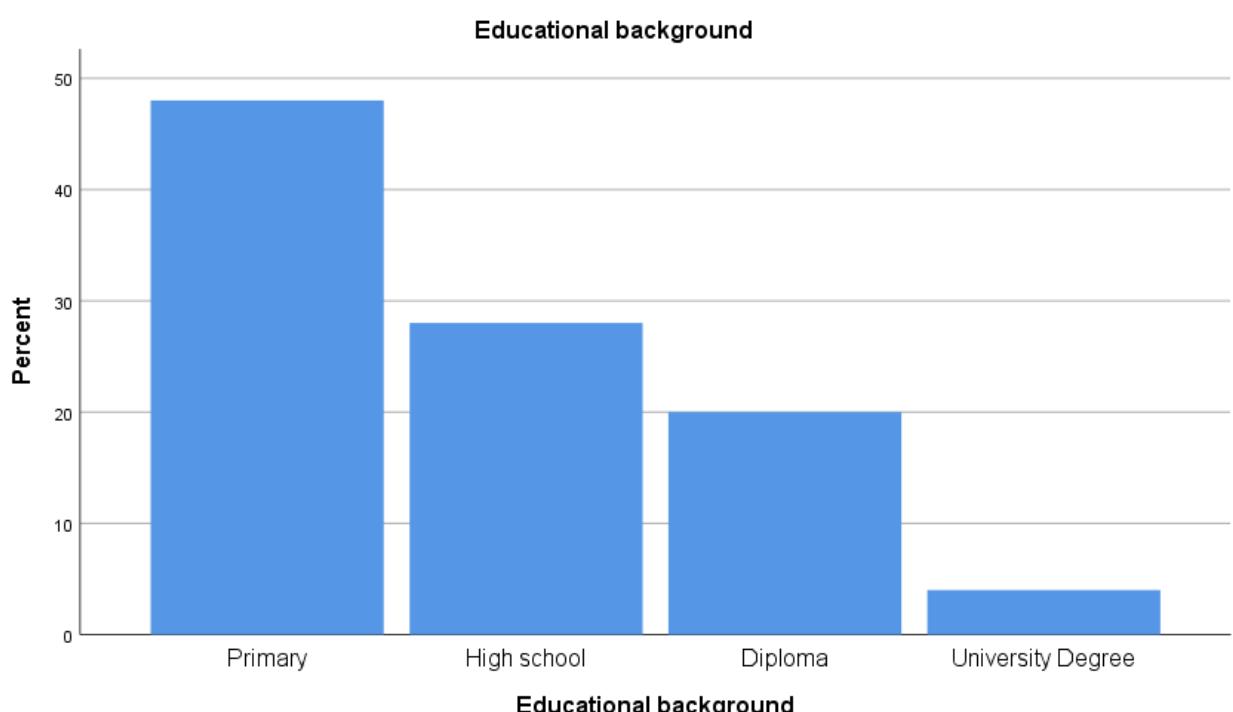


Figure 4.3.4 Educational background (%)

4.4 Section B

4.4.1 Drought occurrence in the farming area

Table 4.4.1 showed that majority of the respondents that constitute 76% strongly agreed that drought was a frequent occurrence in the area where they farm, however 24% also agreed with the question. Ba-Phalaborwa as one of the municipalities under Mopani district of Limpopo province has been declared a drought prone area.

Drought occurrence in the area of farming

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	6	24.0	24.0	24.0
	Strongly agree	19	76.0	76.0	100.0
	Total	25	100.0	100.0	

Table 4.4.1 Drought as a frequent occurrence

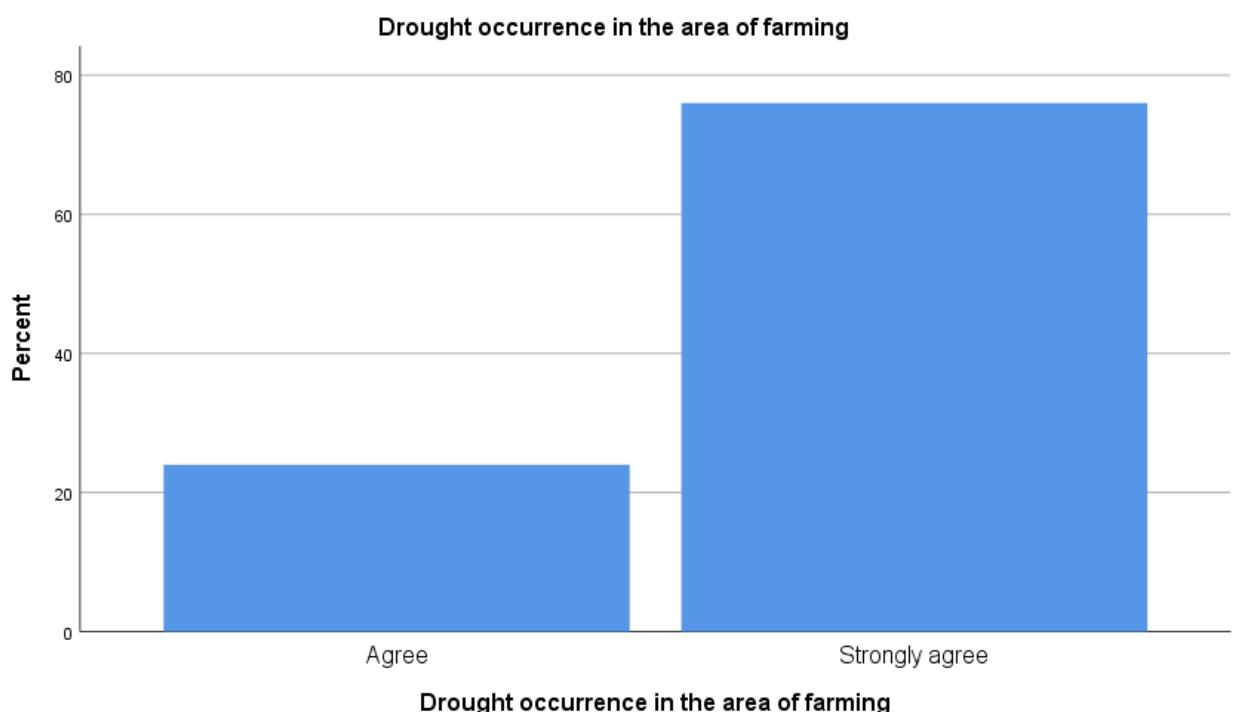


Figure 4.4.1 Drought as a frequent occurrence (%)

4.4.2 Drought affect pasture production

92% of the respondents strongly agreed that drought affect their pasture production and 8% respondents also agreed. Pasture production was affected due to the shortage of rainwater. In this regard only farmers under irrigated pasture production were not strongly affected.

