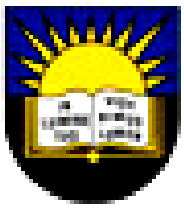

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FACULTY OF SOCIAL SCIENCES AND HUMANITIES

DEPARTMENT OF SOCIOLOGY

MASTERS RESEARCH PROJECT

An Exploratory Study of the Impacts of Climate Variability on Food Production Availability and Access in Chivi District, Zimbabwe.

BY

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A thesis submitted in fulfillment of requirements for the Master of Social Science in Sociology degree at the University of Fort Hare, South Africa

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2013 ACADEMIC YEAR

SUPERVISOR'S STATEMENT

This is to certify that this study was conducted by

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A Student in the Department of Sociology and Industrial Sociology

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Under my Supervision

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DOCTOR PHILANI MOYO

Department Of Sociology

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13th January 2014

DECLARATION

I hereby declare that this research study is a result of my own hard work. As far as I know this research has not been submitted anywhere else for any other purpose or for academic examinations at any other university. Where I have used the ideas and words of others, I have acknowledged them accordingly.

Name: **Raphael Gwindi**

Signature: .....

Date:.....

DEDICATION

This research is dedicated to my family, especially my siblings, who look up to me, may they find inspiration through this research project. I would like to dedicate this to my late parents, especially my father Lt. Col. Solomon Gwindi who supported me and stood by me proudly. I know he would have been proud to see this. I also dedicate this to my aunt Mrs Grace Chitsaka who has been there for me as a mother and a mentor. I would like to also dedicate this research to my friends who supported me all the way, especially in times when I felt I could not go on. Above all I dedicate this whole project to the person who gave me power, wisdom and knowledge to complete this project, the One and Only, MY ALMIGHTY GOD.

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ABSTRACT

The impacts of climate variability have been of global concern for many years. These impacts are affecting economic, social, cultural, agricultural, health and political structures in different countries. Although the impacts of climate variability on agricultural production are being experienced globally, it is generally accepted that the developing countries are the worst affected due to a variety of reasons. Given the high susceptibility of developing countries to climate variability, this study maps and analyses the impacts of climate variability on agricultural production, food production, availability and access in Chivi District, Zimbabwe. The study aimed at finding out experiences, so it used a qualitative approach. The study uses in-depth and focus group discussions to collect data. Chivi district is experiencing erratic weather patterns which are impacting agricultural production in general and food production in particular. Consequently, food availability and access is on the decline in the district. Even though smallholder farmers have devised coping and adaptation strategies, this is not sufficient to help them fully deal with the impacts of climate variability. This is due to their limited assets, inadequate technology and climate information among other things. In an attempt to assist these smallholder farmers cope and adapt to the impacts of climate variability, NGOs and Government Departments have instituted a number of community interventions. This assistance includes agricultural extension services, farming input support and provision of climate change information and a lot of other things. In view of these findings, the study recommends the universal adoption and growing of small grain drought resistant crops in climate variability affected Chivi. It further recommends that farmers adopt conservation agriculture, get into partnerships and co-operatives to practice irrigation gardening where those without water sources provide equipment, labour and knowledge. The study also recommends that more climate science research be conducted in Zimbabwe by both NGOs and Government Departments. Furthermore, government and NGOs should provide more support for farmers in the form of climate change related training, knowledge and technology transfer among other things.

ABBREVATIONS

Agritex:	Department of Agricultural Technical and Extension Services
CA:	Conservation Agriculture
CAP:	Consolidated Appeal Process
CGIAR:	Consultative Group on International Agricultural Research
DFID:	Department for International Development
EMA:	Environment Management Agency
FAO:	Food and Agriculture Organization
GDP:	Gross Domestic Product
GLS:	Grain Loan Scheme
GMB:	Grain Marketing Board
IPCC:	Intergovernmental Panel on Climate Change
MSD:	Meteorological Services Department
NGOs:	Non Governmental Organizations
PES:	Payment for Environment Services
SADC:	Southern African Development Community
SICNA:	Sorghum Improvement Conference of North America
ICRISAT:	International Crops Research Institute for the Semi-Arid Tropics
SLF:	Sustainable Livelihoods Framework
WARDA:	Inter-specific Hybridization Project of the Africa Rice Centre
WFP:	World Food Programme

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CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, among other factors.) of the climate on all temporal and spatial scales beyond that of individual weather events (Intergovernmental Panel on Climate Change (IPCC), 1996). Variability may be due to natural internal processes within climate systems (internal variability), or to variations in natural or anthropogenic external forces (external variability) (IPCC, 1996). On the other hand, climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer) (IPCC, Climate Change, 2001). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or inland use (IPCC, 1996).

Variations in climate are affecting a lot of countries globally. The effects of climate variability are predominantly negative in a lot of countries. Malla (2008) argues that climate variability is a real threat to lives in the world as it largely affects water resources, temperatures, agriculture, food security, freshwater habitats, human health, vegetation and forests. Nelson et al (2009) explains how climate variability is affecting agricultural production and how this is posing a threat to food security when he says *"agriculture is extremely vulnerable to climate change. Higher temperatures*

eventually reduce yields of desirable crops while encouraging weed and pest proliferation…"

With increasing variation in climate, developing countries including those in Africa are likely to be the worst affected. Africa is particularly vulnerable to climate variability because of its overdependence on rain-fed agriculture, compounded by factors such as widespread poverty and weak coping capacity (Adaptation Policy Framework (APF) and NEPAD, 2007). One of the countries in Sub-Saharan Africa experiencing climatic variations is Zimbabwe. Zimbabwe appears on an expansive list of climate change affected nations worldwide and is highly vulnerable to vicissitudes of weather patterns (National Civil Protection Coordination Committee, 1993). The impacts of climate variability are detrimental in Zimbabwe because it is heavily reliant on rain-fed agriculture. Zimbabwe's economy is 75 percent agricultural, with three quarters of industry in the country agriculture driven (Nebakwe, 2002). This makes agriculture the back-borne of the Zimbabwean economy in which maize is a major crop in terms of planted hectares when compared with other crops like tobacco, wheat, cotton, soya beans and paprika (Hanyani-Mlambo, 2004; Mazuru, 2005).

Of Zimbabwe's 32 million hectares (ha) of agricultural land, 16.4 million ha are in communal areas (Makadho, 1996). The overwhelming majority of farmers in Zimbabwe are in communal areas. These have small land holdings and use rudimentary methods for crop production. These farmers in communal areas are small-holders whose livelihood is dependent upon tilling the land under rain-fed conditions (Makadho, 1996). Due to their dependency on rain-fed agriculture their

crop production activities are vulnerable to climate variability. Chivi district is one of the areas in Zimbabwe that has a smallholder population that is dependent on rain-fed agriculture, hence vulnerable to climate variability. Given this Chivi reality, it is imperative to assess how vulnerable Chivi District is to climate variability. It is also important to examine the coping and adaptation strategies being adopted by smallholder farmers to reduce the impact of climate variability. For any adaptation and mitigation options to the impacts of climate change and variability to succeed, there is a need to assess the perception of the communities (Farai, et al; 2012). It is important to find out what the people know about climate variability, the impacts of climate variability and to understand how they are coping and adapting to the new climate patterns.

Against this background this study examines the risks posed by climate variability on agricultural production (in general) in Chivi district. The study also specifically investigates the actual impact climate variability has on food crop production, food access and availability among smallholder agro-based households in Chivi. The study further explores the coping and adaptation strategies being implemented by households to deal with the risks and impacts of climate variability on food production.

1.2 RESEARCH PROBLEM

Climate variations are impacting different countries in various ways. As Davies, et al., (2009) argues; although the whole of Africa is thought to be geographically exposed, the effects of climate variability are not likely to be evenly distributed across and within countries. In countries like Zimbabwe, climate variability is

negatively impacting livelihoods. The negative ripple effects of climate variability mostly affect the rural poor as their livelihoods are predominantly dependent on rain-fed agriculture. Given these climate variability impact projections and scenario models, it is imperative that studies that assess and map climate variability in agro-based communities such as Chivi are conducted. It is within this context that this study assesses and maps the impacts of climate variability on food crop production, food availability and access among smallholder communal farmers in Chivi. The study also examines the coping and adaptation strategies that are being employed by Chivi smallholder farmers to alleviate the impacts of climate variability.

1.3 RESEARCH QUESTIONS

This study answers the following research questions:

- What risk is posed by climate variability on agricultural production (in general) in Chivi district?
- In what ways does climate variability impact food crop production, food availability and access in Chivi?
- Which coping and adaptation strategies are being implemented by households to deal with the risks and impacts of climate variability on food production?

1.4 RESEARCH AIMS AND OBJECTIVES

- To examine the risks posed by climate variability on agricultural production (in general) in Chivi district.
- To investigate the actual impacts of climate variability on food production, food availability and access in Chivi.

- To explore the coping and adaptation strategies being implemented by households to deal with the risks and impacts of climate variability on food production.

1.5 RESEARCH SETTING: CHIVI DISTRICT, ZIMBABWE

Chivi District is in Masvingo Province, Zimbabwe. The levels of poverty and unemployment are extremely high (Parliament, 2011). Subsistence farming and employment at nearby mines and in Masvingo town are the main sources of income for the majority of people in Chivi district. Chivi District is located north of Mwenezi District and west of Masvingo District. It is in a semi-arid region which falls in natural farming regions IV and V. Climatic conditions in Chivi District are typically semi-arid while the soils have inherent low fertility (Sibanda and Chiranda, 2009). Due to the environmental conditions of the district the threats posed by climate variability on agricultural production and food crop production presents a situation of hardship for many of the smallholder farmers in the district.

1.6 STUDY POPULATION: A PRIMER

The study population was smallholder farmers living in Chivi District. The term ‘smallholder’ refers to farmers with limited resource endowments relative to other farmers in the sector (Dixon et. al., 2004). The sample size consisted of 55 smallholder farmers (15 for semi-structured in-depth interviews and 40 for Focus Group Discussions) who were purposively selected. The sample also consisted of 9 key informants who were purposively and snowball chosen from different NGOs and government departments from Agritex, Meteorological Services Department (MSD), Environment Management Agency (EMA) and Practical Action (an NGO).

1.7 SIGNIFICANCE OF THE STUDY

This study has knowledge generation and policy significance. In terms of knowledge generation, it generates new knowledge on how climate variations are affecting agricultural production in general consequently impacting food crop production, food availability and access in Chivi. Context specific new empirical data is provided in this study clearly demonstrating the impacts of climate variability on agriculture (food) production in Chivi. Context specific coping and adaptation strategies (to climate variability) employed by smallholder farmers in Chivi are also fully discussed deepening and extending knowledge in this sociological field of enquiry.

On policy significance, this study has potential to inform policy makers about the impacts of climate variations on agricultural production and food security in Chivi. The empirical data presented and analysed herein can be used to guide policy makers when developing intervention adaptation strategies and coping methods for communities affected by climate variability.

1.8 THEORETICAL FRAMEWORK: A PRIMER

This study utilises the United Kingdom's Department for International Development (DFID) Sustainable Livelihoods Framework (DFID, 2001). The Sustainable Livelihoods Framework (SLF) is suitable for this study as it looks at how livelihoods respond to shocks, stresses or disasters. The approach looks at how the poor cope or recover after experiencing stresses and shocks. Unlike more traditional approaches that have sought to tackle poverty by identifying and addressing needs of poor people, the SLF seeks to improve their lives by building on what they have — their assets (UNDP, 1999).

For a community to recover or improve from stress or shock it depends on the available assets (Majale, 2002). The five major assets emphasized by the SLF are human capital, social capital, physical capital, natural capital and financial capital (Kollmair and Juli, 2002). The SLF views people operating in a context of vulnerability as shown by Figure 3.1 on page 29. It is within this context that people are able to access various assets which they use to improve their livelihoods. Livelihood strategies – the ways in which people combine and use assets in pursuit of beneficial livelihood outcomes that meet their own livelihood objectives – are also influenced by this environment (Majale, 2002). This SLF emphasizes the importance of context and its vulnerability to certain conditions which is why it is suitable for this study. Such a theoretical approach is suitable to assess how Chivi people attempt to cope and adapt to climate variability stresses and shocks.

1.9 STRUCTURE OF THE DISSERTATION

Chapter 1: Overview of the Study

This chapter gives an introduction and a background to the study. The chapter briefly discusses climate variability and how it is impacting agricultural production globally and in Zimbabwe. It also includes a statement of the research problem, research questions, aims and objectives of the study, the research setting, significance of the study and also introduces the theoretical framework used in the study.

Chapter 2: Climate Variability and Its Impacts on Agricultural Production: A Review of Literature

This chapter discusses international and local discourses on climate change and variability. It analyses the different challenges being faced by different countries due to climate variability and change.

Chapter 3: Sustainable Livelihoods Framework: A Theoretical Review

This chapter discusses the study theoretical framework in detail. It explains and justifies why this theory is the most relevant and useful in a study of this nature. The limitations of the theoretical framework are also discussed.

Chapter 4: Research Methodology and Methods

This chapter deliberates on the qualitative research methodology employed by this study. The chapter discusses the overall research design, sampling procedure, tools used in the data collection process. The chapter also discusses the merits and demerits of the research methodology and methods used.

Chapter 5: Impacts of Climate Variability on Agriculture, Food Production, Availability and Access in Chivi

This chapter presents and analyses the empirical research findings. This empirical analysis is based on responses from smallholder farmers, key informants, grey literature and published literature. The knowledge and policy contributions of this study are detailed in this chapter.

Chapter 6: NGOs and State Interventions in Climate Variability Coping and Adaptation in Chivi

This chapter further presents and analyses the empirical research findings. It looks at the role being played by NGOs and government departments in assisting smallholder farmers to deal with climate variability impacts. The policy contributions of this study are detailed in this chapter.

Chapter 7: Conclusions and Recommendations

This chapter consists of the conclusions and recommendations of the study.

CHAPTER TWO

THE IMPACTS OF CLIMATE VARIABILITY ON AGRICULTURAL PRODUCTION: A REVIEW OF LITERATURE

2.1 INTRODUCTION

Climate variability refers to variations in the mean state of climate on all temporal and spatial scales beyond that of individual weather events; examples of climate variability include extended droughts, floods and conditions that result from periodic El Nino and La Nina events (IRG, 2007). Of much concern to climate variability has been the rise in temperatures and erratic rainfall patterns. As the world warms, precipitation patterns will change, with some areas becoming wetter, but some leading agricultural areas becoming drier (Ackerman and Stanton, 2013). The variations in climate are affecting a lot of countries globally and the worst affected being developing countries that are highly dependent on rain-fed agriculture. Agriculture is one of the most climate-sensitive industries. Globally, rain-fed agriculture is practiced in 80% of the total physical agricultural area and generates 62 percent of the world's staple foods (FAOSTAT, 2005; Bhattacharya, 2008). With a lot of countries practicing agriculture and relying on agriculture for food and livelihoods, a lot of countries are consequently affected by climate change and variability. Nelson et al (2009) explains how climate variability is affecting agriculture production and how this is posing a threat to global food security:

> The accelerating pace of climate change, combined with global population and income growth, threatens agriculture production and food security everywhere. Agriculture is extremely vulnerable to climate change. Higher temperatures eventually reduce yields of

> desirable crops while encouraging weed and pest proliferation. Changes in precipitation patterns increase the likelihood of short-run crop failures and long-run production declines. Although there will be gains in some crops in some regions of the world, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security (page 8).

2.2 IMPACTS OF CLIMATE VARIABILITY ON AGRICULTURAL PRODUCTION: GLOBAL DEBATES

Globally, climate change and variability is highly topical and has invoked lots of debate on the serious impacts it poses environmentally, socially, economically and ethically. Some scholars argue that there is a possibility of a positive impact on agricultural production due to climate variability, as some areas tend to benefit from climate variability (Parry et al, 2004). Nelson et al (2009) suggests that *"…there will be some gains in some regions of the world…(pg 8)"* since some areas might have agricultural production increasing due to the fact that some crops will grow well under new climate patterns. This reasoning is based on the fact that there was a general belief in the 1990s that the initial stages of climate change would bring net benefits to global agriculture (e.g., Mendelsohn et al. 1994). Reilly et al. (2001) note that as late as 2001, the U.S. Global Change Research Program still anticipated that U.S. agriculture would experience yield increases due to climate change throughout this century. Ackerman and Stanton (2013) mention that warmer weather was expected to bring longer growing seasons in northern areas, and plants everywhere were expected to benefit from carbon fertilization. It was thought that crop-producing areas may expand pole-ward in countries such as Canada and Russia, and in some regions new opportunities would occur for growing new crops such as grapes for

wine (Earthwatch, undated). Furthermore, the climate change adaptation strategies used in some areas were projected by some scholars to bring about positive rewards for farmers in the long run. For example, animal husbandry was suggested as one alternative that will benefit small scale farmers in some areas affected by climate variability (see Mendelsohn and Seo, 2008; Farai et. al., 2012). The argument is that livestock production in some areas might improve livelihoods. This is however an optimistic view which might be possible for some areas but it has been heavily contested as demonstrated below.

Recent frequencies of droughts and floods in many parts of the world especially in developing countries underscore the negative consequences of climate variability. There is a high possibility that climate variability will negatively affect agricultural production. Most scholars and development organisations are predicting the worst could happen to agro-economies, mostly in developing countries if erratic climatic variations continue (see Ngigi, 2009, Nelson et. al, 2009, Haile 2005; Mendelsohn et. al, 2000). Several authors suggest that climate variability is going to have a disparaging impact overall. Tadesse (2010) states that *"climate change has been identified as a leading human and environmental crisis of the 21st century (pg. 1)".* Environmental change related to climate change has altered the rainfall patterns, amplified drought cycles, increased the frequency of severe weather conditions and increased agricultural pests and diseases (Yanda, 2010; Hewitson, 2010; Unganai, 1996; Makadho, 1996). Negative impacts are expected for a number of crops in developing countries by 2030 (Ackerman and Stanton, 2013). Climate change may also change the types, frequencies, and intensities of various crop and livestock

pests; the availability and timing of irrigation water supplies; and the severity of soil erosion (Adams et al., 1998).

