ADAPTION TO DROUGHT CONDITIONS BY SMALLHOLDER LIVESTOCK FARMERS: LESSONS FROM 2014 - 2016 DROUGHT CONDITIONS IN THE LIMPOPO REGION.

By

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DEDICATION

This dissertation is devoted to my mom Molatelo Johanna Rakgwale for supporting me and always encouraging me to take my studies seriously, the wisdom she has always endeavored to impact in me plus the unceasing prayers she has always offered on my behalf.

DECLARATION

I hereby declare that "Adaption to drought conditions by smallholder livestock farmers: Lessons from 2014 and 2016 drought conditions in the Limpopo region" is my own research study, and all the sources that I have identified have been acknowledged and accepted in a comprehensive referencing manner.

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ABSTRACT

The Limpopo Province is a disaster-prone province, with drought being the most common natural disaster. From the year 2012 onwards, the province experienced extremely dry conditions that culminated in a severe drought in 2016. This negatively impacted the livelihoods of smallholder livestock farmers and the welfare of their livestock. The study investigated the coping strategies that were adopted by smallholder livestock farmers during drought conditions and the factors that were associated with animal loss during the drought that affected the region between 2014 and 2016. A randomly selected sample of 281 smallholder livestock farmers aged 18 years and older from the Greater Letaba Local Municipality participated in the study. Structured interviews, aided by questionnaires were used to collect the primary data. Proportions of categorical variables and the mean and standard deviation for continuous variables were computed and presented as tables and figures. A Poisson regression model was fitted to the data to identify factors that were significantly associated with loss of animals during the drought. More than half (55.50%; n=116) of the participants were made aware of the 2014–2016 drought through the agricultural extension officers, followed by 19.14% (n=40) who got to know about it through radio channels. More than half of the participants (58.29%; n=123) were aware of the impending drought. The most common support received from government agencies to help cope with the drought was in the form of animal feed (80%; n=124). Although most of the farmers (73.55%; n=114) benefitted from the support they received, slightly more than half (53.74%; n=151) did not cope well with the drought conditions. While Bellevue (B=-0.199; 95% CI: -0.380 -0.019) was negatively associated with loss of animals, Mokwakwaila (B=0.568; 95% CI: 0.405 0.731) had a strong positive association with loss of animals. Being married (B=-0.060; 95% CI: -0.305 0.183) or divorced (B= -0.035; 95% CI: -0.316 0.246) was negatively associated with loss of animals. Years of experience in farming (B=0.022; 95% CI: 0.010 0.033) and not receiving support during were strongly positively associated with loss of animals (B=0.324; 95% CI: 0.189 0.459). The low number of farmers who were aware of the impending drought and the large number of farmers who did not cope well suggests that many farmers in the area were not prepared for the drought. Groups such as widows, widowers and farmers who have many years of farming experience are high-risk groups and should be targeted for interventions in the event of a drought. More measures are needed to ensure that all agricultural centres are prepared and supported in event of a drought so as to minimise the impact of drought on local communities.

ABSTRAK

Die provinsie Limpopo is 'n rampgevoelige provinsie, met droogte as die mees algemene natuurramp. Vanaf 2012 het die provinsie uiters droë toestande beleef wat in 2016 op 'n ernstige droogte uitgeloop het. Dit het 'n negatiewe uitwerking gehad op die lewensonderhoud van kleinboere en die welstand van hul vee. Die studie het ondersoek ingestel na die hanteringstrategieë wat deur veeboere in kleinvee tydens droogtetoestande aangeneem is, en die faktore wat verband hou met diereverlies tydens die droogte wat die streek tussen 2014 en 2016 geraak het. 'N Lukraak geselekteerde steekproef van 281 kleinboere van 18 jaar en ouer van die Greater Letaba Local Munisipaliteit het aan die studie deelgeneem. Gestruktureerde onderhoude, gehelp deur vraelyste, is gebruik om die primêre data in te samel. Verhoudings van kategoriese veranderlikes en die gemiddelde en standaardafwyking vir deurlopende veranderlikes is bereken en as tabelle en figure aangebied. 'N Poisson-regressiemodel is op die data toegepas om faktore te identifiseer wat beduidend verband hou met die verlies aan diere tydens die droogte. Meer as die helfte (55,50%; n=116) van die deelnemers is bewus gemaak van die droogte 2014–2016 deur die landbouvoorligtingsbeamptes, gevolg deur 19,14% (n =40) wat dit via radiokanale leer ken het. Meer as die helfte van die deelnemers (58,29%; n=123) was bewus van die dreigende droogte. Die mees algemene steun van regeringsinstansies om die droogte die hoof te bied, was in die vorm van veevoer (80%; n=124). Alhoewel die meerderheid van die boere (73,55%; n=114) voordeel getrek het uit die steun wat hulle gekry het, het die droogtetoestande nie goed hanteer nie (53,74%; n=151). Terwyl Bellevue (B= -0.199; 95% CI -0.380 -0.019) negatief geassosieer is met verlies aan diere, is Mokwakwaila (B= 0,568; 95% CI 0,405 0,731) sterk positief geassosieer met verlies aan diere. Om getroud te wees (B= -0.060; 95% CI -0.305 0.183) of geskei (B= -0.035; 95% CI 0.316 0.246) was negatief geassosieer met verlies aan diere. Jare se ondervinding in die boerdery (B=0,022; 95% CI 0,010 0,033) en om nie ondersteuning gedurende te ontvang nie, was sterk positief geassosieer met die verlies van diere (B=0.324; 95% CI 0.189 0.459). Die lae aantal boere (ongeveer die helfte) wat bewus was van die dreigende droogte, dui daarop dat baie boere in die omgewing nie voorbereid was op die droogte nie. Groepe soos weduwees, wewenaars en boere met baie jare se boerdery-ervaring, is hoërisikogroepe en moet geteiken word vir ingrypings in die geval van 'n droogte. Meer maatreëls is nodig om te verseker dat alle landbousentrums voorberei en ondersteun word in geval van 'n droogte om die impak van droogte op plaaslike gemeenskappe te verminder.

KABOKOPANE.

Komelelo ke bothata bjo bogolo kudu go tsa temo/bolemi, segolothata re lebeletse balemirui ba bannyane. Limpopo province e na le kgatelelego ye kgolo kudu ka komelelo gagolo ge re lebeletse tsa bolemi. Nako le nako komelelo e tsea karolo ye kgolo moo e feleletsago e gatelela tsa temo. Tabakgolo ya rena kego lebelela ditsela le mehuta ye e fapanego yeo e shomishitshwego ke balemi go lwantshana le bothata bja komelelo gareng ga ngwaga wa 2014-2016. Thuto ye e kgobokantshitshwe gotwsa go masepala wa motse selegae wa Greater Letaba Local Municipality, karolo ya Mopani, profenseng ya Leboa mo Afrika Borwa. Tshedimosho ye e hweditshwe ka mokgwa wa poledisano le balemi bao ba fapanego ba go lekana nomoro ya 281 ya balemi go dinaga tsa go fapanafapana. Poledisano ebile ka mokgwa wa peakanyanyo ya dopotsisho. Tshedimosho ye e kopantshitshwe le go hlathollwa ka mokgwa wa go ikgetha wa Strata Version 14. Hlathollo ya go ikgetha e berekishitshwe ka mokgwa wa ditiragalo yoya ka nako le dipalopalo tsa go kopantswa fao tahlegelo e sa tsebjego go ka lekanywa.le bokae la diperesente. Mabakakgolo ao a hlolago tahlegelo ya diruiwa a nyakishitswe ka mokgwa wa Poisson Regression Model. Bogolo bja (64.77%) go bao ba arabilego ebile banna le bogolo bja (74.38%) bja balemi ba be ba tseba ka komelelo ye e batamelago. Go feta halofo (55.50%) ya bao ba arabilegoba tsebishitshwe ka komelelo yeo e batamelang go tswa go bagakolodi, gomme gwa latela thelebisheni (8.13%) le dikuranta (1.44%). Go feta bogolo bja (58.29%) bja bao ba ikarabetsego ba laeditswe gore ba be ba tseba ka komelelo yeo e batamelago ke fao ba bego ba ikemiseditse. Bontshi bja thekgo (80%) yeo balemi ba e hweditsego ebile ka mokgwa wa dijo tsa diphoofolo, gwa latela latela thekgo yeo e filwego ka mokgwa wa meets le dithibela malwetsi go diphoofolo. Bogolo bjago makatsa (73.55%) bo laeditse gore thekgo yeo ba e hweditsego e ba tshwetsi molemo le diphoofolo tsa bona, go feta bonnyane (26.45%) bjoo bo rilego thekgo yeo ba e hweditsegobka nako ya komelelo ga se ya ba tshwela mohola goba gaya ba hola ka selo. Go ba modudi wa Bellevue (B= -0.199; 95% CI: -0.380 -0.019, p= 0.031) le Mokwakwaila (B=0.568; 95% CI: 0.405 0.731, p= 0.0001) ebile nthla ye bohlokwa go tahlegelo ya dirui. Go oketsa seo, go nyadiwa (B=0.942; 95% CI: 0.737 1.201), go hladiwa (B= 0.966 (95% CI: 0.729 1.279), le palo ya mengwaga ya botsebingo tsa temo (B=1.022; 95% CI: 1.010 1.034, p= 0.0001), le ge eba molemi ga se a hwetse thusho ka nako ya komelelo (B=0.324; 95% CI: 0.189 0.459, p= 0.0001) ebile dinhla tsa bohlokwa go tahlegelo ya dirui ka nako ya komelelo. Palo ya fase ba balemi bao ba bego bas a tsebe ka komelelo yeo e bego e batamela, e kgathile tema ye kgolo mo tabeng ya go paledisha balemi go ipeakanyela kgahlanong le komelelo yeo e bego e batamela. Ka fao seo se ba amile gampe. Mo nakong ye

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LIST OF ACRONYMS AND ABBREVIATIONS

CAES – College of Agriculture and Environmental Studies

CI – Confidence Interval

CIS – Climate Information Services

GDP – Gross Domestic Products

GLLM – Greater Letaba Local Municipality

IDP – Integrated Development Plan

NDA – National Department of Agriculture

NGO – Non Government Organization

SABC – South African Broadcasting Commission

SAWS – South African Weather Services

SD – Standard Deviation

SHF – Smallholder farmers

SHLF - Smallholder Livestock farmers

CHAPTER 1

1.1 Introduction

According to Galdies *et al.* (2016) increasing global warming and the frequencies of extreme weather events (such as drought conditions) in many parts of the world will be the key factors contributing to the depletion of valuable agricultural resources from now and into the future. Drought affects both agricultural production and region's ecological system. The later manifests as dry rivers, diminishing under groundwater, deteriorating water quality, animal relocation and human emigration (Wang *et al.* 2015).

Climate variability including drought and other changes, are the most prominent factors that affect the levels of outputs of goods and services obtained from the ecosystem. Drought is especially a climatic catastrophe leading to major disturbances in the natural system of the world's arid and semi-arid regions (Keshavarz and Karami, 2014).

Adaption to climate change and more so drought are critical mostly in Africa where rural livelihoods are subjected to multiple shocks and stress without mitigations or buffer with the resultant increased vulnerability of the poor (Zingore *et al.* 2009). Changes in key climate variables such as temperature and rainfall may act to drive agro-ecosystems beyond their limits, and in some cases endangering the future of agricultural industries and communities (Ghahramani & Moore, 2016).

For countries like Zimbabwe and Malawi, farming remains important key to the livelihoods of the poor (Makate *et al.* 2019). Rural farming remains a major source of food, jobs and income for many rural households throughout the world. For instance, in Zimbabwe, more than 80% of the population relies on agriculture for survival, while 70% of the total population reside in rural areas. Makate *et al.* (2019) suggests that effective adaption of smallholder agriculture to drought can have a profound effect on farmer's livelihoods in South Africa.

Farming in Limpopo is severely constrained by scarcity of water, particularly in the northeast quadrant of the Limpopo Province, which includes the Mopani District Municipality Area. The supply of water is insufficient for irrigation and therefore small-scale farmers rely on dry-land farming. Hence, agricultural extension officers and agricultural experts (scientists) need the capacity and expertise to respond to drought in a timely and effective manner across different farming communities, particularly those with limited resources and skills. However, for the extension officers to be able to respond timeously and effectively there is a need for records of

how previous episodes of drought conditions were handled. Ncube-Phiri *et al*. (2014); Belle *et al*. (2017) are of the view that failure to feature farmers in planning results in unsustainable mitigation measures. According to Makuvaro *et al*. (2018), the farmer's willingness to confront issues affecting their livelihoods is a positive move to the right direction, irrespective of whether they have enough resources or not. From 2014 to 2016, Limpopo experienced prolonged drought conditions that disrupted farming activities; however, there is no evidence of any record of the disruptions that ensured during that period.

In view of this, the present study seeks to document the impact of the drought of 2014-2016 that was experienced in Greater Letaba Local Municipality (GLLM) in Limpopo, and also assess the coping strategies adopted by farmers during the drought. The study will also investigate the interventions which the government implemented to help the farmers deal with the drought.

1.2 Rational and motivation of the study

Due to its geographic location, the ecological systems in Limpopo (GLLM) are complex, fragile and vulnerable to the impact of drought. Climate change does not only impact the bio-diversity of GLLM, but also impacts the livelihoods of local communities, as they are completely dependent on the natural resources (Maiti *et al.* 2017). In 2014-2016, GLLM experienced extreme climatic event that caused loss among farmers, deteriorated agricultural land and immeasurable shock to the smallholder farmer's livelihood. The impact of climate change is highly difficult to evaluate due to limited data availability. As a result, very little about the impact of climate change related events like the drought of 2014-2016 in the GLLM is available.