Drought affect pasture production

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	3	12.0	12.0	12.0
	Strongly Agree	22	88.0	88.0	100.0

Total	25	100.0	100.0
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Table 4.4.2 Drought affect pasture production

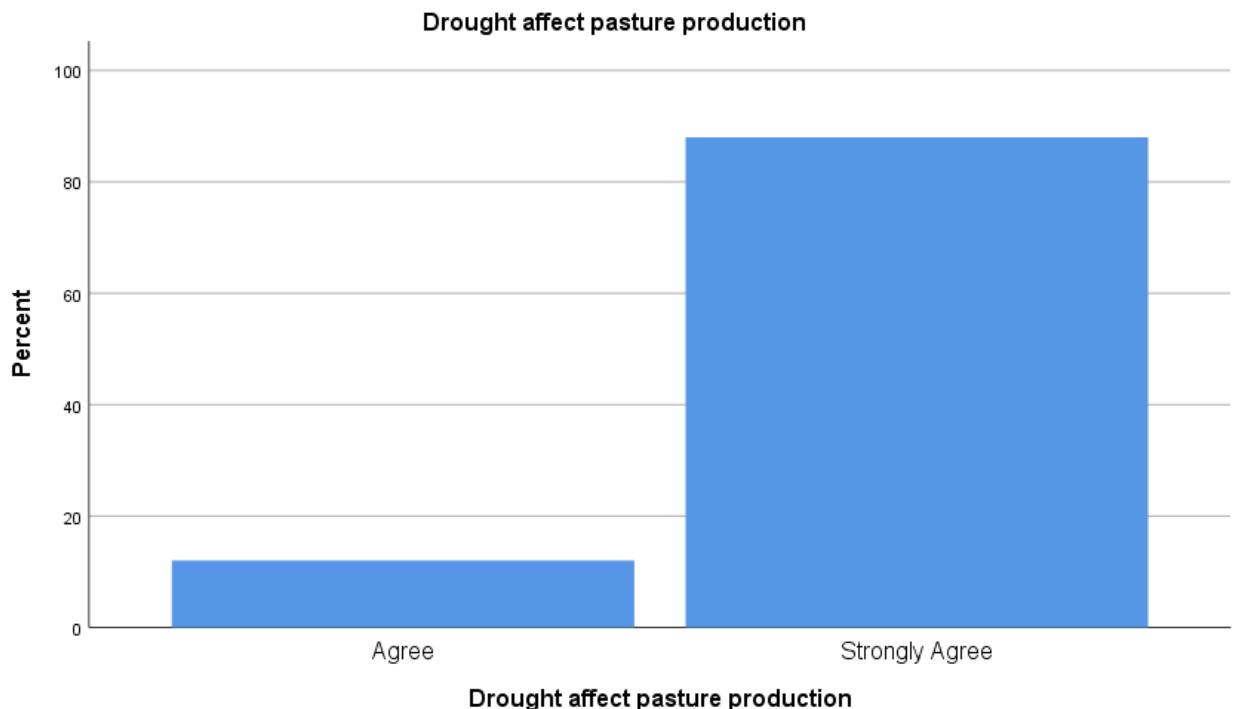


Figure 4.4.2 Drought affect pasture production (%)

4.4.3 Profit loss due to drought

The profit loss due to drought was extremely bad, 92% of the respondents strongly agreed to the question however 8% also agreed. Majority of the respondents were forced to sell their cattle's at a very low price before they could die and it is for this reason why they didn't make profit. Furthermore, their profits were used to purchase inputs for the remaining cattle's.

Profit loss due to drought					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	Agree	2	8.0	8.0	8.0
	Strongly Agree	23	92.0	92.0	100.0
	Total	25	100.0	100.0	

Table 4.4.3 profit loss during drought

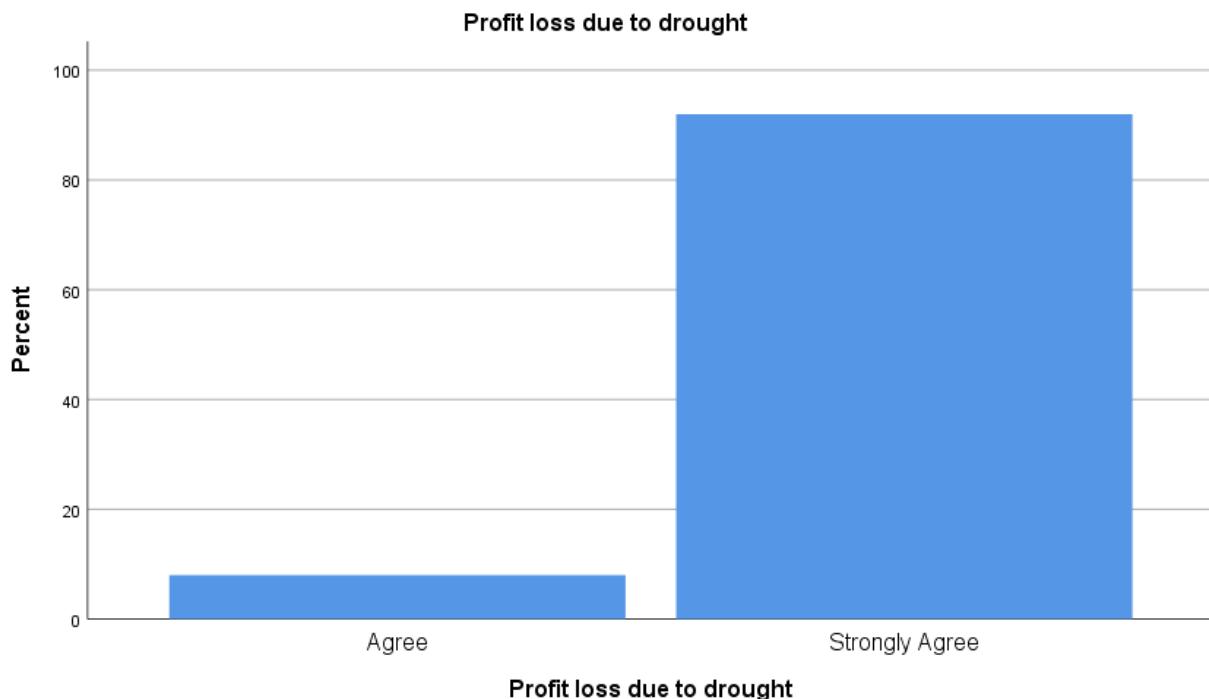


Figure 4.4.3 Loss of profit due to drought (%)

4.4.4 Drought affect livestock and other commodities

The effect of drought on livestock and other agricultural commodities showed to have a tremendous impact on farmers. 80 % of respondents strongly agreed to the question and 16 % also agreed, however 4% disagree.