Climate variability is worryingly affecting crop production. Crop production is affected biophysically by meteorological variables, including rising temperatures, changing precipitation regimes and increased atmospheric carbon dioxide levels (Parry et. al., 2004). Although temperature increases can have both positive and negative effects on crop yields, in general, temperature increases have been found to reduce yields and quality of many crops most importantly cereal and feed grains (Adams et al., 1998). On the other hand, a drop in temperatures also reduces yields. In a research of projected losses due to winter chilling conditions in the USA, Germany, and Oman, fruit and nut trees showed large diminution in yield due to climate change (Luedeling et al. 2011).

Rainfall changes are also affecting crop production. Rainfall patterns in many countries have been changing as a result of rising temperatures. The changing rainfall patterns are negatively affecting crop production world over. Bergaoui (2010) mentions that rainfall irregularity and variability has a spatial and temporal influence on agricultural production. Scarcity in rainfall affects the growth of crops reducing yields. Water availability governs the physiological active period of crop production (Malla, 2008). Extreme cases of lack of rainfall result in agricultural drought. Agricultural drought occurs when low level moisture in soil, coupled with the scarcity of water around plant roots stops growth and reduces crop yields (Bergaoui, 2010). The net change in crop yields is determined by the balance between these negative

and positive direct effects (of climate variability) on plant growth and development, and by indirect effects that can affect production (Adam et al., 1998).

Studies on climate variability have shown that African countries are the most likely to experience the most negative impacts of climate variability. With these increasing variations in climate, African countries will be one of the worst affected continents because agriculture is the main economic activity for the majority of poor people in the continent (see Ellis 1993, Molua and Lambi 2006; FAO, 2008). Africa is particularly vulnerable to climate variability because of its overdependence on rain-fed agriculture, compounded by factors such as widespread poverty and weak coping capacity (APF and NEPAD, 2007). With only about 6 percent of African crop lands irrigated, the impacts on smallholders could be catastrophic (Ngigi, 2009). Enete and Amusa (2010) argue that climate change is perhaps the most serious environmental threat to the fight against hunger, malnutrition, disease and poverty in Africa, mainly through its impact on agricultural productivity. Projected reductions in yield in some African countries could be as much as 50% by 2020, and net crop revenues could fall by 90% by 2100 (Boko et al. 2007).

Climate variability impacts are critically affecting agricultural production in a lot of countries in Sub-Saharan Africa. In Sub-Saharan Africa, 93 per cent of cultivated land is rain-fed (FAO, 2002) thus playing a crucial role in food security and water availability (Wani et al., 2009). Agriculture is a very important sector in Southern Africa in terms of subsistence, contribution to GDP (about 35 percent), employment (70-80 percent of the total labour force) and foreign exchange earnings (about 30 percent) (Abalu and Hassan, 1998). The decline in agricultural production is a huge

threat to many livelihoods in Sub-Saharan Africa. Russell (2008), Mutekwa (2009), Makungwa (2010) note the predicament faced by the region, as they argue that climate change has resulted in declining farm productivity not only in Zimbabwe but in the whole of the Southern African Development Community (SADC).

2.3 CLIMATE VARIABILITY IMPACTS ON FOOD PRODUCTION, AVAILABILITY AND ACCESS

Impacts of climate variability on agricultural production are having a ripple effect on food crop production, food availability and access. Studies show that food production is declining due to climatic conditions which are no longer favourable for viable agricultural production (see UNFCCC, 2007; Eriksen et. al, 2008; FAO, 2008; Witt and Waibel, 2009). A report by the Food and Agricultural Organisation (FAO) (2008) mentions that many countries worldwide are facing food crises due to conflict and disasters, while food security is being adversely affected by many factors including droughts and floods linked to climate change. Climate change and variability has increased the burden of food insecurity and reduced income among many farming families (Mongi, Majule and Lyimo, 2010). At the same time, the world's population will continue to grow through mid-century or later increasing the demand for food just as climate change begins to depress yields (Ackerman & Stanton, 2013).

A decrease of up to 30% in world food production due to effects of climate change on agriculture is generally predicted (IPCC, 2007). According to Lobell et al. (2008) among the crops most vulnerable to temperature increases are millet, groundnut, and rape seed in South Asia; sorghum in the Sahel; and maize in Southern Africa. A warming world may experience food crises much sooner than expected, a threat that should inspire immediate responses (Ackerman and Stanton, 2013).

Climate variability is increasingly impacting food security in Africa. There is a huge concern about food security as agricultural production is declining in most African countries. An Earthwatch paper (undated) points out that if climate change is not averted an additional 80 to 120 million people will be at risk of hunger and 70 to 80% of these people will be in Africa. It is projected that crop yield in Africa may fall by 10-20% by 2050 or even up to 50% due to climate change (Jones and Thornton, 2003). Davidson et al. (2003) notes that the food insecurity threat posed by climate change is greatest for Africa where agricultural yields and per capita food production have been steadily declining, and where population growth will double the demand for food, water and forage in the next 30 years. If the impacts of climate variability continue to escalate, chronic food crises will be experienced in most parts of the African continent, as agricultural production decreases, crop production declines and a lot of people are left vulnerable to hunger (see Haile, 2005; Adejuwon 2006; Enete and Amusa 2010).

Pertinent to this study is the alarming rate of food insecurity caused by the impacts of climate variability in Southern Africa. The precarious food situation that has been afflicting the Southern African region in recent years stems from a combination of factors including unfavourable climatic conditions (erratic rainfall, drought and floods); poor and depleted soils; environmental degradation; failed sectoral and macro-economic policies; inadequate support systems; and political upheavals (Van Rooyen and Sigwele, 1998). A very huge concern about the situation on the impacts of climate variability is the fact that it is mostly rural poor people who are faced with food crises in Sub-Saharan Africa. Enete and Amusa (2010) note that it is estimated that 33 percent of the regional population was undernourished at this time with a

higher incidence of undernourishment found in rural areas, where agriculture is the predominant practice. This is because their livelihoods are highly dependent on agriculture. Unlike other social groups, smallholder farmers in these rural areas have limited sources of income. Therefore changes in climate deeply affect them and expose them to risks of severe famines and abject poverty.

2.4 CLIMATE VARIABILITY COPING AND ADAPTATION STRATEGIES

To adapt to environmental changes related to climate change over the years, humans have transformed agriculture systems through the use of different physical and economic mechanisms. This has been accomplished by adopting new technologies (including investments in genetic improvements), changing crop mixes and cultivated acreages, and changing institutional arrangements (Adams et al., 1998). According to Olmstead and Rhode (2010) farmers adapt to temperature changes by selecting different cultivars that could thrive in the new conditions. Ackerman and Stanton (2013) suggest that to enable adaptation to the inescapable early states of climate change, it is essential to apply the rapidly developing resources of plant genetics and biotechnology to the creation of new heat resistant and perhaps drought-resistant crops and cultivars. Adaptation is an essential possibility but adaptation efforts in some parts of the globe are being undermined by lack of adaptation capacity.

The impacts of climate variability in Africa especially in Sub-Saharan Africa are worsened by the lack of adaptive capacity. Available evidence shows that the most adverse effects of climate change will be felt mainly by developing countries, especially those in Africa due to their low level of coping capabilities (Nwafor 2007; Jagtap 2007). This is partly because climate variability information available to

African households remains very limited. The challenges and problems faced by the poor are thus exacerbated by their lack of access to climate change information. Furthermore, findings from a study by the Centre for Environmental Economics and Policy in Africa across African countries showed that lack of access to credit or saving is one of the major problems encountered by farmers in adapting to the effects of climate change (De Wit, 2006). Deressa et al. (2008) found that lack of money is one of the major constraints to adaptation by farmers in the Nile basin of Ethiopia. Wisner et al (2004) adds that the vulnerability of agriculture is not only determined by the nature and magnitude of environmental stress like climate change per se, but by the combination of the societal capacity to cope with and/or recover from environmental change.

However, efforts have been made by farmers throughout the African continent to try and reduce impacts of climate variability. Some farmers in some parts of Africa are using soil and water conservation as an adaptation strategy (see Sivakumar et. al.,undated, Ngigi, 2009 and Labaris, 2012). A study by Labaris (2012) finds that soil and water conservation strategies such as water harvesting are currently practiced by about 38% of the smallholder farmers in Nasarawa, Nigeria. In some parts of Sub-Saharan Africa, farmers have minimised or spread risks by managing a mix of crops, crop varieties and sites, staggering the sowing/planting of crops, and adjusting land and crop management to suit the prevailing conditions (Eyzaguirre and Iwanaga 1996; Van Oosterhout, 1996; Tengberg et al., 1998; O'brien et al., 2000 and Blench, 2003).

2.5 THE IMPACTS OF CLIMATE VARIABILITY ON AGRICULTURAL PRODUCTION IN ZIMBABWE

One of the countries in Sub-Saharan Africa heavily reliant on agriculture is Zimbabwe. Zimbabwe's economy is 75 percent agricultural, with three quarters of industry in the country agriculturally driven (Nebakwe, 2002). This makes agriculture the back-borne of the Zimbabwean economy in which maize is a major crop in terms of planted hectares when compared with other crops like tobacco, wheat, cotton, soya beans and paprika (Hanyani-Mlambo, 2004; Mazuru, 2005). Of Zimbabwe's 32 million hectares (ha) of agricultural land, 16.4 million ha are in communal areas (Makadho, 1996). Farmers in communal areas are smallholders whose livelihood is dependent upon tilling the land under rain-fed conditions (Makadho, 1996). The "Fast Track Land Resettlement Programme" in the year 2000 marked a shift in distribution of land in Zimbabwe as it resulted in the acquisition of some 11 million hectares, from mostly white commercial farmers for redistribution (Sachikonye, 2003).

Generally, in most places in Zimbabwe, climate variability has a negative impact on crop production. There is a reduction in crop production due to changes in rainfall patterns and extreme temperatures as revealed by a number of studies. Cotton production in Zimbabwe has been on the decline mainly due to climate change and variability (Gwimbi, 2009). Just like other crops, maize production is decreasing in some areas of Zimbabwe. Studies by Makadho (1996), Gwimbi, (2009), Mutekwa (2009), Ndabaningi and Jerie (2011) have found that maize production and other small grains like sorghum have been on the decline.

The decline in maize production (Zimbabwe's staple food crop) and other food crops poses a threat to the country's food security. One major factor that has contributed to the decline of food crop production is the Fast Track Land Resettlement Programme. Richardson (2004) mentions that agricultural production has plummeted since the program was initiated in 2000; in fact, by 2004, it had dropped by 30 percent. Matarira et al., (2004) states that the projected climate changes will cause maize yields to decrease dramatically under dryland conditions in some regions. In drought prone regions of Zimbabwe, maize production has decreased to a point where it is projected that some areas will be non-maize producing zones in future. A UN (1998) projection (cited in Chikodzi et. al., 2012) suggests that Masvingo province will be a non-maize producing region in the future. Chivi district is one of the districts in Masvingo that has been gravely affected by extreme climatic conditions. These changes are affecting the livelihoods of the rural people of Chivi and impacting their rural economy as empirical evidence in chapters that follow shows.

2.6 THE ROLE OF NGOS AND STATE ACTORS IN CLIMATE VARIABILITY COPING AND ADAPTATION STRATEGIES IN AFRICA

Climate variability has become a major challenge for many countries throughout the globe that it has compelled many NGOs and government departments to implement intervention programmes and projects. Several scholars and activists examine how best support by NGOs and government can be provided. Debates on what works, what does not work, under what circumstances and at what cost are usually brought up. Croxton and Appleton (1994) ask how aid provided through projects and information can be maintained beyond the rudimentary appraisal stage. Oakley (1994) questions the form of participation that would be possible if approaches working at a localised level with intensive external inputs (usually from an NGO

project) are replaced by programmes with broader geographical and social constituencies. However, Nhodo et al. (undated) asserts that in the wake of this agricultural catastrophe, local and international non–governmental organizations have devised strategies to ameliorate such challenges and enhance food security in the region.

Some organizations are developing and promoting new technology as an adaptation strategy for farmers to use. For example, a project mentioned by Below et al. (2010) on the development of improved drought-resistant rice varieties in the Inter-specific Hybridization Project of the Africa Rice Centre (WARDA). The Sorghum Improvement Conference of North America (SICNA) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) are continuously working on improving sorghum and millet seed variety to enable greater returns in yields.

To deal with food crises caused by climate variability, several international organizations are implementing different strategies. In 1991, the United Nations General Assembly created the Consolidated Appeal Process (CAP) a mechanism used by aid organizations to plan, implement and monitor their activities (Haile, 2005). Within the CAP mechanism, two of the UN branches WFP and FAO are mandated to assist with food security-related issues. The two branches have been helping a lot of victims of global climate variability impacts (see Haile 2005; FAO, 2010; Gunjal et. al., 2011). Churches are also assisting in drought prone areas with food relief. Churches like Roman Catholic through Catholic Development Commission and Lutheran Church through Lutheran Development Programmes are

assisting several countries globally with food relief (see Ferris 2005; Moberg et. al., 2010).

International organizations are also assisting farmers to deal with climate variability through information dissemination and research. In Sub-Saharan Africa seasonal climate forecasting is being provided through the Regional Climate Outlook Forums (RCOFs) which include SARCOF (Southern Africa), GHACOF (Greater Horn of Africa) and PRESAO (West Africa) (Haile, 2005). These forums generate consensus forecasts by bringing together climate forecasters and facilitate co-operation and dissemination of climate information. According to UNFCCC (2006), one of the most important intervention organizations is the Consultative Group on International Agricultural Research (CGIAR) which is a strategic alliance of international organizations and private foundations that work with national agricultural research systems and civil society organizations as well as the private sector. CGIAR helps with research and information on improving agricultural production and dealing with impacts of climate variability (UNFCCC, 2006).

Different governments in various countries are also assisting farmers with coping and adaptation strategies. Some states are using environment conservation as a mitigation strategy (Prowse and Snilstveit, 2010). Payment for Environment Services (PES) programmes is one of the examples of the conservation strategy used by some countries (Micca, FAO and UN-REDD, 2010). These PES programmes vary among countries. Costa Rica's programme is aimed at reducing deforestation by providing forest owners with financial compensation for the services their forests provide (Prowse and Snilstveit, 2010). The 'Grain for Green' PES program in China

provides farmers with compensation in the form of grain, cash and seedlings if they set aside all or parts of their land to grow trees (Prowse and Snilstveit, 2010). The main objective of the programs is to increase forest cover thereby reducing the impacts of climate variability.

Some governments are assisting farmers to deal with the impacts of climate variability by reducing crop surplus and therefore effectively raise the value of crops (Below et, al. 2010). The US government utilizing the Agricultural Adjustment Act to reduce the impacts of climate variability offered to pay farmers to reduce acreage of certain cultivated crops such as cotton (Below et al., 2010). Some governments are assisting farmers affected by extreme climatic conditions by offering assistance loans and grants. Through the Farm Security Administration, the US government provided loans and subsidies to distressed farmers and ran camps for migrant agricultural workers in other regions of the country that needed agricultural labour (McLeman et al. 2008).

Some government departments are assisting farmers by introducing and promoting new farming methods. For example, Nyanga et. al. (2011) notes that since the establishment of the Conservation Farming Unit (CFU) of the Zambia National Farmers' Union in 1995, CFU has taken a leading role in training and promoting conservation agriculture in the country. These intervention strategies are devised to help farmers deal with climate variability impacts. Fundamentally, as noted by Eriksen et al (2011), adaptation does not occur without influence from other factors such as socio-economic, cultural, political, geographical, ecological and institutional structures that shape the human-environment interactions.

2.7 CONCLUSION

This chapter has examined how climate variability is affecting a lot of countries globally. From the literature reviewed, it was shown that changes in climate are causing a decline in agricultural production. It was also demonstrated that most repercussions of climate variability emanate from the rise in temperatures and erratic distribution of rainfall. Countries that are predominantly vulnerable to the impacts of climate variability are the less developed countries that are dependent on rain-fed agriculture and have low adaptive capacity. Africa, the Sub-Saharan region is one of the most susceptible regions because it has a lot of rural poor farmers who are highly dependent on agricultural production for their livelihood. Zimbabwe is one of the countries in the Sub-Saharan African region that is affected by climate variability. However, limited information exists on the actual local level climate variability impacts, coping and adaptation strategies used by smallholder farmers in drought prone areas like Chivi District. Given this knowledge gap, this study therefore investigates how climate variability has affected agriculture production, food availability and access as well as the coping and adaptation strategies employed by households in Chivi District in Zimbabwe.

CHAPTER THREE

SUSTAINABLE LIVELIHOODS FRAMEWORK: A THEORETICAL REVIEW

3.1 INTRODUCTION

This study utilises the United Kingdom's Department for International Development (DFID) Sustainable Livelihoods Framework (DFID, 2001) as it heuristic theoretical tool. The Sustainable Livelihoods Framework (SLF) is conceptually and intellectually part of the Sustainable Livelihoods Approach (SLA). To understand what makes a sustainable livelihood, it is imperative to define a livelihood. According to Chambers and Conway (1992)

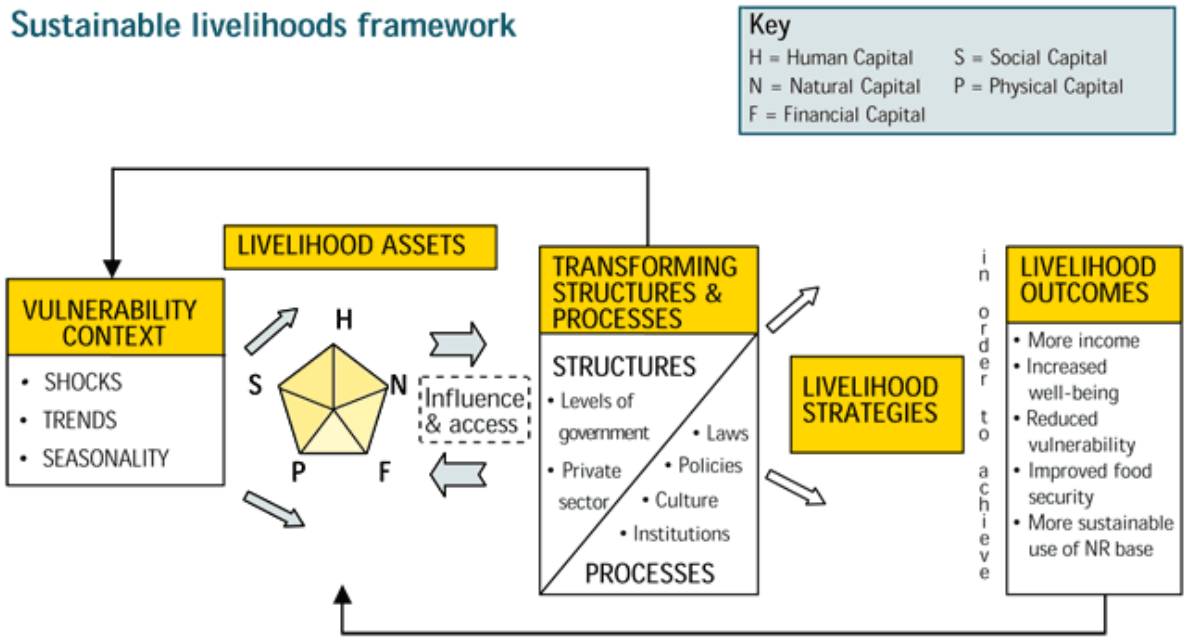
> a livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (pg.9).

