FARMER PERCEPTIONS OF CLIMATE VARIABILITY INDUCED DROUGHT, LOCAL ADAPTATION AND MITIGATION MEASURES:
Case study on the subsistence farming community of Siphocosini, Swaziland

By

Hazel Fadziso Mareverwa

A mini-dissertation

Submitted in accordance with the requirements for the degree

Master in Development Studies

Centre for Development Studies

University of the Free State

Supervisor: Dr. Weldemichael A. Tesfuhuney

Bloemfontein, South Africa

2018

AUTHOR'S DECLARATION

I, HAZEL FADZISO MAREVERWA, declare that by submitting this mini dissertation in partial fulfilment of the Masters in Development Studies at the Centre for Development Studies, University of the Free State, I confirm that this is my individual work, that I have not previously submitted it for any qualification before. I hereby give copyright consent to the University of the Free State.

……. …….

Hazel Mareverwa Date

DEDICATION

This mini dissertation is dedicated to my dear mother Margret Nhamburo, a woman who values education yet she did not have the “privilege” to acquire it. Thank you so much for your unwavering support and wisdom.

ACKNOWLEDGEMENTS

To begin with, I would like to give glory to the Lord Almighty God for His guidance, strength and wisdom given in order to tackle this assignment.

Furthermore, I would like to express my sincere gratitude to the following people:

- Dr. Weldemichael Tesfuhuney, my supervisor, I am eternally grateful. Thank you for your supervision, motivation and knowledgeable guidance throughout this assignment.
- Dr. Deidre Van Rooyen, Anita Harmse and all members of staff in the Department of Development Studies for your endless motivation and reassurance.
- Mr and Mrs Mutsigwa, your prayers as well as your support in the collection of data is much appreciated.
- The subsistence farmers in the community of Siphocosini who willingly provided valued information for this study and the enumeration team, I acknowledge your priceless contribution with gratitude.
- To my parents, Charles Mareverwa and Margret Nhamburo thank you for your love and support.
- Lastly, the acknowledgement will not be complete without including my dear husband, Courage Simbiso Makumucha; to you I say “Asante Sana” your support and guidance is forever cherished.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AGRA	Alliance for a Green Revolution in Africa
DFID	Department for International Development
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Profit
HIV	Human Immunodeficiency Virus
IPCC	Intergovernmental Panel on Climate Change
NGO	Non-Governmental Organization
NERMAP	National Emergency Response, Mitigation and Adaptation Plan
NDMA	National Disaster Management agency
MOA	Ministry of Agriculture and Cooperatives
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organization for Economic Cooperation and Development
SNL	Swazi Nation Land
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
TDL	Title Deed Land
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency
USAID	United States Agency for International Development
UN	United Nations

ABSTRACT

The occurrence of droughts are becoming a prevalent feature in the Swaziland agricultural sector, where over 70 percent of the population is dependent on rain fed agriculture as their main source of livelihood. There is therefore an increased concern that climate variability, through drought, will further threaten the livelihoods of the already vulnerable rural families and increase the vulnerability at household and community level or even the economy of the country. The objectives of the study were to assess the social effects brought on by climate variability induced drought, determine the subsistence farmer perceptions of climate variability induced drought and to understand the local adaptation and mitigation strategies employed by the farmers. It is important to note that this study was conducted at a household level in the community of Siphocosini in Swaziland, which makes it unique, contrasting most research studies carried out at national level.

A household questionnaire and Focus Group Discussion (FGD) were used to collect both qualitative and quantitative data for the study. The descriptive statistical analysis was employed to describe the households and the social effects of climate variability induced drought. The research results indicated that farmers in the community are responding to climate variability induced drought through the implementation of several local adaptation and mitigation strategies in an attempt to build resilience. The adaptation and mitigation strategies are influenced by a number of factors, which include farmer perceptions of climate variability, technology and access to information. The research findings further revealed that there is limited comprehensive awareness of climate variability, indicating a lack of support from the public sector and private sector towards subsistence farming in the community. From the results gathered in the study recommendations such as the promotion and implementation of drought and climate variability preparedness programmes, which can educate and empower farmers to effectively adapt and mitigate effects of weather extremes, are made. The study also recommends that the adaptation strategies implemented should have a participatory approach including existing local knowledge and resources.

Keywords: Climate variability, drought, subsistence farming, perceptions, local adaptation strategies and mitigation strategies.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

The incidence of climatic transformation over the years has turned out to be one of the most discussed topics worldwide. In comparison to other continents, Africa is harshly affected by climate variability due to its geographical position, wide spread poverty, inadequate adaptive ability and low levels of development (Boko et al., 2007). Climate variability presents overwhelming challenges to the farming sector and its sustainability in several developing countries, creating food insecurity and extensive poverty, which is linked to the low agricultural output (Gukurume, 2011). Smallholder or subsistence farmers are the temporary producers of agricultural outputs. They account for 80 percent of all farms in Sub- Sahara Africa. Approximately 70 percent of these farmers are heavily dependent on farming for food, revenue and employment (Alliance for a Green Revolution in Africa AGRA, 2014). Subsistence farmers can find it difficult to live and practise sustainable agricultural living in an environment with unpredictable weather conditions.

Manyatsi, Mhazo and Masarirambi (2010) assert that climate variability is apparent in Swaziland and is witnessed through droughts, inconsistent rainfall patterns and severe weather conditions. Subsistence farmers are most affected by these catastrophes due to their inability to fully adapt to unpredictable weather patterns because of lack of adequate information about climate variability. The 2015 drought severely affected the livestock and crop output in Swaziland. South Africa, Botswana, Lesotho, Malawi, Namibia, Swaziland and Zimbabwe declared drought induced emergencies in 2015, 643 000 livestock deaths were reported in five countries and a regional deficit of almost 9.3 million tonnes of cereal production was indicated during the 2015-2016 harvest season (FAO, 2016). Several millions of people were killed due to the drought and it triggered major social, environment and economic damage throughout the African history (Tadesse, 2016). Parry, Canziani and Palutikof (2007) projections maintains that by the year 2020 about 75 to 250 million people in Africa will be exposed to high water stress conditions mainly due to droughts, with some countries experiencing up to a 50 percent reduction in yield from rain fed agriculture. Local adaptation and mitigation strategies are thus compulsory to lessen exposure to drought pressures and

of the preparation for future extreme climate events (Stringer, Dyer, Reed, Dougill, Twyman, and Mkwambisi, 2009).

According to Pandey and Bhandari (2009) the occurrence and severity of droughts are increasing due to climate variability, therefore the socio-economic impact is expected to rise in the future. Drought is a global multi-faceted natural hazard that has major effects on the livelihood and development of a society (Tadesse, 2016). Wilhite, Sivakumar and Pulwarty (2014) argue that the agricultural sector is the most affected by climate variability due to the high dependence on rain fed agriculture by subsistence farmers. It is important to note that, subsistence farmers in third world countries are already faced with problems such as conflicts, poor governance, economic decline and HVI/AIDS. Therefore, the incidence of climate variability induced drought amplifies their vulnerability to weather extremes.

The variability and unpredictability of the climate is a major problem and it creates risks that can adversely affect options and the development of millions of underprivileged people in Africa (Shiferaw, Tesfaye, Kassie, Abate, Prasanna and Menkir, 2014). In the face of increased climate variability, subsistence farmers in Africa have managed to use local resources and knowledge to adapt, regardless of countless social and economic impacts, however these adaptation strategies might not be adequate. Jennings and Magrath (2009) highlighted that adaptation and mitigation options are mostly restricted by insufficient financial resources and current information on climate issues, therefore lessening vulnerability becomes a crucial feature towards enhancing resilience of subsistence farmers to climate variability. A better understanding of the climatic perceptions of farmers and their adaptation strategies is a vital entry point for decision makers and policy makers to learn how and where to enhance the adaptive capacity of subsistence farmers in wet (rainy) and dry (drought) periods.

1.2 Problem statement

Drought is one of the major barriers to development in Africa. Most farmers on the continent are reliant on rain-fed agriculture and this makes them predominantly vulnerable to climate variability (UNESCO, 2014). Climate variability has resulted in the decline of rainfall patterns and extreme temperatures resulting in water stress,

reduction in agricultural production and heat waves causing loss of livestock and health problems (FAO, 2016). In Swaziland smallholder farmers make up 70 percent of the population that is over 1 million people relying on subsistence farming (FAO, 2016). Frequent droughts have had major impacts on the country because many people are reliant on agriculture for their livelihoods and this has created vulnerability, food insecurity and increased poverty for the already poor farmers (Mhlenga, 2015). If drought is not properly addressed it can perpetuate poverty, food insecurity, diseases, and has the potential to reverse years of development efforts in any society.

Moylan (2012) states that the alarm that is raised by drought through climate variability will further threaten the wellbeing and food security of the already greatly susceptible rural families in developing nations and create a severe challenge to develop these communities. Thus, in the face of this approaching risk, an understanding of the social effects of drought and local adaptation strategies by farmers are important in planning technological and policy interventions for more effective drought mitigation (Pandey and Bhandari, 2009). Perceptions determine whether farmers understand the importance of drought mitigation measures, it also determines resistance of farmers to adaptation. Hence, the key objectives of the study are to investigate the social effects of climate variability induced drought, local adaptation strategies and mitigation measures as well as perceptions of farmers to drought in the community of Siphocosini.

1.3 Research questions

The research will aim to answer the following questions:

- How does the effect of a climatic variability induced drought affect the social aspects of subsistence farmers in the community of Siphocosini?
- How do subsistence farmers in the Siphocosini community perceive climate variability caused drought hazards?
- What are some of the local adaptation and mitigation strategies currently used by the subsistence farmers to adapt to drought in the community?
- What are the barriers to effectively implement drought adaptation in the community?

1.4 Hypothesis

The hypothesis of the study;

H_0 : Due to the frequency of drought in Siphocosini; the community has established local adaptation strategies and has received climate variability and drought preparedness programmes.

H_1: The community has not yet established local adaptation and as well as received climate variability and drought preparedness programmes.

1.5 Aim

The overall aim of this study is to assess the social effects that climate variability induced drought has on subsistence farmers, and to investigate perceptions on local adaptation and mitigation strategies in the community of Siphocosini, Swaziland.

1.6 Specific Objectives

- To investigate the social effects of climate variability induced drought on subsistence farmers in the community of Siphocosini, Swaziland.
- To determine the perceptions subsistence farmers to climate variability caused drought in the Siphocosini community.
- To understand the local adaptation and mitigation strategies employed by the farmers in the face of climate variability induced drought.

1.7 Conceptual framework

A case study was used as the standard framework for this study. The study employed a case research method because the research aim was to carry out an in-depth investigation of the social effects of drought on farmers, their perceptions on climate variability, as well as the local adaptation and mitigation strategies they employ. The use of a case study in this research is aimed at attaining the study objectives through a detailed comprehension of the livelihoods of the subsistence farmers by means of carrying out a livelihood analysis. The sustainable livelihood framework (SLF) was adopted for this study. The concept of a sustainable livelihood is defined by the Department for International Development (DFID, 2000) as:

"….A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses

and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base".

The sustainable livelihood framework is sometimes used as a checklist or tool to comprehend poverty in response to poor people's opinions and their own comprehension of poverty (DFID, 2000). The study employed the sustainable livelihood framework as a means of understanding subsistence farmer perceptions to climate variability induced drought and their local adaptation and mitigation strategies. Kolmar and Gramper (2002) reveal the central principles of the framework, which are people centred, holistic, dynamic, building on strengths, macro-micro links as well as sustainability.

The DFID framework enables the analysis of the perceptions of subsistence farmers, local adaptation and mitigation strategies through conceptualizing:

- How subsistence farmers function in a vulnerability context that is made up of different dynamics such as climate variability and droughts, shifting seasonal restrictions and opportunities and their social shocks.
- How they draw on different types of livelihood assets or capitals in different situation guided by:
    - the effects of climate variability
    - their defenceless situation and
    - a range of institutions and approaches.
    - How the subsistence farmers utilize their asset base to develop a variety of adaptation and mitigation strategies to build resilience (DFID, 2000).

In short, the core features of the SLF were summarized by (Kolmar and Gamper, 2002);

"…*The framework depicts stakeholders as operating in a context of vulnerability, within which they have access to certain assets. Assets gain weight and value through the prevailing social, institutional and organizational environment (policies, institutions and processes). This context decisively shapes the livelihood strategies that are open to people in pursuit of their self-defined beneficial livelihood outcomes.*

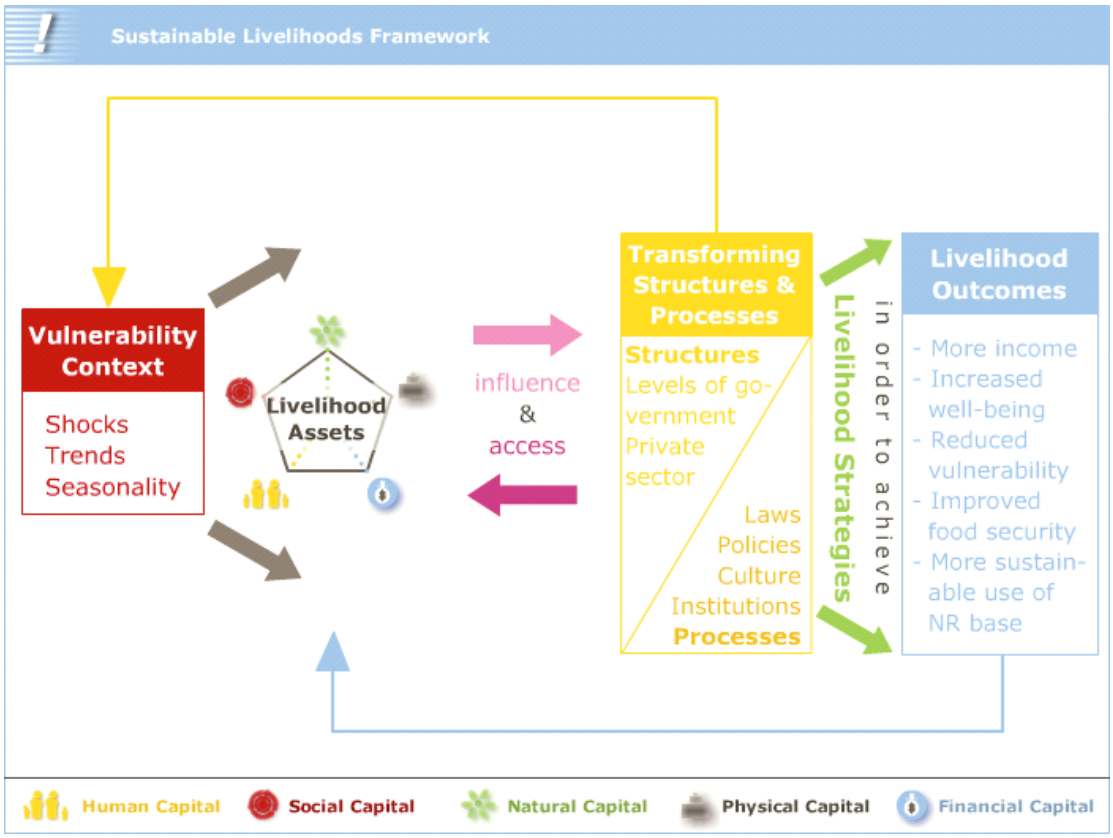

Figure1.1: Sustainable Livelihoods Framework (DFID, 2000).

1.8 Outline of the Chapters

The mini dissertation is divided into five chapters. Chapter one is the introduction where the problem statement and objectives of the study are outlined. Chapter two focuses on the literature review, the social effects of drought, local coping mechanisms and mitigation measures of drought in Africa. Chapter three essentially gives an overview of the study area in terms of location and climatic conditions. Chapter three also describes the detailed methodology that was employed to collect and analyse data in order to address the study objectives. Chapter four presents and discusses the data findings through the use of graphs, tables and charts. Chapter five states the conclusions and recommendations drawn from this study and reference areas that need further research.

1.9 Conclusion

Drought is a recurring climate feature that occurs in almost all climatic regions. It comes with adverse social, economic and environmental problems that often lead to conflict, economic meltdown and water shortages just to name a few. Subsistence farmers are however amongst the most affected by drought mainly because of their inability to fully adapt due to lack of finances and adequate information about climate variability. In the face of climate variability induced drought, local adaptation and mitigation strategies are thus necessary to lessen drought effects as well as preparing for future drought experiences.

As revealed under the problem statement and background of the study, indeed, drought is a problem hence the need to investigate the social effects of drought on subsistence farmers, their perceptions as well as local adaptation measures used to mitigate drought effects in the community.

The following chapter focuses on the literature review, the social effects of drought, local adaptation and mitigation measures of drought used in Africa.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter will review several works pertinent to the topic of research, which is titled Farmer perceptions on climate variability induced drought, local adaptation and mitigation measures: Case study on subsistence farming community of Siphocosini, Swaziland. The concept of drought, farmer perceptions on climate variability induced drought, local adaptation and mitigation strategies, barriers faced by subsistence farmers to apply adaption and resilience building is discussed. The history of drought in Swaziland and the social effects of drought is also addressed in this chapter.

2.2 The concept of Drought

The concept of drought can be difficult to comprehend and define owing to the differences in the nature of water demand in several areas of the world, socio-economic factors as well as hydro- meteorological variables (Udmale, Ichikawa, Manandhar, Ishidaira, and Kiem, 2014). Monacelli, Galluccio and Abbafati (2005) describes drought as a normal, recurring feature of climate, but it is mistakenly considered as an unusual and random event. Droughts can occur in almost all climatic zones, for example, the high and low rainfall areas are frequently linked to the decline in the quantity of rainfall collected over a prolonged period of time, for instance a season or a year (Mishra and Singh, 2010). The decrease in water input causes a major water scarcity for humans, livestock and the environment, resulting in severe impacts. Monacelli et al., (2005) goes on to indicate drought is a prolonged period of a shortage of precipitation, resulting in widespread damage to crops and further resulting in decreased yields.

Drought occurs in all areas, regardless of the standard climate, however its features vary from one region to the other (Gainesville, 1988). The onset of rainfall, its duration, intensity and distribution of rainy days throughout the crop growing seasons, temperatures and high winds play an important part in the occurrence of droughts (Mishra and Singh, 2010). When the temperatures are higher than normal for a considerable period of time, a drought usually occurs (Gainesville, 1988). There are two main categories of definitions of droughts which are conceptual and operational and they will be discussed in length below.

2.2.1 Conceptual Definitions of Drought

Conceptual definitions of drought are made in general terms, to help people grasp the notion of a drought. An example of a conceptual definition is as follows: Drought is a prolonged period of deficient rainfall, causing wide damage to crops, which will further result in a loss of yield (Monacelli et al., 2005). These definitions may also be significant in establishing drought policies.

2.2.2 Operational Definition of Drought

According to Wilhite and Glantz (1985) an operational definition of drought assists people to detect the start, end, as well as the degree of severity of a drought. This definition is generally formulated by equating the present state to the historical average, and is often formed around a 30 year period of recording (Monacelli et al., 2005). In short, an operational definition of drought can be employed to examine the frequency of drought occurrence, severity, and duration for a given historical period. The following categories are operational definitions of drought.

2.2.2.1 Meteorological drought

Meteorological droughts are defined merely on the extent of dryness and the length of the dry period ((Wilhite and Glantz, 1985). A Meteorological drought is the leading indicator of a drought, and it is typically a region specific expression of a precipitation departure from normal over a period of time (Wilhite, 2000). The definitions of a meteorological drought should be region specific, as the atmospheric conditions that leads to shortages of precipitation are greatly region specific (Ojos, 2014). This makes it impossible to use a meteorological definition of a drought from one part of the world to another. Ojos (2014) goes on to give an example of the definition of a meteorological drought that occurred in the United States in 1942, where less than 2.5 mm of rain in 48 hours was considered a drought, and in 1964 in Bali, where six days without rain was considered a drought.

2.2.2.2 Agricultural drought

An Agricultural drought happens when there is a deficiency of soil moisture, that is, the soil moisture does not meet the requirements of a particular crop at a particular time (Brown and Magary, 1998). An Agricultural drought takes place after a

meteorological drought, but before a hydrological drought. The Agricultural sector is usually the first economic sector to be affected by a drought, and the assessment of the intensity of an agricultural drought remains a difficult task for drought researchers and policy makers (Monacelli et al., 2005). This is due to the fact that, unlike a meteorological drought that is measured by rainfall data documented by weather stations or the hydrological drought, assessed by inflows into the surface water bodies measured through gauging points, the assessment of an agricultural drought is not accomplished by direct and quantitative measurements (Sesha Sai, Murthy, Chandrasekar, Jeyaseelan, Diwakar, and Dadhwal, 2016). An Agricultural drought assessment involves the quantitative data connected to rainfall, soil moisture, cropping patterns and crop condition, together with their interactive effects in both spatial and temporal dimensions (Sesha Sai et al., 2016). The climate, soil texture, fertility and moisture, crop requirements and crop type are some of the information groups essential to evaluate an agricultural drought (Ojos, 2014).