Drought affect livestock and other commodities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	4	16.0	16.0	16.0
	Strongly Agree	20	80.0	80.0	96.0
	Disagree	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Table 4.4.4 Drought affect livestock and other commodities

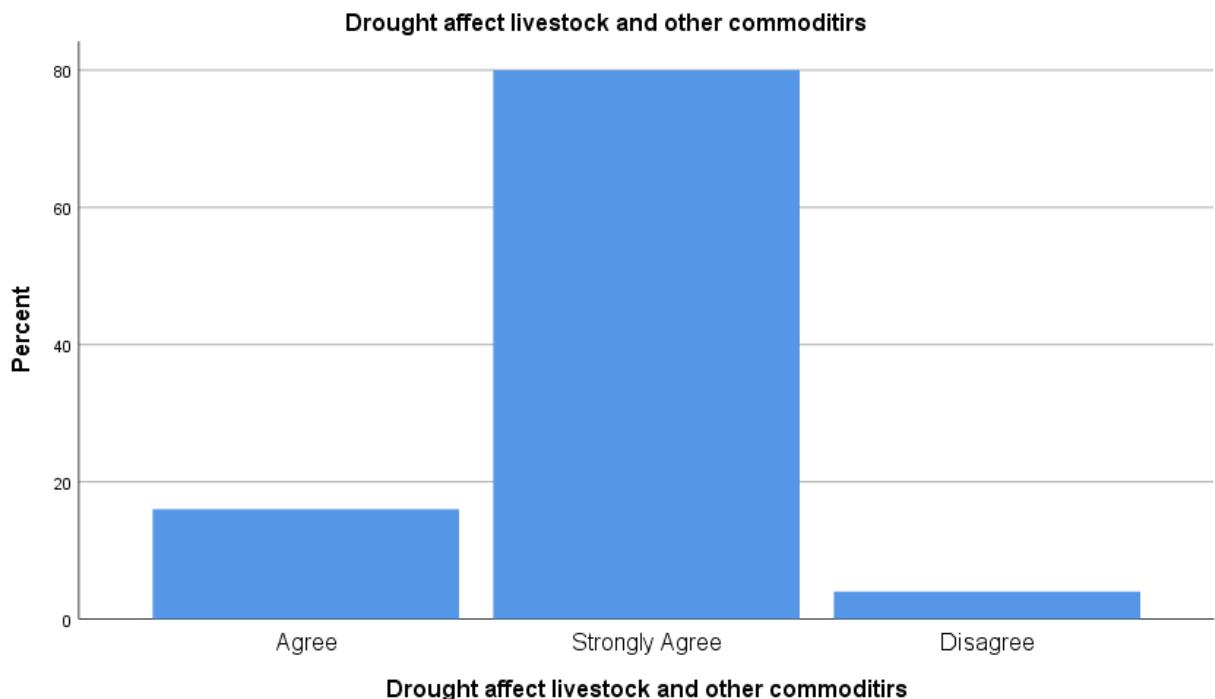


Figure 4.4.4 Drought affect livestock and other commodities (%)

4.4.5 Government intervention during dry seasons

The government intervenes during dry seasons only in drought declared areas. The Government only intervenes once the area has been declared to have been hit by drought, however respondents complained that they get Government assistance when the damage is great and irreversible.

Government intervention during dry seasons

		Frequency	Percent	Cumulative Percent	
				Valid Percent	Cumulative Percent
Valid	Agree	17	68.0	68.0	68.0
	Strongly Agree	5	20.0	20.0	88.0
	Disagree	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

Table 4.4.5 Government intervention during dry seasons

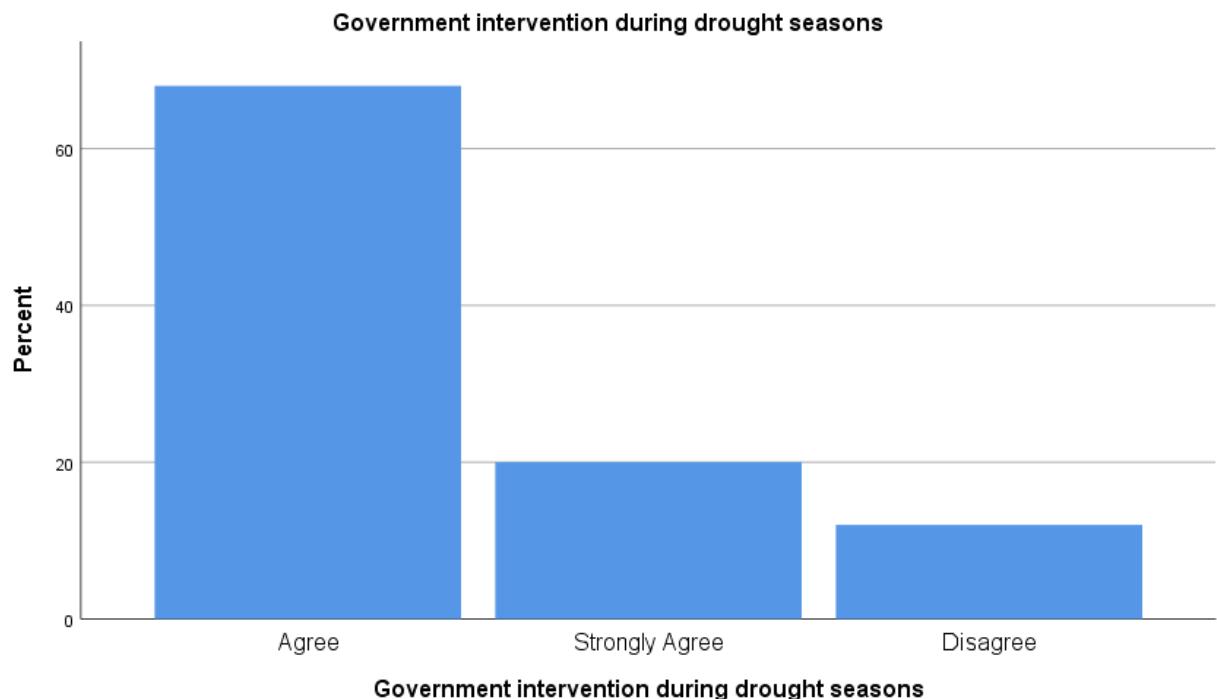


Figure 4.4.5 Government intervention during dry seasons (%)

4.4.6 Strategies to mitigate drought

Respondents revealed their abilities to mitigate drought seasons and from their respond a lot has to be done with regard to education, awareness, preparedness and adoption of coping strategies. 24% respondents strongly agreed that they have strategies in place to mitigate drought seasons, however a large segment also agreed. Furthermore, 32% of respondents disagreed to the question which they don't have mitigation strategies in place, whereas 8% strongly disagreed to have mitigation strategies to drought seasons.

