Perceptions, coping strategies and welfare impact of drought among small stock farmers in Amathole, Eastern Cape

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Dissertation accepted in fulfilment of the requirements for the degree of Master of Science in Agricultural (Extension) at the North West University

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DECLARATION A - PLAGIARISM

I, Lwazi Ndlazilwana, declare that:

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(b) This dissertation has not been submitted for any degree or examination at any other university,

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DECLARATION B – PUBLICATIONS

The following publications (published and under review) form part of the research presented in this dissertation.

Publication 1: L. Ndlazilwana, M. Christian, O. Loki and S. Letsoalo

Smallholder livestock farmers' perceptions and the choice of drought coping strategies in the Eastern Cape

***Manuscript/abstract submitted for South African Society for Agricultural Extension conference review**

DEDICATION

This dissertation is dedicated to my late son, **Usange Zingce Nkubungu**, his older brother, **Abahle Madyibi** and my parents, **Mr Madoda Ndlazilwana** and **Nolulama Ndlazilwana**. My message to my late son, Sponge, I wish I could see you one more time, come walking through the door, but I know that is impossible; I will hear your voice no more. I know you can feel my tears, and you do not want me to cry, yet my heart is broken because I cannot comprehend why someone so precious had to die. I pray that God will help me strengthen and get me through as I struggle with the heartache. I lost you. I remember when your school organised your memorial service, six (6) months after your passing, I cried, not because I was not strong enough but because I felt your presence during that moment. That is why I could not stop the tears running down my face. Continue to rest in eternal peace, my lovely son. Daddy loves you. My message to you, Abahle, is that you are the best thing to ever happen to me. I loved you from the moment I knew your mother was carrying you. The first time I looked into your face, your eyes were closed, but you smiled. I knew then that my treasured and trusted friend for life had arrived. I did not find out if you were a boy or a girl. It just did not matter. You were simply a gift from God.

May this dissertation serve as a motivation to you, my son. Education is the only key that will open the door to impossibilities. Mama no Tata, thank you for sacrificing the little resources you had to educate me. Thank you for working so hard to provide us with the opportunities to be the best we can be. You have inculcated in us the belief in education to improve oneself, as well as the society that one is part of. Thank you for your tireless efforts and guidance from the inception of this project up to its completion. I appreciate that you never doubted my abilities. Your faith in me kept me motivated every moment I took a breath. Above all, thank you for the love that has always been part of the house we grew up in.

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ABSTRACT

The study perused the concept of drought from farmers' perspectives and how it affects their welfare. The study area included Raymond Mhlaba and Amahlathi Local Municipalities under the Amathole District Municipality in Eastern Cape Province of South Africa. A formal survey of 293 farmers was selected using a basic random sampling technique. The data collection instrument was a structured questionnaire administered during interviews and a semistructured interview guide used during focus group discussions. The study used percentages, frequency, standard deviation and mean to elicit demographic and farming information from the respondents. A Likert scale rating was used to assess the perceptions of small stock farmers on the impact of drought, and Chi-square statistics described the relation between the farmer and the coping strategies known, employed and forced to employ. The study used a multinomial probit model and two least square regressions for inferential statistics.

The main findings from the descriptive statistics were that 74% of the respondents were male with a secondary level of education and an average age of 49 years and with five (5) members per household. Moreover, the results showed that 84% of the farmers owned land, although they used community land for their stock grazing and browsing, and the dam was the major (60%) water source. The majority of farmers (67.58%) indicated that they received drought relief support from the government, and this included the provision of fodder (51.88%) and drinking troughs and water tanks (13.65%). For support services, farmers (91.13%) also indicated that they had access to extension services and 59% indicated that they were not satisfied with the monthly visits, and 98.29% posited that they did not receive any droughtrelated training.

Findings from the multinomial regression model indicated that factors such as level of education (p = 10%), farming skills (p = 1%) and access to extension services (p = 1%) were significant at varied statistical levels and had a direct positive influence on the farmers' choice of drought coping strategy. Moreover, support service attributes such as the frequency of response (p = 10%) and the quality of extension services received (p = 10%) positively affected the mechanisms chosen by farmers to withstand drought adversaries.

Results from the two least square regression showed that attributes such as household size (p = 10%), farming experience (p = 10%) and farm location (p = 1%) were significant at various statistical levels and had a direct positive influence on farmers' welfare (captured as agricultural income).

The study concludes that drought seriously affects small stock farmers. This is not only because of a lack of resources, but drought-related training, farming skills, and access to extension services influence how drought affects smallholder farmers. Moreover, farmers still use indigenous methodologies such as wild trees to cope with drought. These need to be integrated with the latest technologies, research findings, training and support regarding funding and inputs. Improvement of these factors could contribute to better farm yield returns and sustained farm profit, which will help address socioeconomic issues such as poverty, unemployment and food security at the household level. The study recommends that the training of farmers on drought-related programmes should be compulsory for extension officials, that is, it should be included as a key performance indicator. Moreover, there should be an integration of indigenous and climate-smart agricultural technologies so that farmers can detect early signs of drought and act instantly. Lastly, drought relief support should be made readily available for farmers in case of unexpected risk disasters such as drought.

Keywords: *Agricultural production, climate change, drought, coping strategies, small stock farmer, Eastern Cape*

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LIST OF ABBREVIATIONS AND ACRONYMS

ADM	**Amathole District Municipality**
ARC	**Agricultural Research Council**
ANC	**African National Congress**
CAQDAS	**Computer Aided Qualitative Data Analysis**
CASP	**Comprehensive Agricultural Support Programme**

CSA	**Climate Smart Agriculture**
DAFF	**Department of Agriculture, Forestry and Fisheries**
DBSA	**Development Bank Of Southern Africa**
DOA	**Department Of Agriculture**
FAO	**Food Agricultural Organization**
FSP	**Farmer Support Programmes**
FGD	**Focus Group Discussion**
GDP	**Gross Domestic Product**
GNP	**Gross National Products**
GHS	**General Household Survey**
IDP	**Integrated Development Plan**
LED	**Local Economic Development**
NGO	**Non-governmental organisations**
NDA	**National Department Of Agriculture**
NWU	**North West University**
SADC	**Southern African Development Community**
SAWS	**South African Weather Services**
UNDRR	**United Nations Office For Disaster Risk Reduction**

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Over the years, climate change has had a significant impact on world food production, and drought has been one of the worst natural disasters humanity has faced. Mare *et al*. (2018) posited that drought accounts for US$6 to US$8 billion in damages annually and affects more people than any other natural disaster. Moreover, the United Nations Office for Disaster Risk Reduction (UNDRR) (2021) reported that since the 18th century, over 11 million people have died from drought, and two billion people have been affected. In 2020, the FAO wrote that over 690 million people do not have enough to eat (FAO, 2020). Ncoyini-Manciya (2019) pointed out that a series of drought occurrences can be a disaster generating agent that exacerbates social and economic problems and reduce society's overall livelihood security.

Drought is described as a situation where there is limited rainfall substantially below what has been established as the standard for the area concerned, leading to adverse consequences for human welfare (Mare *et al.*, 2018). Hulme *et al*. (2009) are adamant that the phenomenon affects all industries but appears to be more damaging in the rural areas where most people depend on agriculture. According to Agri SA (2016), a series of drought occurrences can be a disaster-generating agent that exacerbates social and economic problems and reduces the overall livelihood security of a society.

According to Mniki (2009), drought is most severe in countries where economies are least diversified, and almost everyone depends either directly or indirectly on agriculture. Extended periods of drought can have primary and secondary effects, particularly on the livelihoods of those who depend on agriculture. Ncoyini-Manciya (2019) and Mare *et al*. (2018) indicated that limited rainfall and long dry spells affect all four dimensions of food security: food availability, food accessibility, food utilisation and food systems stability. Moreover, they impact human health, livelihood assets, food production and distribution channels, and changing purchasing power and market flows.

Recurrent droughts in vulnerable regions of Africa have attracted global attention because of the famines and massive social and economic disruptions. According to FAO (2017), the

prolonged drought spells have left over 10 million food-insecure people and 1.4 million children at risk of acute malnutrition. Moreover, the economic damage caused by drought in 2015 was estimated to be US$2.4 billion, with 30% of Africa's population severely affected (United Nations, 2020; World Bank, 2019).

In the Southern African region, the drought caused damage worth US$354 million, and 3.2 million people were severely affected (EM-DAT, 2017). The results filtered down to South Africa, which in 2015 recorded the lowest yearly total rainfall since 1940, declaring the country drought struck. As a result, agricultural production declined by 8.4%, while Agri SA 2016 estimated a 15% reduction in the national livestock herd in South Africa. The effects of droughts are not only economic but also social and psychological. Chabalala (2016) reported that some agricultural producers suffered from depression and most of them were admitted into psychiatric hospitals during the drought due to loss of yield and eventual welfare.

The South African government has responded with drought assistance initiatives. However, fund distributions are typically late and inadequate. Drought relief programmes include R450 million from the Department of Water and Sanitation in 2016 to intensify drought relief efforts, including handing over water tanks, wheelbarrows and other equipment, and R381 million that the Department of Agriculture, Forestry and Fisheries redirected from the Comprehensive Agricultural Support Programme (CASP) and llama/ Letsema towards drought relief to provide animal feed and the drilling and equipping of boreholes for affected communities. Government assistance was limited to smallholder farmers for commercial growers received no assistance (Agri SA 2016; DAFF 2016).

The agricultural sector in South Africa comprises commercial farmers and smallholder farmers. These sectors experience drought risks differently. White commercial farmers are endowed with farming resources while black smallholder farmers employ traditional coping methodologies. Historical root causes such as development support and economic reforms have benefited commercial farmers, who are primarily exporters of food (Mare *et al*., 2018), exacerbating the difference in coping capacity and socio-environmental susceptibilities. Therefore, smallholder farmers have different risk profiles and responses than the commercial farming sector (Thamaga-Chitja & Morojele, 2014).

While commercial farming underpins South Africa's food security, smallholder farming provides income and food security on a household scale for much of the black communities. With the increase in the frequency, severity, and duration of droughts, smallholder farmers appear to be challenged by drought in the last decade as they highly depend on climate-sensitive resources (Mandleni *et al.,* 2012). Smallholder agriculture production remains a bedrock of the rural economy, a source of food security, and a buffer to poverty for many households in developing (Smith *et al.,* 2013). Thus, agricultural production is invariably associated with improved rural development (Salem & Smith, 2008).

1.2 Statement of the problem

Over the past two decades, the impact and frequency of natural disasters on South Africa's farming community has increased significantly, and drought is the most common type of disaster (Ncoyini-Manciya, 2019). Research from the Centre for Research on the Epidemiology of Disaster (CRED) (2011) shows that drought is a major disaster, contributing to total economic loss, whilst floods and other natural disasters top the chart in terms of mortalities. According to Pelser *et al.* (2005), people living in rural areas are predominately resource-poor, and this leaves them to be more susceptible to drought and other natural disasters. Austin (2008) noted that their vulnerability and suffering are often exacerbated by the lack of progress in effective drought management. The Eastern Cape is among the nine administrative provinces in South Africa affected by drought, leading to a decline in the economy through reduced agricultural productivity and a scarcity of water resources (DAFF, 2007). According to Nowers (2011), the Eastern Cape has the most extensive cattle and sheep herds in South Africa, but it is also where communal farming is practised on the most significant scale.

There is a substantial literature in South Africa regarding the impact of drought on agriculture, such as at the national level (Muyambo *et al.,* 2017), quaternary catchment level (Magombeyi & Taigbenu, 2008) and regional level (Masupha & Moeletsi, 2020; Kamali *et al.,* 2018). However, when examining the effects of drought, particularly on the well-being of farmers, just a few local studies have been conducted (Jordaan *et al.,* 2013; Walz *et al.,* 2018). Many drought risk assessment studies in South Africa continue to overlook the relationship between a holistic assessment of socio-ecological vulnerability, exposure and hazard from the local to national scale. Drought policies that promote proactive drought management must be informed

by the effects of drought on farmers' welfare (Sivakumar *et al.*, 2014). A national drought risk assessment that integrates hazard, exposure, and vulnerability to risk for livestock and the irrigated and rainfed crops used to feed animals at the sub-national scale does not exist at this time.

There is evidence that the smallholder sector in the post-apartheid era has received more attention from agriculture policymakers, who intend to untie the past knots carried out by the apartheid regime. Despite this, it appears that smallholder farmers practising small stock production are still unable to deal with climatic and environmental challenges that affect their production, and drought continues to contribute to the diminishing returns of production, threatening livelihoods and leaving many people in poverty and food insecure (Loki, 2019). During the 2018 drought period, both Raymond Mhlaba and Amahlathi municipalities were declared drought-stricken municipalities. Therefore, this study seeks to investigate the perceptions, coping strategies and welfare impact of drought among small stock farmers in Amathole, Eastern Cape.

1.3 Research questions

- What are the farmers' perceptions of the impact of drought on small stock farmers?
- What are the current drought coping strategies used by small stock farmers?
- What are the factors influencing farmers' choices of drought coping practices?
- What effect do drought coping strategies have on farmers' welfare?

1.4 Objectives of the Study

There are four objectives of the study, which are to :

- Assess small stock farmers' perceptions of the impact of drought on small stock farmers,
- Determine the current drought coping strategies used by smallholder farmers,
- Examine factors influencing the choice of drought coping practices/strategies and
- Identify the effects drought coping strategies employed by farmers have on their welfare.

1.5 Hypothesis

- Small stock farmers' welfare is not influenced by drought
- There is no significant relationship between drought coping strategies and per capita expenditure.

- Drought coping strategies do not have a direct effect on the farmer walfare

1.6 Purpose of the study

The study investigates the perceptions, coping strategies and welfare impact of drought among small stock farmers at Amathole District Municipality in Eastern Cape Province of South Africa.

1.7 Significance of the Study

The study is in line with the objectives of the Amathole District Municipality (ADM) risk and local economic development division, which seeks to investigate the perceptions, coping strategies and welfare impact of drought among small stock farmers in the study area. However, the lack of reliable and detailed empirical data in these areas makes it difficult for ADM to intervene effectively. Against this background, this study provides empirical evidence for the Eastern Cape government to understand the dangers of drought on small stock production and farmers' welfare.

The departments and policymakers in formulating sound policies study results will assist in combating drought in the Amathole District Municipality. Moreover, it will motivate drought relief funds to assist farmers in supplementing their expenditure for better yield returns. For developmental practitioners such as researchers, advisory and extension agents, the study findings will assist the officials when planning farm visits with an approach when communicating services to farmers. In the case of farmers, the results will help them align their practices relative to drought and seek technologies that could help deal with the everchanging climatic conditions and sustain profitable farming operations.

The study will also contribute to the current understanding of climatic phenomena and their impact on agricultural productivity and food security, particularly in rural areas of developing countries. The coping strategies employed may be peculiar to the study area and will add new literature on drought coping strategies used by smallholder farmers.

1.8 Scope of the Study

This study followed a book format and comprises six chapters, addressing four specific objectives. Chapter 1 includes the background, problem statement, research questions and research objectives. Chapter 2 reviewed the literature on the characteristics that define

smallholder agriculture in South Africa and drought, including farmers' intervention strategies. Chapter 3 described the methodologies used during fieldwork and how data was collected and analysed using econometric models. Chapter 4 reports on the descriptive characteristics of the respondents. Chapter 5 reports inferential statistics that addressed the study objectives using various analytical methods. Chapter 6 summarises the findings, conclusion, policy implications and suggests prospects for future research.

1.9 Definition of key terms

Agricultural production uses cultivated plants or animals to produce products for sustaining or enhancing human life (Van Zyl, 2006).

Drought is a period of drier-than-normal conditions that results in water-related problems. If dry weather persists and water supply problems develop, the dry period can become a drought. It is a complete depletion of the water supply. It is experienced when the water supply cannot keep pace with water consumption. It is an extended period of abnormal warm temperatures (IPCC, 2012).

Coping strategies Chabalala, (2016) defines coping strategies as psychological patterns that individuals use to manage thoughts, feelings and actions encountered during various stages of ill health and treatments.

Small stock farming Kom (2016) defines small stock farming as the practice of keeping goats and sheep.

Smallholder farmers Aliber (2014) defines smallholders like those peasants who own small plots of land on which they grow subsistence crops and one or two income crops, dependent almost exclusively on family work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter examines the literature on the perceptions, coping strategies and welfare impact of drought among small stock farmers. It then described who smallholder farmers are in the global context and the setting from which many of these definitions are derived. In addition, the chapter provides a global overview of smallholder agriculture and documented the development of smallholder farmers in various nations. The chapter includes in-depth information on the policy, economics and other obstacles inhibiting the development of smallholder farmers. The history and global evolution of extension service will be examined, followed by its organisation, extension modes, rules and standards. The obstacles impeded the sector's ability to assist its receivers effectively.

This chapter presents the nature of smallholder farmers in South Africa, which entails characteristics, agricultural policies, constraints and support. The impact of drought can be explained by extreme weather events, unpredictable temperatures and changes in agricultural returns. Perceptions differ from region to region, and some perceptions are based on beliefs and norms. Also mentioned is that adaptation practices/mechanisms are not the same throughout the area studied. This chapter further discusses the socioeconomic profile of smallholder farmers. Lastly, the adaptation measures concerning drought are explored.