The SLA looks at the way people can cope or recover from stresses or shocks. It is an analytical framework that provides a way of understanding the factors that influence people's ability to achieve sustainable livelihoods in a chosen circumstance (Baumann, 2000). In this study the major factors affecting people's livelihoods are a component of the environment. The SLA looks at how environmental changes (such as climate variability) affect people's livelihoods. These changes in the environment expose people to certain risks, making them vulnerable to several shocks, disasters and seasonality.

3.2 SUSTAINABLE LIVELIHOODS FRAMEWORK (SLF)

The Sustainable Livelihoods Framework (SLF) is a tool for improving our understanding of livelihoods, particularly the livelihoods of the poor (DFID, 1999). The SLF depicts poor people as operating in a context of vulnerability, within which they have access to certain assets. It also highlights the main factors that make up poor people's livelihoods and the typical relationships between these factors as shown in Figure 3.1 below.

Figure 3.1: DFID Sustainable Livelihoods Framework (SLF)



DFID Sustainable Livelihoods Framework: Source, DFID 2001.

A paramount aspect of the DFID Sustainable Livelihoods Framework is livelihood assets. Even though people are the centre of this livelihoods approach; emphasis is made on the need to access assets or capital to achieve or build a sustainable livelihood (Krantz, 2001). The assumption is that people pursue a range of livelihood outcomes by drawing on a range of assets to pursue a variety of activities (Baumann, 2000). People require a range of assets to achieve positive livelihood

outcomes; no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek (DFID, 1999). The inter-relationship of these assets is essential for any livelihoods to be able to deal with shocks or stresses. There are five types of assets that form the core of livelihood resources, namely, financial, human, natural, physical and social capital (Baumgartner and Hogger, 2004).

3.2.1 Sustainable Livelihoods Framework Assets

As mentioned above, there are five types of assets that are central to the SLF: human, social, natural, physical and financial capital. Human capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (DFID, 2000). Absence or lack of human capital (knowledge, skills, ability to labour, etc.) means no development can take place. The knowledge, skills, ability to labour people possess will help them tackle a problem, and develop and sustain their livelihoods. A reduction in human capital either through lack of information or knowledge, skills, health issues poses a threat to a livelihood's sustainability exposing it to a lot of detrimental stresses or shocks.

Social capital refers to social resources upon which people draw on seeking their livelihood outcomes. It refers to social networks (and connectedness) that increase people's trust and ability to cooperate; it also entails membership of more formalised groups and their system of rules, norms and sanctions (Kollmair and Juli, 2002). Social capital in rural settings, like the study area, plays a crucial role. Mutual trust and reciprocity lower costs through working together (DFID, 1999). By improving the efficiency of economic relations, social capital can help increase people's income

and rates of saving (financial capital) (isolated studies have shown that communities with 'higher levels' of social capital are wealthier) (DFID, 1999). Building on social capital helps a community to share important information, knowledge, skills improve their human capital and other assets while at the same time tackling problems. To tackle the problem of climate variability, social capital plays a major role as lack of information is one factor that can increase the impacts of climate variability. Building strong social networks for sharing information might be a coping and adaptation strategy that can be used by communities to curb the impact of climate variability. Social capital could also play a major role especially on adaptation to new weather patterns by farmers.

Natural capital is the term used to refer to the natural resource stocks (such as land, water, forests, air quality, biodiversity etc) from which resource flows and services useful for livelihoods are derived (Kollmair and Juli, 2002). Natural capital is very important to those who derive all or part of their livelihoods from resource-based activities (farming, fishing, gathering in forests, mineral extraction etc.) (DFID,1999). Within the sustainable livelihoods framework, the relationship between natural capital and the vulnerability context is particularly close (DFID, 2000). Climate variations affect natural capital, for example floods destroy agricultural land, cause land degradation and soil erosion. Prolonged droughts will also affect the water levels. All this demonstrates the relevance of focusing on natural capital in a climate variability study such as this one.

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods such as affordable transport, secure shelter and buildings, adequate water supply and sanitation, clean, affordable energy and access to

information (Kollmair and Juli, 2002). Climate variability has a major impact on physical capital: droughts can impact water supply and sanitation; floods can destroy basic infrastructure such as buildings, road and other transport networks etc. Matarira et al., (2004) mention the improvement of infrastructure as one of the adaptation strategies that can be used to reduce the impact of climate variability.

Financial capital refers to the financial resources that people use to achieve their livelihood outcomes (Baumgartner and Hogger, 2004). These are resources in the form of available stocks and regular inflows of money (for example, livestock and the related flows of income) (Baumgartner and Hogger, 2004). Financial capital is vital in tackling the problems experienced in any community. To build or improve infrastructure financial capital is a prerequisite. To improve or provide necessary equipment to improve human capital, there is need for financial capital. For climate variability coping and adaptation strategies to be well implemented there is need for large investments through financial capital. Access to financial capital plays a major role in reducing the impacts of climate variability as this determines the forms of mitigation and adaptation strategies that can be used.

3.3 SLF: A PEOPLE CENTRED, HOLISTIC, DYNAMIC AND SUSTAINABLE FRAMEWORK

The SLF is people-centred. The framework brings out the main factors that matter to people. People rather than the resources they use are the priority concern in the livelihoods approach (Kollmair and Juli, 2002). Being a people-oriented framework has made the approach popular for its stance of addressing problems encountered by people using their available resources as opposed to seeking external support or donations. This aspect made it suitable for the study as it sought to identify local coping and adaptation strategies used by the farmers in Chivi. Another crucial aspect

of the SLF mentioned by Krantz (2001) is that it facilitates an understanding of the underlying causes of poverty by focusing on the variety of factors (at different levels) that directly or indirectly determine or constrain poor people's access to resources/assets of different kinds, and thus their livelihoods. The approach also aims to build on assets important to the people and use them to build sustainable livelihoods. This made the approach relevant for the study because there are a lot of assets that are affected by changes in climate with direct consequences on smallholder farmers in Chivi.

The SLF is also holistic and contributes to identifying the most pressing constraints faced by individuals or households, and conversely it can be used to identify opportunities (Ludi and Slater, 2008). The approach looks at the multiple factors affecting livelihoods and the relationships that influence or shape community activities. Central to the SLF is a vision of a successful community as an outcome of relations based on the interaction between different capital assets (Baumann, 2000). The holistic nature of the SLF allowed the assessment of experiences of farmers in relation to climate variability and an examination of the means (assets) they have and use to help themselves.

The SLF is also dynamic. Just as people's livelihoods and the institutions that shape them are highly dynamic, so is the approach (Kollmair and Juli, 2002). It acknowledges that the environment is constantly changing. These changes impact on livelihoods. This study assesses the impacts of change, with specific focus on climate variability. The SLF further builds on people's strengths. It enables a form of analysis which identifies people's strengths rather than their needs (Ludi and Slater, 2008). It focuses on the strengths and potentials of people looking at how they use

their assets to build livelihoods. This emphasis of the SLF allowed the study to explore how people in Chivi use their strengths and potential to cope and adapt to climate variability. Another central issue of the approach is the recognition of everyone's inherent potential for his/her removal of constraints and realisation of potentials (Kollmair and Juli, 2002). It also sees people as able to overcome hurdles and contribute to the development of their livelihoods through asset acquisition and accumulation.

The SLF also links the macro and the micro environment. Development activity tends to focus at either the macro or the micro level, whereas the SLF tries to bridge the gap in stressing the links between the two levels (Kollmair and Juli, 2002). Although the SLF focuses strongly on individuals, households and their assets (the micro-level), it does not neglect the specific contextual settings (the macro level) (Ludi and Slater, 2008). As people are often affected by decisions at the macro policy level and vice-versa, this relation needs to be considered in order to achieve sustainable development (Kollmair and Juli, 2002). This macro-micro linkage allowed the study to look into the links between rural famers (micro-level) and government/NGO interventions (macro-level) in dealing with climate variability impacts. Sustainability arguments are also central to the SLF. Kollmair and Juli (2002) argue that a livelihood can be classified as sustainable when it is resilient in the face of external shocks and stresses, when it is not dependent upon external support, when it is able to maintain the long-term productivity of natural resources and when it does not undermine the livelihoods options of others.

3.4 CONCLUSION

Even though the SLA and SLF have been criticised by a variety of scholars who point out that the approach requires enormous financial, time and personal resources often lacking in practical projects (Kollmair and Juli, 2002); it remains the most relevant and applicable theoretical framework in a study of this nature. Krantz (2001) mentions that by drawing attention to the multiplicity of assets that poor people make use of when constructing their livelihoods, the SLF produces a more holistic view on what resources or combination of resources, are important to the poor, including not only physical and natural resources, but also their social, financial and human capital. Another merit of the approach is that it is people-centred and has been used to identify challenges that affect poor people's livelihoods. It has been used for designing and assessing new initiatives which are human-based and pro-poor. Krantz (2001) argues that the framework has already been used by the DFID for identifying, designing, and assessing new initiatives (projects or programmes), for re-assessing existing activities to informing strategic thinking and discussion, and for research. It is these merits (and others mentioned above) that justify why this framework is used as a heuristic theoretical tool in this study.

CHAPTER FOUR

RESEARCH METHODOLOGY AND METHODS

4.1 INTRODUCTION

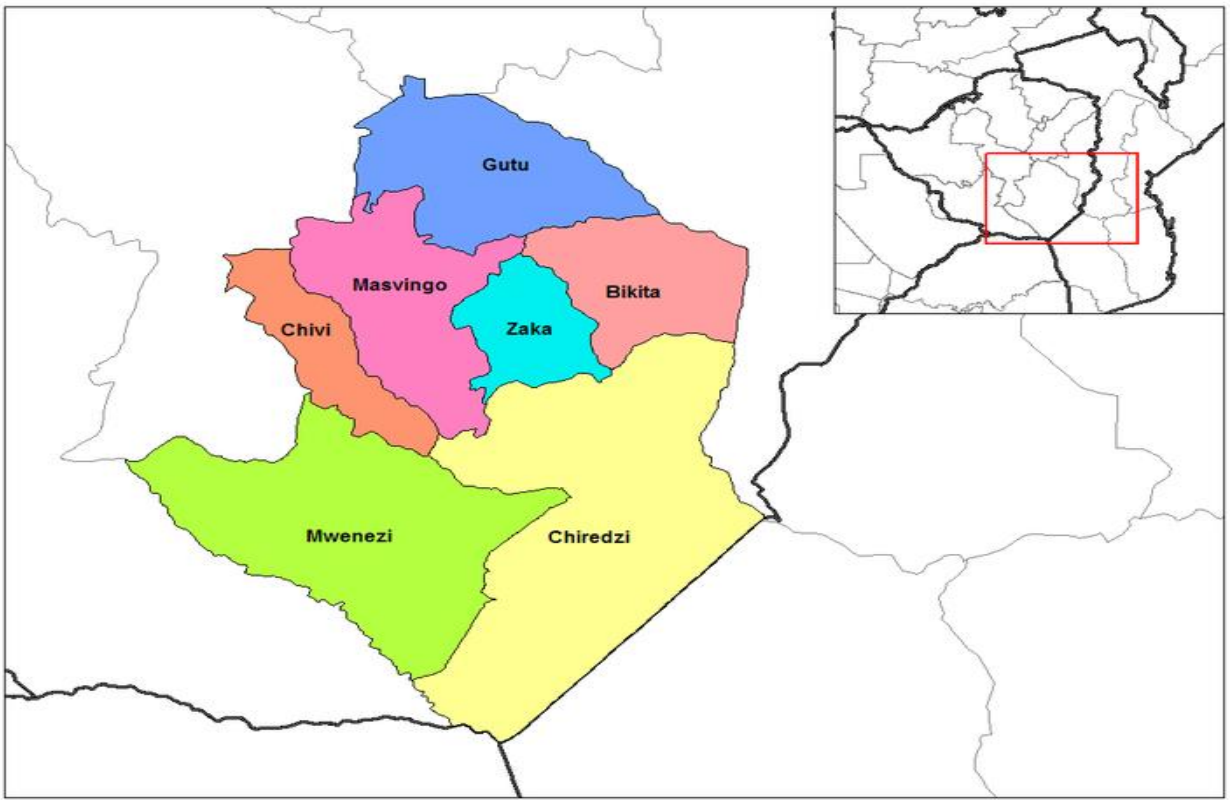
This chapter provides a discussion of the research design, the methodology utilized, research instruments used in data collection, the sampling procedure, data analysis techniques as well as the ethical considerations observed in the study. Before discussing the above-mentioned, it is necessary to provide some background information about the research setting.

4.2 RESEARCH SETTING

This research was conducted in Chivi District in Zimbabwe. Chivi district is located in the southern part of Zimbabwe. It is one of the 7 administrative districts located in Masvingo Province as shown in Figure 4.1 below on page 37. Masvingo province occupies the drier lowveld area in the south of Zimbabwe. Most of the areas in the province devoted to cattle ranching, subsistence crop farming, with mining and irrigated sugar growing also significant (Farai et. al., 2012). Chivi district is located in the drought prone region of the country, north of Mwenezi district and west of Masvingo district. It is a semi-arid area which falls in agricultural regions IV and V as shown in Figure 4.2 below on page 38. Climatic conditions in Chivi district are typically semi-arid while the soils have inherent low fertility (Sibanda and Chiranda, 2009). According to Croxton and Murwira (1997), Chivi

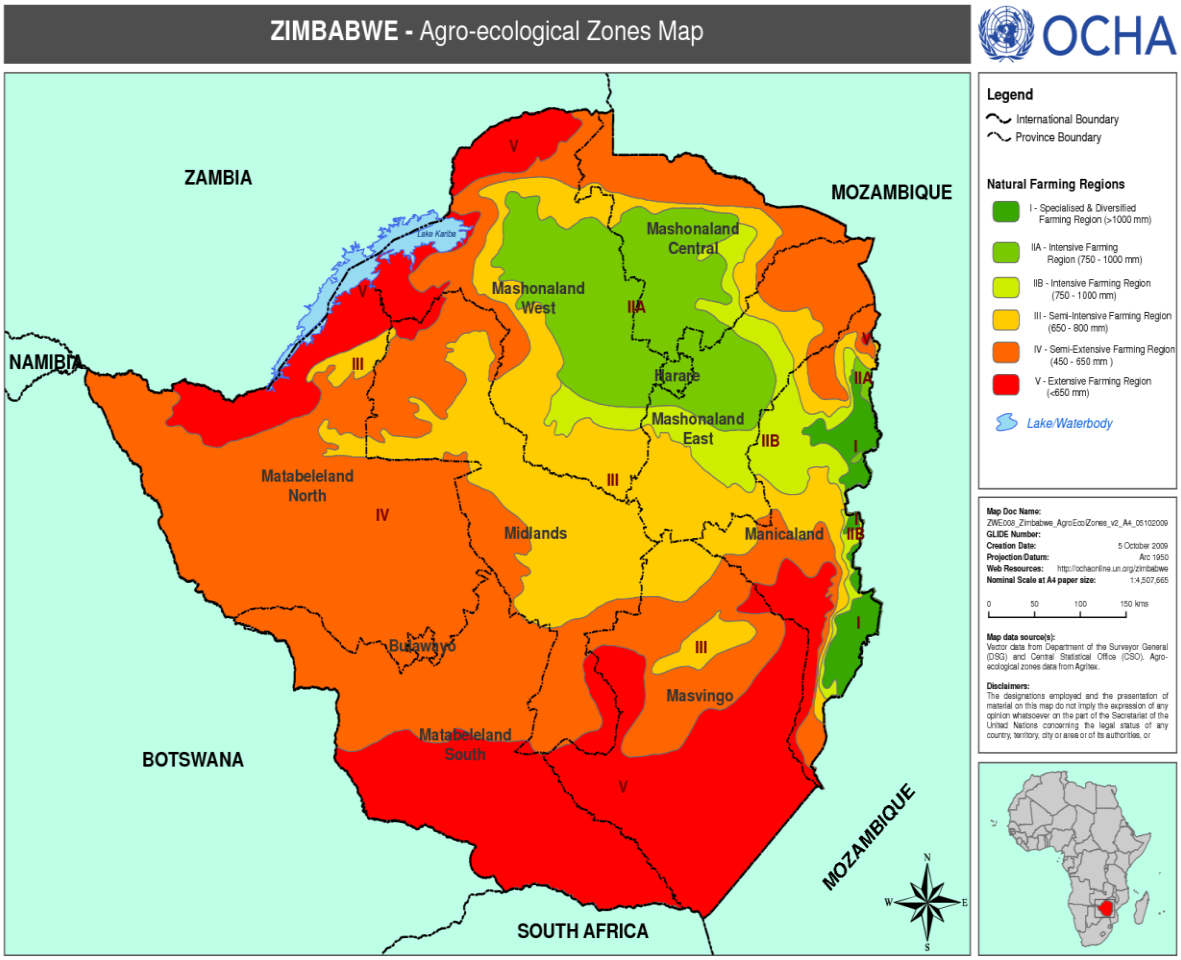
> is inhabited by the Karanga people, a subgroup of the Shona Tribe. A population of up to 100 per square kilometre, growing at around 3% per year, puts enormous pressure on land. Holdings average 1.2 ha per farmer and size is declining. Average annual rainfall is 530mm. Drought years, defined as years with less than 450mm rainfall, or crops failing, occur in three years out of five. Subsistence agriculture is the basis of the rural economy (pg. 2).