Strategies to mitigate drought seasons

	Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Agree		9	36.0	36.0	36.0
	Strongly Agree		6	24.0	24.0	60.0
	Disagree		8	32.0	32.0	92.0
	Strongly disagree		2	8.0	8.0	100.0
	Total		25	100.0	100.0	

Table 4.4.6 Strategies to mitigate drought seasons

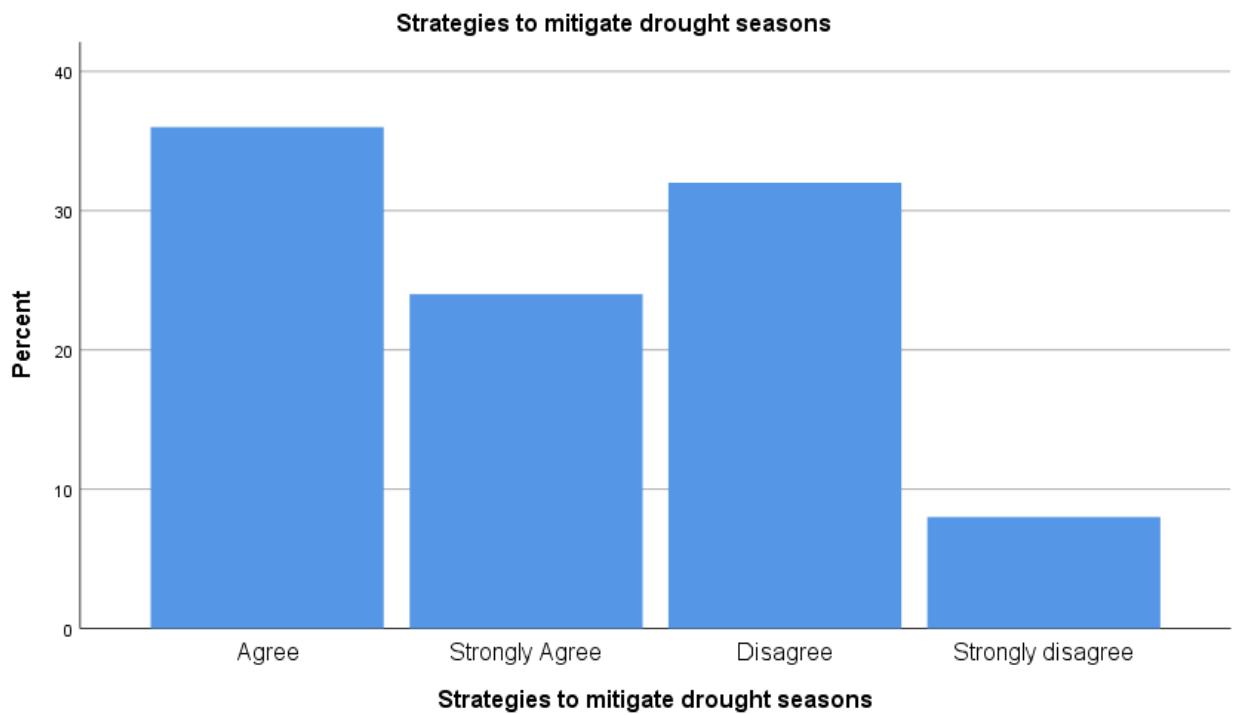


Figure 4.4.6 strategies to mitigate drought seasons (%)

4.4.7 Reasonable knowledge about farming

Majority of the respondents who agreed and strongly agreed to have reasonable knowledge on farming matched evenly at 40%, this so because most of them grew up in a place where farming is practiced in each and every house hold. Moreover 20% disagreed to having the necessary knowledge on farming and such respondents must engage themselves with the agricultural advisors and animal health technicians for farmer's information sharing sessions, exposure visits and farm demonstrations.

Reasonable knowledge about farming

	Frequency	Percent	Cumulative Percent	
			Valid Percent	Cumulative Percent
Valid Agree	10	40.0	40.0	40.0
Valid Strongly Agree	10	40.0	40.0	80.0
Valid Disagree	5	20.0	20.0	100.0
Total	25	100.0	100.0	