2.2.2.3 Hydrological drought

A Hydrological drought focuses on the effects of dry spells on surface or subsurface hydrology, unlike the meteorological description of the event (Wilhite and Glantz, 1985). A Hydrological drought is normally described by its period of onset, its duration, area, degree as well as regularity of occurrence. According to Wilhite and Glantz (1985) the occurrence and severity of a hydrologic drought is regularly defined on the basis of its effect on river basins. Sesha Sai et al., (2016) defines a hydrological drought as a substantial decrease in the availability of water in different forms appearing in the land phase of the hydrological cycle. A Hydrological drought refers to shortages in surface and subsurface water supplies (Brown and Magary, 1998). A Hydrological drought may also be as a result of a long term meteorological drought that leads to the drying up of water reservoirs, lakes, rivers and a drop in groundwater levels (Sesha Sai et al.,2016). The time gap that exists between the shortage of rain and reduced water reservoirs, lakes and streams shows that the hydrological measurements are not the earliest indicators of a drought (Brown and Magary, 1998).

2.2.2.4 Socio economic drought

A Socio economic drought is different from all the above mentioned types of droughts because its occurrence is influenced by the processes of supply and demand (Ojos,

2014). A Socio economic drought occurs when physical water scarcity distresses people individually and collectively. Most socio economic definitions of a drought links it with the supply and demand of an economic product (Brown and Magary, 1998). Ojos (2014) states that a socio economic drought emerges when the demand for economic goods surpasses the supply due to a weather related deficit in water supply. This drought may lead to a significant decrease in hydro-electric power production, due to the fact that power plants depend on stream flow instead of storage for power generation (Monacelli et al., 2005). The reduction in hydro-electric power production may force the Government to adapt to more costly petroleum substitutes to meet its power needs. The socio-economic concept of a drought echoes the inter-dependence that occurs between droughts and human activities, highlighting the significance of handling natural resources in a sustainable manner. Definitions which express features of the socio economic effects of a drought can also incorporate features of a meteorological, agricultural, and hydrological drought (Wilhite and Glantz, 1985).

2.3 Subsistence farming and Climate variability in Africa

Subsistence farming is the most widely used method of farming in Sub Saharan Africa and the majority of the rural poor depend on it for survival. Subsistence agriculture is generally discussed as a form of agriculture in which the farmers' production is predominantly founded on meeting the household food consumption needs, where only a small percentage of the annual yield is sold (Panin and Hlope, 2013). The Africa Development Promise, (ADP, 2014) defines subsistence farming or smallholder farming as the following: When one grows crops and tends animals in such a quantity so as to only feed family. Morton (2007) defines subsistence farming as mainly conducted for household consumption, with only a small portion for trade. On the other hand Morton (2007) defines "smallholder farming" as farming performed in a rural setup, mainly harnessing its labour from the family and the output being the major source of income. It is from this lack of clear distinction between subsistence and smallholder farming that this research will use both terms synonymously. In simple terms, subsistence farming can be described as farming carried out to meet the family needs, using simple farming methods as compared to commercial farming.

Most countries in Africa rely on the agricultural sector as the backbone of native livelihoods and national Gross Domestic Profit (GDP) (Mendelsonh, Dinar, and Dalfet, 2000). In Sub Sahara Africa subsistence farmers are the chief producers of agricultural outputs and they occupy nearly 80 percent of the farms and directly employ about 175 million people (AGRA, 2014). Several African countries presently face semi-arid conditions that result in difficulties in farming. Projections indicate that climatic transformations are expected to shorten the growing season, forcing big regions of minimal agriculture out of production (Boko, et al., 2007). The continent climate variability is set to affect agriculture greatly, causing indescribable distress, particularly for subsistence farmers. AGRA (2014) states that in South Africa, a 30 percent decline in annual rainfall and a 4°C increase in temperature is estimated, whereas a 50 percent reduction in groundwater is predicted in West Africa. This could result in a significant drought risk. Estimated decreases in harvest in various countries could go down by 50 percent by 2020 and produce net revenues might be reduced by 90 percent by 2100 with a heavy impact on subsistence farmers (Boko et al., 2007). The effects of weather variability on agricultural production are potentially severe in an environment that could warm up by 4°C (Thornton, Jones, Ericksen and Challinor, 2011).

Boko et al., (2007) point out that climate change and variability will threaten agricultural outputs and increase food insecurity in several African countries and regions. AGRA (2014) echoes the same sentiments by stating that the effects of climatic transformations such as erratic weather patterns and extreme weather events are decreasing average yields adding to the challenges faced by subsistence farmers in Africa to produce enough food for the region's growing population. Agriculture forms a substantial portion of the economies of most African countries and as a sector it has the potential to contribute towards major continental priorities, such as eliminating poverty and hunger, reducing rapid industrialization, job creation, sustainable resources and environmental management. According to Pandey and Bhandari (2009), the insecurities and risks associated with agriculture are mainly due to climate-related natural disasters, such as flooding and drought, therefore the extensive variation in agricultural production that has transpired through human history proves that agriculture is an activity reliant on the unpredictability of weather. The outcomes of these climatic variations impact significantly on the food security and

livelihood of many people, predominantly the subsistence farmers who are entirely reliant on rain fed agriculture. Even though strides have been made to reduce the negative impact that climate has on agriculture through technical research and technological development, the production of the sector is still largely reliant on the weather (Pandey and Bhandari, 2009). Therefore there is a need for subsistence farmers to protect themselves against possible livelihood losses. The first steps for them are to identify the variations already occurring in their climate and then start a suitable investment in adaptation (Shemdoe, 2011). Urgent research is required in the field of agriculture production under subsistence farming; this is why this research makes an effort to comprehend the social problems facing subsistence farmers in the case of drought, so that local adaptation and mitigation measures can be put into place**.**

In Swaziland the agriculture industry contributes a major part to the economy while the manufacturing industry is the second contributor (Perry, 2011). The farming areas in Swaziland are classified according to four agro ecological zones namely, Highveld, Middleveld, Lowveld and the Lubombo plateau. The main agricultural produce in the country is sugar, tobacco, maize, cotton, sorghum, peanuts, cattle, goats, sheep, eucalyptus and pine, grapefruit, pineapples, limes, oranges and sugar (Sikuka, 2016). The country's agriculture consists of subsistence agriculture practised on Swazi Nation Land (SNL) and commercial agriculture practiced on Title Deed Land (TDL) (Panin and Hlope, 2013). The TDL is a concession form of ownership and encompasses estates, commercial plantations, farms and ranches. The farm sizes under the SNL initially averaged at about 1.3 hectares, but have allegedly been reduced recently, due to population changes.

Subsistence farming in Swaziland constitutes 74 percent of the arable land and accounts for almost three quarters of the total employment in the kingdom (Nkondze, 2013). According to the Food and Agriculture Organisation, FAO (2015) more than 70 percent of Swaziland's population depend on subsistence farming, however agricultural activities have been deteriorating over the last two decades due to a series of droughts. Given the above statistics of subsistence farming in Swaziland, it becomes imperative to understand the social effects of drought occurrences, local adaptation strategies as well as mitigation measures used by the subsistence farmers.

2.4 Social effects of drought

Drought has killed several million people in Africa and caused major social, environmental and economic damage in the course of the continent's history (Tadesse, 2016). It has been the continent's major natural disaster and many countries in the Sub-Saharan region are facing frequent droughts that have overwhelming impacts on their economies and livelihoods (Onesmo, 2013). This natural disaster is threatening development by making communities less able to absorb and adapt to climatic transformations (Tadesse, 2016). The extreme variability of rainfall and temperature in the extensive arid and semi-arid areas of Africa and also the poor capacity of the continent's soils to preserve humidity are seen as the major causes of droughts in Africa (Benson and Clay, 1998). The increasing rainfall variability and recurrent climatic events, specifically floods and droughts, interrupt the agricultural production, which leads to food crises and loss of livelihood amongst subsistence farmers (Mendelsonh et al., 2000).

The definitions of drought given earlier relate to the effects of a dry spell on human activities, however it is important to note that the impacts or effects of drought may be economic, social or environmental. Drought has the possibility to cause severe direct and indirect effects to a society. Direct impacts include food shortages and water scarcity, which can indirectly affect quality of life in a society, leading to disease, loss of life, malnutrition, conflict and starvation. Some of the environmental effects of drought are loss of biodiversity, water quality, degradation of landscape and soil erosion. The environmental effects can be short term or long term or may be permanent, leading to a perpetual loss of biological productivity. Drought also has economic effects and sectors such as agriculture, forestry, water and energy are predominantly at risk (Jenkins, 2011). Social effects of climate variability induced drought on subsistence farmers will be discussed in the following segments.

2.4.1 Food insecurity as a result of crop failure

Subsistence farming is the main source of staple food production and is the livelihood foundation of the rural people in Africa (Boko et al., 2007). One of the instant impacts of drought is crop failure due to insufficient and scantily spread rainfall (FAO, 2013). When drought has affected crops it leads to a decline in food supply for the affected people. This will greatly affect subsistence farmers because of their over dependence

on their yield for food and income (Boko et al., 2007). Subsistence farmers also contribute towards food security of the nation as a whole by selling their surplus produce. Ilaboya, Atikpo, Asekhame and Umukoro (2012) are of the opinion that natural disasters, such as drought caused by climate variability, are major sources of vulnerability to food security and these events can result in massive crop loss and the consequent increase in food prices.

In Africa, drought is the number one cause of food insecurity and is also one of the most significant causes of malnutrition and famine (FAO, 2011). It is projected that a harvest can decrease by as much as 50 percent by 2020, and crop net revenues could decrease by ninety percent by 2100 (IPCC, 2007). This is largely due to climate variability manifestation through droughts (Kotir, 2010). In a report issued by the United Nations International Children Emergence Fund (UNICEF, 2016) about 2.5 million people and 1.5 million children are facing a food crisis in Malawi. Between December 2015 and March 2016 the United States Agency for International Development (USAID, 2016) issued disaster declarations for Lesotho, Madagascar, Mozambique, Swaziland, and Zimbabwe due to drought and provided nearly $47.4 million at the time in humanitarian help to procure food for drought-affected populations.

The World Food Programme Executive Director, once said;
"We know, we have seen it throughout human history, that a hungry world is a dangerous world. If people don't have enough to eat, only one out of three things happen: they either revolt, they migrate or they die". (Barilla, 2010).

The above quotation indicates that food scarcity leads to a number of social problems and unrest in a society. Ilaboya et al., (2012) adds that food insecurity is a major constraint to a country's immediate and long-term social, economic and political development. Food insecurity is linked to a number of social effects of drought that subsistence farmers face such as malnutrition, death, migration, diseases, conflict, reduced school attendance and learning capacity as well as high levels of poverty. These effects, which are linked to food insecurity will be discussed in-depth in the following segments.

2.4.2 Malnutrition and drought

Hunger, poverty and disease are interlinked and are a direct result of a lack of a sustainable food supply or availability. Reduced food intake, due to food insecurity caused by drought, and a lack of a wide-ranging diet leads to protein-energy malnutrition, especially amongst children below the age of 5 years (UNICEF, 2016). The report further states undernourishment has long-term effects, such as increased vulnerability to illness, slow mental development and premature death. FAO (2017) indicates that malnutrition hinders people from reaching their full potential as malnourished people often underperform in school, minimizing their future job opportunities. Furthermore, malnourished mothers are more likely to have underweight children, who will in turn have a higher risk of physical and cognitive impairment (FAO, 2017). Sick and malnourished adults are therefore less able to work, contribute to local economies, and provide care for their families. This perpetuates a cycle of poverty and underdevelopment in a society.

During the 2015-2016 farming season, Ethiopia was faced with the worst drought in decades, affecting over 10.2 million people who needed food aid and about 435 000 children were under severe acute malnutrition, all in all about 1.7 million children and pregnant women required urgent supplementary feeding (Tadesse, 2016). In Somalia the rainy season which normally starts from October to December had limited amounts of rain and high temperatures leading to drought conditions, therefore the nutrition situation deteriorated with over 320 000 acutely malnourished children needing urgent support and 500 000 children treated for severe malnourishment (United Nations Office for the Coordination of Humanitarian Affairs OCHA, 2016).

During a drought there is usually inadequate water and poor sanitation, which can increase the risk of infectious diseases such as cholera, typhoid fever and diarrhea (WHO, 2016). There are serious concerns that recurring droughts have the potential to increase the spread of HIV predominantly in South Africa, which is currently the most affected region in the world (UNICEF, 2016). The UNICEF (2016) report goes on to say that a study conducted in 2014 in eighteen countries in Sub Sahara Africa displayed that the infection rate of HIV increased in the rural areas by 11 percent after every latest drought. The incidence of hunger and malnutrition leads to poverty and risky survival strategies such as prostitution, used as an option to escape from the

clutches of poverty, however increasing the spread of diseases such as HIV/AIDS. It is important to point out that some of these coping strategies are not sustainable and they create additional problems in a society that can lead to more impoverishment by putting pressure on the already strained family structures.

2.4.3 Livestock loss

Livestock plays different roles in the livelihood of subsistence farmers in Africa, going beyond the direct value of providing food or earning potential. Livestock contributes enormously to the development of a society through finances, nutrition, improved agricultural output and social functions (Campbell and Knowles, 2011). Drought is a serious threat to livestock because inadequate water accessibility and reduced grazing land aggravate livestock conditions in times of drought. According to a report by the FAO (2015), over 80 percent of the damage and losses caused by drought is in the farming sector, particularly crop production and livestock.

Statistics indicate that in 2016, an increasing number of livestock deaths were reported in parts of Lesotho, Namibia, Swaziland and Zimbabwe by the World Food Programme (FAO/WRP, 2015). The loss of livestock, such as cattle, can be a major blow to the livelihoods of subsistence farmers in Africa because livestock plays a vital role in the provision of income, food and nutrition, however they also have significant social roles. Livestock helps in elevating the social status of owners and adds to gender balance by providing women and children the possibility to possess livestock, particularly small stock (Swanepoel, Stroebeland and Moyo, 2010). Livestock, such as cattle, is often used in traditional rituals ceremonies and festivities or given as gifts of worship for example the installation of ancestral spirits, ritual slaughter and bride price (Bettencourt, Tilman, Narciso, Carvalho and Henriques, 2015). The loss of livestock does not only affect the household income and nutrition but it also affects the social life of a subsistence farmer by hindering them to perform traditional rituals, which are believed to be an important part of their wellbeing (Bettencourt et al., 2015).

2.4.4 Children’s withdrawal from school

Research conducted in Zimbabwe by Nyamanindi (2016), discovered that rising food prices and food insecurity due to drought increases child marriages because young

girls are used as a coping strategy to access livestock and food for the family. This however affects the life, education and future of the girl child. According to a report by UNICEF (2015) a severe drought in 2011, that occurred in the Eastern part of Africa, resulted in a major food crisis, leading to a radical drop in school attendance as children were forced to beg for food as well as taking dangerous jobs to help provide for their families. During a drought some children are forced to skip school to fetch water over long distances or to migrate with the family as a result of crop and livestock loss (UNICEF, 2016). This drought coping strategy can hinder the future of children as they are not able to acquire an education and dropping out of school increases the risk of exploitation and abuse (UNICEF, 2015). Children generally become the most vulnerable group during disasters because of their inability to fully protect themselves.

Ndichu (2013) also supports the view that in most cases children of subsistence farmers in developing countries are forced out of school when their only source of livelihood, which is farming, is disturbed. School children are the worst off when poverty creeps in as they are forced to drop out of school and endure starvation because they do not possess experience and knowledge to fight off the pains of hunger. On that note, Ndichu (2013) further argues that the foundation of any economic and social development in a society is education. Therefore, education is supposed to provide a stand where children perform to the best of their ability, lively and positively in the society, as well as shaping them to attain a profession. The acquired education should then mould people into useful citizens, producing quality knowledge towards the development of their respective communities (UNICEF, 2015). Ndichu (2013) believes that education can improve the productive capacity of societies and their political, economic, and scientific institutions. The failure of children to attend school exposes them to threats of abuse, especially the girl child and their inability to acquire skills to develop the societies also perpetuates poverty.

2.4.5 Increased poverty and forced migration

Climate is involved in most of the shocks that keep or bring households into poverty, notably crop and livestock loss, food insecurity and food price increases (Hallegatte et al., 2016). The incidence of drought threatens the goal of sustainably eradicating poverty, as poverty remains the single most critical barrier to the social-economic development of any country. Poverty hinders access to basic needs such as health

care, nutrition and education and as a result communities are trapped in a vicious cycle of poverty. Variations in rainfall patterns can augment rural poverty and food insecurity and as resources becomes scarce, migration might be the only available option (UNICEF, 2016). Mobjörk and van Baalen (2016) are of the opinion that weather extremes and degradation of ecosystems endanger livelihoods and undermine human security, which often result in involuntary migration as well as population displacement. However this migration often disrupts livelihoods as the economically active age group are more likely to migrate, and also causes family displacement. The drought migrants place increasing pressure on the social infrastructure of the urban areas they migrate to in search of greener pastures, leading to increased poverty and social unrest (Ojos, 2014). When the drought has abated, the migrants seldom return home, depriving rural areas of valuable human resources (Hallegatte et al., 2016).

2.4.6 Conflicts as result of drought

According to the (IPCC 2007a) the definite and potential relations between the environment, climate variations and conflicts are vital for Africa, as it is one of the most vulnerable regions subject to climate stress. The connections between conflict and climatic shocks are believed to bear negative impacts on vulnerable communities. In Africa, climatic shocks such as droughts and floods are deemed to be amongst the main causes of conflict, particularly in communities where resources are limited (Calderone, Heady and Maystadt, 2014). Conflicts are also likely to compound prevailing vulnerability, which often leads to poverty as well as conflict at household, community even national levels (Calderone et al., 2014). According to Mobjörk and van Baalen (2016) climate-related environmental changes such as droughts and floods are often environmentally unfriendly, which might offer people limited time to adapt or to find non-violent resource sharing systems, therefore leading to conflicts.

A number of studies indicate that in times of unfavourable weather conditions, like droughts, there is an increase in communal conflict or civil wars. Mobjörk and van Baalen (2016) note that these violent conflicts can result because of the collapse of social relations, which frequently propel communities to embrace unsustainable livelihoods, therefore perpetuating a cycle of conflict leading to long-lasting insecurity. Calderone et al., (2014) states that conflicts during droughts can result from migration,

these migration-induced conflicts usually occur in areas with more resources where livelihood conditions are better. In East Africa for instance, regional migration occasionally results in violent conflicts over natural resources because people's inability to sustain their livelihoods often lead to them migrating to regions where more resources are available (Mobjörk and van Baalen 2016). This often results from the absence of common conflict resolution mechanisms to resolve conflicts over resources peacefully, due to different cultures. In this case migration can also be viewed as an adaptation strategy.

Besada and Sewankambo (2009) state that in conflict zones, such as the Horn of Africa, Darfur and Sahel, people are already living in fragile conditions, which make them more vulnerable to weather shocks such as drought and increase their risk of violent conflict. Calderone et al., (2014) echoes the same sentiments by alluding that most countries in the Horn of Africa are vulnerable to conflict and drought occurrence, however Somalia exemplifies the multifaceted links that exist between climatic shocks, conflict as well as weak governance. It can therefore be noted that these fragile countries have a higher risk of conflict due to weather extremes worsening their existing vulnerability.

2.5 Previous drought experiences in Swaziland

Manyatsi et al., (2010) assert that climate variability is noticeable in Swaziland, such as droughts, erratic rainfall and severe weather conditions. The kingdom of Swaziland has been suffering from severe climate variability induced droughts, which are revealed by above normal temperatures, below normal rainfall and prolonged dry spells (National Emergency Response, Mitigation and Adaptation Plan NERMAP, 2016). Droughts leading to the decline of maize production, incessant lightning such as cyclone Domonia in 1984, heavy rains and floods in 2000, hailstorms and strong winds are given as evidence of climate variability in the country (Manyatsi et al., 2010).