Figure 4.1: Map of Masvingo Province



Source: Rarelibra, 2006

Figure 4.2: Agro-Ecological Zones of Zimbabwe



Source: UN Office for the Co-ordination of Humanitarian Affairs, 2009

The economy of Chivi district is mainly agrarian. Various crops like maize, which is the staple food of Zimbabwe, are grown in the district. The majority of farmers in Chivi are smallholder farmers who are highly dependent on rain-fed agriculture. As a result most of them are vulnerable to climatic variability (Care, 2009). With such unreliability in climatic conditions there is always a possibility that agricultural production in Chivi district is under threat. The threat on the main mode of rural economy production has resulted in the emergence of other sources of income. Its proximity to South Africa has encouraged many residents to engage in cross border

trading especially following the collapse of the country's economy in the last decade (Parliament, 2011). The Masvingo – Beitbridge highway is a busy road with long distance buses and trucks plying the route. Some residents are using this route for trade (Parliament, 2011). These other economic activities are coping and adaptation strategies to the extreme weather patterns in the district.

4.3 PILOT STUDY

Before embarking on field work, the researcher visited the research site for familiarization and to seek any information vital to successful collection of data. Another reason for the pilot visit was to seek permission from community leaders and other stakeholders that are helping smallholder farmers in the district to conduct the study. The District Administrator, Ward Councillor, the Department of Agriculture and the Environment Management Agency in Chivi district were also visited for authorization and information purposes. The researcher also visited the Meteorological Services Department and Practical Action NGO to seek more information. The researcher also tested the research instrument by interviewing two random farmers and one key informant while timing them and analyzing how comfortable the respondents were with the nature of questions.

4.4 RESEARCH DESIGN

This study used a qualitative research approach. Qualitative research is characterised by its aims, which relate to understanding some aspects of social life, and its methods which (in general) generate words rather than numbers as data for analysis (Quinn-Patton and Cochran, 2002). This methodology was the most appropriate methodology to elicit the necessary, relevant and reliable data from

smallholder farmers. Smallholder farmers' own words fully express their experiences unlike what quantitative data or numbers would do.

According to Hoepfl (1997) qualitative research seeks a wide contextual understanding of phenomena rather than causal determination approaches used in quantitative research. Using a qualitative approach allowed exploration of climate variability in detail bringing out the experiences or 'stories' of the farmers in their own words. Patton (2001) notes that qualitative research explores phenomena in a "real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest". This approach allowed the study to investigate the actual impacts of climate variability on agricultural production and explore the coping and adaptation strategies used by households to deal with the impacts of climate variability.

Moreover, the qualitative approach provides clarity and understanding about the experiences of smallholder farmers because of its naturalist and interpretive nature. Denzin and Lincoln (2000) state that qualitative research methodology is interpretive in nature and enhances meaning and understanding of phenomenona. The qualitative approach therefore has the advantage of producing rich in-depth information rather than mere numbers from quantitative techniques (Glesne and Peshkin, 1992). Making use of this approach the research managed to obtain rich and insightful data that can be easily understood and fully unpacks the situation of smallholder farmers in Chivi district.

The qualitative approach does have its shortfalls. Quinn-Patton and Cochran (2002) mention that one of the demerits that has been raised by critics of the approach is on sample representation. They mention that samples are small and not necessarily representative of the broader population, so it is difficult to know how far we can generalise the results. To contest this viewpoint, Quinn-Patton and Cochran (2002) point out that for many research projects, there are different sorts of questions that need answering, some requiring quantitative methods, and some requiring qualitative methods. In this case, the experiences and perceptions of smallholder farmers were not going to be fully explored through quantitative data collection.

The qualitative approach has also been criticized on its reliability and validity in comparison to quantitative research. Healy and Perry (2000) critique the approach for its inferior reliability and validity in comparison to quantitative approach. More so, other critics have cited the issue of data analysis in qualitative research being cumbersome and subject to the influence of the researcher's own biases (Denzin and Lincoln, 2000). However, this criticism of qualitative research has been strongly (and correctly) countered. For example, according to Lincoln and Guba (1985) it is worth noting that reliability in qualitative research can be attained through selecting methods that ensure credibility, neutrality or confirmability, consistence or dependability and applicability or transferability. Consistency of data in qualitative research is also achievable through thorough examination of raw data and notes compiled during field work while guarding against bias (Campbell, 1996). The many merits and suitability of the approach in conducting this study thus demean its minor weaknesses. The qualitative approach was thus the most applicable approach for

exploring the experiences of smallholder farmers who are vulnerable to risks posed by climate variability in Chivi District.

4.5 SAMPLING PROCEDURES

Sampling is defined as the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population (Mugo, 1995). This study made use of purposive and snowball sampling methods. These are non-probability sampling techniques in which subjective judgment was used to select respondents based on their relevance to the issue under investigation. According to Denzin and Lincoln (2000) purposive sampling targets a particular group of people with knowledge on the subject matter. This type of sampling was used for the study as it selected relevant respondents who were able to share their experiences and perceptions about climate variability, its impacts and their coping and adaptation strategies. In addition to purposive sampling, snowballing was also used in the sampling process. Snowballing or chain sampling identifies a person who has adequate knowledge about the subject under investigation (Mugo, 1995). This person, adds Mugo (1995), in turn knows and refers the researcher to someone else or a group of people who could also provide useful data on the topic under investigation.

The sampling frame was composed of smallholder farmers who are involved in food crop production. The researcher chose two wards (ward 25 and 30) in the district where there is a lot of agricultural activity. The two chosen wards were also easily accessible for research purposes. The researcher then purposively selected fifteen smallholder farmers who are involved in food crop production (eight from ward 25 and seven from ward 30). The researcher also purposively selected 40 respondents

for focus group discussions (with 16 of the respondents selected from ward 25 and 24 respondents selected from ward 30). Five focus group discussions were carried out (explained below on pg 46-47).

Purposive and snowballing sampling methods were also used to select key informants. From the first selected key informants, the researcher got referrals for the other key informants. At Agritex, the first key informant, Agritex officer 1, referred the researcher to the other two key informants, Agritex officer 2 and 3. Agritex officers referred the researcher to the EMA for more information on mitigation strategies being used in Chivi. Key informant, EMA officer 1, referred the researcher to EMA officer 2. At MSD, Meteorologist 1 referred the researcher to key informant, Meteorologists 2, who was involved in programmes in research and outreach programmes on climate variability in Chivi. The meteorologists at MSD mentioned the NGOs active in Chivi and mentioned the ones that were involved in wards 25 and 30. The NGO staff 1, referred the researcher to the other key informant, NGO staff 2. The researcher selected and interviewed nine key informants with specialized knowledge on climate change and mitigation strategies. The researcher selected two meteorologists from Belvedere, Harare MSD head office. Then the researcher interviewed two Practical Action staff members in Newlands, Harare. The researcher then interviewed three Agritex officers from Chivi district. The researcher then interviewed two key informants from EMA in Chivi district.

4.6 RESEARCH INSTRUMENTS

The main research instruments used to collect data for this study were in-depth semi-structured interviews guides, key informant interviews and focus group

discussions (FGDs). (see Table 3.1 below for a link between the research questions and research instruments).

In-depth semi-structured interviewing is a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation (Boyce and Neale, 2006). In-depth semi-structured interviews were used as one of the main qualitative data collecting tools for this study. This technique was used to gather information on the risks and impacts caused by climate variability in great detail. This technique helped with information on the perceptions and experiences of respondents about climate variability in Chivi. Uniform semi-structured in-depth interviews schedules (see Appendix C) were administered to respondents and key informants.

Fifteen in-depth semi-structured interviews were carried out with purposively selected respondents. The fifteen smallholder farmers are involved in food crop production. Information from the interviews was recorded through notes by the researcher with relative easy as there was no language barrier because the respondents speak the same language as the researcher.

Nine semi-structured interviews were also carried out with key informants. Key informants are those whose social positions in a research setting give them specialist knowledge about other people, processes or happenings that is more extensive, detailed or privileged than ordinary people, and who are therefore particularly valuable sources of information to a researcher, not least in the early stages of a project (Payne and Payne, 2004). Key informant interviews are in-depth

interviews of a select (nonrandom) group of experts who are most knowledgeable of the organization or issue (Lavrakas, 2008). Three key informants were Agritex officers, two were meteorologists at MSD, two were EMA officers and the other two were Practical Action (an NGO) staff. Meeting key informants required scheduling meetings in advance. The researcher called and emailed the relevant departments before visiting the premises. The key informants were willing to participate in interviews.

In-depth semi-structured interviews were pertinent to this study as they unearth rich insightful information on experiences of smallholder farmers because of their flexibility. Bryman (2004) asserts that qualitative interviews tend to be flexible, responding to the direction in which interviewees take the interview and perhaps adjusting the emphases in the research as a result of significant issues that emerge in the course of interviews. In-depth interviews are essential tools in the qualitative approach when conducting exploratory studies to reveal and fully understand the 'what', the 'how' and the 'why' of certain phenomenon (scribed website, undated).

Furthermore, in-depth semi-structured interviews helped the researcher to probe and get more insight from the respondents. They also enabled the researcher to understand the coping and adaptation behaviours resulting from the impacts of climate variability. Their merit is emphasized by Robson (1993) who states that they allow the interviewer to modify the order of the questions based on the conversation, change wording of the questions, give explanations and skip inappropriate or already answered questions, and add more questions where necessary.

One of the strengths of interviews (which was useful for this study) is establishing a rapport with respondents. The researcher sat and ate with some of the respondents as a way of establishing rapport. This allowed the researcher to comprehend their situation better and probe more into information provided by different respondents. This also permitted a deeper understanding of the experiences of the smallholder farmers as the respondents freely expressed their perceptions and pointed out the day to day challenges that they were facing as result of climate variability.

However, the interview method has been criticised for its perceived bias, either through the respondents' bias to or against the researcher, or through the complexities of data analysis and generalisability (RDSU, 2004). It was possible to remove any bias through explaining to the respondents the essence of the study in detail. The other criticism levelled against interviews has been the aspect of time consumption. The researcher made prior arrangement with the respondents so as to try save time as much as possible.

Focus group discussions (FGDs) were also used as a data collection method in this study. A FGD is a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive non-threatening environment (Krueger, 1994). Focus group discussions were used to complement in-depth semi-structured interviews. Five FGDs were carried out; each consisting of eight respondents. Two out of five FGDs were held in ward 25 and the other three were carried out in ward 30. The FGDs in each of the wards were carried out at one of the farmers' homestead chosen by the farmers. The venues were chosen by respondents

because they were central and easily accessible for everyone including the researcher.

These FGDs were used to assess different perceptions and experiences by smallholder farmers on the impacts of climate variability, its risks on food production, impacts on food availability and access as well as the coping and adaptation strategies used by households to deal with the impacts of climate variability. FGDs also helped in bringing multi-vocality as respondents worked together to corroborate each other's information. Furthermore, using this technique enabled the researcher to gain exploratory feedback in a group setting thereby understanding the magnitude of the impacts of climate variability on the farmers' livelihoods. FGDs also facilitated the sharing of different and diverse views and this helped the researcher get more insightful information as the farmers became more open in the forums.

Table 4.1: Research methods linked to research questions (this table summarises how the various research techniques are aligned to the three research questions, as well as their justification)

Research question	Research method and Sources of empirical data	Justification
What risk is posed by climate variability on agricultural production (in general) in Chivi District?	**1. Key Informant Interviews:** A total of 5 officials were purposively selected for interviews, 3 Agritex officials and 2 Met Department officials **2. In-depth semi-structured interviews:** A total of 15 households of smallholder farmers (SHFs) were purposively selected for interviews. **3. FGDs with SHFs**: A total of 5 FGDs were conducted, each consisting of 8 SHFs per ward. Random sampling was used to choose respondents.	This method is crucial for privileging the perspectives of officials. This method is crucial for privileging the perspectives of informants in the communities under study. FGDs permit the elicitation of empirical data in an interactive, discussion context – in this case, with regard to agricultural production, methods of production and public perceptions on climate variability. FGDs are important for capturing both verbal and non-verbal data.
In what ways does climate variability impacting on food production and availability in Chivi district?	**Key informant interviews** with 3 relevant Agritex officers and 2 Meteorological officials. Purposive sampling was used to select respondents. **In-depth semi-structured interviews** with SHFs. A total of 15 households of smallholder farmers were interviewed. Purposive sampling was used to select farmers that are into food crop production. **3. FGDs with SHFs**: A total of 5 FGDs were conducted, each consisting of 8 SHFs per ward. Random sampling was used to choose respondents.	This method is crucial for privileging the perspectives of officials. This method is crucial for privileging the perspectives of informants in the communities under study. FGDs permit the elicitation of empirical data in an interactive, discussion context – in this case with regard to food production, methods of production and public perceptions on climate variability. FGDs are important for capturing both verbal and non-verbal data.
Which coping and adaptation strategies are being implemented by households to deal with the risks and impacts of climate variability on food crop production?	**In depth interviews with the selected SHFs:** A total of 15 households of smallholder farmers were used to find out what coping and adaptation strategies are they using. **3. FGDs with SHFs**: A total of 5 FGDs were conducted, each consisting of 8 SHFs per ward. Random sampling was used to choose respondents.	This method is crucial for privileging the perspectives of informants in the communities under study with regard to the coping and adaptation strategies used in the community to deal with the impacts of climate variability FGDs permit the elicitation of empirical data in an interactive, discussion context – in this case with regard to the coping and adaptation strategies used in the community to deal with the impacts of climate variability. FGDs are important for capturing both verbal and non-verbal data.

4.7 DATA ANALYSIS

‘In-field’ data coding and analysis was done thematically in tandem with the research questions. ‘Post field’ work data coding and analysis encompassed the reading and re-reading of field notes, and relating findings to research questions, reviewed literature and the theoretical framework.

4.8 ETHICAL CONSIDERATIONS

The following ethical considerations were followed by the researcher;

Voluntary Participation and Informed Consent: Before interviewing, respondents were made aware that they were not obliged to participate in the interviews. Informed consent was obtained from every participant. Participants were also made aware of the purpose of the study by outlining the objectives of the study. The researcher made it clear to the respondents that the data collected would be used for academic purposes only.

Anonymity: All respondents were assured that their identity and responses remained anonymous.

Confidentiality: Before participating in the research, the respondents were also assured that the information they would provide would be treated with confidentiality.

Lastly, the researcher also acquired Ethical Clearance from the University of Fort Hare`s Research Ethics Committee (UFHREC). All ethical considerations required by the UFHREC were observed during the entire research process.

4.9 CONCLUSION

This study used a qualitative approach which is suitable for exploratory studies. The study used both purposive and snowball sampling. In-depth semi-structured interviews were one of the main instruments for collecting data. Key informant interviews and focus group discussions were also used to collect data. These sampling methods were used to select relevant respondents. The methods were used to select fifteen smallholder farmers for in-depth semi-structured interviews, 40 respondents for focus group discussions and nine key informants. Data was coded and analysed ‘in-field’ and ‘post-field’ in themes in accordance with the objectives of the study.

CHAPTER FIVE

IMPACTS OF CLIMATE VARIABILITY ON AGRICULTURE, FOOD PRODUCTION, AVAILABILITY AND ACCESS IN CHIVI

5.1 INTRODUCTION

This study set out to answer the following research questions:

- What risk is posed by climate variability on agricultural production (in general) in Chivi district?
- In what ways does climate variability impact food production and availability in Chivi?
- Which coping and adaptation strategies are being implemented by households to deal with the risks and impacts of climate variability on food production?

This chapter discusses and analyses data collected in response to these questions. It finds that there is extreme climate variability in Chivi district. The district is experiencing erratic, low rainfall patterns. The rainfall received in the district is unreliable and inadequate, and often results in crop failure. The district is also experiencing an increase in temperatures. These high temperatures are not conducive for agricultural production. The other noted variation in climate is increase in wind pressure and speed.

Climate variability experienced in the district has had detrimental effects on agricultural production. Agricultural productivity in the district has been altered and

declined. The methods of farming used by the smallholder farmers have also gradually changed. These changes have resulted in a drop in food crop production as yields obtained by the farmers have significantly decreased. The types of food crops produced in the district have also been altered. This has aggravated food insecurity and vulnerability to hunger and poverty as availability and access of food has become a major challenge for most smallholder farmers in the district.

The study also found that while climate variability is the biggest challenge faced by the respondents, lack of resources, limited agriculture-related information and capital fuels the problem of reduced food crop production, reduced food availability and access in the district. However, smallholder farmers in the district have resorted to different ways of coping and adapting to climate variability. The farmers are changing methods of farming and food crops they produce. They are engaging in livestock production as an alternative source of food and income. Farmers are also engaging in non-agricultural activities like brick-making, gold panning, firewood trading to subsidize their income and sustain their livelihoods. The study also finds that external bodies like Agritex and nongovernmental organizations (NGOs) are playing a major role in assisting with coping and adaptation strategies through different projects, donations and information.

5.2 CLIMATE VARIABILITY AND AGRICULTURE PRODUCTION

One of the objectives of the study was to explore the existence of variations in climate in Chivi District. Climate variability in the district was examined to understand the magnitude of vulnerability of smallholder farmers. Most of the local farmers (93%) stated that rainfall patterns have changed drastically in the past 10 years. Rainfall patterns have become erratic. In addition to unpredictable rainfall patterns,

there is a decrease in the amount of rainfall that is received in the district. The seasons are shifting. Rainfall seasons becoming shorter and rainfall patterns are changing. This was supported by one of the key informants who noted that;

> *"Indications from analyzed data collected from Chivi district weather stations are showing that climatic conditions in the district are erratic. Rainfall varies over space and time thus affecting rainfall events, for example, start of rainfall season, end of rainfall season, dry spell, among other things. There are glaring indications in the district of decreasing total precipitation showing a gradual slide towards drier conditions. The intensity of hydro-meteorological hazards has magnified, for example, hail storms and strong winds"* (Meteorologist 1 interviewed in Harare, 26/07/13).