Table 4.4.7 Reasonable knowledge about farming

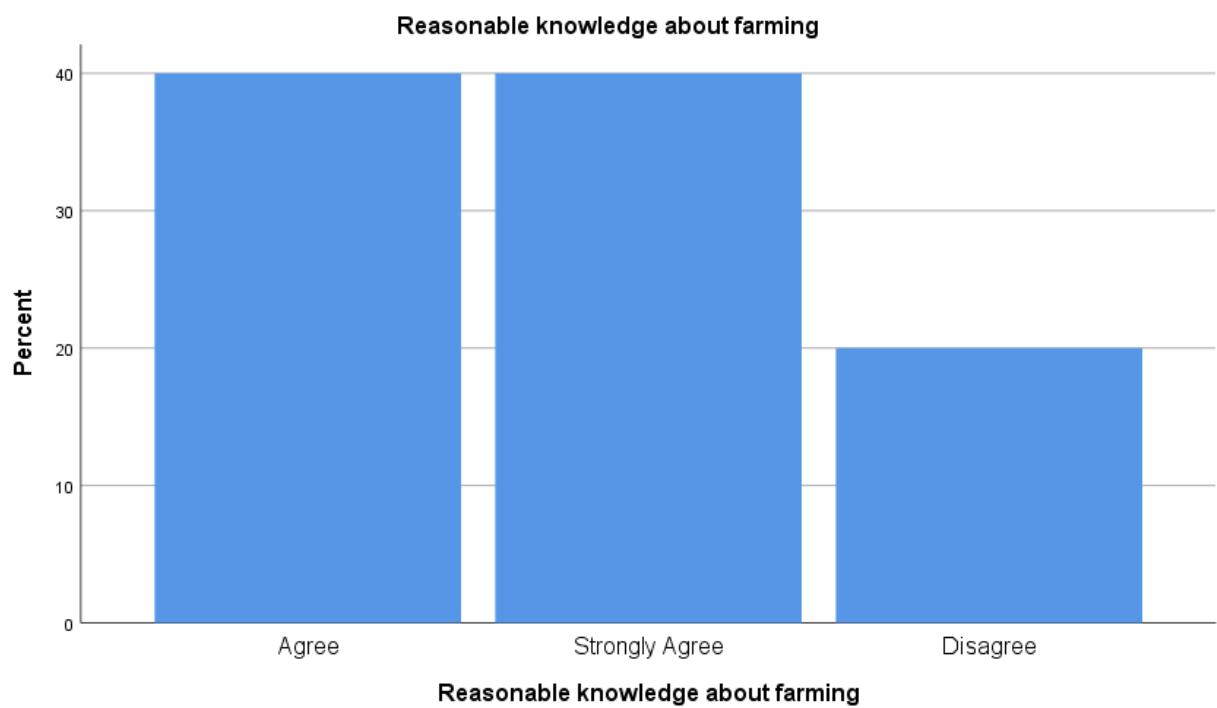


Figure 4.4.7 Reasonable knowledge about farming (%)

4.4.8 Business skills to survive dry seasons

44% respondents agreed to have business skills in place to help them survive dry seasons, however 28% strongly agreed. 24% of the respondents don't have the necessary business skills to survive dry seasons, whereas 4% strongly disagree to have business skills in place to survive dry seasons. These pose an alert to the Government officials in the farming and business sector to intervene in enhancing farmers business skills to survive any form of natural hazard.

Business skills to survive dry seasons

	Frequency	Percent	Valid Percent	Cumulative
				Percent
Valid Agree	11	44.0	44.0	44.0
Valid Strongly agree	7	28.0	28.0	72.0
Valid Disagree	6	24.0	24.0	96.0
Valid Strongly Disagree	1	4.0	4.0	100.0
Total	25	100.0	100.0	

Table 4.4.8 Business skills to survive dry seasons

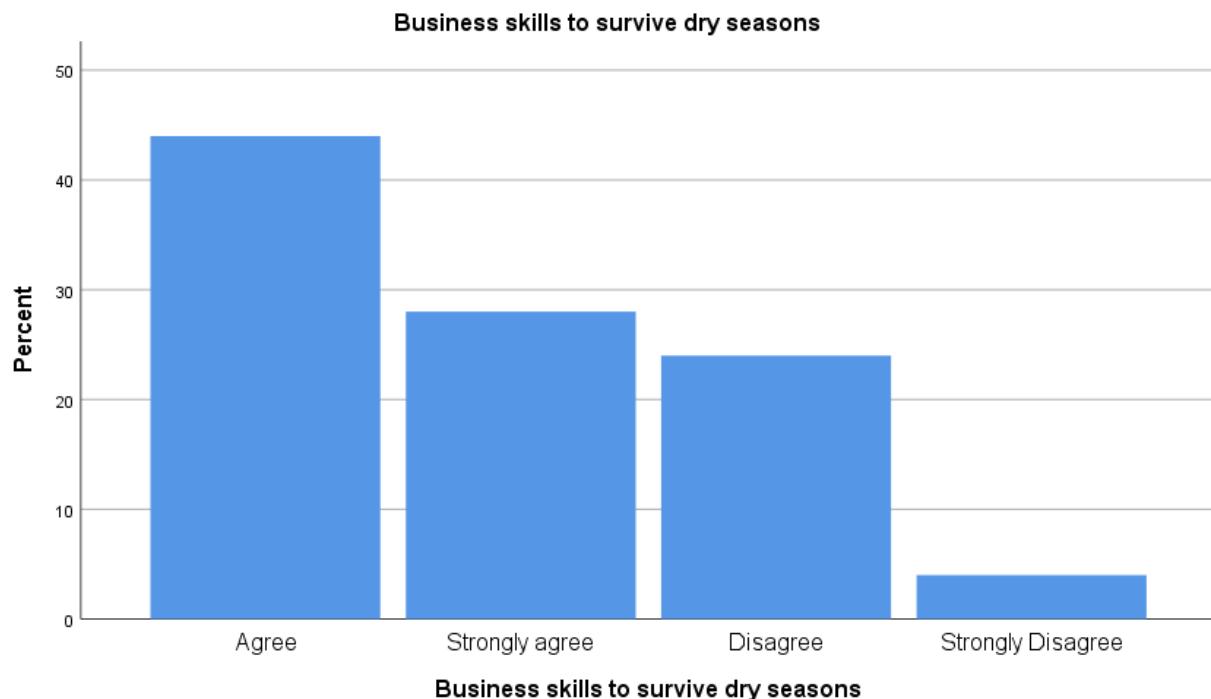


Figure 4.4.8 Business skills to survive dry seasons (%)

4.4.9 Proper management of finances

Respondents showed to have means in which they manage their finances properly. A drought season is one of the periods where farmers find themselves spending a lot on inputs in order for their livestock to survive extreme conditions. 52% respondents agree that they manage their finances properly, whereas 20% strongly agreed. Moreover 24% respondents disagreed to managing their finances properly, however only 4% strongly disagreed to managing their finances properly.

		Proper management of finances			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Agree	13	52.0	52.0	52.0
	Strongly Agree	5	20.0	20.0	72.0
	Disagree	6	24.0	24.0	96.0
	Strongly Disagree	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Table 4.4.9 Proper management of finances