According to Zeweld *et al.* (2017) most studies do not sufficiently capture the beliefs and social pressure of farmers (socio-psychological behaviour) and the alternative information sources. Furthermore, without considering the beliefs, knowledge and the pressure farmers faces, we might never understand the intention and behaviour of farmers making decisions to mitigate against climate change (Zeweld *et al.* 2017).

In view of this, there's a need for studies to investigate how the smallholder farmers were able to cope with adverse weather conditions, the effectiveness of intervention measures by government or other stake holders, and the impact drought had on the livelihood of smallholder farmers.

1.3 Problem statement

Currently, more than 50% of the world's population, including South Africa, depends on rural livelihoods that are highly vulnerable to the impacts of climate change (McIntyre *et al*. 2009). As a result, smallholder farming (SMF) plays a crucial role in supporting the livelihoods of farmers and contributing to the economy. However, it faces challenges related to climate change particularly high environmental temperatures and limited rainfall with resultant drought. In the period 2014 and 2016, small-scale farmers in Limpopo experienced losses due to high environmental temperatures and lack of rain; with the Mopani and Sekhukhune Districts being the worst affected (SABC unpublished). However, even though the drought was severe and resulted in deaths of livestock (Figure 1 and 2), there is no published evidence of research to show how the adverse conditions experienced during the said drought impacted livestock farming in the Limpopo region.

Figure 1: Due to the drought of 2014-2016, cattle in villages like Selwane village, outside Phalaborwa, died to water scarcity (Photo courtesy of SABC).

Figure 2: These are carcasses scattered in dry grasslands in Makuleke village in Limpopo near Thoyondou. (Photo Courtesy of SABC).

Furthermore, there is no record of whether the farmers were prepared to face the adverse weather conditions and the kind of strategies they adopted during the adverse weather conditions. Therefore, there is a need for a study to document how farmers were able to cope with adverse weather conditions, the effectiveness of interventions and the impact the drought had on the livelihood of the farmers.

1.4 Research aims, questions and objectives

1.4.1 Aims

The aim of this research project was to highlight the constraints to the livelihood of farmers in the GLLM related to the adverse weather conditions experienced in 2014-2016, and to investigate the impact of the adverse weather conditions on cattle farming in the study area.

1,4,2 Research questions

I. Were the smallholder farmers prepared for the drought that occurred in 2014-2016 in the GLLM?

II. What coping strategies did the smallholder farmers in the GLLM area adopted that enabled them to cope with the drought of 2014-2016?

III. What interventions did the government implement to assist the farmers in the study area to cope with the drought of 2014-2016?

IV. Which socioeconomic factors were significantly associated with the number of animals that the farmers lost?

1.4.3 Research objectives

I. To describe how the farmers prepared for the drought that occurred during the 2014-2016 period.
II. To describe the coping strategies farmers implemented during the 2014-2016 drought.
III. To describe interventions that the government implemented in the area with a view to alleviate the impact of the drought that occurred during 2014-2016.
IV. Assess the factors that were significantly associated with the number of animals farmers lost during the drought of 2014-2016 in GLLM.

1.5 Scope of the study

The study was carried out in the Limpopo Province. However, the research only focused on GLLM. With the assistance of extension officers in GLLM, rural farming areas dominated by small-scale farmers were selected from three agricultural centres. These agricultural centres included Mokwakwaila, Bellevue and Sekgosese agricultural centres.

1.6 Limitations of the study

The study was confined to GLLM of Mopani District boundaries and therefore excluded areas beyond this geographical region. In view of this, the findings of this research cannot be generalized to other parts of South Africa. However, the lessons learnt through this study can benefit other areas. Since this is an observational study, errors in measurements may arise from unprofessional respondents giving inaccurate answers to the questions.

1.7 Significance of the study

This research adds to the information gathered on how small-scale farmers in areas like the GLLM are able to cope during the adverse weather conditions, and also documents such information in detail to provide baseline data for further research. Lesson learnt on how the small-scale farmers in GLLM were able to cope during the 2014-2016 drought period will be available for small-scale farmers elsewhere in South Africa to adopt.

1. 8 Outline of the study

The chapters of this study are structured in the following way:

Chapter 1: Study background: Provides research background on drought and climate change. Also provides problem statement, motivation, aim, research questions and objectives, the scope and significance of the study.

Chapter 2: Literature review: Explains how small-scale farmers in South Africa and in other countries cope in event of droughts. Furthermore, it also explains how small scale farmers are impacted by droughts.

Chapter 3: Methodology: Focuses on the study area, method of sampling, data collection methods and how data was analysed and interpreted.

Chapter 4: Results: Provides a summary of findings obtained from research participants.

Chapter 5: Discussions: Explores and discusses the factors that were significantly associated with animal loss. Copying strategies adopted by farmers during the drought and the various interventions by government and other stake holders are also discussed.

Chapter 6: Conclusion and recommendations: Concludes by making recommendations based on the study's investigative results.

CHAPTER 2

2.1 Literature Review

2.1.1 Vulnerability of smallholder agriculture to drought

The phrase "Smallholder agriculture" generally describes farming that is carried out predominantly in developing countries by rural producers who primarily use family labour to develop the land; such farming is the principal source of income for the family (Morton, 2007). Although it is generally accepted that small-scale agriculture is associated with poor, non-commercial subsistence farming in parts of the former homeland regions in South Africa, the term 'smallholder' is problematic in its definition and use (Kirsten and Van Zyl, 1998). For example, the term smallholder agriculture is at times used in reference to 1) farmers who occasionally sell farm products for cash to supplement other sources of income; 2) farmers who from time to time market the surplus after they have met their consumption needs; and 3) farmers whose primary focus is on production for the market.

According to Cousins, (2010) other criteria that are used to define smallholder agriculture include the size of land holding and extent of production for the market. Although rarely used, the different types of labour (e.g. household or family labour, hired workers or co-operative labour) or source of farming capital are other criteria that are used to define smallholder agriculture.

The term 'emerging smallholder farmers is at times used interchangeably with the term 'smallholder farmers. However, the former is increasingly being used to refer to smallholder farmers who are market-orientated and who aspire to commercialise their produce (Zantsi *et al*. 2019). Other authors have also defined emerging farmers as black farmers in the former homelands who are beneficiaries of the Land Reform Policy of the Government of South Africa

Since the dawn of democracy in 1994, the South African government has endeavoured to implement transformation policies to remedy the injustices of the past. These transformation policies manifest through the Land Reform Policy and other support measures intended to aid previously disadvantaged farmers (Zantsi *et al*. 2019). With the commercial agricultural sector in South Africa increasingly showing a strong trend of job shedding, which has been attributed to factors such as intensive use of machinery that reduces the need for unskilled labour, smallholder farming is in a better position to contribute towards job creation in the agricultural sector. This is because smallholder farming tends to be labour intensive.

Smallholder agriculture in Sub-Saharan Africa is vulnerable to adverse weather conditions, particularly because of intensifying challenges of poverty, high dependence on rainfall and low infrastructural and technological development (Ayanlade, Radeny and Morton, 2017). Moreover, future climate change models predict more serious and regular drought events (Verma *et al*. 2004). The water shortage associated with drought is one of the main threats to future sustainable agriculture, particularly in rural areas. Within the wider context of agricultural sustainability studies, sustainable agricultural water management is an important issue that needs to be considered at a practical level (Forouzani & Karami, 2011).

Droughts result from reduced seasonal rainfall and environmental extreme heat that exhausts the bodies of water and the soil moisture through rising evaporation and delayed wet-season (Kabir, Alauddin and Crimp, 2017). Although available evidence suggests that livestock communal farming has the capacity to create jobs for the rural poor, smallholder agriculture in Sub-Saharan Africa, including South Africa, is confronted by challenges of poverty that result in heightened vulnerability to adverse weather conditions, a high dependence on rainfall and low infrastructural and technological development (Zantsi *et al*. 2019). Therefore, water scarcity throughout the year is a potential threat to environmental quality and food security for both humans and livestock in many parts of South Africa, including the GLLM in the Limpopo province.

Establishing a universal view about drought might be challenging. However, the term "drought" generally refers to a regional phenomenon which covers huge territorial extensions, occurring anywhere in the globe with significant impacts on water resources and socio-economic activities (Diaz *et al.* 2020). Drought affects both agricultural production and the region's ecological systems, leading to dwindling rivers, declining groundwater tables and deteriorating water quality and human emigration. Furthermore, in vulnerable communities that rely mainly on agriculture; livestock farmers are more vulnerable as it takes a long period of time for them to rebuild herds extinguished by the drought events.

The livelihood of small-holder livestock farmers is threatened wherever there is a decrease in annual rainfall and an increase in frequency of extreme climatic occurrences. This is particularly true in marginal highland areas where small scale livestock farming is common and where livestock producers are already vulnerable to changing weather patterns (Mansard *et al.* 2017). Among the effects of climate induced stress on agriculture are a corresponding

increase in food insecurities, and an increase in poverty levels among smallholder farmers. Table 1 below summarises the categories of drought impacts and their effects.

Table 1: Categories of drought impacts and their effects on society and environment.

Social Impacts	**Effects**
Lack of resources (food and water for farmers and their animals)	Relocation and migration
Increased desire for water	Disputes amongst water users
Marginal lands become unproductive	Poverty and unemployment
Reduced pasture yield and grazing efficiency	Overstocking; reduced living standards
Food insecurity	Malnutrition
Public safety	Increased risk to both human and animal life
Economic Impacts	**Effects**
Reduction of livestock quality	Poor meat quality
Loss of employment, wages and property	Increased unemployment rate and poverty
Environmental Impacts	**Effect**
Lack of food and drinking water for animals	Increased mortality in animals
Increased environmental temperatures	Increased number of wildfires
Loss of wetlands	Drying-out of crops
Increase in dust	Increased air pollution
Poor soil quality	Degradation of soil
Increased animal mortality and disease	Earnings and food loss; decreased breeding stock

2.1.2 Adaption to drought

Within social systems, the term adaption refers to changes in a human group's actions and characteristics that improve its ability to cope with external stresses. The direct effect of adaption is to minimize individual and social vulnerability (Smit and Wandel, 2006). As a result, adaption is a key concept in climate change research, and serves as a measure of whether social systems are becoming more adaptive to impacts of climate change.

Understanding small-holder adaption at the farm level and risk management approaches is key to helping smallholder farmers in climatically prone countries (Kabir, Alauddin and Crimp, 2017).Therefore, exploring the development of adaption strategies to the predicted drought increase has become a critical issue for poverty reduction and sustainable agriculture (Lei *et*

al. 2016). Furthermore, predicting and understanding how small-scale farming system may evolve in the future is decisively critical if poverty alleviation and food security goals are to be achieved (Thornton *et al.* 2004).

In the agricultural sector, the impact of climate change and drought could be minimized if farmers adopt appropriate strategies that are feasible for the farmer to apply with understanding . Nevertheless, little is known about what form of adaption strategy is appropriate and feasible for farmers (Lei *et al.* 2016). There are very few studies that quantitatively identify the farmers' adaptive mechanism, and evaluation of its efficacy. In view of this, more empirical studies are needed to address these knowledge gaps, especially at the rural community level (Lei *et al.* 2016).

According to Woods *et al.* (2017), impact studies of climate change in agricultural production systems always assume that either farmers are restricted to their current practices and will not respond to future climate conditions or that farmers are fully rational and will adjust immediately to climate change. The notion of 'reasonable farmers as an alternative, arguing that it is important to analyse what drives the decisions of the farmers under realistic conditions rather than assuming no response to adaption or a complete response to adaption (Woods *et al.* 2017).

Drought is a major threat to small scale farmers in the Limpopo province because the province is in a semi-arid area with very low and unreliable rainfall. So in the event of a severe drought, there is reduced pasture and water for livestock and irrigation which adversely effects the agricultural sector (Maponya and Mpandeli, 2012). However, there is no record of the impact of the drought events that hit farmers in Limpopo from 2014 to 2016, and how farmers were able to cope. The researcher hypothesizes that the farmers were not prepared for the drought; and that interventions by government and other stake holders, was minimal and insufficient to mitigate the impact of the drought. The researcher further hypothesized that farmers were adversely affected by the drought conditions and that it will be possible to identify factors that were significantly associated with loss of animals.

2.1.3 Factors influencing farmers' behaviour towards adverse weather condition (Drought).

Studies note that the attitude towards natural disasters is a prime feature of perceptions, beliefs and characteristics of hazards (Zamasiya *et al*. 2017). Furthermore, if the behaviour towards the weather condition is aligned to positive attitude, then a positive attitude is likely to lead to

adaption. On the other hand, a negative stance towards adaption is more likely to lead to no adaption to adverse weather conditions. Zamasiya *et al*. (2017) further explains that although attitude is identified as a necessary condition for adaption, little knowledge is known of how attitude affects adaption. Hence the policy makers are hindered from enhancing adaption to climatic stress by smallholder farmers.

According to Kibue *et al*. (2015), the gender of the household head influences the information access to climatic formation. Furthermore, in Anhui province in China, Kibue *et al*. (2015) noted that female farmers value social relationships which have been shown to improve information sharing. As a result, access to such information is likely to give them a positive attitude towards adaption. In the study by Sundblad *et al*. (2007), it was also observed that female farmers have a feminine identity which emphasizes attachment, empathy and care. Such qualities are thought to put greater intrinsic value on the environment and as such, make them more likely to take action that reduces the impact of climate change on food security.

The level of education also plays a crucial role in the attitude of the farmers towards adverse weather conditions. The higher the level of education the farmer has, the greater the ability to understand the available information on climate. Through education, farmers understand and are in a better position to easily access information regarding quite a lot of things including climate change. As such, education improves farmers' beliefs and expectations about climate; it also improves farmers' awareness of the possibility of adaption on food security, and positively influences the farmers' behavioural intention towards adaption (Zamasiya *et al*. 2017). In view of this, literate farmers are more likely to have a positive attitude towards adaption to adverse weather conditions.

The farmer's age is an important factor that influences the attitude of the farmer since experience is a key factor in the farming enterprise. Older farmers are more aware about climate change, and are more likely to have experienced climate change conditions over longer periods of time (Zamasiya *et al*. 2017). This implies that older farmers are more likely to understand climatic patterns, their causes, and mitigating actions that might need to be put in place in order to reduce the impact of climate change (drought). Older farmers are also more likely to adapt compared to the young farmers who still lack experience. Intrinsically, age positively affects farmers' intention towards adaption of climate adoption.

According to Kibue *et al*. (2015), access to agricultural extension services has an impact on growing awareness of adverse weather conditions among smallholder farmers. Extension

services infuse a positive attitude in the smallholder farmers through transmitting knowledge, technology and increasing awareness. They are also the transparent link between farmers and information providers (researchers, policy makers and NGOs). Extension officers as a' resource, provide technical assistance, information on improved varieties and agricultural technologies. Smallholder farmers with access to extension services are more receptive and willing to take action to minimize the effects of climate events such as drought (Zamasiya *et al*. 2017). Consequently, farmers with access to extension services tend to have a more positive outlook towards adaption than farmers that have no access to extension services.

CHAPTER 3

Research Methodology

This chapter provides a description of the study area, the main agricultural activities and other economic activities in the study area. It also describes the climatic conditions of the area. The chapter also presents the study designs adopted to realise the objectives of the study, the sampling strategy, data management and data analysis and the ethical implications of the study.

3.1 Study Area.

The study was conducted in the Greater Letaba Local Municipality (GLLM), with a land area of 1 891 Km². It is situated within the jurisdictional region of the Mopani District in the north-eastern quadrant of the Limpopo province (Figure 3). It is estimated that approximately 8% of households in the municipality live in proclaimed towns, 73% live in rural villages, and the rest reside on farms and in informal settlements (IDP, 2014). Limpopo provincial capital city is Polokwane, which is just 300 Kilometres (km) away from South Africa's capital city Pretoria, and 200 Km away from the south of the province's border with Zimbabwe).

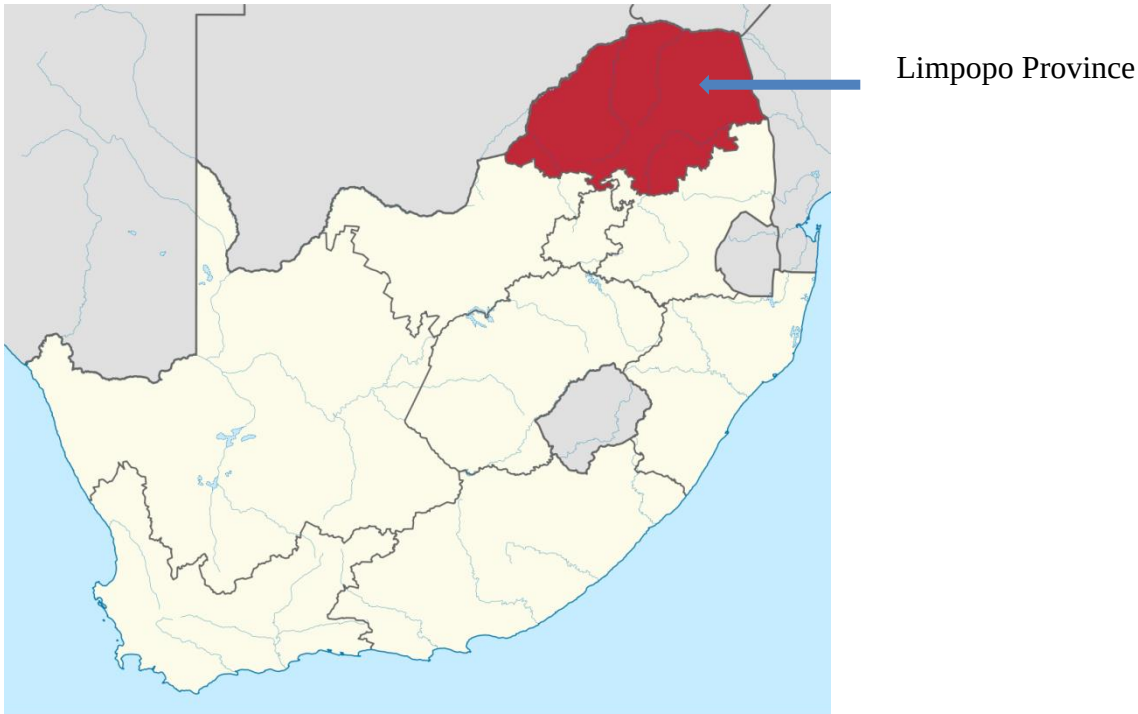

Figure 3: **Map of Republic of South Africa, highlighting Limpopo province and the study area (GLLM) (sourced from: [www.limpopo.gov.za)](www.limpopo.gov.za)**

Limpopo Province is split up into five district municipalities namely; Mopani, Vhembe, Capricorn, Waterberg and Sekhukhune districts (Figure 4).

Figure 4: Map of Limpopo province showing the district municipalities within Mopani District. (www.limpopo.gov.za).

Mopani District consists of four local municipalities of category B namely: Phalaborwa (leading in mining and tourism), Greater Giyani (leading in agriculture), Greater Letaba Local Municipality (a leading in agriculture, tourism and small-scale mining) and Greater Tzaneen (leading in agriculture, forestry, tourism and small-scale of mining (IDP, 2015/2016). The present study only focuses on the Greater Letaba local Municipality.

There are approximately 131 rural villages within the GLLM jurisdiction and approximately 94% of the population reside on state-owned land in rural villages under custody of traditional authorities. Entrances to the municipal areas are considered as Mamaila-Kolobetona in the north, Modjadjiskloof in the south, Makgakgapatse in the east, and Sekgopo in the west. Available natural resource such as lakes, tourist attractions, nature reserves, and proximity to intense economic activity creates opportunities for agricultural by-products.

Agriculture in the GLLM contributes about 16% of the district's GDP. More specifically, the agricultural sector is a leading contender in the municipality as a significant employer, and continues to grow as an activity that generates employment. According to the Integrated Development Plan (2014) the agricultural sector employs more than 23% of the Mopani

District workforce. However, smallholder and emerging farmers (farmers who are the beneficiaries of one of the government's land reform programmes such as land redistribution for agricultural development) with potential to create economic growth are impeded by lack of resources and funding and, therefore, need financial backup. Water availability is the most significant factor limiting agricultural production and growth in the GLLM. This is also true for most of the Limpopo province since it is located in the dry savannah sub-region.

In general, the Limpopo province experiences hot summers and mild winters, with the average annual rainfall ranging between 300 mm and 600 mm. Although a large proportion of farmers are located away from these rivers, Smallscale farmers are mainly located alongside perennial rivers. The province also encompasses a wide range of topographies, with elevations varying between 600 and 900m above sea level (Figure 5 & 6). The northern and north-western parts of the GLLM consist of land with marginal potential for arable and non-arable farming and low to moderate grazing (Integrated Development Plan, 2014). For years, the GLLM has been experiencing moderate drought across all the villages and urban settlements.

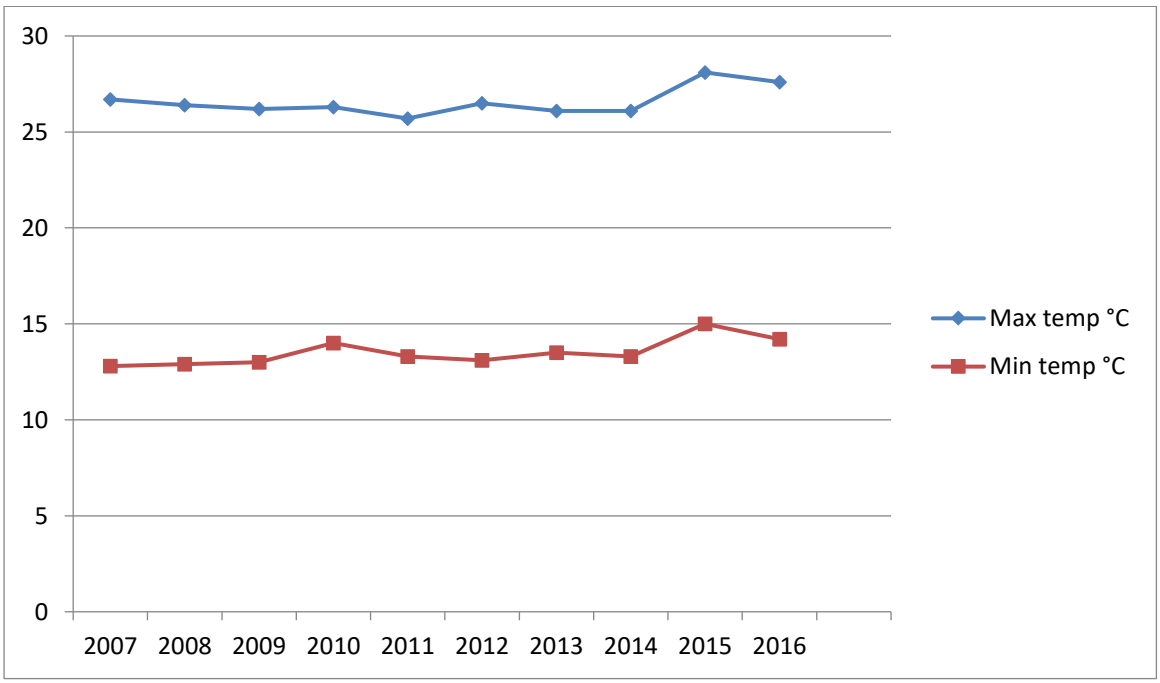

Figure 5. Greater Letaba Local Municipality monthly average temperatures: 2007 – 2016 **(Data Sourced from SAWS).**

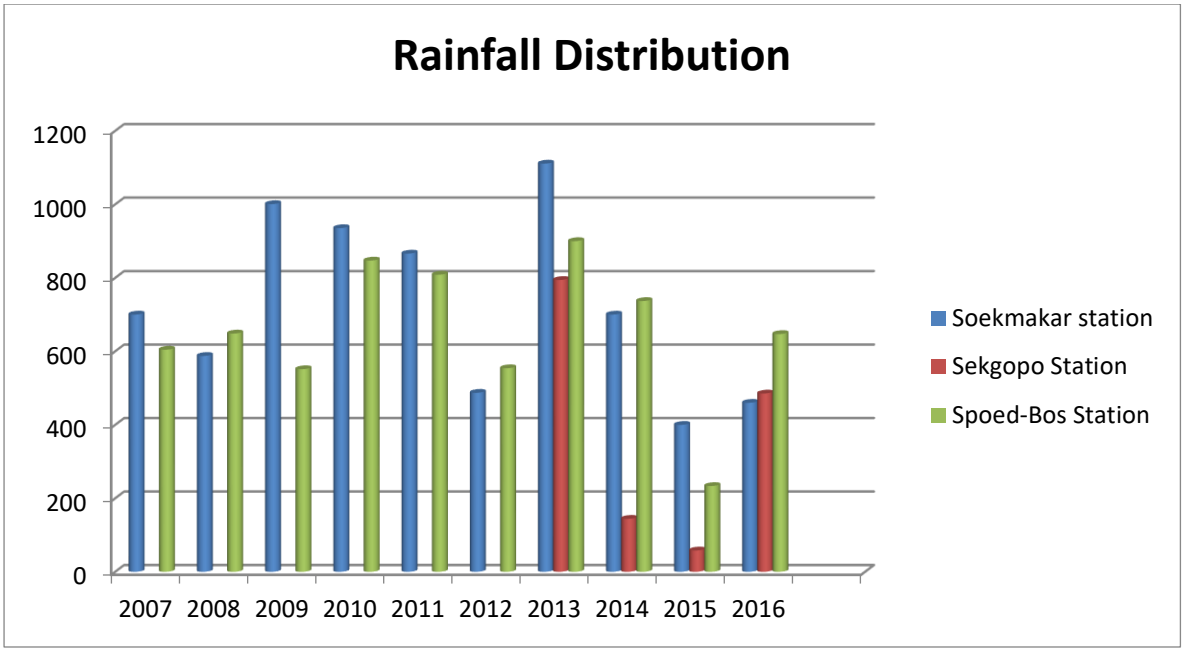

Figure 6. Annual Rainfall Distributions in some areas of the Greater Letaba Local Municipality: 2007 – 2016. Source: (Water Research Commission, 2017).

The municipality's northern and north-western areas mostly have land with limited arable and non-arable farming potential, including land for low to moderate potential for grazing. These sections are all under the tribal authority. Although the potential for agriculture in GLLM is limited, further development potential in these parts of the municipality is relatively low. As a result, most land is available for grazing purposes.

3.2 Study population and inclusion criteria

The study population consisted of a representative sample of smallholder farmers aged 18 years and older, residing in the three agricultural centres within the GLLM. The inclusion criteria consisted of the following: 1) the participant must be rearing livestock alone or be involved in mixed farming; 2) the participant must own farmland that is equal to or less than 10 hectares; and 3) the farmland must be recognised by the agricultural extension service of the GLLM.

3.2.1 *Sample frame and determination of sample size*

Only farmers who were in the database of the Department of Agricultural Economics, Extension and Rural Development of the GLLM were invited to participate in the study. These formed the sampling frame from which the random sample was selected. The sample size was determined using sample size tables developed by the Research Advisors (2016) at a 95% confidence interval (CI) and a margin of error of 5%.

3.2.2 *Sampling design*

Stratified random sampling with proportional representation was employed to select the 281 smallholder livestock farmers for the study. The GLLM consists of three (n=3) agricultural service centres namely: Mokwakwaila, Sekgosese and Bellevue agricultural centres. All the three agricultural centres were included in the study as stratas. Simple random sampling was then applied to each stratum to obtain a proportional random sample.

3.2.3 *Study design*

A cross-sectional study design was adopted to investigate the adaption to drought and the impacts that the drought had on smallholder farmers in GLLM during the 2014-2016 period. This method is easy to mount and to conduct and involves the administration of questionnaire.

3.2.4 *Data collection*

A pretested structured questionnaire (Annexure 1) written in English and translated into Northern Sotho was used to collect data. The questionnaire consisted of both close and open-ended questions.

The following areas were included in the questionnaire:

- Demographic data
- Drought and climate change preparedness
- Effects on livestock herds
- Effects of drought on farmers and their household
- Economic impact
- Government interventions to aid farmers mitigate drought

Before the final study commenced, a pilot study was conducted to test the questionnaire to ensure that the questions were clear, and that the data collection instrument captures all the required information.

In total, 281 randomly selected smallholder livestock farmers from the three agricultural centres were invited to participate in the study. Face-to-face structured interviews were conducted with the farmers, and each interview lasted between 20–40 minutes.

3.3 Research ethical statement

Approval to conduct the research was obtained from the Ethics Committee of the College of Agriculture and Environmental Science, University of South Africa before the study commenced (Reference No: 2017/CAES/127) (Annexure 2).

In addition, authorisation to carry out a survey amongst farmers in the GLLM was requested from the Department of Agriculture in the Mopani District and the GLLM of the Limpopo province (Annexure 3). Lastly, permission was sought from all the tribal leaders of the villages that were selected to participate in the research study (Annexure 4). Participants were informed and briefed about their participation and told that their involvement was voluntary and that they were free to exit the study at any time. The participant's consent form clearly stipulated the individual's rights of confidentiality. To ensure that the participants remained anonymous, personal identification was not included in the results

3.4 Data Management and Analysis

3.4.1 *Data capturing*

The filled-in questionnaires were reviewed for completeness at the end of each data-collection day or immediately after the fieldwork. Data was initially captured using Microsoft Excel and later exported to the statistical software Stata (StataCorp version 14.2) for analysis. Data cleaning was carried out by checking for duplicate observations, missing values and inconsistencies across the variables. All the variables were labelled and recoded. Age as a continuous variable was categorised into eight categories (19–24, 25–30, 31–36, 37–42, 43-48, 49–54, 55–60, >60).

3.4.2 *Data analysis*

Categorical variables such as demographic data (age, gender, marital status, etc.), drought preparedness, effect of drought on farmers, economic impact and government interventions were summarised and presented as proportions, while continuous variables were summarised as means and standard deviation (SD). A univariate analysis was performed with each explanatory variable to assess the association with the outcome variable (number of animals lost) using the Poisson regression model. The backward elimination selection method was used to select variables for inclusion in the multivariate analysis. Variables with an alpha level >0.20 were automatically dropped by Stata and were not included in the multivariate model.

To assess the factors that were significantly associated with the number of animals lost by the farmers during the drought, a multivariate analysis was performed using the Poisson regression model. The Poisson regression model was fitted to account for the fact that the outcome variable was a count. The assumption of the Poisson regression model was checked before fitting the model. The log likelihood-ratio test was used to compare models, and significance was set at a p-value of <0.05.

CHAPTER 4
RESULTS

4.1 Demographic profile of participants

Tables (2-4) below present the proportions, means and standard deviations of the demographic and socio-economic characteristics of the respondents who experienced the drought conditions in GLLM, Limpopo province. A total of 281 farmers participated in this study. Out of this number, the majority (64.77%; n=182) were males, and the majority were from the Bellevue community centre (38.79%; n=109). Mokwakwaila contributed the least (28.47%; n=80) number of respondents (Table 2).

The majority of the farmers (74.38%; n=209) indicated that they were aware of the impending drought. Just over half (55.50%; n=116) of the respondents indicated that they had heard about the drought through the extension officers. This was followed by those who said that they had heard about the drought through the radio (n=40; 19.14%) and other means (n=24; 11.48%). Very few respondents indicated that they got to know about the drought through the television (n=17; 8.13%) and newspapers (n=3; 1.44%).

Over half the farmers (n=123; 58.29%) that were aware of the drought indicated that they had prepared themselves. The remaining 41.71% (n=88) indicated that they were not prepared for the impending drought (Table 2).

Table 2: Percentage responses to questionnaire items: Agriculture centre, gender, awareness, drought preparedness, source of information and ability to cope

Variable/Category	**Level**	**% (n)**
Agricultural centre (n=281)		
	Sekgosese	32.72 (92)
	Bellevue	38.79 (109)
	Mokwakwaila	28.47 (80)
Gender (n=281)		
	Female	35.23 (99)
	Male	64.77 (182)
Awareness of the impending drought (n=281)		
	Aware	74.38 (209)
	Not aware	25.62 (72)
Information source about the impending drought (n=209)		
	Television	8.13 (17)
	Radio	19.14 (40)
	Newspaper	1.44 (3)
	Extension officer	55.50 (116)
	All sources	3.83 (8)
	Other	11.48 (24)
	Missing	0.48 (1)
Drought preparedness (n=211)		
	Yes	58.29 (123)
	No	41.71 (88)
Coped (n=281)		
	Yes	46.26 (130)
	No	53.74 (151)

4.2 Impact of the drought and support received to help farmers mitigate drought conditions

In Table 3, just over half (58.36%; n=164) of the respondents indicated that the coping mechanisms they adopted were helpful, while 41.64% (n=117) indicated that the coping mechanism they adopted did not work for them. Regarding the water source, majority of the farmers (38.43%; n=108) indicated that they got water from boreholes. This was followed by those who indicated that they got water from the rivers and streams (32.74%; n=92), and the least number received water from the municipal taps (n=42; 14.95%).

On the average each farmer owned 37 (Sd=25.69) animals before the drought in 2014-2016, while the average number of animals each farmer had at the time of the study, was 21.64 (Sd=18.51).

On the average, farmers lost 4.9 animals (Sd=4.06) over the drought period. Animals slaughtered and consumed by the farmers as a way of reducing poverty (1.67; Sd=1.22) contributed the least to the loss of animals during the drought period. With respect to the support given to the farmers to alleviate the drought, most of the help came from the government agency (n=118; 76.13%) while the remaining (n=27; 23.87%) was offered by the NGOs and other agencies (Table 3).

Majority of the farmers (n=124; 80%) received feed for their animals. Only six (n=6) farmers (3.87%) indicated that they received help in the form of water. The least support to the farmers was in the form of vaccines and dips (n= 1; 0.65%).

Majority of the farmers (n=114; 73.55%) further indicated that the support which they received benefited them and their animals, while fewer farmers (n=41; 26.45%) said that they had not benefited from the support which they received.

Table 3: Support received during the drought and impact of the drought on the farmers

Variable/Category	Level	Mean (SD)	% (n)
Did coping strategies work?			100 (281)
	Yes		41.64 (117)
	No		58.36 (164)
Source of drinking water			100 (281)
	Stream/river		32.74 (92)
	Borehole		38.43 (108)
	Municipal tap		14.95 (42)
	Other		13.88 (39)
Number of animals			
	Original number	37 (25.69)	
	Current number	21.64 (18.51)	
	Number that died	4.9 (4.06)	
	Number sold off	8.5 (8.18)	
	Number slaughtered	1.67 (1.22)	
	Number that got lost	4.2 (4.65)	
Support from any institution			100 (281)
	Yes		55.16 (155)
	No		44.84 (126)
Support from agency			100 (155)
	Government		76.13 (118)
	NGO		6.45 (10)
	Other		17.42 (27)
Type of support			100 (155)
	Feed supplied		80 (124)
	Water supplied		3.87 (6)
	Vaccines and dips		0.65 (1)
	Other		15.48 (24)
Was the aid beneficial?			100 (155)
	Yes		73.55 (114)
	No		26.45 (41)

Figure 7 below shows that the majority of the farmers (45.20%) belonged to the 49–54 year age group, followed by 13.52% in the 55–60 year age group. Farmers aged between 19 years and 24 years were in the minority (2.14%).

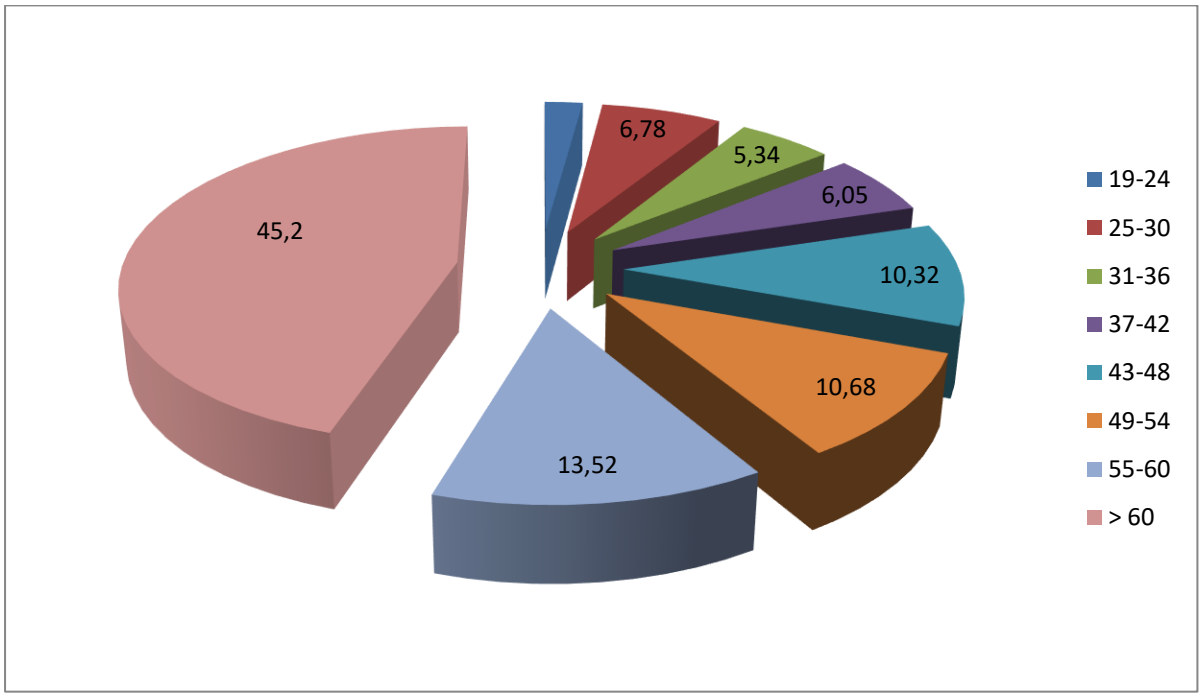

Figure 7: Age groups of participants affected by drought in Greater Letaba Local Municipality, Limpopo Province, South Africa.

Figure 8 shows that a greater proportion of farmers were married (28.47%; n=80). This was followed by farmers who indicated that they were single (23.84%, n=67). Meanwhile, the proportion of farmers who were divorced or widowed was about the same and the lowest (15.66%; n=44).

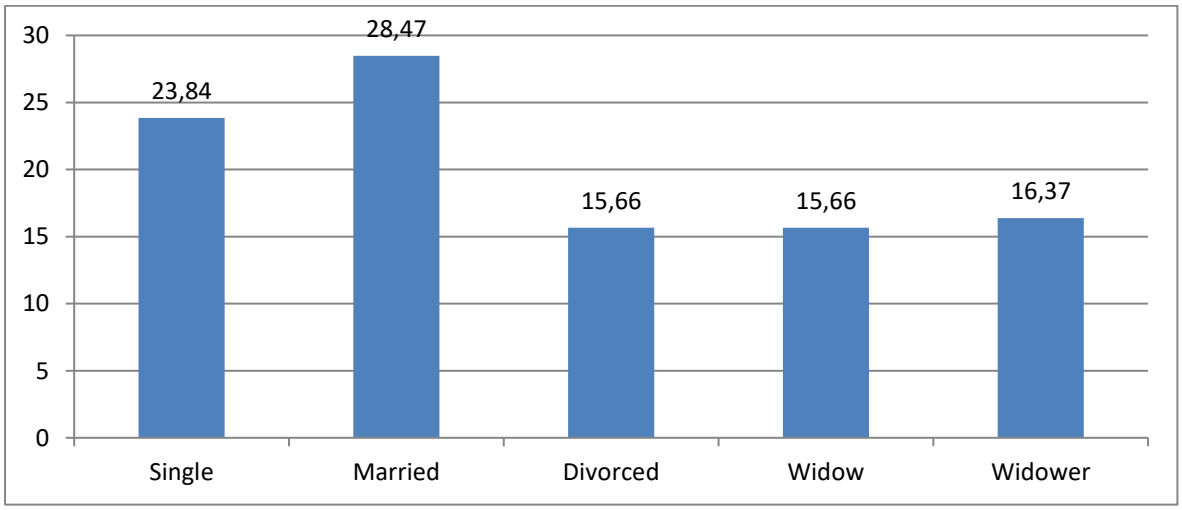

Figure 8: Marital status of participants affected by drought in Greater Letaba Local Municipality, Limpopo Province, South Africa.

The majority of the farmers (27.76%; n=78) indicated that they had high school level education (Figure 9). This was followed by those who indicated that they had primary school level education (24.56%; n=69) and those that did not have any formal education (21%; n=59).

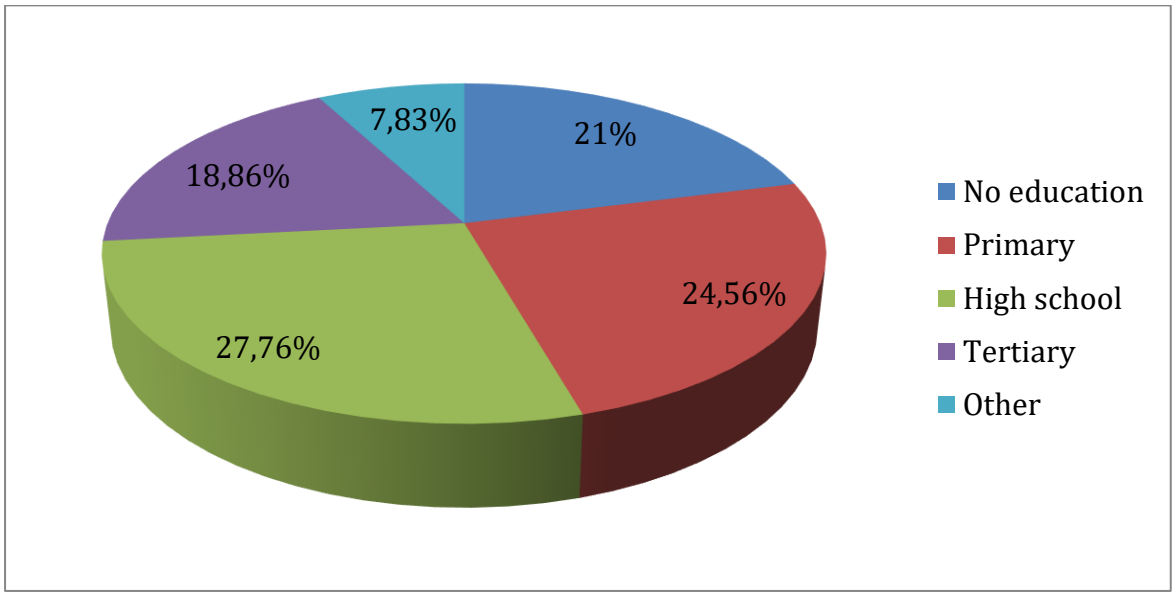

Figure 9: **Education level of participants affected by drought in Greater Letaba local Municipality, |Limpopo Province. South Africa**

Most farmers (36.3%; n=102) indicated that they only farm with cattle. This was followed by the farmers who were engaged in cattle and goat farming (23.84%; n=67). There are farmers who indicated that they are engaged in farming with multiple animals (21%; n=59). The least popular combination was farming with cattle and sheep (4.27%; n= 12) (Figure 10).

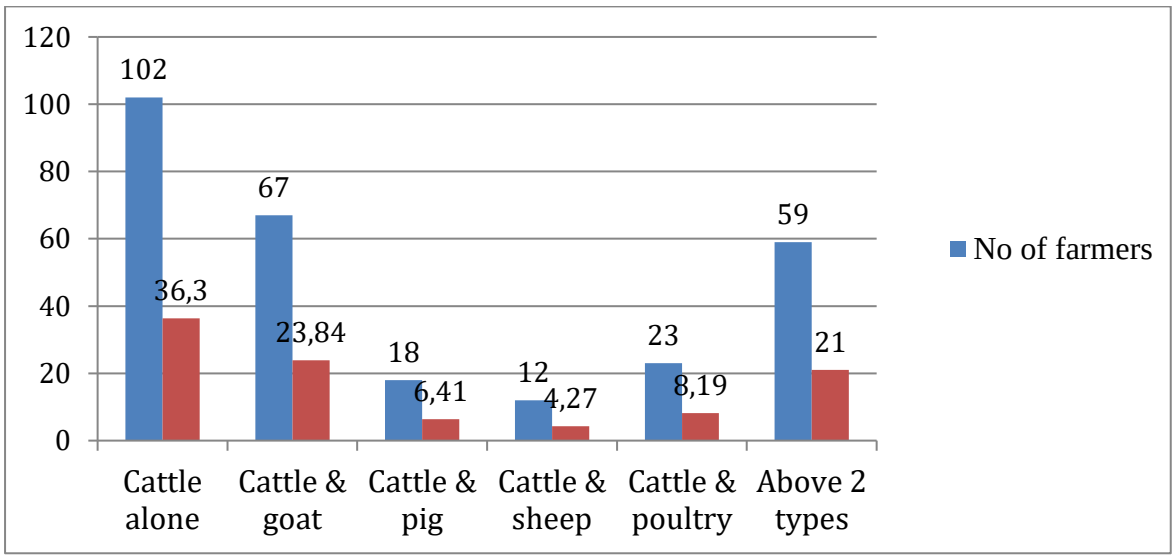

Figure 10: Types of farming enterprises and proportion of farmer within the Greater Letaba Local Municipality, Limpopo Province, South Africa

4.3 Coping strategies adopted by farmers to mitigate effects of the drought

The findings show that among farmers (58.29%; n=123) who indicated that they were prepared for the drought conditions, the manner in which they prepared varied. For example, the majority of the farmers sold their animals (36.59%; n=45) so as to reduce the number of animals they had to rear during the drought. Some farmers bought supplements for their animals (25.20%; n=31) while the remaining farmers (5.69%; n=7) opted for drilling boreholes for self-water supply (Figure 11).

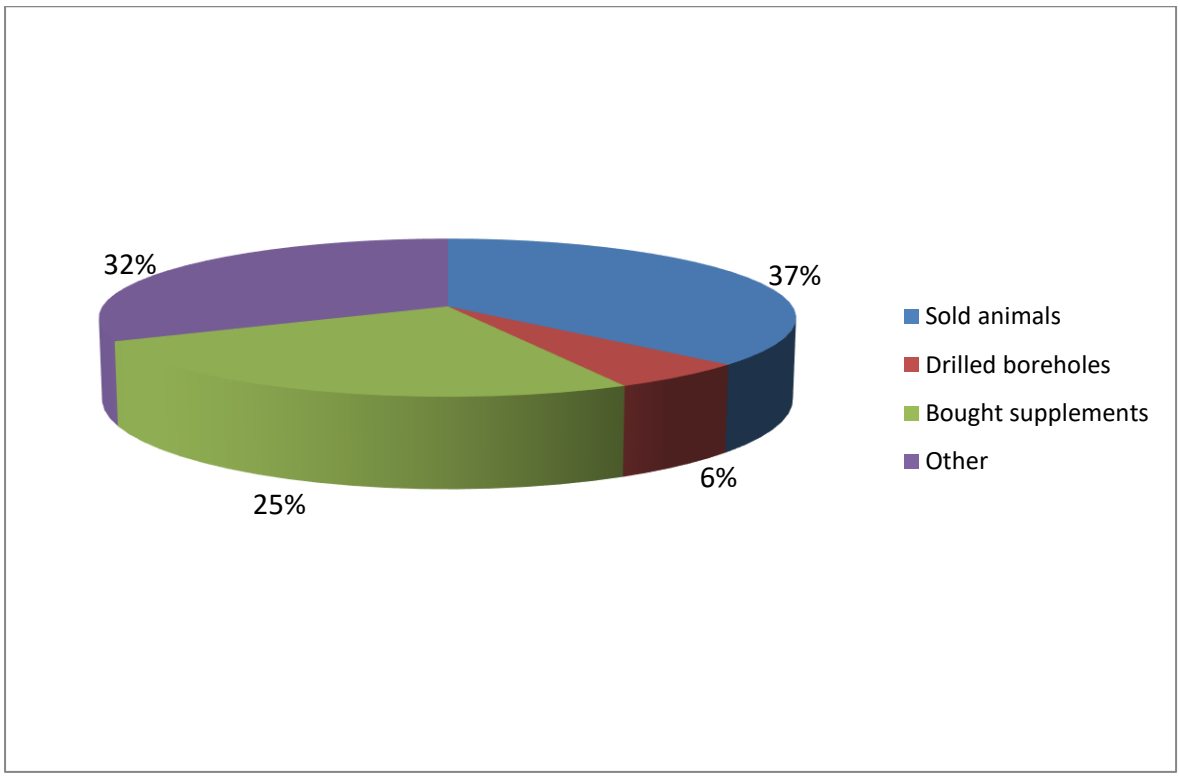

Figure 11: Drought preparation methods adopted by farmers (%) in the Greater Letaba Local Municipality, Limpopo Province, South Africa.

4.4 Factors associated with loss of animals

The results of the simple association between animal loss and unadjusted independent variables are presented in Annexure 6. The result shows that agricultural centre, marital status, education, age, coping mechanism were significantly associated with animal loss at a generous p value ≤ 0.2. These variables were selected as co-variates for inclusion in the multivariable model.

The agricultural centres of Bellevue (B=-0.199; 95% CI: -0.380 -0.019, p=0.031) and Mokwakwaila (B=0.568; 95% CI: 0.405 0.731, p=0.0001) were significant predictors of the number of animals lost. The predicted log count of animals lost by farmers in Bellevue was 0.199 (95% CI: -0.380 -0.019) units less than that for farmers in the Sekgosese centre, which

was the referent category. In addition, the predicted log count of animals lost in Mokwakwaila was 0.568 (95% CI: 0.405 0.731) units greater than that for farmers in Sekgosese.

Being a widow (B=0.377; 95% CI: 0.098 0.654, p=0.008) and a widower (B=0.290; 95% CI: 0.0212 0.559, p= 0.034) were both significant positive predictors of the number of animals lost. The predicted log count of animals lost by farmers who were widows was 0.377 units greater than for farmers who were single. Likewise, the predicted log count of animals lost by farmers who were widowers was 0.29 units greater than for single farmers. The predicted log count of animals lost by married farmers was 0.060 (95% CI: -0.305 0.183) units less than for single farmers, while for divorced farmers, the predicted log count of animals lost was 0.035 (95% CI: -0.316 0.246) units less than for single farmers. However, being married and divorced were not significant predictors of animal loss during the drought period (p>0.05).

Receiving assistance from government agencies was a significant positive predictor of animal loss during the drought period (B=0.324; 95% CI: 0.189 0.459, p=0.0001). The predicted log count of animals lost by farmers who did not get assistance was 0.324 units greater than for those who received assistance.

Years of experience of farming was also a significant positive predictor of animal loss during the drought period (B=0.022; 95% CI: 0.010 0.033, p=0.0001). For every unit increase in number of years in farming, the farmers lost 0.022 units of animals.

Table 4: Multivariable analysis of factors associated with loss of animal during the drought that hit the GLLM, Limpopo Province, South Africa, 2014-2016

Variable/Categories	Coeff	95% Confidence Interval		p-value	Exp(B)/Relative risk	95% Confidence Interval	
Agricultural centre		Lower	Upper			Lower	Upper
Sekgosese	**Ref**						
Bellevue	-0.199	-0.380	-0.019	0.031	0.820	0.683	0.981
Mokwakwaila	0.568	0.405	0.731	<0.0001	1.765	1.50	2.077
Marital status							
Single	**Ref**						
Married	-0.060	-0.305	0.183	0.626	0.942	0.737	1.201
Divorced	-0.035	-0.316	0.246	0.809	0.966	0.729	1.279
Widow	0.377	0.098	0.654	0.008	1.458	1.103	1.923
Widower	0.290	0.0212	0.559	0.034	1.336	1.021	1.749
Support from any institution							
Yes	**Ref**						
No	0.324	0.189	0.459	<0.0001	1.383	1.208	1.582
Years of farming	0.022	0.010	0.033	<0.0001	1.022	1.010	1.034

CHAPTER 5
DISCUSSION

5.1 Demographic and Socio-economic characteristics of respondents

In Africa, including South Africa it is a norm that when adults retire from active serve, they relocate to rural areas and start practicing farming for the remaining days of their lives (Belle, Sithabile and Ogundeji, 2017). This explains why 13.52% of the farmers were in the age range of 55−60 years. According to Mutekwa, (2009) the economic status of the rural area forces many young people to migrate from rural villages to the large cities such as Johannesburg, Pretoria and Cape Town in search of better lives, leaving mainly the elderly behind. This could also explain why young people formed only a small component of the farmers in the study area.

Majority of farmers in this study were males (64.77%; n=182). This was anticipated because farming tends to be a male-dominated activity in most parts of the world. For example, Habiba, Shaw and Takeuchi, (2012) observed that in North-western Bangladesh, more males engage in agricultural practises than females. Mehar, Mittal and Prasad (2016) obtained similar results; more males were involved in agricultural farming than females in Vaishali district of Bihar (India). Bahta, Jordaan and Muyambo (2016) further observed similar finding in the Eastern Cape Province of South Africa, with more males (71%) dominating farming compared to females who only made up 29% of the farming community. However, there are cases on the continent where females dominate farming. For example, Belle, Sithabile and Ogundeji (2017) observed that in Zimbabwe, more females (68%) were involved in farming compared to the males (32%).

5.2 Smallholder farmers' preparedness and coping strategies for drought

In the current study, most of the farmers (74.38%; n=209) were aware of the impending drought, with slightly more than half (55.50%; n=116) indicating that they had heard about the drought through the extension officers. Likewise in the study of Belle, Sithabile and Ogundeji (2017) carried out in Zimbabwe, the majority of farmers were also aware of the impending drought that affected their area in the Ntabazinduna village of Umguza district. However, unlike results reported in this study, the majority of the Zimbabwean farmers (60%) had heard about the impending drought from NGOs and not the extension officers. The difference in the source of drought-forecasting information between this study and the study done in Zimbabwe could be due to the different economic status of each country, with South Africa being able to

provide extension services and Zimbabwe possibly being unable given the poor economic situation prevailing in the country.

According to Muema *et al*. (2018), farmers with ties to agrarian extension officials are able to make valuable farming decision and are capable of managing their herds much better than farmers who do not have such ties. Furthermore, according to Mehar, Mittal and Prasad (2016), farmers with access to extension services have a significant advantage and the ability to make enlightened decisions. This is to be expected since it reflects the role of extension services, which is to minimize farmers' distress through the provision of skills and knowledge to maintain their farming practices.

In South Africa, agrarian reforms are mandated to assist farmers in producing and implementing systems that enhance food security (Cousins, 2010). Furthermore, post 1994, the private and semi-private sectors have increasingly become involved in offering extension services to the emerging farming sector. The governmental extension particularly is mandated with facilitating (mediating) land reform, financial support and other initiatives, focusing primarily on the development of the emerging farming sector (Koch and Terblanche, 2013).

During the drought seasons, smallholder farmers across South Africa are expected to receive assistance from several organizations including government, non-government organizations, families, neighbours and churches (Belle, Sithabile and Ogundeji, 2017). In this study, the majority of the farmers (76.13%; n=118) indicated that they had received support from the government agencies, suggesting that government was the main provider of support for farmers in the study area during the drought period. The results of this study are consistent with the findings of a study conducted in Pakistan by Abid *et al*. (2016), which showed that the government plays a crucial part in making local livelihoods less vulnerable to climate-related risks by promoting input access, information services and certain farm resources (i.e. feeds, vaccines, dipping infrastructure etc.).

Belle, Sithabile and Ogundeji (2017) reported that in Zimbabwe more than 60% of the assistance received by farmers during the drought periods came from NGOs and not government. This is in contrast with what was observed in the present study in which, the majority of support came from the government (76.13%; n=118). The difference between Zimbabwe and South Africa regarding the main providers of assistance during a drought is probably because the government lacks the resources to support the farmers.

The water scarcity in the GLLM (IDP, 2014; Maponya and Mpadleni, 2012), explains why as many as 32.74% of the participants had to walk their animals for long distances to reach water from the river streams. In view of this, the researcher expected that government assistance to farmers would include increased access to water, thus enabling the farmers to access water for their animals more easily. This finding could explain why 26.45% of the farmers indicated that the support they had received had not benefitted them.

Since 26.45% of the farmers stated that the help they had received was of no benefit, the question arises regarding the effectiveness of the extension services rendered, especially the services of the government extension agencies. This needs to be viewed seriously given that many governmental extensionists are underqualified not only in the natural sciences but also in the extension sciences (Koch and Terblance, 2013).

Results reported here prove that many farmers did not cope at all during the drought, which is indicated by 53.74% (n=151) of participants who stated that they did not cope with the drought conditions compared with only 46.26% (n=130) of participants who said that they were able to cope. This was expected because unlike commercial farmers, smallholder farmers in South Africa and other parts of the continent do not have access to trust funds and insurance to assist during difficult times. If this had not been the case, smallholder farmers would have been able to cope better and would not have had to walk animals long distances in search of water. Lack of access to funding is likely to cause immense difficulty among smallholder farmers in dealing with such conditions compared to commercial farmers (Cai *et al.* 2017).

This study did not compare the coping and adaption ability between the two genders. However, according to Mehar *et al*. (2016), the gender of the decision-maker does not differ between coping strategies because some of the decisions are made jointly or collectively by all family members.

In this study, more than half (55.50%) of the participants indicated that they had heard about the drought through the extension officers. Participants indicated that they had heard about the drought on the radio (19.14%) and television (8.13%), while fewer indicated that their source of information was newspapers (1.44%) and other means (11.48%). To a great extent, the finding of the current study that suggest that the radio is favourable source of information, is consistent with the findings of Maponya and Mpandeli, (2012) who observed that the radio, television, newspapers and magazines were popular sources of information during the 2012 drought in the Limpopo province. Mandleni and Anim, (2011) also found a similar situation in

the Eastern Cape during the drought period of 2005–2009; they observed that popular sources of information included radio (54.30%) and magazines (2.90%). This shows that radio broadcasting is a good tool to use in South Africa for drought forecasting.

5.3 Farmers educational background

Most of the farmers (27.76%; n=78) had high school level education, followed by those who had only primary school (24.56%; n=69) level education. Farmer's educational background is very important in managing drought and during decision making. According to Habiba, Shaw and Takeuchi (2012) a higher level of education facilitates better access to information. Furthermore, Habiba *et al*. (2012) mentioned that a higher level of education is frequently hypothesized to enhance the probability of embracing new technologies.

In addition, Habiba *et al*. (2012) revealed that an enhancement in educational status of farmers positively correlates with improved practices. Cai *et al.* (2017) put it this way: "drought preparedness is complex and challenging", and this is because drought is a chronic disaster and environmental adversity. Therefore, an increase in farmer's education results in an increase in access to information and awareness about climate-related issues, which ultimately helps the farmers to adopt several mitigation strategies. It will always be a challenge for illiterate farmers to prepare effectively for a drought because certain information such as drought alerts are circulated through newspapers and magazines.

5.4 Factors associated with loss of animals during the drought

The multivariate analysis in Table 5 showed that where the farmer resides (agricultural centre) was significantly associated with the number of animals lost during the drought period. Compared to Sekgosese centre (referent category), the predicted log count of animals lost in Mokwakwaila was significantly greater (B=1.765; 95% CI: 1.50 2.077, p=0.0001), while the contrary was true for farmers in Bellevue, in that farmers in the Bellevue lost fewer animals (B=0.568; 95% CI: 0.405 0.731, p= 0.0001) compared to their counter parts in Sekgosese. The difference in the number of animals lost between different agricultural centres was not expected. In view of this, it can be deduced that farmers from the different agricultural centres did not have equal access to extension officers and assistance from the government and other agencies that could have helped them cope with the draught equally.

According to Maponya and Mpandeli, (2012) the expected average rainfall in Limpopo province is 600 mm, while the threshold for agricultural rainfall is averaged at 250 mm annually. However, during the drought year 2015, in Sekgopo village (under Sekgosese

agricultural centre), there was an annual rainfall of less than 100 mm (Figure 6). It is therefore possible that the different district municipalities were not equally affected and hence the difference in impact between the three agricultural centres.

Married farmers (B= -0.060; 95% CI: -0.305 0.183) and divorced farmers (B= -0.035; 95% CI: -0.316 0.246) fewer units compared to their counterparts, the single farmers (reference group). However, being married and divorced were not significant predictors of animal loss during the drought period. This was not expected because according to Stain *et al.* (2011) drought related issues for farmers who are married is geared towards financial concerns and therefore provision for the spouse or households needs take precedence over providing for animals. Stain *et al.* (2011) further proposed that drought-related issues were felt more strongly by those working and also by married persons with financial responsibilities towards their households. In view of this we expected married farmers to experience more losses compared to the single farmers. This is because married people tend to put more focus on the family issues, such as; children's school fees, food provision for the household, jobs etc. As a result, they spend less time and money on looking after livestock. Furthermore, the researcher expected divorced farmers to lose more animals compared to the referent category (single). However, this was not the case, the researcher is not able to explain this finding.

High levels of susceptibility to drought tended to be greater on widowed farmers. This could explain why farmers who were widows lost 0.377 units more than farmers who were single. This was expected given that after one spouse has passed on, more so if it is the male partner who has passed on, the widow finds it difficult to look after the farms. Therefore, in event of adverse weather conditions they are likely to suffer great loss.

The number of years in farming was found to be a significant predictor of animal losses during the drought period, with every unit increase in number of years of experience in farming, resulting in loss of 0.022 (B=0.022; 95% CI: 0.010 0.033, p= 0.0001) units of animals. Although experience in farming is very important, Shi-yan *et al.* (2018) is of the view that as farmers engage in farming for too long, they are less likely to adopt relevant mitigation measures; reason being that experienced farmers are more likely to engage in traditional farming techniques and not likely to make any changes, such as adopting new technologies.

Ainembabazi and Mugisha (2015) indicated that there is evidence of a relationship between experience in agricultural farming and adopting of a agricultural technologies. However, it has been observed that agricultural experience is primarily useful in the initial stages of adoption

of given technology; this is when farmers are still checking for potential benefits. But also experienced farmers tend give up on technology when the benefits are few and instead, opt to continue relying on the experience that they have gained in farming over the years (Ainembabazi and Mugisha, 2015).

As shown in the multivariate analysis, receiving support was a significant predictor of animal losses during the drought, the predicted log count of animals lost by farmers who did not receive support being 0.324 units greater than for those who received support. This was not surprising because farmers who did not receive support from any agency could not have coped the same way as those who received support.

According to Pradhan *et al.* (2014), in China farmers indicated that government funds helped farmers to cope with the impacts of drought and minimized the challenges they would have faced if they had been left to themselves. Therefore, assisting farmers during such events is a positive move towards sustaining small-scale agriculture. On the other hand, it makes farmers to be more dependent on the government. According to Mehar, Mittal and Prasad, (2016) farmers with ties to extension officials have a significant advantage in their ability to make enlightened decisions.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

This study was undertaken to assess and identify factors significantly associated with the loss of animals among small scale farmers in Greater Letaba Local Municipality in Limpopo province of South Africa using survey data. The study observed that a low number of farmers (approximately half) were aware of the impending drought. The study also observed that although many farmers considered the help they received as being beneficial, many of them did not cope well. In addition, results reported here suggest that not all the three agricultural centres were equally impacted by the drought. All these observations suggest that farmers in the study area were not adequately and equally prepared for the drought.

Furthermore, the study also observed that agricultural extension officers were the main source of drought forecast information. However, results suggest that the radio channels have great potential as a source of drought forecast information.

Groups that are at a high risk of losing animals include: widows, widowers and farmers who have many years of farming experience are high-risk groups. These groups should be targeted for interventions in the event of a drought.

6.2 Recommendations

Findings reported in this study should be considered by policy makers when designing policies and interventions to help mitigate the effect of droughts on small holder farmers. Government should make a greater investment in extension services so as to increase the reach of extension officers in the study area. By so doing, smallholder farmers will have a greater access to extension officers and timeously access the latest available information on disaster management, adaption and general information about farming.

The government should aim to further development in the study area by implementing activities such as drilling of bore-holes and building water reserve dams so that in event of a drought livestock do not have to travel long distances in search of water.

In addition to using extension agents, a lot of emphasis should be placed on the use of radio channels as a source of drought forecast information. In event of a drought this has the potential to increase the number of farmers who are aware of the impending drought and hence the number of farmers who are prepared.

Given the limited scope of this study, larger studies that include more larger areas and larger numbers of participants are needed to help improve our understanding of how small scale farmers cope and the factors which influence loss of animals during droughts at a local level.

BIBLIOGRAPHY

Ainembabazi, J. H., Ainembabazi, J. H. and Mugisha, J. (2015) 'The Role of Farming Experience on the Adoption of Agricultural Technologies : Evidence from Smallholder Farmers in Uganda The Role of Farming Experience on the Adoption of Agricultural Technologies : Evidence from Smallholder Farmers in Uganda', (November). doi: 10.1080/00220388.2013.874556.

Ayanlade, A., Radeny, M. and Morton, J. F. (2017) 'Comparing smallholder farmers??? perception of climate change with meteorological data: A case study from southwestern Nigeria', *Weather and Climate Extremes*. Elsevier B.V., 15(December 2016), pp. 24–33. doi: 10.1016/j.wace.2016.12.001.

Bahta, Y. T., Jordaan, A. and Muyambo, F. (2016) 'crossmark', *International Journal of Disaster Risk Reduction*. Elsevier, 20(October), pp. 39–50. doi: 10.1016/j.ijdrr.2016.10.007.

Belle, J., Sithabile, M. and Ogundeji, A. A. (2017) 'Assessing communal farmers'preparedness to drought in the Umguza District, Zimbabwe', *International Journal of Disaster Risk Reduction*. Elsevier Ltd, 22(November 2016), pp. 194–203. doi: 10.1016/j.ijdrr.2017.03.004.

Cai, X. *et al.* (2017) 'Key issues in drought preparedness : Reflections on experiences and strategies in the United States and selected countries', *Water Security*. Elsevier B.V., 2, pp. 32–42. doi: 10.1016/j.wasec.2017.11.001.

Diaz, V. *et al.* (2020) 'Advances in Water Resources An approach to characterise spatio-temporal drought dynamics'. Elsevier Ltd, 137(January). doi: 10.1016/j.advwatres.2020.103512.

Forouzani, M. and Karami, E. (2011) 'Agricultural water poverty index and sustainability', *Agronomy for Sustainable Development*, 31(2), pp. 415–431. doi: 10.1051/agro/2010026.

Galdies, C. *et al.* (2016) 'Climate change trends in Malta and related beliefs, concerns and attitudes toward adaptation among Gozitan farmers', *European Journal of Agronomy*. Elsevier B.V., 74, pp. 18–28. doi: 10.1016/j.eja.2015.11.011.

Ghahramani, A. and Moore, A. D. (2016) 'Impact of climate changes on existing crop-livestock farming systems', *Agricultural Systems*. Elsevier B.V., 146, pp. 142–155. doi: 10.1016/j.agsy.2016.05.011.

Habiba, U., Shaw, R. and Takeuchi, Y. (2012) 'International Journal of Disaster Risk Reduction Farmer ' s perception and adaptation practices to cope with drought : Perspectives

from Northwestern Bangladesh', *International Journal of Disaster Risk Reduction*. Elsevier, 1, pp. 72–84. doi: 10.1016/j.ijdrr.2012.05.004.

Kabir, M. J., Alauddin, M. and Crimp, S. (2017) 'Farm-level adaptation to climate change in Western Bangladesh: An analysis of adaptation dynamics, profitability and risks', *Land Use Policy*. Elsevier Ltd, 64, pp. 212–224. doi: 10.1016/j.landusepol.2017.02.026.

Keshavarz, M. and Karami, E. (2014) 'Farmers ' decision-making process under drought', *Journal of Arid Environments*. Elsevier Ltd, 108, pp. 43–56. doi: 10.1016/j.jaridenv.2014.03.006.

Koch, B. H. and Terblanché, & (2013) *An overview of agricultural extension in South Africa, Tydskr. Landbouvoorl./S. Afr. J. Agric. Ext., Koch & Terblanché*.

Lei, Y. *et al.* (2016) 'How smallholder farmers adapt to agricultural drought in a changing climate: A case study in southern China', *Land Use Policy*. Elsevier Ltd, 55, pp. 300–308. doi: 10.1016/j.landusepol.2016.04.012.

Maiti, S. *et al.* (2017) 'An assessment of social vulnerability to climate change among the districts of Arunachal Pradesh, India', *Ecological Indicators*. Elsevier Ltd, 77, pp. 105–113. doi: 10.1016/j.ecolind.2017.02.006.

Mandleni, B. and Anim, F. D. K. (2011) 'Perceptions of Cattle and Sheep Farmers on Climate Change and Adaptation in the Eastern Cape Province of South Africa', *Journal of Human Ecology*, 34(2), pp. 107–112. doi: 10.1080/09709274.2011.11906375.

Mansard, L. *et al.* (2017) 'Combining models to address the speci fi cities of pastoral systems', *Agriculture, Ecosystems and Environment*. Elsevier, 242(March), pp. 89–101. doi: 10.1016/j.agee.2017.03.020.

Maponya, P. and Mpandeli, S. (2012) 'Impact of drought on food scarcity in Limpopo province , South Africa', 7(37), pp. 5270–5277. doi: 10.5897/AJAR12.1453.

Mehar, M., Mittal, S. and Prasad, N. (2016) 'Farmers coping strategies for climate shock : Is it differentiated by gender ?', *Journal of Rural Studies*. Elsevier Ltd, 44, pp. 123–131. doi: 10.1016/j.jrurstud.2016.01.001.

Mutekwa, V. T. (2009) 'Climate change impacts and adaptation in the agricultural sector: the case of smallholder farmers in Zimbabwe', *Journal of Sustainable Development in Africa*, 11(2), pp. 237–256. Available at: http://0-search.ebscohost.com.catalog.library.colostate.edu/login.aspx?direct=true&AuthType=cookie

,ip,url,cpid&custid=s4640792&db=lah&AN=20103307506&site=ehost-live%5Cnhttp://www.jsd-africa.com/Jsda/V11N02_Fal2009/PDF/Climate ChangeImpactsAdaptation.pdf.

Shi-yan, Z. *et al.* (2018) 'Climate change and Chinese farmers : Perceptions and determinants of adaptive strategies', *Journal of Integrative Agriculture*. CAAS. Publishing services by Elsevier B.V, 17(4), pp. 949–963. doi: 10.1016/S2095-3119(17)61753-2.

Shrestha, N. *et al.* (2017) 'Land Use Policy Farmers ' perception of e ff ective drought policy implementation : A case study of 2009 – 2010 drought in Yunnan province , China', 67(May), pp. 48–56. doi: 10.1016/j.landusepol.2017.04.051.

Smit, B. and Wandel, J. (2006) 'Adaptation, adaptive capacity and vulnerability', *Global Environmental Change*, 16(3), pp. 282–292. doi: 10.1016/j.gloenvcha.2006.03.008.

Stain, H. J. *et al.* (2011) 'Social Science & Medicine The psychological impact of chronic environmental adversity : Responding to prolonged drought', *Social Science & Medicine*. Elsevier Ltd, 73(11), pp. 1593–1599. doi: 10.1016/j.socscimed.2011.09.016.

Thornton, P. K. *et al.* (2004) 'Evaluating management options that use climate forecasts: Modelling livestock production systems in the semi-arid zone of South Africa', *Climate Research*, 26(1), pp. 33–42. doi: 10.3354/cr026033.

Verma, S., Tsephal, S. and Jose, T. (2004) 'Pepsee systems: Grassroots innovation under groundwater stress', *Water Policy*, 6(4), pp. 303–318.

Wang, J. *et al.* (2015) 'Information provision, policy support, and farmers' adaptive responses against drought: An empirical study in the North China Plain', *Ecological Modelling*. Elsevier B.V., 318, pp. 275–282. doi: 10.1016/j.ecolmodel.2014.12.013.

Water Research Commission (2017) 'Rainfall Data'.

Woods, B. A. *et al.* (2017) 'Farmers??? perceptions of climate change and their likely responses in Danish agriculture', *Land Use Policy*. Elsevier, 65(March), pp. 109–120. doi: 10.1016/j.landusepol.2017.04.007.

Zeweld, W. *et al.* (2017) 'Smallholder farmers' behavioural intentions towards sustainable agricultural practices', *Journal of Environmental Management*. Academic Press, 187, pp. 71–81. doi: 10.1016/j.jenvman.2016.11.014.

Zingore, S. *et al.* (2009) 'An integrated evaluation of strategies for enhancing productivity and

profitability of resource-constrained smallholder farms in Zimbabwe', *Agricultural Systems*. Elsevier Ltd, 101(1–2), pp. 57–68. doi: 10.1016/j.agsy.2009.03.003.

ANNEXURE 1: RESEARCH QUESTIONNAIRE

ADAPTION TO DROUGHT CONDITIONS BY SMALLHOLDER LIVESTOCK FARMERS: LESSONS FROM 2014 AND 2016 DROUGHT CONDITIONS IN THE LIMPOPO REGION.

Thank you very much for accepting me. My name is Thabang Jantjie Rakgwale (student no: 61980595) and I come from Ga-Sekgopo. I am a post graduate student at the University of South Africa (UNISA) research at the Department of Agriculture and Animal Health for a Master's degree in Agriculture (MSc).

I am doing research on "Adaption to drought conditions by smallholder livestock farmers: Lessons from 2014 and 2016 drought conditions in the Limpopo region. I am investigating how the drought of 2014-2016 affected farmers in this area.

The findings of my research will help in highlighting the how farmers coped and the factors that had an influence on the number of animals a farmer lost. This information will be used in future during drought preparedness exercise in this area and other parts of the country.

Your participation is voluntary and you are entitled to refuse to answer any question I may ask, or to discontinue the interview at any time without giving any reason to do so. You don't need to disclose identity. Codes will be assigned all respondents when reporting on the findings. All respondents will be assigned codes upon reporting on the findings. I want to assure you, too, that all the information you provide will be kept confidential. Only Proffessor James W. Oguttu (Dept of Agric & Animal Health, UNISA) and I will have access to your information.

I would like to remind you that by answering the questions I ask to you, it is assumed that you understood what my research is all about and agreed to take part in my study. Please do not hesitate to ask me any question concerning my research project before you decide on your participation.

CODE: **Interview date [DATE]**

(A) Demographic data

1. Name of agricultural centre, where the farmer is based. [CEN]

2. Age of respondent (Range) [AGE]

18 - 22	
23-28	
29-34	
35-40	
41- 46	
47- 52	
53- 58	
>60	

3. Marital status [MS]

Single	Married		Divorced	Widow	Widower

4. Gender [GEN]

Male	Female

5. Education level achieved [EDU]

No education	
Primary school	
High school	
Tertiary	
Others	

6. Number of years in farming. [YRSFARM]

7. Which segment best describes your farming enterprise [ENTPR]:

Cattle	
Sheep	
Goats	
Pigs	
Poultry	

(B) Drought and climate change preparedness

8. Were you aware that during 2014-2016 extreme drought conditions would hit GLLM? [AWARE]

Yes	No

9. If yes, what was your source of information?[INFOSO]

Television	
Radio	
Newspaper	
Extension officers	
Other, specify	

10. If you knew about the drought before it started, did you prepare for the drought? [PREP]

Yes	No

11. If yes, what did you do to prepare? DIDPREP]

12. If no, why did you not prepare? [WHYNOTPREP]

I did not have information on how to prepare	
I did not have enough money to make necessary changes to prepare	

I did not think it would impact me as much as it has	
Other, specify	

13. Were you able to cope during the drought period? [COPE]

Yes	No

14. Can you conclude that the coping mechanisms you have adopted have helped to ease the impact of drought on your home? [COPEDWEL]

Yes	No

15. If no why not?

(C) Effects and responses on the livestock herds

16. Describe the water sources used during the drought at your farm:[WTERSOUCE]

Stream/river	
Bore hole	
Municipal tap	
Others, specify	

17. How many pastures have you been able to access before & during the drought?[GRZSITE]

Before drought		During drought	

18. Have you given your animals any supplementary feeds before the drought?[SUPPFEED1]

Yes	No

19. Have you given provide for your animals any supplementary feeds during the drought?[SUPPFEED2]

Yes	No

20. What was the most significant change you encountered in livestock management during the drought? [MANAGCHG]

(D) Socioeconomic impact of climate change & drought on farmers and their household

21. Had any family member relocated during the drought?[FAMRELOC]

Yes	No

22. Have you had access to clean water for domestic use? [ACCSWTR]

Yes	No

23. How would you rate clean water access during the drought?[RATEACC]

Good	
Fairly good	
Bad	

24. Did you have sufficient food for your family during drought? [FODFAM]

Yes	No

(E) Economic effect and production analysis

25. How many animals did you have before drought?.....[ORGNo]
26. How many animals do you have currently? ……. Difference =……..[SHTFALL]

27. How many animals died? [DEAD]	
28. How many animals sold? [SOLD]	
29. How many slaughtered and consumed? [EATEN]	
30. How many disappeared? [LOST]	

31. If you sold animals during the drought, how much did you sell each?.....[AMTSOLD].
32. How much does each animal cost during normal time?.....[USUALPRIC].

(F) Assistance received to assist alleviate the impact of the drought.

33. During the drought period did you receive support from any institution to mitigate against climate change and drought? [RECVSUPP]

Yes	No

34. If yes to question 33, which agency below did you receive help from? [SOFSUPP]

Government agencies	
NGOs	
Others, specify	

35. What kind of assistance did they provide you with?[KINDSUPP]

36. Have you benefited from the help or assistance from organizations you mentioned? [AIDBENEF]

Yes	No

37. If yes, how?

38. Now that drought period is finally over, what have you planned to do in order to recover from the loss and improve on your vulnerability?[PLANSPOST]

39. What would you like government to help you with in order to recover and perform like before?[HELPNEED]

THANK YOU SO MUCH FOR PARTICIPATING IN THIS RESEARCH STUDY!

ANNEXURE 2: UNISA CAES ETHICS APPROVAL.

UNISA university of south africa

UNISA CAES GENERAL ETHICS REVIEW COMMITTEE

Date: 08/09/2017

NHREC Registration # : REC-170616-051
ERC Reference # : 2017/CAES/129
Name : Mr TJ Rakgwale
Student #: 61980595

Dear Mr Rakgwale

Decision: Ethics Approval from 07/09/2017 to 30/09/2018

Researcher(s): Mr TJ Rakgwale
tjrakgwale@gmail.com

Supervisor (s): Dr JW Oguttu
joguttu@unisa.ac.za; (011) 471-3353

Working title of research:

Adaptation to drought conditions by smallholder livestock farmers: Lessons from 2014 and 2016 drought conditions in the Limpopo region

Qualification: MSc Agriculture

Thank you for the application for research ethics clearance by the Unisa CAES General Ethics Review Committee for the above mentioned research. Ethics approval is granted for a one-year period, **subject to submission of the relevant permission letters**. After one year the researcher is required to submit a progress report, upon which the ethics clearance may be renewed for another year.

Due date for progress report: 30 September 2018

Please note the points below for further action:

1. Permission from the Limpopo Department of Agriculture and the leaders of the targeted local communities is outstanding. The permission letters must be submitted to the Committee before data gathering may commence.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
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2. The exclamation marks at the end of the questionnaire should be removed to ensure the professional appearance of the document.

*The **low risk application** was **reviewed** by the CAES General Ethics Review Committee on 07 September 2017 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:
*The reference number **2017/CAES/129** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

URERC 25.04.17 - Decision template (V2) - Approve

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Yours sincerely,

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ANNEXURE 3: RESEARCH CONSENT FROM GLLM

GREATER LETABA MUNICIPALITY

P.O Box 36, Modjadjiskloof, 0835, Tel (015) 309 9246/7/8,
Fax (015) 309 9419, Email:greaterletaba@glm.gov.za

Enquiry : Tangananalo M. Desmond

Date : 14 February 2017

The Head of Department
University of South Africa
P O Box 392
PRETORIA
0003

Attention: Dr. James Oguttu

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH AT GREATER LETABAMUNICIPALITY.

1. Receipt of your letter dated 13 February 2017 is hereby acknowledged.
2. This letter serves to inform you that Greater Letaba Municipality has approved your request for conducting research.
3. Kindly note that the municipality has no objection to the research to be conducted by you, however, the information gathered must only be used for the purpose alluded to in the letter of request.
4. The municipality will appreciate it if the Researcher (Mr. Thabang Rakgwale) could privilege the municipality with the final report.
5. We will be looking forward to your prompt attendance of our request.

Kind regards

MRS. MASHABA T.G

MUNICIPAL MANAGER

"To be an outstanding agro processing and eco-cultural tourism hub"

ANNEXURE 4: CONSENTS FROM DIFFERENT GLLM TRIBAL AUTHORITIES.

ANNEXURE 4.a.

UNISA university of south africa

University of South Africa
PO Box 392
Unisa
0003

The Village Master/King
Greater Letaba Municipality
Limpopo Province
South Africa
Dear Ms/Mr

REF: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master of Science student in the Department of Agriculture and Animal Health at the University of South Africa.
The proposed topic of my research is: **ADAPTATION BY SMALLHOLDER LIVESTOCK FARMERS IN THE LIMPOPO REGION TO CLIMATE.**
The objectives of the study are:

a) Assess how do farmers perceive and cope with climate change particularly high temperatures and less rainfall (drought).
b) Evaluate the coping mechanisms adopted to reduce drought vulnerability.
c) Identify the differences between coping strategies adapted from one farming family to the other.
d) Document the constraints to successful response to drought.

I hereby seek your consent to conduct a research in your village. To assist you in reaching a decision, I have attached the following to this letter:

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SUPERVISOR: Dr James Oguttu, joguttu@unisa.ac.za , 011 471 3353

Your permission to conduct this study will be greatly appreciated.
Head/King's Full Name: Mohale Mtsaupa David
Head/King's Signature: Date signed: 14/02/2017

RAKWADU TRIBAL AUTHORITY
2017 -02- 14
P/ BAG X 747
GA-KGAPANE 0838

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ANNEXURE 4.b

UNISA university of south africa

University of South Africa
PO Box 392
Unisa
0003

The Village Master/King
Greater Letaba Municipality
Limpopo Province
South Africa
Dear Ms/Mr

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Head/King's Full Name: Kgoshi Patrick Rapahlelo
Head/King's Signature: _____ Date signed: 14/02/2017

DEPARTMENT OF CO-OPERATIVE GOVERNANCE, HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
RAPHAHLELO TRADITIONAL COUNCIL
2017 -02- 14
P.O. BOX 650 PAULUSWEG
0814
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Head/King's Full Name: NGWEIKO CEDRIC PHOOKO
Head/King's Signature: Phooko Date signed: 14/02/2017

DEPARTMENT OF CO-OPERATIVE GOVERNANCE, HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
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Head/King's Full Name: MAKHUBELA DUVULA
Head/King's Signature: _____ Date signed: 14/02/2017

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ANNEXURE 4.e.

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Head/King's Full Name: TINTSWALO MERIAM MAHUNTSI
Head/King's Signature: TIM. MAHUNTSI Date signed: 14.02.2017

DEPT OF LOCAL GOVERNMENT & TRADITIONAL LEADERS
CHIEF M.T.MAHUNTSI
PRIVATE BAG 1515
VUYANI 0931
DATE

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ANNEXURE 4.f.

8

UNISA university of south africa

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Head/King's Full Name: TSEAMANANCY NKWANAZLA
Head/King's Signature: _____ Date signed: 15-02-2017

Department of co-operative Governance
Human Settlements & Traditional Affairs
Mamaila -Mphotwane, Traditional Council
2017 -02- 16
P/ Bag 903 Molototsi 0827
Mopani District Support Centre

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ANNEXURE 4.g.

3

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Head/King's Full Name: MAMAILA KHUDUNSANO SOLOMON
Head/King's Signature: MAMAILA Date signed: 14-2-2017

DEPARTMENT OF CO-OPERATIVE GOVERNANCE HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
MAMAILA-KOLOBETONA TRADITIONAL COUNCIL
14 FEB 2017
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ANNEXURE 5: CODING OF VARIABLES

CEN	Name of agricultural centre-where the farmer is based.	Sekgosese=0. Bellevue=1. Mokwakwaila=2
AGE	Age of respondent	
MS	Marital status	Single=0. Married=1. Divorced=2. Widow=3. Widower=4.
GEN	Gender of respondent	Female=0. Male=1
EDU	Education level of respondent	No education=0. Primary school=1. High school=2. Tertiary=3. Other=4.
YRSFARM	Number of years in farming	
ENTPR	Farming enterprise	Cattle alone=0. Cattle & goats=1. Cattle & pigs=2. Cattle & sheep=3. Cattle & Poultry=4. Above two types=5
AWARE	Were you aware of drought?	Yes=0. No=1
INFOSO	Information source	Television=0. Radio=1. Newspaper=2. Extension officer=3. All sources=4. Other=5
PREP	Did you prepare for the drought?	Yes=0. No=1
DIDPREP	What did you do to prepare?	Sold animals=0. Drilled a bore-hole=1. Bought supplements=2. Other=3
WHYNOTPREP	Why did you not prepare?	No information=0. No money=1. Did not think it would impact me=2. Other=3
COPE	Were you able to cope?	Yes=0. No=1.
COPEDWEL	Did the coping mechanism you applied help you ease drought?	Yes=0. No=1.
WTERSOUCE	Water source	Stream/River=0. Bore-hole=1. Municipal water=2. Other=4.
SUPPFEED1	Have you given your animals any supplementary feeds before the drought?	Yes=0. No=1.

SUPPFEED2	Did you provide supplementary feeds during drought?	Yes=0. No=1.
MANAGCHG	Livestock management change	Restricted feeding=0. Long travelling to the river/grazing site=1. Higher amount of money spent=2. High livestock mortality rate=3. Selling livestock at lower price=4. Theft of livestock=5. Other=6.
FAMRELOC	Had any family member relocated during the drought?	Yes=0. No=1.
ACCWTR	Have you had access to clean water?	Yes=0. No=1.
RATEACC	Rate access to clean water	Good=0. Fairly good=1. Bad=2
FODFAM	Did you have sufficient food for your family?	Yes=0. No=1.
RECVSUPP	Did you receive support from any institution?	Yes=0. No=1.
SOFSUPP	Which agency did you receive support from?	Government agencies=0. NGOs=1. Other=2.
KINDSUPP	What kind of support?	Supplied feeds=0. Supplied water=1. Vaccines & Dip=2. Other=3.
AIDBENEF	Did the aid from agencies benefit you?	Yes=0. No=1.
PLANSPOST	What do you plan to do in order to recover from all the losses?	Sell animals=0. Quit farming=1. Inherit the livestock=2. Buy more new livestock=3. No plans=4. Other=5.
HELPNEED	What would you like the government to help you with?	Compensate for the losses=0. Provide basic farming training=1. Create bore-holes=2. Provide feeds=3. Monitor, maintain and control the grazing areas=4. Other=5.

ANNEXURE 6: UNIVARIATE ANALYSIS

Variables/Categories	Coeff.	p-value
Agricultural centre		
Sekgosese	**ref**	
Bellevue	-0.246	0.006
Mokwakwaila	0.598	<0.0001
Marital status		
Single	**ref**	
Married	-0.002	0.985
Divorced	0.059	0.649
Widow	0.680	<0.0001
Widower	0.496	<0.0001
Gender		
Female	**ref**	
Male	0.013	0.850
Education		
No education	**ref**	
Primary	-0.132	0.134
High school	-0.564	<0.0001
Tertiary	-0.711	<0.0001
Other	0.205	0.066
Farming enterprise		
Cattle alone	**ref**	
Cattle and goat	-0.585	<0.0001
Cattle and pig	-0.354	0.020
Cattle and sheep	-0.368	0.057
Cattle and poultry	-0.348	0.027
Above 2 types	0.247	0.002
Drought Awareness		
Yes	**ref**	
No	0.124	0.094
Information source		
Television	**ref**	
Radio	0.414	0.062
Newspaper	-0.821	0.179
Extension officer	0.667	0.001
All sources	0.755	0.006
Other	0.645	0.005
Drought preparedness		
Yes	**ref**	
No	0.257	0.001
What was done to prepare		
Sold animal	**ref**	
Drilled borehole	0.481	0.013

Bought supplement	0.127	0.386
Other	-0.027	0.852
Coped		
Yes	**ref**	
No	0.016	0.816
Did cope mechanism work		
Yes	**ref**	
No	0.258	<0.0001
Source of drinking water		
Stream/river	**ref**	
Borehole	-0.221	0.008
Municipal tap	0.080	0.413
Other	-0.114	0.272
Age		
19-24	**ref**	
25-30	-0.288	0.381
31-36	-0.192	0.558
37-42	0.012	0.969
43-48	-0.033	0.908
49-54	0.102	0.717
55-60	0.818	0.002
>60	0.627	0.013
Support from any institution		
Yes	**ref**	
No	0.345	<0.0001
Support agency		
Government	**ref**	
NGOs	-0.504	0.029
Other	-0.057	0.664
Kind of support		
Supplied feed	**ref**	
Supplied water	0.264	0.205
Vaccines& Dip	0	
Other	0.404	0.001
Aid Benefit		
Yes	**ref**	
No	0.482	<0.0001
Years of farming	0.037	<0.0001

ANNEXURE 7: TURNITIN REPORT RECIEPT

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File size:	6.41M
Page count:	70
Word count:	12,973
Character count:	72,891
Submission date:	27-Feb-2020 10:06AM (UTC+0200)
Submission ID:	1265152315

ANNEXURE 8: PUBLISHED SCHOLARLY ARTICLE

International Journal of Disaster Risk Reduction 50 (2020) 101869

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: http://www.elsevier.com/locate/ijdrr

The impact of the 2014–2016 drought in Greater Letaba Local Municipality: How the farmers coped and factors that were significantly associated with loss of animals

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ARTICLE INFO

Keywords:
Climate change
Drought
Limpopo province
Smallholder farmers
South Africa

ABSTRACT

Background: From 2012, Limpopo province experienced extremely dry conditions that culminated in a meteorological drought between 2014 and 2016. There is no evidence of studies that have documented how the smallholder livestock farmers in the area were impacted. This study investigated factors that were associated with loss of livestock and the coping strategies farmers adopted.

Methodology: A cross-sectional questionnaire based survey was adopted for this study. Structured interviews were used to collect data from a random sample of 281 smallholder livestock farmers aged ≥18 years. Proportions of categorical variables, and the mean for continuous variables were computed and presented as tables and figures. A Poisson regression model was fitted to the data to identify factors significantly associated with loss of animals.

Results: Some of the copying strategies adopted by the farmers during the drought included: reducing their livestock numbers (37%), buying supplementary feed for their animals (25.20%) or drilling boreholes (5.69%). Majority of respondents (76.13%) received aid from the government agency. However, just over half (53.74%) of the farmers indicated that they did not cope well with the drought conditions. The Agricultural Centre to which the farmer belonged, marital status, number of years of experience in farming and receiving support during the drought were significantly associated with the number of animals that farmers lost during the drought.

Conclusion: Results show that copying strategies adopted in the study area were varied, and government was the main provider of support for farmers during the drought. However, overall, preparation for the drought was not adequately executed. These findings provide a framework for decision makers and other agencies on groups and intervention strategies that should be prioritised for drought mitigation among smallholder livestock farmers to be more effective.

1. Introduction

The term 'smallholder' is problematic in its definition and use [1]. For example, the term smallholder agriculture is at times used in reference to 1) farmers who occasionally sell farm products for cash to supplement other sources of income; 2) farmers who from time to time market the surplus after they have met their consumption needs; and 3) farmers whose primary focus is on production for the market.

According to Cousins [1], other criteria used to define smallholder agriculture includes size of land holding and extent of production for the market. Although rarely used, the different types of labour (e.g. household or family labour, hired workers or co-operative labour) or source of farming capital are other criteria that are also used to define smallholder agriculture.

However, generally the phrase 'smallholder agriculture' is used to describe farming that is carried out predominantly in developing countries by rural producers who primarily use family labour to develop the land; and such farming is the principal source of income for the family [2]. Furthermore, in South Africa, smallholder agriculture is generally associated with poor, non-commercial subsistence farming in parts of the former homeland regions.

Although the term 'emerging smallholder farmers' is at times used interchangeably with the term 'smallholder farmers', the former is increasingly being used to refer to smallholder farmers who are market-

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