Respondents also indicated that, previously the first rains, known in the local Shona language as *gukurahundi* or *bumharutsva,* were received end of September or beginning of October. As one respondent noted:

> *"I have seen this rainfall problem growing over years, we used to receive our first rains (bumharutsva kana kuti yamunoti gukurahundi) in September or early October, but now we don't know when we will get our first rains, we just wait for the ancestors to open the heavens"* (Respondent 1 interviewed in ward 25, 13/08/13).

The respondents indicated that the first rains now start falling towards the end of October or mid November. Much of the rainfall is now being received late December or early January contrary to the previous decades where much of the rainfall was received in November and December. After two weeks of heavy rainfall, there is a significant decrease in rainfall and a prolonged mid-season dry spell. From mid-

January onwards the district hardly receives rainfall. If any rainfall is received it is usually not enough to sustain growth of crops.

These views by the smallholder farmers were confirmed by the government Meteorological Services Department (MSD) and the Agritex office. The two offices confirmed that the rainfall patterns were becoming erratic each year as shown in Table 5.1 on page 54 below which contains statistics for the 2012-2013 agricultural season:

Table 5.1: Rainfall Patterns in Chivi (Ward 25 and 30), 2012-2013

	Oct 2012	**Nov 2012**	**Dec 2012**	**Jan 2013**	**Feb 2013**	**Mar 2013**	**Total (mm)**
Ward 25	33	25	28	216	24	30	356
Ward 30	10	0	35	151	10	35	241

Source: (Gwindi, 2013, Field Data)

Not only is Chivi experiencing changes in rainfall patterns, temperatures are also changing. All respondents noted that temperatures have radically changed. The district is experiencing a rise in temperatures. The farmers mentioned that they are experiencing high temperatures which are not conducive for agricultural production. One farmer said, *"for as long as I can remember, the heat is getting worse each year in this area, the past five years have been worse"* (Respondent 2 interviewed in ward 25, 14/08/13). Another respondent added that *"we have been experiencing such hot temperatures for a long time now"* (Respondent 3 interviewed in ward 30, 15/08/13).

The MSD revealed that data from meteorological stations around the country shows that temperatures are increasing in most parts of the country. In Chivi district, as early as 0600hrs the temperatures are averaging above 20°C. According to one key

informant (Meteorologist 2 interviewed in Harare, 28/07/13) the highest temperature recorded in Chivi is 44 Degrees Celsius. The district experiences high temperatures for most of the year as shown in Table 2 on page 55:

Table 5.2: Monthly Average Temperatures for Chivi District (2012- 2013)

	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013
Max Temp (°C)	36	34	35	33	28	31	27
Min Temp (°C)	28	27	29	28	23	24	22

Source: (Gwindi, 2013, Field Data)

Furthermore, smallholder farmers noticed a change in wind speed and pressure. As one of the farmers explained, *"we don't know whether it is because people are cutting a lot of trees or it is just the weather that is changing but the winds are blowing very strong"* (Respondent 4 interviewed in ward 30, 15/08/13). Another respondent stated that, "*this wind is even blowing our rooftops off, last month, I had to replace my rooftop for my main house because it was damaged by wind*" (Respondent 1 interviewed in ward 25, 13/08/13). The MSD supported the same view point of the farmers, stating the region is experiencing strong winds and increased wind speed. This was confirmed by one of the key informants who said, *"the district is experiencing heavy strong winds, there is a noted increase in wind speed and pressure"* (Meteorologist 1 interviewed in Harare, 26/07/13). These findings are consistent with Dhliwayo (2008) who cites a respondent saying, *"Young man, I am disturbed by this. Maybe our ancestors are not happy. That house you see with no roof, it was destroyed by heavy winds which just came from nowhere and I cannot afford to get asbestos to repair it..."*

The above observations from respondents and the key informants show that there is climate variability in Chivi. Climate variability is affecting the daily weather patterns in the form of scarce rainfall or heavy rainfall, high temperatures, strong and heavy winds. Given the above climate variability in Chivi district, the next sub-section assesses how and whether these weather patterns have made smallholder farmers in Chivi vulnerable. It also examines risks posed by climate variability on agricultural production.

5.2.1 Risks Posed By Climate Variability on Agricultural Production

After establishing the climate variations in the district, the study sought to find out the impacts of these variations on agricultural production. The respondents (87%) cited rainfall scarcity as their biggest challenge to agricultural production. As one respondent put it, *"we don't receive adequate rainfall which is resulting in crop failure"* (Respondent 5 interviewed in ward 25, 16/08/13). Another one said *"shortage of rainfall is our biggest problem we cannot do anything when we don't have water"* (Respondent 6 interviewed in ward 25, 16/08/13). The pattern and quantity of rainfall varies over time and this affects the process of agricultural production, as one farmer pointed out: "*this rain is not reliable and this affects our crops"* (Respondent 4 interviewed in ward 30, 15/08/13).

Other participants (87%) also pointed out that increase in temperature was a challenge. They stated that high temperatures combined with low erratic rainfall, results in crops wilting. As one respondent mentioned, *"for a long time my land has been producing enough food for my family but this has changed now our crops are dying in the fields because it is too hot and there is no rain"* (Respondent 7

interviewed in ward 25, 16/08/13). Another farmer said: *"I do not get any harvest from this field anymore because it is too hot, crops cannot grow in this heat"* (Respondent 8 interviewed in ward 25 17/08/13). The key informants from the MSD and Agritex offices reported the same views aired by the smallholder farmers. One key informant observed that;

> *"There is a noted change in temperatures, temperatures in this district are increasing annually and this is affecting crop production as it results in crop failure and at times high frequency of droughts"* (Agritex officer 1 interviewed in Chivi, 21/08/13).

Erratic, low rainfall patterns and high temperatures in Chivi have made it difficult for farmers to plan for new farming seasons, prepare land for a new farming season and engage in production. All farmers (100%) mentioned that climate variability affects them in their planning processes. One farmer said:

> *"In the previous years we used to have our seed, fertilizers, implements and labor ready for the new season by August or September in preparation for the new season, but now we cannot do that, we do not know when to get ready for the new season, the rains delay or if we receive rain, there is a prolonged mid-season dry spell until December and the seed in the ground rots or gets eaten by these creatures*" (Respondent 8 interviewed in ward 25, 16/08/13).

While another farmer added to this by saying: *"if we want to plant, it is not easy to know how to do it anymore because it's now unpredictable"* (Respondent 9 interviewed in ward 25, 17/08/13). Farmers cannot have a solid consistent plan for an upcoming farming season due to unreliable and inconsistent rainfall patterns and quantity. The farmers used to plan for a new season using reliable trends of rainfall, however lately there has been an erratic variation in the rainfall patterns making it

difficult for them to plan for a new farming season. In the past, farmers would receive the first rains in October and would start planting their first seed mid-October. Now planning has to be altered and it is not based on the patterns of rainfall but on the availability of rain. If, and when they get their first rains that is when they start planning for the season. On farmer said, *"we now have to wait and see if the rain is going to fall and we plant in fear that the rain might go after putting seed in the ground"* (Respondent 3 interviewed in ward 30, 15/08/13).

The smallholder farmers (93%) also revealed that climate variability presents major challenges in land preparation. Land preparation has been altered or affected due to delays in rainfalls. Traditionally, farmers till the land before planting. They do this to loosen and aerate the soils, and to allow easy penetration of rain into the ground. This land preparation is done two to three weeks before the first rains. As one farmer said:

> *"when I was young we would till the land in preparation for the new farming season, but now (muzukuru) my grandchild we cannot do that, the ancestors are angry, these days the heavens do not open well for us, the rains are no longer reliable. We do not know if we should till the land because the land will get hard again, (woti waiteyi) what will you say you have done"* (Respondent 10 interviewed in ward 25, 17/08/13).

Another farmer said:

> *"We used to have very stable rainfall that was adequate and more reliable. These days no one knows when to till the land or when to put seed on the ground. When rains come, they are either too little for planting or too heavy. A*

prolonged mid-season dry spell follows and scorches the germinated crops. Then we lose our seed" (Respondent 11 interviewed in ward 30, 18/08/13).

Delays or alterations in rainfall patterns have a huge impact on these preparations as these result in soils getting harder and also loss of moisture that is already in the ground leading to dryness of soils. Planting cannot begin if there is no rainfall and this affects the crop production cycle. Only farmers that are close to sources of water and have adequate irrigation equipment can risk commencing farming without receiving rainfall. One farmer said:

"*Soon after we till the land, it gets hard because of the loss of moisture due to heat. We cannot take that chance of tilling the land before we receive rain and after receiving the rain we might not get more rain after that. We are suffering because of this we do not know when to till our land anymore…"* (Respondent 12 interviewed in ward 30, 18/08/13).

Another respondent explained that, *"only those who have boreholes nearby can plant a small portion because water is scarce, we cannot do that, we wait for the rain"* (Respondent 13 interviewed in ward 30, 19/08/13).

The other challenge caused by climate variability is that farmers cannot engage in agricultural production if they do not receive rainfall. Under normal circumstances, after receiving their first rains farmers should start the process of planting. In the past this was a smooth process with few complications for farmers. Rainfall patterns were reliable and consistent. Farmers would plant their crops in mid-October or early November (except in drought years like 1982, 1992) with the first rains. The erratic rainfall patterns have however made the planting process difficult. The respondents (80%) pointed out that lately farmers face a risk of losing their seed due to erratic,

scarce rainfall. Due to the erratic rainfall, sometimes crops do not get to germination stage, and if they do, they might not get to full maturity stage. In such seasons, farmers encounter losses in seed planted. One farmer mentioned that, *"we lose a lot of seed almost every year because rainfall comes and goes so we do not plant our seed at once"* (Respondent 14 interviewed in ward 30, 19/08/13).

Low, erratic rains also mean that farmers lose fertilizers that are used during the production process. Organic and inorganic fertilizers that are used during the production process go to waste if there is no rainfall and crops do not get to ripen. Furthermore, capital is lost as well. Losses start with money that is used for tilling. Many of the local smallholder farmers (93%) do not have their own farming implements or machinery to do their own tilling. They rely on the Department of Agriculture and other independent parties that hire out tilling machinery. So, if nothing is produced at the end of the season after the farmer hires or pays for tillage, that will be a huge loss for the farmer. Not only is it a loss it also leaves most farmers in arrears. One respondent said, *"I have to pay for a tractor to till my small land but I do not have the money, so if I do not get anything I will be in debt"* (Respondent 15 interviewed in ward 30, 20/08/13). There is also loss of money through labor. Farmers pay people to help them with clearing the land, planting and weeding. So, if nothing is produced during harvest season, this means there are no returns on the labor investment. One farmer said, *"you can see I am old, I have to pay these young ones to help me to plant and weed my field, I cannot do it myself*" (Respondent 10 interviewed in ward 25, 17/08/13).

Some scholars support the above findings. For example, Mutekwa (2009) argues that many farmers in recent years have suffered one bad harvest after another due to late or erratic rainfall. This was confirmed by the majority (80%) of the farmers who said that they used to get 6-10 bags of maize in one season. In recent years, they have been getting a single bag or less if they plant maize. Most of the farmers (73%) indicated that they last got a good yield in 2005. Erratic rains combined with the high temperatures make it difficult for them to produce good yields. Even though some farmers (53%) point out lack of resources as another factor that has contributed to the decline of yields, the main cause of the change in yields in Chivi is climate variability.

Droughts are also very frequent in the district now. The frequency of droughts is a cause for concern in the district. Some of the respondents (80%) pointed out that the most severe drought agricultural seasons, were, 1981-1982, 1991-1992, 2007-2008, 2012-2013. One respondent said, *"almost every year we have a drought but the most severe drought years I remember them very well because we always have elections, 1982, 1992, 2008 and 'gore rino',(this year) 2013"* (Respondent 4 interviewed in ward 30, 15/08/13). This high frequency of droughts affects agricultural production in the district, since it is highly dependent on natural rainfall. Due to the farmers' dependence on rain-fed agriculture for their livelihood, the frequency of droughts has aggravated food insecurity and vulnerability to hunger and poverty in Chivi. One farmer lamented the impact of droughts, "*nearly year after year we are faced with (zhara) hunger, maybe our ancestors are angry at us, why do we experience droughts a lot"* (Respondent 2 interviewed in ward 25, 14/08/13). These

findings are consistent with Frost et al. (2007) who argue that the area experiences crop failure due to drought every three years on average.

In addition to high temperatures and scarcity of water, lack of inputs was also of concern to the farmers. These inputs are mainly seed, fertilizers, and agricultural machinery like tractors. Lack of these inputs always affects their agricultural output. Most of the respondents (53%) receive most of their inputs from the Agritex Department. Agritex supplies them with seed, fertilizer and machinery for production. The supply of inputs by Agritex is mainly done through agro-dealers. The process of getting inputs to the farmers through agro-dealers is sometimes delayed or the agro-dealers distribute the inputs unfairly. Other farmers (33%) get their inputs as handouts from non-governmental organizations like CARE International. These handouts are limited to seed and fertilizer only. Any delay from these input sources results in a delay in production. In some cases, some farmers do not get the inputs at all or are given insufficient inputs. A small portion of farmers (13%) buy all their inputs. Those that buy inputs however revealed that shops do not always stock inputs on time. In some instances inputs like fertilizers are unavailable in shops with negative consequences on crop production.

5.2.2 Climate Variability Impacts on Food Production, Availability and Access

It is clear from the responses above that agricultural production has been affected by climate variability. The extent to which smallholder farmers are vulnerable to food insecurity is highly dependent on food crop production, availability and access in the district. One respondent said,

"for now we just hope God will send good Samaritans to help us with food because we do not have enough, we are faced with starvation, we have not

been receiving rainfall for a few years now or the rain is too much it destroys our crops, the sun is burning everything in the fields and it's just hunger everywhere" (Respondent 8 interviewed in ward 25, 16/08/13).

Most of the respondents (80%) acknowledged that food crop production which includes maize, round nuts, sorghum, millet and ground nuts has declined in the region. The yields have dropped significantly. Food availability has thus become a major challenge in the district. The yield most farmers (86%) get is not enough to sustain them to the next harvest season. A number of them (80%) end up getting food aid from different nongovernmental organizations (NGOs) and donors such as Care International, World Vision, Red Cross, Christian Care among others.

Gukurume and Mahiya (2013) argue that widespread poverty and food insecurity in many African countries are inextricably linked to low agricultural productivity which is aggravated by climate change and variability. The majority (86%) of the respondents mentioned that they used to get 6-10 bags of maize. However, of late if they plant maize they get a single bag or half a bag. One farmer said, "*you see those crates (referring to a small plastic beer crates that had maize cobs), we only managed to fill two of those this year, it was that bad"* (Respondent 14 interviewed in ward 30, 19/08/13). Another one said, *"from my field I used to get 8 to 10 bags at the end of a cropping season"* (Respondent 11 interviewed in ward 30, 18/08/13). For millet they used to get 10-15 bags but now they get 3 bags or less. For most (93%) of the farmers this is not enough to sustain them to the next harvest season. If they have a good season of getting 10 bags or more, the yield can sustain them to another harvest season but they will not have surplus or seed for the next farming season. Some farmers (66%) indicated that they last had a good season in 2005. These

findings are in line with Mudzonga's (2011) argument that climate change in the form of higher temperatures, reduced rainfall and increased rainfall variability reduces crop yields and threatens food security in low income based economies.

Most of the farmers (93%) interviewed mentioned that lack of rainfall and increasing temperatures are the main causes of decrease in yields. A number of the farmers (93%) agreed that crops like maize, groundnuts, pumpkins, sunflowers and sweet potatoes are more affected by temperature variations and lack of water. Other farmers (73%) mentioned lack of resources as the other cause of the decrease in yield. One farmer said, *"we do not have enough money to buy properly treated seed so some of the seed is (pfukutwa) eaten by these (zvipfukuto) aphids, this decreases our yields"* (Respondent 11 interviewed in ward 30, 18/08/13). Another one said, *"we do not have water sources, irrigation facilities, tractors, even the technical knowledge on climate variations, this is affecting our production, how we wish we can get more support"* (Respondent 9 interviewed in ward 25, 17/08/13).

Farmers have been forced to alter the type of food crops they produce. From the sample, 80% of the farmers mentioned that climate variability has forced them to alter the type of food crops they are producing. They are now planting millet, sorghum, cow-peas, round nuts and small portions of maize compared to the past when they used to plant maize (staple crop), pumpkins, groundnuts, sweet potatoes and sunflowers. One of the farmers explained,

> *"we used to plant maize, pumpkins, sweet potatoes, sunflowers and get something to feed our families but now we cannot plant maize anymore it's too hot and there is no rain, we have to plant crops like millet, sorghum and cow*

peas at least those ones can survive this scorching heat" (Respondent 8 interviewed in ward 25, 16/08/13).

Another one said, *"we are now planting cow peas, millet and sorghum we don't really like these crops because our children don't like (sadza rezviyo) millet's thick porridge and cow peas but what can we do"* (Respondent 3 interviewed in ward 30, 15/08/13). Climate variability is thus resulting in deprivation of proper food access as the farmers cannot afford to plant diverse food crops and their staple crop (maize) due the harsh climatic conditions.

5.3 COPING AND ADAPTATION STRATEGIES USED BY SMALLHOLDER FARMERS IN CHIVI

As a way to cope with the climate variations some (66%) of the smallholder farmers have changed farming methods. Crop choice is highly dependent and sensitive to climatic conditions mainly precipitation and temperatures. A number of farmers (66%) have shifted from crops like maize, pumpkins, groundnuts, sunflowers and potatoes and they are now planting drought resistant food crops like millet, sorghum and cow peas. One farmer said *"when I was young we would plant maize and pumpkins mainly but you cannot plant those you have to plant these drought resistant crops like millet and sorghum"* (Respondent 6 interviewed in ward 25, 16/08/13). Another respondent said, *"now we only plant millet, sorghum, round nuts and cow-peas at times"* (Respondent 9 interviewed in ward 25, 17/08/13). Sorghum and millet have been noted as staple food grains in many semi-arid and tropic areas of the world, particularly in Sub-Saharan Africa because of their good adaptation to hard environments and their good yield of production (Dicko et al., 2005). Some scholars like Simba, Chikodzi and Murwendo (2012) argue that drought resistant crops like most small grains guarantee food security and are worthwhile. The

farmers mentioned that some of the drought resistant crops benefit them in terms of storage period longevity. This finding corresponds with Mvumi et al (1995) who found that pearl millet and finger millet can store for up to 3 years and no storage insect pest control measures are taken.