2.2. Theoretical and Conceptual framework

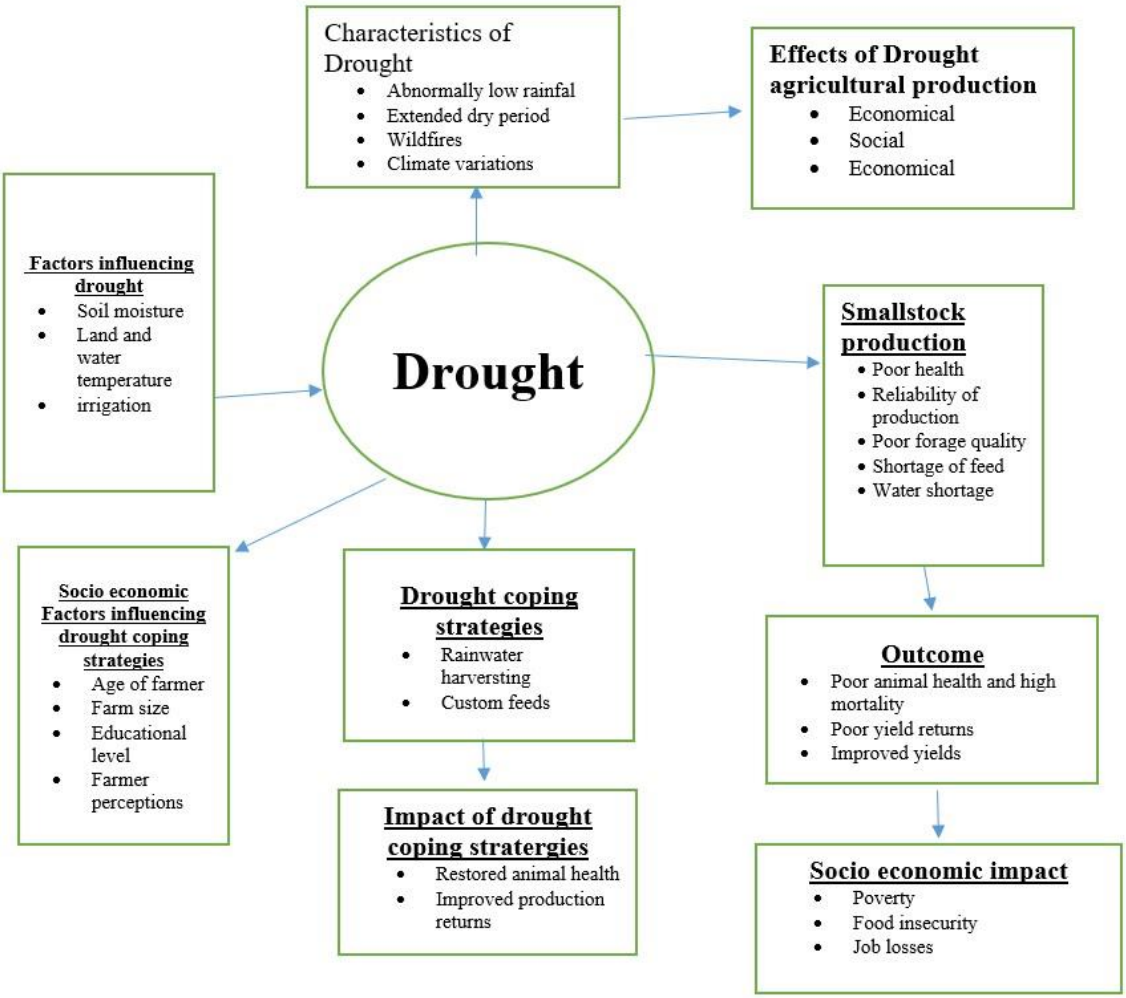
A conceptual framework functions as a road map for the study research, assisting in planning and putting the research into action. It identifies and defines the variables used in research and how they correlate to each other. On the other hand, the theoretical framework introduces and describes the theories underpinning the research and its development from existing theories. This study used these frameworks to provide a comprehensive overview of the investigated phenomenon (drought), and these form the foundation for the rest of the Chapters.

2.2.1 Theoretical Framework

According to Hansen *et al*. (2004), drought effects can be ex-post and ex-ante. Ex-post impacts are the losses that follow a climate shock. In contrast, ex-ante impacts relate to the opportunity costs associated with conservative tactics that risk-averse decision-makers take in advance to

insulate themselves against the prospect of climatic shocks (Ncoyini-Manciya, 2019). The conventional ex-ante responses of farmers to climate risks documented by Chaura *et al.* (2015) include less risky but less profitable forage, avoidance of potentially dangerous improved production technologies, and shifting household labour away from farming non-productive but more liquid assets as precautionary savings. Zimmerman and Carter (2003) posited that even in favourable years with strong relative risk aversion, poorer families are frequently impacted more by ex-ante responses to climate variability than wealthier households. The research by Hellmuthetal (2007) and Bhavnanietal (2007) described the direct and indirect economic and environmental effects of drought in a variety of ways. These include productivity loss in crops, rangelands, and forests, increased fire risks, decreased water levels, higher cattle and wildlife death rates and damage to wildlife and fish habitats (loss of biodiversity). Shiferaw *et al.* (2004) postulated that these effects could ultimately manifest as reduced income for farmers and agribusiness, increased food prices, unemployment, decreased tax revenues, increased conflict, migration and displacement, malnutrition and famine, disease epidemics and significant insect infestations.

2.2.2 Conceptual Framework



Source: Author's own development (2021)

Figure 2.1 Conceptual Framework

The conceptual framework provides an analytical overview of the factors, effects and socioeconomic impact drought has on small stock farmers in the study area. The South African population depends heavily on agriculture for food supply and livelihoods (STATSSA, 2011). Therefore, drought usually has a crippling effect on agriculture and tends to increase vulnerability to such changes (Ncoyini-Manciya, 2019).

This framework illustrates the factors that influence droughts, such as soil moisture content and extreme temperatures. These factors will harm the severity of the drought if the following characteristics, such as abnormal low rainfall and extended dry period, are evident. This will have adverse effects on small stock production, particularly on forage quality and, ultimately,

a shortage of feed for small stock. Also, the severe water shortage leads to poor quality of products, and the outcome will be poor animal health, high mortality rate and insufficient cattle returns. This will later impact the socioeconomic status of a particular area because this could pose a threat to food security, and people will be badly affected by poverty. To some extent, people will lose their jobs.

2.3 Smallholder agriculture in South Africa

Apartheid's formal demise in 1994 necessitated reform of the government sector, which resulted in the modification and abolition of numerous policies. Smallholder farming policy objectives have been implemented to assist smallholder farmers in becoming commercial (Aliber & Hall, 2012). These efforts attempted to reverse historical segregation and restore the agricultural sector to foster economic growth and development (National Department of Agriculture (NDA), 2001). The Department of Agriculture (DoA) developed a variety of initiatives to assist smallholder farmers, ostensibly to address long-standing issues of rural neglect and unemployment. However, these legislative initiatives have done little to strengthen this sector; in some cases they actually exacerbated its collapse.

Agriculture has been at its lowest point in the past two decades, contributing an average of only 3% of GDP (Mutimba, 2014; Hlomendlini, 2016). Much of this contribution to GDP has been made by white commercial farmers, while black smallholder farmers have made a negligible contribution (StatsSA, 2020). According to Sikwela (2013), the reduced contribution to the GDP appears to be accurate, as smallholder farmers are not commercial, so their Gross National Product's (GNP) contribution remains limited. This is because they have fewer resources and endowments than their white commercial counterparts. However, Aliber and Hart (2009) claimed that despite smallholder farmers' low contribution to agricultural output, they appear to be indispensable to many black households. Tshuma (2009) reaffirmed that some smallholder farmers involved in farming systems could earn an income from their farming operations, but solely for self-satisfaction. According to 2010 estimates from the General Household Survey (GHS), 5.8 percent of all black farmers earned an income from farming operations (GHS, 2010). Additionally, household participation in home gardening in former homelands benefits household hunger and food security (van Averbeke & Khosa) (2007).

Diversification of income and livelihoods is among the various characteristics that identify South African smallholder farmers. According to Alemu (2012), their livelihoods are characterised by a heterogeneous economic environment, which may be agricultural or nonagricultural. According to Hart (2008), farmers maintain their livelihoods through various agricultural activities, such as agricultural and animal production, off-farm income, commercial activities, and government contributions such as pensions. According to Aliber and Hart (2009), smallholder farmers' off-farm income is as vital to their daily lives as agricultural productivity. Government handouts are an essential method of poverty reduction, and some farmers use the funds to purchase planting seeds and livestock vaccination.

2.3.1 Characteristics of smallholder farmers

Smallholder farmers are not a homogeneous group; they vary by environment and geography. However, their qualities and farming methods appear quite distinct (Ngemntu, 2010). Smallholder farmers are concentrated in agrarian societies in the former lands of origin, where they practice rain farming and collect water with buckets and drums (Baloyi, 2010). Additionally, these farmers employ animal traction to dig the soil and fertilise using animal excrement. According to Chabalala (2016), one social characteristic that smallholder farmers appears to share is keeping animals for various reasons, including food, cultural rites and cash. Due to their grazing camps' damaged borders and internal fences, smallholder farmers frequently lack grazing management tools. Communal farmers are typically a subcategory of small-scale farmers who work on small-scale projects established or sponsored by provincial agriculture departments' extension services (Hart, 2008).

Smallholder farmers often manage their small pieces of land on these projects and occasionally receive support from extension services with access to inputs and technology transfer, including agrochemicals, irrigation and plant material (Chabalala, 2016). Due to the limitations of local, natural and other resources, this assistance is frequently insufficient. They may access the neighbourhood market through the community events, extension service, pension days and social grant days (Cousins, 2012). Most of the groups are female-dominated, and the elderly typically receive expert assistance with standard inputs and routines (Loki, 2016). In certain countries, this type of farmer is referred to as a peasant, that is, a farmer who owns a small plot of land that is mainly used for subsistence (Cambell, 2015). The surplus of peasant agriculture directly or indirectly appropriates the representatives of a larger economic system. Many of these farmers face poverty, and traditional agricultural practices that employ little or no modern

technology and are frequently labelled as foot-draggers due to their proclivity for late adoption, conservatism and suspicion of strangers and novel concepts (Ngemntu, 2010).

2.3.2 Challenges facing smallholder farmers

According to the smallholder farmers' literature, most restraints they experienced in developing nations emanate from historical occurrences (Williams *et al.*, 2008; Pienaar, 2013). Colonialism, tax price inflation and apartheid were all implemented to impede smallholder farmers' development and growth (Worth, 2012). These constraints impair their growth and development and their capacity to donate to food security and GDP (Gross Domestic Product) (Sinyolo & Mudhara, 2017). Smallholder farmers are affected by numerous obstacles, increasing uncertainty and risk and acting as impediments for higher production, preventing their access to markets (Mudhara, 2010). Apart from the opportunities to expand the market, there is a risk that smallholder farmers will be phased out, despite having some competitive advantages over larger-scale farmers, particularly regarding access to family labour and extensive local expertise (Mudhara, 2010).

2.3.2.1 Access to land

The Natives' Property Act of 1913, for example, arguably set a clear divide between black and white landholding and barred black people from purchasing, hiring or acquiring land (Vink & van Zyl, 1998). Under this Act, approximately 7% of the land was reserved solely for Africans, increasing to 13% later (under the 1936 Land Act) (Pienaar, 2013). This Act attempted to prohibit tenancy and sharecropping, unsettling production by black farmers (Pienaar, 2013; Vink & van Zyl, 1998). Black farmers were deprived of autonomy by the Land Acts and several other actions, forcing them to produce on the marginal community land reserves. In 1994 when the African National Congress (ANC) led government took office, it tried to address the issue of unequal access to natural resources such as land. Reforms to policies and legislation have been made to address the injustices of the previous regime. The land reform programme was the first of many initiatives to resolve long-standing equality challenges in the agricultural sector of South Africa. The goal of this programme was to increase rural people's access to land, ensure their security of tenure and strengthen their production capacity. Land restitution, land tenure reform, and land redistribution were the primary instruments used (Lyne & Darroch, 2003; Pienaar, 2013). Despite efforts to address land distribution in South Africa, there is evidence that land reform and other land programmes were shallow and did not adequately address the issue (Pienaar, 2013). After two decades of democracy, white

commercial farmers own 86.2% of arable land for farming, while black smallholder farmers own only 14.5% (DAFF, 2016).

2.3.2.2 Poor physical Infrastructure

Llanto (2012) divided agricultural infrastructures into three categories: capital intensive infrastructure, such as irrigation, roads, and bridges, extensive capital infrastructure, such as institutional infrastructure and extension services, such as informal and formal institutions. Inadequate access to adequate infrastructure is a crucial issue contributing to smallholder agriculture's underperformance in developing countries. Physical infrastructure is inextricably linked to farmers' access to institutional finance and markets, and it enhances crop yields, hence promoting agricultural expansion (Gomo, 2012). A well-developed infrastructure system has the potential to turn the smallholder sector that already exists into a commercial, dynamic and modern agricultural sector (Raphela, 2014).

The provision and development physical infrastructure can also increase agricultural production and profitability while lowering farming expenses. According to the World Bank (2010) and Christen and Anderson (2013), infrastructure plays a critical role in generating multiplier economic effects associated with agricultural growth. According to studies conducted in developing nations, a percentage increase in infrastructure stock is connected with a percentage increase in GDP in countries worldwide (Jamilu *et al*., 2014; Ferris *et al.*, 2014). According to Yoshino and Nakahigashi (2000), the access to physical infrastructures such as storage facilities, irrigation systems and road networks was a critical factor in the smallholder farmers' success in Thailand and China.

The physical infrastructure of South Africa is insufficient, especially in former homeland areas, where it continues to impede substantially the agricultural growth of smallholder (Raphela, 2014). While the South African government has made tireless attempts to improve the rural infrastructure's quality and quantity through programs for development such as the Community Based Public Works Programme, it is clear that additional work is required (Hlomendlini, 2016). According to Makhura (2001) and Chaminuka *et al.* (2008), smallholder farmers face barriers to accessing official markets.

2.3.2.3 Lack of capital

Human capital

According to Aliber (2005) and Rosen (2008), human capital is the cumulative knowledge created during the lifelong process of human resource development, which begins in childhood and continues throughout one's life. Llanto (2012) emphasised the significance of enhancing the human capital of the agricultural population. Lack of human capital has been cited as one of the most critical obstacles for smallholder farmers in South Africa. Farmers in rural areas are frequently uneducated and technologically illiterate, which presents a formidable barrier to their access to formal institutions that impart technical information (Sikwela, 2013). Most smallholder farmers lack financial and marketing expertise and cannot achieve the quality criteria established by fresh produce markets and food processors (Hart, 2008; DAFF, 2014). Small-scale farmers' low technical efficiency and technology adoption result in lower production quality. According to Agholor (2012), the productive performance of a farm is measured by its technical competency. In the context of South African rural smallholder farmers, it can be described as an agricultural household's ability to obtain the maximum output from a given set (Khapayi & Celliers, 2016).

Instead of viewing technical inefficiency as a measure of income or gross output, it should be viewed as a measure of management error; greater inefficiency is not correlated with lower yields or loss of revenue (GHS, 2012). The use of human capital has recently been identified as key to achieving sustainable productivity gains in many African countries (Albers, 2013). Education can directly increase technical efficiency by enhancing labour quality, enhancing farmers' adaptability to imbalances, and influencing input use (Albers, 2013).

Physical assets

In economic theory, physical capital, land and labour are the three fundamental production components (Albers, 2013). Farm buildings, farm machinery and the various equipment and facilities utilised in agricultural output are considered as physical capital goods. Most South African smallholder farmers face challenges in accessing physical capital and other production parameters. According to Pienaar (2013), as a result, their output is restricted to staple items for household use rather than products for traditional markets. According to Khapayi and Celliers (2016), the absence of production assets, such as tractors, machinery, equipment, and cars, is significant for smallholder agricultural systems in Southern Africa. According to Pote (2008), farmers with assets face limited impediments to market access. A lack of

householdspecific productive assets frequently prevents farmers from participating in lucrative markets.

2.3.2.4 Poor access to reliable markets

For small holder farmers, the access to agricultural markets has become more challenging; consequently, many government ministries in developing nations concentrate on this issue (Pote, 2008). The deteriorating agricultural performance is a significant factor in the increasing poverty among African smallholder farmers. Its revival provides a substantial opportunity for rural areas to escape poverty (DAFF, 2012). The South African government could establish a structure that enables smallholder farmers to join and compete in the market. Khapayi and Celliers (2016) postulated that South Africa's smallholder farmers encounter barriers that buffer market access and involvement.

These constraints include a) a lack of market information; b) poor infrastructure and access to farming equipment; c) a lack of access to productive land for farming; d) high transaction costs; e) limited access to financial assistance and credit; f) illiteracy and the use of obsolete technology; g) a lack of access to markets, and h) a distance to the market.