The country has been experiencing adverse weather conditions for two consecutive years, which resulted in the Government declaring a national drought disaster on the 18th of February 2016, reacting to extensive climate variability induced drought conditions witnessed from 2014 (The United Nations UN, 2016). According to the

National Meteorology department of Swaziland (2017), October 2014 to February 2016 received below average rainfall with projections forecasting that the severe weather conditions will last into the year 2017. The 2015 to 2016 cropping season was characterized by below normal rainfall and the 2014/2015 cropping season was also characterized by long dry spells and uneven rainfall distribution, which has had negative effects on subsistence farming (NERMAP, 2016). Mlenga (2015) points out that these drought experiences have compromised efforts to accomplish sustainable development and livelihoods as well as food security in Swaziland.

Agriculture as a sector is at risk to climatic transformations, especially in a situation where 70 percent of the population is dependent on the agricultural sector for their livelihood and to add to this, the country has been facing an economic decline and the impact of HIV/AIDS (Mlenga, 2015). Manyatsi et al. (2010), indicate that over the years Swaziland has experienced frequent, severe droughts where people lost their lives as well as livestock. In 2007, a severe drought was experienced and declared a national disaster, it affected the four regions of the country with over 410 000 people in need of humanitarian aid including agricultural inputs (Mlenga, 2015).

A report by SADC (2016) offers an analysis of the rainfall patterns, stating that the October 2015 to December 2015 phase, which symbolizes the first half of the planting period, was the driest in 35 years in numerous parts of Southern Africa, resulting in a drought. On the other hand the Swaziland Drought Assessment Report (SDAR, 2016) indicated that there was a noticeable decline in the harvest in the 2015-2016 farming season, which had not been observed in the past 20 years. NERMAP (2016) indicates that the total area of crops planted was significantly reduced due to the below average rainfall received during the 2015 to 2016 farming season. Maize planting in 2015 declined by 80 percent and projections indicated that those who managed to plant their harvest were estimated to have a drop in production of 64 percent, resulting in about 550 744 households that will be food insecure during the 2016 to 2017 consumption year (SDAR, 2016). This situation resulted in severe food insecurity in the country. Drought in Swaziland has led to a scarcity of water supplies for humans, crops and livestock. By the end of January 2016, thirty eight thousand cattle had been reported dead due to deteriorating pasture because of the drought (NERMAP, 2016).

2.6 Subsistence farmer perceptions of climate variability and drought

Drought is at the top of the list of all the natural hazards, with the highest numbers that directly affect people (Tadesse, 2016). Adger, Saleemul Huq, Brown, Conway and Hulmea (2003) are of the opinion that the perceptions, which are the identification and understanding of ecological phenomena, bear a huge impact on people's choice of response. Sanfo, Lamers, Mueller and Fonta (2014) assert that the capability of farmers to perceive climatic transformation such as climate variability is an important prerequisite to adapt. Jarawura (2014) points out those subsistence farmers in Africa possess the competence and understanding of their climate to identify variations, predominantly those regarding rainfall. Farmers in general manage climate variability based on their perceptions of shifting climatic patterns (Sanfo et al*.,* 2014). Kalinda (2011) argues that subsistence farmer perceptions of climate concerns are influenced by their age, beliefs, education, judgment and their previous experiences with bad seasons.

Perceptions of subsistence farmers to climate variability and the risks associated with it, such as droughts, are significant in configuring the problem and the way forward (Kalungu, Filho and Harris 2013). According to Slegers (2008), the perceptions about climate is a requirement for subsistence farmers to make knowledgeable decisions about local adaptation plans, and their perceptions are formed by their own experiences of how climate has impacted their livelihoods. Kalungu et al. (2013), further note the importance of the perceptions of the people affected by climate variability such as drought before trying to come up with solutions. Udmale et al. (2014), claim that the perceptions and information on earlier drought impacts are thus vital for the development of future drought reactions. An understanding of the perceptions and social impacts of drought on subsistence farmers is essential in formulating technological and policy interventions for successful drought relief and mitigation (Udmale et al., 2014). Consequently, before any discussion of adaption methods to climate variability induced drought can be made, the perceptions of subsistence farmers must be considered as vital, as it significantly influences the decision making towards their farming activities.

A study conducted in the Laikipia District of Kenya on "Local Perceptions and Responses to Climate Variability" by Ogalleh, Vogl, Eitzinger and Hauser (2012)

indicate that subsistence farmers noted that the rainfall was more regular and predictable in previous seasons, but the rain was becoming more unpredictable in recent years. Subsistence farmers in the district continually emphasized the deteriorating agricultural production as a result of erratic, low or occasionally non-stop rainfall combined with high temperatures and the incidence of extreme climatic events comprising persistent droughts, frost and hailstorms (Ogalleh et al., 2012). Rainfall was reported as reduced whereas an increase in temperature and wind was also noted.

In a research conducted by Mtambanengwe, Mapfumo, Chikowo and Chamboko (2012) in Wedza and Makoni districts in Zimbabwe about 95 percent of farmers in both Makoni and Wedza specified that they had detected shifting trends in weather patterns stating progressively random trends in rainfall distribution as the key change observed during their generation. The rainy season was believed to be currently described by extended dry spells, increased occurrences of flash floods as well as stretched intra-season dry spells. Approximately 40 percent of respondents in Makoni credited changes in weather patterns to natural causes. Over 20 percent of the respondents in Wedza district said that cultural forces, such as a lack of respect of sacred places such as traditional prayer shrines, the increase in Christianity and the collapse of rain-making ceremonies were some of the causes of low rainfall and droughts. While ozone weakening was pointed out as the cause for changing weather patterns during the focus group, it was predominantly by those retrenched and retired teachers who were seemingly knowledgeable (Mtambanengwe et al., 2012).

The two studies mentioned above support the notion that subsistence farmers are aware that the climate around them is changing. Subsistence farmers in both studies are aware that the weather is changing by giving evidence of weather patterns. However, the respondents in the Mtambanengwe et al., (2012) study believe that the climate variability is mainly due to cultural forces with only a few educated farmers convinced that it was due to the weakening of the ozone layer. This alludes to an earlier argument by (Kalinda, 2011) that perceptions subsistence farmers to climate concerns are influenced by beliefs and not education. On this note, Jarawura (2014) states that a successful adaptation plan to drought is partially reliant on the farmers' perceptions as well as how they are harmonized with scientific information systems

and local strategies. Nhemachena, Mano, Mudombi and Muwanigwa (2014) goes on to say that it is not enough to just perceive climate stress, the farmers need to adapt to it as well. Farmer perceptions of climate variability need to be updated with current climate information in order for them to adopt relevant adaptive strategies.

2.7 Local adaptation strategies to drought by subsistence farmers in Africa

Overwhelming and recurring droughts as a result of rainfall variability occurs frequently in many parts of Africa causing significant loss to the agriculture sector. The continent is one of the most vulnerable continents to climate change and climate variability, a condition worsened by the interaction of numerous pressures happening at different levels and low adaptive capacity (Boko et al., 2007). Adger et al., (2003) defines adaptation strategies as responses to climatic transformations that can be utilized to lessen vulnerability. Adaptation often allows a system to decrease threats related to hazards by reducing its social susceptibility, poverty as well as building resilience especially when backed up by policy. Adaptation strategies are defined by Pandey and Bhandari (2009) as a means that farmers can use to make various modifications in their production, consumption and livelihood practices, implementing conservative measures to decrease the negative impact of climatic transformations. Morton (2007) stipulates that vulnerability of subsistence farmers to climate variability is due to their location and the lack of information on ways to adapt to changing weather conditions. Climate variability, particularly severe variability, generates new risks such as more recurrent and extreme droughts, sudden breaks in seasonal rainfall and severe high temperatures (Gukurume, 2013). African farmers have established numerous adaptation alternatives to cope with climate variability induced droughts; nonetheless such adaptations may not be adequate for future changes in the climate (Boko et al., 2007). It becomes essential thus to seek to improve the ability of farmers to react and adapt to such climatic misfortunes (Chhetri, 2012).

2.7.1 Examples of local adaptation strategies used in Africa

It is important to note that subsistence farmers are not motionless prey to the effects of climate variability induced droughts. Subsistence farmers have been affected by drought impacts for many years, and they have established different strategies to adapt to this phenomenon (Mpandeli, Nesamvuni and Maponya, 2015.) Udmale et al.,

(2014) states that there are several drought adaptation and mitigation choices accessible for arid land farming and these normally focus on soil and water conservation. According to research conducted by Mpandeli et al., (2015) in the Sekhukhune District of Limpopo subsistence farmers are planting crops that mature early and require less water such as sorghum. Others are decreasing the number of livestock, particularly in times of weather uncertainties. In Malawi, due to recurring droughts, some farmers are moving away from farming, starting small businesses, such as selling charcoal and firewood. Others are changing crop types to cope with droughts and alleviate the unfavourable impact of crop failure on livelihoods of subsistence farmers (Coulibaly, Gbetibouo, Kundlande, Suleshi and Beedy, 2015).

According to Mavhura, Manatsa and Mushore (2015) in Zimbabwe, in the Zambezi valley, some of the adaptive measures used by subsistence farmers included planting short season crops and drought-resistant crops, staggering the planting period of fields to reduce risks on the total crop failure and making use of zero tillage, stockpiling supplies, selling livestock, reducing the intake of meals per day and gathering wild fruits. In Tanzania subsistence farmers utilize native adaptation measures to deal with the impacts of climate variability and these include anti erosion and maintenance of pits and ridges on steep slopes, bush fallow, using ponds on mountain slopes fed by springs as a form of irrigation and using land between rivers to grow crops throughout the low rain season (Shemdoe, 2011). Gathering of wild fruits and moving towards none farming activities such building, crafting and informal labour are also some of the adaptation strategies utilized by the locals in Tanzania. Planting anti drought crops, changes in nutritional choices and use of different livestock feed traditions and relocation of livestock in seeking grazing land and water are some of the adaptive strategies that can help bring sustainable agriculture to the subsistence farmer (Shemdoe, 2011). Migration has been cited by Dercon (2002) as one of the coping strategies in drought disasters..

2.7.2 The importance of local knowledge in adaptation strategies

When communities are equipped with local knowledge and insights it should be considered as important knowledge that has viable livelihood adaptation options (Shemdoe, 2011). Communities must therefore build their resilience by adopting

appropriate technologies while making the most of their traditional knowledge and diversifying their livelihoods to cope with current and future climate stresses (Blanco, 2006). Morton (2007) is of the view that local knowledge and experience are important because it is these people's livelihoods that are directly impacted by extreme climate stresses. Addressing local adaptation plans from the bottom up therefore helps communities to create their own local adaptation strategies (Arendse and Crane, 2010). Agrawal and Perrin (2008) echoes the same sentiments by stating that "adaptation is inherently local''.

It is important to note that scientific knowledge is not the only valid type of information about drought adaptation, local knowledge and experiences should also be prioritized. Mtambanengwe et al., (2012) states that limited availability of contemporary climate information forces farmers to only depend on native knowledge to carry out their farming activities and react to droughts and climate variability. There is a need to bridge the gap between scientific and local knowledge in order to create interventions and policies capable of withstanding natural hazards like floods and droughts (Blanco, 2006). Local coping strategies and traditional knowledge need to be used in synergy with Government and local interventions. On this note, Shemdoe (2011) reiterates the need to find, learn and write down these indigenous adaptation strategies and complement them with technical based information. Therefore, in order to have positive and successful adaptation strategies it becomes important to integrate the native and contemporary information and adaptation strategies. Adger et al., (2003) assures us that local adaption plans can be successful and can result in sustainable agriculture in the face of increased climate variability. Coulibaly et al*.,* (2015) further notes that there is therefore a necessity for polices to support subsistence farmers, to help them on a daily basis with drought related adjustments.

2.8 Factors affecting the local adaptive strategies

Climate variability brings new dynamics and qualms into the farming sector, hence agricultural adaption is a continuous and dynamic process through which farming communities adapt to altering socio-economic, technology, resources, and regions (Chhetri, 2012). Therefore, the over reliance on marginal lands, stressed natural resources as well as sensitive rain-fed agriculture for development in Africa generate

a difficult future in the face of increased climate variability (Arendse and Crane, 2010). Adaptation is expected to address the effects of climate variability and other weather stresses; however, adaptation strategies are normally inhibited in many ways. Barriers to adaptation emerge due to the characteristics of the people involved, the nature of the institutions involved and the setting within which the societies and systems function (Islam, Salu, Hubaccek and Paavola, 2014). The prevailing conditions of poor access to information and knowledge, ineffective institutions, limited economic resources and limited infrastructure also place accumulative pressure on the existing adaptation strategies (Arendse and Crane, 2010). These barriers can inhibit the development and execution of adaptation strategies. Therefore, there is an urgent need to strengthen successful adaption strategies and move beyond the barriers, since the effects of climate variability are presently witnessed and felt (Arendse and Crane, 2010). The identified barriers to effective adaptation strategies are finance, social and cultural barriers, limited information, lack of advanced technology and unsupportive institutions. This will be discussed in depth in the following section (Section 2.8.1).

2.8.1 Financial barriers

The impacts of climate variability tend to be felt more by developing countries and their capabilities to adapt to the new climatic transformations are limited (Gukurume, 2011). The lack of financial capital is one of the main barriers to adaptation because it limits the usage of improved crop varieties and change of livelihoods in agricultural communities (Islam et al., 2014). Financial barriers also limit the implementation of new adaptive strategies which can protect farmer yields in underprivileged households and societies (Antwi-Agyei, Dougill and Lindsay, 2013). As a result, communities and households with restricted financial capital tend to focus on short term adaptation plans rather than on long term plans with benefits of reduced vulnerability and sustainability (Gukurume, 2011). Deressa, Hassan, Alemu, Yesuf and Ringler (2008) state that barriers to adaptation such as lack of information and money, unavailability of labour and poor potential for irrigation are connected to poverty. Limited financial resources therefore deter farmers from attaining the much needed resources and expertise that enable them to fully implement successful adaption plans. This further exposes subsistence farmers and can trap them in a vicious cycle of poverty, which can be difficult to escape.

2.8.2 Social and cultural barriers

Social barriers to adaptation strategies focus on the social and cultural practices that rule how people respond to climate variability such as prolonged drought, rising temperatures, floods and uncertain rainfall (Jones, 2010). The way people perceive, understand and think about climate risks and adaptation depends on their beliefs, values and worldview (Islam et al., 2014). Adger, Barnett, Brown, Marshall and O'Brien (2013) indicate that culture is central to the decision to adapt and therefore the identification of risks and the subsequent implementation of appropriate adaptation strategies are vital. Antwi-Agyei et al. (2013), argue that the belief systems of communities can create a major barrier to the implementation of climate adaptation strategies. Strong beliefs, cultural traditions and the worldviews of individuals or society significantly influence the way people perceive climate issues and thus their adaptation strategies.

2.8.3 Limited information

The access to information on climate matters is a very important instrument that can be utilized to improve the acceptance and application of adaptation strategies by households in Sub-Saharan Africa (Antwi-Agyei et al., 2013). The adaptive capacity of subsistence farming is influenced by the farmer knowledge and perceptions on climate variability and further requires that farmers observe and acknowledge that the climate is changing around them (Sanfo et al., 2014). Mtambanengwe et al., (2012) state that the accessibility of climate information and services can potentially allow farmers to come up with knowledgeable farm management and adaptation choices. Deressa et al., (2008) points out that farmers who have an advanced education are expected to adapt better to drought because advanced education is linked with access to information about enhanced technologies. Deressa et al., (2008) further argues that lack of information on suitable adaptation choices could be attributed to the absence of research on climate issues and adaptation alternatives in many African countries. The absence of suitable information on climate issues can be connected to the shortage of sufficient advanced equipment at meteorological departments in Africa (Antwi-Agyei et al., 2013). Mtambanengwe et al., (2012) states that increased awareness of risks linked with climate change and variability amid smallholder farmers is vital in elevating their ability to expand the essential adaptive methods.

2.8.4 Technological barriers

Adaptation can be hindered by technology, which includes lack of hard engineering structures or smaller equipment, tools as well as a lack of techniques (Islam et al., 2014). Antwi-Agyei et al. (2013), points out that technological development such as the development of new crop varieties, early warning systems and irrigation techniques are important for climate adaptations. Africa has low levels of technological development compared to developed countries, hence subsistence farmers may have limited adaptation choices available. This can therefore restrain adaptation prospects to adopt advanced technologies that could improve food security through the development of early warning systems (Antwi-Agyei et al., 2013). Africa's low levels of technology can therefore inhibit the timely forecast and prediction of the precipitation patterns that can permit farmers to make knowledgeable choices (Deressa et al., 2008). According to Islam et al. (2014), technological barriers can lead to incorrect information as a result of restrictions in modelling the climate system or a lack of precise weather forecasts. However it is important to note that although some adaptations may be technologically possible, they may be constrained by economic and cultural barriers as well.

2.8.5 Institutional barriers

Institutions are defined as the "social cement which link stakeholders to capital of different kinds with the means of exercising power and so define the gateways which they pass on the route to positive or negative adaptations" (Antwi-Agyei et al*.,* 2013). Institutional factors comprise of all social tools of communication, which are used to achieve adaptation to climate and these tools consist of rules, principles, implementation and agricultural extension which govern access to adaptation (Komba and Muchapondwa, 2012). According to Agrawal and Perrin (2008) institutions play a vital role in the improvement of the local society's abilities to manage climate variability and providing tools that assist in shaping the collective and individual communications in a society. Institutional barriers may restrain adaptation since they define the procedures and laws that administer and control access and entitlement to a livelihood. Islam et al*.,* (2013) asserts that institutional barriers have restricted the capability of the rural societies to manage extreme climate events through restrictive access to markets and in terms of uncomplimentary development policy assets. On

that note Antwi-Agyei et al. (2013), predicts that limited climate adaptation information as well as weak institutional capacity, combined with the climate variability will result in food insecurity in many African countries.

2.9 Agricultural risk and vulnerability

Agricultural production is prone to several uncertainties because whichever farm production strategy is employed, it is normally related to numerous possible consequences with assorted probabilities (OECD 2009). Jennings and Magrath (2009) argue that subsistence farmer vulnerability to climate variability is predominately intensified by their overdependence on rain-fed farming methods combined with issues such as prevalent poverty and fragile financial capacity. According to Fafchampsy (2009) for many subsistence farmers risk is a serious root for poverty and remains a matter of life and death for many. According to Bazza, (2014) smallholder farmers are facing many threats towards their agricultural production such as pests, disease, plagues, extreme weather conditions and market shocks, which repeatedly weaken food and income security at household level (Harvey, Rakotobe, Rao, Dave, Razafimahatratra, Rabarijohn, Rajaofara and MacKinnon, 2014).

Since smallholder farmers usually rely directly on agriculture for their livelihoods and possess inadequate resources as well as little capability to manage shocks, any cutbacks to agricultural productivity implies major effects on their wellbeing, food security, nutrition and also income (FAO, 2012). According to Harvey et al. (2014), agriculture remains the backbone of most subsistence farmer livelihoods, operating as the key source of household food as well as a source of income. Therefore, the fate of most subsistence farmers is narrowly intertwined with that of farming. Mudombi-Rusinamhodzi, Siziba and Kongo (2012) assert that vulnerability to climate variability induced threats such as drought can be effectively lessened given the comprehension of the most susceptible effects and also how the connections between nature and society shape the hidden elements that contribute to vulnerability.

2.9.1 Subsistence farmer risks in the context of climate variability and drought

Climate variability is presently impacting the agricultural production systems in Africa. Agriculture is profoundly connected to weather and climate, which are the main drivers

of agricultural production (Selvaraju, 2013). In many regions, smallholder farmers are facing various risks to their farming activities, which includes extreme weather events, pests and disease outbreaks, just to name a few, which often weaken their household income and food security (Harvey et al., 2014). The fact that smallholder farmers normally rely directly on agricultural production for their livelihoods and own insufficient resources and skills to mitigate shocks or any cutbacks to their yield can have substantial effects on their well-being, income and food security (Derribew, 2013).

In Southern Africa climate variability is the leading cause of food insecurity. Thornton et al., (2014) indicate that variations in terms of frequency and severity of extreme climate events and the variability of weather patterns will have major impacts on human and natural systems increasing incidences of heat stress, drought and flooding. Occurrences are predicted to bear countless adverse impacts due to changes in mean variables alone (IPCC, 2012). Rainfall variability is largely high in Africa and it stresses the biophysical resources such as crops directly and social conditions indirectly (Barnett and Adger, 2007). According to Dile, Karlberg, Temesgen and Rockström (2013) drought risk holds back farmers in terms of farm investments like procuring fertilizers as well as and other farming inputs. As a result yields are low, even in seasons where enough rainfall is received for cropping, therefore farmers are trapped in poverty and locked in a subsistence condition.