Smallholder farmers are also using conservation agriculture (CA) methods. Conservation farming has been widely embraced as an antidote to the perennial food insecurity situation, bedevilling drought prone regions in Zimbabwe, such as Chivi south district (Gukurume, Nhodo & Dube, 2010). According to FAO (2001), conservation farming involves reducing soil degradation through several practices that minimize the alteration of soil composition and structure and any effects upon natural biodiversity. CA includes any practice that reduces changes or eliminates soil tillage and avoids the burning of residue in order to maintain adequate surface cover throughout the year (EACF, 2001). Lately, conservation agriculture is being promoted instead of the traditional tillage system. The traditional tillage system has been discredited because of the negative environmental effects such as pulverization of surface layer, compaction of underlying layer and reduction of vegetative cover. Scholars like Hobbs (2005) argue that these negative impacts lead to natural resources and soil degradation and also reduce yields. The effects are detrimental to marginal areas like Chivi district that have fragile soils that experience high levels of erosion and leaching. In the sample, a total of 66% farmers were doing CA specialising in crops such as millet, sorghum, cow-peas and round nuts. A number of farmers (53%) mentioned that the new methods are effective in improving yield if they get adequate rainfall. They were positive that these changes will assist in reducing the impact of climate variability.

The smallholder farmers together with the Agritex Department agreed that the methods of agricultural production have been forced to change by climate variability. One key informant said, *"farmers are feeling the effects of climate variability, they are gradually adopting new methods of farming and planting drought resistant crops"* (Agritex officer 2, interviewed in Chivi, 21/08/13). The respondents mentioned that there are several changes that have occurred in the last ten years.

In addition to farmers adopting conservative agriculture and producing drought resistant crops, the farmers are no longer using large portions of land when farming. They try and cut costs and losses by farming on small pieces of land that are around their homesteads. One farmer said,

> *"instead of me using a lot of seed, diesel and labor to plough a large portion of land and lose a lot if I don't get anything, I am using the resources to plough my small piece of land there, this has helped me in the past 10 years"* (Respondent 11 interviewed in ward 30, 18/08/13).

Another farmer said,

> *"I do not have resources to use for these 3 acres that I have available, it is expensive to plough such a big portion of land and I have to use more seed and fertilizer for this land. I am now using this area that you see there which is closer to my house"* (Respondent 8 interviewed in ward 25, 16/08/13).

Some farmers (26%) that have water sources (boreholes, wells and taps) nearby mentioned that they engage in gardening as a coping strategy. They grow tomatoes, mixed vegetables and onions. They produce these mainly for consumption and sell surplus. As one farmer noted, *"we are fortunate to have a tap here, we are able to*

grow vegetables for consumption and we sell sometimes when we have more" (Respondent 4 interviewed in ward 30, 15/08/13). Another said, *"ever since we got this borehole we have been growing vegetables and we are able to sell some of the vegetables"* (Respondent 11 interviewed in ward 30, 18/08/13). Apparently the soils are very much suitable for gardening. Most (93%) of the farmers were of the view that if they get water sources they are able to do home gardening and use that to sustain themselves.

The majority of the respondents (93%) pointed out they are looking for assistance in the form of water supply systems. They feel that if they can get water they will be able to carry out different projects like gardening, livestock breeding, brick making among others. Resuscitation of irrigation systems was mentioned as a possible solution to the water problem. The farmers (86%) pointed out that if irrigation systems are repaired and reinstated, farmers can form farming cooperatives around Chivi. As one farmer pointed out, "*our biggest problem is water if we can have irrigation schemes restored like in the olden days then we will be able to do our farming well"* (Respondent 9 interviewed in ward 25, 17/08/13). Another one said, *"our crops wilt each year in the fields because of lack of water, if we can get sources of water then we will be happy, because we can save our crops from wilting when we plant them"* (Respondent 3 interviewed in ward 30, 15/08/13). The farmers believe that if water sources can be increased it will reduce the impacts of climate variation and change.

Some farmers (53%) mentioned the importance of excavating Muchenami and Mushandike dams which are responsible for the local irrigation schemes so that they

can be useful again. As a result of poor farming methods, there has been siltation of the Muchenami Dam as one farmer pointed out, *"our dam Muchenami is now covered because people were cultivating next to the river banks of the dam, now the dam is no more"* (Respondent 8 interviewed in ward 25, 16/08/13). A key informant also mentioned that*, "we have been stopping farmers from plowing along river as this led to the siltation and dry up of Muchenami dam"* (EMA officer 1 interviewed in Chivi, 22/08/13). The dam used to provide water for many farmers for a long time. The farmers indicated that together with Mushandike dam the two dams were sustaining a number of irrigation projects. Gwazani et al (2012) mentions that since 1985, when the irrigation scheme was first established, water from the dam has been used to irrigate crops such as cotton (*Gossypium* spp.), wheat (*Triticum* compactum)*,* sugar beans (*Phaseolus lunatus*)*,* soyabeans (*Glycine max*), paprika (*Capsicum annuum* var. *angulosum mill*), maize (*Zea mays*) tomatoes (*Solanum lycopersicum*) and cabbages (*Brassica oleracea* var. *Capitata*). Gwazani and colleagues (2012), also reveal that the Mushandike irrigation scheme has since dilapidated due to high demand for water, lack of maintenance and siltation.

Respondents (80%) also mentioned that they need more technical information about climate change to assist them in their coping and adaptation strategies. Their knowledge is not sufficient to entirely help them deal with climate variability impacts on agricultural production. They lack information on how to cope and adapt with the impacts of climatic variability. They said they know that the lack of rainfall was the primary cause of poor yields but did not have technical knowledge that meteorological departments have on the changes in weather variations. One farmer mentioned that, *"if the meteorological departments can warn us about certain*

forecasts then we can prepare in time" (Respondent 6 interviewed in ward 25, 16/08/13). They mentioned that they would like assistance with more information on climate variability and change as well as on new methods of farming. They were of the opinion that if they get a lot more information from appropriate authorities they will be able to make adjustments when it comes to the farming season. This concern on lack of information is raised by Mudzonga (2011) as a contributing factor to the decline of agricultural production in the district and the country as a whole.

Some of the farmers now engage in non-farming activities as way to deal with climate variability impacts. The smallholder farmers mentioned using other sources of income as a coping strategy. Some (40%) of the mostly noted to be young farmers do informal jobs like carpentry, brick making and house building, gold panning and sell firewood to earn money to buy food. One respondent said, *"during the agriculture off season there is no activity for us to have money we to do piece jobs, like carpentry, making bricks and building, sometimes we go to the mines (kuno korokoza) to look for gold"* (Respondent 6 interviewed in ward 25, 16/08/13). The respondents mentioned that they sell their carpentry products to visitors or to other people in the community like teachers. Some farmers (53%) stated that they do informal "piece" jobs such as selling firewood, brick making and building houses in order to survive. As one farmer pointed out, *"we sometimes cut firewood or (kanya zvitinha) making bricks and sell those for us get money to buy food"* (Respondent 14 interviewed in ward 30, 19/08/13).

Some farmers (40%) mentioned that they are involved in carpentry as a way to cope with the impact of climate variability. The farmers mentioned that they make

cupboards, wardrobes, chairs and stools, as well as fixing broken wooden furniture as a way of earning money to buy food. One of the respondents mentioned that, *"I make these stools, the one you are sitting on and sell them to people around but some of them I send to Harare"* (Respondent 6 interviewed in ward 25, 16/08/13). They pointed out that the carpentry business is not very big in the district but it is now growing because of the houses that are being built. One farmer mentioned that, *"I have a desire to make good products and I know I can but I do not have enough resources"* (Respondent 1 interviewed in ward 25, 13/08/13). The farmers mentioned the need for external bodies to support such business initiatives and projects.

Some farmers (33%) mentioned that they do brick-making and building of houses as coping and adaptation strategy. They engage in brick-making and building houses in order to survive. They use the local forests and land for excavation of soil for brick-making. The farmers mentioned that they sell bricks to local people since a lot of building is going on especially with people who are coming from South Africa and teachers who are buying land and building houses. One farmer said, *"we make bricks and sell to these teachers and nurses who have been buying land near the growth point"* (Respondent 13 interviewed in ward 30, 19/08/13). Another farmer said, *"faced with hunger, we go into the forest and make bricks and sell to these people who are coming from (Joni) South Africa and buying stands for houses and we build for them"* (Respondent 3 interviewed in ward 30, 15/08/13). The findings are consistent with Bird et al (2002) who found that one of the non-farm occupations by farmers and non-farmers is brick making. This brick making activity has had negative impacts on the environment as one key informant mentioned, *"we are*

dealing with people who are just digging everywhere, it is causing land degradation, erosion and siltation of rivers" (EMA Officer 2 interviewed in Chivi, 22/08/13).

Other farmers (26%) cut trees around and sell them as firewood. Some farmers said they sell firewood to get money so that they can buy food. One respondent mentioned, "*we go and cut trees in that forest nearby and we sell them as firewood, we have to do it to get money to survive"* (Respondent 10 interviewed in ward 25, 17/08/13). They mentioned that they sell the firewood for different prices depending on the amount of firewood. Their smallest bunch is sold for U$2. They pointed out that most of the firewood is sold locally. Some buyers from neighboring towns like Masvingo also come to buy from these farmers.

Other farmers (40%) mentioned that they are involved in illegal gold panning. They sell the gold they get to buyers who come from South Africa. One respondent said*, "we need money, especially now that we have experienced drought, we go and look for gold there at Ngundu, sell to these buyers from South Africa"* (Respondent 9 interviewed in ward 25, 17/08/13). This was also confirmed by one key informant who mentioned that, *"some of these farmers are now engaging in illegal mining as a way to get money because they do not have any other source of income"* (EMA officer 1 interviewed in Chivi, 22/0813). The farmers indicated that this subsidizes their income but they were a lot of dangers that are involved in gold panning. They cited incidences of people dying in collapsed mines, spreading of diseases like tuberculosis, sexually transmitted diseases and being arrested by local authorities for engaging in illegal mining. For some, illegal mining has become their main source of livelihood as farming to them is no longer productive and sustainable. One

respondent mentioned that, *"gold mining (kukorokoza) gives me more money, I am able to buy my family food and clothes, when agriculture season comes I employ other people to do the farming for me*" (Respondent 4 interviewed in ward 30, 15/08/13).

Some of the farmers (33%) mentioned that they sell their livestock to get money to buy food and other things. The farmers said when they are left with no choice they sell their livestock. One of the farmers said, *"sometimes we are forced to sell our goats so that we can buy maize"* (Respondent 11 interviewed in ward 30, 18/08/13). The other farmers (53%) mentioned that they do barter trade with their livestock. The farmers exchange 1 goat for 2x50kg bags of maize. Some farmers complained though that some of the buyers take advantage of the farmers' situation and buy their livestock for low prices, as one respondent mentioned, *"these buyers especially from Harare, come with U$15 to buy my good goats, they know I need the money because my family is dying of hunger and they use this to rip us off"* (Respondent 13 interviewed in ward 30, 19/08/13). The farmers bemoaned that this trade is not regulated as the only people that benefit from such trade are the buyers. They are forced by their situation to engage in such unfair merchant deals.

Some of the farmers (80%) partly rely on donations from donors for copying with the impacts of climate variability. They claim that different nongovernmental organizations have been helping them to reduce the effects of climate variability. The aid comes in the form of food, monetary grants, agricultural inputs, and resources for projects like poultry, rabbit rearing and goat-rearing. They also receive technical knowledge and training on climate variability which has been provided mainly by

agriculture extension officers. Some NGOs like Care International, World Vision and Christian Care donate food, seed, livestock for projects and monetary grants in the district to farmers and non-farmers. Food donations and monetary grants are given monthly. These are given to every family that needs assistance especially the most vulnerable such as those headed by old people and those that do not have any source of income. An amount of U$50 per month is given to every household by NGOs. One farmer said, *"we get U$50 monthly but you have to register if you want to get the money and have a bank account as well"* (Respondent 10 interviewed in ward 25, 17/08/13).

Other NGOs like Practical Action are providing technical support and funding of livelihoods projects like drip irrigation to the district to help farmers deal with impacts of climate variability. They train agriculture extension officers on climate variability. One key informant mentioned that, "*we as Practical Action we assist communities with technological innovations, we work with the farmers and work together with the Agriculture Department and Meteorological Services Department"* (Practical Action Officer 1 interviewed in Harare, 24/07/13). The projects can be 3 months, annually, for a long period of more than 5 years or on-going for as long as possible. The aim of the projects is to help create sustainability among the farmers. Other NGOs like Care International and USAID have been providing agricultural inputs like fertilizers and seed as well as different resources for the farmers to start projects like livestock breeding (rabbits, goats and poultry), peanut butter making machines, flour and stoves for baking projects. One farmer mentioned that, *"some of us got goats, while others have received peanut butter making machines and some flour to make bread as co-operatives"* (Respondent 11 interviewed in ward 30, 18/08/13).

5.4 CONCLUSION

This chapter has demonstrated, discussed and analyzed the risks posed by climate variability on agricultural production (in general) in Chivi district. It has shown that there are various risks posed by climate variability on agricultural production. The rainfall received in the district is unreliable and inadequate and often results in crop failure. The district is experiencing high temperatures which are not conducive for agricultural production. Increased frequency of extreme weather events has led to high frequency of droughts in the district. The climate variability experienced in this district has had detrimental effects on agricultural production hence agricultural productivity in the district has been altered and declined. The methods of farming used by the smallholder farmers have gradually changed. These changes have forced a drop in food crop production as yield obtained by the farmers after an agricultural season has significantly decreased. The type of food crops produced in the district has also been altered. This has aggravated food insecurity and vulnerability to hunger and poverty as availability and access of food has become a major challenge for most smallholder farmers in the district. Farmers are now engaging in livestock production as an alternative source of food and income. Farmers are also engaging in non-agricultural activities like brick-making, gold panning, firewood trading to subsidize their income and sustain their livelihoods. The study also finds that other external bodies like Agritex and NGOs are assisting with coping and adaptation strategies through different projects, donations and information.

CHAPTER SIX

NGOS AND STATE INTERVENTIONS IN CLIMATE VARIABILITY COPING AND ADAPTATION IN CHIVI

6.1 INTRODUCTION

Erratic weather patterns and high frequency of droughts in Chivi district are affecting agricultural production and increasing food insecurity. Consequently, climate variability is posing serious threats to a lot of lives and livelihoods in Chivi district. In response to this predicament different NGOs and state actors are taking various measures to assist smallholder farmers curb the impacts of climate variability. Prioritizing the most vulnerable areas, these players are offering different forms of assistance to help with mitigation and adaptation strategies. The various forms of assistance include the formulation of climate variability policies geared towards assisting vulnerable regions, with emphasis on food security, poverty reduction and sustainable livelihoods.

Assistance has also been in the form of resources such as food handouts and grants, aimed at alleviating the impacts of climate variability. Resource allocation has been directed towards developmental strategies and programmes that are aimed at improving mitigation and adaptation technologies and innovations to reduce the impacts of climate variability.

6.2 THE ROLE OF NGOS IN COMMUNITY COPING AND ADAPTATION STRATEGIES IN CHIVI

6.2.1 Development Assistance

The farmers pointed out that they are getting support and assistance from different external bodies mainly NGOs. Most of the farmers (93%) said they partly depend on donations and grants from donors. Africa has been identified by the IPCC as the most vulnerable continent to climate variability and change, due to its low adaptive capacity. Consequently this has necessitated the need for foreign aid especially in drought prone areas like Chivi. As Brown *et al*. (2012) point out: in response (to the threat of climate variability), a growing number of NGOs and research organisations, including UN agencies, are engaging in a variety of development projects, many of which have strong adaptation components (pg.15). Chivi district has a number of active NGO actors who are assisting local smallholder farmers. The respondents (93%) mentioned that in the past 10 years they have received some form of support from different humanitarian organizations. One respondent said, *"yes we get assistance annually for the past 10 years or so from NGOs, we are told to come and register so that we get maize or money sometimes"* (Respondent 4 interviewed in ward 30, 15/08/13). The assistance provided is monetary or in kind, ranging from food to farming inputs especially seed and fertilizers.

6.2.2 Food Hand-Outs and Monetary Grants

Some farmers (86%) mentioned that they also receive food hand-outs from different NGOs like Care International, World Vision, World Food Programme and Christian Care. They mentioned that the hand-outs are usually in the form of mealie-meal, grain, cow-peas and beans. This helps alleviate food gaps in some households. One

respondent said *"we get food like maize, cow-peas and beans, a lot of times from these NGOs, you know them, Care, World Vision and Christian, they really help us, the hunger is bad here"* (Respondent 10 interviewed in ward 25, 17/08/13). The respondents mentioned that food donations were given monthly. At times these donations are given to the headman *(sabhuku)* of the wards who then co-ordinate their distribution in the community.

The respondents mentioned that some NGOs like Red Cross and Care have offices in the district from which they collect the food handouts. As one farmer said, *"we register and go collect the food from the (sabhuku) headman or we go collect from their offices"* (Respondent 14 interviewed in ward 30, 19/08/13). As postulated by several scholars such as Rosenzweig and Parry (1994), Kandji, Verchot and Macksen (2006) Mutekwa (2009), Gukurume (2010), and Brown et al., (2012), climate variability is affecting agricultural production thereby increasing food insecurity in southern Africa. Food availability and access has become a major challenge in the district which has made the role played by NGOs very important.

Some smallholder farmers (60%) indicated that they receive monetary grants assistance from NGOs like Care International. The farmers stated that they are meant to receive U$50 monthly, but there is no consistence in the disbursement of this money. The grants are not given to every household. Beneficiaries are registered households, especially those that are headed by elderly people. The beneficiaries should have bank accounts, a system which is disadvantaging some of the old-aged smallholder farmers because of their illiteracy. As one respondent said,

"yes we are given U$50 monthly but you must have a bank account. I have a bank account but I lost my bank card and when I changed my bank card I have not received any money since then, I don't know whether the money is going to into my account or its not" (Respondent 11 interviewed in ward 30, 18/08/13).

The farmers mentioned that even though the money is little it helps in lessening food insecurity as the farmers use the money to buy food. As one farmer mentioned: *"we do not get much from our fields so with this small money we get we can buy mealie-meal"* (Respondent 3 interviewed in ward 30, 15/08/13).

6.2.3 Farming Inputs and Other Technical Support

Other respondents (73%) mentioned that NGOs are assisting smallholder farmers with drought resistant seed crop. This finding is coherent with Gukurume (undated) who finds that a number of NGOs like Care International, Concern Worldwide and Action Faim in Bikita (another district in Masvingo) have been introducing new crop varieties that are able to withstand the long and protracted hot spells. The farmers mentioned that they are getting a variety of hybrid maize, sorghum, cow-peas and millet special type which the farmers said is called *"Martia SV2".* They receive the seed at the beginning of the agricultural planting season, mostly in September. One of the farmers said, *"at the beginning of every season, we get drought resistant seed crops from NGOs, lately we have been receiving a millet seed called Martia SV2*" (Respondent 4 interviewed in ward 30, 15/08/13). The farmers mentioned that they have been receiving this seed for more than 10 years now, since the weather patterns have become extremely erratic. The NGOs distribute the seed sometimes or the farmers are called for a meeting and receive the seed. This finding is consistent with Mushuku et al. (2012) who mentions that NGOs are active in education, food and seed distribution as well as improving sanitation.

Some farmers (53%) indicated that they have received aid in the form of farming inputs like treated seed, fertilizers and chemicals at times. The respondents mentioned that the NGOs have been giving them chemically treated seed which is resistant to diseases and pests. The respondents also mentioned that they get fertilizers as well. At times the farmers are given chemicals to spray their crops but this is not done on a regular basis. One farmer explained: *"we do get farming inputs from these NGOs like treated maize seed, fertilizers and sometimes spraying chemicals (mushonga), but mushonga (chemicals) we do not always get it"* (Respondent 15 interviewed in ward 30, 20/08/13). The chemicals for spraying are scarcely distributed as the farmers get these after 2 or 3 farming seasons. They are often distributed when there is an outbreak of diseases or pests. The distribution is done by the NGOs. At times the inputs are handed over to the headman and distributed at meetings, a method that has been criticized because it is politicized and has corruption repercussions. One farmer said,

> *"we collect inputs from the NGOs' offices but sometimes "sabhuku" calls for a meeting and we collect the inputs, but there, you have to have a card (political) and other people do not get the inputs"* (Respondent 1 interviewed in ward 25, 13/08/13).

NGOs like World Vision and Action Faim are also helping farmers with resources to diversify their farming production through livestock projects such as rabbit and goat-rearing while others get resources for poultry production. Some respondents (67%) pointed out they are being helped with livestock to start breeding projects. The respondents mentioned that it is not every household that receives such assistance of livestock. One respondent said, *"we were not that fortunate, we did not receive*

goats but our neighbours got some goats from these NGOs" (Respondent 8 interviewed in ward 25, 16/08/13). One key informant mentioned that, *"some NGOs are helping the farmers with food handouts and livestock but we specialize with technology innovations"* (Practical Action Officer 2 interviewed in Harare, 24/07/13). From the responses, livestock has become an integral part of the smallholder farmers' livelihoods. This is in line with discoveries by Gandure and Drimie (2011), who revealed that livestock, including small stock and poultry, are an important alternative source of livelihood and income for smallholder farmers. Some farmers mentioned that they sell their livestock to buy food and pay for other household needs like school fees and health care fees.

6.2.4 Off-Farm Income Generation Projects

NGOs are also helping farmers to start off-farm income generating projects like peanut butter making, baking of bread and soap making. The support by NGOs has facilitated the diversification and increase of these off-farm income generating activities. These off-farm activities have become an alternative source of income that is important for some smallholder farmers. The farmers indicated that they receive this form of assistance annually or after two years. The frequency depends on the life span of the projects, availability of the resources and progress of the projects. One farmer mentioned that,

> *"we were asked to join groups or co-operatives, then we are given different machines or equipment to start projects. We work together as a group with assistance from staff from the NGOs. The NGO staff will then leave everything in the hands of the group or co-operative once the project is up and running. The projects differ in life span hence the frequency of the assistance differs but we*

usually get assistance annually or after two years" (Respondent 7 interviewed in ward 25, 16/08/13).

This finding is also corroborated by Mombeshora et al (undated) who mentions that off-farm income generating activities are critical to people's survival, during both drought and non-drought periods.

6.2.5 Information, Technology and Innovation

Nongovernmental organizations also help with information, technology and innovation. Some of the farmers (73%) mentioned that sometimes they receive new information on technology and innovation that can help them reduce the impact of climate variability. One of the key informants mentioned that:

> "as *Practical Action we work with the National Agriculture Department and Meteorological Service Department to disseminate new research information and technological innovation on climate change and variability to the Agriculture Extension Office which then uses that information or technology to assist smallholder farmers*" (Practical Action Officer 2 interviewed in Harare, 24/07/13).

Practical Action has carried out a number of projects in Chivi to help reduce the impact of climate change. In 2012-2013, Practical Action and University of Reading through funding from Nuffield Foundation Africa carried out a project called *"Mainstream Climate Change Adaptation in Zimbabwe's Agricultural Extensions System"*. The project was aimed at integrating climate change adaptation into Agritex which is mandated to deliver agricultural extension in Zimbabwe. One key informant commented on the fundamental role being played by the NGO, "*yes Practical Action is one of the NGOs that is helping a lot in this district, with new technology, training and updated research information"* (Agritex Officer 3 interviewed in Chivi, 21/08/13). The Practical Action project trained Agritex staff from Masvingo province and Chivi

district on ways to help smallholder farmers to deal with the impacts of climate change. The assistance that has been given to farmers so far has helped them improve the ways of farming and dispensation of updated information and technology. The organization is coming up with intervention programmes that are aimed at assisting farmers with food production so as to reduce food shortages in the district. The importance of information and technological innovation is one area emphasized by Mudzonga (2011) as an area that can assist with dealing with the impacts of climate variability.

However, the role of NGOs has not been entirely embraced without criticism. A small portion (0.06%) of the population sample mentioned that the agenda of the NGOs is not clear. One respondent said, *"we need these NGOs because they help us with food but we are not clear if their food is good and also if they are not supporting other parties"* (Respondent 6 interviewed in ward 25, 16/08/13). Some African governments have viewed food aid as a manipulation strategy by NGOs arguing that the food donated is hazardous to people. For example Zerbe (2004) mentions that in October 2002, the food relief effort took an unexpected twist, as the governments of Malawi, Mozambique, Zambia and Zimbabwe rejected US food aid because of concerns over the inclusion of genetically modified maize. Other critics of foreign aid like Reality of Aid Report (2004) have mentioned political influence, territorial hegemony and 'tied-aid' as the main motive of donors.

Some critics have questioned the ability of NGOs to create sustainable development projects for the rural poor. A lot of projects by NGOs have a timeframe and involve various expertise sometimes provided through external consultancies. When these

NGOs shift from the area or change their priorities, the projects collapse. Croxton and Appleton (1994) argue that this raises the question of how local people's own capacity and capability to manage technical change without external support can be enhanced. As one key informant noted: *"NGOs are playing a very important role in this District but the challenge comes when the projects have ended. The farmers usually are incapable of coping afterwards"* (Agritex Officer 3 interviewed in Chivi, 21/08/13). Moreover critics have questioned the sustainability of these projects due to the management and implementation structures of these projects. Chagutah (2010) argues that many of the adaptation activities undertaken by NGOs and international organizations tend to be uncoordinated, leading to potential challenges in targeting beneficiaries and duplication of roles. Even though there is such criticism, the essential role played by NGOs in assisting smallholder farmers in Chivi district should not be underestimated.

6.3 THE ROLE OF THE STATE IN COMMUNITY COPING AND ADAPTATION STRATEGIES IN CHIVI

6.3.1 Assistance by Agritex and Grain Marketing Board (GMB)

Some farmers (60%) revealed that government bodies like Agritex and the GMB help farmers with inputs, especially seed and fertilizers. The Ministry of Agriculture, Mechanisation and Irrigation Development (Ministry) together with the GMB assists smallholder farmers through the Grain Loan Scheme (GLS). The GLS was introduced in 1994 by the government aimed at assisting vulnerable households (Zhou, 2012). Under the scheme a household is allowed to borrow up to 100kg of grain from the GMB during bad years and repay it in good years (GTA, undated; Harare 24, 2011). The Ministry also supports local smallholder farmers through

providing agricultural inputs like fertilizers. Farmers provided with inputs have to repay these after harvest. A key informant mentioned that,

> *"the department assists farmers with seed as well as fertilizers and sometimes we give them chemical to spray their crops especially in case of pests and diseases outbreaks. The farmers are supposed to pay for the seed if they harvest but most of them experience crop failure so they end up owing the department but they pay when they can"* (Agritex officer 2 interviewed in Chivi, 21/08/13).

The Ministry provides, through agro-dealers and/or headmen, the farmers with hybrid seed which is suitable for the climatic conditions and soils in the district. The major challenge with this type of seed is that hybrid seed cannot be used again. An average of 2 bags of 50kg seed is given to every household that is in need. The Ministry tries to provide seed annually but it has not been able to each year. Together with the seed, the Ministry provides fertilizers and these are 2 bags of 50kg per household. The Ministry, however, encourages the use of inorganic fertilizers as it is cheaper and does not affect crops during mid-season dry spells. This was pointed by one key informant who said,

> *"We try give seed to every household annually, through agro-dealers and headmen at times. We give at least 2x50kg bags of seed per household and fertilizer. We encourage the use of inorganic fertilizers though."* (Agritex officer 1 interviewed in Chivi, 21/08/13).

It has to be pointed out that the provision of inputs is not a sustainable solution for the smallholder farmers as it creates a dependency syndrome, which impacts on the farmers if aid is not available. The farmers are also increasing their seed and fertilizer debts especially after drought seasons which are frequent in the district.

Furthermore, the hybrid seed cannot be reused therefore each year farmers buy or get new seed from the government.

The Ministry also assists local farmers by hiring out their farming equipment and/or machinery. This equipment includes tractors, ploughs and spraying knapsacks. Not only does the Ministry help with machinery, it also sells diesel for tractors at a subsidized price or debt basis. One of the key informants mentioned this,

> *"as a department we assist with the tractors and diesel for an affordable price for farmers. We do not have enough working tractors but we try to provide to every household and farmers know that they have to register to get a tractor. We also give farmers ploughs and our staff goes out to spray the fields if there is a huge outbreak of diseases or pests, or we just provide the knapsacks and chemical then the farmers do it themselves"* (Agritex officer 2 interviewed in Chivi, 21/08/13).

The Ministry provides farming equipment and machinery to any household that needs to use the equipment depending on availability. The farmers pay in advance or after they harvest. These subsidies by the Ministry of Agriculture are helping the smallholder farmers as most of them can hardly afford farming material in preparation for a new season. One farmer mentioned that, *"Agritex helps us a lot as we cannot afford to buy equipment for farming ourselves, we are poor"* (Respondent 9 interviewed in ward 25, 17/08/13).

6.3.2 Conservation Agriculture (CA)

The Ministry is also assisting the local farmers by teaching them new methods of farming. Through conservation agriculture, farmers practice farming that reduces changes or eliminates soil tillage and avoids the burning of residue in order to

maintain adequate surface cover throughout the year. One key informant mentioned that, *"we are introducing this new method of farming called conservation agriculture as a way to deal with these extreme weather patterns"* (Agritex officer 3 interviewed in Chivi, 21/08/13). The Ministry mentioned that, to some extent, the intervention method has worked well to improve crop production in the district. However, some of the smallholder farmers are yet to accept change as they are still complaining about poor yields and using traditional methods of farming.

6.3.3 Seed Multiplication Programme

Through the seed multiplication programme, the Ministry is encouraging smallholder farmers to grow seed. The production of seed is done under the guidance of the Ministry of Agriculture and research unit. The programme is aimed at improving seed production for local supply, to increase varieties in the district, reduce seed cost and to allow easy access of seed that will be reserved for the next seasons such that the farmers do not have to rely on the government for seed. This helps the farmers not to buy seed but to use the seed they have produced. This programme, according to the Ministry, is supposed to sustain the smallholder farmers and reduce the impact of climate variability as they will use this seed every agricultural season. One key informant said,

> *"we have introduced the seed multiplication programme which encourages farmers through our guidance to grow seed and use it in the coming seasons as well as sell some of the seed. We assist with the seed to start the program"* (Agritex officer 1 interviewed in Chivi, 21/08/13).

The Ministry is promoting the production of mainly grain seed like maize seed, millet and sorghum. The programme targets every household in the district but farmers are encouraged to use a portion of their land not the entire land. The same method is

being used in other African countries like Ethiopia. According to Alemu (2011), the seed multiplication programme is playing an important role in the Ethiopian national seed system.

6.3.4 Diversification of Crop Production

Farmers are taught by the Ministry to produce small grain crops which are drought resistant like sorghum and millet. The Ministry promotes such small grain crops and helps the farmers to get as much information about them. This has increased the production of small grain farming in the district increasing the available alternative food sources. The Ministry mentioned that the effectiveness of the intervention largely depends on the willingness of the farmers. One key informant mentioned that,

> *"we are promoting small grain production in the district and we try to give as much information as we can on small grain production. Some farmers are now planting small grain crops while others still mainly grow maize. Resistance by some farmers makes some intervention strategies ineffective in some areas"* (Agritex officer 1 interviewed in Chivi, 21/08/13).

Some farmers (66%) are willing to shift from the traditional staple crop –maize- to try the small grain drought resistant crops. Some farmers (34%) are reluctant to shift from maize production to small grain farming.

6.3.5 Irrigated Gardening

The Ministry is supporting and encouraging some farmers to do irrigated gardening if they have water sources nearby. The Ministry encourages mixed gardening where possible. The Ministry is teaching the farmers the importance of gardening and the advantages of having gardens. Increasing alternative food supply and income base was cited by key informants as the main drivers that help farmers to engage in

gardening. Some of the Ministry staff is deployed into the communities to do programmes that help farmers to learn about different vegetables that they can grow in the district. One key informant said, *"we help farmers to engage into gardening and to utilize as much as possible the information that we offer them through our extension programmes that are conducted by extension officers"* (Agritex officer 3 interviewed in Chivi, 21/08/13). The farmers are encouraged to grow onions, tomatoes, spinach and other vegetables that do well in loose soils. The Ministry is working on attempting to connect more water sources to many more households so that they can engage in gardening.

6.3.6 Livestock and Poultry Farming

The Ministry helps farmers to start livestock and poultry farming. This is a method that the Ministry feels can alleviate the risks of climate variability and food insecurity. Livestock farming can be an alternative food source as well as an income source for households. The respondents mentioned that livestock like goats and poultry (roadrunner) is able to survive in dry areas. One of the key informants mentioned that, *"however livestock production has to be carefully planned through well calculated stocking density especially with cattle production. Grazing land has to be managed properly"* (Agritex officer 2 interviewed in Chivi, 21/08/13). The Ministry therefore helps the farmers with information and arrangements on how to manage livestock density and natural resources available. The Ministry also provides equipment and chemicals needed by farmers for their livestock like dipping tanks and dipping chemicals.

6.3.7 Research, Innovation and Technology

The Ministry has a research unit which deals with many aspects of climate change and variability. The Ministry's research unit looks into issues of rainfall patterns and how it is affecting production of both crops and livestock. For instance, research on how climate change and variability is either increasing or reducing crop diseases or pests affecting crop and livestock production is done. One key informant said, *"we have a research unit and it assists with information that is used by the department, extension officers use this information to assist farmers"* (Agritex officer 1 interviewed in Chivi, 21/08/13). The research unit works with other departments like Environmental Management Agency (EMA) and Meteorological Services Department (MSD). The research unit also works with nongovernmental organizations as well. Recently, Practical Action helped agriculture extension officers with information on climate change and variability. It conducted training workshops which equipped them with the latest information on climate change and variability. This information was then used by the extension officers to assist farmers.

The advisory unit consists mainly of agricultural extension officers who after receiving information from the research unit and other sources disseminate the information to farmers. One key informant said, *"yes we have an advisory unit that helps farmers with information they need, from issues of planting, crop rotation, diseases and pests among other things"* (Agritex officer 2 interviewed in Chivi, 21/08/13). Using researched information, the extension officers hold meetings with farmers, teaching and informing farmers on upgraded and updated information. Through this dissemination of information the Ministry is attempting to do community capacity building since trained extension officers act as advisors to farmers. This

new information on farming and climate variability equips farmers to be able to adapt to climatic changes.

6.3.8 Assistance by Meteorological Services Department

The Meteorological Services Department (MSD) has direct and indirect intervention strategies that help with reducing the impact of climate variability. The MSD has ongoing outreach programmes where climate change information is mainstreamed in agriculture extension services. One key informant mentioned that, *"we have outreach programmes that we do at times within Chivi district"* (Meteorologist 1 interviewed in Harare, 26/07/13). Through the ongoing outreach programmes, farmers are taught on climate variability and climate change. This is done using pamphlets and other information leaflets that carry information on climate variability and change. The MSD carries out such programmes once or twice a year mainly during the off-farming season. The MSD has plans underway to train and deploy educators who can teach farmers about climate variability and change in different districts.

6.3.9 Assistance by Environment Management Agency

The Environment Management Agency (EMA) is helping local farmers and local community by educating them on ways to reduce the effects of climate change through environment protection. There are campaigns to protect natural resources especially forests and vegetation. There are also campaigns about veld fires. Veld fires destroy plants, crops, livestock and wild animals. The destruction caused by veld fires has detrimental effects on sources of food and also on the land and its vegetation which have an effect on the local climate. Through protection of grass from veld fires, livestock feed is protected. The destruction of vegetation is

increasing the impacts of climate variability through global warming. One key informant mentioned that,

> *"we emphasize on the protection of the environment which is an asset for the rural people, as they use land for agriculture, forest for food and medicine, grass for livestock feed. Destruction of forests leads to desertification which results in global warming"* (EMA officer 1 interviewed in Chivi, 22/08/13).