These factors have driven most farmers to sell their produce at low market value on informal marketplaces (farm gates, street vendors) (Khapayi & Celliers, 2016). The distance to output markets is another critical consideration; farmers who wish to commercialise may be discouraged by large travel distances to the market. According to a study conducted by Khapayi and Celliers (2016) in King Williams's Town, Eastern Cape Province, markets location was among the obstacles because they were distant from the farmers. Farmers traversed vast miles on gravel roads to reach official markets while transporting their goods using substandard transportation. Due to insufficient infrastructure and facilities, the product's quality was impaired.

2.3.2.5 Poor Support services

Without access to support services, the agricultural growth of smallholders is unfeasible. Smallholder farmers require support services for income generation, poverty alleviation commercialisation, food security and rural development (Aliber & Hall, 2012). In the absence of adequate farmer support services, the commercialisation of beginning farmers is impossible (Agholor, 2012). Emerging agriculture can boost agricultural development and farm revenue (Pienaar, 2013; Sikwela, 2013).

In the mid-1980s, according to Aliber & Hall (2012), the Development Bank of Southern Africa began assisting the smallholder sector in South Africa. This was accomplished through the creation of Farmer Support Programmes (FSP) and providing inputs, capital, mechanisation, marketing, training and extension services from 1987 to 1993 to smallholder farmers in homeland areas (Pienaar, 2013; Williams *et al*., 2008; Worth, 2012). In 1994, when the homelands were reintegrated into South African provinces, these operations officially came to an end, despite their flaws.

Aliber and Hall (2012) evaluated the assistance supplied to South African smallholder farmers; what they found indicated that smallholder farmers' agricultural support, particularly livestock producers, is low. This is due to the South African government's inadequate policy planning and ineffective bureaucratic strategies. According to Aliber and Hall (2012), a few smallholder farmers receive support because agricultural departments appear oblivious to the number of farmers. Consequently, in 2008, DAFF initiated a pilot study for its farmer register project to establish a comprehensive database of smallholder farmers (DAAF, 2009). Another aspect of this issue is the ratio of extension personnel to farmers, and research has shown that the assistance provided by extension services to farmers is rather limited due to a lack of extension personnel.

According to the Province of the Eastern Cape (2008), the ratio of extension officers to farmers in South Africa was 1:1500 as per their most recent count. This has hampered most smallholder farmers, who rely only on governmental extension services to keep up with the rapid speed of technological change (Nkosi, 2017). In a discussion paper on the qualification assessment of extension and advisory officials in South Africa, Liebenberg (2015) determined that eight out of ten extension and advisory officials are insufficiently prepared to function as agricultural consultants or subject matter experts. In addition, less than 25% of extension personnel have participated in technical training programmes since entering the public sector.

2.4 Drought in South Africa

Drought has multiple causes, including biophysical and social variables (Wilhite, 2000). There are numerous aspects of drought, including its characteristics, causes, susceptibility to drought and effects or consequences (Austin, 2008). Drought has occurred frequently in South Africa (Vogel, 2005). According to the South African Weather Service (2020), precipitation below

75% of the average annual precipitation defines a meteorological drought. The most important lesson is that drought lacks rain and can be identified by its direct and indirect effects, such as agricultural shortages and price rises (Glantz *et al*., 1997).

Drought is a natural hazard that cannot be avoided. Numerous aspects of society are negatively affected, including soil quality, the area planted for local use and export, food imports, labour supply and rural poverty (Glantz *et al.,* 1997). As the drought intensifies, interdependent socioeconomic factors such as price hikes become evident (FAO, 2011). Thus, drought is an exogenous supply-side shock that typically results in substantial drops in agricultural output, export earnings, employment rates and income levels (Glantz *et al.,* 1997).

South Africa's population relies mainly on agriculture for food supply and livelihoods (StatsSA, 2011). Therefore, droughts typically have a devastating impact on agriculture and enhance sensitivity to such changes (UNDP-BCPR, 2005). Droughts usually take at least two to three months to develop and can last for months or years; they are sometimes referred to as a creeping phenomenon (AgriSA, 2018). As a result of this variety in drought length, smallholder farmers should increase their understanding of the likelihood that drought may concurrently impact all or multiple key crop-producing regions inside their country's boundaries (Malunga *et al.,* 2020). Drought may also harm neighbouring nations whose food supply is dependent on them (Gerald *et al.,* 2014). Droughts have a substantial negative impact on the agricultural share of a nation's gross domestic product because of rain-fed (FAO, 2017).

2.4.1 Effects of drought on agricultural production

2.4.1.1 Livestock production

Livestock production is significant in South Africa and globally (Rust, 2013). According to FAO (2017), livestock generates 40% of agricultural GDP and employs over a billion people. It also provides livelihoods for more than one billion underprivileged people. Food and Agriculture Organisation (2011) research indicates that cattle farming is the world's primary land use, occupying approximately 45% of the earth's land surface, much of it in harsh and changeable settings unsuitable for other services. Drought can influence the quantity and quality of products, the dependability of production and the natural resources utilised by agriculture (Kang *et al.,* 2009).

In developing countries, the livestock production efficiency of smallholder farmers is hindered by the lack of livestock feeds, poor human and animal health, limited access to markets, unresponsive policy frameworks and depletion of natural resources (David, 2011). The livestock products serve many functions that are beneficial to the health and welfare of households, such as the provision of cash income from sales of animal products, nutrition from consumption of livestock products, fertilisation of soil with manure, and draught power during planting times, as most poor households lack tractors (Moyo, 2013). It is also economical to keep animals since they consume grass and shrubs that naturally grow in fields and along roadsides rather than grain (Aliber, 2010). After harvest, they can feed on maize stalks and cabbage leaves that would otherwise be discarded or turned into compost (Moyo, 2013).

In pastoral and agro-pastoral systems, livestock farming protects the poor against economic, social and risk management shocks (FAO, 2010). Domestic livestock production is essential for household economies in the Greater Horn of Africa (GHA), which consists of Sudan, Somalia, Ethiopia, Uganda, Rwanda, Tanzania and Burundi (World Bank, 2011). There are numerous reasons for keeping livestock, including revenue, manure, ploughing, status and savings (Notenbaert *et al.,* 2010). The impact of climate change is anticipated to enhance the vulnerability of livestock systems and intensify current factors that affect livestock production systems simultaneously, such as rapid population and economic growth and increased demand for food (including cattle) and goods (Rust & Rust, 2013).

Cattle, sheep, goats, pigs and poultry are examples of livestock raised in the rural tropical developing countries where many impoverished people reside (Aliber *et al.,* 2010). This livestock is their most valuable possession (Aliber, 2010). Livestock is a liquid currency when it is needed and generates income for the needy (FAO, 2011; Thornton, 2010). In many regions, drought is becoming an increasing problem.

Similarly, in the Eastern Cape Province (the research area), livestock farming remains the foundation of rural household economics (Mpandeli, 2011). Similar to other rural communities in South Africa, livestock is viewed as a source of income and is associated with social standing (Rosati *et al.,* 2005). According to Akpalu (2005), livestock is kept in the Eastern Cape as a store of wealth for quick income, milk, draught power, manure, and less frequently, meat. The loss of cattle could result in persistent poverty with lasting impacts in rural areas (World Bank, 2010). Higher temperatures and altered rainfall patterns will be among the direct repercussions

of drought, leading to an increase in the transmission of current vector-borne diseases and animal macro parasites and the appearance and spread of new diseases (Machete, 2011).

2.4.2 Socioeconomic effects of drought

2.4.2.1 Economic

Income loss is one of the indicators utilised for the assessment of drought effects. Reduced farming income influences retailers and other service providers to farmers, resulting in reduction of business operations, unemployment, greater credit risk for financial institutions, capital deficiencies and a loss of tax revenue for local, state and federal governments. As resources diminish, the cost of energy, food and other goods rises. For example, when there are local shortages of specific items, these goods must be imported from other outside regions that are not affected by drought to supply those drought-stricken regions. The reduced supply of water reduces the navigability of rivers and raises the cost of transportation because goods must be delivered using other forms of transport (Ncoyini-Manciya, 2019).

2.4.2.2 Social

This refers to impacts such as health, public safety, conflicts between water users, impaired quality of life, disaster assistance, inequities in the distribution of effects and population migration. In several countries, population migration is a significant issue, frequently encouraged by the availability of better food and water elsewhere; some move to urban areas to escape drought-affected regions. There may even be migration to neighbouring countries. Even when the drought is less severe, the migrants rarely return home, depriving rural areas of crucial human resources, skills and expertise. Drought migrants place additional strain on the social infrastructure of urban areas, resulting in increasing poverty and social instability (Muthelo, 2018).

2.4.2.3 Environmental

Muthelo (2018) narrated that a prolonged drought can harm the quality of water and air, animal and plant species, cause range and forest fires that destroy the habitats of wildlife, landscape quality degradation, soil erosion and biodiversity loss. Some effects are transient, and conditions return to normal once the drought is over. Other environmental effects are longlasting and eventually become permanent. For instance, the wildlife habitat may be degraded by losing wetlands, lakes and vegetation. However, many species eventually recover

from this transient anomaly. High soil erosion and degradation of landscape quality may result in a more permanent loss in biological output.

2.4.3 Drought coping strategies employed by smallholder farmers

Drought severely affects the agriculture sector by reducing production, primarily on maize which is among the staple food for most households in South Africa (AgriSA, 2018). Throughout the twentieth century, the South African government and other role players, including the private sector and NGOs, had to establish numerous coping measures and adaptation practices, including the Drought Investigation Commission in 1914 and the Report on Drought Feeding in 1965, to mitigate the damage caused by drought occurrences (AgriSA, 2018). Moreover, these government initiatives have typically focused on drought relief and agricultural assistance and have been mostly reactionary (van Zyl, 2006). Whenever a new drought episode begins, crisis management has typically proceeded (Malunga *et al.*, 2020). Strengthening the capacity of smallholder farmers' response to drought is essential for sustaining their well-being. Chenje and Johnson (2004) noticed that South Africans had established drought-prevention and -mitigation strategies over centuries. However, Boko *et al.* (2007) stated that traditional adaption strategies may not be adequate for climate change in the future. Due to the apparent inefficacy of conventional adaptation strategies, Ziervogel *et al.* (2008) reported that adaptation practices, particularly in South Africa, have progressed from being very basic to incorporating modern technology.

2.4.3.1 Smallholder crop farmers

Many South African provinces are water-stressed and confront climate variability and continuous vicious drought cycles (DAFF 2011). Water availability is arguably the major challenge faced by several provinces. Strzepek and McCluskey (2006) reported that the majority of Southern African nations are witnessing a significant decline in streamflow. Eastto-west climate variation in South Africa, for example, affects water runoff (FAO, 2011). For instance, threshold assessments for mean annual runoff show a reduction of up to 10% in the western portion of South Africa by 2015, whereas the same threshold will be achieved in the eastern part by 2060 (Turpie *et al.*, 2002).

It is projected by du Toit *et al*. (2010) that South African crop production could decline by 10 to 20%. South Africa is currently seeing a decrease in maize production (Farmers Weekly, 2016). Comparing 2011 to previous years, crop production declined by 2 million tonnes or 15%

(FAO, 2012). This drop in crop yield hurts the agriculture industry and therefore impacts employment, food prices and food security (DAFF, 2012).

Food becomes scarcer during a drought, but food costs and farming inputs also tend to rise (Austin, 2008), posing a significant problem for smallholder farmers. Given that smallholder farmers in the Eastern Cape are especially susceptible to drought, it is crucial to improve their adaptability to drought (Aliber, 2011). Small-scale crop farmers employ indigenous drought adaptation strategies to manage drought, the limitations of which include elder individuals' propensity for weather forecasting. In addition, other approaches include shifting the cropping calendar, storing and preserving seeds in granaries, growing drought-resistant crops, intercropping and rainwater gathering (Makhando, 2011). Each adaptation method bears advantages and disadvantages that smallholder farmers must consider if they decide to implement it in their agricultural practices (Machete, 2013).

2.4.3.2 Smallholder livestock farmers

According to the IUCN (2010), 70% of African rural poor are livestock owners. This demonstrates that livestock production is vital to the sustenance of the livelihoods of rural people, particularly through food provision, the payment of 'lobola' (wedding price) and savings and income. Additionally, the quantity of livestock a farmer has signifies wealth and social status in the communities. According to Boko *et al.* (2007), livestock is susceptible to climatic variability and change. However, according to Calvosa *et al.* (2010), livestock farming is more drought-resistant compared to crop cultivation. This is mostly centred on livestock mobility, moving them to water sources or regions with forage and shade. Drought has a direct impact on livestock output by decreasing feed, hay and water availability (Ozor & Cynthia, 2011).

In winter, Southern African nations have a dry season, which limits grazing. This means that any delay in precipitation lengthens the winter season, worsening livestock food shortages. This situation leads to substantial livestock mortality, particularly among cattle. Loss of livestock could aggravate poverty and badly impact the livelihoods and food security of rural residents (Calvosa *et al.*, 2010). Therefore, the adaptability of small-scale farmers must be improved to prevent or reduce future livestock losses.

These indigenous adaptation strategies include daily livestock care, lending livestock to families, limiting the quantity of livestock, purchasing feed and water, farming with droughtresistant livestock and adopting rotational grazing. There are advantages and disadvantages associated with each adaption measure. If they wish to apply such approaches in their farming system, smallholder farmers must consider these constraints (Nkosi, 2017).

2.4.3.3 Technologically-driven drought adaptation practices

Boko *et al*. (2007) claimed that indigenous adaptation strategies may not be adequate now or in the future and may result in long-term responses that are unsustainable. According to Dube and Sekhwela (2008), indigenous adaptation strategies are flawed and dependent on the inadequate transfer of generational knowledge. The Department of Agriculture, Forestry, and Fisheries (DAFF) (2016) acknowledged that adaptation strategies based on indigenous knowledge systems provide a great starting point for localised adaptation. However, these methods cannot solve the complex and long-term challenges created by drought and other aspects of climate change on their own.

Therefore, indigenous strategies must be reinforced by scientific and technological practices (FAO, 2011). Stringer *et al*. (2009) also noted that indigenous adaptation tactics are primarily reactive, meaning their effectiveness is questionable unless complemented by policy-based and planned approaches. Therefore, South African smallholder farmers are increasingly turning to adaptation strategies that are driven by technology. This is primarily attributable to the fast modernisation of society and the ineffective transmission of traditional knowledge.

All these obstacles undermine the efficacy of indigenous adaptation techniques. The degradation of traditional adaptation methods has diminished the resilience of communities to the risk of drought and increased their vulnerability to its effects (DFID, 2004). Klein (2011) hypothesises that technology development is essential for successful drought adoption. Unlike indigenous adaptation strategies, however, technologically driven adaptation practices are very complicated and expensive. The current obstacle is that smallholder farmers are impoverished and so unable to purchase and utilise technology-driven adaptation devices. This suggests that small-scale farmers in South Africa will need cash to acquire such adaptation technologies and direct technical support to run them (ARC, 2011). The exploration of drought adaptation strategies driven by technology is crucial for enhancing the capacity of smallholder farmers to adjust to drought (Moyo, 2013).

These technologically-driven drought adaptation practices include the construction of boreholes and dams, the introduction of irrigation systems, subsidy provision to farmers, the construction of water supply systems, the provision of extension services to farmers, the practice of mixed farming, genetic modification to increase production, risk reduction through effective monitoring and early warning, the support of adaptation plans in national programmes, and the promotion of sustainable agriculture (Kom, 2016).

2.5 Chapter Summary

This chapter examines the literature on the perceptions, coping strategies and welfare impact of drought among small stock. It then described who smallholder farmers are in the global context and the setting from which many of these definitions are derived. In addition, the chapter provides a global overview of smallholder agriculture and documented the development of smallholder farmers in various nations. The chapter includes in-depth information on the policy, economics and other obstacles inhibiting the development of smallholder farmers. The history and global evolution of extension service will be examined, followed by its organisation, extension modes, rules and standards. The obstacles impeded the sector's ability to assist its receivers effectively.

The last section of the chapter narrated and reviewed the drought coping strategies employed by small stock farmers. It illustrates the effects of drought on farmers and their susceptibility to the effects of drought. Usually, drought devastates households economically, environmentally, and socially, impacting animal health, farming income and increasing prices.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The main objective of this study was to investigate the perceptions, coping strategies and welfare impact of drought among small stock farmers in Raymond Mhlaba and Amahlathi

Local municipality, Eastern Cape. In an attempt to achieve the goal mentioned above and to provide more insight into the concept of perceptions, coping strategies and welfare impact of drought among small stock farmers, the study employed a combination of quantitative and qualitative approaches aimed at describing the research problem and obtaining information on farmers' ideas, perceptions, thoughts, beliefs and experiences. This chapter explained the research strategy and design, data collection methods and analytical models. A properly planned and conducted research project produces reliable results, which are essential for making an informed decision about future courses of action (Legesse, 2014).

3.2 Description of the study area

The study was conducted in Amathole District in Eastern Cape Province of South Africa. The study was conducted in Raymond Mhlaba and Amahlathi Local Municipality.