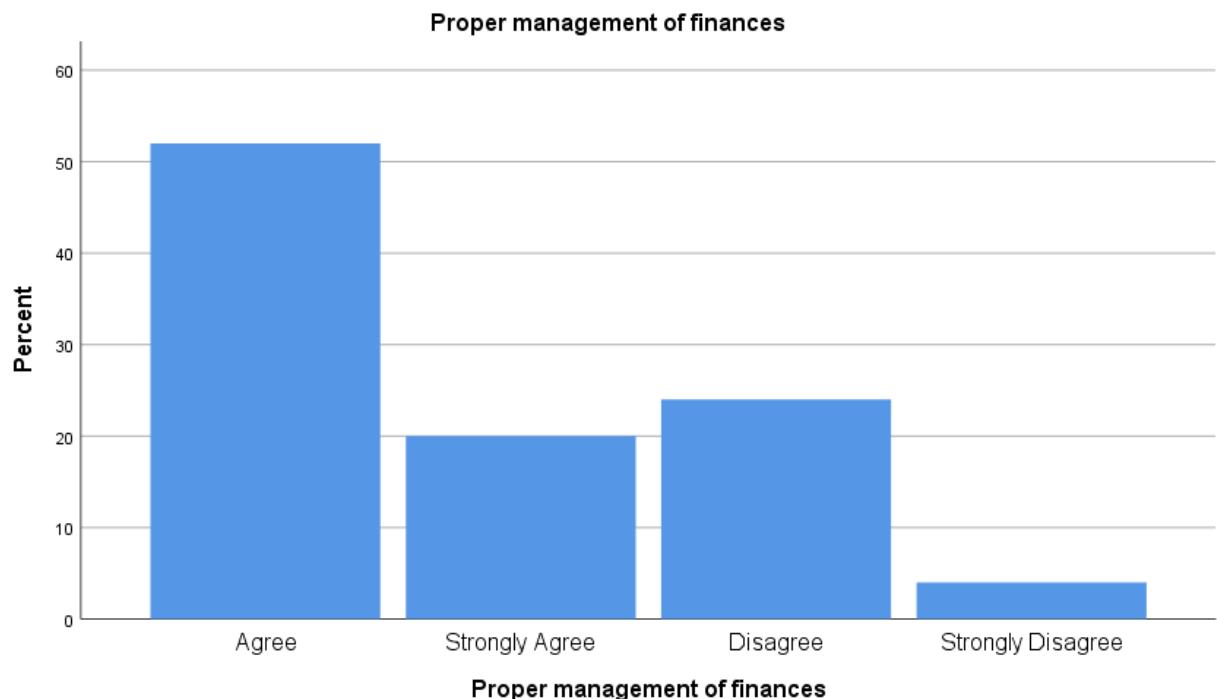


Figure 4.4.9 Proper management of finances

4.5 Section C

4.5.1 Strategies in place to mitigate drought

Respondents seem to have strategies in place to mitigate drought in their farms. Most of them during the drought season they are left with no choice but to reduce their cattle herd in order for them to maintain the remaining livestock. Majority of the respondents depended on the subsidised fodder from LDARD, however there are complaints that they get support when the damage is beyond control. It's only few respondents about 8% who had boreholes and depended on it for livestock drinking water. 36% of the respondents don't have strategies in place to mitigate drought effects in their farms.

The strategies in place to mitigate drought

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No strategy	9	36.0	36.0	36.0
	Reduce cattle herd & supplement with fodder	11	44.0	44.0	80.0
	Reduce cattle herd	2	8.0	8.0	88.0
	Supplement with fodder	1	4.0	4.0	92.0
	Rely on borehole & supplement with fodder	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

Table 4.5.1 Strategies in place to mitigate drought

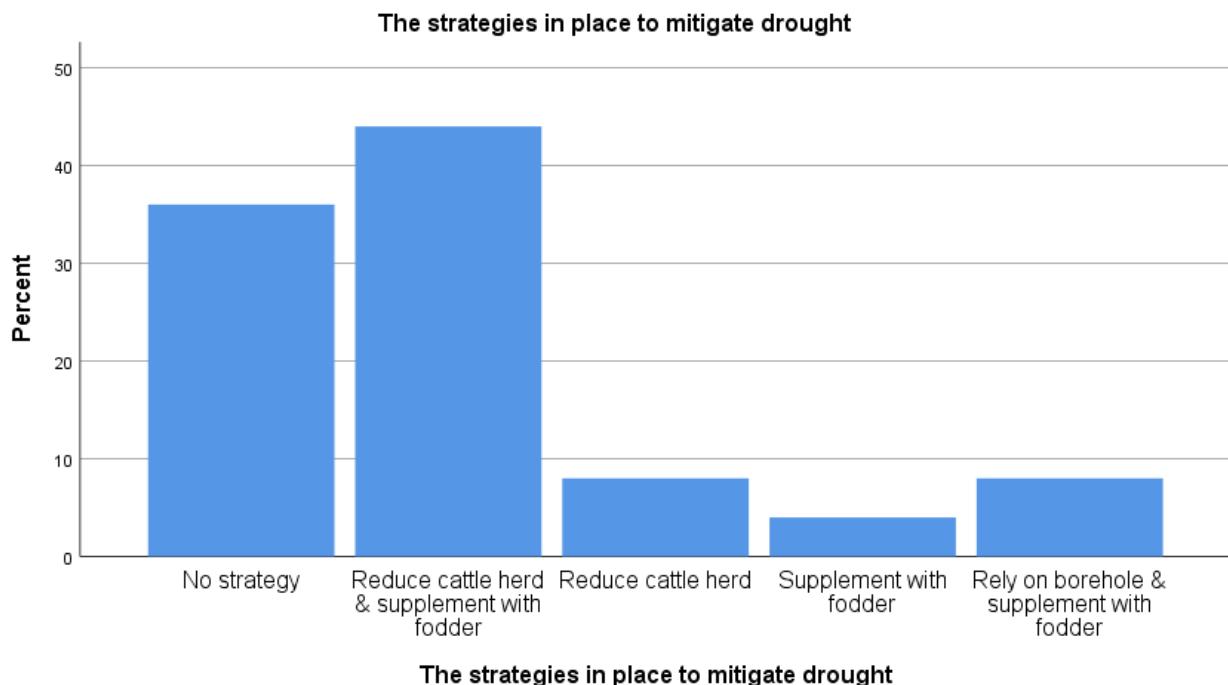


Figure 4.5.1 strategies in place to mitigate drought (%)

4.5.2 The effect of drought on financial resources

One of the aspects that is affected by drought is the financial resources. All the respondents suffered loss of financial resources during drought. They sold their livestock at lower prices because they were in a bad condition. Furthermore, they spent their profits and savings and other financial resources on inputs such as supplements, medication, transport, Lucerne and water expenses.