2.9.2 Vulnerability to climate variability induced drought

According to Jones, Jaspars, Pavanello, Ludi, Slater, Arnall, Grist and Mtisi (2010) vulnerability can be managed. Systems have the capability to manage, fight and recover from the effects of weather shocks or stresses. Rain-fed agriculture is responsible for approximately 90 percent of the continent's food as well as the provision of a livelihood for over 70 percent of the population, therefore nearly 60 percent of the population in Africa is vulnerable to recurrent and severe droughts due to the over dependency on rain fed agriculture (Shiferaw, Tesfaye, Kassie, Abate, Prasanna and Menkir, 2014). Projections indicate that by the year 2025 several African countries will experience water stress, scarcity of food and vulnerability signifying that water resources are greatly reliant on and controlled by climate (Kandji, Verchot and Mackensen, 2006). The inappropriate use of land and resources also intensifies the

vulnerability of people on the continent, as livelihoods of many subsistence farmers and pastoralists are dependent on degraded areas making them greatly vulnerable to droughts and other climate threats (Padgham, 2009). Drought vulnerability is also as a result of a number of factors such as insufficient finances, structures and management, limited technology, or environmental limitations (Naumann, Barbosa, Garrote, Iglesias and Vogt, 2013). It therefore becomes imperative for subsistence farmers to invest in better rainfall management systems such as irrigation and rain harvesting techniques to reduce the vulnerability of agricultural production to drought.

The augmentation of drought vulnerability in Africa is also linked to the incessant growth of the population, which bears vast consequences when accompanied with poverty and insufficient policies (Tadesse, 2016). Increased population growth imposes heavy burdens on inadequate and fragile land resources, which often result in unsustainable resource use and environmental destruction. In subsistence farming, crop failure presents limited alternatives to the provision of food for households, therefore subsistence farmers are often left with limited choices exploiting delicate land resources for survival, automatically becoming both agents and victims of environmental degradation as well as desertification (Matous, 2015). Generally, the high levels of chronic poverty add to a low adaptive ability to drought and impends livelihoods of the underprivileged, more than other social groups (Shiferaw et al., 2014). The increased vulnerability to drought disasters might arise from augmented frequency and severity of drought, increased societal vulnerability or a mixture of the two (Kandji et al., 2006). However, a comprehension of the vulnerability of subsistence farmers to drought can assist towards increasing the continent's preparedness and therefore inhibit the overwhelming effects of the risks (Naumann et al., 2013).

2.10 Building resilience to climate variability induced drought

Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Resilience also essentially comprises of processes focused on changes, changes to the manner in which communities and households learn, exploiting new opportunities and reacting to weather events (Jones et al., 2010).

According to Keck and Sakdapolrak (2013) there are three central capacities for resilience namely persistence, adaptation and transformation, the equilibrium between the three elements is necessary to move toward resilience building.

Resilience can be built by reducing exposure to climate shocks, reducing the vulnerability of systems to shocks through utilizing drought resistant crops and lastly by increasing the adaptive capacity of a society (FAO/OECD, 2012). Therefore in simple terms, resilience can be accomplished through the reduction of vulnerability and increasing the adaptive capacity of a society. According to Adger (2003) resilience centres on risk reduction through enhancing the adaptation abilities of a society and agricultural systems on which they are dependent on. This allows farmers to fulfil present and future food requirements, whilst coping with weather uncertainties. Implementation of drought tolerant crop varieties, crop diversification, improved soil fertility and water management as well as strengthening community support networks have been identified as key components of building drought resilience and will be discussed in the following segments.

2.10.1 Drought tolerant crop varieties and crop diversification

In agriculture, one of the major strategies of dealing with drought has been the implementation of drought resistant crop varieties in order to address water scarcity (Shiferaw et al., 2014). Many new drought-tolerant seeds are being developed using advanced conventional breeding, without the need of genetic engineering for example sorghum, millet soybean and rice varieties (Thompson, Chidawanyika, Kruszewska and Tirado, 2015). Many national and international research institutes have recorded vital improvements on drought tolerance of major grain crops in Africa (Shiferaw et al., 2014). The use of drought tolerant crops has been reported to be effective in combating food insecurity in drought prone areas such as the Horn of Africa.

According to Thompson et al., (2015) growing diverse crops has been proven to be a dependable method of making agriculture resilient to a progressively unpredictable climate. Therefore if subsistence farming is diverse, so is their stream of income, offering security during periods of uncertainty. Frison, Cherfas and Hodgkin (2011) indicate that narrow crop diversity has been recognized to be one of the causes of

malnutrition in Africa. Instead of sticking to a monoculture of drought sensitive crops, farmers can plant a diversity of resilient crops with a different nutrient base as a drought resilient strategy. The diversification of crops by subsistence farmers guarantees harvesting of crops year round, mostly if early maturity crops were used such as sweet potatoes or cassava, which permits cultivating two crops per year (Thompson et al., 2015).

2.10.2 Improved soil fertility and water management

The reduction of soil nutrients has turned out to be one of the major limitations to food security in sub-Saharan Africa due to low crop yields that are leading to decreasing per-capita food production (Shiferaw et al., 2014). A crucial stage towards strengthening the resilience against drought shocks is securing the availability of sufficient water, availability of soil nutrients and planting crops with low water uptake (Dile et al., 2013). Soils that have adequate nutrients are necessary for good yields however, due to extreme weather events such as drought soils are affected and become vulnerable. Therefore, in the face of increased climate variability, resilient soils that are capable of producing great harvests can be established through practices that provide nutrients as well as good soil conditioning in order to advance water holding capacity, which is an important factor during drought (Greenpeace, 2010). Building drought resilient soils also requires measures that are sustainable for example through utilizing resources that are locally accessible and methods that rely on knowledge rather than costly outside inputs which are susceptible to price increases (Thompson et al., 2015). These include cover crops and crop residues that protect soils from wind and water erosion, and legume intercrops, manure and composts that build soil rich in organic matter, enhancing soil structure. These are all ways to help increase water infiltration, hold water once it gets there and make nutrients more accessible to the plant (Shiferaw et al., 2014).

A key strategy in improving food security in a continent which is dependent on rain-fed agriculture is through retaining and using variable rainfall effectively. A combination of local knowledge and scientific climate information, on-farm and community water harvesting and water conservation management measures can improve yield as well as providing advantages under climate variability (Shiferaw et

al., 2014). The implementation of water harvesting systems lessens the risks of failure in agricultural production and also increases the willingness of farmers to invest in farming inputs such as fertilizers (Dile et al., 2013). Therefore the combination of water harvesting with fertilizer usage systems has the potential to increase agricultural production. The mutual effect of improved productivity coming from improved water management as well as other inputs has the potential to convert the farming system from subsistence to commercial farming (Dile et al., 2013).

2.10.3 Strengthening community support networks

The possibility and severity of droughts are projected to increase globally due to the incidence of climate variability, however strengthening community support networks is believed to help in building resilience against the climatic phenomenon. Social networks are ties that facilitate in the informal exchange of information, resources or agricultural inputs such as fertilizer (Bernier and Meinzen-Dick, 2014). These ties can comprise friendship, kinship, tribal or religious connections. According to Dile et al., (2013) social networks are important in building an adaptive capacity, which therefore increases resilience to extreme weather events. Consistent networks of interactions between rural households could possibly increase the resilience of rural communities to weather shocks. Abid, Ngaruiya, Scheffran and Zulfiqar (2017) indicate that social networks are an essential consideration in discussions of resilience because they define whom and how people work together and also affect the circulation of resources.

Social networks can have a positive impact on the implementation of new technologies and farmers use social networks as a trusted and dependable source of information (Bernier and Meinzen-Dick, 2014). Thompson et al., (2014) is of the view that by strengthening community-based networks farmers can find solutions to existing problems as well as build resilience to climate shocks through farmer field schools that will extend new methods and safeguard indigenous knowledge. Subsistence farmers usually face challenges in acquiring finances from banks that can help improve their farming activities. However, Bernier and Meinzen-Dick (2014) indicate that through social networks farmers are able to access more formal credit opportunities.

2.10.4 Combination of technologies and institutional innovations

Drought should to be regarded as a long-term developmental problem that demands a multi-sectorial and multi-dimensional reaction in most of Africa's regions (Gautman, 2006). Therefore, measures for tackling drought and improving resilience of farmers to weather shocks should involve combining technological, institutional as well as policy alternatives (Shiferaw et al., 2014). The use of combined strategies therefore offers positive effects in lessening sources of risk in production and vulnerability, thus extending livelihood resilience. The integration of technological, institutional and policy interventions provide great possibilities for reinforcing livelihoods over enhanced agricultural productivity and building the ability of families to expand incomes to deal with drought-induced shocks in consumption (Hellmuth, Moorhead, Thomson and Williams (2007). Keck and Sakdapolrak (2013) argue that the fundamental strategies for lessening vulnerability as well as efficiently handling climate variability and extremes are enhanced infrastructure, diversification of livelihoods, improved access to markets and information, access to risk-reduction and productivity-enhancing tools. Resilient communities can be created in the face of recurring drought by improving farmer decision making through assess to climate information, building safety-nets and social protection programmes, usage of early warning systems and monitoring information to alert farmers and enhance farmer access to credit (Hellmuth et al., 2007).

2.11 Conclusion

The chapter started by defining different types of drought and went on to give the previous drought experiences in Swaziland. The role of subsistence farming in Africa and Swaziland was also addressed in the chapter. The chapter also focused on the social effects of drought caused by climate variability and how they affect the livelihoods of the farmers in question. Farmer perceptions on drought and the importance of these perceptions were reviewed in this chapter. Local adaptation measures and factors hindering adaptation strategies to climate variability were also outlined in this study together with the agricultural risks and vulnerabilities faced by subsistence farmers in the face of climate variability induced drought. The literature reviewed in this chapter indicates that many scholars echoed the same sentiments that Africa, as a continent, is the most affected by climate issues due to its low adaptive capacity and overdependence on rain-fed agriculture. Therefore, the importance of as

well as how farmers can build resilience to climate variability induced droughts was addressed at the end of the chapter.

CHAPTER 3: STUDY AREA AND RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives the background of the study area, which is the Siphocosini community located in Swaziland. A description of the community's location, population, weather and agriculture activities are also given. The methodology used to collect both quantitative and qualitative data as well as data collecting tools employed in the study are outlined. The chapter concludes with ethical considerations that need to be observed in the study as well as the study limitations.

3.2 Study Area Description

3.2.1 Location and topology

Swaziland, also known as the kingdom of Swaziland, is a land locked country located in the Southern part of Africa and it has neither coastline nor maritime claims (Figure 3.1). It is surrounded by South Africa to the north, west and south, and Mozambique to the east. It lies between latitudes 25º 43' and 27º19' south, and longitudes 30º47.5' and 32º06' East (Loffler and Loffler, 2005). The kingdom has a total area of about 17.363 km² and in terms of land boundaries, it borders with Mozambique for 105 kilometres, and South Africa for 430 kilometres, giving a total land boundary length of 535 km. The topography mainly comprises of mountains and hills with various temperately sloping plains. The Great Usutu River is the lowest point at 21 metres and Emlembe is the highest point at 1,862 m in the country (Wikipedia, 2017).

The study area, which is Siphocosini, is a community situated in the Hhohho administrative District, under the Motjane (Tikundla) constituency in Swaziland. It is located about 17.5 kilometres away from the capital city of Mbabane. The community falls under the Highveld ecological zone lying in the western part of the country, covering an area of approximately 49.74 km2 (Census, 2007). The Highveld ecological zone, in which the Siphocosini community falls, is dominated by hills on a sharply dissected escarpment with transitions to a plateau and has short grassland on rocky outcrops dissected by narrow gorges (Loffler and Loffler 2005).

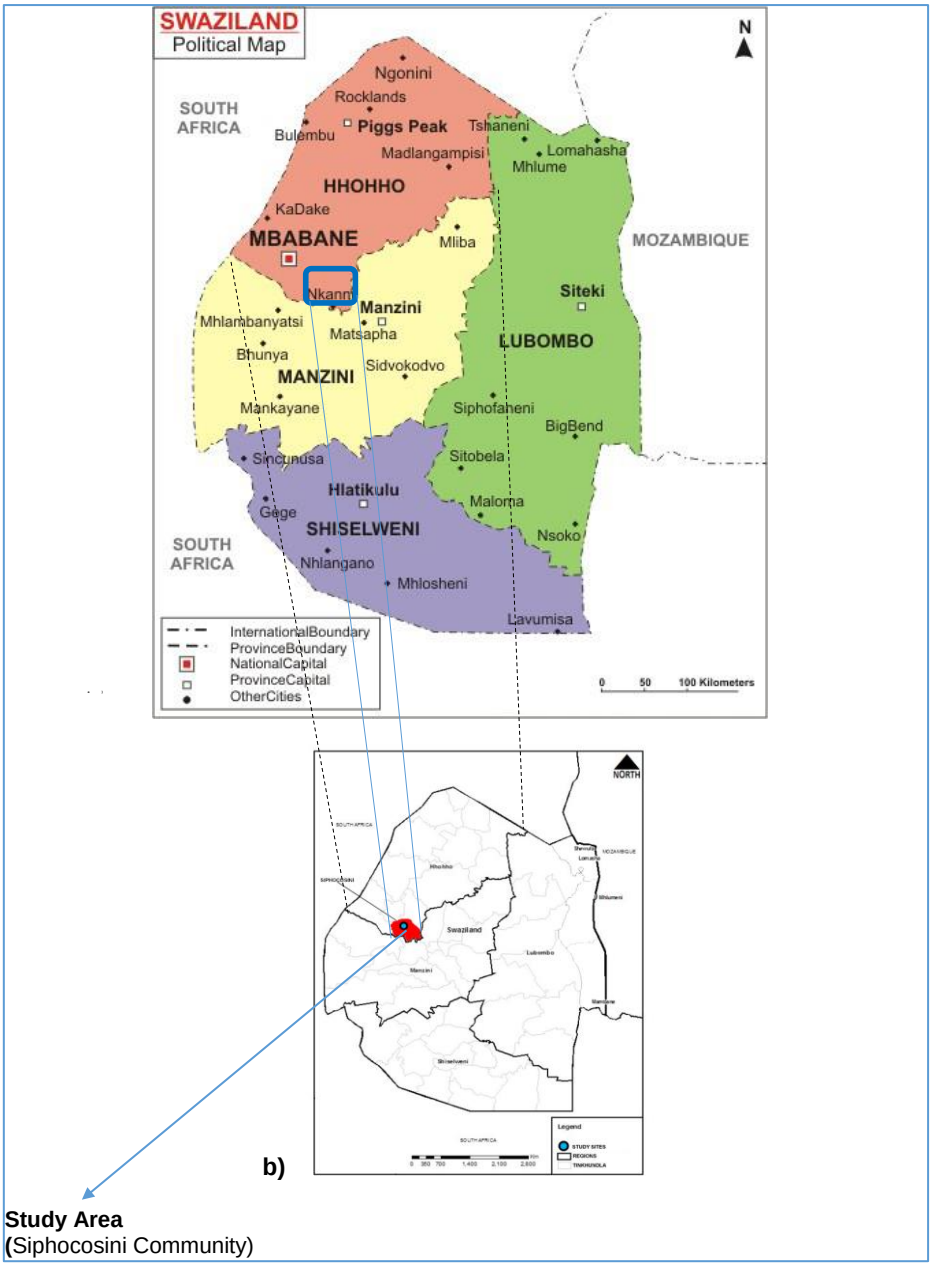

Figure 3.1: Location of Study area a) Swaziland with divisions of administrative regions / provinces & cities and b) Project area of Siphocosini Community.

3.2.2 Demography

Swaziland is amongst one of the smallest countries on the African continent with a population of approximately 1.287 million people (World Bank, 2015). The community in the study included four villages namely Siphocosini, Mantabeni, Ka Nyama and Lomoya with 1320 households (Census, 2007). According to the Census (2007) the Siphocosini community has a population of approximately 7482 people. The commonly spoken language in the community is Siswati.

3.2.3 Climate

Swaziland is characterized as a subtropical climate with summer rains from October to March and cold, dry winters from April to September (Loffler and Loffler, 2005). The country is divided into four climatic regions namely the Highveld, Middleveld, Lowveld and Lubombo plateau and the climatic condition of the zones have specific characteristics that are peculiar to that zone. Mean annual temperature varies from 17°C in the Highveld to 22°C in the Lowveld; the temperatures are zonal averages and variations across zones exists (Loffler and Loffler, 2005). Swaziland is located at the conversion of major climatic zones; therefore it is impacted by the air masses from divergent sources. These are namely the equatorial convergence zone which brings rain in summer, subtropical eastern continental moist maritime which brings onshore winds with infrequent cyclones, as well as dry continental tropical and marine west Mediterranean responsible for winter rains (Mlenga, 2015). Previously the mean annual rainfall used to ranges from about 1500 mm in the northern Highveld to 500 mm in the southern Lowveld, however statistics indicate that mean annual rainfall has dropped to between 650 and 850 mm in the past five years in the Highveld ecological zone where Siphocosini community is located (NDMA, 2016). Rainfall differs significantly on a yearly basis which may result in intervals of droughts or flash floods. Drought is a characteristic feature of the existing semi-arid climate.

3.2.4 Soils

The soils in the Highveld where the community is located are described by deep weathering and leaching with deep soil formation (Loffler and Loffler, 2005). They are also described to have low clay and base saturation of the exchange complex. It is important to note that to a certain extent soils contribute to the vegetation type variation. The characteristics such as soil, rainfall and vegetation establish the four agro-ecological zones to which different farming practices transpire. The soils in the Highveld ecological zone in the Siphocosini community are characterised as slightly acidic with relatively high clay content and the area has short grasslands with increased exploitation of grazing lands (Loffler and Loffler, 2005).

3.2.5 Agricultural activities

Mhlenga (2015) states that more than 70 percent of Swaziland's population depend on subsistence farming, mainly under rainfed cropping systems, however agricultural activities have been deteriorating over the last two decades due to a series of droughts related to climate change and variability. Subsistence farming in Swaziland constitutes 74 percent of the arable land, which accounts for almost three quarters of the total employment in the kingdom (Nkondze, 2013). Swaziland agriculture consists of subsistence agriculture practiced on Swazi Nation Land (SNL) and commercial agriculture found on the Title Deed Land (TDL) (Panin & Hlope, 2013). The TDL is a concession form of ownership and encompasses estates, commercial plantations, farms and ranches which are vastly productive. The TDL farmers mostly export, timber, citrus and pineapple however sugarcane is their chief export crop (Perry, 2011). The farm sizes under SNL initially averaged at about 1.3 hectares but have allegedly been reduced recently due to population changes. The output on the SNL farms is generally low and income from agriculture has remained small. The SNL is crown territory, held in trust for the nation by the King, and allocated to individual families as communal tracts by the Chiefs. Subsistence farming is the major livelihood activity in the community of Siphocosini.

3.2.6 Crop production

Subsistence farming in Swaziland is dominated by maize cultivation that is of importance to the SNL since it is the main staple food for small-scale farmers. Some of the crops cultivated in the community include round nuts popularly known as jugo beans, sorghum and sweet potatoes. However, the occurrence of drought has reduced the yield of most subsistence farmers throughout the country (Mhlenga, 2015).

3.2.7 Livestock production

Under subsistence farming in Swaziland, livestock farming is also practiced alongside crop farming, although the communal livestock herds, especially cattle and goats, are decreased due to deteriorating grazing lands and frequent drought conditions (Sikuka, 2016). Cattle, goats and chickens are the common livestock kept in the Siphocosini community.

3.3 Research design

The study employed a case study research design. The case study research design was used in the study to execute a comprehensive analysis of subsistence farmer perception to climate variability induced drought, social effects faced as well as the local adaption and mitigation strategies used against climate variability induced droughts. The selected community practices, which include crop production and livestock keeping is not entirely different from other communities in the district. Therefore, results from this case study can be applicable to other communities in the districts with similar climatic conditions and farming practices. Zainal (2007), states that case studies are familiar to several social science research studies, which focus on topics pertaining to sociology, education, and community based problems such as poverty, illiteracy and unemployment, just to mention a few.