3.2.1 Amathole District Municipality

The Amathole District Municipality has six local municipalities; namely: Great Kei, Mbashe, Mnquma, Amahlathi, Ngqushwa and Raymond Mhlaba. Amathole was purposively selected for the study because it is amongst the districts declared as drought-stricken during the drought period and has the highest number of farmers involved in small stock production. Farmers from this region are mainly dependent on agriculture and minimal stock production (small stock sales and wool sales). Within Amathole District, some municipalities were severely affected by drought, and some were moderately affected. In this case, Raymond Mhlaba Municipality was amongst the municipalities severely affected according to small stock mortalities recorded during the drought period. Amahlathi Municipality was amongst the municipalities that were not severely affected by drought. The Amathole District makes Eastern Cape the leading province, with a fifth of the country's cattle, a quarter of its sheep and nearly half its goats found in the area (Kom, 2016). In addition, a quarter of the nation's milk is produced in the province; mohair-producing Angora goats and wool-producing Merino sheep thrive in the province's interior (near Alice, Seymour and Fort Beaufort) (Kom, 2016). Deciduous fruit (in the Langkloof), citrus fruit (near Addo/Kirkwood/Fort Beaufort) and chicory (in Alexandria) are vital components of the province's agricultural diversity (Sikwela, 2013).

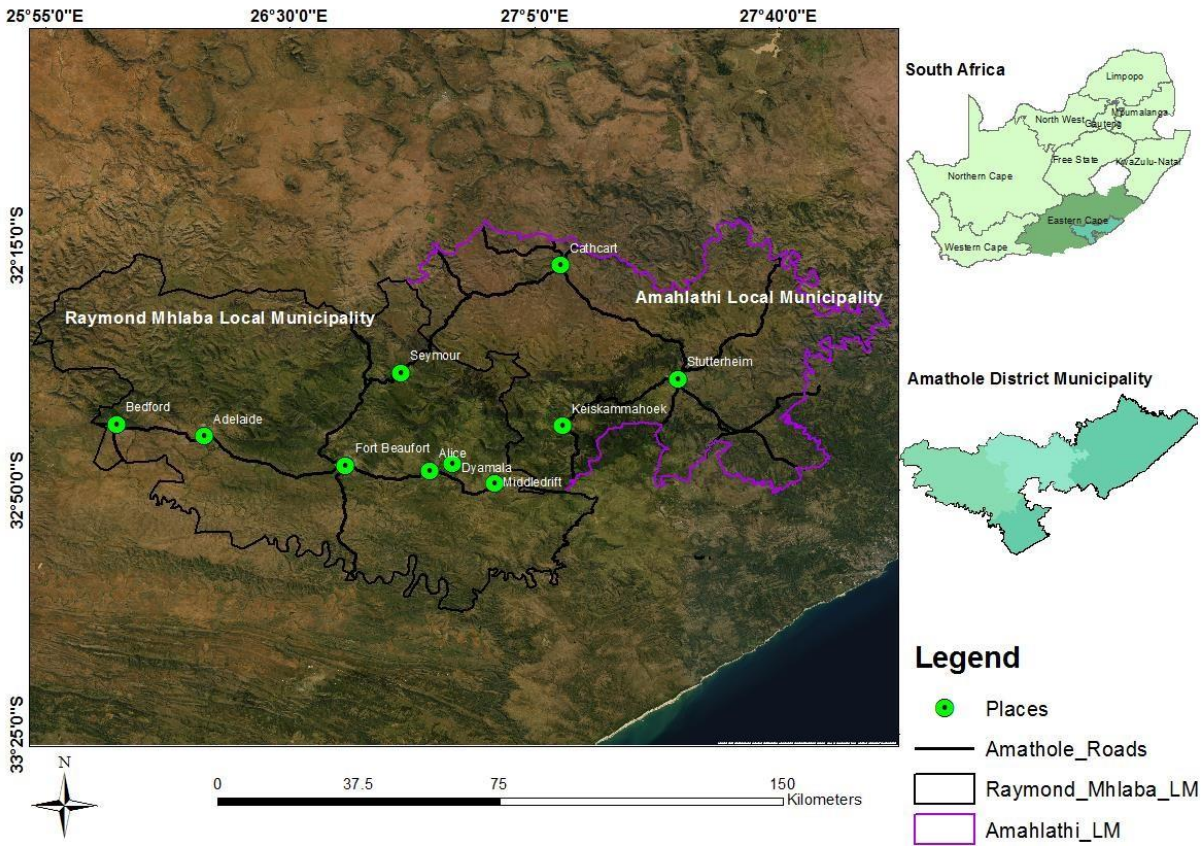


Figure 3.1 Map of the study area

3.2.1.1 Raymond Mhlaba Local Municipality

The Raymond Mhlaba Municipality is along the southern slopes of the Winterberg mountain range and escarpment. It is within the greater Amathole District Municipality in the Province of the Eastern Cape. According to Raymond Mhlaba, local municipal IDP (2017), the main economic sectors are community services, tourism, and the agricultural industry, including citrus, forestry, small stock and crop production. The citrus industry is the second-largest employer, and following community service, forest plantations and timber processing are also undertaken in the area.

The literature reviewed and the researcher's experience were instrumental when choosing the study area. When selecting the study area, data availability, target population (number of farmers practising small stock), farmers' welfare, climate, and environment (rainfall distribution and vegetation) were critical. A study by Malunga *et al.* (2020) posited that most farmers in both municipalities are farming with small stock, and practices such as seasonal sales of sheep and goats (traditional rituals) and sheep shearing are the mainstay that contributes to farmers' welfare. During the 2018 drought period, Raymond Mhlaba municipality was

declared a drought-stricken municipality. Therefore, it is for this reason that this study area was selected through purposive sampling.

3.2.1.2 Amahlathi Local Municipality

Amahlathi is in the northern part of the Amathole District Municipality, and it measures 4266.21 km2 in extent. There are informal rural settlement areas and extensive, privately owned farmland. The communal, social, and personal services industry is the sole economic sector at the municipal level, accounting for 27% of employment in the municipal area. This is followed by the sectors of Agriculture, Forestry, Fishing, and Hunting, given the abundance of scenic and historically significant regions in Amahlathi. The researcher used purposive sampling to select the study area, where a list of drought-stricken municipalities was requested from Amathole District Municipality. Amahlathi local municipality was amongst the municipalities that were declared as drought-hit. Both these municipalities have a lot in common and were affected by drought. The Amahlathi Local Municipality was selected for the study because many farmers engage in small stock farming and high levels of small stock sales characterise the municipality. Therefore, the researcher relied on his experience and the availability of primary data to investigate the perceptions, coping strategies and welfare impact of drought among small stock farmers.

3.3 Research Methodology

3.3.1 Criteria for selecting the study area

A list containing the location and details of farmers practising small stock production in Amathole District Municipality was obtained from the local office of the Department of Rural Development and Agrarian Reform and the Department of Local Economic Development from both local municipalities in question. The different farmer categories included in the list were: individuals, small stock farmers, and mixed-farming farmers who received or did not receive direct support from the government, for example, through CASP, Ilima/Letsema programmes and LED fund. The list was stratified and had a section representing farming activity in the region and contact details of extension officials responsible for service provision in each local municipality in the district. According to the ADM IDP (2020), the population of small stock farmers in the Raymond Mhlaba and Amahlathi local municipality is 7 540 farmers.

The literature reviewed and the researcher's experience were instrumental when choosing the commodity. Data availability, target population (number of farmers practising small stock), farmers' welfare, climate and environment (rainfall distribution and vegetation) were critical when selecting the commodity for the study. Studies suggest that most farmers are farming with small stock. Therefore, Malunga *et al.* (2020) asserted that practices such as seasonal sales of sheep and goats (traditional rituals) and sheep shearing are the mainstay that contributes to farmers' welfare. The type of vegetation of the study area favours selective grazers due to the aridity of the areas and the predominantly mountainous topography. Moreover, studies suggest that both local municipalities provide a conducive environment to investigate farmers' perceptions, coping strategies and welfare impact of drought among small stock farmers.

3.3.2 Research Design

This study adopted a descriptive cross-sectional design to investigate perceptions, coping strategies and welfare impact of drought among small stock farmers in Amathole District Municipality, Eastern Cape. A cross-sectional research design is one of the most popular and convenient research designs among other research designs and is also known as a social survey design. This research design was adopted because it is not costly and is not time-consuming; it allows the researcher to collect data at one point in time (Mathers *et al.*, 2007)

3.3.3 Research approach

A mixed-method comprising the qualitative and quantitative approach was used to answer the research questions. The goal was to better comprehend the research problem by integrating the benefits of qualitative and quantitative research techniques (Cant *et al.,* 2005). Using a questionnaire, quantitative information was gathered. Focus group discussions were used to acquire qualitative data about respondents' attitudes, feelings, beliefs, experiences, and reactions in a manner that would not be feasible using other quantitative methods. A systematic questionnaire consisting of both open-ended and closed-ended questions was utilised to obtain data from the selected respondents. The answers to closed-ended questions provide a general summary of the topic. In contrast, open-ended questions provide a vast amount of information on respondents' thoughts on the examined subject (Schoonenboom & Johnson, 2017). The questionnaire was written in English; however, the enumerators were trained in data gathering before collecting data to ensure its trustworthiness.

3.3.3.1 Qualitative approach

Qualitative research is primarily exploratory; it is employed to understand an individual or a group's underlying reasons, opinions and motivation about a particular event (Flick, 2009; Morris & Burkett, 2011). In this study, structured research interviews and focus group discussions were the two methods employed to collect data on farmers' opinions, thoughts and perceptions on the impact of drought on small stocks. The two methods are essential, particularly for accessing areas inaccessible to quantitative methods and for gaining depth, insight, and understanding of certain phenomena. Structured interviews are simply questionnaires administered verbally. A list of predetermined questions was posed, with little variety and no opportunity for follow-up questions in response to comments that merit further clarification. Focus groups contributed to a comprehensive grasp of the experiences and beliefs of members.

3.3.3.2 Quantitative approach

The quantitative research approach quantifies a problem by generating numerical data that can be transformed into usable statistics (Hair *et al.*, 2008). This was the most dominant approach throughout the study. The majority of questions in the questionnaire assigned a number, and this was done to represent all data in a numerical form. For example, farmers' age and agricultural income were numerically presented. Non-numerical data such as gender and farming goals were assigned figures of 1 or 0 depending on the nature of the variable.

3.3.4 Eligibility criteria

Eligibility criteria are defined as a subset or combination of the inclusion and exclusion criteria used to rule in or out the target population in a research study (Garg, 2016). Exclusion criteria refer to predefined characteristics used to identify farmers who will not be included in the research study. At the same time, inclusion looks at traits used to identify farmers who will be included in the study. In this study, eligibility criteria were guided by the study's research objectives. Before data collection, the two methods were used to formulate a criterion that farmers had to meet to be part of the sample.

Farmers must/can/have:

- Practice livestock agriculture
- Practice agriculture for either business purposes, consumption or both,
- Access to farming land, either owning, leasing or communal

- Be old enough to give accurate information regarding agriculture and extension services and
- Be any gender, marital status and educated or otherwise.

3.3.5 Sampling techniques and size

There are numerous methods for estimating sample size. These include utilising a census for small populations to simulate the sample size of comparative research and employing available tables and formulas to compute sample size (Gill *et al*., 2010). Although tables can give a valuable reference for estimating the sample size, it is essential to determine the sample size for various precision, confidence and variability levels (Breweton & Millward, 2001). Gill *et al.* (2010) suggest that the presumption should be assumed there is a large population, but the variance in the proportion that would adopt the practice is unknown; therefore, assume p = 0.5 (maximum variability). Furthermore, suppose we desire a 95% confidence level and +/- 5% precision. The resulting sample size is demonstrated in the following equation;

$$n_0 = \frac{Z^2pq}{e^2} = \frac{(1.96)^2(0.5)(0.5)}{(0.5)^2} = 385 \text{ farmers}$$

3.3.6 Methods of data collection

3.3.6.1 Preparation for data collection

Before collecting data, a preliminary visit to the Raymond Mhlaba and Amahlathi Local Municipality was conducted. This was done to present the research objectives and questionnaire to the Local Extension officers and local economic developers who work with the farmers. This approach was critical in gaining the necessary contacts, support, and information that made the study possible in both study areas. Well-trained enumerators conducted the interviews. The questionnaire was in English. However, the interviews were conducted in isiXhosa, the indigenous language in both areas.

3.3.6.2 Data collection instrument

Structured questionnaire

A structured questionnaire was utilised to collect primary data from respondents. A structured questionnaire was used because of its capacity to collect data by selecting individuals/households/farmers, to mention a few through self-report; people reply to a series of questions posed by the researcher via self-report (Creswell *et al.*, 2006). The questionnaire

contained various sections with both open-ended and closed-ended pre-coded questions. Each affiliated team achieved the study's objectives. The questionnaire was written in English, but enumerators were trained to ensure the accuracy of data collection. During the interviews, the enumerators interpreted the questions into isiXhosa as many of the respondents were incompetent in the English language. Participants in the study were interviewed inside or outside their homes or farms, depending on whether or not they desired privacy during the interview. The focus group discussions were conducted with respondents after the survey was completed.

3.3.7 Focus Group Discussions (FGD)

The focus of the FGD was on small-scale livestock farmers in the research region. The objective of the FGD was to gain a deeper understanding of how small stock farmers perceive the effects of drought. The FGD employed the participatory ranking technique (PRM). This methodology encourages a participatory and dynamic process by incorporating local knowledge and perspectives. Participants identify, support or reject what is most important to them. It provides a place for peer-to-peer discussion of pertinent topics, the sharing of ideas and solutions, and the identification of hurdles to existing or potential initiatives (Potts, 2010). **3.3.8 Data collection process**

Extension officials, enumerators, and the sampled farmers were briefed on the purpose and objectives of the study, and data needs were made clear. Knowing what was required, ideas were shared on how to approach the respondents. Before the interview, extension workers from each municipality introduced the enumerators to the respondents to put them at ease. The interviews continued once it was determined that the farmers were at ease and willing to answer questions. All these measures were taken to develop a positive relationship with respondents and encourage them to collaborate and provide honest responses.

The extension officials helped arrange community halls; after ensuring that farmers had settled and were ready for the interviews, they were asked to vacate from the interview sites. This was important to avoid biases or skewed answers from the farmers and avoid damaging their working relationship with extension officers. Farmers were given a questionnaire, and each group was assigned an enumerator with an interview guide to help the farmers understand the questions. Data were collected through face-to-face interviews and for focus groups, an interview guide was used.

3.3.9 Reliability and validity

To ensure the validity of the data collection tool, the questionnaire was pre-testing on 40 farmers practising small stock in Koloman areas. Before the primary survey, the results were excluded in the overall study data. The questionnaire was pre-tested, and how farmers answered revealed consistency in responses. Bernard *et al.* (2014) investigated the impact of drought on livestock farmers and made similar findings regarding the reliability and validity of the research instrument. The physical and psychological environment for data collection was made comfortable by ensuring privacy, confidentiality and physical comfort.

3.3.10 Ethical considerations

The informed consent was prepared and written in English and isiXhosa. It was administered to farmers before the collection of data. This allowed farmers to decide whether they wanted to be part of the study; those who agreed signed the form and accepted it. Data for this study were also collected using a questionnaire; therefore, the privacy and confidentiality of the answers provided by farmers were protected, and questionnaires were stored in the supervisor's office. An application for an ethical clearance certificate was made to the ethical committee at the North-West University before data collection.

3.4 Choice of Analytical model and variables used

Analytical models are predominantly quantitative and depict the system in mathematical equations that specify parametric relationships and the associated parameter values as functions of time, space and other system characteristics (Gujarati, 2004). Typically, this is accomplished by modelling the underlying phenomena to anticipate or evaluate the system's performance or other attributes. In this case, the study investigated the perceptions, coping strategies and welfare impact of drought among small stock farmers. Diverse analytic models document various facets of the system and its environment, including performance, dependability and perceptions (McFadden, 1978).

3.4.1 Descriptive statistics

To give an overview of the respondents' characteristics, frequencies and percentages were employed to provide descriptive statistics. The primary reason behind this part of the study was to overview the sampled farmers' social-economic characteristics, farming activities and production systems.

3.4.2 Objective 1

The first objective aimed at assessing farmers' perceptions of the impact of drought on small stock farmers. Content analysis and descriptive statistics were used. The data from the fivepoint

Likert rating scale: Strongly agree = 5, Agree = 4, Neutral = 3, Disagree = 2, and Strongly disagree were analysed using content analyses (summative content approach) together with the descriptive statistics (percentages). Data from focus group discussions were analysed using thematic studies. Data from the focus group were recorded using an audio recorder, then transcribed and coded into themes using CAQDAS (computer-aided qualitative-data–analysis software) and farmers' narratives on the impact of drought on small stock production welfare.

3.4.3 Objective 2

The second objective determined the current drought coping strategies used by small stock farmers, and descriptive statistics were used. Descriptive statistics are broken down into measures of central tendency, that is, mean, median and mode and measures of variability, that is, standard deviation and variance. Descriptive statistics helps to describe and understand the features of a specific data set by giving short term summaries of the sample and measures of the data.

Mean: $\tilde{x} = \frac{\sum x}{n}$ standard deviation: $S = \sqrt{\frac{\sum(x - x^x)^2}{n}}$

Where : $\tilde{x}$ = mean of the data where: x = each of the values

$\sum x$ = sum of score, values of the data$\tilde{x}$ = mean of all n = sample size of

the score n = sample size of the score

The coping strategies anticipated to be employed by these farmers will include;

a) Rainwater harvesting
b) Fodder/ silage for cattle
c) Improved societal awareness
d) Preparedness and custom feeding.