The Effect of drought on financial resources

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Suffer financial loss during drought	11	44.0	44.0	44.0
	Sell all my cattle at lower price	1	4.0	4.0	48.0
	No profit during drought	5	20.0	20.0	68.0
	Spend financial resources on inputs	6	24.0	24.0	92.0
	Loss of profit & savings during drought	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

Table 4.5.2 The effects of drought on financial resources

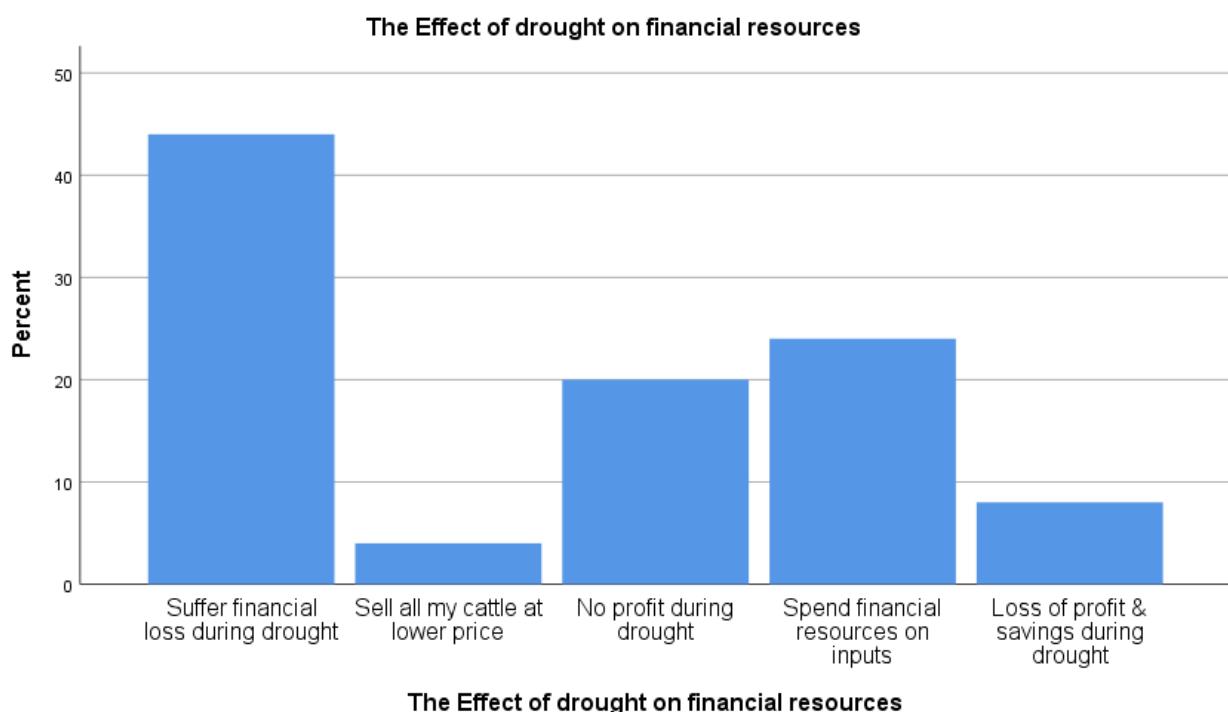


Figure 4.5.2 The effects of drought on financial resources

4.6 Summary

From the literature it can be concluded that drought is a major hazard in the municipality and its effects are extreme on small scale beef cattle farmers and their finances. According to a study by Ndlovu (2010) on page 31 of the literature, farmers have to sell their cattle in order to reduce the herd and acquire supplements to feed the remaining cattle. Furthermore, the study that was conducted by Scoones (2006) reveals that farmers not only lose their cattle during drought but they also lose profit.

Moreover, according to the FAO (2010), during drought crops are severely affected by drought which leads to reduced fodder production and a decline in fodder production may accumulate. However, farmers from Lulekani depend more on the department for fodder which they acquire at subsidised price.

Lastly, Scoones et al., (1996) maintain that in some contexts farmers prefer to move their livestock to other areas that have sufficient pastures. This practice is impossible for farmers in Lulekani because they are under redline which restricts them from moving their cattles to other areas.

4.7 Conclusion

From the results it can be concluded that drought is a major concern for livestock farmers and the agricultural sector at large. Furthermore, the farming sector is male dominant, with elderly people that have been in the sector for years and majority of them are illiterate.

Moreover the analysis from this study shows that drought is a frequent occurrence in the municipality and that during the drought period farmers lose their livestock, don't make profit, sell their livestock at lower prices and spend all their savings on inputs.

The summary of the result is unpacked on the next chapter.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Introduction

In this chapter conclusions are drawn and recommendations made based on the research, discussions and literature reviews of previous chapters. Recommendations are made on some grey areas that were identified by the researcher, but could not be covered either because they were not within the scope of the study or due to resource constraints.

5.2 Summary of findings

The study was conducted in Lulekani village where 25 farmers were randomly selected from Lulekani A and B village under the objective of investigating the effects of drought on small scale beef cattle farmers in Ba-Phalaborwa municipality in Limpopo province. Primary data was collected using questionnaires and analysed using Statistical Package for Social Science (SPSS) version 25 2018 software. The following are a summary of findings:

- Drought is a major hazard in Ba-Phalaborwa municipality and has adverse impacts on farmers and their finances. The feature of the hazard has been outlined by farmers during the data collection.
- Water shortage is severe in the area, which exacerbates the devastating effects of drought in Ba-Phalaborwa municipality. This increases the vulnerability context of farmers and as a result makes the community's ability to reduce risk difficult since they do not have sufficient access to water and proper rural water infrastructure.
- The effects of drought in Ba-Phalaborwa results in a decline in agricultural productions in the area. During drought episodes, livestock mortalities increase significantly, farmers don't make profit, they spend their financial resources in purchasing inputs, they are forced to reduce their cattle herds in order to maintain the remaining livestock and lay off some of their employees. This makes it difficult for farmers to earn income and provide for their families.
- Inadequate relationship between some farmers and the government also makes it difficult for farmers to cope during the drought period. Such farmers seems not to be well informed about the necessary operations of the government regarding drought, other disasters and other services.

- The level of drought relief and response provided by the government is not sufficient and farmers need support from the government to reduce these impacts, rather than to calculate the results of the episodes without any funding provision. The government conducts assessments in order to make funding provision for the community. However, that funding might not be sufficient for all the farmers. As a result some farmers do not necessarily receive assistance from the government.
- The government process of drought relief is not ideal and it takes too long before the farmers get assistance. The process can take up to two years after the drought episodes. In most cases drought relief processes reach farmers when they have already lost their livestock.
- The government does not have enough funding provision for drought related issues. Funding provision for drought is made available when the affected municipality/district/province requests it. However, the government is unable to provide all the farmers with enough fodder.
- There is a lack of disaster risk reduction practices. Farmers does not necessarily make use of disaster risk reduction strategies for drought episodes. This can be ascribed to the lack of a disaster management plan and knowledge because disaster risk reduction practices can be recommended when there is an existing plan for the area.
- There is a lack of knowledge regarding droughts from both the government and the community. The causes of drought are known by certain officials and community members. However, the community does not have the necessary knowledge regarding drought and coping mechanisms. The government cannot classify the difference between drought phenomena. This in turn makes it difficult for government to provide what is necessary to reduce the risk of drought and safeguard the livelihood of the community.
- Mitigation measures are not fully implemented as a result of lack of boreholes in grazing areas for livestock. Since the study area is susceptible to water shortage, some mitigation measures that are suggested by the government are not viable. Farmers need full water access to sustain their livestock.
- Furthermore, most farmers don't have the necessary skills and knowledge to help them during drought events, however they depend on the government for assistance. Our farmers don't take full responsibility when it comes to drought coping strategies instead the responsibility for drought phenomenon is normally assigned for the

government. It's about time our farmers take the necessary steps to reduce the impacts of drought, these will reduce farmer's dependency syndrome and livestock mortalities.