In a case study research, multiple data sources are used to reach a conclusion in a given study. Tellis (1997) echoes the same sentiments arguing that the inclusion of both quantitative and qualitative data in case studies assists in clarifying both the procedure and result of a phenomenon through a comprehensive observation, reconstruction and analysis of the cases under investigation. The study used both quantitative and qualitative research methodology. Tashakkori and Teddlie (1998) indicate that the combination of both quantitative and qualitative data offers a holistic view to the research problem. The qualitative data was used to clarify and elaborate results collected during the study.

3.4 Data collection methods

Suitable data collection methods for this study were selected through the study's research objectives and research questions. A combination of both a quantitative and a qualitative approach was employed by the study because it offered a holistic view to the research problem. The data collecting methods used in the study were household surveys, using a semi-structured questionnaire (Appendix A). A Focus group discussion (FGD Appendix B) as well as a secondary data review, and analysis were also used in the study.

3.4.1 Primary data

This study employed primary data sources to collect both quantitative and qualitative data. The primary quantitative data was collected through a household survey by conducting household interviews with selected household heads**.** A focus group discussion (FGD) as a data collection method was also used to collect the primary qualitative data with the key informants, that is, members of the Farmers Union of Siphocosini community.

3.4.2 Quantitative data

Quantitative data gathers data in numerical form, which can be put into groups or measured in units. The study used household interviews as a data collection method targeting household heads. A semi structured questionnaire was used to collect the quantitative data at household level.

3.4.3 Qualitative data

The aim of qualitative interviews is to see the world through the eyes of the participants and they can be a valuable source of information, provided they are used correctly (Maree, Creswell, Ebersohn, Eloff, Ferreira, Ivankova, Jansen, Nieuwehuis, Pietersen and Plano Clark, 2016). FGD as a data collection method was chosen because it allows richness and flexibility in the collection of data and at the same time permitting spontaneity and interaction among the participants (Freitas, Oliveira, Jenkins and Popjoy,1998).The FGD was recorded using a digital audio recorder to capture all the data in order to avoid distortion of facts.

3.4.3 Secondary data

A desk review of existing literature was conducted prior to field data collection to give the researcher a picture of how other communities have experienced drought and implemented local adaptation strategies. The researcher reviewed sources such as the Swaziland drought reports and national emergence reports covering the recent drought experiences of the 2015-2016 farming season, census reports and meteorology reports about the community. National surveys carried out by National Disaster Management (NDMA, 2016) contributed to the study by providing livestock and crop assessment after the drought experience. The desk review also helped and

guided the researcher towards the correct direction of collecting primary data in the field.

3.4.4 Pre-testing of tool

The researcher verified the comprehension of questions by the participants on a small sample of the subsistence farmers in Siphocosini community. The pre-testing of the data collection tools was important to establish errors in the questionnaire; minimizing the risk of asking vague questions and it was also useful in providing training for the data collecting team. The researcher chose five households from one of the four villages and conducted the pre-testing, some necessary changes were made to the questionnaire.

3.5 Data collection Instruments

3.5.1 Household survey/questionnaire

A household questionnaire was designed as a data collection tool for this study. A questionnaire is a data collection tool consisting of a series of questions with the aim of gathering information from the respondents (Abawi, 2013). A semi-structured questionnaire was used to collect data, mainly because of its flexibility in opposition to its highly structured counterpart. Probing participants helped to understand the issues at hand better.

3.5.2 Focus Group Discussion (FGD)

A semi-structured focus group discussion guide was formulated as the data collecting tool. The FGD guide was administered to subsistence farmers who are members of the Farmers Union in Siphocosini community.

3.6 Sampling design

The target community was made up of four villages with a total population of 1320 (N) households and the population distribution across the four villages is shown in Table 3.1.

Table 3.1: Number of household and sample size from the four villages in the study area

Name of village	Number of households	Sample Size
Siphocosini	632	44
Mantabeni	435	31
Ka Nyama	178	12
Lomoya	75	6
TOTAL	**1320**	**93**

An Israel Glenn formula for determining the sample size for the study, where the level of precision is 5%, 95% confidence interval and the degree of variability is 0.5.
where **n** is the sample size, **N** is the population size, and **e** is the level of precision.
The sample size spread proportionally relative to the size of the village is indicated in Table 3.1. The target population for this study is subsistence farmers residing in the community of Siphocosini. It is important to note that the community engages in subsistence farming. As indicated by the above equation, sample sizes of 93 households across the four villages were used with an equal representation of the villages.
A systematic random sampling technique was employed whereby the sample units were collected systematically throughout the population. A systematic random sample is achieved by picking one unit on a random base and selecting other elementary units at consistently spaced intervals until the desired number of units is acquired (Mugo, 2002). This sampling technique was chosen because it reduces bias and guarantees that each sampled unit is a fixed at a distance from those that surround it.

A FGD was conducted across the four villages with a group consisting of 8 participants. The participants of the FGD were chosen purposively across the four villages with the help of the Farmers Union, targeting only influential farmers who are members of the farmers Union in the community. The FGD therefore consisted of the management of the Farmers Union of Siphocosini and selected subsistence farmers across the four villages who are members of the Farmers Union. The researcher ensured that equal gender representation was employed in the group discussions reducing dominance of a particular gender.

3.7 Data analysis

Bryman (2012) defines data analysis as the process that incorporates numerous elements and is about decreasing large amounts of generated data into expressive information. The quantitative data collected through the use of a questionnaire was coded. The main reason for data coding is to allow the organization to display large amounts of data and helps for analysis. An Excel spread sheet was used to capture the data and errors were cleaned up as well. The cleaned data from the Excel sheet was exported to a Statistical Package for Social Sciences (SPSS) and analysed through descriptive statistics tables and crosstabs. The data findings are presented in chapter 4 and interpreted using descriptive statistics, frequency tables, charts and graphs. The analysis of qualitative data from the household questionnaire was analysed in a thematic approach where the acquired data on farmer perception were grouped into causes of drought and climate variability. The data FGD information was used in chapter 4 where thoughts and views of some participants were are cited.

3.8 Research ethics

It is important to take ethical issues into consideration before carrying out a research. In this study the researcher acquired an ethical clearance from the Research Ethics Committee of the University of the Free State, as well as from the Ministry of Agriculture in Swaziland before the collection of data. This was done to limit the risks associated with the research as well as assessing the sensitivity of questions before presenting them to the intended respondents. The confidentiality and anonymity of the participants were ensured by the researcher at all times. The information obtained from the respondents through household interviews and focus group discussions was kept confidential and their anonymity was respected. At the beginning of the focus group discussions or household interviews, each respondent was made aware of the voluntary nature of the research, which gave them freedom to withdraw their participation at any given time without consequences. The respondents were each given a consent form to sign before participating in the research. It is important to note that societies have their own rules and regulations that preside over their interactions. It was therefore necessary for the researcher to respect the rules and culture of subsistence farmers living in the community of Siphocosini. The researcher worked

closely with an interpreter who was well versed on the protocols that needed to be followed in the community.

3.9 Study limitations

In the field of research each study has limitations and this study also has identified the limitations. Firstly, as a result of limited finances and time a small sample was chosen for this study, therefore results cannot be generalised and also perceptions, local adaptation strategies and mitigation measures employed by subsistence farmers may be area specific. Secondly, the results gathered in this research about the perceptions of farmers on drought and local adaptation strategies used might change over time since these are dynamic variables. Finally, due to preconceived perceptions by the participants on the research process as a result of previous experiences with researchers, some household heads were not eager to take part in the research.

3.10 Conclusion

This chapter gave the background, climate and farming activities in the study area which is the Siphocosini community. The chapter also discussed the research methods, data collection tools and sampling methods used in the study. Furthermore, this chapter discussed the importance of using both qualitative and quantitative research methods in data collection of the study. A sample of 93 households was conducted in the community and the data collected was analyzed through SPSS which is a statistical package and Excel. The next chapter will present the findings from the primary data collection and discuss it in detail using graphs and tables.

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the research findings and the discussion of the results found in the study conducted in the Siphocosini community of Swaziland. The results are presented in the form of figures and tables. The chapter is divided into ten sections; the first section gives the community demographics of households interviewed. The following three sections (Section 4.3 – 4.5) outline the ownership and source of income and perceptions of subsistence farmers on climate variability induced drought. Section 4.6 – 4.8 indicates the causes and social effects of drought and local adaptation strategies. The chapter concludes with farmer strategies to tackle drought events and major mitigation strategies used by the farmers against climate variability induced drought in Sections 4.9 and 4.10.

4.2 Household Characterization

The community of Siphocosini is comprised of subsistence farmers. This section outlines some of the features of the households interviewed, looking at characteristics such as the number of the respondents per village, gender, age, education level, total number of people in the household, years in farming, major crop and livestock kept. From the target sample of 93 households 60 household heads (64.5%) were interviewed across the four villages (Table 4.1). The majority of the respondents (46.7%) were from the Siphocosini community as expected, being the largest of the four villages and Lomoya, being the smallest, had 8.3% representation from the respondents. The survey revealed that there were more male headed households (55%) than female headed households (45%). Across the four villages of Siphocosini 56.7% of the respondent's fell in the above 50 years age group, followed by the 26-40 years age group with 23.3 %, respondents aged between 41 and 50 years were 16.7% and the smallest category was the less than 25 years with 3.3% as shown in Table 4.1. Total numbers of people in all households are presented in a Table 4.1 with the mean value of 6.43 (std. dev. = 3.7). According to the Census (2007), on average, there are 5 persons per household in Swaziland. Therefore, the household size statistic of the community is above the Swaziland national average.

Table 4.1: Household characteristics for Siphocosini Community

Variables	Description	Quantity	Remarks
Total Number of respondents • Siphocosini village • Mantabeni village • Ka Nyama village • Lomoya village	No	60 28 26 11 5	Out of 93 (47.7%) (26.7%) (18.3%) (8.3%)
Household size	Average	6,5	
Gender of household head	% females	45%	55% male
Age of household head	Mean (yrs)	55	55
No. 25 years and less	No	2	3.3%
No. of 26 – 40 years	No	14	23.3%
No. of 41 –50 years	No	10	16.7%
No. 50 years+	No	34	56.7%
Education level of household head	None Primary Secondary Tertiary	7 22 23 8	11.7% 36.7% 38.3% 13.3%
Primary occupation of household head	% farmers	100%	100%
Farming experience • Above 15 years • 11-15 years • 5-10 years • Less than 5 years	Mean	13.2	 51.7% 11.7% 21.6% 15.0%
Agricultural training on climate variability	% of Yes	6%	6%

It is important to note that the statistics illustrated in Table 4.1 cover household heads only. From the survey result, the level of education in the community indicates that 38.3% and 36.7% of the respondents have attended school at secondary level and primary level respectively; however 11.7 % of the respondents have not attended school at all. These results indicate that 88.3% of the respondents have been through some form of basic education with 13.3% of respondents reaching tertiary level.

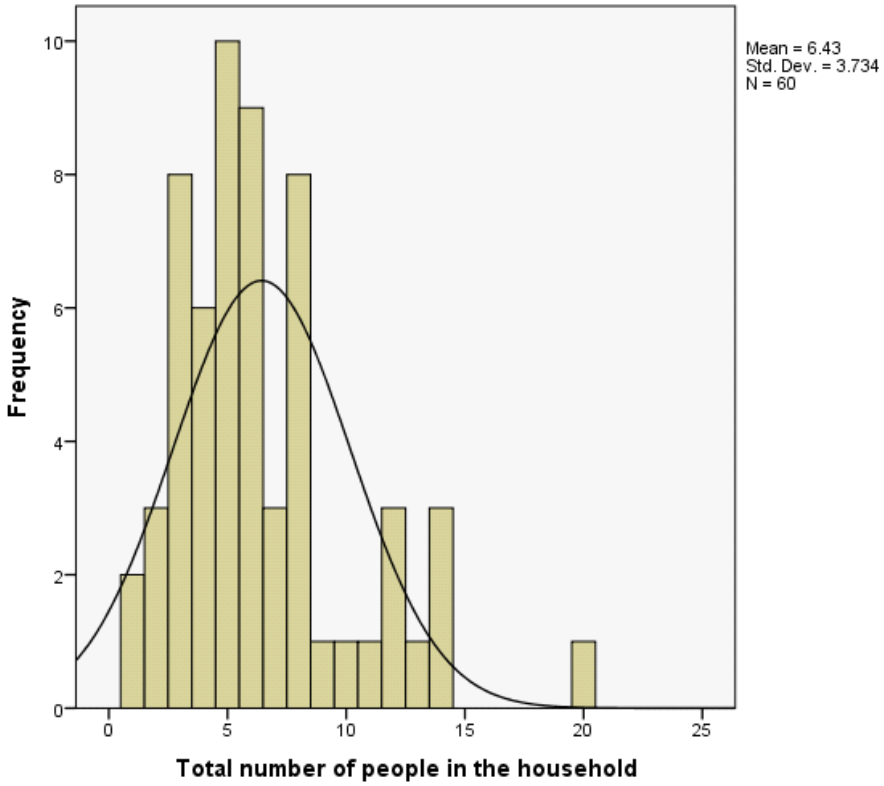

Figure 4.1: Distribution and frequency of the total number of people in household of the interviewed community in the study area.

The research findings revealed that 51.7% of the respondents have above 15 years' experience in farming, however only a few farmers (6%) obtained training on the effect of climate variability on agriculture (Table 4.1). More years of farming experience can result in higher abilities in spotting climate variability and using enhanced adaption measures in comparison to amateur farmers.

4.3 Ownership of Livestock and crop production

The majority of the households owned poultry (55.1%) and a few households owned cattle and goats, 26.5% and 18.4% respectively (Figure 4.2a). One respondent justified the reason why he did not own cattle by saying:

"….. *In 2015 a severe drought killed all six (6) of my cattle. Cattle were dropping dead like flies in the heat due to lack of water and pasture. I cannot stand confidently amongst other men now, as I resort to hiring or begging friends to use their cattle to plough my fields".*

The participant's statement indicates the importance of cattle in subsistence farming for cattle drawn ploughing and the status of men in the African culture. According to Swanepoel et al., (2010) livestock has several functions in the livelihoods of the farming community, especially in developing communities. Livestock is a source of food, nutrition, provides work, economic and social status of subsistence farmers in Africa.

The dominant crop grown by farmers in the community of Siphocosini is maize, however farmers also cultivate other crops such as sorghum, millet and legumes. Figure 4.2b shows the percentage of farmers that grow maize and vegetables. Almost all the interviewed farmers grow maize (98.3%) with very low yields; however, a few farmers grow vegetables (1.7%) in small patched plots due to insufficient access to irrigation. Maize is the staple food of Swaziland. Sacolo (2016) indicates that the country's subsistence farmers are generally determined to grow maize, even though there is an increased erratic rainfall pattern, resulting in constant low yields during consecutive drought years. During the household interviews farmers expressed their feelings by stating that due to the influence of climate variability both the crop and livestock production have decreased in comparison to previous years of good seasons.

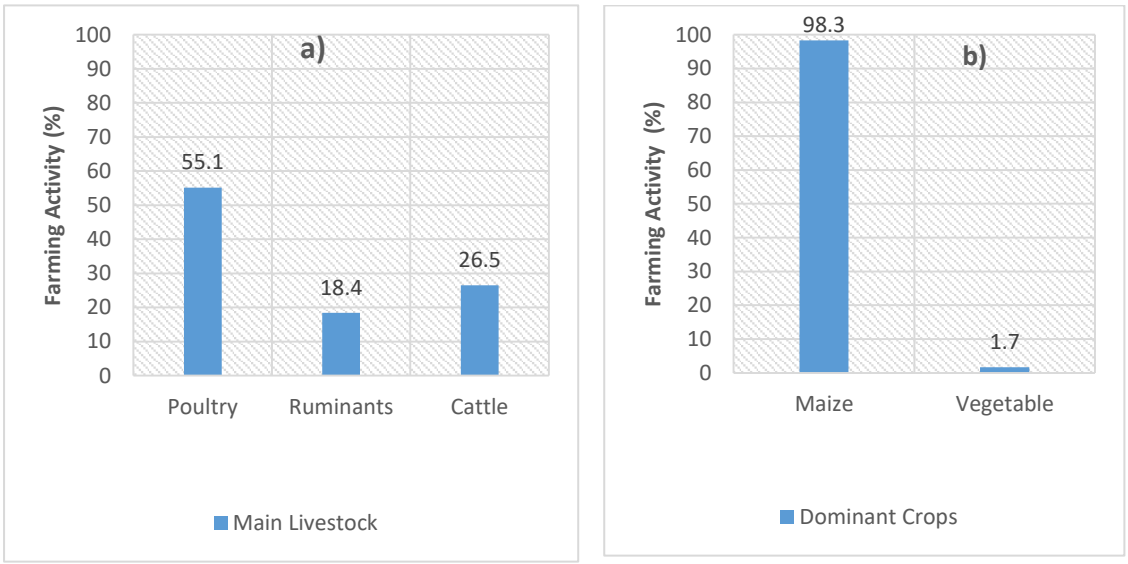

Figure 4.2: Farmer farming activities in percentages, a) main livestock kept by the community and b) dominant crop (maize) and vegetable growers.

4.4 Sources of household income

The major source of income in the community is the informal sector, which contributes 68.3% to the household income of the respondents Figure 4.3. The respondents were probed to give examples of informal work they are engaged in. Basket weaving, building, selling cooked food and selling firewood were the most popular responses. One of the subsistence farmers interviewed expressed that:

"….I can no longer rely on farming alone as in the previous decades due to the unpredictability of the weather experienced in the community. Drought has affected my yield and livestock therefore the income I get from building houses for others has also helped in sustaining my household".

The second major source of income is crop sales, which is a key characteristic of subsistence farming where farmers sell some of their yield for household income. Results indicate that 66.7% of the survey respondents acquire their household income from crop sales.

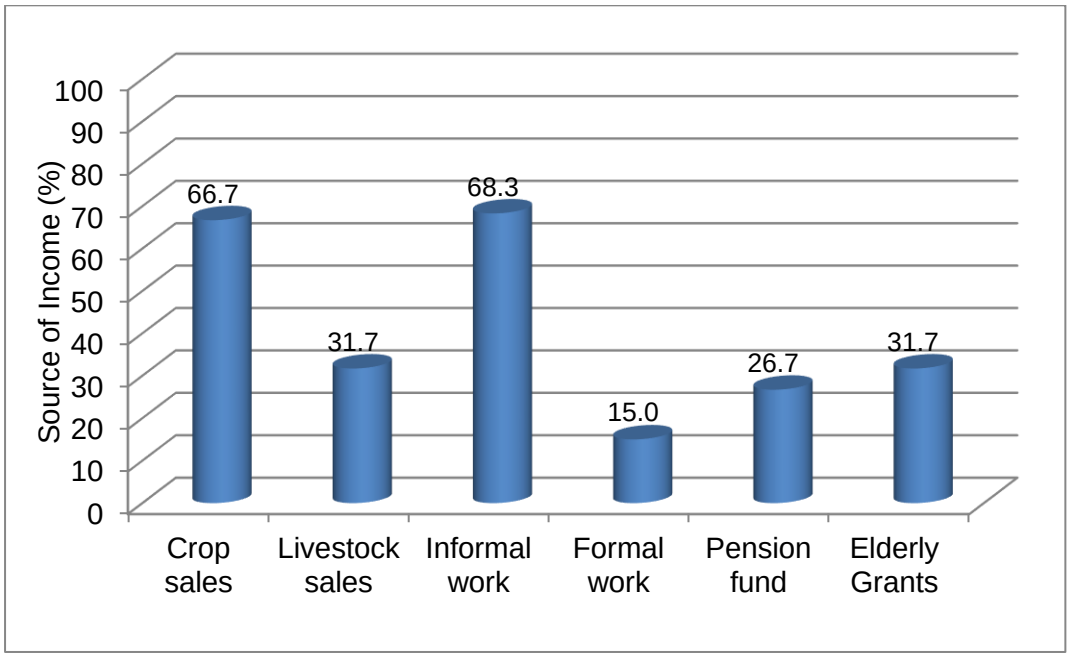

Figure 4.3: Major sources of household income in the Siphocosini community.

As indicated in Figure 4.3, livestock sales and elderly grants were reported to contribute towards household income by 31.7% of the farmers and 26.7% of the respondents indicated that pension funds provided towards their household income. Only 15.0 % of the respondents indicated that they get an income from engaging in

formal work. In the rural community's household income generally emanates from farming as well as off farm activities. The household income covers education, health, general household expenses as well as acquiring agricultural inputs such as seeds and fertilizers for the cropping season.