3.4.4 Objective 3

The third objective examined the factors influencing the choice of drought coping practices/strategies; the multinomial probit model was used to assess the drought coping strategies used by smallholder farmers.

Below is a brief outline of the multinomial probit framework and empirical model specification.

Multinomial probit framework

Y_i^* ϵ_i ... ... (1)

Where Y_i^* represents a discrete dependant variable, that is, rainwater harvesting, fodder/ silage, improved societal awareness and preparedness and custom feeding, with more than two categories and $\mathbf{x_i}^*$ is a vector of the independent variable. The parameter to be estimated is β. the errors are normally distributed.

Empirical model estimation

The relationship between a chosen coping strategy and influencing factor is expressed using the following model:

$$\hat{CSTR}_i = \alpha + \hat{\beta}_1 AGE_i + \hat{\beta}_2 EDUC_i + \hat{\beta}_3 RISK_i + \hat{\beta}_4 agTRAIN_i + \hat{\beta}_5 EL_i) + \hat{\beta}_6 FamerType_i \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots .. (2)$$

Where $\hat{C}STR_i$ is the predicted value of the farmer's chosen coping strategy, $AGE_i$is the age of the farmer in years, $EDUC_i$ is the number of years of formal education completed by the farmer, $RISK_i$ is the dummy variable representing the risk profile (low, medium, high), $agTRAIN_i$ is a dummy variable representing whether or not agricultural training was received, EL_i is the number of external labour employed, $TypeFamer_i$ is a dummy variable representing whether a farmer is pursuing agricultural business full time, α and β_i are regression coefficients to be estimated. The parameter estimates of the factors that affect farmers' coping strategies were calculated on STATA and SPSS software.

3.4.5 Explanatory (independent) variables used in the study

The study used the Chi-square to test the association between categorical predictor variables and regression models for the association between quantitative predictor variables and the qualitative dependent variable. Using this method, the study sought to build a statistical model to reduce explanatory variables until the most appropriate model that describes the data is predicted (Gujarati, 2004).

3.4.5.1 Dependent and independent variables for Multinomial Probit model

Table 3.1 presents the expected outcome of the relationship between the dependent and independent variables used in the Multinomial Probit model.

Table 3.1 Dependent and independent variables for Multinomial Probit model

Dependent variable	Measure
Water harvesting (dams, tanks, river)	1 if the farmer is harvesting water for their livestock, 0 if otherwise
Pastures and lick	1 if the farmer is cultivating lucerne and other pasture and uses mineral lick as a supplement for their small stock, 0 if otherwise
Use of Wild tress	1 if the farmer is using wild trees like wild olive, acacia karoo, spekboem during drought to feed their small stock, 0 if otherwise

Explanatory variables	How it is measured	Expected outcome
Age groups	Categorical – 20 years and less = 0; 21-35 years = 1; 36-50 years = 2; 51-65 years =3; 66 years and older = 4	+
Farming experience	Categorical – 5 years and less = 0; 6 - 10 years = 1; 11-15 years = 2; 16- 20 years =3; 21 years and older = 4	+
Gender	Dummy - Male = 1; Female = 0	+
Marital status	Dummy: 1= Married ; Single 0 =	-
Level of education	Categorical - No education = 0; Primary = 1; Secondary = 2; Tertiary = 3	+
Agricultural income	Continuous - Amount/year	+
Farm size	Continuous - Farm hectares (ha)	-
Farming skills	Dummy: Do you have farming skills: 1=Yes 0=No	
Access to extension services	Dummy; Do you have access 1= Years; 0 = No	+
Frequency of extension response	Dummy - Instant = 1; Otherwise = 0	
Quality of extension services received	Categorical – Poor = 0; Neutral = 1; Good= 2	

3.4.5.2Age

Age was divided into groups and included in the multinomial probit model to assess its effect on farmers' choice of drought coping strategies. The tested hypothesis is that as age decreases, the likelihood of farmers choosing varied coping strategies increases. The tested theory is that younger farmers are open and receptive to trying new farming practices that come from diverse sources of extension services compared to their conservative older counterparts (Bester, 2008;

Sikwela, 2013). Older farmers cannot convert their observations into coping action, implying that risk awareness alone is insufficient to make coping choices. Given the risk-averse nature of older farmers, older age may imply less coping ability. Therefore, the coefficient for age is predicted to be positive. A study by Gebrehiwo (2017) used the farmer's age, among other social variables, to determine farm efficiency in Ethiopia.

3.4.5.3 Farming experience

The farming experience was included in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. The coefficient for farming experience is positive when tested against the dependent variable. Farming experience will have a positive influence on farmers' decisions to adopt adaptation measures. This suggests that agricultural experience influences the farmer's choice of adapting to varied strategies positively. Farmers with more experience are more likely to choose drought-resistant crop types than those with less experience. A one-year increase in experience would improve the likelihood of adopting drought-resistant crop varieties (Mahouna *et al.* 2018).

3.4.5.4 Gender

The gender variable was included in the multinomial probit model to examine the effect being a male or female has on farmers' choice of drought coping strategies. The gender of the farmer is expected to be positive about the dependent variable. Female-headed households are more likely to choose adaptation alternatives, according to Shongwe *et al*. (2014), because most rural farming is done by women, while men work in towns, cities and mines. The impact of gender on adaption strategy selection is either positive or negative relative to the dependent variable. Male farmers are hypothesised to be more flexible than their female farming counterparts (Tiwari *et al.*, 2008; Gebrehiwo, 2017).

3.4.5.5 Marital status

Marital status was included in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. The coefficient for marital status was predicted to be negative when tested against the dependent variable. According to Mandleni and Anim (2007), farmers who are married are more aware of climate change and better able to adapt to it. This could be because these farmers have families that stayed with them for an extended period to watch climate change. The farmer's marital status suggests that most farmers have land ownership rights, as found in the study by Shongwe *et al*. (2014).

3.4.5.6 Level of education

Education was included in the multinomial probit model to assess the effect varied education levels have on farmers' choice to use different drought coping strategies. Marital status is expected to be positive about the dependent variable. According to Deressa *et al*. (2009), a higher level of education is associated with access to information on improved technologies and higher productivity. The tested hypothesis is that farmers with higher levels of education tend to be flexible with ideas, willing to venture out of tradition and try various coping practices which can improve productivity (Reimers & Klasen, 2013). This means education significantly increases the probability of farmers using different drought coping strategies.

3.4.5.7 Agricultural income

The agricultural income variable was included in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. The coefficient for agricultural income is predicted to be positive relative to the dependent variable. Alam (2015) found that an increase in sales raises influences the choice of farmers' adoption strategy. For instance, a unit increase in agricultural income increases the probability of adaptation of a coping strategy, although not to a greater extent (Alam, 2015).

3.4.58 Farm size

The farm size variable was included in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. Farm size has been demonstrated to influence adoption decisions positively (Pham *et al.,* 2014). Farm size has a positive influence on multiple coping strategies, thus farmers with larger farms may employ mechanisms like agroforestry and perennial plantation, crop and livestock diversification, as a buffer against drought.

3.4.5.9 Farming skills

Farming skills were used in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. This is because extension agents focus on promoting capacity building to farmers. Thus, a lack of skills might limit adaptation (Ncoyini-Manciya, 2019). Although being capacitated/skilled about climate change affects transformation, it does not significantly affect awareness. It shows that farming skills play an essential role in equipping small stock farmers about climate change, increasing their tendency to adapt to climate change (Ncoyini-Manciya, 2019).

3.4.5.10 Frequency of response from extension officials

The frequency of response from extension officials was included in the multinomial probit model to assess its effect on farmers' choice to use different drought coping strategies. The coefficient for the frequency of extension response is predicted to be positive when tested against the dependent variable. This follows the hypothesis that a farmer will choose to use different extension sources because there is a high probability that the response will be instant compared to using one source for extension services. According to Makara (2010), the government-led extension services do not respond instantly to farmers' queries in South Africa.

3.5 Objective 4

The Two-Stage Least Square regression method was employed to analyse the fourth objective. In the first stage of the analysis, the factors influencing coping strategies were determined, and in the second stage, the effects of coping strategies on welfare were determined. The TwoStage Least-Squares regression uses instrumental variables that are uncorrelated with error terms to estimate the problematic predictor(s) (the first stage) and then uses those estimated values to construct a linear regression model of the dependent variable (the second stage). The findings of the two-stage model are optimal since the estimated values are based on variables uncorrelated with the errors.

The assumption behind the Ordinary Least Square (OLS) technique is that the value of the error term is independent of predictor factors. When this assumption is invalidated, this method assists in solving the problem. This study presupposes a correlation between a secondary predictor and the problematic predictor, but not the error term. Hutcheson (2011) pointed to the existence of the instrument variable and proposed that the following two methods are used:

$$Y = \beta_0 + \beta_1\bar{X}_1 + \beta_2\bar{X}_2 + \beta_3\bar{X}_3 + \varepsilon_i \quad (1)$$

Regress $\bar{X}_1$ on Z_1, and X_3 to obtain $\check{X}_1$

$$\check{X}_1 = y_0 + y_1Z_1 + y_2X_2 + y_3X_3 + v \quad (2)$$

Where $Z_1$is the instrument variable and v is a composite error term that is uncorrelated $\check{X}_1, X_2\bar{X}_3$

According to Fox (2002) Plug in the fitted values of $\check{X}_1$ derived from equation1 into the original linear regression equation :

$$Y = \beta_0 + \beta_1\bar{X}_1 + \beta_2\bar{X}_2 + \beta_3\bar{X}_3 + v \quad (3)$$

Y = dependent variable (farmers' walfare) represented as farmers' income

β_1 = regression coefficients $\bar{X}_1$ = Vector of independent variable v =

error term

The anticipated independent variables to be employed include $\bar{X}$age, $\bar{X}$Edu level. $\bar{X}$size of a farm, $\bar{X}$type of farm……Xn

3.5.1 Dependent and independent variables for Two Least Square regression model

The table below represents the expected outcome of the relationship between the dependent and independent variables for the Two least square regression model. The effectiveness of the coping strategies were represented by agricultural production.

Table 3.2 Dependent and Explanatory variables for Two Least Square regression model

Dependent Variable	**Measure**	
Agricultural Production	Yield returns and farmer's welfare improvement	
Explanatory variables	**How it is measured**	**Expected outcome**
Age groups	Categorical – 20 years and less = 0; 21-35 years = 1; 36-50 years = 2; 51-65 years =3; 66 years and older = 4	+
Farmer experience	Categorical – 20 years and less = 0; 21-35 years = 1; 36-50 years = 2; 51-65 years =3; 66 years and older = 4	+
Gender	Dummy - Male = 1; Female = 0	-
Level of education	Categorical - No education = 0; Primary = 1; Secondary = 2; Tertiary = 3	
Agricultural income	Continuous - Amount/year	+
Farm size	Continuous - Farm hectares (ha)	-

Access to extension services	Dummy; Do you have access 1= Years; 0 = No	+
Frequency of extension response	Dummy - Instant = 1; Otherwise = 0	
Quality of extension services received	Categorical – Poor = 0; Neutral = 1; Good= 2	

3.5.2 Age

Age was included in the Two-stage least square regression method to determine the effects of coping strategies on farmers' welfare. Old age negatively affects climate change and drought adaptation measures, because agriculture is labour-intensive and, therefore, requires healthy personnel (Shongwe *et al*., 2014). The ageing respondents might imply the adoption of modern technologies, especially if there is no succession plan to infuse the youth to take over from the old generation.

3.5.3 Gender

Gender was included in the two least square regression methods to determine the effects of coping strategies on farmers' welfare. According to Asfaw and Admassie (2004), male-headed households are more likely to get information about new technologies and undertake risky businesses than female-headed households.

3.5.4 Level of Education

The level of education variable was included in the two least square regression methods to determine the effects of coping strategies on farmers' welfare. The coefficient for education is predicted to be positive when tested against the dependent variable. An increase in years of schooling increases the farmers' probability to adapt to climate change (Deressa *et al.*, 2009). Therefore, farmers with higher levels of education are more likely to adapt better to climate change and run profitable and sustainable businesses. This indicates a positive relationship between education and the effects of coping strategies on farmers' welfare.

3.5.5 Agricultural income

Agricultural income was included in the two least square regression methods to determine the effects of coping strategies on farmers' welfare. The small stock sales are most likely to have a positive sign due to seasonal sales and wool shearing when regressed against the dependent variable (Sinyolo, 2016).

3.5.6 Farm size

Farm size was included in the two least square regression methods to determine the effects of coping strategies on farmers' welfare. The tested theory is that land size directly correlates with agricultural income. This is to say that farmers with large farm sizes are predicted to have a higher income than their small-scale counterparts (Tshuma, 2012). With the necessary support and guidance from extension officers, farmers with small plots of land can generate profit from small landholdings (Pienaar, 2013) Farmers with a smaller land size were more inclined to invest in soil conservation, according to research by Nyangena (2007). Hassan and Nhemachena (2008) hypothesised that farmers with large farms would adopt land-intensive practices, such as livestock systems, while farmers with small farms would vary their alternatives.

3.5.7 Farming skills

Farming skills were in the two least square regression methods to determine the effects of coping strategies on farmers' welfare. This is because extension agents focus on promoting capacity building to farmers; thus, a lack of skills might limit adaptation (Ncoyini-Manciya, 2019). Although being capacitated/skilled about how climate change affects transformation, it does not significantly affect awareness. It shows that farming skills play an essential role in equipping small stock farmers about climate change, increasing their tendency to adapt to climate change (Ncoyini-Manciya, 2019).

3.8 Chapter Summary

The chapter described the research methodology used in this study. It started by describing the study area where data was collected and further explained why a formal survey was the most suitable method to collect standardised information from the selected sample of farmers. This was followed by the research design, which included both the quantitative and qualitative approaches, eligibility criteria and a simple random method used to select the targeted population. In preparation for data collection, the questionnaire was pre-tested to check for its reliability and validity as a data collecting instrument. Moreover, a preliminary visit to the study areas in Kolomani took place. The study used a semi-structured questionnaire to collect primary data on a sample of 293 small stock farmers through interviews and a semi-structured interview guide for the focus group discussions in Amathole District in the Eastern Cape province.

An ethical clearance certificate was obtained from the North-West University; the ethics reference number is NWU – 00594 – 21 – A9. The latter section of the chapter focused on the relationship between the different dependent variables and explanatory variables. It sought to predict the possible outcome of each of the analytical models used for inferential statistics in Chapter 5 of the study. Lastly, the chapter looked at the analytical models and variables included in the research, and the results are presented in Chapters 4 and 5.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter reports on the descriptive characteristics of farmers surveyed in Amahlathi Local and Raymond Mhlaba Local Municipalities in the Eastern Cape provinces of South Africa. The

chapter begins with brief explanations of the demographic characteristics of the sampled farmers and discusses the results of the descriptive statistics.

4.2 Demographic characteristics of respondents

This section provides frequencies, percentages, standard deviation and averages. It includes the age of the household head, number of years in the formal education, household size, gender of the household head and number of years farming on the land. Table 4.1. provides descriptive statistics results such as mean, median, minimum, maximum and standard deviation.

Table 4.1 Demographic characteristics of farmers

Variables	**Amahlathi**		**Raymond Mhlaba**		**Overall**	
Demographic	**N**	**%**	**N**	**%**	**N**	**%**
Gender						
Male	141	81.03	77	64.71	218	74.4
Female	33	18.96	42	35.29	75	25.6
Marital status						
Single	82	47.13	47	39.49	129	44.03
Married	92	52.87	72	60.50	164	55.97
Type of farmers						
Full time	168	96.55	97	81.51	265	90.44
Part time	6	3.45	22	18.49	28	9.56
Level Education						
No formal education	11	6.3	6	5.1	17	11.4
Primary	48	27.6	11	9.2	59	36.8
Secondary	68	39.1	54	45.4	122	84.5
Tertiary	47	27	48	40.3	95	67
	Mean value		**Mean value**			
Variables					**Mean values**	
Age	49.01		49.71		49.29	
Agricultural income	53500.62		16560.48		38497.63	
Household size	4.34		5.26		4.71	
Farming experience	12.59		12.30		12.47	

Source: Field Survey, 2021

4.2.1 Gender

The study results showed that most farming households and farmers were male farmers with 74%, while the remaining 30% were female farmers and households. This contradicts several socioeconomics surveys (GHS, 2016; DAFF, 2016; StatsSA, 2017;) that posit that smallholder farming is female-dominated in the rural areas of South Africa.

4.2.2 Marital status

Many (55.97%) of the farmers in the study area were married; this is consistent with the results by Muthelo (2018), who found that most farmers in rural communities are married. According to Kom (2016), married farmers are more aware and adapted to climate changes of the past years and can contribute to the practices that reduce the impact of climate.

4.2.3 Type of Farmer

Full-time farmers spend most of their days on the farm managing daily operations compared to their part-time counterparts (Stats SA, 2013). Table 4.1 shows that 90% of farmers were farming full-time. This is positive because they can detect early signs of drought in their enterprise and put control measures in place.