One of the farmers also raised his concern on this issue of environment destruction as a cause for climate variability *"people are cutting down a lot of trees and this is causing the temperatures to rise and strong winds"* (Respondent 4 interviewed in ward 30, 15/08/13). As a way to protect the environment, EMA regulates the use of fragile lands. For example, it prohibits cultivation along river banks which helps to prevent river siltation hence prolonging the life span of rivers used as water sources for farming and irrigation.

The EMA research unit also assists with the generation of new knowledge concerning climate variability and change. One key informant mentioned that, *"we have a research unit that works with universities, government departments, NGOs and communities to investigate about the environment and climate change"* (EMA officer 2 interviewed in Chivi, 22/08/13). The research unit is currently researching together with other government departments and other nongovernmental organizations on aspects around impacts of climate variability and change and on other natural resources in the district.

EMA is also advocating for a green economy. This is meant to benefit the farmers as promotion of the green economy introduces ways that will protect the environment

which might result in more suitable stable climatic conditions for farmers. One key informant indicated that, *"our policies as EMA advocate for environment conservation and the promotion of a green economy which are more likely to improve and better the climatic conditions"* (EMA officer 1 interviewed in Chivi, 22/08/13). The EMA uses different methods to try and promote a green economy like encouraging communities to conserve natural resources, educating farmers on the impacts of desertification on climate change and how this eventually affects agricultural production. It also penalizes stakeholders within the community who violate ecosystem conservation regulations like unlawful cutting down of trees for commercial purposes. EMA is also devising and advocating alternative sources of energy that will not destroy natural resources and cause global warming.

6.4 CONCLUSION

This chapter has shown that NGOs and government assistance is needed and vital in the district as the farmers have limited assets to cope with the impacts of climate variability. The NGOs are playing a fundamental role in assisting smallholder farmers with mitigation strategies and reduction of food insecurity in the district. The aid provided in the form of food hand outs, grants, farming inputs, information and projects initiatives and resources is helping sustain the livelihoods of the smallholder farmers who have been largely affected by the extreme weather patterns. The role of NGOs has been important despite the limitations and negative connotations that are raised by some critics. The government departments are also playing a major role in assisting the farmers to cope and adapt to the impacts of climate variability. Agritex is at the forefront assisting farmers with resources ranging from inputs, equipment, information and technological assistance. The MSD is directly helping the farmers with weather and climate information. The EMA is playing a crucial role in raising awareness about the need to protect the environment for the benefit of current and future generations.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

This chapter presents a summary of the findings, discusses the main conclusions and makes some recommendations. This is done with guidance of the main objectives of the study. The chapter also presents other areas of study that can be researched on in future.

7.2 CLIMATE VARIABILITY AND ITS IMPACTS ON AGRICULTURAL PRODUCTION

The study found that there are extreme climatic conditions in Chivi district. There are erratic rainfall patterns and temperatures continue to rise. Thus there is a high frequency of droughts due to these extreme climatic conditions. Smallholder farmers and key informants mentioned that this climate variability is impacting agricultural production. Erratic rainfall patterns were cited as the biggest challenge faced by 93% of the smallholder farmers. Even the 7% of smallholder farmers with water sources near their household also mentioned the adverse impacts of erratic rainfall patterns. The increase in extreme weather patterns and high frequency of droughts is depressing yields by damaging crops at crucial growth stages causing crop failure almost every season which consequently increases the risks of food insecurity in the district.

Planning for the forthcoming season, preparations and engaging in crop production has become difficult in Chivi. Climate variability has also forced farmers to alter their methods of farming. Sixty percent of smallholder farmers in the district are now using conservation agriculture as one of the methods to adapt to climate variability.

Farmers have also been coerced to alter the type of crops they produce shifting from predominantly producing maize, sweet potatoes, groundnuts, pumpkins and sunflowers to mainly millet, sorghum, round nuts and cow-peas.

Climate variability is not only affecting crop production, it is also eroding the assets possessed by the smallholder farmers. Losses of farming inputs like fertilizers, seed, and capital due to poor yields and high frequency of droughts exposes the farmers to several risks like food insecurity, debt accumulation, engagement in risky off-farm activities. These impacts of climate variability are intensifying local level food insecurity and deepening levels of poverty.

7.3 CLIMATE VARIABILITY IMPACTS ON FOOD PRODUCTION, AVAILABILITY AND ACCESS

The study found that food crop production in Chivi district has been significantly affected by climate variability. Extreme climatic conditions have forced food crop production alteration in the district. Smallholder farmers have been forced to change the food crops they produce, from maize, sweet potatoes, groundnuts, pumpkins and sunflowers to mainly millet, sorghum, round nuts and cow-peas. Mainly drought resistant crops are now being grown in the district. The farmers no longer produce a wide variety of food crops as the climatic conditions are not favourable for such.

Yields received by smallholder farmers have drastically decreased. Eighty percent of the farmers used to get 6-10 bags of maize in one season but now receive a single bag or less. This means the local sources of food are dwindling. Climate variability has thus resulted in decreased food crop production, poor output quality and a drastic decrease in amount of food crops produced per cultivated area. Climate variability is thus resulting in reduced food availability and diminished food access for

many poor people in Chivi. The poor yields have aggravated food insecurity and exposed poor people in the district to hunger.

7.4 COPING AND ADAPTATION STRATEGIES USED BY SMALLHOLDER FARMERS IN CHIVI

The study found that farmers are changing the type of crops grown to small grain drought resistant crops as a coping strategy. The drought resistant crops (millet, sorghum and cow-peas) have better returns in yields than the traditional food crops (maize, groundnuts and sweet potatoes) that were grown previously by farmers. The study also found that some farmers (60%) have changed methods of farming from traditional methods to new methods like conservation agriculture (CA). The CA method is meant to reduce heavy use of machinery, reducing the cost for farmers as well as heavy exploitation of the land and reduce loss of soil fertility. CA is aimed at improving yields but responses from farmers indicate that they have not experienced any increase in yields. Smallholder farmers are also reducing the cultivation area as a coping strategy to climate variability. This has been effective in reducing the excessive use of depleted resources possessed by the smallholder farmers. Irrigation gardening is another coping and adaptation strategy used by some farmers to deal with climate variability. This strategy is however limited to farmers that have water sources in their homesteads or nearby.

Farmers are also using off-farm income generating projects to cope with the impacts of climate variability. Some farmers (40%) are engaging in informal jobs like carpentry, brick making and house building, gold panning and selling firewood. They then use money earned from these activities to sustain themselves. These off-farm

income generating projects are becoming an integral aspect of the farmers' livelihoods in dealing with the impacts of climate variability.

Despite having these coping and adaptation strategies, the smallholder farmers still need more support to enable them to deal with the impacts of climate variability. There is need for the government to resuscitate Mushandike irrigation scheme, excavate Muchenami dam and invest in building water sources in the district. There is also need to increase availability and access to climate related information at household level. More technical information like accurate weather forecasts, trends or rainfall patterns, better crop variety is also needed by farmers. The study also found that farmers need access to other financial and physical assets to help them deal with impacts of climate variability. Farmers mentioned the need for access to capital and advanced farming inputs, equipment, information and technology.

7.5 THE ROLE OF NGOS AND STATE INTERVENTIONS IN COPING AND ADAPTATION STRATEGIES

The study reveals that NGO actors are playing an integral role in helping smallholder farmers to deal with the impacts of climate variability. NGOs assist the smallholder farmers with food hand-outs, grants, technical support, climate related information and technological innovations. The NGOs are however facing constraints in assisting smallholder farmers. An NGO key informant stated that, *"there is need for further training of farmers and Agritex officers, so the organization needs more sponsorship to get the training programme done"* (Practical Action Officer 1 interviewed in Harare, 24/07/13). Lack of resources especially capital has thus been the biggest challenge to NGO intervention efforts.

Most farmers (86%) mentioned that they wanted the government to assist them in the best way possible with more information on agriculture and inputs suitable for the climatic conditions in their district. However, the reality is that government departments and NGOs do not have enough resources to meet some of the needs by the farmers. They too lack human resources, capital and infrastructure that are enough to fully assist the farmers.

The Ministry officials also mentioned that they come across numerous challenges when dealing with issues that have to do with climate change and variability. For example, some local farmers are resistant to the new methods of farming like conservation agriculture and seed multiplication farming programme that are being introduced to them. Some farmers find it difficult to shift from their traditional crops like maize and sweet potatoes that they have always been producing to new small grain crops like sorghum, millet and cow-peas. Farmers have their traditional beliefs and preferences that make them resist new farming practices.

The EMA is also helping local farmers by educating them on ways to reduce the effects of climate change through environment protection. Through its green economy advocacy, EMA is directly trying to benefit the poor smallholder farmers who are suffering from the impacts of climate change. However, a lot of local people are yet to fully understand the reasons and the benefits of EMAs green economy advocacy. Continued cutting of trees is increasing land degradation and desertification which creates micro-climatic conditions that do not promote agricultural production. Furthermore, while EMA wants to do more outreach programs targeting households, it is unable to due to lack of resources. EMA does

not have adequate resources to educate the whole local community on the negative impacts of destroying the environment.

7.6 RESEARCH, POLICY AND DEVELOPMENT PRACTICE RECOMMENDATIONS

Intervention strategies crafted after considering people's perceptions are most likely to succeed because they have public support, unlike situations where a few technocrats design solutions for people's problems without their participation (Simba, Chikodzi and Murwendo, 2012). Based on the findings, this study makes the recommendations below which can be used to address the challenges caused by the impacts of climate variability on agricultural production.

7.6.1 Recommendations for Smallholder Farmers

The main findings show that some of the smallholder farmers who are producing drought resistant crops have slightly better yields than those still growing traditional crops. Given this reality, the study therefore recommends the universal adoption and growing of small grain drought resistant crops. The study also recommends that farmers adopt conservation agriculture as it reduces soil erosion, promotes soil fertility and reduces costs of farming.

The study further recommends that farmers should get into partnerships and co-operatives to practice irrigation gardening with those without water sources providing equipment, labour and knowledge. The farmers should build better social assets by forming working groups that allow the sharing of knowledge, techniques and assets.

The study also recommends that farmers practice more environmentally friendly coping and adaptation strategies. This is said because the study discovered that farmers are cutting down trees to sell for firewood. To address this problem, the

study therefore recommends that farmers engage in agro-forestry so that they can make more money as well as conserve the forests. Community incentives should be provided for those who implement such practices.

7.6.2 Recommendations for NGOs and Government Departments Implementing Interventions in Chivi

The study reveals that lack of information is one of the challenges faced by smallholder farmers. Unganai (1996) states that often the problem facing developing nations in formulating response strategies to the threat of climatic change is lack of background information on the most probable direction and magnitude of climate change to anticipate. The study therefore recommends that more climate science research be conducted by both NGOs and government departments. They can, for example, begin by setting up research points in drought prone areas such as Chivi. These research centres should value perceptions and views of farmers in the formulation of climate change and adaptation policies.

The study further recommends more support for farmers in the form of climate change related training, knowledge and technology transfer. This can be achieved by allowing full participation by farmers in community engagement projects with NGOs and government experts providing climate change technical expertise.

The study also found that lack of water sources and strong winds is also a major challenge. The study therefore recommends the use of wind energy-driven pumps to extract underground water for water security and irrigation purposes in and around Chivi. The resuscitation of irrigation schemes especially in drought prone areas should also top the government's community development list.

7.6.3 Recommendations for Further Research

The study recommends that more research be conducted on Zimbabwe's climate change and mitigation policies in order to find out their relevance and if they are making an impact in helping smallholder farmers.

The study also recommends that more studies be done on the role of the Meteorological Services Department in directly assisting smallholder farmers especially in drought prone areas such as Chivi.

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APPENDICES

ANNEXURE A: SEMI STRUCTURED IN-DEPTH INTERVIEWS

Research Question 1

1. What risk is posed by climate variability on agricultural production (in general) in Chivi district?

a. Has there been a change in rainfall patterns in this community in the last 5 to 10 years?

b. Has there been a change in temperature patterns in this community in the last 5 to 10 years?

c. What are the challenges you are facing during production?

d. Does production get affected by the resources available?

e. How has been agricultural production been in the past 10 years?

f. How have been the yields in the past 10 years?

g. Have you experienced any changes in production in the last 10 years?

h. If you have experienced changes in yields what has been the main cause of the change in yield?

i. How frequent are droughts in this area (Chivi)?

j. How are the changes in climate affecting food crop production?

k. How does the impact of climate change affect availability of food?

2. Is climate variability impacting food production and availability in Chivi?

a. What are the main crops that you produce?

b. How much yield do you get each season and is it enough to sustain you to the next season?

c. In the past 10 years have you noticed a decrease in yield?

d. If you have noted a decrease, what do you think causes this decrease?

e. Are there crops that are more affected by rainfall or temperature changes than others?
f. Has food crop production become more expensive due to changes in rainfall or temperature changes?
g. Have you experienced food shortages due to bad farming seasons?
h. If so, how often have you experienced this?
i. In addition to droughts what other factors have led to food shortages in this area?

3. Which coping and adaptation strategies are being implemented by households to deal with the risks and impacts of climate variability on food production?

a. Due to changes in climate, have you changed farming methods or variety of crops grown?
b. If yes, how effective have the new farming methods or variety been?
c. Apart from changing farming methods what other ways do you use to cope with changes in climate? Are they effective?
d. How do you cope with, or adapt to climatic changes?
e. What are the challenges you are facing when trying to cope and adapt to the changes in climate?
f. Do you have enough resources to cope with the climatic changes?
g. Do you get any form of assistance from external bodies like the government to deal with changes in rainfall and temperatures?
h. How often do you get the assistance?
i. Is the assistance helpful to improve and curb food shortages?

j. What is needed – technically, economically and politically – to ensure you have adequate food?

k. Do you have any other sources of survival or income besides agricultural produce?

ANNEXURE B: FOCUS GROUP DISCUSSIONS

Focus Group Questions

a. What are the challenges you are facing during food crop production?

b. What are the changes in weather patterns that you have noticed?

c. To what extent is climate change affecting food crop production?

d. Do you have sufficient knowledge about climate change and how it affects agricultural production?

e. How do you cope and adapt with the changes in climate?

f. Do you have enough resources to cope with changes?

g. What do you think can be done to reduce the impact of climate variability?

h. Do you have any other source of income that helps you to cope with food shortages?

i. How do you think changes in farming methods will assist in reducing the impact of climate change?

j. Do you think climate change has advantages that benefit your area?

k. What has been done about climate change in Chivi to reduce its impact?

l. What can be done to reduce the impact of climate change?

ANNEXURE C: KEY INFORMANT INTERVIEWS

Agritex Officers, EMA and NGOs

a. How have the climatic conditions been like for the past 10 years in Chivi?

b. How has it affected the crop production in the district?

c. What do you think is the biggest challenge faced by local smallholder farmers in the district?
d. Does your department assist the local farmers in any way?
e. How effective do you think your assistance is in improving food crop production and availability?
f. Does the department have research and advisory units that specifically deal with climate change?
g. Are there new methods of farming that are been introduced to farmers to help them to cope and adapt with the climatic changes?
h. What should be done to deal with food shortages?
i. As a department what are the challenges you face when dealing with climate change related issues?
j. Are there long term strategies and policies that are being devised to assist local smallholder farmers to improve food crop production and food availability?

Meteorological Officers

a. How have the climatic patterns changed in the past decade?
b. Have rainfall patterns changed over the decade?
c. How frequent are droughts in this district (Chivi)?
d. Are there changes that are still occurring in weather patterns?
e. How are the changes in climate likely to change the farming seasons?
f. What has been done to alert the local residents of the climate changes?
g. How can you help the local farmers to get information on climate change?
h. Do you have educators that are deployed to help local farmers on climate changes?

i. What can be done to help farmers cope and adapt with changing weather patterns?

m. What kind of assistance do you think you need to reduce the impact of climate change?

n. What are the main obstacles that you face when getting assistance?

o. Do you have any recommendations for policy makers that can help in improving farming conditions?

ANNEXURE D: INTERVIEW SCHEDULE

RESEARCH INTERVIEW SCHEDULE

Respondent	Time	Ward	Place	Date
1	12:00	25	Chivi	13/08/13
2	12:00	25	Chivi	14/08/13
3	09:00	30	Chivi	15/08/13
4	15:00	30	Chivi	15/08/13
5	09:00	25	Chivi	16/08/13
6	12:00	25	Chivi	16/08/13
7	15:00	25	Chivi	16/08/13
8	16:00	25	Chivi	16/08/13
9	09:00	25	Chivi	17/08/13
10	12:00	25	Chivi	17/08/13
11	09:00	30	Chivi	18/08/13
12	13:00	30	Chivi	18/08/13
13	09:00	30	Chivi	19/08/13
14	13:00	30	Chivi	19/08/13
15	09:00	30	Chivi	20/08/13
FGD 1	14:00	30	Chivi	20/08/13
FGD 2	14:00	25	Chivi	21/08/13
FGD 3	14:00	25	Chivi	23/08/13
FDG 4	14:00	30	Chivi	24/08/13
FGD 5	14:00	30	Chivi	25/08/13
Meteorologist 1	09:00	N/A	Harare	26/07/13
Meteorologist 2	09:00	N/A	Harare	28/07/13
Agritex Officer 1	09:00	30	Chivi	21/08/13
Agritex Officer 2	12:00	30	Chivi	21/08/13
Agritex Officer 3	16:30	25	Chivi	21/08/13
EMA Officer 1	09:00	25	Chivi	22/08/13
EMA Officer 2	12:00	25	Chivi	22/08/13
NGO Staff 1	09:00	N/A	Harare	24/07/13
NGO Staff 2	12:00	N/A	Harare	24/07/13
MSD Email Appointment	10:00	N/A	East London, SA	11/07/13
MSD Tele-	11:00	N/A	Harare	19/07/13

Appointment				
Agritex Email Appointment	10:00	N/A	East London, SA	12/07/13
Agritex Tele-Appointment	12:00	N/A	Harare	26/07/13
EMA Email Appointment	09:00	N/A	Harare	26/07/13
EMA Tele-Appointment	11:00	N/A	Harare	29/07/13
NGO Tele-Appointment	09:00	N/A	Harare	19/07/13
Headmen and DA Appointment	08:30	N/A	Chivi	12/08/13