4.5 Perceptions on climate variability and drought

4.5.1 Drought experiences in the community

The study assessed if the farming community in the study area experienced drought occurrences over the past 5 to 10 years. This information can assist in the evaluation of the farming community's perception on climate variability and in recognizing causes of drought that affect their livelihoods. Table 4.2 shows that 93.3% of the respondents experienced drought in the current year, followed by 40% of the farmers that have experienced drought in the last 5 years. However a few senior farmers narrate drought experiences during the past 10 years. This suggests that drought occurrences in the community have increased in recent years and awareness increased for dry or below normal conditions.

4.5.2 Perceptions of the causes of weather variability

When the interviewed farmers were asked about the major causes of climate variability in the community, it was interesting to note that the majority of the respondents (31.7%) indicated negligence of culture as the major cause (Table 4.2). This sentiment was further echoed during the FGD where one participant expressed that:

"…. Nowadays more and more people are neglecting our cultural activities such as taking part in the rain making ceremony and the reed dance. These ceremonies are now flooded with tourists and the Swazi numbers are reducing as many now call themselves "Christians". This has saddened our ancestors and as a result all these changes in the weather are now taking place".

The response above displays the role that culture plays in the community and how people's choice to engage in Christianity has been perceived by some as the cause of climate variability. Nature and limited participation in rain making ceremonies are both believed to be the causes of climate variability in the community by 23.3% of the interviewed farmers. From the results it is clear that deforestation and pollution as

causes of climate variability are rated very low compared to cultural activities and behaviours.

Table 4.2: **Drought experience in the community and major causes of the weather variability**

Description	Response (%)
Drought Experience	
• Last 10 years	28.3
• Last 5 years	40.0
• Current years (1-3 years)	93.3
Major causes of weather variability	
• Nature	23.3
• Limit participation in rain making ceremonies	23.3
• Neglecting culture	31.7
• Climate change	5.0
• Deforestation	10.0
• Pollution	6.7

4.5.3 Farmer perceptions on weather variations

In the survey farmers were asked to identify the occurrence of the weather variations that were happening in their community in the past 5 years. High temperatures and late rainfall were observed by 90% and 80% of the respondents respectively as presented in Figure 4.4. These two extreme weather events are usually related to drought occurrences and their incidence typically results in drought. The results disclosed that both shorter rainfall seasons and inconsistent rainfall patterns were observed by 78.3% farmers in the past 5 years. Early rainfall patterns were observed by 73.3% of the respondents and 21.7% observed low temperatures. Frequent storms and flooding were identified by a small percentage of the respondents, 10% and 5% respectively.

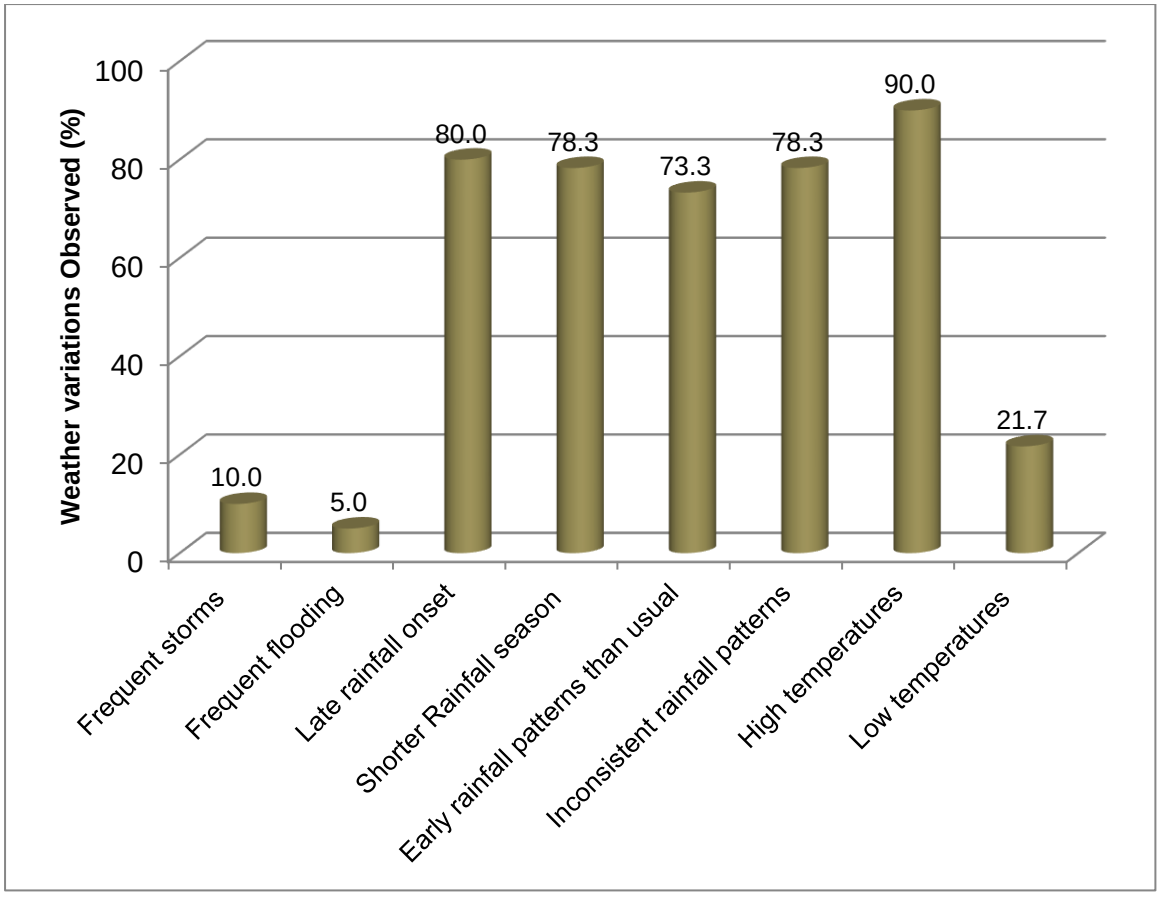

Figure 4.4: Weather variations observed in the past 5 years in the study area

From the results (Figure 4.4) one can notice that several extreme weather conditions have been observed by the community members, which might be an indication of increasing weather variability in the Siphocosini community. According to Abid, Scheffran, Schneider and Ashfaq (2012) a good understanding of farmer problems and the way they perceive climatic transformations is central in designing effective strategies that support successful adaptation plans. Therefore perceptions of subsistence farmers on climate variability and risks associated are significant in configuring the problem.

4.5.4 Perceptions on weather forecasts and drought frequency.

As farmers in the community have witnessed weather variations in the past 5-10 years, it was expected that farmers had the knowledge of weather forecasts. Thus, farmers were asked to give their perceptions on the concept of weather forecasts where drought conditions frequently occurred in the study area. The results in Table 4.3

show that 60% of the respondents believed in weather forecast information and 36.7% indicated that they did not believe in weather forecasts. The survey further asked the respondents if they perceived the drought frequency to be increasing or lessening in the community for the past 5-10 years. The results in Table 4.3 illustrate that the majority of the respondents, which is 58.3%, believe that drought frequency has increased in the community for the past 5 - 10 years. This is an indication that with increasing drought frequency in the community there is a high probability of increased farmer perceptions and awareness of weather forecast information. As respondents expressed during the focus group discussion sessions, access to weather forecast information is limited and sometimes there are language barriers to the accessibility of the information.

Table 4.3: Farmer perceptions on weather forecast information and drought frequency occurrences in the community

Description	Percent (%) responded
Farmer perceptions on weather forecast • Positive response • Negative response • Not sure / no idea	 60.0 36.7 3.3
Farmers perception on drought occurrences • More frequent • No difference between years • Less frequent • No ideas	 58.3 8.3 28.4 5.0

Table 4.4: Farmer perceptions on drought frequency in terms of education level of the community during the last 5 – 10 years

Education level	Drought occurrences in the 5 – 10 years in percent (%)			
	More Frequent	No difference	Less Frequent	No idea
None	57.1	-	28.6	14.3
Primary School	45.5	18.2	31.8	4.5
Secondary School	65.2	4.3	26.1	4.3
Tertiary level	75.0	-	25.0	-

To further establish whether there was any relationship between the perceptions of the respondents on drought frequency and their level of education, a cross tabulation was used as presented in Table 4.4. It is interesting to note that there are high statistics values for those with secondary and tertiary levels who said droughts are becoming more frequent up to 65.2% and 75.0% respectively. Since the value of Pearson Chi-square is equal to 0.611, it shows the relationship between the farmer perceptions and the level of education of the community is not significant at a level of 0.05%. Therefore, the notion that droughts are becoming more or less frequent in the last 5 - 10 years is not influenced by the level of education of the respondents.

4.6 Perceived causes of drought in the community

Subsistence farmers in the community of Siphocosini were asked what they perceive to be the main causes of drought in their community. Most of the respondents believed that drought was caused because it is simply God's plan. Others indicated that drought in the community was due to the abandonment of cultural practices, where only a few people are now participating due to many people following Christianity. One elderly community member said that:

"…… The frequency of drought has increased in our community compared to the past decades because our children are now running to Christianity abandoning our culture. When the king calls for people to attend the rainmaking ceremony a few are attending because they say it clashes with their religion"

Others also indicated that the high incidence of drought is due to the ancestor's anger towards sins being committed in the community and as a result drought is used as a form of punishment to the people by the ancestors. A small portion of the farmers believe that drought is caused by climate change, depletion of the ozone layer and pollution. One respondent interviewed stated that:

"……Drought in this community can be linked to the timber plantation that is near the community where they burn trees and cause pollution that contributes to the occurrence of drought in our community".

4.7 Social effects of drought in the community

Drought can affect a society's economy, social life as well as the environment. This study selected to only focus on the social effects of drought on subsistence farmers in the community of Siphocosini. The results obtained in the survey on the social effects of drought in the community are presented in Table 4.5.

Table 4.5: Social effects of drought on subsistence farmers in the community of Siphocosini

Social effects of drought on subsistence farmer households	Percentage (%)
Food insecurity	86.7
Limited food choices	85.0
Affected health	21.7
Children's health	20.0
Migration	31.7
School drop outs	10.0
Conflicts	13.3
Cancel ceremony	13.3

The data acquired indicated that drought experiences in the community resulted in food insecurity experienced by 86.7% of the respondents and consequently 85% of the interviewed farmers faced limited food choices as a result. The FGD participants were further asked how food insecurity and limited food choices affected their social life. One participant responded by saying that:

"…Without adequate food in the house children are always crying and even the adults are ill-tempered. It is difficult to live in peace when you are always hungry because you are always thinking about where to get your next meal".

The study also revealed that 31.7% of the farmers had some of their household members migrate due to the drought. The FGD attempted to establish how migration affected the social aspect of the community. A FGD participant declared that:

"…. My young boys who were helping me in the fields had to migrate to South Africa to look for jobs so as to help support the household. It's unfortunate that one of them came back injured from the mines and I now have to take care of him".

The statement above indicates that not all cases of migration end up with successful stories where the migrants send income home. In this case the respondent had to take care of the injured son, which will result in increased responsibilities on the household

head. Results also indicated that 21.7% of the farmers stated that drought experiences affected the health of their family members and 20% of the farmers reported their children's health was affected by drought, with malnutrition being the main cause of deteriorating health among the affected children. Conflicts were experienced by 13.3% of the farmers in their household during the drought experience in the community. The recorded conflicts were mainly verbal conflicts around the issue of grazing land and household quarrels. Through the FGD a community member revealed that:

"…I was involved in a verbal conflict with a neighbour due to the loss of his cattle; he accused me of bewitching his cattle herd. That affected our relationship up to now and the village head had to resolve this issue".

The statement above indicates that due to the loss of cattle, accusations of witchcraft resulted in conflict, consequently, peace between the FGD participant and the neighbour was non-existent.

Swazi people are well known for being amongst the remaining African people who are still guarding and practicing their culture fully. Cancellation of ceremonies was also experienced as a social effect of the drought by 13.3% of the respondents. Two ceremonies that was cancelled were lobola and the cleansing ceremony due to the drought in the community. A participant narrated that:

"… After I lost my cattle to drought my son could not proceed to marry his wife because we did not have anything to offer to the bride's family. The lobola ceremony had to be cancelled and our family name was tarnished".

The survey results showed that 10% of the respondents had their children drop out of school as a result of drought. The respondent was probed to give reasons for the children dropping out of school and the main reason was food shortages in the households. One community member revealed that:

"…My primary school children have to walk quite a distance to school and without eating proper meals it was difficult for them to walk to school. They had to drop out of school during the drought".

The results on the social effects of drought reveal that the social life or wellbeing of the people in the community was affected by the drought. Food insecurity and limited food choices were the main factors that affected the respondents.

4.8 Local adaptation and mitigation strategies employed in the community

4.8.1 Farmer awareness of drought occurrences

When asked about their awareness of drought occurrences 83.3% of the farmers, which is the majority of the respondents in the community, were aware of the drought occurrence before its arrival (Table 4.6a). However 16.7% of the respondents indicated they were not aware of the drought until its occurrence. Some of the respondents attempted to make some preparation to alleviate the impact of the drought on their crops. Some of the measures used by the farmers included shifting planting time and using drought tolerant crops. One of the respondents mentioned his preferences to leave the fields fallow rather than planting during drought events.

Table 4.6: Farmer awareness for drought occurrences and source of information in the study area

Description	Percent (%) responded
(a) Farmer awareness	
• Before drought occurrences	83.3
• After drought occurrences	16.7
(b) How farmers identify / Source of information	
• Radio	61.7
• Local newspapers	5.0
• Traditional knowledge transfer	21.7
• Other channels	1.6
• Not responding / missing	10.0

4.8.2 Sources of information used by farmers to identify drought occurrences

In considering the farmers awareness of drought occurrences, the questionnaire asked about methods used by subsistence farmers to identify drought occurrences in their community as shown in Table 4.6b. The larger portion of the farmers interviewed (61.7%) revealed that the community used radios, and the information they obtained from the radio were mainly weather reports and news. A portion of the farmers, 21.7%

interviewed in the survey, used traditional knowledge as a source of information for weather forecasts. Local newspapers were read by 5% of the respondents as a source of information on weather forecasts and 1.6% used other sources of information such as hearsay from neighbours and social interactions.

Participants in the FGD were asked to give examples of local knowledge indicators used to detect a drought before its occurrence in the community. Experiencing extremely cold winters, immature fruits drying on trees or dropping from the trees and occurrence of army worms were some of the commonly used indicators of traditional knowledge on drought forecasting.

4.8.3 Major crop adaptation strategies to drought employed by the community

The results of major crop adaptation strategies utilized by the farmers in the community of Siphocosini are presented in the Table 4.7. Adjusting the planting schedule was the most widely used adaptation strategy used by 46.7% of the respondents in the community. As most farmers use conventional farming practices, there is a possibility to choose convenient planting times but sometimes farmers are forced to replant after aborting seeds due to insufficient moisture in the soil.

Table 4.7: Major crop adaptation strategies to drought

Adaptation strategies	Percentage (%)
Plant early maturity crops	13.3
Adjust planting schedule	46.7
Plant drought resistant crops	1.7
Use of zero tillage method	38.3

Another dominant adaptation strategy utilized in the community by 38.3% of the farmers was the zero tillage method. With the increased frequency of drought in the community, the zero tillage farming method can increase the water infiltration into the soil as well as soil nutrients by leaving the soil mostly undisturbed with high levels of crop residues. Planting early maturing crops is also another adaptation strategy used by 13.3% of the respondents in the community and a mere 1.7% of the farmers planted drought resistant crops as an adaptation strategy. However, this is not always practical, as tolerant crops are not always available to the farmers, and there are no cultivars which will easily adapt to their environment.

4.9 Farmer strategies to tackle drought events to survive

The other strategies used to adapt to drought in the community includes the use of stored food from previous farming seasons and 85.5% of the respondents employed this strategy as indicated in Table 4.8. Farmers indicated that they store crop yields from a good harvest to shield them from starvation during drought. Migration of some family members in search of employment as an adaptation strategy is used by 33.3% of the farmers. The respondents were further questioned to establish if the household members migrated locally or across the borders. It was reported that household members migrated mostly to the neighbouring country, South Africa, with a few migrating locally to towns such as Malkerns. Offering services in exchange for food and selling livestock was used as an adaptation strategy by 30% of the farmers interviewed as illustrated in Table 4.8. The cited services offered by farmers in exchange for food were weeding harvesting, laundry and cattle herding. One respondent reported that:

"… In our household we offered services such as weeding and harvesting other people's fields in exchange for food and money. My children helped with offering these services as well".

Seeking food alternatives; such as wild fruits and game meat as an adaptation strategy was used by a mere 11.7% of the respondents in Siphocosini.

Table 4.8: Farmer strategies to tackle drought events to survive

Strategies to survive during drought events	Percentage (%)
Use of stored food	85.5
Offering services in exchange for food	30.0
Selling livestock	30.0
Seeking food alternatives such as wild fruits and game meat	11.7
Migration of household members seeking employment outside farming	33.3

4.10 Major mitigation strategies used to cope with drought

This section shows results of strategies used by subsistence farmers in mitigating or building resilience against climate variability induced drought. Farmers respond to extreme weather events such as drought by implementing strategies that help them to mitigate the challenges brought about by climate variability. Farmers revealed that because of increased occurrence of droughts and inconsistent rainfall patterns in the community early planting was now common amongst the households with 43.3% confirming that they practice this mitigation strategy (Figure 4.5). The second most commonly used mitigation strategy in the community was migration for employment used by 18.3% farmers. Due to the low productivity of farming some family household members are opting to migrate in search of greener pastures. One FGD participant voiced that:

"….. It's sad to see our children going to South Africa to look for work but at the same time we need other sources of income for survival so that we can survive with the increased incidence of drought in the community".

Other drought mitigating strategies that have been implemented by the farmers include mixed cropping and adjusting cropping patterns used by 10% and 8.3% respectively. A smaller percentage (10%) indicated that they sell livestock as a mitigation strategy from drought while 6.7% of the farmers store crop residues for livestock feed as a mitigation strategy to drought. The mitigation strategies employed by farmers on crop production guarantee that these subsistence farmers continue to be productive in the face of climate variability. The implementation of these mitigation strategies protects farmer yields after the occurrence of an extreme weather event such as drought.

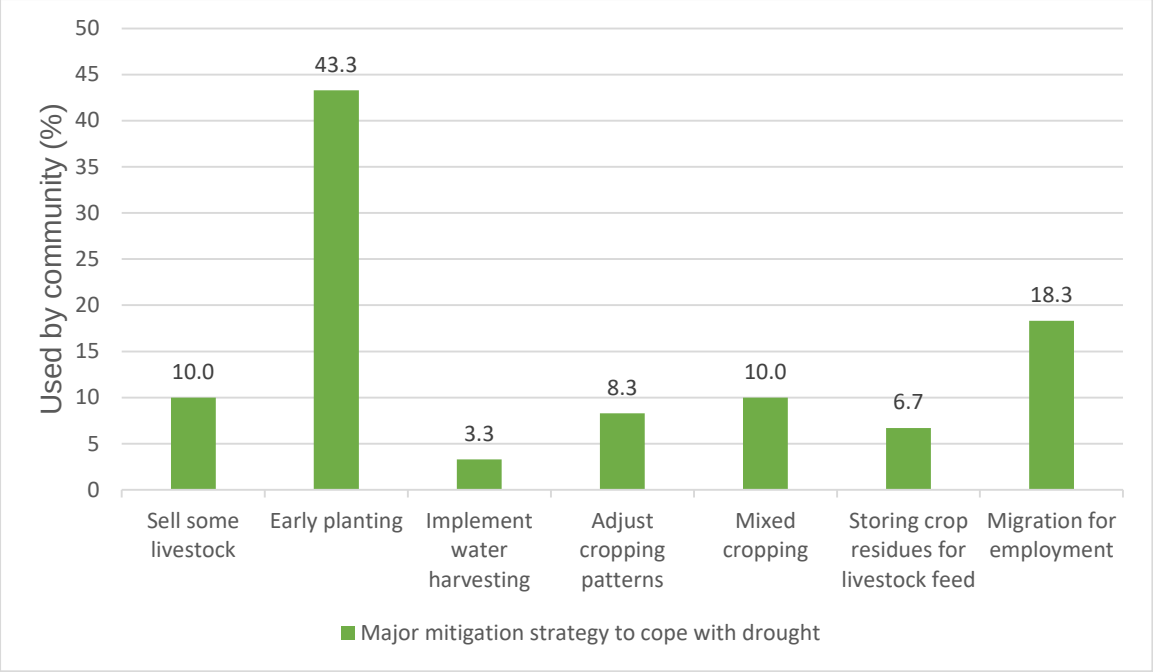

Figure 4.5: Major mitigation strategies used by the community to cope with drought

4.10.1 Forms of aid received by farmers during drought

One of the mechanisms of survival during drought events is by securing food aid to the needy community. A general survey was conducted to assess the timely food aid availability to the community during recent years. Most of the respondents (51.7%) confirmed that they had received food aid in their household while 45% indicated that they did not receive food aid for a long time, even during extreme drought conditions (Table 4.9). The respondents stressed the point that food aid distribution in the community was late. For example, as indicated in Table 4.9, more than half of the food aid recipients (29.0%) complained about the late arrival of the food aid to the community after the drought events. One elderly respondent in the FGD expressed his concerns as follows;

. . . . . *"In our community it is rare to receive food aid distribution by the donors on time, therefore selling our animals and supplementary employment would be the only solution during extreme drought events".*

Table 4.9: Food aid distribution by donor agencies, timely availability to the farming community, drought preparedness programmes and local coping mechanisms

Description	Percentage of respondents (%)		
	Yes (received)	Not received	Not willing to respond
Food aid availability /distributed	51.7	45.0	3.3
Aid on time arrival during drought	29.0	96.	3.3
Drought preparedness programmes	3.5	96.5	-
If local coping mechanism reduces effect of drought in the household	33.3	66.7	-

4.10.2 Drought preparedness programmes

The absence of Non-Governmental Organizations and private companies assisting farmers is shown by the findings that indicate that limited aid has reached the subsistence farmers in the Siphocosini community. In the study, 96.5% of the respondents revealed that they did not receive drought preparedness programmes to support their livelihood (Table 4.9). This shows the limited institutional support to subsistence farmers in the Siphocosini community during drought hazards. The limited or unavailability of NGOs, donor agents and private or Government developmental companies in the community gives little assistance to vulnerable communities. After further questioning most farmers displayed interest in learning about the effect of climate variability and effective mitigation strategies and they also indicated the need for assistance in terms of various preparedness programmes.