4.2.4 Level Education

Most farmers (84.5%) had a secondary level of education, making them literate to comprehend drought and adopt mechanisms and innovative technologies and information that could help them cope with the impact of drought. The result is supported by Oyewole and Sennunga (2020) that educational attainment is crucial for adopting improved farming techniques and drought coping strategies.

4.2.5 Age

The average age of farming households was 49 years. This showed the frequent participation of middle-aged farmers in farm production, which agrees with various community-based surveys that posit that, on average, farmers in rural areas are older (General Household Survey) (GHS) (2016). These results are in line with As-sunny *et al.* (2018) argument that farmers aged 40-55 years are active and can contribute to the betterment of farm practices

4.2.6 Agricultural income

According to StatsSA (2016), agricultural income refers to the total payment (cash or in-kind) earned from farm products sold and other income sources. The average annual farm income was R38 497.63; this was made from sales of wool, mohair and stock sales. Ncoyini-Manciya (2019) argued that drought could harm livestock production and even later, farmers' livelihood. A study by Ajieh (2014) pointed out that farm income directly influences the drought strategy used by a farmer.

4.2.6 Household Size

The average household size was five people per household, which played a considerable part in family labour, especially if household members fall within the working-age group (Yusuf, 2018). Family members can also be a key source of knowledge relative to climate change and coping mechanisms.

4.2.7 Farming Experience

The study results show that the average farming experience was 13 years. This is a relatively good average for a smallholder farmer to operate a farm with minimal assistance. A study by Muthelo (2018) posited that the more experienced a farmer is, the more likely they are to have adequate knowledge of weather and climatic conditions and thus adjust to these risk factors. Hisali *et al*. (2011) noted that farming experience has varying effects on adaptation measures and farm decision making.

4.3 Farming Activities

Farmers in South Africa use different farming activities, and to understand them, the study sought to look at the farming enterprise. A farmer's choice to be involved in one or more farming enterprises depends on several factors; resource endowment, inputs and interactions with other farmers.

Table 4.2 Farming Activities

Variables	**Amahlathi**		**Raymond Mhlaba**		**Average**	
Farming Activities	**N**	**%**	**N**	**%**	**N**	**%**
Small stock Enterprise						
Sheep production	99	56.89	77	64.71	176	60.07
Goat production	46	26.43	7	5.88	53	18.09
Mixed production	29	16.67	35	29.41	64	21.84
Feeding sources						
Community grazing	89	51.15	64	53.78	153	52.22
Roadside	46	26.44	27	22.69	73	24.91
Riverbanks	39	22.41	28	23.53	67	22.87
Land ownership						
Yes	154	88.51	93	78.15	247	84.30
No	20	11.49	26	21.85	46	15.70
Farming purpose						
Household consumption	34	19.54	5	4.20	39	13.31
Both Sales_Consumption	87	50	108	90.76	195	66.55
Sales	53	30.46	6	5.04	59	20.14
Perc_CSA_technology						
Good	105	60.34	95	79.83	200	68.26

Neutral	69	39.66	21	17.65	90	30.72
Bad	-	-	3	2.52	3	1.02

Source: Field survey 2021

4.3.1 Farming enterprise

Table 4.2 shows the various farming enterprises farmers in the study area were involved. The distribution indicates that 60.07% were practising sheep production, and only 21.84% were involved in mixed farming. Kom (2016) supported these findings that most smallholder farmers in the Amathole region practice small stock farming (sheep and goat).

4.3.2 Source of feed

As shown in Table 4.2, 52% of the respondents use community grazing camps, followed by roadside (24%) and riverbanks grazing (22%). Farmers use roadside and riverbank grazing when communal grazing lands have dried because of drought.

4.3.3 Land Ownership

Over the history of South Africa, many different forms of land ownership, distribution, tenure, and laws have been established. A landholder/landowner is a holder of the estate in land with considerable ownership rights. Table 4.2 shows that 84% of the respondents owned farming land, despite sometimes using communal grazing camps. Muthelo (2018) argued that farmers use their land during the droughty spells.

4.3.4 Farming purpose

Table 4.2 shows the farming purpose of the respondents in the study area. Most farmers (66.55%) indicated that they were farming for both selling and household consumption. This is common among smallholder farmers, despite the surplus being sold to informal markets (Sikwela, 2013).

4.3.5 Farmers' perception of new agricultural technologies (CSA)

Table 4.2 reports on farmers' perceptions of using the new agricultural technologies (Climatesmart agriculture). The findings show that 68.26% of the respondents perceived the latest technologies as good agricultural practices, and 30.72% were neutral. A study by NcoyiniManciya (2019) made similar findings that farmers were adamant that the latest technologies could help them detect early drought signs and help improve farm returns.

Table 4.3 Sources of water

Variables	**Amahlat ıi**	**Raymond Mhlaba**	**Ave 'age**

Sources of water	N	%	N	%	N	%
Borehole	1	0.57	1	0.84	2	0.68
Dam	85	48.85	91	76.47	176	60.07
River	86	49.43	26	21.85	112	38.23
Windmill	2	1.15	1	0.84	3	1.02

Source: Field Survey, 2021

4.4 Source of water

Table 4.3 reports the different sources of water used by small stock farmers in the study area. The results show that 60% of the water used for livestock drinking comes from the dam. This was followed by a river (38%), particularly during droughty seasons. The findings resonate those made by Kom (2016).

4.5 Support services

The agricultural support services in South Africa focus primarily on improving the farming practices of smallholder farmers, and extension officers provide much of this support. Although there have been changes in the extension policy, recent works show that there is no evidence to suggest any improvements in the output of farmers, particularly those in their former homelands (Loki, 2020). **Table 4.4 Support services**

Variables	Amahlathi		Raymond Mhlaba		Average	
Support services	**N**	**%**	**N**	**%**	**N**	**%**
Drought relief support						
Yes	165	94.83	33	27.73	198	67.58
No	9	5.17	86	72.27	95	32.42
Drought Aid Programs						
Jojo Tanks and drinking troughs	34	19.54	6	5.04	40	13.65
Dam scooping	18	10.34	54	45.38	72	24.57
Provision of fodder	122	70.11	30	25.21	152	51.88
Refurbishment of boreholes	-	-	19	15.97	19	6.48
No knowledge of programme	-	-	10	8.40	10	3.41
Access to extension services						
Yes	174	100	93	78.15	267	91.13
No	-	-	26	21.85	26	8.87
Frequency of extension officers' visits						
Weekly	44	25.29	20	16.81	64	21.84
Monthly	123	70.69	51	17.40	174	59.39
Quarterly	6	3.45	30	25.21	36	12.29
Annually	1	0.57	18	15.13	19	6.48

Satisfied with the frequency of visit						
Yes	70	40.23	28	23.53	98	33.45
No	104	59.77	91	76.47	195	66.55
Quality of extension services						
Very good	35	20.11	20	16.81	55	18.77
Good	47	27.01	31	26.05	78	26.62
Neutral	40	22.99	38	31.93	78	26.62
Poor	52	29.89	23	19.33	75	25.60
Very Poor	-	-	7	5.88	7	2.39
Drought related Training						
Yes	-	-	5	4.20	5	1.70
No	174	100	114	95.80	288	98.29

Source: Field Survey, 2021

4.5.1 Drought relief support

Support relief in the event of disasters has been a major challenge for most smallholder farmers in South Africa. Tables 4.4 show that 68% of farmers in the study agreed to have received drought relief support from the government. These findings are supported by Ngaka (2012) and the support included tanks and drinking troughs, dam scooping, fodder provision and borehole refurbishment.

4.5.2 Access to extension services

Table 4.4 shows that 91.13% of the respondents in the study area had access to extension services. This is supported by Nyam (2017), who found that sheep producers in Amathole have more access to extension services compared to other district municipalities in the Eastern Cape. Access to extension services could help farmers detect early signs of drought and reduce farmers' vulnerability to the impact of prolonged drought spells (Loki *et al.*, 2021).

4.5.3 Frequency of extension officers' visits

Farmers were asked to indicate how often they get visits from extension officers. The results showed that 59% of the farmers indicated that extension officers visit monthly. The findings contradict a survey on extension officers' visits in South Africa (Afful & Lategan, 2015).

4.5.4 Farmer satisfaction

As shown in Table 4.4, farmers were asked whether they were satisfied with farm visits from extension officers. The results showed that 66.55% of the farmers were not satisfied with the visits from the extension officers and would prefer weekly in-person visits and frequent advice on drought.

4.5.5 Quality of extension services

The success and progress of farming activities depend on the quality of extension services received (Agholor, 2012). Using the 5 points Likert rating scale of 1-5 (where 5 = very good and 1= very poor), farmers were asked to indicate the quality of extension services received from extension officials. The results show that farmers indicated that the quality of extension services they received was good (26.62%), and an equal representative number of farmer (26.62%) said they were neutral relative to the quality of services. The findings contrast with Loki *et al.* (2021) who postulated that the quality of extension services received by farmers in rural areas of South Africa is generally poor.

4.5.3 Drought related Training

Table 4.5 reports the results of drought-related training provided by service providers in the sector. The findings show that 98.29 % of the farmers small stock farmers did not receive any training about drought or any risk-related information, and this might harm their production.

4.7 Chapter Summary

The chapter examined the socio-economic characteristics of farmers and how these were instrumental in explaining the relationship between small stock farmers' perceptions, coping strategies and farmers' welfare in drought. The study employed descriptive statistics in the form of a frequency, percentage and mean to determine the sampled farmer demographic, farming characteristics and support services received by farmers from the government. Agricultural income made from wool, livestock sales and farming characteristics such as farming goals, farming enterprises and land size were critical characteristics in identifying farmers' perceptions of the impact of drought. Farmers were asked about the new agricultural technologies that address drought. The significant findings were that most farmers agreed that these new technologies are good. Lastly, the study discussed the farming challenges faced by small stock farmers and some of the support services provided by the government and other institutions.

CHAPTER 5: EMPIRICAL RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter presents the results of the analysis employed to address the following research objectives

- Assess small stock farmers' perceptions of the impact of drought on small stock farmers,
- Determine the current drought coping strategies used by smallholder farmers,
- Examine factors influencing the choice of drought coping practice/strategy, and
- Identify the effects drought coping strategies employed by farmers have on their welfare.

5.2 Farmers' perceptions of the impact of drought on small stock farmers

This section reports on the findings of objective one which looked at farmers' perceptions of the impact of drought on small stock farmers, using the Likert rating scale and descriptive statistics. Farmers were given four (4) topics relative to drought and asked to rank according to their experience with drought and its impact on small stock farming in their respective areas. Farmers were asked to evaluate using the five-point Likert rating scale, presented as follows; Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, and Strongly disagree = 1. The values were then summed up and analysed using SPSS version 25 to provide descriptive statistics in the form of percentages. The findings are presented in Table 5.1.

Table 5.1 Farmers' perception of the impact of drought on small stock farmers

Farmers' Perceptions of the impact of drought on Small stock Farmers	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly disagree %
Government support changed the effects of drought	68.26	6.48	15.01	1.37	2.05
Drought has a negative impact on the livelihood	99.66	0.34	-	-	-
People lost their jobs due to drought	92.83	7.17	-	-	-
Drought can cause poverty	99.66	0.34	-	-	-

Source: Field survey (2021)

Farmers were asked to indicate whether the assistance they received from the government made a significant change. Table 5.1 shows that 68% of farmers strongly agree that the support they received contributed meaningfully to helping them ease the effects of drought. Furthermore, when asked to rate the negative impact drought has on farmers' livelihood, 99% of farmers strongly agreed that indeed, drought harms the livelihood of farmers, and this forces them to

spend more money on drought-resistant inputs. Farmers were also asked about the job losses of farmworkers and 93% of the farmers indicate they had to let go of some workers due to low yield returns and farm income, which are a direct effect of prolonged drought. This further leads to poverty and food insecurity among families who depend purely on farm income.

5.2.1 Focus Group Discussion

Following the Likert rating scale which investigated farmers' perceptions of the impact drought has on small stock, focus group discussions were held with the respondents. The farmers' perceptions thoughts and views on drought and its impact were recorded and analysed using thematic content analysis. This section will include direct quotes from the farmers and discussions.

Theme 1: Drought-related changes that influence small stock farming

What visible changes have you observed?

When small stock farmers were asked about the visible changes they had observed as related to rainfall, temperature, soil fertility, forest vegetation, wildlife, and livestock productivity observations, one respondent stated that:

"*The heat was just too much; we never experienced such extreme temperatures in over 30 years. That is why our small stock took a hard knock during that summer period because it was very long and dry; there was no rainfall for about 6 months*".

A study by Kom (2016) concurs with these findings and highlights that prolonged heat stress and dryness are observable in the Amathole district municipality and this negatively impacts farming outputs.

Theme 2: Rainfall trends in the study area

What is the trend of the rainfall and the temperature during the past 10 to 20 years?

The responses of farmers showed that the rainfall trend in the past 10 years was relatively low. For most parts, there was no rainfall for a very long time and this harmed the health and quality of their animals. Moreover, livestock did not have drinking water for their rivers and dams were dry, leading to stock mortalities during that period. One farmer responded that:

" *We were out of water for a prolonged period, and we had even forgotten that we would still live to see better days. Things were just getting worse each passing day; it was not a good sight to see dams and rivers in those dry conditions*".

The average rainfall in Amathole district municipality ranges from 500-700mm. This rainfall average is the lowest compared to other district municipalities in the province (WeatherSA, 2018).

Theme 3: Strategies employed by farmers to cope with drought

What coping strategies have you crafted to alleviate problems arising because of drought?

Farmers indicated that they made use of maize sheath, crop residues and supplementary feeds and mineral licks as the best drought coping practices. One farmer noted that:
"*These practices are not new; they were used by our forefathers, so we just had to reintroduce it and it worked so well*".

Another farmer posited that

" *We were forced to go back to the basics; these practices are less costly for some of us (farmers) who also grow fodder and some vegetable crops. This drought coping practice worked for our parents*".

Kom (2016) argued that farmers in Amathole make use of traditional methodologies to feed their stock; these include wild trees like Acacia karoo, wild olive and Spekboom that grow naturally on the veld. Again, this drought coping practice worked well because these trees are highly nutritious, and they are dominant in the study area. Moreover, some traditional ways of harvesting water such as rainwater harvesting and fetching water from the river are critical to coping with drought and its effects.

Theme 4: Customary self-help arrangements

What customary self-help arrangements are there to support small stock farmers?

When farmers were asked about the customary self-help arrangements, the responses show that the use of crop residues was among the arrangements that played a significant role in supporting small stock farmers. One farmer indicated that:

"*We had forgotten about the customary self-help arrangements; things could have been worse. We would have really suffered a great loss*".

Another farmer noted that:

"*I had to harvest wild olives and spekboom from the veld and feed them fresh to old, aged ewes and lambs and they looked healthy*".

The responses of farmers are similar to findings by Muthelo (2018), who posited that the use of customary self-help arrangements plays a pivotal role in supporting small stock farmers and is very cost-effective. Farmers' responses also showed that the use of wild olives that grow naturally on the veld supported them during drought.

Theme 5: Drought effect on small stock farmers' livelihoods

What effect has drought inflicted on the livelihood of the small stock farmers?

The responses of farmers showed that the majority of smallholder farmers agree that drought inflicted a negative effect on their livelihoods as most of them incurred a lot of costs on vaccines, supplementary feeds and mineral licks, which are very expensive. This means that the small stock maintenance during this period was just too exorbitant. To some extent, most farmers had to retrench farmworkers to cut costs. One farmer posited that:
"*I was at a point where I had to reduce my herd size so that I could buy some supplements and also pay the farmworkers*".

Another farmer indicated that:

"*it was even hard to keep all my farmworkers. I was forced to terminate their employment contracts, and I was only left with two employees who had to look after everything on the farm".*

Some farmers could not tell whether the drought inflicted a negative or positive impact on their livelihood. This could mean that they relied mainly on the use of wild trees and did not see a difference in their livelihoods and farming returns during the drought. The findings are similar to those made by Mare *et al.* (2018).

5.3 Drought coping strategies used by smallholder farmers

The following section presents the findings of objective two, which investigated the current drought coping strategies employed by small stock farmers. Chi-square was used to determine the relationship between the dependent and explanatory variables. Farmers were asked the coping strategies they employed during drought. The question had 3 categories where: (1) farmers were asked about the drought coping strategies they know, (2) drought coping strategies they employed during the drought and (3) coping strategies that they employed because of drought.

Table 5.2 Current drought coping strategies

Coping Strategies				**X^2**
	Known %	**Employed %**	**forced to employ %**	
Rotate grazing camps	1.37	12.3	0.34	0.182
Feeds and mineral licks	4.44	29.01	46.08	0.002***
Fetching water from rivers and dams	1.71	1.37	1.37	0.851
Dry Maize cobs and shealth	27.65	11.60	10.24	0.070*
Harvest Wild Olive	13.99	31.74	14.68	0.026*
Harvest Acacia Karroo	2.39	6.14	4.78	0.622
Harvest Spekboom	5.46	0.34	-	0.243
Water harvesting and storage in reservoirs	33.45	2.73	10.24	0.014**
Grow fodder / silage	1.37	3.07	12.29	0.512
Custom feeding	8.19	1.37	-	0.193

*Notes: *** , **, *, means significant at 1%, 5% and 10% levels of significance, respectively ns = not statistically significant Source: Field survey (2021)

5.3.1 Feeds and mineral licks

Table 5.2 shows that feeds and mineral licks were statistically significant at a 1% level. This means that although very few smallholder farmers knew about the use of supplementary feeds

and mineral licks, but at some stage, they were forced to make use of them as shown in Table 5.2. The results presented in Table 5.2 indicate that 29% of small stock farmers employed this drought coping strategy. However, 46% of the farmers were forced to use supplementary feeds and mineral licks because of drought.