- Moreover, farmers do not take the advices from government officials, during drought awareness they are advised to sell their livestock before they die but because want to see their herds increasing they don't such advices.

5.3 Recommendation

Drought is natural hazard of South Africa's climate, and it is expected worsen with climate change projections. Therefore, the country needs to prepare for this natural phenomenon.

The key to drought preparedness and readiness is about knowing the what, how and when of the drought. To achieve this goal the scientific expertise to monitor and predict, the capability of the observation networks, information systems for drought early warning have to be improved.

I firmly believe that preparedness measures will go far to reduce the country's vulnerability to drought. But we also recognize that prolonged drought causes risks that the best preparedness measures may not adequately address. Below are the recommendations that can help mitigate drought impacts on farmers:

- We recommend that Congress authorize and fund the Department of Agriculture, forestry and fisheries to evaluate different approaches to livestock insurance, including a cost of production plan. The evaluation should assess whether the approaches are practicable and prudent for all farmers and other stakeholders in all regions of the country and whether they set standards that encourage efficient water.
- Furthermore, it is recommended that the Department of Agriculture, forestry and fisheries in cooperation with state and local governments and the private sector, expand training to rural communities, farmers, and ranchers across the country on various financial strategies.
- Moreover, I recommend that the Small Business Administration, through its private-sector partners, provide information and training to small business owners on developing financial and business management strategies.

- Provision of financial assistance to address long-term developmental needs (such as investment in water infrastructure and water-harvesting techniques) of the farming community, thereby improving their resilience, may prove more beneficial in the long run than short-term drought relief assistance in the form of fodder supply.
- A significant and sustained attempt should be undertaken by government to ensure that an extension service becomes an integral part of disaster risk management at both provincial and local level.
- In order to protect the natural resource base and encourage sustainable and good farming practices, policies on drought management should emphasise and enforce adherence to stocking rates, particularly for private tenure farmers.
- There is a need to develop and maintain a systematic approach to collecting data on drought (and other hazards) at all levels of government (national, provincial and local). This will be helpful in understanding drought risk and conducting drought disaster impact assessments to inform policy making.
- Government should prioritise gazetting of the draft Drought Management Plan and implementing the long overdue measures to enhance the resilience of the farming community to drought.

5.4 Conclusion

The agriculture sector's reliance on seasonal, rain-fed cultivation makes the sector particularly vulnerable to climate variability and change (Andear, 2009). Ba-Phalaborwa municipality is prone to drought. Although drought can result from a number of different causes, one of the most common drought scenarios occurs when crops and livestock suffer from severe moisture stress. This is when available water is less than the physiological needs of the same.

Poor rainfall has resulted in small scale livestock farmers failing to have meaningful produce. They experienced a massive loss of livestock. The decline and mortalities

has been exacerbated by shortage of drinking water and grazing pasture. The majority of communal farmers lost drought power and the high cost of inputs and unavailability of inputs had further compounded the challenges rural farmers faced. Most farmers lacked the requisite knowledge and skills to manage their livestock and prepare for drought with the early warnings being evident.

Preparedness measures, particularly comprehensive drought planning and proactive mitigation measures, can lessen the impact of drought on farmers, Government and the environment. They can also reduce the need for future drought relief and emergency financial resources. Effective drought plans should have clearly identified objectives and performance standards and a clear exposition of the vulnerability of a region to drought, given current and expected water resources infrastructure and water uses. For both commercial and small scale farmers, they should consider the location of alternate or supplemental sources of water, how this water can be conveyed to the point of need, and whether additional treatment is needed.

Effective plans should evaluate drought programs to determine whether they identify and address priority economic impacts and improve proactive mitigation of drought's impacts on the economy through training, incentives, technical assistance, research, and public education. Individuals, businesses, local/county/state governments, tribes, and nongovernmental organizations with an interest in or responsibilities for drought management would benefit from training and technical assistance to plan for and reduce the impacts of drought.

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APPENDIX A

QUESTIONNAIRE

THE EFFECTS OF DRAUGHT ON SMALL SCALE FARMERS OF BA-PHALABORWA MUNICIPALITY OF LIMPOPO PROVINCE

INTRODUCTION

Thank you for taking your time to complete this questionnaire. This questionnaire will take about 20 minutes of your time. There are no wrong or right answers. You are requested to participate on this study on voluntary basis, and you are free to withdraw from the study at any time.

INSTRUCTIONS

This questionnaire consists of three sections, complete all the sections.

SECTION A: BIOGRAPHICAL QUESTIONS				
<i>Please mark the appropriate answer with an X</i>				
Gender	Male		Female	
Age category	20-39	40-50	51-60	60 and above
Farming experience	Less than a year	1-2 years	2-5years	5-10years
Educational background	Less than high school	High school	College diploma	University degree
SECTION B: State to what extent do you agree or disagree with the provided statements. Mark your responses with an "X" in the appropriate boxes.				
Draughts are a frequent occurrence in the area where I farm	Agree	Strongly Agree	Disagree	Strongly Disagree
Draughts affect our crop production.	Agree	Strongly Agree	Disagree	Strongly Disagree
We lose profit due to droughts.	Agree	Strongly Agree	Disagree	Strongly Disagree
Draughts affect our livestock and other commodities.	Agree	Strongly Agree	Disagree	Strongly Disagree

Government help us with the finances during dry seasons.	Agree	Strongly Agree	Disagree	Strongly Disagree
We have strategies to mitigate draught seasons.	Agree	Strongly Agree	Disagree	Strongly Disagree
We have reasonable knowledge about farming.	Agree	Strongly Agree	Disagree	Strongly Disagree
We have business skills that help us to survive dry seasons.	Agree	Strongly Agree	Disagree	Strongly Disagree
We manage our finances properly.	Agree	Strongly Agree	Disagree Disagree	Strongly
SECTION C: OPEN ENDED QUESTIONS				
Discuss the strategies that are in place in your farm to mitigate draught.				
Discuss the effect of draught on your financial resources.				