4.10.3 Effectiveness of adaptation strategies employed

Following the discussion with the community, farmers were asked if the local adaptation strategies they employed were effective in mitigating the effects of drought in their respective households. The results in Table 4.9 shows that 66.7% of the respondents revealed that local adaptation strategies were not effective in mitigating drought effects and a mere 33.3% indicated they were effective. In the survey farmers were questioned to clarify why they believe the adaptation strategies they used did not work to their advantage. The respondents pointed out that despite applying crop adaptation strategies such as adjusting planting schedule and using zero tillage

methods, their yield still suffered because of lack of water. A survey respondent pointed out that:

"..After I noticed the incidence of army worms in the community I knew that a dry season was on its way. I planted my seeds early using the zero-tillage method to preserve moisture, however my plants were still affected by the drought".

This response indicates that despite incorporating adaptation to their farming activities not all were effective. This also displays the need for proper drought preparedness programmes in the community that can help with effective drought adaptation strategies such as on farm water harvesting techniques.

Through the FGD, participants were asked what type of support they would require in their community to improve their adaptive capacity and resilience to climate variability induced drought. The participants indicated that the Government's help is required in reviving the Farmers Union and use it as a body where they voice their concerns as farmers, and also as a means to acquire current information on weather forecasts. Farmers also requested financial support to enable them to purchase inputs and current technology for their farming. Training and programmes on climate variability was also a requirement made by the farmers.

4.10.4 Gender and farming experience based mitigation strategies

Subsistence farmers in the study area are often characterized by gender, and farming experiences that have evolved to reduce the effect of climate variability through mitigating various drought hazards. Recent changes in the climate and severe drought conditions have prompted subsistence farmers to employ various mitigation strategies to build resilience towards crop and livestock production. A test of relationship was conducted to establish whether there was a relationship between mitigation strategies employed and gender as well as the years of farming experience for each farmer. As shown in Table 4.10, in the Siphocosini community two factors selected for cross assessment were gender and farming experience as a contribution to mitigate the drought effect on crop production.

The study established that the most popular mitigation strategy to cope with drought hazards was early planting/ early maturing cultivation as indicated by an average

42.2% across gender as well as the highest among all levels of farming experience, the majority being those with less than five (5) years. There is a negative and insignificant correlation between gender and mitigation strategies employed in the community. Generally, since women are more involved in farming it is expected that they implement mitigation strategies more as compared to men. Hence, a study conducted by UNWomen (2013) supports that women have a strong body of knowledge and expertise of utilizing local resources that can be used in climate variability adaptation and mitigation. However, this study revealed that there is a negative and insignificant correlation between gender and mitigation strategies employed in the community.

Table 4.10: Major mitigation strategies to cope with drought hazards based on gender and farming experience in the farming community

Description	Major mitigation strategy to cope with drought hazards (%)						
	Gender			Farming experience			
	Male	Female	Av.	< 5 years	5-10 years	11-15 years	>15 years
Sell some animals, ruminants or cattle	6.1	14.8	10.0	22.2	7.7	14.3	6.5
Early planting / early maturing cul.	36.4	51.	42.2	55.6	46.2	42.9	38.7
Implement Water harvesting	-	7.4	3.6	-	-	-	6.5
Adjust cropping methods	9.1	7.4	8.3	11.1	15.4	-	6.5
Mixed cropping / Intercropping	15.2	3.7	9.5	-	-	-	19.4
Storing-crop residue for feed	12.1	-	6.1	11.1	7.7	14.3	3.2
Migration for employment	21.2	14.8	18.0	-	23.1	28.6	19.4

**Significant level at 0.05 = 0.124 for Gender and 0.641 for farming systems*

Since the p-values for gender = 0.124 and farming systems = 0.641 are greater than 0.05, the results indicates that the relationship is not significant. Therefore, there is no relationship between mitigation strategies and gender and farming experience. Farming experience in the community has no significant influence on the choices of mitigation strategies implemented by subsistence farmers. The results are unexpected to some extent because typically farmers with experience in farming are usually expected to implement more mitigation strategies as a way of building resilience against climate variability and drought.

4.11 Conclusion

The chapter aimed to have a good understanding of the subsistence farmers in the Siphocosini community. The results revealed that all the farmers interviewed practise farming as their primary livelihood, with an average farming experience of 13.2 years. The subsistence farmers in the community of Siphocosini practise crop and livestock production. Climate variability induced drought has affected the social lives and livelihoods for subsistence farmers in the community. Farmers in the community are using adaptation and mitigation strategies to lessen the effects of climate variability however there is a need for more farmers to be introduced and encouraged to implement effective adaptation and mitigation strategies to improve productivity. The majority of the farmers indicated that they have not received any climate or drought preparedness programmes. Therefore, there is a need to educate subsistence farmers on matters to do with climate variability and drought to empower them with information and skills that can assist in dealing with climate variability.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The first objective of the study was to investigate the social effects of climate variability induced drought in the community.

Using household surveys and FGD farmers in the community were asked to identify the social effects of droughts and how they affected their lives socially. Research findings indicated that the major social effect of drought in the community was food insecurity experienced by 86.7% of the respondents. The focus group indicated that food insecurity affected their social lives through starvation that limited their abilities to fully perform in their farming work.

Food insecurity in the community was reported to result in limited food choices for the respondents and FDG participants indicated skipping meals as a coping strategy to drought. From the research findings health problems, because of drought, was identified as a social effect of drought in the community. These health problems were linked to limited food choices and meal skipping, which resulted in some household members reported feeling weak and sick hence reducing the much-needed manpower in the field. Children's health was also another social effect of drought that affected the community, as 20% of the respondents reported the children's health were linked to malnutrition. Migration was also identified by 31.7% of the respondents as a social effect of drought in the community. As a result of migration the able bodied household members were reported going away leaving the old with the burden of dealing with the effects of drought and looking after the family alone. This study found that indeed the social lives of subsistence farmers in the community of Siphocosini were affected by the climate variability induced drought.

The second objective was to determine subsistence farmer perceptions of climate variability induced drought in the Siphocosini community.

Most of the respondents in the Siphocosini community agreed that they were experiencing climate variability. Rainfall and temperature were the two main variables recognized. Under rainfall variability, late rainfall onset was perceived by 80% of the respondents, inconsistent rainfall patterns 78.3%, early rainfall patterns 73.3% and inconsistent rainfall patterns 78.3% of the respondents. Another general perception that was shared by the respondents was that the drought concurrence was increasing,

hence the community was becoming drier. Low rainfall received in the community was reported as the main cause of drought and 90% of the respondents indicated that they perceived higher temperatures in the community. The combination of low rainfall and high temperatures often result in drought occurrences. The frequency of drought was perceived to be increasing in the community by 58.3% of the respondents over the last 5-10 years.

People in Swaziland are well known to still carry strong beliefs in their tradition. Respondents in the community perceived the causes of climate variability induced drought to be linked to limited participation in rainmaking ceremonies and neglecting culture. A few respondents perceived climate variability and drought to be caused by scientifically proven causes such as climate change, deforestation and pollution. The research findings revealed that 58.3% of the respondents perceive that drought experiences are becoming frequent. Subsistence farmers in the community of Siphocosini perceive climate variability induced drought as the main cause of low yields and livestock losses. Despite the reported evidence of increased drought incidents in the community 96.5% of the respondents reported they have not received any drought preparedness programmes in the community.

The third objective was to understand the local adaptation and mitigation strategies employed by farmers in the face of climate variability induced drought.

The increase of climate variability incidents causing extreme weather conditions such as drought often drives farmers to adjust their farming methods. The crop adaptation strategies such as adjusting planting schedule was used by 13.3% of the respondents and using zero tillage method by 38.3% of the respondents. Planting drought resistant crops as an adaptation strategy was used by 1.7% of the respondents and this adaptation strategy should be prioritized by the community due to the increased frequency of drought in the community.

Farmers in the community are also using off farming adaptation strategies to drought such as migration, selling livestock and offering different services such as weeding and ploughing in exchange for food. Mitigation measures of drought such as mixed cropping, adjusting cropping patterns and storing crop residues for livestock feed were also employed by the farmers in the community. However, it is important to note that

these mitigation measures are implemented by a small percentage of the respondents, which is below 11% of the farmers. The interviewed farmers (66.7%) also indicated that in their opinion the adaptation strategies they employed were not effective because they still experienced low yields resulting in food insecurity and livestock loss.

The results of the hypothesis revealed that the respondents were using some local adaptation measures to reduce the effects of drought such as selling animals, early planting, mixed cropping, storing-crop residue for feed and migration for employment. The null hypothesis of the study is accepted because although the community has implemented local adaptation measures to drought 66.7% of the respondents reported that the local adaptation strategies they used were not effective in mitigating drought effects on their farming. Furthermore, results also indicates that only 3.5% of the respondents received drought preparedness programmes and this shows the need for proper drought preparedness programmes in the community that can help with effective drought adaptation strategies.

Recommendations

Recommendations resulting from the findings and data analysis of the study are given in this segment. The following recommendations are provided to improve subsistence farmer resilience as well as to facilitate farmers and Governments to efficiently combat future droughts:

- Promotion and implementation of drought preparedness programmes that can help farmers to effectively adapt and mitigate effects of weather extremes.
- The introduction of drought resistance crops should be considered to increase resilience against drought as well as reducing crop failure.
- There is a need for developing, introducing and implementing water harvesting techniques in the community through community participation.
- The results indicate that the majority of the respondents were aware of climate variability and drought occurrences in their community, however a significant number credited their occurrences to non-scientific proven causes. Therefore it is essential to educate this community to comprehend the scientific basis of climate variability in such a way that when combined with valuable traditions the community is able to adapt and mitigate the adverse effects of climate variability using locally available resources.

- There is a need to revive the Farmer's union in the community through engaging relevant Government departments and NGOs so that it can act as a hub of information that constantly informs farmers on weather forecasts, climate variability and drought as well as drought impact on their agricultural activities.

REFERENCES

Abawi, K., 2013. Data Collection Instrument, Geneva: Geneva Foundation for Medical Education and Research.

Abid, M., Scheffran, J., Schneider, U.A and Ashfaq, A., 2012 Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab Province, Pakistan. Copernicus Publications, 6(5), pp. 225–243.

Abid, M., Ngaruiya, G., Scheffran, J. and Zulfiqar, F., 2017. The Role of Social Networks in Agricultural Adaptation to Climate Change: Implications for Sustainable Agriculture in Pakistan, Centre for Climate Research and Development, 5(4), pp.85-101.

Adger, W., 2003. Social Capital, Collective Action and Adaptation to Climate Change, Economic Geography, 79(4), pp. 387-404.

Adger, W., Huq, S., Brown, K., Conway, D and Hulme, S., 2003. Adaptation to Climate Change in the Developing World, Progress in Development Studies, 3(3), pp. 179–195.

Adger, W. N., Barnett, J., Brown, K., Marshall, N., and O'Brien, K. (2013). Cultural dimensions of climate change impacts and adaptation. Nature Climate Change, 3, 112–117.

ADP, 2014. What is subsistence Farming? [Online]
Available at: http://www.africadevelopment.org/blog
[Accessed 6 June 2016].

AGRA, 2014. Climate Change and Smallholder Agriculture in Sub Sahara Africa, Nairobi: Alliance for a Green Revolution in Africa.

Agrawal, A. and Perrin, N., 2008. Climate Adaptation, Local Institutions, and Rural Livelihoods, Michigan: International Forestry Resources.

Antwi-Agyei, P., Dougill, A. and Stringer, L., 2013. Barriers to climate change adaptation in sub-Saharan Africa: evidence from northeast Ghana & systematic literature review, London: Sustainability Research Institute.

Arendse, A. and Crane, T., 2010. Impacts of Climate Change on Smallholder Farmers in Africa and their Adaptation Strategies: What are the roles for research? Arusha, Tanzania: International Centre for Tropical Agriculture.

Barilla, C., 2010. The Challenges of Food Security, Parma, Italy: Barilla Centre for Food and Nutrition.

Barnett, J. and Adger, W., 2007. Climate Change, Human Security and Violent Conflict. Political Geography, 3(26), pp. 639-655.

Bazza, M., 2014. Drought Preparedness Mitigation and Response, Cairo, Egypt: Food and Agriculture Organization.

Benson, C. and Clay, E., 1988. Understanding the Economic and Financial Impacts of Natural Disasters, Washington, DC: The World Bank.

Bernier, Q. and Meinzen-Dick, 2014. Building Resilience for Food and Nutrition Security, Washington D.C: International Food Policy Research Institute.

Besada, H. and Sewankambo, N.K, 2009. Climate Change in Africa: Adaptation, Mitigation and Governance Challenges, Ontario, Canada: Centre for International Governance Innovation.

Bettencourt, E., Tilman, M., Narciso, V., Carvalho, M.L.S. and Henriques, P.D., 2015. The Livestock Roles in the Wellbeing of Rural Communities of Timor-Leste, Évora, Portugal: Department of Medicine.

Blanco, A., 2006. Local Initiatives and Adaptation to Climate Change. Disasters, 30(1), pp. 144-147.

Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., Osman-Elasha, B.,Tabo, R. and Yanda, P., 2007.Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK: Cambridge University Press,

Bryman, A. 2., 2012. Social Research Methods. 4th ed. New York: Oxford University Press Inc.

Calderone, M., Heady, D. and Maystadt, J.F, 2014. Enhancing Resilience to Climate – induced Conflict in the Horn of Africa, Addis Ababa, Ethiopia. International Food Policy Research Institute (IFPRI).

Campbell, R. and Knowles, T., 2011. The Economic Impacts of Loosing Livestock in a Disaster, Melbourne, Australia: Economists at Large.

Census, 2007. Census Report 2007, Mbabane: The Government of Swaziland.

Census, P. a. H., 2007. Population and Housing Census: Household and Living Conditions, Mbabane: Central Statistical Office.

Chhetri, N., 2012. Adaptation to Climate Variability and Change: Capacity Building Through Technological Innovation. Consortium for Sciences, 33(9), pp. 181-191.

Coulibaly, J. Gbetibouo, G.A., Kundhlande, G. Sileshi, W.G. and Beedy, T.L., 2015. Responding to Crop Failure: Understanding Farmers' Coping Strategies in Southern Malawi. Sustainability, 7(2), pp. 1620-1636.

Dercon, S., 2002. Income Risk, Coping Strategies, and Safety Nets. The World Bank, 17(2), pp. 141-166.

Deressa, T., Hassan, R.M., Alemu, T., Ysuf, M. & Ringler, C., 2008. Analysing the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of

Climate Change in the Nile Basin of Ethiopia, Washington D.C: The International Food Policy Research Institute.

Derribew, A., 2013. An Assessment of Coping Strategies for Drought Induced Food Shortages in Fedis District, East Hararghe Zone,Ethopia. International Journal of Science and Research, 4(1), p. 289294.

DFID, D. f. I. D., 2000. Sustainable Livelihoods Guidance Sheets, s.l.: http:/www.livelihoods.org/info/info guidances heets.html

Dile, T., Karlberg, L., Temesgen, M. and Rockstrom, J., 2013. The role of water harvesting to achieve sustainable agricultural intensification and resilience against water related shocks in sub-Saharan Africa. 3(18), pp. 69-79.

Fafchampsy, M., 2009. Vulnerability, Risk Management, and Agricultural Development, Oxford: Oxford University.

FAO/WFP, 2015. FAO/WFP Crop and Food Security Assessment Mission to Swaziland, Mbabane: Food and Agriculture Organization and World Food Programme.

FAO/OECD, 2012. Building Resilience for Adaptation to Climate Change in the Agriculture Sector, Rome, Italy: Food and Agriculture Organisation of the United Nations and Organisation for Economic Co-operation and Development.

FAO, 2011. Drought –related Food Insecurity: A Focus on the Horn of Africa, Rome, Italy: Food and Agriculture Organization.

FAO, 2012. Climate Change Adaptation and Mitigation: Challenges and Opportunities in the Food Sector, Rome: Food and Agriculture Organization of the United Nations.

FAO, 2013. The impact of disasters on agriculture and food security, Rome, Italy: Food and Agriculture Organization.

FAO, 2015. Swaziland looks to a revitalised agriculture sector. [Online] Available at: http://www.fao.org/in-action/swaziland-looks-to-a-revitalized-agriculture-sector/en/
[Accessed 9 May 2017].

FAO, 2016. The impact of disasters on agriculture and food security, Rome, Italy: Food and Agriculture Organization.

FAO, 2017. The State Of Food Security and Nutrition in the World, Rome, Italy: Food and Agriculture Organization

Freitas, H., Oliveira, M., Jenkins, M. and Popjoy, O., 1998. The Focus Group, a qualitative research method., Baltimore: Merrick School of Business, University of Baltimore.

Frison, E., Cherfas, J. and Hodgkin, T., 2011. Agricultural Biodiversity Is Essential for a Sustainable Improvement in Food and Nutrition Security. Sustainability, 3(10), pp. 238-253.

Gautam, M., 2006. Managing Drought in Sub-Saharan Africa: Policy Perspectives, Washington,D.C: The World Bank.

Greenpeace, 2010. Ecological farming: Drought-resistant agriculture, London: University of Exeter.

Gukurume, S., 2011. Climate Change, Variability and Sustainable Agriculture in Zimbabwe's Rural Communities. Russian Journal of Agricultural and Socio-Economic Sciences, 2(14), pp. 89-100.

Hallegatte, S., Vogt-Schilb, A., Bangalore, M. & Rozenberg, J., 2016. Building the Resilience of the Poor in the Face of Natural Disasters, Washington D.C: The World Bank .

Harvey,C.,Rakatobe,Z.L.,Rao,N.S.,Dave,R.,Razafimahatratra,H.,Hasinandrianina, R.,Rajaofara.H. and MacKinnon,J.L., 2014. Extreme vulnerability of smallholder farmers to agricultural risks and climate change in Madagascar. The Royal Society, 36(169), pp. 369-389.

Hellmuth, M., Moorhead, A., Thomson.M.C and Williams, J., 2007. Climate risk managment in Africa: Learning from Practice, New York: International Research Institute for Climate and Society.

Ilaboya, I.R. Atikpo, E., Omofuma, F.E., Asekhame,F.F. and Umukoro,L.., 2012. Causes, Effects and Way Forward to Food Insecurity. Iranica Journal of Energy and Environment, 3(1), pp. 35-43.

IPCC, 2007a. Climate change 2007: Impacts, Adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden P.J., and Hanson (Eds.), Cambridge University Press, United Kingdom.