5.3.2 Dry maize cobs and shealth

The results in Table 5.2 show that the use of dry maize cobs was statistically significant at a 1% level. These results show that 28% of the farmers knew about the drought coping practices prior to the drought period. This means that these farmers knew the importance of harvesting maize and feeding it dry to animals when there is no food in the veld. Most of the small stock farmers grow maize and other grain crops and vegetables for home consumption, so with the surplus, they always keep it for their small stock to withstand drought.

5.3.3 Wild Olive

Table 5.2 reports that the use of wild olive was statistically significant at a 1% level relative to coping strategies. The results show that 32% of the farmers employed the drought coping practice. This means that this drought coping practice was among the cost-effective drought coping strategies and most farmers employed it because the wild olives grow naturally in the wild and it is not even labour intensive to harvest them.

5.3.4 Water harvesting

As shown in Table 5.2, water harvesting was statistically significant at a 1% level related to the dependent variable. The results show that 33% of the farmers knew that their small stock entirely depends on water to withstand drought. This means that 10% of small stock farmers were forced to go fetch water from the rivers and dams because there was not enough drinking water for their animals. Small stock farmers harvested rainwater until it stopped raining but luckily for them, they had reservoirs where they had stored the water for their animals. The adoption of this coping practice proved to be significant as most of the farmers were able to withstand drought.

5.3 Factors influencing the choice of drought coping practice

The following section presents results on the multinomial probit regression model chosen to address research Objective 4: to determine factors influencing farmers' choice of drought

coping practices in the Eastern Cape province. The coping strategies were grouped into three categories namely water harvesting, pastures and licks and wild trees. The results of the multinomial probit regression are in Table 5.3.

Explanatory variables	Coefficient.	Std. Err.	dy/dx	Std. Err.
Water harvesting (rain, dam, rivers)				
Age	-0.557903	.3538372	0.0321822	0.0313392*
Gender	-0.2508826	.1470622	0.0406394	0.0627012*
Level of Education	0.6055218	.2913575	0.0015493	0.0331877*
Marital status	0.4192605	.3064082	0.0011125	5.18e-08
Farming skills	0.0008612	.0005891***	-0.0000391	0.0000832***
Farming goals	-0.331971	.264506	-0.0139554	1.44e-06
Access to extension	0.2945636	.1795915	-0.0049865 -	0.0013279***
Frequency of extension	0.0389169	.3550754	0.066765	0.0269586*
Quality of extension	.3271457	.1458498	-0.1502921	0.0665871*
Pastures and licks				
Age	-0.2876788	0.2636777	-0.0190745	0.0224008*
Gender	-0.98022	0.5199284	0.0034981	0.0438654*
Level of Education	0.4677008	0.2875454	0.0273214	0.0247243*
Marital status	0.30e-07	0.32e-07	-0.0005736	2.33e-08
Farming skills	.000215	.0005747***	0.0228045	0.000044***
Farming goals	.0000281	8.09e-06	0.0025283	3.45e-07
Access to extension	0.034531	.0110158*	0.0001689	0.0009189***
Frequency of extension	1285908	.2252807	-0.0358665	0.0193955*
Quality of extension	.17 28103	.498637	-0.0326636	0.0433335*
Wild trees				
Age	-.1341719	.167294	-0.0131077	0.0330097*
Gender	-0.2323793	.3318477	-0.0441375	0.0650677*
Level of Education	-0.0709013	.1761475	-0.0288707	.0351268*
Marital status	6.35e-07	2.79e-07	-0.0009574	4.84e-08
Farming skills	0.0001948	.0004367***	0.0000299	0.00008***
Farming goals	0.0000288	8.01e-06	0.0114270	1.19e-06
Access to extension	-0.0279193	.0079276**	0.0051554	.0014784***
Frequency of extension	0.4504991	.1548144 .38513	0.1026314	0.291624
Quality of extension	0.9043985	1.053499	0.1829557	0.0753529*
_cons	-0.3096931			
Number of obs = 293				

Prob > chi2 = ***					
*Notes: ***, ** ,* means significant at 1%, 5% and 10% levels of significance, respectively *dy/dx is for discrete change in variable from 0 to 1					

Table 5.3 Factors influencing the choice of drought coping practices

Nine independent variables were fitted into the multinomial probit regression model. Table 5.3 showed that outcome 1 (water harvesting) had seven statistically significant variables relative to factors influencing the choice of the drought of coping practice and these were: age, gender, level of education, farming skills, access to extension services, and frequency of extension and quality of extension. Moreover, outcome 2 (Pastures and licks) also had seven variables that were statistically significantly related to factors influencing the choice of the drought of coping practices. The results showed that outcome 3 (Wild trees) had six statistically significant variables related to factors influencing the choice of drought coping strategies and these were age, gender, level of education, farming skills, access to extension services and quality of extension. According to Greene (2000), the probit model coefficients cannot be evaluated from the initial output, thus, the marginal effects must be run. The marginal effect predicts how much the outcome variable's (conditional) probability changes while the values of other variables are held constant (ceteris paribus).

5.3.1. Water harvesting (rain, dam, rivers)

The age variable was statistically significant at a 10% level relative to drought coping strategies. The coefficient was negative coefficient indicating that the age of a farmer had a negative correlation with water harvesting as a drought coping strategy. Table 5.3 shows that gender was statistically significant at a 10% level to water harvesting as a coping strategy. A farmer's gender had a negative coefficient, and this means no correlation with the dependent variable.

The level of education was statistically significant at a 10% level related to water harvesting as a drought coping strategy. The coefficient was positive, indicating that the average marginal

effect on the probability of y = 1 associated with the farmers' level of education increases by 60% ceteris paribus. This is because formal education is an imperative enabler of adopting technologies and farm practices that bring best yield returns; farmers with formal education are more motivated to adopt new techniques like harvesting water than their counterparts. The findings are in line with those by Hagos and Hadush (2017) and Oyetunde-Usman *et al*. (2021) that farmers who spent years in school appear to have a higher propensity to adopt sustainable farming techniques and technologies than less educated farming households.

The farming skills variable was significant at a 1% level related to water harvesting as a drought coping strategy. The coefficient was positive, and this meant that the average marginal effect on the probability of y = 1 is associated with farming skills increase by 0.08% all things remaining constant. This implies that an increase in a farmer's farming skills increases the probability of using water harvesting as a drought coping strategy.

These results agree with Bese *et al*. (2021) that having great farming skills increase the chances of adopting sustainable coping strategies for farmers as they have vast information about new technologies used in agriculture.

Access to extension services was found to be statistically significant at a 1% level related to water harvesting as a coping strategy. The coefficient was positive, implying that the expected difference in probability of y = 1 associated with a farmer accessing extension services concerning drought strategies increases adoption of water harvesting by 29% ceteris paribus. Having access to extension services improves farmers' knowledge about innovative water harvesting technologies available and information on effective ways to harvest water. These results concur with Oyetunde-Usman *et al*. (2021) that having access to extension services is endogenous to the adoption of agricultural technologies and having access improves farmers' awareness and demonstration of improved production practices of farmers.

The frequency of response from the extension officer's variable was significant at a 10% level relative to water harvesting as a drought coping strategy. The coefficient was positive, and this meant that the average marginal effect on the probability of y = 1 related to the frequency of response from extension officers increases farmers' use of water harvesting as a drought coping strategy by 38%, with all other factors remaining constant. These results mean that an instant response extension officer has a high probability that farmers can use water harvesting as a drought coping strategy for sustained production. According to Makara (2010), the government-led extension services do not respond instantly to farmers' queries in South Africa.

The quality of extension services was statistically significant at a 10% level related to water harvesting. The coefficient was positive, and this implies that the expected difference in probability of y = 1 relative to the quality of extension services received increases by 17%. Having quality extension services improves farmers' knowledge about innovative water harvesting technologies available and information on effective ways to harvest water.

5.3.2 Pastures and licks

The age of the farmers and gender were both significant at a 10% level relative to using pastures and licks as a drought coping strategy. The coefficients for both variables were negative, indicating no statistical correlation with the dependent variable. The level of education had a 10% significant level relative to using pastures and licks as means to cope with drought. The coefficient was positive, suggesting that the average marginal effect on the probability of y = 1 associated with the farmers' level of education increases by 46%. This implies that the higher the educational level of a farmer, the more likely they are to adopt coping strategies such as the use of pastures and mineral licks during drought. Sikwela (2013) agreed with this assertion that educated farmers often make decisions that improve returns. The farming skills variable was significant at a 1% level relative to the dependent variable. The coefficient was positive, and this means the anticipated difference in probability of y = 1 related to farming skills increases by 0.021%. Kom (2016) found that farming skills are essential for sustainable and productive farming.

The response frequency from the extension officer's variable was significant at a 10% level relative to the dependent variable. The coefficient was positive, and this meant that the average marginal effect on the probability of y = 1 related to the frequency of response from extension officers increased by 34%, with all other factors remaining constant. Access to extension services is at the centre of farmer and rural development, thus, support services should be geared toward achieving this goal and addressing the socioeconomic issues (Afful & Lategan, 2017).

The quality of extension services was significant at a 10% level related to using pastures and licks as a drought coping mechanism. The coefficient was positive, and this means that the average marginal effect on the probability of y = 1 related to the quality of services received increases by 17% ceteris paribus. This means the quality of extension services received contributes to farmers using supplementary feed such as pasture and mineral licks during

drought periods. This signifies the importance of agricultural extension services in farmers adopting farming technics and technologies (Ngomi *et al.* 2020).

5.3.3 Wild trees (Olive trees, acacia karoo, spekboom)

The variables farmers' age, gender and level of education were all significant at a 10% level relative to using wild tress as a drought coping strategy. The coefficients for all variables were negative, indicating no statistical correlation with the dependent variable. The coefficient for farming skills was positive, and this means the probability of y = 1 related to the frequency of response from extension officers increases by 0.08%.

This implies that a farming skill directly influenced the use of wild trees that are palatable to small stock as a drought coping mechanism.

Access to extension services was statistically significant at a 10% level relative to using wild trees as a drought coping mechanism. The coefficient was negative, indicating that accessing extension services did not correlate with using wild trees as a drought coping strategy. This could be because this variable is passed down from one generation to the next.

The quality of extension services was statistically significant at a 10% level related to the use of wild trees. The coefficient was positive, and this implies that the expected difference in probability of y = 1 relative to the quality of extension services received increases by 17%.

Yusuf (2017) indicated that having good quality extension services improves farmers' knowledge about innovations and indigenous practices such as the use of wild trees like acacia karoo, Spekboom and wild olive.

The overall results of the multinomial probit regression show that farmers practise diverse coping strategies to withstand drought conditions. Most of these practices are inherited from one generation to the other and these continue to sustain the farmers' small stock. The multinomial probit regression showed the correlation between the social characteristics of the farmers and the use of varied drought coping strategies. From the regression model, farmers appeared to practise water harvesting more frequently compared to other mechanisms, although this could depend on the villages where farmers reside within the district municipality.

5.5 Effects of drought on farmers' welfare

This section reports on the findings of the fourth objective, which investigated the factors influencing the effect of drought on farmers' welfare. Agricultural income was used as a dependent variable, and the two least-square regression was used to assess the relationship

between the dependent and independent variables. The results are presented in Table 5.4 **Table 5.4 Effects of drought on farmers' welfare**

Explanatory variables	**Coefficient**	**Std. Err.**	**P>z**
Age	-364.5128	343.1283	0.288
Gender	-1259.708	885.4174	0.155
Marital status	-12486.52	4650.373	0.007 **
Level Education	-5093.914	2759.067	0.065 *
Household Size	3711.674	1245.955	0.003 ***
Type of farmer	5366.027	8769.252	0.541
Farming skills	-24427.52	10149.56	0.016 *
Farming experience	1263.862	411.3491	0.002 ***
Farm location	4571.442	1073.728	0.000 ***
Access to extension services	-32324.98	8139.377	0.000 ***
Cons	18406.7	17904.75	0.304
Number of obs = 293			
Prob > chi2 = 0.0000			
R-squared = 0.8690			
**Notes: *** p<0.01, ** p<0.05, *p<0.1, means significant at 1%, 5% and 10% levels of significance, respectively Source: Field survey (2021)			

Six (6) explanatory variables (captured as marital status, level of education, household size, type of farmer, farming skills, farming experience, village, and access to extension services) were identified to have a significantly positive effect on farmers' welfare (captured as agricultural income) at different statistically significant level 10% or better (5% and 1%) are presented in Table 5.4. The R-squared value is 87%, suggesting a reasonably powerful model for this objective.

5.5.1 Marital status

The marital status variable was statistically significant related to agricultural income ($p<0.05$). The coefficient, however, was negative, suggesting that the marital status of the farmers hurt farmers' welfare.

5.5.2 Level Education

Education was statistically significantly related to agricultural income ($p<0.1$). The coefficient was negative, indicating no correlation between farmers' education on the effects of drought relative to their welfare.

5.5.3 Household size

Table 5.3 shows that household size was statistically significant related to agricultural income ($p<0.01$). The coefficient was positive; this means that household size positively influenced the effect of drought on farmers' welfare. This could be the result of some highly educated household members who assist/work at the farm and who can do research on the impact of drought. Yusuf *et al.* (2011) posited that family members could also be a key source of knowledge relative to climate change and coping mechanisms.

5.5.4 Farming skills

Table 5.3 shows that farming skills were statistically significant relative to agricultural income ($p<0.05$). The coefficient was negative, indicating no statistical correlation between farming skills and the effects of drought on farmers' welfare.

5.5.5 Farming experience

Table 5.3 shows that farming experience was statistically significant relative to agricultural income ($p<0.01$). The coefficient was positive, suggesting that the farming experience has a direct positive influence on the effects of drought on farmers' welfare. This is because farmers with experience may have found coping mechanisms to withstand drought conditions over the years, thus operating and maintaining farm returns like income. According to a study by Muthelo (2018), the higher a farmer's experience in farming, the more likely they are to have a thorough understanding of the weather and climatic conditions and thus be able to respond to these risky factors.

5.5.6 Farm Location

Table 5.3 presents findings that farm location was statistically significant related to agricultural income ($p<0.01$). The coefficient was positive, suggesting that the farm's location had a direct positive influence on the effects of drought on farmers' welfare. This means farmers located near towns, where institutions like universities, government sectors, and other private companies can easily access services, including relief funds, than their fellow farmers in deep rural areas. Also, this could result from different vegetation covers, and some farmers can easily access wild trees that are palatable to small stock.

5.5.7 Access to extension officer

Access to extension services was statistically significantly related to income ($p<0.1$). The coefficient was negative, indicating no statistical correlation between accessing extension services and the effects of drought-related to farmers' welfare. This could be because farmers do not adopt or put into practice the advice given to them by extension officers (Stevens, 2017).

The two least square model results validate the assertion that most smallholder farmers in South Africa are old, have a secondary level of education, have relatively large households, and depend on government services for extension access. Drought seriously affects smallholder farmers. This is not only because of a lack of resources, but drought-related training, farming skills, and access to extension services are among the factors that influence how drought affects smallholder farmers. Improvement of these factors could contribute to better farm yield returns and sustained farm profit, which will help address some of the socioeconomic issues such as poverty, unemployment, and food security at the household level.

Chapter summary

CHAPTER 6: SUMMARY AND CONCLUSIONS, POLICY IMPLICATIONS AND AREA FOR FURTHER RESEARCH

6.1 Introduction

This chapter summarises research findings and briefly discusses the implications, conclusion and recommendations made from the study. The summary of the findings includes input from both qualitative and quantitative approaches that were employed in the descriptive and empirical analysis. This research was done to understand better the perceptions, coping strategies and welfare impact of drought among small stock farmers. Furthermore, the study intended to provide an insight into, and empirical evidence on, the impact of drought and whether farmers were able to withstand drought. If yes, which coping strategies did they employ?

6.2 Recap of research objectives and summary of key results

This section explains the statistical analysis of the socio-economic characteristics related to farmers' perceptions of the impact of drought. For descriptive statistics, the study used percentages, frequency, standard deviation and mean to elicit information from the respondents. Various econometric models were employed to analyse data and generate results.

The first research objective assessed farmers' perceptions of the impact of drought on small stock farmers using the Likert rating scale and descriptive statistics. Farmers were given four (4) topics relative to drought and asked to rank them according to their experience with drought and its impact on small stock farming in their respective areas. Farmers were asked to evaluate using the five-point Likert rating scale, presented as follows: Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly disagree = 1. The second objective investigated the current drought coping strategies employed by small stock farmers. Chi-square was used to determine the relationship between the dependent and explanatory variables. The third objective used a multinomial probit regression model chosen to address research Objective 4 to determine factors influencing farmers' choice of drought coping practices in the Eastern Cape province. The coping strategies were grouped into water harvesting, pastures and licks, and wild trees

The fourth objective investigated the factors influencing the effect of drought on farmers' welfare. Agricultural income was used as a dependent variable, and the two least-square

regression was used to assess the relationship between the dependent and independent variables.