IPCC, 2012. Summary for Policymakers. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA.

Islam, M., Salu, S., Hubaccek, K. and Paavola, J., 2014. Limits and Barriers to Adaptation to Climate variability and Change in Bangladeshi Coastal. Marine Policy, 43(4), pp. 208-216.

Jarawura, F., 2014. Perceptions of drought Among Rural Farmers in Savelungu District in the Northern Savannah of Ghana. Ghana Journal of Geography, Volume 6, pp. 102-120.

Jennings, S. and Magrath, J., 2009. What Happened to the Seasons? London: OXFAM

Jones, L., 2010. Overcoming social barriers to adaptation, London: Overseas Development Institute.

Jones, L., Jaspars, S., Pavanello, S., Slater, E.L.R., Arnall, A., Grist,N. and Mtisi,S., 2010. Exploring how disaster risk reduction, social protection and livelihoods approaches promote features of adaptive capacity, London: Overseas Development Institute.

Jenkins, K.L., 2011. Modelling the Economic and Social Consequences of Drought under Future Projections of Climate Change. University of Cambridge, Cambridge.

Kalinda, T., 2011. Smallholder Farmers' Perceptions of Climate Change and Conservation Agriculture: Evidence from Zambia. Journal of Sustainable Development, 4(4), pp. 73-85.

Kalungu, J., Filho, W. and Harris, D., 2013. Smallholder Farmers' Perception of the Impacts of Climate Change and Variability on Rain-fed Agricultural Practices in Semi-arid and Sub-humid Regions of Kenya. Journal of Environment and Earth Science, 3(7), pp. 129-141.

Kandji, S., Verchot, L. and Mackensen, J., 2006. Climate Change, Climate and Variability in Southern Africa: Impacts and Adaptation in the Agricultural Sector, Nairobi: United Nations Environment Programme.

Keck, M. and Sakdapolrak, P., 2013. What is Social Resilience? Lessons Learned and Ways Forward. Erdkunde, 67(1), pp. 5-19.

Kollmair, M. and Gamper, S., 2002. The Livelihood Approach, Zurich: University of Zurich.

Komba, C. and Muchapondwa, E., 2012. Adaptation to Climate Change by Smallholder Farmers in Tanzania, Cape Town, South Africa: University of Cape Town.

Kotir, J., 2010. Climate change and variability in Sub-Saharan Africa:Xa review of current and future trends and impacts on agriculture and food security. Springer Science, 13(3), p. 587–605.

Loffler, P. and Loffler, L., 2005. Swaziland Tree Atlas including selected shrubs and climbers, Pretoria, South Africa: Southern African Botanical Diversity Network.

Manyatsi, A., Mhazo, N. and Masarirambi, M., 2010. Climate Variability and Change as Perceived by Rural Communities in Swaziland. Environment and Earth Sciences, 2(3), pp. 165-169.

Maree, K., Creswell, J.W., Ebersohn,L., Eloff, I., Ferreira,R., Ivankova, N.V.,Jansen, J.D., Nieuwehuis, J., Pietersen J. and Plano V.L., 2 016. First Steps in Research. 2nd ed. Pretoria: Van Schaik Publishers.

Matous, P., 2015. Social networks and environmental management at multiple levels: soil conservation in Sumatra. Resilience Alliance, 3(20), pp. 1-17.

Mavhura, E., Manatsa, D. and Mushore, T., 2015. Adaptation to drought in arid and semi-arid environments: Case of the Zambezi Valley, Zimbabwe. Journal of Disaster Studies, 7(1), pp. 1-7.

Mendelsohn, R., Dinar, A. and Dalfelt, A., 2000. Climate Change Impacts on African Agriculture, New York: World Bank.

Mhlenga, D., 2015. Drought Disaster Risk Reduction Through Agriculture Development, The Role of Appropriate Technology Transfer: Experiences from Swaziland. Environment and Earth Sciences, 5(10), pp. 6-16.

Mishra, A. and Singh, V., 2010. A Review of Drought Concepts. Journal of Hydrology, Issue 391, pp. 202-216.

MOAC, 2005. Assessment Report, Mbabane: Ministry of Agriculture and Cooperatives.

Mobjork, M. and van Baalen, S., 2016.Climate Change and Violent Conflict in East African- Implications for Policy, Stockholm, UK, Stockholm University.

Monacelli, G., Galluccio, M. and Abbafati, M., 2005. Drought Assessment and Forecasting, Prochoice: World Meteorological Organisation Weather, Climate and Water.

Morton, J., 2007. The impact of climate change on smallholder and subsistence agriculture, Kent, United Kingdom: Natural Resources Institute, University of Greenwich.

Moylan, H., 2012. The Impact of Rainfall Variability on Agricultural Production and Household Welfare in Rural Malawi, Illinois: University of Illinois.

Mpandeli, S., Nesamvuni and Maponya, P., 2015. Adapting to the Impacts of Drought by Smallholder Farmers in Sekhukhune District in Limpopo Province, South Africa. Journal of Agricultural Science, 7(2), pp. 115-124.

Mtambanengwe, F., Mapfumo, P., Chikowo, R. and Chamboko, T., 2012. Climate Change And Variability: Smallholder Farming Communities In Zimbabwe Portray A Varied Understanding. African Crop Science Journal, 10(2), pp. 227 - 241.

Mudombi-Rusinamhodzi, G., Siziba, S. and Kongo, V., 2012. Factors Affecting Smallholder Farmers' Responsiveness to Climate Variability Induced Hazards in Zimbabwe. African Crop Science Journal, 20(2), pp. 297-301.

Mugo, F., 2002. Sampling in Research, London: Research Institute.

National Meteorology Department of Swaziland, 2016. Annual Report of National Meteorology, Mbabane, Swaziland, Government of Swaziland.

Naumann, G., Barbosa, P., Garrote, L., Iglesias and Vogt, J., 2014. Exploring drought vulnerability in Africa: an indicator based analysis to be used in early warning systems. Hydrology and Earth System Sciences, Issue 18, pp. 1591-1604.

Ndichu, G., 2013. Impact Of Drought On Primary Schools Learning In Laikipia West District Of Laikipia County, Kenya, Laikipia: Kenyatta University.

NDMA, 2016. Swaziland Comprehensive Drought, Health and Nutrition Assessment Report, Mbabane: National Disaster Management Agency.

NERMAP, 2015. National Drought Mitigation And Adaptation Plan (NERMAP) 2016-2017, Mbabane: National Disaster Management.

Nhemachena, C., Mano, R., Mudombi, S. and Muwanigwa, V., 2014. Perceptions on climate change and its impact on livelihoods in Hwange district, Zimbabwe. Journal of Disaster Risk Studies, 6(1), pp. 123-126.

Nkondze, M., 2014. The Impact of Climate Change on Livestock Production in Swaziland: The case of Mpolonjeni Area Development Programme. Journal of Agricultural Studies, 2(1), pp. 1-15.

Nyamanhindi, R., 2016. Eastern and Southern Africa UNICEF. [Online] Available at: https://www.unicef.org/esaro/5440_zim2016_impact-of-drought.html [Accessed 9 November 2017].

OECD, 2009. Managing Risk In Agriculture: A Holistic Approach, Paris: OECD.

OECD-FAO, 2012. Agricultural Outlook, New York: OECD Publishing.

OCHA, 2016. Consequences of Drought in Somalia, New York: OCHA

Ogalleh, S., Vogl, C., Eitzinger, J. and Hauser, M., 2012. Local Perceptions and Responses to Climate Change and Variability: The Case of Laikipia District, Kenya. Sustainability, 4(12), pp. 3302-3325.

Ojos, 2014. Definition of Drought, California: The Ojos Negros Research Group.

Onesmo, K., 2013. Short- and Long-term Effects of Drought on Human Health, Geneva, Switzerland, The United Nations Office for Disaster Risk Management.

Parry, M.L., Canziani, O.F. and Palutikof, J.P., 2007: Technical Summary. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 23-78.

Padgham, J., 2009. Agriculture Development Under a Changing Climate: Opportunities and Challenges for Adaptation, Washington D.C: The World Bank.

Pandey, S. and Bhandari, H., 2009. Drought, Coping Mechanisms and Poverty: Insights from Rainfed Rice Farming in Asia, Rome: International Fund for Agricultural Development.

Panin, A. and Hlope, S., 2013. Does Subsistence Agriculture Play a Crucial Role in Food Security Developing Country Studies, 3(4), pp. 32-37.

Perry, B., 2011. Swaziland Agricultural Development Programme, Mbabane, Swaziland: Food and Agricultural Organization.

SADC, 2016. Regional Humanitarian Appeal, Gaborone: Southern African Development Community.

Sacolo, S., 2016. University of Dar es Salaam, Tanzania, Dar es Salaam.

Sanfo, S., Lamers, J., Mueller, M. and Fonta, W., 2014. Farmers' Perceptions on Climate Change and Variability versus Climatic Evidence in Burkina Faso, West Africa, Bonn, Germany: Centre for Development Research.

SDAR, 2016. Swaziland Drought Assessment Report, Mbabane: Deputy Prime Minister's Office.

Selvaraju, R., 2013. Climate Risk Assessment and Management in Agriculture, Rome: FAO.

Sesha Sai, M. V. R., Murthy, C. S., Chandrasekar, K., Jeyaseelan, A. T., Diwakar, P. G. and Dadhwal, V. K.,2016. Agricultural Drought: Assessment and Monitoring. Mausam, 1(67), pp. 131-142.

Shemdoe, R., 2011. Tracking Effective Indigenous Adaptation Strategies on Impacts of Climate Variability on Food Security and Health of Subsistence Farmers in Tanzania, Dar es Salaam, Tanzania: The African Technology Policy Studies Network.

Shiferaw,B.,Tesfaye, K., Kassuie, M., Abate, T., Prasnna, B.M., Menkir, A., 2014. Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa:Technologyical ,institutional and policy options. Weather and Climate Extremes, 3(2), pp. 67-69.

Sikuka, W., 2016. Swaziland Agricultural Economic Fact Sheet, Pretoria: USAD.

Stringer,L.C., Dyer,J.C.,Reed,M.S., Dougill,A.J., Twyman,C. and Mkwambisi,D., 2009. Adaptation to Climate Change, Drought and Desertification: Local Insights to Enhance Policy in Southern Africa. ScienceDirect, III (30), pp. 1-18.

Swanepoel, F., Stroebel, A. and Moyo, S., 2010. The Role of Livestock in Developing Communities: Enhancing Multifunctionality, Bloemfontein, South Africa: The Technical Centre for Agricultural and Rural Cooperation.

Tadesse, T., 2016. Strategic Framework for Drought Management and Enhancing Resilience in Africa. Nebraska, University of Nebraska-Lincoln,

Tashakkori, A. and Teddlie, C., 1998. Mixed methodology: Combining qualitative and quantitative approaches. Applied Social Research Methods Series, London: Sage.

Tellis, W., 1997. Introduction to Case Study, Winston: Fairfield University.

Thompson, K., Chidawanyika, F., Kruszewska, I. and Tirado.R., 2015. Building Resilience in East African Agriculture in Response to Climate Change, Johannesburg: Greenpeace Africa.

Thorton, P., Jones, P., Ericksen, P. and Challinor, A., 2011. Agriculture and food systems in sub-Saharan Africa in a 4°C+ world. The Royal Society, 2(4), pp. 176-136.

Thornton, P., Van de Steeg, J., Notenbaert, A. and Herrero, M. 2013. The livestock, climate change and poverty nexus. The Futures of Agriculture. Brief No. 43 - English. Rome: Global Forum on Agricultural Research (GFAR).

Udmale, P. Ichikawa, Y. Manandhar, S.Ishidaira, H and Kiem, A.S., 2014. Farmers' Perception of Drought Impacts, Local Adaptation and Administrative Mitigation Measures in Maharashtra State, India. International Journal of Disaster Risk Reduction, Issue 10, pp. 250-269.

The United Nations Educational, Scientific and Cultural Organization (UNESCO), 2014. African Drought Monitor, Paris: International L Hydrological Services.

UNICEF, 2015. Unless we act now: The impact of climate change on children, New York: United Nations International Children's Emergency Fund.

UNICEF, 2016. The State of The World's Children 2016: A fair chance for every child, New York: United Nations International Children's Emergency Fund.

UNWomen, 2013. Women, Gender Equality and Climate change. United Nations Women Organization.

USAID, 2016. Southern Africa- Drought Report, Washington,D.C: United States Agency for International Development.

WHO, 2016. Climate Change and Health. [Online] Available at: http://www.who.int [Accessed 5 April 2016].

Wikipedia, 2017. Swaziland climate. [Online] Available at: https://en.wikipedia.org/wiki/swaziland#climate [Accessed 16 May Wikipedia, 2017. Swaziland. [Online]].

Wilhite, D., 2000. Drought as a Natural Hazard: Concepts and Definitions, Lincoln: Drought Mitigation Centre Faculty.

Wilhite, D. and Glantz, M., 1985. Understanding the Drought Phenomenon: The Role of Definitions, Lincoln: Drought Mitigation Centre Faculty Publications.

Wilhite, D., Sivakumar, M. and Pulwarty, R., 2014. Managing drought risk in a changing climate: The role of national drought policy. Elsevier, I (3), pp. 4-13.

Zainal, Z., 2007. Case study as a research method, s.l.: Faculty of Management and Human Resource Development, University of Malaysia.

APPENDIX A: RESEARCH QUESTIONNAIRE

Project: Farmers' perception on climate variability induced drought, local adaptation and mitigation measures:

Interviewer Name: ……. Date of the interview …….

Section B: General household information

1. **Name of the village**
   1) Siphocosini
   2) Mantabeni
   3) Ka Nyama
   4) Lomoya

2. **Gender**
   1) Male 2) Female

3. **Age:**
   1) Less than 25 years
   2) 26 – 40 years
   3) 41 – 50 years
   4) Above 50 years

4. **Education- level**
   1) None
   2) Primary school
   3) High school
   4) College/ University
   5) Other (Specify) ……..

5. **Total number of people in the house hold:**_____

6. **How many years have you been farming? _____(years)**

7. **What is the main type of crops do you grow?**
   1) Maize
   2) Groundnuts
   3) Sorghum/Millet
   4) Vegetables
   5) Other (Specify)

8. **What is the main kind of livestock do you keep?**
   1) Cattle
   2) Goats
   3) Sheep
   4) Poultry
   5) Other (Specify)_____

9. **Over the past 5 years what has been the main source of income in your household? (Tick all applicable)**

a. Crop sales	
b. Livestock sales	
c. Informal work	
d. Formal work	
e. Pension fund	
f. Elderly Grants	
g. Other specify	

10. **Estimated annual Household Income? _____(Emalangeni)**

Section B. Farmers perceptions on climate variability induced drought.

B1 What is drought?

……..

……

…

B2 What do you think are the causes of drought in this community?

……

……

……

……

B3 Have you ever experienced drought in your farming years?

a) Last 10 years	b) Last 5 Years	c) Current (1-3) years
1 = Yes	1 = Yes	1 = Yes
2 = No	2 = No	2 = No

B4 When was your last severe drought years' experience?

_____**(years)**

B5 Have you experienced any of the below weather variations in the past 5 years? (Tick where applicable)

a. Frequent storms	
b. Frequent flooding	
c. Late rainfall onset	
d. Shorter Rainfall season	

e. Early rainfall patterns than usual	
f. Inconsistent rainfall patterns	
g. High temperatures	
h. Low temperatures	

B6 What do you think is the major cause of weather variability in your community?

1) Nature
2) Limited participation in rainmaking ceremonies
3) Neglecting culture
4) Climate change
5) Deforestation
6) Pollution

B7 How did you recognize / identify the occurrence of a drought that year?

1) Radio
2) Newspaper
3) Television
4) Farmers union
5) Traditional knowledge sources
6) Friends and neighbors
7) Other (specify)

B8 Do you believe in the Weather / drought forecast?

1) Yes 2) No

B9 Do you think droughts are becoming more or less frequent in last 5-10 years?

1) More
2) No difference
3) Less

4) No idea

Section C: Social effects of drought on subsistence farmer's household

C1 Has drought affected your household food security?

1) Yes 2) No

C2 Did drought limit your food choices?

1) Yes 2) No

C3 Did drought cause food shortage in your household?

1) Yes 2) No

C4 Did any household member's health get affected by drought?

1) Yes 2) No

C5 If yes how?

……..

……

…

C6 Did any of your children fall sick during drought period?

1) Yes 2) No

C7 If yes, was it due to malnutrition?

1) Yes 2) No

C8 Did the drought cause any of your household members to migrate?

1) Yes 2) No

C9 Did any family member dropped out of school due to drought effects?

1) Yes 2) No

C10 Was any family member involved in any conflict due to drought?

1) Yes 2) No

C11 If yes what form of conflict? ……...

C12 Did the household experience death due to drought?

1) Yes 2) No

C13 As a family did you at one point had to cancel a ceremony due to drought?

1) Yes 2) No

C14 If yes which ceremony? ……

Section D: Local adaptation strategies to drought

D1 Were you aware of drought occurrence before its arrival?

1 = Yes 2 = No

D2 If yes, how did you plan for the new season?

1. Plant early maturity crops
2. Adjust planting schedule
3. Planting drought resistant crops
4. Using Zero tillage method
5. Increase water reservoirs
6. Water harvesting techniques

D3 Did you use stored foods during drought?

1 = Yes 2 = No

D4 Did you offer service in exchange for food during drought?

1= Yes 2 = No

D5 If yes what kind of services?

……
….

D6 Did you sell some of your livestock?

1 = Yes 2= No

D7 Did you look for food alternative such as wild fruits and game meat during drought period?

1= Yes 2 = No

D8 Did any family member had to you seek employment outside farming to meet family needs?

1 = Yes 2 = No

D9 If yes were you employed locally or had to migrate?

……
……

D10 Did you have to disperse household members during drought in order to meet family needs?

1 = Yes 2 = No

D11 If yes where did you disperse them?

……..

……
……

E. Mitigation measures

E1. What was your major mitigation strategy to cope with drought?

1) Use irrigation
2) Plant drought resistant varieties of crops
3) Sell some livestock
4) Early planting
5) Implement water harvesting
6) Adjust cropping patterns
7) Mixed cropping
8) Soil-conservation techniques
9) Developing enhanced storage facilities
10) Storing crop residue for livestock feed
11) Reducing livestock herd
12) Migration for employment

E2. Did your family receive food aid form donors or any agencies during drought?

1 = Yes 2 = No

E3. Did the aid arrive on time?

1 = Yes 2 = No

E4. Did you receive any drought preparedness programmes in your community?

1 = Yes 2 = No

E5. If yes who initiated these programmes?

1 = Government

2 = Churches

3 = NGOs

4 = Farmers union

5 = Others

E6. Have you benefited as a household from these drought preparedness programmes?

1 = Yes 2 = No

E7. If yes explain how have you have benefited?

……
….

E8. In your opinion have the local adaptation strategies you used reduced the effects of drought on your household?

1 = Yes 2 = No

E9. Why or why not?

…….....……..……
……

……..……..…….....
.....

E9 what kind of support would you require to improve your adaptive capacity and resilience to climate variability and drought in your community?

(a)

(b)

(c)

(d)

APPENDIX B: FOCUS GROUP DISCUSSION

Semi structured Focus Group Guide: Key informants

Question	Probing pointers
Can you please describe weather variations you have observed in this community over the past 5 years?	E.g. high temperatures, late rains,
What do you think are the causes of this climate variability in your community?	
Can you please give a background of drought experiences in this community in the last five years?	Which year had the most severe drought? What do you think are the causes of drought in this community?
What are the signs that you notice that show that there is going to be a drought?	
How did the social effects of drought affect you as community/ individual? E.g how did conflict affect your life socially?	Food insecurity ,migration, diseases due to drought, conflict , cancellation off ceremonies, children drooping out of school
What were the adaptation strategies employed by the community?	On both crops and livestock
Do you think the adaptation strategies employed by the community to manage the drought were useful?	Yes or no, Explain why you say so?
Did this community receive any awareness programs on drought, climate, adaptation and mitigation methods	
What community support structures are available to assist households to deal	e.g. Farmers Union of Siphocosini

with the drought and how do they operate?	
How did the government and other did agencies responded to the 2015/16 drought in this community?	e.g. food aid programes, offer training on drought
Can you name some of the agencies or organizations that are involved in drought mitigation in your community?	What are their roles?
In our opinion, what needs to be done in this community to mitigate the drought effects?	1.By the community members 2. by the various stakeholder
Do you have any questions or additions?	
Thank you so much for your participation and time!	,