Results of the first research objective indicated that 68% of farmers strongly agree that the support they received contributed meaningfully to helping them ease the effects of drought. Furthermore, when asked to rate the negative impact drought has on farmers' livelihood, 99% of farmers strongly agreed that drought harms their livelihood of farmers; this forces them to spend more money on drought-resistant inputs. The Likert rating scale showed that drought hurt small stock farmers' welfare. Other critical factors included rainfall trends where farmers indicated that they were out of water for a prolonged period.

The second research objective showed the drought coping strategies that small stock farmers employed. From the Chi-square, coping strategies such as feeds and mineral licks, water harvesting and palatable wild trees were critical in influencing the farmers' decision to use different extension sources. Findings from the probit regression model indicated that seven explanatory variables namely level of education, farming skills, and frequency of extension visits, were statistically significant. These also included age, gender and quality of education. Moreover, the study established that age (categorised into groups) and frequency of responses from extension officers to farmers were the other attributes influencing small stock farmers' choice of drought coping strategies.

The two least square model results confirm that most smallholder farmers in South Africa are old, have a secondary level of education, have relatively large households, and depend on government services for extension access. Drought seriously affects smallholder farmers. This is not only because of a lack of resources, but drought-related training, farming skills, and access to extension services are among the factors that influence how drought affects smallholder farmers. Improvement of these factors could contribute to better farm yield returns and sustained farm profit, which will help address socioeconomic issues such as poverty, unemployment, and food security at the household level.

6.3 Conclusion

This section provides the conclusion of the study based on the results of the descriptive statistics and the econometric models. The results from descriptive statistics indicated that 74% of the respondents were male with a secondary level of education and an average age of 49 years and a household size of 5 members per household. The farming activities included land ownership, varied water sources for small stock and support received from the government. These were essential to give insight and an overview of the respondents and their farming activities in the

study area. The study identified that water, inadequate financial support, and insufficient farm visits were some of the challenges that negatively affected the farming prospects of small stock farmers in Amathole District Municipality. The farmers' perceptions were investigated, and the FGD findings indicated that farmers observed visible signs of drought in the form of rainfall, vegetation, and extreme temperature. Furthermore, they gave their account of the strategies they used which included harvesting water, wild trees and fodder supplementation, that is, mineral licks and pastures, to mention a few and how these had an impact on farmers' livelihoods.

Then, objective three investigated the factors influencing the choice of drought coping strategies. The findings were that socioeconomic characteristics such as age, gender, and level of education and farming skills directly influenced the farmers' choice of drought coping strategy. Moreover, support services attributes such as access to extension services, frequency of response and the quality of extension services received were other mechanisms chosen by farmers to withstand drought adversaries. The overall results of the multinomial probit regression showed that farmers make use of diverse coping strategies to withstand drought. The study concluded that farmers are affected by drought, and this extends to their welfare and farmers are still using indigenous methodologies to cope with drought. From the regression model, farmers appeared to practise water harvesting more frequently compared to other mechanisms, although this could depend on the villages where farmers reside within the district municipality. The study also observed that most of these practices are inherited from one generation to the other, and these continue to sustain the farmers' small stock.

Objective four is about the farmers' welfare (captured as agricultural income) and it showed that marital status, level of education, household size, farming skills, farming experience, farm location, and access to extension services had a direct influence on farmers' welfare. The study concludes that drought seriously affects small stock farmers. This is not only because of a lack of resources, but drought-related training, farming skills, and access to extension services are among the factors that influence how drought affects smallholder farmers. Improvement of these factors could contribute to better farm yield returns and sustained farm profit, which will help address some of the socioeconomic issues such as poverty, unemployment, and food security at the household level.

6.4 Policy Implications based on the findings

The study forms part of the objectives of the ADM risk and local economic development division, which seek to investigate the perceptions, coping strategies and welfare impact of

drought among small stock farmers in the study area. However, the lack of reliable and detailed empirical data in these areas makes it difficult for ADM to intervene effectively. This study was undertaken to provide empirical evidence for the Eastern Cape government to understand the dangers of drought on small stock production and farmers' welfare.

The study results will help inform the departments and policymakers in formulating sound policies; the study results will also assist the government in combating drought in the Amathole district municipality. Moreover, the results will motivate the need for drought relief funds to assist farmers in supplementing their expenditure for better yield returns. For developmental practitioners such as researchers, advisory and extension agents, the study findings will assist the officials when planning farm visits to assist the small stock farmers. In the case of farmers, the results will help them align their practices relative to drought and seek technologies that could help deal with the everchanging climatic conditions and sustain profitable farm operations. The findings of this study should be used as a blueprint and provide direction to be considered by donors and policymakers alike.

6.5 Recommendations

The following recommendations are based on the empirical evidence provided by the study. Several recommendations can be made about the perceptions, coping strategies and welfare impact of drought among small stock farmers in the Eastern Cape.

- Farming skills and level of education were found to affect drought resistance significantly. When farmers are educated and skilled, they have a greater chance of surviving a drought. Consequently, the study recommends support services in terms of training in risk and drought-related programmes; this includes key performance areas of extension officials and other service providers.
- Based on the findings on coping strategies, the study recommends integrating indigenous and climate-smart agricultural technologies so that farmers can detect early signs of drought and act timemously.
- Drought relief support should be made readily available for farmers in unexpected risk disasters such as drought.

6.6 Areas of further research

The empirical evidence provided by this research study should be explored further and reassessed in the different spatial and time circumstances of the various provinces of South

Africa. A methodological comparison of the findings at various periods and locations is necessary to establish the authenticity of the results and gain more insights to advise policy. Additional empirical efforts can verify the validity of these findings. There is a need for further research on the impact of drought on small stock farmers. Other relevant issues are not addressed in this study, hence the following areas for further research are recommended:

- The focus of the study was on small stock farmers' perceptions, coping strategies and welfare impact of drought. There is a need for research to investigate the overall performance of small stock farmers in Amathole.

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APPENDICES

Appendix A: Questionnaire

QUESTIONNAIRE

TOPIC: PERCEPTIONS, COPING STRATEGIES AND WELFARE IMPACT OF DROUGHT AMONG SMALL STOCK FARMERS IN AMATHOLE DISTRICT MUNICIPALITY, EASTERN CAPE.

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This questionnaire is prepared to collect data that will be used in the study of the above subject.
Instruction

- Please supply the information required by choosing the appropriate code and inserting it in the box/column/space of your choice.
- Do not mark against each statement more than once.

Interview No	
District municipality	
Local municipality	
Village	
Date	

SECTION A: DEMOGRAPHIC INFORMATION OF THE SMALL STOCK FARMERS

A.1. Are you a full-time or part-time farmer?

Full-time Part-time

A.2 Do you have any farming skills?

1 = Yes 0 = No

A.3 How long have you been farming years?

A.4. What is your age years?

A.5.What is your gender? 1 = Male 0 = Female A.6.

What is your marital status?

0 = Single 1 = Married

A.7.What is the highest level of education you have completed?

0 = No formal education 1= Primary 2 = Secondary 3 = Tertiary

Other specify) …… A.8.

What is your household size?

SECTION B: DROUGHT COPING STRATEGIES BY FARMERS

B.1. What coping strategies do you know of that can be employed during a drought?

……

……

……

B.2. Which coping strategies did you employ during the drought period?

……

……

……

B.3. What do you think about the new agricultural technologies that are said to be addressing drought?

……

……

……

B.4. Which coping measures to drought are in place in your community?

1= Rain water harvesting 2= Fodder/silage 3= custom feeding

4 = None ☐ 5 = Other (Specify)..... ☐

B.5. What trainings are given to small stock farmers to reverse drought shocks?
……
……
…….

B.6. Where is the source of feed?
1= Community grazing ☐ 2 = Road side grazing ☐ 3= River side grazing
4 = Supplementation ☐ 5. Crop residue ☐

B.7. Ways of grazing
1 = Sheep graze separately ☐ 2 = Sheep mixed with other livestock ☐

B.8. What source of water do you have for animal watering?
1 = Borehole ☐ 2 = Dam ☐ 3 = River ☐ 4 = Windmill ☐ 5 = Others (Specify)……

B.9. Do you experience feed shortages? 1 = Yes ☐ 2 = No ☐

B.10. If yes, how do you prioritise feeding during feed shortages? 1 = Feed ewe ☐ 2 = Feed ram ☐ 3 = Feed lamb ☐ 4 = Feed weaners ☐ 5 = Feed wither

B.11. Do you supplement your flock? 1 = Yes ☐ 2 = No ☐

B.12. What class of animal do you supplement? 1= Ewe ☐ 2 = Ram ☐ 3 = Wither ☐ 4 = Lambs ☐ 5 = All of them ☐

B. 13. What type of supplement?
1 = Pellets ☐ 2 = Crip-feed ☐ 3 = Maize ☐ 4 = Lucerne ☐ 5 = Other ☐

B.14. Reason for supplementing your flock
_____
_____
_____

B.15 Which measures are you putting in place to address the problem?
……
……
…….

SECTION C: CHOICE OF COPING STRATEGIES

C.1. Which of the coping strategies were you forced to employ during the drought?

……

……

…….

C.2. Can you conclude that the coping strategies employed helped to ease the effect of drought on your small stock?

1 = Yes ☐ 0 = No ☐

C.3. Why or Why not?

……

……

……

C.4. What other associated disaster did you encounter during drought in your area (e.g fire outbreaks, epidemics, etc)

……

……

……

C.5. What else did you do to cope with the worst drought? Please include changes in management strategies, livestock relocation, herd size, etc.

……
……
……
……

C.6. How long of a drought could you now cope with? How would you cope? A season? A year? Two years? Please explain.

……
……
……
…….

C.7. How would you get capital or other resources to get through a drought? Please explain
……
……
……
……
……

SECTION D: PRODUCTION AND MARKETING INFORMATION

D.1. Between sheep farming and goat farming, which farming enterprise are you involved in or practising?

Farming system	Seasonally	Annually
1 = Goat production ☐		
2 = Sheep farming ☐		
3 = Mixed farming ☐		

D.2. Do you own the land you are farming on?

Yes ☐	No ☐

D.3. If no to D.2, how did you acquire the land?

Bought		Lease		Renting		Communal		Inherited		Other (Specify)…….

D.4. Land Use

Size of land (ha)	Amount of (ha) allocated to fodder	Amount of (ha) allocated to small stock

D.5. What is the main reason (goal) for your involvement in farming? (Tick the appropriate)

Wool production	
Selling (markets)	
Wool and meat production	
Meat consumption	
Other	

D.6. Agricultural income

Source	**Do you receive income? (Yes/ No)**	**Cycle**	**How much? (R)**	**Annual income (Monthly income x 12)**
Wool				
Animals (livestock sales)				
Meat				
Other, Specify				

SECTION E: THE WELFARE OF FARMERS

E.1. Have you received anything through the government drought relief programmes?

1 = Yes ☐ 0 = No ☐

E.2. Please explain

Year	**Received From**	**Money (R)**	**Other goods / Services**

E.3. What are current government programmes or projects for drought?

……

……
……

E.4 How has this changed, and over what period? For example, has the funding for programmes been increased or decreased; some programmes dropped or have new ones started?

……
……
……
……
……

E.5. Are you aware there are extension officers that are assigned specifically for risk and drought-related matters?

……
…….

E.6. Did you seek help from them during the drought?

……
……
…….

E.7. How far are the extension officers from you? …… km

E.8. How often do the extension officers visit you and capacitate you on drought-related matters? (Tick the appropriate)

Weekly ☐ Monthly ☐ Quarterly ☐ Annually Other, specify = …….

E.9. Are you satisfied with this visitation period? (Tick the appropriate)

Yes ☐	No ☐

E.10. If no to .9, how frequently would you like to see the extension officers? Weekly ☐; Monthly ☐ ; Quarterly ☐; annually ☐ other, specify ……

E.11. How would you rate the quality of Extension Services you get in relation to droughtrelated matters?

Very good ☐ Good ☐ Neutral ☐ Poor ☐ Very Poor ☐

E.12. Do you ever call Extension Officers when you need them?

Yes ☐	No ☐

E.13. How often is their response?

Immediate ☐ They take their time Neutral ☐ they only promise to come but they do not they never respond ☐

E.14. Would you say, drought has a negative impact on small stock farmers' livelihoods due to an increase in expenditure? Please explain

……
……
……

E.15. Are there people you know of that have lost their jobs due to drought? Please elaborate on how it has impacted their welfare

……
……
……

E.16. Do you think the drought is capable of causing poverty? Please elaborate

……
……
…….

INTERVIEW GUIDE FOR FARMERS

Appendix B: Focus group discussion guide 1. Preface

Thank you for agreeing to participate. We are very interested in hearing your valuable opinion on farmers' perceptions, coping strategies, and the welfare impact of drought among small stock farmers.

- This study aims to explore farmers' perceptions of the impact of drought on small stock farmers. What do you understand about drought?
- The information you give us is completely confidential, and we will not associate your name with anything you say in the focus group.

- You may refuse to answer any question or withdraw from the study at any time.

2. Introduction

This study investigates farmers' perceptions of the impact of drought on small stock farmers in Amathole, Eastern Cape. The objectives of the study are as follows:

- Assess small stock farmers' perceptions of the impact of drought on small stock farmers
- Determine the current drought coping strategies used by smallholder farmers
- Examine factors influencing the choice of drought coping practices/strategies

- Identify the effects drought coping strategies employed by farmers have on their welfare

Basic rules for the discussions

- Everyone is expected to participate; however, if they cannot engage any further, the participant is allowed to leave the discussion without explaining
- One focus group discussion should be conducted in each village
- Each group should have at least 20 participants
- The team members have the right to challenge, criticise and disagree during the discussion or decision
- Only those participating in the focus group will be allowed to contribute
- There are no right or wrong answers.

3. **Questions: Farmer's perceptions and welfare impact of drought**

a) What visible changes have you observed as related to rainfall, temperature, soil fertility, forest vegetation, wildlife, crop productivity, livestock productivity, the flow of streams, the occurrence of big floods, the incidence of drought, forest vegetation cover, river/stream flow, etc during your lifetime in the village?
b) What is the trend of the rainfall and the temperature during the past 10 to 20 years? Is it increasing, decreasing, coming on time and stopping at the right time?
c) What coping and adaptation strategies have small stock farmers crafted to alleviate problems arising as a result of drought?
d) Do small stock farmers have sufficient knowledge about adaptation options to climate change?
e) Are the animals you are raring not the same as your father's or forefather's animals? If not, what reasons for changing the animals?
f) What customary self-help arrangements are there to support small stock farmers in your villages during times of drought?
g) What effect has drought inflicted on the livelihood of the small stock farmers?
h) How do you evaluate the agricultural extension agents' role in motivating and mobilising the community to strengthen their adaptive strategies to the effects of drought among small stock farmers?

Appendix C: Ethical Clearance Certificate

NWU®
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Web: http://www.nwu.ac.za
Senate Committee for Research Ethics
Tel: 018 299-4849
Email: nkosinathi.machine@nwu.ac.za

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Faculty of Natural and Agricultural Sciences Ethics Committee (FNAS-REC)**, the Faculty of Natural and Agricultural Sciences Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-SCRE) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Perceptions, coping strategies and welfare impact of drought among small stock farmers in Amathole District Municipality, Eastern Cape
Study Leader/Supervisor: Dr M Christian
Student: LC Ndlazilwana

Ethics number: N W U - 0 0 5 9 4 - 2 1 - A 9
Institution Study Number Year Status

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application type: Single **Risk Category:** Minimal

Commencement date: 27/08/2021
Expiry date: 30/11/2022

Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):

- The following documentation are archived by FNASREC and should be complete and kept up to date:
  - Research proposal
  - Signed approval from the scientific committee indicating the proposed risk category
- All researchers involved in the study should submit signed NWU code of conduct statements annually.
- All researchers of low risk studies should submit proof of relevant ethics training every two years.
- All researchers that take part in activities that pose a safety and security threat to the researchers or the environment should submit a risk assessment form annually.
- All research involving human interaction should follow best ethical practise and keep documents as proof. This includes informed consent, questionnaires, incorporation of risk-benefit, and responsible data management.
- Any research at governmental or private institutions, permission must still be obtained from relevant authorities and provided to the FNASREC. Ethics approval is required BEFORE approval can be obtained from these authorities.

File reference: 9.1.5.4.2 Page 1 of 2

General conditions:
While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the FNASREC:*
  - *annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the FNASREC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately forfeited.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-SCRE and FNASREC reserves the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
  - *withdraw or postpone approval if:*
    - *any unethical principles or practices of the study are revealed or suspected;*
    - *it becomes apparent that any relevant information was withheld from the FNASREC or that information has been false or misrepresented;*
    - *submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
    - *new institutional rules, national legislation or international conventions deem it.*
- *FNAS-REC can be contacted for further information or any report templates via Roelof.Burger@nwu.ac.za 018 299 4269*

The FNASREC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the FNASREC or the NWU-SCRE for any further enquiries or requests for assistance.

Yours sincerely,

Prof Roelof Burger
Chairperson Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC)