UNDERSTANDING CLIMATE CHANGE AND RURAL LIVELIHOODS IN ZIMBABWE: ADAPTATION BY COMMUNAL FARMERS IN NGUNDU, CHIVI DISTRICT

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ABSTRACT

Climate change and variability is a global phenomenon which has deeply localised patterns, dynamics and effects. Amongst those people who are particularly vulnerable to climate change effects are small-scale farmers who are dependent in large part on rain-fed agriculture in pursuing their livelihoods. This is true of small-scale farmers in contemporary Zimbabwe and, more specifically, farmers in communal areas. At the same time, at international and national levels, there are attempts currently to minimise the effects of, and to adapt to, climate change. However, adaptation measures also exist at local levels amongst small-scale farmers, such as communal farmers in Zimbabwe. In this context, as its main objective, this thesis examines climate change and small-scale farmer livelihood adaptation to climate change with specific reference to communal farmers in Chivi District in Zimbabwe and, in particular, in Ward 25 which is popularly known as Ngundu. In pursuing this main objective, a number of subsidiary objectives are addressed, including a focus on the established livelihoods of Ngundu farmers, the perceptions and concerns of Ngundu farmers about climate change, the coping and adaptation measures of Ngundu farmers, and the enablements and constraints which affect attempts by Ngundu farmers to adopt such measures. The fieldwork for the thesis involved a diverse array of research methods, such as a questionnaire survey, life-history interviews, key informant interviews, focus group discussions and transect walks. In terms of theoretical framing, the thesis makes use of both middle-level theory (the Sustainable Livelihoods Framework) and macro-theory in the form of the sociological work of Margaret Archer. Combined, these two theories allow for a focus on both structure and agency when seeking to understand livelihood adaptations to climate change by communal farmers in Ngundu. The thesis concludes that there are massive constraints inhibiting adaptation measures by Ngundu farmers, but that this should not distract from the deep, often historically-embedded, concerns of Ngundu farmers about climate change and the multiple ways in which they express agency in and through adaptation and coping activities. It also highlights the need for more specifically sociological investigations of climate change and small-scale farmer adaptation, as well as the need for localised studies which are able to identify and analyse the specificities of adaptation.

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ACRONYMS

AGRITEX	Agricultural, Technical and Extension Services
AIPPA	Access to Information and Protection of Privacy Act
ATR	African Traditional Religion
BHASO	Batanai HIV and AIDS Service Organisation
CA	Conservation Agriculture
CARE	Cooperative for Assistance and Relief
CH_4	Methane
CLFPA	Communal Lands Forests Produce Act
CO_2	Carbon Dioxide
COMESA	Common Market for Eastern and Southern Africa
COTTCO	Cotton Company in Zimbabwe
CSO	Central Statistical Office
DA	District Administrator
DDF	District Development Fund
DDR	Disaster Risk Reduction
DFID	Department for International Development
DMC	Disaster Management Committee
DSS	Department of Social Services
DRC	District Relief Committee
DVS	Veterinary Services Department
EMA	Environmental Management Agency
ENSO	El Nino-Southern Oscillation
ESAP	Economic and Structural Adjustment Programme
FAO	Food Agriculture Organisation
FGDs	Focus Group Discussions
FTLRP	Fast Track Land Reform Programme
GAPWUZ	General Agriculture Plantation Worker's Union of Zimbabwe
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emissions
GMB	Grain Marketing Board
GMO	Genetically Modified Organisms
GNU	Government of National Unity
GoZ	Government of Zimbabwe

GPA	Global Political Agreement
HIV/AIDS	Human Immune Deficiency Syndrome/Acquired Immune Deficiency Syndrome
HLS	Household Livelihood Security
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDS	Institute for Development Studies
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
MDC	Movement for Democratic Change
MDG	Millennium Development Goals
MTP	Medium Term Plan
NAC	National AIDS Council
NAMAS	Nationally Appropriate Mitigation Actions
NAP	National Action Programme
NCCRS	National Climate Response Strategy
NEP	National Environmental Plan
NGOs	Non-Governmental Organisations
NGP	Ngundu Growth Point
NO_X	Nitrogen Oxide
NTTP	National Tree Planting Day
POSA	Public Order Security Act
RDC	Rural District Council
SADC	Southern African Development Community
SFAIDS	Southern Africa HIV and AIDS Dissemination Service
SLA	Sustainable Livelihoods Approach
SLF	Sustainable Livelihood Framework
SSA	Sub-Saharan Africa
STD	Sexually Transmitted Diseases
STERP	Short Term Emergency Recovery Programme
UNCCRS	United Nations Conventions on the Rights of the Child
UNFCC	United Nations Framework Convention on Climate Change
WFP	World Food Programme
WHO	World Health Organisation
WMC	Watershed Management Committee

ZANU PF	Zimbabwe African National Union Patriotic Front
ZCTU	Zimbabwe Congress of Trade Union
ZIMSTAT	Zimbabwe Statistics
ZimVAC	Zimbabwe Vulnerability Assessment Committee
ZINWA	Zimbabwe National Water Authority

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Climate change has posed insurmountable challenges to humankind in the contemporary world, making it difficult for the world's poorest people to deal with poverty among other issues. Changes in climate are one of the biggest threats facing humankind today and are already having adverse impacts in Zimbabwe specifically (ZimStat, 2013). Zimbabwe's climate has changed over the past decades with experiences of more hot and fewer cold days. The country's annual mean surface temperature has warmed by about 0.4^{o}C from 1900 to 2000 (Zimbabwe NCCRS, 2015). The effects of climate change in rural areas have become more pronounced given how the majority of the people depend on rain-fed agriculture. Zimbabwe has one of the highest degrees of rainfall variability in the world and the climate is characterised by frequent drought years and occasional flood events making it very difficult for farmers (Manjengwa et al., 2014).

The timing and amount of rainfall received in Zimbabwe are becoming increasingly uncertain. There has been an overall decline of nearly 5% in rainfall across the country since 1901 until the early 1990s (Manjengwa et al., 2014). The erratic nature of rainfall patterns has serious adverse impacts for agricultural production, with significant consequences on livelihoods, particularly for vulnerable groups. The effects of drought spells are drastic given the heavy dependence of the country on agriculture. Indeed, agriculture forms the basis of the direct and indirect livelihoods of almost 70% of the population and economic growth is directly linked to the performance of this sector (Anseeuw et al., 2012).

The thesis seeks to understand how Ward 25 (commonly known as Ngundu) farmers located in Chivi District (a communal area in Zimbabwe) perceive and problematise climate change, and it also analyses their adaptive strategies in the face of constraints and enablements that exist or might arise. The reliance of Ngundu farmers on rain-fed agriculture makes them very susceptible to the vagaries of climate change. Ngundu is found within natural ecological IV and V of Zimbabwe. In the Zimbabwean context, agricultural regions are delineated on the basis of soil type, rainfall and other climatic factors, with region V having the least amount of average rainfall of below 650mm per annum (Mafu, 2008). Agro-ecological regions IV and V occupy about 64% of Zimbabwe's land mass and most of the country's communal areas (inhabited by a majority of the black population) are situated within these two regions.

Due to low rainfall, regions IV and V are unsuitable for dry land cropping and are more suited to large-scale livestock production and game ranching, with the latter pursued by white commercial farmers historically (Moyo et al., 1991). Nevertheless, many communal people in these regions engage in crop production. In the case of Ward 25, rainfall is erratic and unreliable making it difficult to support rain-fed agriculture. This has largely resulted in persistent crop failures and subsequent food shortages. The farmers in Ngundu recognise the existence of climate change and they have major concerns about its effects on rainfall, temperature, and extreme weather events like droughts and floods. Given this, the thesis examines the Ngundu farmers' livelihoods, how these have been affected by climate change, and the adaptation strategies pursued and implemented by the farmers in the presence of constraints and enablements.

1.2 Background to the Study

Climate change is a global phenomenon that has affected nations and communities around the world. Humans have always been able to adapt to environmental and climatic challenges in the past, but the sheer severity of contemporary climate changes has triggered diverse and seemingly insurmountable challenges that have in turn affected local communities to unbearable magnitudes. The effects of climate change and drought are wide-reaching and complex. Climate change as defined by the IPCC (2007a) is the change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate variability in particular refers to variations from the mean state (and other statistics, such as standard deviations) involving the occurrence of extremes in climate on all temporal and spatial scales beyond that of individual weather events (IPCC, 2007a). The manifestations of climate change are the increase in earth's temperature and the rise in sea levels while the manifestations of climate variability are inconsistent rainfall patterns and major variations from season to season.

Studies reveal that the world is undergoing serious climate change as global temperature is ever increasing (Mawere, 2011; Kinuthia, 1997). Studies done by for instance Unganai (1996), UN (1998), Makhadho (1996) and Chikodzi et al. (2012) have concurred that climate change alters rainfall patterns, amplifies drought cycles, increases the frequency of severe weather conditions and increases agricultural pests and diseases. The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001) also revealed that the global

average temperature will increase by 1.4° C to 5.8° C between 1990 and 2100 if the levels of greenhouse gas emissions are not reduced.

The African continent has not been left out on the effects of climate change. According to the IPCC (2007a), the African continent is more vulnerable to climate change impacts as attributed to its proximity to the Equator, low adaptive capacity and high poverty levels. Burke (1997) postulates that the historical climate record for Africa was showing a warming trend of approximately 0.7^0C over most of the continent during the twentieth century, a decrease in rainfall over large portions of the Sahel Region and an increase in rainfall in East Central Africa. DFID (2004) points out that climate change will have significant negative effects on agriculture, on food and water security and on economic growth in Africa. From a food security perspective, Sub-Saharan Africa (SSA) is the most vulnerable region to many adverse effects of climate change. This is because of a very high reliance on rain-fed agriculture for basic food security and economic growth in the region (Komba et al., 2012; Dixon et al., 2001; IPCC, 2007; Cooper et al., 2008).

Empirical studies have been carried out to show the impact of climate change on livelihoods. Many researchers have shown the impact of climate change on crop production and farmers' livelihoods in particular (Moussa et al., 2006; Jain, 2006; Hassan et al., 2008; Molua et al., 2006b; Mano et al., 2006). Reid et al. (2006) used the DFID Sustainable Livelihoods Framework to identify constraints to secure livelihoods that were being faced by small-scale farmers in the Muden area of KwaZulu-Natal in South Africa. Their study revealed that, among the constraints, climate change effects were of major concern to the farmers as these adversely affected their agricultural based livelihoods. Smallholder farmers in particular are suffering from the impacts of dramatic climate events such as severe storms, drought and flooding, while unpredictable weather patterns have impacted on harvests, thereby preventing farmers from feeding themselves (Komba et al., 2012). Lack of financial capital and technology is likely to worsen the situation in which small-scale farmers find themselves.

Adaptation and coping measures are thus significant as they help communities, including farming communities, to better face extreme weather conditions and associated climatic variations (Adger et al., 2003). Coping is the manner in which people act within the confines of existing resources and range of expectations to achieve certain short-term goals, without addressing climate change-induced challenges over time (Wisner et al., 2003). Adaptation is more than coping as it is a process through which societies increase their ability to cope with an uncertain future through implementing appropriate action. At times, coping strategies may turn into adaptive strategies as farmers continue to implement the coping strategies over an

extended period of time. Adaptation can be understood as adjustments or interventions which take place in order to manage the losses or take advantage of the opportunities presented by a changing climate (IPCC, 2001). It is thus understood as the process of improving society's ability to cope with changes in climatic across time scales, from short term to long term (Nhemachena et al., 2007). Adapting to the changes has consequently emerged as a solution to address the impacts of climate change. It is considered especially relevant for developing countries, where societies and communities are already struggling to meet the challenges posed by existing climate variability (Yamin et al., 2005; Adger et al., 2003; Handmer, 2003; Kates, 2000); as well, they are expected to be the most adversely affected by climate change (McCarthy et al, 2001). Adaptation assists farmers to achieve their food, income and livelihood security objectives in the face of climate change (Kandlinkar et al., 2000).

Adaptation is not really a new phenomenon. The book *Origin of Species* by Charles Darwin (1859) represents one of the key roots of the concept of specifically biological adaptation. Over a number of decades, different disciplines have examined biological, cultural and social adaptation processes from a variety of perspectives, including anthropology, archaeology, biology, ecology, geography, political ecology, psychology and global environmental change science (Schipper, 2007). Adaptation of a social-cultural character, which takes advantage of new opportunities and minimises adverse consequences of environmental and climatic change, has existed since the beginning of the human presence on Earth (Smithers et al, 1997). Societies have a long record of adapting to the impacts of climate change and variability through a range of practices that include crop diversification, irrigation, water management and disaster risk management (Adger et al., 2007). These adaptation processes involve farmers themselves, and there is a growing literature on this. For instance, Kurukulasuriya et al. (2006), Nhemachena et al. (2007), Mano et al. (2007) and Seo et al. (2006) have all carried out studies on the impact of climate change on agriculture and, in their studies, they highlight the significance of adaptation as a way that reduces the heavy impacts of climate change.

However, adaptation to climate change is a two-step process which requires that farmers perceive and frame climate change in the first place and respond to climate changes in and through adaptation thereafter (Deressa et al., 2011). The first step, then, that enables adaptation to occur at all is the perceptions of the people as they go about their daily lives. Farmers' ability to perceive and recognise climate change is a key precondition for their choice to adapt, as perceptions pave way for any potential action to take place. Perception as the first step entails a cognitive understanding of the problem often based on lived experiences over time (Simba et

al., 2012). Understanding the perceptions of climate change by farmers is important as perceptions can shape the preparedness of these actors to adapt and change their practices. According to Gallup (2009) and Simba et al. (2012), in the absence of perception, inaction or unguided action arises; and, in the absence of action, perception will not serve any purpose. In simpler terms, it is necessary for people to realise that certain changes are occurring in order to take action to adjust to those changes (Deressa et al., 2011); however, for many reasons, recognition of climate change does not necessarily lead to the emergence of adaptation strategies. What perceptions if any exist and what adaptation strategies exist or do not exist, are open to significant temporal and spatial variation, and thus are subject to dynamic contingencies. This point highlights the importance of localised studies of specific communities, such as Ngundu farmers in the case of the thesis.

Studies have been conducted on perceptions of climate change at country level (Leiserowitz, 2007), and at local level in developed countries (Leiserowitz, 2006) and developing countries in Africa (Deressa et al., 2011; Gbetibouo, 2009; Maddison, 2007) and Asia (Byg and Salick, 2009). In research on "Perceptions and Realities of Climate Change among the Chepang Communities in Rural Mid-Hills of Nepal", conducted by Piya et al. (2012), it was discovered that nearly a third of respondents from a total of 221 Chepang households were able to perceive the changes in line with the recorded data. Okonya et al. (2013), in "Farmers' Perception of and Coping Strategies to Climate Change: Evidence from Six Agro-Ecological Zones of Uganda", discovered that 99% of all households interviewed had observed a change in the climate in the last ten years. Coping strategies towards extreme events like droughts and floods included storing food, income diversification, digging drainage channels and planting trees among other strategies (Okonya et al., 2013). Both studies showed the necessity of farmers noticing that climate change is occurring as the first step leading to coping and/or adaptation strategies. In this same line of thinking, Simba et al. (2012) highlight that understanding of climate change by a farmer is a crucial element in spearheading adaptation options.

Adaptive capacity is very important in adaptation processes and a concentrated focus on this in research is said to be necessary and crucial (Fussel et al, 2006). Adaptive capacity is the ability of a local or national system to respond effectively and successfully to climate variability and change, and it includes adjustments in human practices, resources and technologies. Thus, the presence of adaptive capacity has been shown to be a necessary condition for the design and implementation of effective adaptation (Brooks and Adger, 2004). Adaptive capacity also enables different sectors and institutions to take advantage of

opportunities or benefits that can come from climate change. Consistent with these thoughts, the thesis grapples with adaptation of farmers in Ngundu (Ward 25), examining how they problematise climate change and the constraints and enablements presented to them in processes of adaptation.

1.3 Study's Significance

This study is significant given that climate change, climate change effects and climate change adaptation are place-specific. Climate change impacts are being felt globally but take on localised forms; plus, adaptation to these impacts is often locally constructed and pursued. In understanding adaptation to climate change and variability, local studies hence become crucial. Certainly, the need to comprehend farmers' perceptions from a local level is significant in climate change studies. It is vital to note that countries, regions, economic sectors and social groups differ in their form and degree of vulnerability to climate change. This is due partly to the fact that changes in temperature and precipitation are occurring unevenly and that climate change impacts are unevenly distributed around the globe. It is also due to the fact that resources and wealth are distributed unevenly. According to IPCC (2001), vulnerability differs substantially across regions, and so do the impacts and adaptive capacity. For instance, a temperature increase of between 2 and 4^0 C may cause agricultural losses in the Philippines, yet rice yields in Indonesia and Malaysia might increase (IPCC 2007b). Appreciating the complex nature of adaptation processes, and their sheer diversity, is missing from studies which are focused on higher spatial levels such as the nation scale.

Taking note of the above sentiments, it is clear that many studies assume uniformity of problems associated with farmers in their endeavours to adapt to climate change. According to Nautiyal (2011), globally many studies on climate change are available, but the impact of climate change at the micro-level along with adaptation is yet to be studied in detail. In this regard, most studies assessing the potential effects of climate change on small-scale agriculture in Africa are regional or national in their spatial analyses; yet climate change and adaptation are place-based and understanding this necessitates the use of place-specific research methodologies (Fischer et al., 2002; Hassan et al, 2008; Lobell et al., 2008; Deressa et al., 2011; Kurukulasuriya et al, 2008). The disaggregated blanket approach is problematic because it ignores place-specific issues. Further, it is clear that research on climate change and its impact only at the national level is not a sound approach towards even identifying adaptation activities at the micro level. Adaptation to climate change is a local process (Leary et al, 2007; Fussel et

al 2006; Agrawal 2008). In line with all this, my thesis supports the view that though climate change and adaptation may be a universal phenomenon, its indicators and manifestations are mainly local, and so are the perceptions, adaptation choices, strategies and practices. This involves sensitivity to more qualitative research methodologies involving the study of farm and local-level perceptions and strategies of farmers such as those in Ward 25 in Chivi District. This points to a key significance of this thesis.

In addition to the above, macro level projections may fail to give useful and viable solutions to climate-related problems at local level due to information gaps and other uncertainties. In a study of India, it was found that rural and agricultural development policies and the principles underlying them may note the likely consequences of climate change; but they often lack a plan for adaptation at sub-national levels (Singh et al., 2015). Most such policies, in India and elsewhere, are blanket or highly aggregative in character and thus fail to address and understand the various micro-level processes and practices. This resonates with my concern about the need for more micro level studies which document the constraints and enablements that people experience in their efforts to adapt to climate change. In another study, Okonya et al. (2013) point out that, despite Uganda being highly vulnerable to rainfall variability and climatic shocks like droughts and floods, micro-level studies at the farm-level on how rural smallholder farmers perceive these changes are limited. Hence, any policy prescriptions become deeply problematic.

A better understanding of micro level perceptions and strategies is imperative for effective and informed planning at the macro-level. Lemos et al. (2009) argue that designing programmes and policies for enhancing adaptation to climate stress without considering the multiplicity of factors (including the perceptions of farmers on climate change and their livelihood vulnerabilities) which condition adaptation possibilities at local levels is misplaced and of limited worth. Bearing this in mind, eliciting and understanding farmers' perceptions and adaptation mechanisms as adopted, in addition to standard climate models, is a prelude for effective adaptation planning (Jodha et al., 2012) at local and national levels. Chagutah (2010) echoes the need for micro level studies in Zimbabwe when he points out that, although systematic research has been undertaken on key sectors through the United Nations Framework Convention on Climate Change (UNFCCC) planning process, less is known about micro-level vulnerabilities and challenges due to limited research.

Micro level studies, as agreed by many researchers (Frankhauser et al., 1999; Schneider et al., 2000), enable the grasping of the different constraints faced by farmers in their efforts to adapt to climate change. A better understanding of grassroots-level realities across spatial sites

helps in designing effective and informed planning at the macro-level for successfully enhancing resilience of the agricultural sector vis-à-vis climate change and variability (Bryant et al., 2000; Singh et al., 2015). This approach stems from the understanding that macro level data cannot necessarily be scaled down in providing accurate and useful information at the micro-level. Understanding the lived experiences of farmers in rural areas and their micro-level problems, though not detached from broader economic and political conditions at national and even global levels, will certainly open doors for development policies that are more effective. The difficulties that local farmers face do not have to be universalised in order to be understood, and any generalisations about the status of farmers, climate change and adaptation strategies must be grounded in localised empirical research. Adaptation to climate change should be localised, though its effectiveness depends on local and extra-local institutions through which incentives for individual and collective actions are structured (Agrawal, 2008). All this is discussed more fully in chapter 3.

1.4 Research Questions

In pursuing the major concerns of this study, the following questions guided the research:

- ❖ What are the major livelihood strategies pursued by Ngundu farmers in Chivi and the challenges encountered?
- ❖ What climate changes have occurred in Ngundu as perceived by Ngundu farmers?
- ❖ What are the adaptive and coping strategies implemented by Ngundu farmers?
- ❖ What are the constraints and enablements experienced by Ngundu farmers in seeking to pursue adaptation processes?

1.5 Objectives of the Research

In this context, the main objective of the study is to *understand livelihood adaptation to climate change by Ngundu farmers in Chivi communal area, Zimbabwe.* In seeking to address this main objective, the main subsidiary objectives are as follows:

a) Understand the major livelihood strategies pursued by Ngundu farmers.
b) Identify the climate changes that have occurred in Ngundu as perceived by the farmers.
c) Understand and analyse the adaptive and coping strategies constructed and pursued by Ngundu farmers.

d) Examine the enablements and constraints facing Ngundu farmers in the adaptation process.

The main thesis objective and the subsidiary objectives are pursued analytically through the use of the Sustainable Livelihoods framework as a middle-level theory, which is strengthened by way of drawing upon the morphogenetic theory of sociologist Margaret Archer (chapter 2).

1.6 Background to Research Site

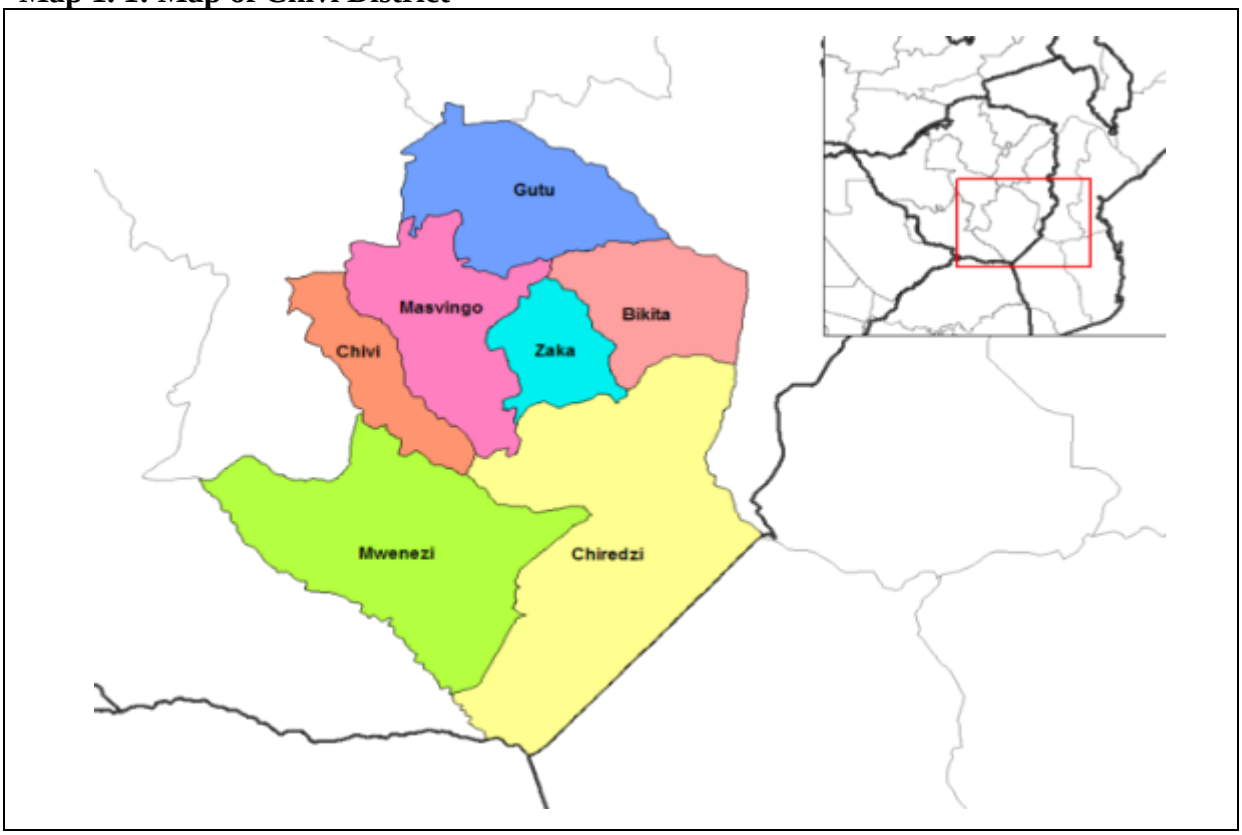
Chivi District (shown in Map 1.1 below) is found in Masvingo Province in the south-eastern part of Zimbabwe. The district was known as Chibi in colonial times before 1980. The name comes from a mission station established in 1892 by Wedpohl, Neitz and Dietrich from Berlin, Germany. Chivi is a communal farming area with low levels of natural capital and does not have the agro-ecological conditions suited to cropping (Bird et al., 2003). The district contains natural forests and common grazing which have become fragile due to over-exploitation. The district is located in the drought-prone region of the country, north of Mwenezi District and west of Masvingo District. Two thirds of the district's land are in Zimbabwe's lowest agro-ecological category (66% in Natural Region V) in terms of agricultural potential, and the remaining third is not much better (33% in Natural Region IV) making most of Chivi to be semi-arid.

Ward 25 (Ngundu), the case study for this study, is located in Chivi District and is one of the 32 wards that make up the district. According to Mutekwa et al. (2006), Ward 25 is approximately 146km^2 and is comprised of 39 villages. There are 10,893 people in Ward 25 (Zimstat, 2012) as per the most recent statistical data. The communal area people in Ngundu rely on rain-fed agriculture for their livelihoods but rainfall has become increasingly unreliable over a number of years, which is common in the district as a whole. At a district level, unreliable rainfall has largely resulted in persistent crop failures and subsequent food shortages for Ngundu farmers. Persistent droughts are common and rainfall is not only low (with a mean rainfall 650mm/annum) but is also erratic, with severe mid-season dry spells being common. Despite this, rain-fed farming continues to be the principal livelihood activity for most Ngundu farmers with small-scale farming therefore forming the mainstay of household economies (Mudavanhu et al., 2013). Soils are inherently low fertility sandy or sandy loams with limited moisture retention capacity and declining fertility exists due to the increased cost of inorganic fertilisers and the scarcity of natural alternatives like anthill soil and manure (Mudavanhu et

al., 2013). By the late 1990s, soil erosion had become extensive and deepening poverty had led poor households to increasingly exploit common property resources to supplement their incomes.

Chivi District is largely populated by members of the Karanga ethnic group, which is the most populous ethnic group in Zimbabwe, and it is a sub-group of the Shona speaking people that also includes the Zezuru, Manyika and Ndau. Chivi District has 45.7% males and 54.3% females and the total number of people in Chivi is 167,049 (ZimStat, 2012). The crude birth rate (per 1,000) is 29.0 and the crude death rate (per 1,000) is 12.4; with the rate of natural population increase in the district being 1.7%. The marital status breakdown in the district, according to the 2012 census, is as follows: never married amounts to 27.7%, married 55.8%, divorced or separated 4.0%, widowed 11.6%, and not stated 0.9% (ZimStat, 2012).

Map 1. 1: Map of Chivi District



Source: https://upload.wikimedia.org/wikipedia/commons/2/23/Masvingo_districts.png

Census information on education reveals that about 13% of the district's population aged 3-24 years have never been to school (ZimStat, 2012). However, 84% of these were below 6 years of age and many of them were likely to start school later than usual. Overall 61% of the population was currently attending school. The proportion of the population age 3-24 years

which had left and dropped out of school at the census time was 26%. Of those who left school, 44% were males and 56 % were females. More specifically in Chivi South constituency, where Ward 25 is found, there are 28 primary schools enrolling a total of 18,007 pupils. As well, 9,041 (50.21%) of the pupils are girls whilst boys constitute a total of 8,966 (49.79%) of the total enrolment (ZimStat, 2012). There are 509 teachers (both trained and untrained) in the constituency and the constituency's pupil-to-teacher ratio stood at 18:1 which is better than the national average of 43:1. The primary teaching staff complement consists of 47.15% male teachers and 52.85% female teachers (ZimStat, 2012). Poverty levels in Ngundu are quite high, just as levels of educational attainment tend to be quite low. Regrettably, statistical details about Ngundu in particular, whether about education or other social dimensions, do not appear in the 2012 census.

1.7 Research Methodology

In this section I discuss the research methodology underpinning the research for the thesis, including ontological and epistemological claims, research design, sampling and research methods.

1.7.1 Ontological and Epistemological Concerns

According to Fleetwood (2005:1), "the way we think the world is (ontology) influences: what we think can be known about it (epistemology); how we think it can be investigated (methodology and research techniques); [and] the kinds of theories we think can be constructed about it". In what follows I discuss briefly the ontological and epistemological foundations of this research as it is necessary when undertaking research for one to acknowledge explicitly these philosophical foundations. The issues of what the social world entails, and how it can be studied, are therefore crucial. As Fleetwood notes, with which Margaret Archer (1998) concurs, the adoption of a particular ontological position leads to a particular epistemological position. Archer (1998) further points out that any substantive social theory necessarily draws upon a social ontological claim.

In this regard, ontology is concerned with the nature of social reality, what constitutes reality and what there is to know about reality (Ritchie et al., 2013). A key ontological question concerns whether or not there is a social reality that exists independently of human conceptions and interpretations, and thus whether reality is simply reducible to subjective understandings

of it. If it is claimed to be reducible, this would end up as a strong and – ultimately unsustainable – idealist ontological commitment. Likewise, if the social world is said to be constituted by 'things' existing fully independently of human conceptions and even constructions, then this might lead down the path of a positivist version of realism which seeks above all to identify casual relationships between such 'things'. Archer (1995) posits that social reality is a stratified reality and argues that neither idealism nor positivism, alone or in combination, adequately capture the way in which the social world is constituted.

Grounded in the Critical Realism of Roy Bhaskar (1989), Archer adopts a non-positivist realist ontology which highlights the existence of deep ontological structures which generate (or cause) the world as seen, sensed and experienced (Olvitt, 2012). This is a crucial foundation for her morphogenetic theory. Critical Realism is thus concerned with causal relationships, seeking to understand the mechanisms and structures that make social life possible (Mingers, 2004). As Bhaskar (1989) argues, 'the real' (deep structures and mechanisms) underlie 'the actual' (events) and 'the empirical' (experiences). According to Bhaskar (1998), Critical Realism allows for in-depth explanatory critique that goes beyond empirical experience to uncover causal mechanisms that would otherwise be invisible, thus avoiding the fallacy of actualism. In recognising the significance of this, Archer gives ontological depth to her morphogenetic theory by speaking of casual powers and generating mechanisms which have a real existence but may not even be recognised as existing by people in their everyday world of experiences (Healy, 1998). While the thesis does not use fully the complexities of Archer's ontological claims, it does nevertheless seek to show the ways in which both structure and agency (society and people, respectively) have both emergent properties and powers which are irreducible to one another (Archer, 1995). Importantly, Archer's so-called social realism shows how society can be modified by people, as they hold a reservoir of potential abilities (Donati, 2011).

This broad ontological position leads to an epistemological position consistent with the former. More specifically, it becomes crucial to identify the structural properties and the agential powers – and the interrelationships between them – in order to understand and explain for instance the world of climate change perceptions and climate change adaptations. Understanding subjective interpretations (idealism) and explaining 'things' (or events) through establishing causal (law-like) relationships (positivism) may have some significance epistemologically, but these must be foregrounded by an appreciation of how the world is generated by causal powers and mechanisms. Both 'events' and 'experiences' as encountered

in the world are important, but a deeper quest for understanding and explanation entails moving beyond 'appearances' (to use an orthodox Marxist expression).

When it comes to issues of structure and agency, which are critical to her morphogenetic approach, Archer proposes (consistent with Critical Realism) what is called analytical dualism. This implies that agency and structure are separable and irreducible to each other. According to Archer (1995), analytical dualism is significant in understanding societal phenomena and circumventing the pitfalls of upwards, downwards or central conflation. Explanation must attend both to structure and to agency, and any explanation which attends to either exclusively is likely going to be inadequate (Archer et al., 1998). Structural mechanisms do not determine agency in any hard sense, and agents are unable to compel structural modifications. Structures and agents have their own sets of powers (or at least potential powers) which interact in complex manners such that societal change is bound to be marked by tendencies rather than by fixed, linear and law-like paths. Structural stability is also not inherently guaranteed.

Archer's morphogenetic theory, which is used in this thesis (see chapter 2), is thus rooted in certain philosophical claims. In terms of research methodology, the study is primarily qualitative – in large part because of the focus on the perceptions, experiences and practices of Ngundu farmers. A qualitative methodology is also strongly associated with Critical Realism and Archer's theory, particularly given that powers, processes and conditions are best captured through qualitative analyses. Denzin et al. (2005) note that qualitative research is mainly linked with an interpretive or constructionist approach to social realities. However, as indicated, it is also appropriate for studies consistent with Critical Realism which posit the existence of underlying structures and mechanisms which breathe life into everyday social life. As well, though Critical Realism does not necessarily privilege certain research methods, a qualitative methodology tends to lead to the prioritisation of certain research methods in sociology (Creswell, 2003). In this context, I now turn to the research design and research methods used for this study of Ngundu farmers.

1.7.2 Case Study Research Design

I chose the case study method as it proved to be the most appropriate design in investigating a particular social problem being faced by a particular group of people. It thus provided the platform to study social phenomena through an analysis of an individual case. A research design more broadly can be thought of as the master plan of a research project which throws light on how the study is to be conducted (Thomas, 2010). It shows how all the major parts of

the research project connect together in an attempt to address the research questions and objectives. A research design draws upon, and is consistent with, the underlying philosophical assumptions of the research and facilitates the identification of appropriate data collection methods which are consistent as well with the study's objectives (Mouton, 1996). In this sense, it is also an action plan for travelling from 'here' to 'there'. The 'here' is understood as the initial set of questions to be answered and the 'there' is the findings and conclusions about the social phenomena under investigation.

The case study design more specifically involves investigating a particular case of a broader phenomenon (Gillham, 2000), such as the case of climate change and adaptation by Ngundu communal farmers in the context of the broader phenomenon of the adaptation by communal farmers in Zimbabwe in the face of climate change. In addition, the case study design for this study is of a qualitative kind and thus entails examining a multiplicity of perspectives, experiences and practices which are rooted in a specific context. This entails, for example, a situation where people under study air their views from their own standpoint, which brings out diverse perspectives that allow the researcher to develop a holistic understanding of the problem under study. In a certain sense, a case study examines a bounded or confined system (including its developments over time) in an in-depth manner, employing multiple sources of evidence found in the setting (McMillan and Schumacher, 2001). However, this is not to claim that a case study is somehow a closed system. Local contexts, such as Ngundu communal area, exist in a broader social context (including the political economy of Zimbabwe) and indeed local and extra-local processes are intimately intertwined in each other. Examining the case in depth, in its broader context and with a sensitivity to temporal change, sharpens the researcher's understanding of the social phenomenon (or case) being investigated. Using Ward 25 as the case study (and as one unit of analysis) offered me an entry point into comprehending the complex and convoluted processes no doubt marking climate change and adaptation. There is no claim to the effect that Ward 25 is statistically representative of the Chivi district more broadly, though insights into the lives of Ngundu farmers likely depict the lives of other Chivi communal area farmers.

1.7.3 Selection of Main Case Study, the Ward and Villages

Non-probability sampling was used to identify the case under study in this thesis. Purposive sampling (which falls under non probability sampling) was used in the first instance to select Chivi District. Under this type of sampling, the researcher subjectively targets a certain area or

group of people whom he/she perceives to be suitable – if not most suitable – to address the concerns of the study. My study is on climate change and livelihood adaptation in rural Zimbabwe. The areas that are most deeply affected by climate change in Zimbabwe are those that are found in semi-arid areas since these areas lie in the lowveld and are the driest areas in Zimbabwe. According to Mudavanhu et al. (2013), Chivi is one of the driest areas of Zimbabwe and is found in region IV and V which are the most arid areas in Zimbabwe.

According to the Agricultural Technical and Extension Services (AGRITEX) officer in Ngundu, the District traditionally receives 450-650 mm of rain per year, but it now receives around 350mm per year. The temperatures in Chivi District are high and have increased sharply over the last couple of decades which has made drought to be more frequent and severe. Given that the communal farmers in the area depend on rain-fed agriculture, Chivi District appeared to be very suitable to address the main thesis objective. Ward 25 (popularly known as Ngundu) was selected as the main case study unit. Ward 25 was chosen given its comparatively large population and the popularity of the Ngundu Growth Point (NGP) which draws many Zimbabweans in the area to it. In this regard, the ward is in a strategic position as it is situated along the Beitbridge-Chirundu road corridor, which also facilitated access to it as a research site. In addition, the area was established as a Rural Highway Service Centre considering that it is the spot at which all routes to major cities such as Bulawayo, Harare, Chipinge and Mutare meet, therefore enhancing its popularity.

There are 39 villages in Ward 25, and 3 villages (namely Pedzisai 1, Nduna 1 and Guti) were purposively selected; the villages have 160, 100 and 96 households respectively. Pedzisai 1, Nduna 1 and Guti were chosen in part due to the high numbers of households that they have as compared to other villages. The three villages were also chosen because of their proximity to the NGP where so much activity takes place in the area. In selecting three villages only, the aim was to obtain a micro-level understanding of problems faced by farmers in the context of climate change. As well, the fact that the three villages are close to one another facilitated the fieldwork as it meant avoiding the hassles of walking several kilometres between different villages.

1.7.4 Historical Timeline

Evidence of climate change often takes years (even decades) to be noticed and observed. In this regard, to understand the trends and trajectories of climate change, it is necessary to choose a period that is long enough to identify and monitor that climate change is in fact taking place.

In order for me to understand the changes that had occurred in Ward 25, it was important to stretch the historical timeline to cover a period of 2-3 decades. The study thus covered the period 1990 to 2017. The period of 27 years is sufficient to show that climate change is prevailing. Choosing this period enabled me to recognise and comprehend the livelihood dynamics that had taken place over an extended period. The period shows the major climate trends that took place and facilitates an understanding of climate change from the perspective of the Ngundu people. The period 1990 to 2017 was marked by extreme weather events that included droughts and floods. The major drought and floods experienced involved the agricultural years 1991/1992, 2001/ 2002, 2007/2008 and 2011/2012 among other years.

My fieldwork was done in two phases: the first was done from October 2015 to April 2016 then the second one was from October 2016 to April 2017. This was pursued in order to see and compare climate change over different agricultural seasons. There were droughts in the seasons 2014/2015 and 2015/2016 and a flood in the season 2016/2017. Going into the field for two consecutive seasons assisted me in understanding the predicaments faced by farmers as they made decisions on what to plant in a particular season and how to plant it. In the same vein, stretching my timeline to cover 27 years helped in comprehending the effects of the drought (2015-2016) and flood (2016-2017) that occurred during my fieldwork.

1.7.5 Data Collection Methods

As Myers (2009) puts it, qualitative research is designed to help researchers understand the daily lives of people, and the social, political and cultural contexts within which they live. Data collection methods which are aimed at gathering in-depth evidence were employed so that the multiple dimensions and characteristics of the social phenomena under study are properly understood. Qualitative research is the most appropriate approach when one wants to grasp the complexity of the adaptation process. The approach enabled me to understand the culture, problems that Ngundu people face, their network systems and how they try to solve their problems. The main data collection methods used in this study were in-depth interviews with key informants, questionnaires, observation, Focus Group Discussions (FGDs) and life histories. Below I discuss the methods used, including in the sequence that I implemented them.

1.7.5.1 Questionnaires

Questionnaires were the first research method that I made use of and they date back to the initial stages of my field work which was in October 2015. The questionnaire survey was used so as to complement the qualitative methods. Questionnaires have the advantage of reaching a wider audience compared to interviews, but they are marked by an inability to customise evidence collected in relation to specific individuals encountered in the field. In this study, questionnaires were a very important instrument in data collection (see Appendix 2). As Burgess (1982) indicates, for research findings to be generalised to the population or universe with limited degrees of error, a sample should comprise about 10% of the population under study.

Following this, I covered 12% of the households from each of the three villages (10 from Guti, 20 from Pedzisai 1 and 12 from Nduna 1) bringing the total number of households who participated to 42. From the households that participated in the questionnaire, 45.2% were male headed, 40.5% were *de facto* female headed (headed by females because senior males were not around as they were travelling distances looking for work, or because the senior male was chronically ill) and 14.3% were *de jure* female headed. In terms of age, the age group 30-39 had 3 respondents; 40-49 years had 6 respondents; 50-59 years had 12 respondents; 60-69 years had 8 respondents; 70-79 had 10 respondents; 80-89 years had 2 respondents and 90 to 99 years had 1 respondent.

Research assistants assisted me in the administration of the questionnaires, and they included village secretaries from each of the villages, the Councillor and the ZANU PF Youth Leader. The language used in the questionnaires was English and the questions had to be translated into the vernacular language (Shona) in cases where the interviewee experienced challenges with English. The research assistants had to then translate the answers which were given in the vernacular language and write them in English on the questionnaire.

The questionnaires assisted me in obtaining a broad overview of the villages and the lives of Ngundu farmers in the villages, including their livelihood activities and their general perceptions about climate change and its challenges. The survey thus allowed me to ensure that the ensuing research methods were more refined than they would have been otherwise. In this sense, questionnaires were the gateway into my research sites and made it easier for me as well to identify the people with whom I needed to engage more fully through (in particular) in-depth interviews about climate change and adaptation activities.

1.7.5.2 Key Informant In-depth Interviews

In-depth interviews with key informants are designed to elicit a vivid picture of the respondent's perspective on the research topic, including feelings, opinions and even experiences.

I made use of these in-depth interviews to obtain a vivid understanding of the problems faced by Ngundu farmers from the diverse perspectives of key informants. The interviews were carried out with purposively selected key informants who were divided into two groups: which I name as the formal and informal group. The formal group involved the District Administrator (see Appendix 4) for Chivi; 3 Village Heads from Pedzisai 1, Nduna 1 and Guti (see Appendix 4); NGO officials (see Appendix 3); an AGRITEX Officer (see Appendix 6); a local Chief (see Appendix 4); Ward Councillor (see Appendix 4); Youth Leader (see Appendix 4); a Zimbabwe National Water Authority (ZINWA) official (see Appendix 3); and a Social Welfare official (see Appendix 3). The second group, which I refer to as the informal group, was made up of people from around the villages whom some I had identified during the questionnaire phase of the fieldwork. This group (see Appendix 8) comprised of Mr. Madzivire (chosen because of his relation to the chief clan); 3 elders chosen for their knowledge of the area; 2 members of Banga irrigation scheme; 1 Conservation Agriculture farmer; 3 casual labourers; 1 farmer (because of his livestock production); 2 women who had shown their deep knowledge on climate change during questionnaires; 1 small grain farmer; and 4 farmers who gave their deep insights on adaptive/coping strategies they are implementing and challenges being faced. This group was thus comprised of certain people whom I felt had contributed significantly during the questionnaires and who appeared to be more knowledgeable on climate change and adaptation in the area.

The in-depth key informant interviews began at the end of October 2015 and ended in April 2017. The in-depth interview schedules were written in English but had to be translated into Shona in cases where the interviewee was insufficiently proficient in English. Data gathered during in-depth interviews were captured through field notes and a voice recorder. These interviews were of great importance in identifying diverse experiences and perspectives around climate change and Ngundu farmer adaptation strategies, including highlighting local enablements and constraints.

1.7.5.3 Life Histories

A life history is a type of in-depth interview which traces and documents the life of an individual over time. It entails a deeply personal account of a person's life in his or her own words and in a manner sensitive to personally constructed time-lines, as the person recounts and reflects upon his or her personal biography and key events in the past and present. As a qualitative research method, a life history focuses on subjective understandings, interpretations and evaluations of experiences, events and practices. In this respect, listening to the voice of the subject becomes crucial as the researcher seeks to follow the stories being told (Rahamah Hj et al., 2008). Generally speaking, it can be said that the life history approach explores the subject's experiences and the meanings he/she attributes to these experiences. In doing so, the approach also seeks to ensure that the subject speaks to his or her experiences in the context of broader social developments occurring at the time of the experiences.

Life histories were conducted between January 2016 and April 2017 and they were done with 12 elderly people in Ngundu, comprising six females and six males. As per the definition put forward by the United Nations (UN, 2007), elderly are people aged 60 years and above, though the normal retirement age in Zimbabwe is 65. Non-random purposive sampling was used to select elders within Ngundu who had lived in the area for 50 years or more. The questionnaire that I had administered earlier in October 2015 was a useful basis for identifying such elderly people in Ward 25. In other words, I was able to use the evidence collected by way of the questionnaire to select 12 people suitable for the life history method. Respondents for life histories comprised of five people from Pedzisai 1, four people from Guti and three from Nduna 1.

The use of open-ended questions or unstructured questions, based on a life history schedule (see Appendix 7), ensured that the subjects reflected upon their past experiences with minimum direction from the researcher. This gave them the leeway to speak about their lives in the area from early childhood until now, including details about climate change and livelihoods. The life histories were a rich source of evidence which helped me to visualise and imagine what was transpiring during every period in their lives. Due to the one-on-one interaction, I was able to be fully attentive to their stories while also being able to take down notes of key points raised. The life history subjects were asked about local farming activities during their childhood years, including crops and animals, and the rainfall patterns during this time; these same issues were traced during the course of their lives. The life histories facilitated an understanding of continuities and change in climate and agriculture over an extended period, and how these were conditioned by broader social and political forces.

1.7.5.4 Focus Group Discussions (FGDs)

Focus group discussions (FGDs) are a form of data collection which usually involve approximately 6-10 people who are invited to come together to discuss a particular topic (Ritchie, 2013). Focus groups have always been portrayed as a means of stimulating conversations amongst individuals because of the significance and advantages of small group dynamics (Desai, 2006), and they allow for the identification of possible differences of perspectives and experiences as group members engage with each other under the facilitation of the researcher. They can be used as well for ascertaining collective views on social phenomenon, though not necessarily fully consensual views, including collective perceptions on climate change. Insofar as the group discussion is able to delineate local forms of collective action, the reasons for these actions are also brought to the fore. Further, FGDS are an excellent way of determining the uncertainties, tensions and contradictions embedded in a local community, including questions around power differentials and dynamics.

Of course, an individual's expressions are conditioned by the group setting and it thus becomes important to be sensitive to how these expressions entail acts of performance for other members of the group. Further, the possibility exists that certain individuals may dominate the group discussion while others feel disinclined to participate fully. However, I sought to ensure that each individual felt a degree of comfort and ease in order to facilitate input from all group members. In this light, the focus group discussions were participatory and hopefully empowering for some members, such that the members felt some level of control over the discussions which ensued.

Using a focus group schedule (see Appendix 5), I carried out 2 FGDs in each of the 3 villages, leading to six FGDs in total. The first 3 FGDs were carried out during the first phase of my field work (that is, in 2015-2016) while the last 3 FGDs were done during the second phase (during 2016-2017). Each focus group involved one session only, and no person participated in more than one group discussion. Having two FGDs in each village, and on two separate occasions (or in two separate agricultural years/seasons), allowed me to identify similarities and differences spatially (i.e., across villages) and over time. In this respect, the same set of questions were used in guiding all 6 FGDs, most of which focused quite directly on climate change such as rainfall and temperature patterns as well as agricultural activities and adaptation measures. During the FGDs I also carried out a wealth ranking for the different villages based on the villagers' own conceptions of wealth and how villages are differentiated in terms of wealth and the factors leading to such differentiation.

The focus groups consisted of between 10 and 15 people and the FGDs were mainly done during farmers' agricultural field days. Even though I wanted a maximum of 10 people per FGD, at times people tended to just join them and it was awkward to simply insist that they are to be excluded from the discussion. In the FGDs, there was a more or less equal number of men and women, though women tended to be more heavily represented. Though I tried to identify group participants by selecting individuals of particular interest from the questionnaire respondents, some of the participants were not part of the questionnaire sample. The questionnaires also assisted me in identifying the representation of different age groupings in Ward 25. In this context, I tried to incorporate people into the FGDs who ran across the different age categories to capture the multiplicity of perspectives and experiences arising from age differences. All the age groups (30-39 years; 40-49 years; 50-59 years; 60-69 years; 70-79 years; 80-89 years) were therefore incorporated. Only one respondent who gave her life history insisted that she also wanted to participate in a FGD carried out in Pedzisai 1 village. I also participated in the FGDs through clarification of some questions and also probing further where I observed a valid point that required further understanding. My participation also made the people to feel comfortable around me and enabled the development of strong relationships between me and them.

Information gathered through the FGDs was collected through note taking and this was made more effective by research assistants who included a secretary from each of the 3 villages. The research assistants assisted in asking questions and also clarifying where some people did not understand. They were very helpful given that they knew the people better and managed to assist me to form ties with the people.

1.7.5.5 Observation

Besides the pre-arranged interviews (mentioned earlier), I had numerous informal interviews (conversations) with people whom I met as I carried out my research, especially in the fields as I carried out transect walks. These free-flowing and impromptu conversations facilitated my familiarisation with local agricultural conditions and allowed me to observe the adaptation activities as they were being pursued and implemented.

The logic behind observation stems from the fact that what people say and do is not necessarily the same (Tierney, 2008); for instance, they may claim one thing during an interview or FGD, but do another thing in their daily lives. The essence of observation is to view directly what happens unmediated by interpretations offered by research subjects, but in

a manner which is as un-obstructive as possible so as to avoid changes in daily practices because of the very presence of the researcher. Observation was of great significance in carrying out this study, which I captured through field notes. My informal conversations during the transect walks were primarily designed to confirm or refine my understanding of what I observed, or to understand what I observed from the perspective of the Ngundu farmer. During the walks, I was able to observe the effects of climate change in terms of for instance land degradation and the types of agricultural activities which took place on a daily basis.

1.7.6 Data Analysis

Sunday (n.d.) postulates that qualitative data analysis is the range of processes and procedures whereby we move from the qualitative data that have been collected, into some form of explanation, understanding or interpretation of the people and situations we are investigating. In order to attain this, qualitative data analysis was used putting emphasis on a narrative approach. Narrative analysis is a strategy that recognises the extent to which the stories we tell provide insights about our lived experiences (Sandelowski, 1994 in Thorne, 2008). I made use of narratives from life histories and in-depth interviews as a way of recounting the importance of livelihood and adaptive strategies for Ngundu people and their perceptions of rainfall and temperature. In as much as the life history approach in qualitative research emphasises the importance of unpacking and presenting the individual's social experiences and his or her interpretation of these experiences in a temporal context (Rahamah Hj, 2008), life histories offer the researcher an opportunity to trace continuities and changes in life trajectories with reference to wider structural changes at the local level and beyond. Therefore, life histories gave me insights into different people's perspectives on crucial elements on rainfall and temperature patterns and allowed me to construct similarities and differences from people's stories in a comparative manner. Through recounting the life histories and interviews, I made use of quotations and they were instrumental in bringing about the main themes found in the study. As analytic processes help us to detect the main narrative themes found within the accounts people give about their lives (Thorne, 2008), I was able to discover how Ngundu people understand and make sense of their lives. Archer's theory was instrumental as Critical Realism holds that reality can be apprehended by tracing the origins of experience through to the level of events, and then to underlying structures and processes (Plant, 2001).

Qualitative data analysis was done through thematic analysis. Braun et al. (2006) point out that thematic analysis is the process of identifying patterns or themes within qualitative

data. They further argue that thematic analysis is a useful method for examining the perspectives of different research participants, highlighting similarities and differences, and generating unanticipated insights. The recording of data during FGDs and unstructured interviews was done thematically in tandem with research objectives and issues that arose during fieldwork. Data from interviews were organised by questions whereby questions (which sought to answer research objectives) were used to organise data that was collected. Responses that were similar were then put under the same category therefore forming a particular theme that would have emerged from the participants. For instance, themes that emerged included the difficulties associated with planting basins (*dhiga udye*), the labour associated with small grain production, and the drastic changes in rainfall patterns among others.

Issues to do with frequency, intensity and specificity were also used to come up with themes. Issues to do with frequency looked at how often an issue was raised by different people. For example, the issue to do with land scarcity in the area was continuously mentioned showing that it was a major problem and a theme coming out of the study. Intensity was also used as it brought out the depth of feeling that respondents held about certain issues as shown by their emotions during discussions. In this study, intensity showed how farmers strongly felt about issues like rainfall and temperature changes as shown by their emotive expression of feelings as they responded during FGDs and in-depth interviews. Specificity was used as well; for instance, respondents knew specific droughts that were very extreme like the 1992 drought and they used personal experiences in showing how droughts personally affected them (such as the death of livestock as mentioned by particular individuals). Re-reading of field notes assisted me in coming up with the central themes which were arising from different age groups as well as from women and men.

The themes were ultimately presented in descriptive narration with words, interpreting phenomena in terms of the meanings people were bringing to their lives. Central themes emerging from the study pertain to changes in rainfall seasons from decade to decade, the importance of NGOs as enablements in the adaptation process, and the constraints associated with small grain production among other issues. In this regard, the major advantage of using thematic analysis is that it produces "an insightful analysis that answers particular research questions" (Braun et al., 2006:97).

In order to capture quantitative data from the questionnaire, the SPSS computer package software was used. The software helped in analysing data using descriptive statistics such as frequencies and percentages and also establishing graphs and the presentation of tables.

1.7.7 Challenges in the Field

Lincoln et al, (1985) point out that qualitative research is an approach which acknowledges the researcher's subjectivity and the possible biases associated with it. In this regard, I sought to bracket and put aside any preconceived notions to ensure that I did not find what I possibly expected to find. I constantly framed my research in terms of questions, and ensured that I did not lead the research subjects in any shape or form in terms of the content of their thoughts and recollections. I was faced as well with challenges around skewing the range of subjects involved in the research, which might lead to distortions or biases in evidence collected. In particular, a number of women in Ngundu constantly requested that they participate in each and every research method pursued, seemingly because of expectations that they would obtain food handouts from me at some point in exchange for their participation. It was only through the assistance of Village Heads that I managed to prevent this practice from taking place. To inhibit problems arising with regard to the reliability of my findings, the multi-method approach (or triangulation) was particularly important. Triangulation is a way of deliberately seeking evidence from a wide range of sources and comparing findings from different sources. In my case, I used interviews, questionnaires, life histories, observations and FGDs to compare and confirm findings. Confirmation of findings ensured the authenticity of this research.

1.7.8 Ethical Considerations

Ethical approval for research with human participants is needed for several reasons which encompass the protection of the rights and welfare of participants and minimising the risk of physical and mental discomfort. Ethical approval is also meant to protect the rights of the researcher to carry out any legitimate investigation as well as the reputation of the institution to which the researcher is affiliated. The researcher sought clearance from the District Administrator in Chivi to conduct research. The letter from my supervisor from Rhodes was the gateway to my field work. I also sought permission from community leaders to collect data. The leaders included the councillor, Chief, village heads, youth leader, NGOs and AGRITEX officials.

I also sought informed consent from the respondents. Informed consent involves issues pertaining to voluntary involvement in providing information. Information is necessary to ensure that respondents are given sufficient and full details about the nature of the research and the procedures involved. There is a need for the researcher to highlight clearly and honestly the objectives of the study, as well as any potential risks and benefits. In terms of the voluntary

component of the research, consent must be freely given and may be withdrawn at any time. Voluntary participation implies that participants make an informed choice while informed consent assumes that the information given is accurate. I sought voluntary participation from all research subjects, and consent was given in both verbal and written forms. I did this given that coercing people into participating is against ethics for research. Appendix 1 shows how I verbally informed the people for FDGs, life histories and key informant interviews that participation was on a voluntary basis. In the case of the questionnaire, written consent was requested and given (Appendix 2), and respondents had to put their signature to the form to confirm participation after knowing fully their rights as research subjects.

Most research subjects did not want their names to be cited in my thesis, though one person insisted that her name be used. Besides her, all other names appearing in the thesis are pseudonyms. This I arranged prior to conversations in all of the research methods. I did this because I did not want a situation whereby people would hide crucial information from me simply because they thought that I would record their real names. Thus the use of pseudonyms made people participate more freely and added greater value to the research. There are certain instances, however, where it is difficult to use pseudonyms. This is the case with certain key informants, including the councillor, chief and village heads. Identifying them simply by their institutional position would regrettably not hide their identities either.

1.8 Outline of the Thesis

This thesis is divided into nine chapters. The next three chapters are contextual chapters. Chapter 2 provides a discussion of the concept of adaptation with specific reference to climate change and then goes on to offer the theoretical framework for the thesis, including the Sustainable Livelihoods approach and the sociological theorising of Margaret Archer. Chapter 3 examines climate change trends, causes and effects globally (including in relation to Africa) and, on these spatial levels, also considers literature on small-scale farmers and adaptation to climate change. The following chapter (chapter 4) covers similar topics but with specific reference to Zimbabwe. But, in doing this, the chapter analyses the post-1980 political economy of Zimbabwe and hones this in on communal areas, before looking at climate change effects in communal areas and literature on communal farmer adaptation to climate change. Chapters 5 to 8 focus on the research site of Ngundu and are thematically arranged according to the subsidiary objectives of the thesis. In the context of an overview of Ngundu (including its history and politics), chapter 5 details the livelihoods and livelihood activities of communal

Ngundu farmers. Chapter 6 then examines the perceptions and concerns of Ngundu farmers in relation to climate change, seeking to trace these historically. Chapter 7 identifies the diverse ways in which Ngundu farmers seek to cope with, or adapt to, climate change (given their perceptions and concerns). After this, chapter 8 identifies both the constraints and enablements faced and experienced by Ngundu farmers in seeking to pursue adaptation measures. The last, concluding chapter (chapter 9) seeks to show how the thesis addresses the main objective of the thesis and how the theoretical framing adopted contributed to this endeavour.

CHAPTER TWO: THEORETICAL UNDERPINNINGS ON CLIMATE CHANGE AND FARMERS' ADAPTATION

2.1 Introduction

The central element of this study is adaptation, making conceptualisation and etymological understanding of this term a pre requisite. The chapter dwells into the most important aspects of climate change adaptation. It traces the roots or origin of adaptation as a response mechanism to climate change. Farmers across the globe are adapting to climate change as they have realised that climate change is an irreversible process that will only worsen as time proceeds. This chapter is premised on two themes, the first one being on the etymological understanding of the term adaptation. The second focal theme discusses the two theories that guide this study which are Archer's Reflexivity theory which is a macro-level theory and the Sustainable Livelihoods (SL) approach which is a middle-level theory. The chapter shows how Archer's theory strengthens the SL Approach in some aspects where it tends to be weak.

2.2 Adaptation

Adaptation should be understood as both a process and an outcome leading to many interpretations and much debate. It is a complicated process that has been understood differently by different people. As Morin (1985) puts it, the notion of adaptation is itself subject to change and transformation. According to Simonet (2010), the word 'adapt' comes from the Latin word *apere* which means to bind, or literally to attach. He adds that, rhetorically, the term expresses the suitability to a situation, a meaning that was revived in the 19th century to indicate the transformation of work into a new form. The term adaptation became a central concept in several major disciplines in the 19th century (Simonet, 2010). It is observed that in every discipline, the environment was strongly linked to the concept of adaptation. I thus give a brief historical understanding of the concept, reviewing different fields of biology, psychology, geography, anthropology and sociology.

The term adaptation largely originates from biology, the study of the living, which as a discipline understands adaptation as a process by which an animal or plant species becomes fitted to its environment. In this regard, even the simplest organisms may be adapted in a great variety of ways i.e. in their structure, physiology and genetics, in their locomotion or dispersal, in their means of defence and attack, in their reproduction and development and in other

respects[1]. Laborit (1976) reinforced the idea that, if a being lives and reproduces, it is because it has adjusted its biological functions to its external conditions. Morin (1985) adheres to this general idea by affirming that adaptation is the prime and general condition of all existence.

Adaptation is an important concept in anthropology as well. Simonet (2010) points out that anthropology studies the evolution of human cultures and the cultural and biological changes that have unfolded on a planetary scale. It looks at the manner in which individuals and groups adapt to their environment by measuring costs and benefits and successes and failures of these changes. He adds that, in anthropology, adaptation is defined as the process through which organisms or populations make behavioural adjustments that will facilitate or assure their reproductive success, and therefore survival, in their environment. In geography the concept adaptation focuses on the notion of natural milieu, which implicates the integration of the physical to the social and of the natural to the cultural. Just as in biology, the concept of adaptation in geography was debated during an epistemological analysis that was guided by reflections on the importance to be given to mankind in nature (Simonet, 2010).

The term adaptation is however underused in sociology. Etienne et al. (2005) point out that sociology seldom uses the concept of adaptation preferring the terms acculturation, deviance or socialisation. In sociology adaptation is nevertheless understood as a process central to change by which a social system can raise its complexity by lowering its constraints (Simonet, 2010). Overall, the function of adaptation is a principal of organisation that enables one to understand the relations between parts of the system, as well as the system as a whole (Morin, 1985).

2.2.1 Theory and Practice of Adaptation

Humans have always adapted to natural climate variability by altering settlement and agricultural patterns and other facets of their economies and lifestyles (Burton et al., 2006). However, the record of collapsed societies shows that coping with climate has not always been easy or successful, and there are limits to adaptation. Yet societies have been able to thrive in all but the most extreme climate zones (Burton et al., 2006). In climate-change studies there is rich literature on adaptation and its definitions (Carter et al., 1994; IPCC, 1996; UNEP, 1998; Smit et al., 2000). Simply put, adapt means to make more suitable or to fit some purpose by altering or modifying some dimension of existence (Smit, 1999). Adaptation refers to both the

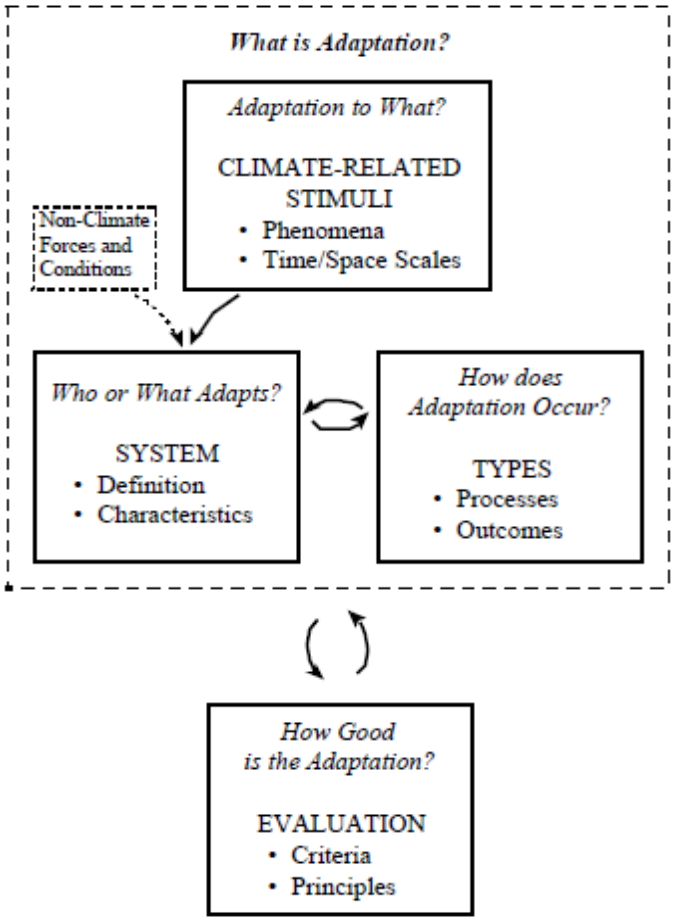
1https://www.britannica.com/science/adaptation-biology-and-physiology

process of adapting and the condition of being adapted (Burton, 1997; Smit, 1999). The IPCC Third Assessment Report states that adaptation is any adjustment in ecological, social or economic systems in response to actual or expected climatic stimuli, and their effects or impacts. This refers to changes in processes, practices or structures to moderate or offset potential damages or to take advantages of opportunities associated with changes in climate (McCarthy et al., 2001), which is general enough to encompass the widest spectrum of options.

Burton (1992) understands adaptation as a process whereby people aim to reduce adverse effects of climate change taking into consideration their health and well-being as they take advantage of the opportunities that are provided to them by their climatic environment. Watson et al. (1996) define adaptability as the extent to which changes are possible when it comes to practices, processes or structures of systems in the face of projected or actual changes of climate. Tompkins et al. (2003) point out that adaptation are the actions people take in response to or when they anticipate changes in climate so as to minimise the impacts or to take advantage of the opportunities brought by climate change. Bowyer et al. (2014:35) point out that adaptation "involves taking action in response to the impacts of climate change in social, economic and ecological systems, to minimise any threats and maximise any opportunities that may be presented by a changing climate". In terms of all these definitions, adaptation is a process through which societies make themselves better able to cope with an uncertain future. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change by making the appropriate adjustments and changes (Smit et al., 1999). Figure 2.1 below, from Smit et al. (2000), gives a broad understanding of the adaptation process.

There are four questions that are critical to the understanding of the process of adaptation as shown in Figure 2.1. The first question is: adapt to what? In the case of climate change, adaptive responses can be induced by stimuli either by changes in average conditions or by changes in variability of extreme events. Climatic stimuli pertinent to adaptation are commonly known as shocks, stresses, disturbances or hazards. Adaptation can thus be to climate change, to change and variability, or just to climate. It can be in response to adverse effects or vulnerabilities, but it can also be in response to opportunities (Smit, 1999). It can be in response to current, actual or projected anticipated conditions, changes or consequences (Smit, 1999). Thus, analysis of adaptation needs to specify the stimuli to which adaptive responses are being considered.

Figure 2. 1: Adaptation to Climate Change and Variability



Source: Smit et al. (2000).

The second important question is who or what adapts; this means that the system or the subject that does the adapting also needs to be specified. Adaptations need to be understand in terms of a particular unit of analysis (Carter et al., 1994). Every analysis of adaptation requires delineation of the system's subject and boundaries. Therefore, adaptation at the level of a farmer's field might involve planting a new hybrid seed and/or crop diversification (Smit et al, 1999). The third question is: how do they adapt? This question seeks to show the process and outcome of adaptation as noted in Figure 2.1. The central issue rests on how adaptation occurs; for instance, what resources are used, when and how are they used and with which results? (Wheaton et al, 1999). The fourth issue, which flows from the third point, refers to a consideration of the effectiveness of any adaptation process, which requires the specification of criteria and principles to be used in making such an evaluation.

Further, adaptation can be autonomous or planned (Esterling et al., 2007). For Bowyer et al. (2014), autonomous adaptation is a change that occurs without the conscious directed action

of humans whereas planned adaptation requires the explicit and direct action of humans. Inside the notion of planned adaptation, there is need to distinguish between anticipatory or proactive and responsive or reactive adaptation (Bosello et al., 2012). Thus, an important distinction is the one based on the timing of adaptation actions. Responsive adaptation entails strategies undertaken in response to impacts of current climate variability or climate change; and, hence, these are often related to the idea of coping mechanisms. Anticipatory adaptation involves implementing strategies with forethought before impacts are realised. The difference between reactive and proactive is thus identified through stimulus i.e. whether an action is in response to observed climate impacts, or in anticipation of future climate change.

Adaptation can also be understood as short-term adaptation or long-term adaptation. Short-term adaptation entails urgent adaptation and recovery measures. This type of adaptation is important in initiating and encouraging measures to inhibit the effects of short-term impacts already occurring. Examples include the introduction of drought-resistant crop varieties and promotion of appropriate cultivation methods so as to increase crop yields. Medium- to long-term adaptation is designed to cover for even future climate change impacts; for instance, land use regulations and systematic water supply development to cope with recent frequent droughts, among others. In a sense, short-term adaptation tends to overlap with reactive adaptation, and long-term adaptation with anticipatory measures.

To be most effective, adaptation must proceed at several levels and dimensions simultaneously. The direct impacts of climate change are felt locally, and response measures must be tailored to local circumstances (Burton, 2006). The measures must be guided and supported though by national policies and strategies so that they are successful. But, as Ogden and Innes (2008) highlight, there is need for local actors and institutions to be involved in mainstreaming adaptation measures as they play a key role in knowledge transfer. To be successful, adaptation strategies need to be developed by local actors so that any strategies are consistent with local priorities, norms and institutions (Newton et al., 2005). This is because adaptation, as noted by Bowyer et al. (2014:22), is "a complex, highly context specific, multifaceted issue".

There are also certain requirements like information, technology, capacity, financial resources and institutions that are required so that the process of adaptation takes place (Burton, 2006). The size and/or complexity of the climate problem being addressed, alongside the resources available and governance structures in place, often condition the success of adaptation (Bowyer, 2014). Moser et al. (2010) point out that adaptation involves a continuous process of awareness and understanding, and requires proper planning, implementation,

monitoring and review. However, there are barriers to adaptation which include lack of knowledge, inadequate financing of adaptation activities, and legislative or institutional barriers (Bowyer et al., 2014) among others.

2.2.2 Adaptive Capacity and its Importance

Climate change is one of humankind's most pressing integrated economic, social and environmental issues (Parry et al., 2005). The changes that are coming with climate change signal an urgent need to take action. Zimbabwe like several countries has started to adapt to climate change. The level and form of adaptation in the country varies however, as this is structured in part by the adaptive capacity of particular groups and communities. The rural areas have largely struggled to adapt, because of their impoverished situation, reliance on local ecological resources, and limited financial and institutional resources; all this makes them more vulnerable and least able to adapt to the impacts of climate change (IPCC, 2001). The rapidity of climate change is now indeed testing the limits of people's ability to adapt, even though human societies have always responded to environmental, social, economic and technological change.

In broad terms, a society's or community's vulnerability to natural variability or to human-induced climate change reflects its degree of exposure and its capacity to adapt (Burton, 2006). Exposure encompasses the climatic conditions themselves, and the extent and character of the population including its levels of wealth and development. Rural areas dependent upon rain-fed agriculture are marked by a high level of exposure. Capacity is crucial, as it refers to the ability to adapt to changing climatic conditions, whether by reducing harm, exploiting beneficial new opportunities, or both (Burton, 2006). Enhancement of adaptive capacity reduces vulnerabilities and promotes sustainable development (Burton, 1997; Cohen et al., 1998; Klein, 1998; Rayner et al., 1998; Smit et al., 2000).

Adaptation therefore depends greatly on the adaptive capacity or the adaptability of an affected system, region, or community to cope with the impacts and risks of climate change (Smit et al., 1999). Finding reliable ways to measure adaptive capacity has been a top priority for researchers and policymakers, because the capacity to adapt is a necessary condition of successful adaptation. Numerous indicators have been developed which include education, income and health, as well as access to financial, technological and institutional resources. Rural areas, certainly the communal areas in Zimbabwe, tend to be deficient in this respect.

Thus, both a community's exposure to climate risk and its capacity to adapt are closely related to the nature and level of its development, such that the capacity to adapt varies considerably among regions and countries. The most vulnerable regions and communities are those that are highly exposed to hazardous climate change effects and have limited adaptive capacity in terms of economic resources, low levels of technology, inadequate information and skills, poor infrastructure, and unstable or weak institutions (Smit et al., 1999.). Exposure and capacity will be investigated in relation to Ngundu communal farmers.

In order for adaptation to be possible and successful, there is need for small-scale farmers – in the first instance – to be knowledgeable. More broadly, it has been realised that knowledge represents an important determinant of adaptive capacity. However, the nature of knowledge varies across scales, since priorities and decision-making processes vary from actor to actor, and from community to community; because of this, any reliable assessment of knowledge should be scale-specific (Hellmuth et al., 2007). Knowledge (involving perceptions and conceptions) lays the groundwork for adaptation by making it possible for actors to shift their focus from short-term to long-term solutions, to invest more fully in adaptation, and to move from a passive acceptance of environmental changes to a willingness to pursue possible solutions and, in general, to shift from a reactive to a proactive approach to adaptation (Hellmuth et al, 2007). This brings to the fore the significance of considering the climate concerns, and projects, of Ngundu farmers despite the possibilities of limited capacities.

2.3 Sustainable Livelihoods Approach

The sustainable livelihoods idea was first introduced by the Brundtland Commission on Environment and Development as a way of linking socio-economic and ecological considerations in a cohesive, policy relevant structure (Krantz, 2001). Overall, the approach can be understood now as existing on three different levels, which are as a set of principles, as an analytical framework and as an overall developmental objective (Farrington, 2001). Most of the analytical work based on the SL framework has focused on rural areas and thus on situations where people are farmers or are make a living from some kind of primary self-managed production. Meizen-Dick et al. (2003) note that the livelihoods framework is used in particular for understanding and analysing the causes of poverty through identifying relationships between relevant factors at micro, intermediate and macro levels which tend to generate poverty; and then prioritising appropriate development interventions to counter

conditions of poverty. In the end, a sustainable rural livelihood has been defined by Chambers and Conway (1992:7) as

> Comprising the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term.

While the definition of a livelihood can be applied to different hierarchical-spatial levels, the SL approach tends to be used most commonly at the household level with an emphasis on the (often limited) range of livelihood practices and strategies existing notably during times of stress and shock.

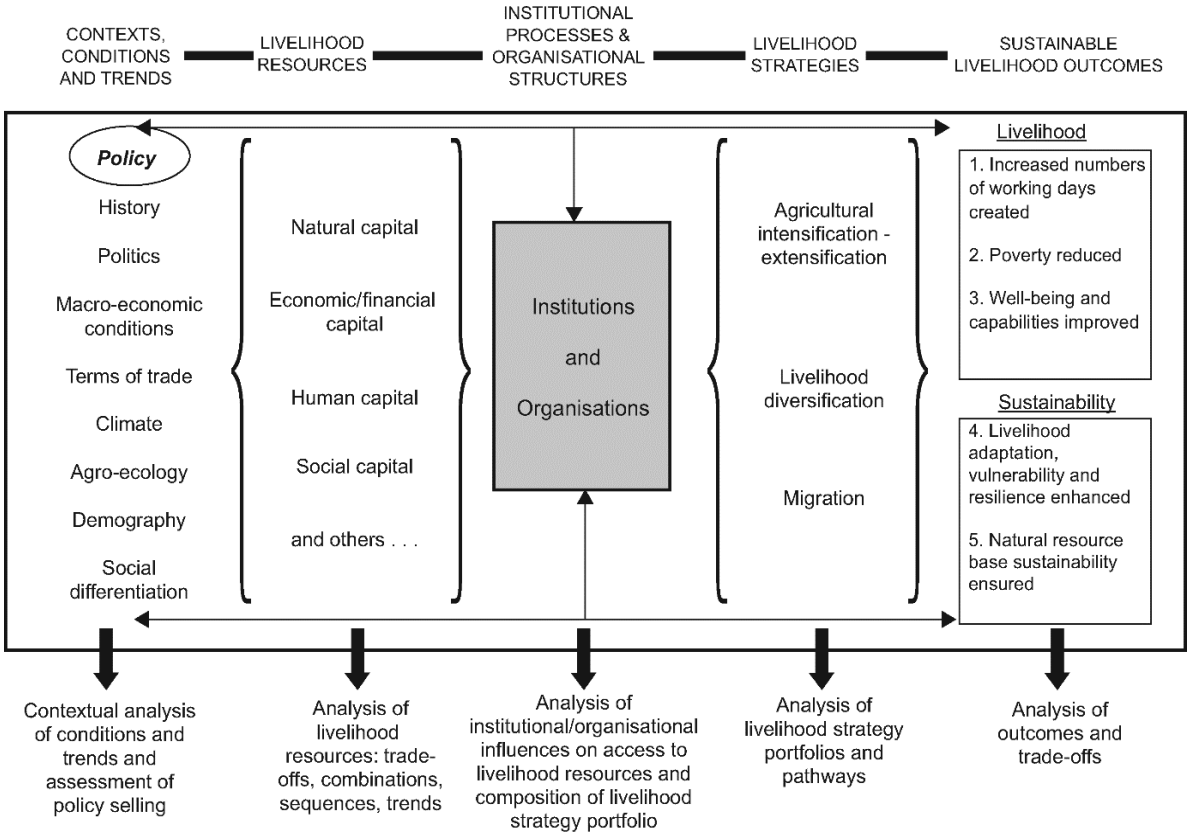
From this it is clear that the SL approach and its ensuing interventions are people-centred, focusing on the livelihood activities of households and supporting them to build upon their strengths and realise their potential, while at the same time acknowledging the effects of policies and institutions, and of external shocks and trends, on livelihood possibilities. Assets, capabilities and activities-cum-strategies are significant variables within the SL approach, as the combination of these variables is what makes up a livelihood. In this vein, livelihood strategies include how people combine their income-generating activities and other livelihood activities (into a livelihood portfolio), the ways in which they invest in and use a particular set of assets, and how they manage to preserve assets and income and livelihood streams (DFID, 2000). As Ellis (1998) argues, a livelihood strategy is a process by which rural families construct a portfolio of activities and social support capabilities (no matter how limited these might be) in their struggle for survival and in order to potentially improve their standards of living. Different households therefore employ different strategies for various reasons, and hence the importance of spatially-delimited studies.

Different scholars and organisations have used the SL framework differently to understand different contexts but they concur on key aspects (Kranzt, 2001; Schaffer, 1996; Scoones, 1998; Chambers, 1997; DFID, 2000). In this context, Carney (1998) indicates the need to understand the livelihood strategies and vulnerability of the poor as the starting point in livelihood analysis; and this entails considering how a particular context, given a combination of livelihood resources, result in certain livelihood strategies and outcomes (Scoones, 1998). This involves the recognition that livelihoods result from the complex interaction of a dynamic set of factors that influence people's livelihood choices. Particular attention is placed on the physical, socio-political, economic, environmental, institutional and

historical context in which livelihoods occur. In this way, the SL approach enhances our understanding of the livelihoods of the poor and it organises conceptually the factors that constrain or enhance livelihood opportunities (Serrat, 2008).

The Figure 2.2 below shows the various dimensions of the SL framework, which are unpacked in the following discussion.

Figure 2. 2: Sustainable Livelihoods Approach



Source: Scoones (1998).

2.3.1 Dimensions of SL Approach

As shown, there are livelihood resources (an asset portfolio) which constitute the basic material and social, tangible and intangible, assets that people use for constructing their livelihoods. The approach therefore entails identifying and understanding household assets and analysing how households endeavour to convert their assets into positive livelihood outcomes (Bebbington, 1999). Assets (or capitals) are the basic building blocks for pursuing any livelihood activity. As noted later, these resources are drawn upon and utilised in a context often marked by vulnerability. They represent the capacity, or at least the potential capacity, to pursue livelihoods.

Natural capital is the term used for the natural resource stocks or natural resource flows (Vorsah, 2015), such as soil, water, air, trees and other environmental phenomena. Within the SL framework, at least for small-scale farmers, the relationship between natural capital and the vulnerability context is particularly close. Shocks like fires, floods, droughts and earthquakes are natural processes, sometimes human-induced, which destroy natural capital. Natural capital thus becomes very important to those who derive all or part of their livelihoods from resource-based activities (such as communal people in Zimbabwe), and such capital relates quite intimately to climate change and variability.

Economic or financial capital is the monetary base for households which people also use to achieve livelihood objectives. It includes cash, credit/debt, savings, credit-providing institutions, money from pensions, remittances and other economic assets (including basic infrastructure and production equipment and technologies) which are essential to some extent for the pursuit of any livelihood strategy. Human capital refers to skills, knowledge, ability to labour, and good health and physical capabilities. Deficiencies in human capital, such as illness or illiteracy, may inhibit the capacity to pursue livelihood strategies including those pertinent to adapting to climate changes.

Social capital is taken to mean the social resources upon which people draw in pursuit of their livelihood goals (Vorsah, 2015). Hence, it denotes the social relations that bind individuals together within a household or a community. These relations increase people's trust and the ability to cooperate. They encompass associations, church groupings and other affiliations which facilitate intra-household and inter-household cohesion in bringing about collective and co-ordinated actions which, in turn, might bolster livelihoods. As a dimension of social capital, there is political capital as well – this entails the position held within the public sphere by people in a particular location, including forms and levels of involvement in party politics. Social capital broadly may bind people together in united action, but it can also be a form of exclusion in which a cohesive group inhibits others from partaking of group benefits.

Overall, particular households are marked by a particular combination of assets or capitals, which are also subject to change over time as particular assets are built-up while others may decline. The presence or absence of these various capitals tend to depict the wealth status of households in a particular community. They also tend to condition the form and extent of household vulnerability and the capacity of households to undertake processes of adaptation in the face of stresses and shocks, such as climate changes.

Besides an asset portfolio, households are also characterised by a livelihood portfolio (i.e. a combination of livelihood activities, such as crop production, casual labour and petty

trading). A livelihood portfolio may be highly specialised and concentrate on only one or two activities, or it may be quite diverse involving a range of simultaneous activities (Krantz, 2001). The activities making up a livelihood portfolio frequently vary between households, depending upon differences in asset ownership, income levels, gender, age, and social or political status. As a result, even when considering one community (such as Ngundu), a socially-differentiated analytical approach to livelihood strategies is a necessity. At times, livelihood portfolios entail an actual well-defined livelihood strategy, with a particular household for instance seeking to engage in agricultural intensification, livelihood diversification (including non-agricultural and off-farm activities) or migration as a basis for maximising the household's future possibilities.

Beyond asset and livelihood portfolios, the SL framework also considers contextual conditions within which households pursue their livelihoods. On the one hand, this context refers to institutional processes and organisational structures which either enable or constrain livelihoods locally, though invariably conditioning them in some way. These would include the policies and practices of state structures, the presence of absence of non-governmental organisations, and the cultural norms and practices around for instance patriarchy (Scoones, 1998). How these various structures and processes play themselves out within a local community not only condition livelihood possibilities in general, but may have differential effects within the community. In this way, structures and processes may mediate the relationship between assets and livelihood activities, perhaps allowing the capacity embedded within existing assets to be realised or even blocking the realisation of such capacity (Serrat, 2008). This, in turn, has effects on climate adaptation possibilities, with the practices of the state and non-governmental organisations in particular tending to enhance or inhibit the range of possibilities.

On the other hand, the SL approach refers the vulnerability context. The vulnerability context refers to the insecurities and uncertainties embodied in the prevailing context, and the unanticipated and anticipated changes which occur within this context (Devereux, 2001). Vulnerabilities refer to long-term trends and tendencies as well as sudden shocks and stresses which might undercut the asset base of households and their livelihood portfolios. Vulnerability has two facets: an external side of shocks and critical trends and an internal side of often defencelessness caused by the lack of ability on the part of households to cope with these contextual factors. Some vulnerabilities may be idiographic in character in the sense of effecting a particular household only, such as the death of the household head. Others may be nomothetic in character such as the overall decline in the national economy. At the same time, nomothetic vulnerabilities (such as climate changes effecting an entire community) will have

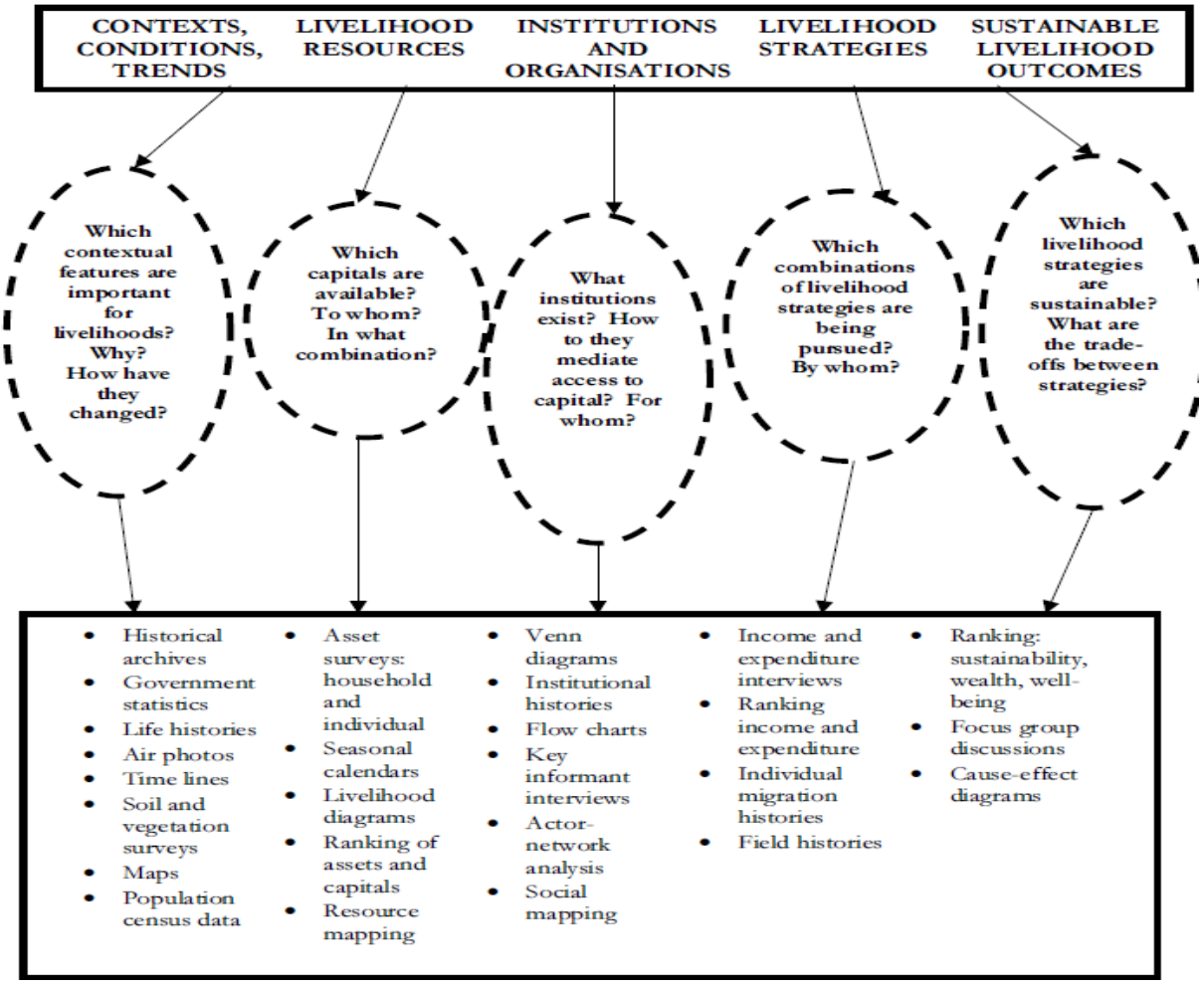
multiple and diverse idiographic effects, which simultaneously entail a multiplicity of household-based livelihood responses (Kollmair and Gamper, 2002).

Though the two sets of contexts (structures-processes and vulnerabilities) are distinguished conceptually, in practice they interrelate in complex ways. Combined with household-based assets and livelihood portfolios, they allow for an investigation and analysis of livelihood outcomes (Hussein et al., 1998), as depicted in Figure 2.2. This provides the basis for a synchronic examination of household livelihoods, unpacking the different dimensions of livelihoods (seen in Figure 2.2) and how these dimensions interconnect and lead to livelihood outcomes. Social reality of course is messy and convoluted, so it is important to avoid a linear and straightforward depiction of actually-existing household livelihoods. Further, in terms of a diachronic analysis, an outcome is invariably simultaneously a first condition as households are involved in an ongoing and continuous process of livelihood construction and reconstruction. Nevertheless, the SL approach in its fundamental form is a useful heuristic device for undertaking research in rural communities, including with specific reference to climate change and variability in the case of Ngundu villagers.

In this light, Figure 2.3 below gives a more comprehensive portrayal of the SL approach and what it seeks to achieve analytically. The Figure shows how the SL approach – as a research framework – can be used to generate broad questions about livelihoods as well as identify a range of methods which can be used to collect data to answer them.

Scoones (1998) points out that the SL approach provides researchers with a broad 'model' for examining holistically the livelihoods of households and the contexts within which households pursue these livelihoods. Murambadoro (2009:4) likewise indicates that through "using the SLF as a tool one can get an understanding of the vulnerability context in which poor households operate in as well as the assets they draw on to support their livelihoods". In this way, Figure 2.3 above shows the seeming relevance of the SL framework to this study of the livelihoods of Ngundu farmers in the face of climate-based challenges. Indeed, as will become clearer later in the thesis, the questions as asked in Figure 2.3 were central to this study as they enabled me to grasp the livelihoods of the people of Ngundu. To give but on example, life-histories are said to be a crucial research method when studying 'contexts, conditions, trends' – as will be shown, life-histories of elderly Ngundu farmers provided thick descriptions of climate change over many decades.

Figure 2. 3: Range of Methods to Implement a Sustainable Livelihood Framework



Source: Brock (1999).

The SL framework is used in this study to explicitly understand the adaptation (livelihood) strategies being implemented by the Ngundu people. The SL approach, as a middle-level theory, is particularly useful at the household level and aims to understand the livelihoods and activities of households at localised levels, and the ways in which households may constrain or enable the livelihoods of other households. Adaptation is carried out by individuals at the household level and it is through a critical analysis and understanding of the household that one can learn about the adaptation strategies being undertaken by local people and the reasons behind the implementation of such adaptive strategies. With its noted strength in studying rural livelihoods, the SL approach was seen as particularly relevant for considering communal farmers facing changes in climate and the effects of these changes on their natural capital base and associated agricultural practices. As Peng (2017:2) has recently reiterated, "researches on rural household livelihood strategies, particularly on the types of strategies that

rural households typically adopt and the factors that shape these strategies, have contributed to (the) understanding of the relationships between rural household livelihoods and the natural environment". In studying the livelihoods of Ngundu farmers, and their various livelihood practices, it becomes important to identify the contextual factors pertinent to climate change as well as the local perceptions, projects and practices which can be framed as some form of adaptation initiative and the problems associated with these initiatives.

2.3.2 Criticisms of SL Approach

Although the SL approach is a viable and well-recognised theoretical framework in the livelihoods literature, it has been subject to significant criticisms – including for largely concentrating on the micro level at the expense of the macro level (Beall, 2002; Van Dijik, 2009; Prowse, 2008; Scoones, 2009; Sakdapolrak, 2014). In this regard, the major problem of the SL approach in its concentration on the micro level is said to be its failure to adequately account for the effects of structure, including structures of power and inequality. This is despite its recognition of contextual factors (structures/processes and vulnerabilities). Hence, the agency of households tends to be overplayed, as if households have an unbridled ability to choose and select activities with which to construct livelihoods. In other words, the structural constraints impinging daily on the lives of rural households, which emanate from the global and national (spatial) levels as well, do not receive due attention (Wood et al., 2000; Rakodi, 2002; Toner, 2003; Kranzt, 2001). In particular, the SL approach has been criticised for failing to address power relationships adequately (Green et al., 2005); yet, power relationships condition the availability and distribution of assets and hence livelihood possibilities, including adaptation possibilities. Power relations enable and constrain "because some are marginalized by a social structure empowering the reflexivity [or agency] of others" (Adams 2006:522). Further, it is argued that the SL approach has a 'rational man' understanding of agency, as if households as rational agents are constantly strategising their way through the world by selecting the most suitable livelihood options in a well thought-out maximising fashion (Moser, 1996; DFID, 1999; Mdee, 2002; Beall, 2002). These criticisms have considerable validity, and the temptation then is to engage in theorising which is more structuralist in leaning. But, agency is central to my study of Ngundu farmers as I seek to understand their construction of adaptation measures. Hence, from my perspective, it is best to strengthen sociologically the SL framework in a manner which provides a firmer foundation for analysing agency without denying the

centrality of structure. For this reason, I draw upon the work of Margaret Archer, as it strengthens the SL approach and addresses its weaknesses.

2.4 Archer, Morphogenesis and Reflexivity

Although there are climate change studies that have provided significant insights into the impact of climate change at global and regional levels, very few studies have looked at climate change through the prism of sociological theories (Davidson, 2012; Olvitt 2012; Bhatasara, 2015). This is despite the fact that climate change in relation to livelihoods and adaptation are constituted by a range of social processes and practices, which can only be comprehended by drawing upon appropriate sociological perspectives and theories. In this context, this thesis draws upon the macro-theorising of Margaret Archer (Archer, 1988, 1995, 2000) as the main sociological anchor for this study. The lack of inclusion of Archer's sociological theories in climate change studies in Zimbabwe (and beyond) shows the importance of this thesis as a way of understanding the structure-agency debate (Sawyer, 2005) from an Archerian perspective with reference to climate change adaptation.

Like other sociologists such as Anthony Giddens and Pierre Bourdieu, Archer seeks to offer an understanding and explanation of human society which is sensitive to both structure and agency: which she refers to as her morphogenetic approach. There are many positions on the structure-agency debate within sociology, with Archer offering her own rendition. For Archer, though structures bear upon the world of agents and condition their agency, agents act back upon structures (entailing agential power), including by way of reproducing or transforming them. Structures determine agency in the soft sense through conditioning them, rather than causing them in any strict positivist sense. These structures have a real ontological existence and they generate the world as experienced. At the same time, in emphasising the significance of reflexivity, Archer argues that agents have concerns and, on the basis of these, they develop and pursue projects which lead to social practices in the phenomenal world. These become inscribed in the world as it exists, and they may or may not reconfigure the deep structures of human society. In this way, Archer shows the importance of humans in the world as agents of possible change as they negotiate their way in and through the world.

Morphogenesis is a term crucial to Archer's theory. This term literally entails a change in form or shape, and was originally used in biology and picked up as a term for social change by social system theorists (Porpora, 2013). Archer (1982, 1995, and 2007) lifted the term into social theory by using morphogenesis to identify a non-positivist realist approach to the

structure-agency problem. This entailed a rejection of Giddens' structuration theory (Giddens 1979, 1981, 1984) which emphasises the inseparability of structures and agents and thus, according to Archer, conflates the two – as noted in chapter 1, Archer insists on an analytical dualism between structure and agency, with morphogenesis involving the working out of a dialectical relation between structure and agency. Archer thus emphasises that, although structure and agency interrelate dialectically through mutual interaction, structure and agency remain ontologically separate such that it is possible to speak of agential power in its own right.

Archer's work is now being used in livelihood studies (Lyon and Parkins, 2013; Prowse, 2010) but only recently and quite peripherally. In fact, Bourdieu is now used more extensively (Sakdapolrak, 2014). Years ago, Carter et al. (2004) noted that the potential to use Archer's approach for empirical research is yet to be realised. More recently, Horrocks (2009) argues that, over a decade after Archer's publication of her morphogenetic approach, the potential of the approach continued to remain largely unrealised. This remains the case with work more specifically on climate change and adaptation of small-scale farmers, despite the seeming potential of her morphogenetic understanding. Many studies of these phenomena have been carried out, including in relation to Zimbabwe; although such studies are of importance, they have been insensitive to the central sociological question of structure and agency, including from a non-Archerian perspective (Unganai, 1996; Chagutah, 2010; Dube et al., 2013; Chikodzi et al., 2012). The one key exception, in using Archer, is Bhatasara (2015) in relation to communal farmers in Mutoko district.

Reflexivity is central to Archer's perspective and it will be considered in this study because of the importance of reflexivity in understanding the ways in which farmers such as those in Ngundu problematise climate change and think thorough the implications of climate change for their livelihoods. In this regard, Archer (2012:1) defines reflexivity as "the regular exercise of the mental ability, shared by all normal people, to consider themselves in relation to their contexts". In making our way through the world, Archer (2007) talks about reflexivity and how human beings reflect upon themselves and their concerns in relation to society. People pay attention to certain problems after reflecting on particular issues which lead to the formulation of concerns and projects that may trigger action. Reflexivity is integral to human existence as agents engage with their own concerns and negotiate the best course of action for themselves (Akram et al., 2015). Archer thus states that "[b]eing an active agent hinges on the fact that individuals develop and define their ultimate concerns" (Archer, 2007:6). Reflexivity influences the responses and practices of human agents in addressing their subjective concerns and problems. Whether or not they can in fact engage in certain projects and practices depends

very much on the context in which they exist and the enablements and constraints embedded in that context. Enablements must exist in order for proposed practices to come to fruition.

Intrinsic to reflexivity is also Archer's notion of internal conversations, as agents carry out such conversations in reasoning through the problems they encounter. Human reflexivity works through internal conversations as people make use of language, emotions, sensations and images in thinking about the world around them (Archer, 2007). As Akram (2015:4) puts it, "the internal conversation reflects the on-going conversations in agents about who they are and how they see their lives progressing". It appears that, in life, people engage in more internal dialogues than external dialogues: "no reflexivity, no society" (Archer 2007:25). In Archer's words, "[a]t its most basic, reflexivity rests on the fact that all normal people talk to themselves within their own heads, usually silently and usually from an early age" (Archer 2007:2). These conversations, therefore, condition the ways in which agents think about climate change (their own climate discourse) and seek to adapt to climate change challenges, with both constraints and enablements being taking into consideration in doing so (Archer, 2003). In this way, Archer gives a broad understanding of how people problematise certain issues and how they end up projecting and taking action, which may simply reproduce their fundamental condition of existence (albeit in altered form) because of the abiding presence of structural inhibitors.

As much as reflexivity is central to our daily lives, Archer argued ten years ago that surprisingly little research has been done on internal conversations and their role in mediating between people's concerns and the social contexts they confront (Archer, 2007). While Archer's work has certainly been influential over the past decade, its use in climate change adaptation studies – as indicated – has been minimal. Reflecting on the potential of Archer's work for climate change studies, it would seem that focusing on the reflexivity of for instance Ngundu farmers should be important in understanding the ways in which farmers problematise and raise concerns about climate change (i.e. localised climate change discourses) as well as the presence (and absence) of specific adaptation activities in their communal area.

2.5 Relevance of Archer and the SL Approach

Central to this study is that adaptation to climate change is open to considerable variation both temporally and spatially. This necessitates spatially de-limited studies of particular communities as understood across time as well. The capacity of the SL approach to offer micro-level studies is significant in this regard. The various dimensions of the approach indicate that the livelihoods of households are invariably marked by a diverse array of factors which interact

in complex and contingent ways. Thus, livelihoods do not necessarily follow clear trajectories or pathways but may be subject to the ebbs and flows of dynamic situations. Because of this, adaptations to climate change are not straightforward processes and they may be embodied in quite messy and muddy social processes devoid of uniform patterning. Archer's sociologically-grounded notion of agency provides a useful platform for seeking to organise descriptively and analytically the complexities of the concerns, projects and practices of Ngundu farmers in the face of climate change and variability.

Archer's work is highly complex and this thesis draws upon key points emanating from her work insofar as these points provide insights into the lives and livelihoods of Ngundu farmers. In doing so, the theoretical framing used gives this thesis additional significance in relation to the prevailing literature on climate change and small-scale farmer adaptation strategies. At the same time, as discussed, the thesis makes use of the Sustainable Livelihoods approach as a middle-level theory. This approach is commonly used in climate change and livelihoods studies and it has been shown to offer important insights in this regard (Vorsah, 2015). One of the reasons, though, for using Archer's macro-theory is that it strengthens sociologically the Livelihoods approach, particularly around the conceptualising of agency. Given that Archer's theory is of relevance to all areas of social life, it is important to complement it with a middle-level theory which is pertinent to livelihood studies such as the one contained in this thesis. The Livelihoods approach speaks about vulnerability contexts, the use of resources (or capitals) in constructing livelihoods and livelihood outcomes (Shackleton et al., 2001; World Bank, 2002); and it has a particular sensitivity to environmental factors including the effects of climate change on the natural environment. Given the importance of the natural environment to small-scale farmers in Ngundu, the approach facilitates an understanding of climate change and adaptation strategies particularly when it is bolstered by Archer's theory.

2.6 Conclusion

Considering the specific focus of this thesis, namely, climate change and small-scale farmer adaptation in a communal area in Zimbabwe, this chapter sought first of all to unpack the notion of adaptation with particular reference to climate change. Secondly, given that the thesis seeks to *understand* small-scale farmer adaptation to climate change in all its complexity, the chapter outlined the theoretical framing for the thesis. In particular, the chapter presented two theories, one middle-level theory (the Sustainable Livelihoods approach) and one macro-level theory

focusing on the work of Margaret Archer. The Sustainable Livelihoods approach, despite certain criticisms levelled against it, has shown its worth in examining the daily lives and daily livelihoods of small-scale farmers particularly with regard to the household level. However, to provide some sociological weight to the thesis, and to bolster the middle-level theory, Archer's work is drawn upon with a particular emphasis on her interpretation of human agency. In this context, the following chapter considers and reviews literature on climate change, livelihoods and agricultural adaptation at a global level, including with reference to Africa.

CHAPTER THREE: GLOBAL LITERATURE ON CLIMATE CHANGE, ADAPTATION AND LIVELIHOODS

3.1 Introduction

The major aim of this chapter is to provide a clear understanding of the character and extent of climate change taking place globally and in Africa, and the ways in which climate change conditions livelihoods and adaptation activities. It thus first shows (in Section 3.2) the sheer presence of climate change, including change climate trends, causes and effects, with a specific emphasis on effects on agriculture. This is done in relation to global climate change and subsequently in relation to the African continent. In Section 3.3, the chapter then turns to adaptation to climate change in terms of small-scale farmer adaptation, based on a review of pertinent literature – again, narrowing the discussion down to Africa. This chapter therefore provides the broader context for the next chapter on climate change and adaptation in Zimbabwe.

3.2 Climate Change Trends, Evidence, Causes and Impact

Climate change is a pressing challenge that is affecting people and their livelihoods on a global scale. Although adaptation strategies vary from country to country, and are often deeply localised, it is important to understand the various dimensions and the sheer extent of climate change as it is currently unfolding. Davies (2011) thus points out that understanding climate change and variability is crucial, as such an understanding is necessary for identifying and constructing appropriate strategies to minimise climate change and its effects.

The Earth's climate has always changed but, because of human activities, it is now changing faster than it has for thousands of years (Shanahan et al., 2013). Global temperature trends, which have been collected from the mid-19th century, show a sharp rise in overall temperature that strongly correlates with the increasing levels of greenhouse gases in the atmosphere caused by human activities (Brazier, 2015). Substantial changes are occurring on Earth which include an increase in air and ocean temperatures, widespread melting of snow and ice, and rising sea levels. Likewise, precipitation and rainfall patterns have undergone significant changes, leading to pronounced droughts and flooding in places not accustomed to these extreme weather events in the past. Literature on climate change often details the trends, causes and effects of climate change, and these issues are addressed in this section.

3.2.1 Global Trends and Evidence of Climate Change

The rigorous investigation of change in climatic conditions and the detection of an anthropogenic signal in the changing climate have been on-going for several decades (Wigley et al., 1990). Anthropogenic climate change, or climate change arising from human activity, has been impacting and continues to impact the natural environment world-wide (Rosenzweig et al., 2007). Numerous models and measurements have been developed by natural scientists as a reliable basis for identifying the form and extent of climate change over an extended period as well allowing for projections into the future. A variety of instruments have been used to measure temperature, ocean salinity, rainfall variability and currents beneath the ocean surface, including data from satellites and weather balloons, all of which confirm in particular the warming of the Earth. Research groups like NASA's Goddard Institute for Space Studies, Britain's Hadley Centre for Climate Change and the Japan Meteorological Agency have used these raw measurements to produce records of long-term global surface temperature change.

All these analyses show that Earth's average surface temperature has increased by more than 1.4°F (0.8°C) over the past 100 years, with much of this increase taking place over the past 35 years (National Research Council, 2012). The IPCC Third Assessment Report (2007a), which assessed climate change research up to 2001, concluded that the global average surface temperature increased by 0.6°C (±0.2°C) over the 20th century, and it is predicted to increase by 1.4 to 5.8°C between 1990 and 2100. Further, average precipitation is said to have increased over tropical latitudes by about 2 to 3% throughout the 20th century and, on average, to have decreased by about 3% in the sub-tropics. According to Szwed et al. (2010), Europe has already warmed by almost 1^{o}C over the past century, faster than the global average. Worse still, model-based climate projections indicate considerable further warming.

Even without these measurements, extreme weather events have evidenced the presence of climate change. As IPCC (2007a) notes, observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases. There are also changes in the presence of snow, ice and frozen ground and this is evidenced by the enlargement and increased numbers of glacial lakes, increasing ground instability in permafrost regions and changes in some Arctic and Antarctic eco-systems (IPCC, 2007). Increasing global temperatures have led to higher maximum temperatures, more heat waves, and fewer cold days over most land areas (Johnson, 2008). Brazier (2015) concurs that global warming affects ocean and wind currents resulting in fires, droughts and floods. Spatial and temporal variability of rainfall and temperature, more intense and widespread droughts and aggravated floods have therefore become common (Deressa and

Hassan, 2009). Human-induced climate change is changing the precipitation and the hydrological cycles especially at the extremes, as global warming influences rainfall trends. Hence, Trenberth et al. (2007) argue that there are observed changes in patterns of where it rains, as dry areas are becoming drier and wet areas are becoming wetter.

Although warming trends are occurring across the African continent, climate changes are not always uniform. New et al. (2006) point out more specifically that, over the past decades, the African continent has experienced an increased number of warm days and a decreased number of extremely cold days. In the Sahel Region of Nigeria, there has been a decrease in heavy daily precipitation rates, coincident with an overall decrease in annual rainfall (Dore, 2005). Williams and Funk (2011 in Olsson et al., 2014) indicate that over – the last three decades – rainfall has decreased over Eastern Africa between March and May/June due to rapid warming of the Indian Ocean. Evidence also shows that the temperature in Tanzania has increased and precipitation has decreased in several areas of the country (Bakari, 2015). A study carried out in Tanzania by Senga et al. (2013 in Bakari et al., 2015) reported a decrease in rainfall and increases in both the annual highest maximum temperature and lowest minimum temperature over a period of 30 years in the area of the Pangani basin and Pemba Island.

A rate of warming of about 0.05°C per decade in southern Africa was also observed during the previous century (Hulme, 1996). There has been an increase in warming rates of 0.29°C in tropical forests after every ten years (Malhi et al., 2004). In South Africa and Ethiopia, minimum temperatures have increased slightly faster than maximum or mean temperatures and, between 1961 and 2000, there was an increase in the number of warm spells over southern and western Africa, and a decrease in the number of extremely cold days (New et al., 2006). Mano et al. (2006) point out that Zimbabwe is now a much warmer country than it was at the beginning of the twentieth century. The annual mean temperature in the country has increased by about 0.4°C since 1900. Unganai (1996), in his study, also confirmed that daytime temperatures over Zimbabwe have risen by up to 0.8°C from 1933 to 1993, which translates to a 0.l°C rise per decade.

3.2.2 Causes of Climate Change

Typically, attempts are made to divide climate change causes into two categories, namely, natural causes and human-induced causes. Johnson (2008) notes, therefore, that both human activities and natural variability are contributing to global and regional warming. In her study, Mubaya (2010) notes for instance that natural causes include processes of heat storage in the

atmosphere. She alludes to the fact that the accumulation of greenhouse gases (GHG) in the atmosphere has occurred naturally in the past and this causes the Earth's climate to change. Clay et al. (2003) point out that, even though it is not so entirely clear what causes low rainfall in southern Africa, what is certain is that the droughts of 1991/92, 1994/95 and 1997/98 were all associated with the El Niño-Southern Oscillation (ENSO) and that climatologists have established a relationship that is significantly high between ENSO and inter-annual variations in rainfall in Southern Africa. In their argument, both the ENSO and human activities have led to the change in climate. As well, Unganai (1996) notes climatic predictions indicating that the ENSO phenomenon will continue to occur in future as it does today.

The most common understanding, however, is that human activities are contributing to climate change. The IPCC (2007a) concludes that human activity primarily related to fossil fuel consumption is largely responsible for climate change. Although Mubaya (2010) recognises that GHG occur naturally, she points out that human activities increase greenhouse gases in the atmosphere by removing natural sinks such as forests, or by introducing new sources of these gases by burning fossil fuels and wood and changing land tillage practices (Brazier, 2015). This is despite the fact that it is typically acknowledged that some amount of greenhouse gases is necessary for life to exist on earth by keeping the planet warm and in a state of equilibrium (EPA, 2010), which is commonly known as the greenhouse effect. But human activities are increasing the concentrations of many of these gases, amplifying the natural GHG and distorting the greenhouse effect. Observations and climate model assessments of the natural and anthropogenic factors responsible for global warming conclude that rising anthropogenic emissions of greenhouse gases have been an increasingly important contributor since the mid-1800s and the major factor since the mid-1900s (Meehl et al., 2004; GSA, 2015).

The atmospheric concentrations of key anthropogenic greenhouse gases reached new recorded high levels in the 1990s primarily due to the combustion of fossil fuels, agriculture, and land-use changes (IPCC, 2001; IPCC 2007a). According to the National Research Council (2010), the release of greenhouse gases has increased significantly since the Industrial Revolution, mostly from the burning of fossil fuels. For at least 2000 years before the Industrial Revolution, atmospheric carbon dioxide concentrations were steady and then began to rise sharply beginning in the late 1800s (National Research Council, 2010). Carbon dioxide, a major greenhouse gas, is increasing in the atmosphere faster than at any time measured in the past, having grown by about 35% since 1850 (CIER, 2008). Specifically, carbon dioxide annual emissions have grown by about 80% between 1970 and 2004.

Clearly human population growth in the context of global industrialisation has led to increasing demands for energy and land resources. Through the burning of fossil fuels to produce energy for industrial use, transportation and domestic power, and through land-use changes for agriculture and forest products, humans have been altering the Earth's energy balance. Recognising how, and to what extent, climate change and variability arise from human activities is crucial if appropriate methods of adaptation are to be identified and pursued.

3.2.3 Global Impact and Challenges of Climate Change

The effects and impacts of climate change are being felt across the globe, including by way of the increasing frequency and intensity of extreme weather events (IPCC, 2012), as documented for instance by the IPCC and World Meteorological Organisation (WMO) (Bakari, 2015). The key impacts of climate change relate to the timing and spatial distribution of precipitation, sea level rise, changes in temperature and the frequency, intensity and duration of extreme climate events such as droughts, floods and tropical storms (USAID, 2009; UNDP, 2009).

According to FAO (2007), climate change impacts can be roughly divided into two categories. The first category is known as the bio-physical impacts, which include: physiological effects on crops, pasture, forests and livestock; changes in land, soil and water resources; and increased weed and pest challenges. Recent warming is strongly affecting terrestrial biological systems, including such changes as earlier timing of spring events (including leaf-unfolding, bird migration and egg-laying), and upward shifts in ranges in plant and animal species (IPCC, 2007a). These effects have both temporal and spatial dimensions which are subject to fluctuation. The second category is known as the socio-economic impacts which comprise declines in crop yields and production; reduced marginal Gross Domestic Product from agriculture; fluctuations in world market prices; changes in geographical distribution of trade regimes; increased number of people at risk of hunger and food insecurity; and migration and civil unrest. Climate change is affecting daily lives and nearly every aspect of society, from health and food supplies to industrial growth and national economies (Shanahan et al., 2013). Of course, these two categories of effects interconnect in various ways, with many bio-physical impacts effecting rural livelihoods detrimentally, and vice versa.

The croplands, pastures and forests that occupy 60% of the Earth's surface are progressively being exposed to threats from increased climatic variability and, in the longer run, to climate change (FAO, 2007). As pointed out by CRED (2012), the number of climate-related disasters has risen from an annual average of 200 in the early 1990s to more than 350

annually since 2000. Abnormal changes in air temperature and rainfall, and resulting increases in the frequency and intensity of drought and flood events, have long-term implications for the viability of ecosystems. As climatic patterns change, so do the spatial distribution of agro-ecological zones, of plant diseases and pests and of fish populations, which impact on agriculture and food production (FAO, 2007). Developing countries are the ones most severely affected by climate change (Kurukulasuriya and Mendelsohn, 2008). Their dependence on rain-fed agriculture makes them more vulnerable to climate change. Climate variability has a direct adverse influence on agricultural production in Africa because nearly 80% of agricultural production in these countries is rainfall and temperature dependent (Thornton, 2011).

Water is becoming an increasingly important resource. A warmer world leads to more evaporation of water from the surface, more water vapour in the atmosphere and more precipitation on average (Houghton, 2011; Zhai et al., 1999; Dore, 2005). As a result, flood and drought occurrences have become more frequent. Between 1975 and 2002, due to flooding from rainfall, over 200,000 lives were lost and 2.2 billion people affected; and, due to drought, over half a million lives were lost and 1.3 billion affected (Houghton, 2011).

As noted, climate change is a global phenomenon and it has spatially diverse trends, causes and effects. Considerable literature exists about the impacts of climate on Europe and other continents beyond Africa (Jones and Moberg, 2003; Klein et al., 2002; Parry, 2000; Preston and Jones, 2006; National Research Council, 2010; Easterling and Mehl, 2000; Frederick and Gleick, 1999; Hanson-Easey, 2013; McElroy et al., 2012:12). Of particular significance for this thesis is the impact of climate change in Africa.

3.2.3.1 Impact of Climate Change in Africa

There is evidence that climate change poses a massive threat for development especially in developing nations (Boyd et al., 2009; Besada et al., 2009). Africa in particular has been identified as one of the parts of the world most vulnerable to the impacts of climate change (IPCC, 2014; Niang et al., 2014). Assessments of regional impacts of climate change within Africa also pinpoint to particularly vulnerable areas, such as islands like Cape Verde, Seychelles and Mauritius, as well as mega deltas such as the Nile delta in Egypt, Niger Delta, and the Kalahari and Okavango deltas in Botswana (Black, 2001; Muller-Kuckelberg, 2012).

Overall, the African continent might be the epicentre of a major global food crisis if climate change issues remain unaddressed at regional, national and local levels (Bunce et al., 2010. It has been estimated that one third of people in Africa already live in drought-prone and

arid areas and 220 million people are exposed to drought each year (UNFCC, 2007). Further, this has major implications for agricultural production and rural livelihoods across the continent (Usman et al., 2004; Nicholson et al., 2000; Tadross et al., 2005; Fauchereau et al., 2003; Richard et al., 2001; Washington et al., 2006; Held, 2005; Wang 2002). Although, for the large part, developed countries are culpable for climate change and have contributed most to total global emissions, it is thus the developing nations which are most at risk and likely to suffer the catastrophic impacts in the medium and long term (Besada et al., 2009). This is particularly the case as, simultaneously, they may have the least capacity to adapt to the negative consequences of climatic change.

Considering that Africa is the world's second-largest and second most-populous continent after Asia, the effects of climate change will be substantial. During the last century, a rise in temperature of approximately 1^{o}C was measured on the African continent, higher than the global average (Muller-Kuckelberg, 2012). For precipitation in most parts of Africa, either there is decline in annual rainfall or no long-term trend has been noted so far (Boko et al., 2007).

Climate change in Africa includes an increasing frequency of extreme weather events, rising sea levels, changes in precipitation patterns and droughts, increasing water shortages, the spread of tropical and vector borne diseases and increased frequency and intensity of storms (Besada et al., 2009). In the period 2000-2008, Africa accounted for over 20% of all the weather and climate-related disasters that occurred globally while the economic set-back was 0.6% of global economic losses (UNISDR, 2011). Climate change threatens to reverse many of the development gains that African nations have made (Shanahan et al., 2013; Boko et al., 2007; Hulme et al., 2001). Vastly altered weather patterns and climate extremes threaten agricultural production and food security, health, water and energy security, which in turn undermine Africa's ability to grow and develop. Overall, climate change in Africa poses threats to food and water security, to political and economic stability, to livelihoods and landscapes (Shanahan et al., 2013).

Africa has the highest mortality-related vulnerability indicators for droughts. The continent has a higher proportion of countries experiencing water stress currently and projections indicate that this will continue into the future (Mubaya, 2010; Arnell, 2006b; World Bank, 1995). In the last thirty years, seven out of the 10 worst drought disasters in the world have taken place in sub-Saharan Africa (UNISDR, 2011). The water resources of Africa are increasingly under stress due to climate change variability and increased demand for water throughout the continent (UN Economic Commission for Africa, 2011). According to Wilhite

et al., (2000), the 1991/1992 drought in Southern Africa affected almost 20 million people and resulted in a deficit of cereal supplies of more than 6.7 million tonnes. High temperatures and declining precipitation levels will increasingly result in reduced agricultural production in sub-Saharan Africa (Mano and Nhemachena, 2007; Biggs et al., 2008).

The impact of changes in precipitation and enhanced evaporation in Africa has profound human effects around lakes and reservoirs. Africa will continue to face increasing water scarcity and stress with a subsequent potential for increased water conflicts (at local level and between nations), with almost all of the 50 river basins in southern Africa being trans-boundary (UNFCCC, 2007). In fact, about 63% of the total land in Africa lies within trans-boundary river basins (Riebsame et al., 1995*).* There are five major river basins in Africa, namely, the Congo, Nile, Niger, Chad and Zambezi, which occupy about 42% of the geographical area and sustain more than 44% of the African population. In this context, the number of people exposed to floods in the region grew from 500,000 per year in 1970 to almost 2 million people per year in 2010 (Mubaya, 2010). Flood mortality risk is still increasing in sub-Saharan Africa, despite a downward global trend (GAR, 2009; GAR, 2011). Floods in Mozambique in 2000 resulted in two million people being displaced with 350,000 jobs lost (impacting the livelihoods of up to 1.5 million people) (Nkomo et al., 2006).

The greatest impact of climate change will likely be on the already-vulnerable rural poor in Africa, who often have the most limited access to water resources (Riebsame et al., 1995; Centre for International Earth Science Information Network, 2009). These negative impacts of climate change, involving adverse changes in land and water systems, imply an undermining of rain-fed agriculture. This is being exacerbated and indeed fuelled by the low adaptive capacity of developing nations in Africa. Simultaneously, higher frequencies of climate extremes have made it difficult for rural households which have recovered from one climate shock to cope with another. For example, the Horn of Africa's pastoralist areas (Ethiopia-Kenya-Somalia border) have been severely hit by recurrent droughts; livestock losses have plunged approximately 11 million people dependent on livestock for their livelihoods into a crisis and triggered mass migration of pastoralists out of drought-affected areas (Besada et al., 2009). But the pastoralists subsequently found themselves facing livestock disease, conflict over access to land, and other conditions that could plunge them back into poverty (Dinar et al., 2006).

The developing world, including Africa, already contends with chronic food problems (Johnson, 2008). In Africa, about 11 % of arable land could be affected by climate change, including a reduction of cereal production and a significant drop (up to 20%) in agricultural

GDP (IPCC, 2007). According Besada et al. (2009), crucial in this regard is further land degradation, which occurs because more intense rainfall promotes soil erosion. Deforestation caused by illegal logging, the felling of trees for firewood and charcoal for cooking, and slash and burn farming practices have all reduced biodiversity in Africa, and weakened the ability to adapt to climate change. Besada et al. (2009) also highlights that, as much as this situation reflects the reality of energy insecurity in Africa in terms of the dwindling supply of traditional fossil fuels, heavy reliance on non-renewable fuel sources for domestic energy supply in most of sub-Saharan Africa contributes to ecosystem degradation, which is threatening wildlife and destroying natural forests.

One of the most pertinent issues in Africa regarding human development is clearly reduced agricultural productivity (Muller-Kuckelberg, 2012). While key sectors such as transportation, infrastructure, water and tourism are sensitive to extreme weather events in Africa, it is the agricultural sector that is particularly exposed and vulnerable (IPCC, 2011). This is especially evident when it is recognised that rain-fed agriculture accounts for approximately 96% of overall crop production in sub-Saharan Africa (World Bank 2015 in Serdeczny et al., 2016). For most sub-Saharan African economies, agriculture is of great importance, supporting up to 80% of national livelihoods, and contributing an average of 30% of GDP and at least 40% of exports (Mubaya, 2010). The sector employs 65% of Africa's labour force and its output has increased since 2000, mainly due to an expansion in agricultural areas (World Bank, 2013 in Serdeczny et al., 2016). Already, rural poverty accounts for 90% of total poverty in the region and approximately 80% of the poor still depend on agriculture or farm labour for their livelihoods (FAO, 2005).

Climate change scenarios indicate substantial losses in the production of food staples linked to drought and rainfall variation, especially in areas of sub-Saharan Africa, where projected revenue losses due to loss of arable land and desertification amount to 26% by 2060 (Muller-Kuckelberg, 2012). Muller-Kuckelberg (2012) further posits that such an impact on agricultural production would directly influence food security, leaving 600 million facing malnutrition by 2080. In Morocco, of the total 4.2 million poor people, 69% live in rural areas (Douidiche et al., 2007); and most of them depend on rain-fed agriculture, making this type of population highly vulnerable to reduced rainfall and shifts in rainfall timing and distribution (Cline, 2007; Aydinalp et al., 2008). The almost inevitable results are crop failures (or at least reduced harvests) and losses of livestock (Nkomo et al., 2006). At times, the results are heart rendering. A case in point would be the weather conditions on the Horn of Africa, where severe drought due to failing rains two years in a row led to widespread famine in 2011 (Muller-

Kuckelberg, 2012). Droughts have largely occurred in the Sahel and in some parts of southern Africa and during the Sahelian drought of the early 1970s, about 300,000 people and millions of animals died (Besada et al., 2009). As well, because most agriculture and food production activities in Africa are sensitive to climatic changes, these changes cause food prices to soar resulting in the most vulnerable people in urban spaces facing dire circumstances (Muller-Kuckelberg, 2012).

Climate change is also associated with negative effects on the economy. African countries are experimenting with different approaches to offset the impacts of natural hazards on their economies so as to address disaster risk in their national and local public planning and budgeting (Houghton, 2011). Governments in Africa, such as Mozambique, Senegal and Uganda, are investing resources to reduce the risk to natural hazards as climate change could lead to falls in the GDP of many countries in Africa. Several historical case studies have identified a connection between rainfall extremes and reduced GDP because of low agricultural yields. For example, climate change could lead to a fall of about 1.5% in South Africa's GDP by 2050, a fall roughly equal to the total annual foreign direct investment in South Africa in the late 2000s (Mubaya, 2010). Kenya suffered annual damages of 10 to 16 % of GDP, not accounting for indirect losses, because of flooding associated with the El Nino in 1997–1998 and the La Nina drought in 1998–2000 (Serdeczny, 2016). The cost of the year floods in Mozambique in 2000 was an estimated US$550 million, lowering the country's GDP by 1.5% (World Bank, 2005).

Climate change also has indirect and direct effects on health in the region through eco-systems degradation, unsafe water and poor sanitation, which contribute to malnutrition, cholera and diarrheal diseases and an increase in child mortality (Mubaya, 2010). Increases in temperature, climate change-induced natural disasters and scarcity of safe drinking water due to droughts are major contributors to the spread of infectious and water-borne communicable diseases in Africa (Besada et al., 2009). The distribution of climate-related health burdens is described as almost inverse to the global distribution of greenhouse gas emissions (Patz et al., 2007). Africa accounted for 80% of the total reported number of cholera cases globally in 1997 (WHO, 1998a). Following the 1997–1998 El Nino events, malaria, Rift Valley Fever (RVF) and cholera outbreaks were recorded in many countries in east Africa (Mubaya, 2010). Therefore, major reductions in the amount of rainfall or changes in its patterns would lead to ill health of the population (Besada et al., 2009).

Weather extremes also threaten livelihoods and erode human security, causing forced migration and population displacement. Pastoralists in communities of northern Kenya

continue to move as they are ravaged by both droughts and floods. There is also rural-urban migration in Ethiopia due to adverse environmental changes in its highlands and internal displacement of populations in the low-lying and flood-prone plains of the river Niger in Nigeria. In line with migration, climate change may also trigger conflicts as people fight for resources mostly in the Sahel, the Horn of Africa, the DRC and northern Kenya (Besada et al., 2009).

3.3 Adaptation to Climate Change

In this context, climate change threats and risks have aroused widespread international concern and demands for action (UNFCCC, 2006; Wamari et al., 2012). Due to its widespread effects, it is likely then that climate change will be pivotal in redefining development in the twenty-first century (Agrawal, 2008). The most basic requirement, as a basis for responding to the threats and risks, has been to investigate the character and extent of the problem. This explains the existence of the numerous researches and reports discussed in the preceding section. Indeed, since the 1990s, the IPCC in particular has issued a series of reports detailing the sheer scale of greenhouse gas emissions and indicating potential consequences of climate change by presenting a range of scenarios. As well, governments came together to draft the United Nations Framework Convention on Climate Change (UNFCCC); this went into effect in 1994 and envisaged two main strategies, namely, mitigation and adaptation (UNFCCC, 2006).

Mitigation seeks to slow the emissions of GHG or to store and absorb them in forests or other carbon sinks. Adaptation, which is the concern of this study, involves short- to long-term measures designed to reduce the negative effects of climate change, or sometimes to exploit the positive ones, by making appropriate adjustments (UNFCCC, 2006). Climate change, as indicated, is generally detrimental to the agricultural sector as this sector is particularly vulnerable to its effects. With adaptation, the possibility exists that this vulnerability can be reduced or minimised (Smith, 1996; Mendelsohn, 1998; Smit and Skinner, 2002). Adaptation is a very complex process and is at times over-simplified in impact studies, where it is seen regularly as involving a change in planting date for a particular crop or switching to a different crop variety. One of the key challenges when it comes to adaptation is the fact that there is no one-best-fit model or simple template which can be merely applied uncritically across all regions and countries. Yet some form of adaptation, if suitably developed with local circumstances in mind, is now understood as the best means of addressing climate change in

order to reduce the vulnerability of livelihoods dependent in large part on rain-fed agriculture (Kane and Shogren, 2000; Smit and Pilifosova, 2001).

Adaptation, as discussed earlier, entails the ability to respond and adjust to actual or potential impacts of changing climatic conditions in ways that moderate harm or takes advantage of positive opportunities. It reflects positive actions to change the frequency and/or intensity of impacts, as opposed to coping strategies which are responses to impacts once they occur (Adger et al., 2005). In this sense, the possible effects of climate change are softened or cushioned by adaptive interventions such that these effects do not translate into impacts. Hence, adaptation is associated with actions intended to reduce harm and risk to an extreme event as well as to maintain social well-being in the face of overall climate change by facilitating and forging designs of action and enforcement of actions intended to reduce vulnerability (Adger et al., 2005). While mitigation appeals to the international common good, adaptation tends to be targeted at addressing the climate change-induced vulnerability of often localised groups facing particular challenges (IPCC, 2007). In this light, a vast array of specialists in diverse fields cutting across the natural and social sciences have sought, for some time now, to bring their expertise to bear on the multi-faceted dimensions of climate change effects in relation to human populations (Klein, 1998)**.**

The contrast between adaptation in the developed and developing worlds is often brought to the fore, with the capacity to adapt seen as more pronounced in the developed world. In places like London, people are being protected against the risks associated with rising sea levels through foresighted infrastructure planning based on detailed climate studies and risk assessments (Muller-Kuckelberg, 2012). In a study done by Seerisk (2014) on climate change adaptation and risk aversion in the Danube macro-region in Europe (including countries such as Romania, Serbia, Bosnia and Herzegovina, and Slovakia), it was discovered that the frequency of floods, strong winds and snow storms has multiplied. In this context, the countries in Danube implemented the Seerisk project as a joint assessment of the risks associated with climate change from a disaster management point of view. The project identifies and analyses risks along with a climate change adaptation discussion platform, while also undertaking risk awareness and enhancing the preparedness of local populations. Nations in the developing world tend to have less vigorous and focused national programmes to address climate change through adaptation, with local communities sometimes being at the forefront of adaptation measures.

In Asia, for instance, farmers have traditionally observed a number of practices to adapt to climate variability, such as intercropping, agro-forestry, and the development of new seed

varieties in the face of changing local climate conditions. Farmers in Peru have been using an ancient irrigation and drainage system called *"waru waru"*, or raised field agriculture, which makes it possible to bring into production the low-lying, flood prone and poorly drained lands found all over the Altiplano (UNFCCC, 2007). In El Salvador, communities employ a number of soil conservation measures to cope with recurrent droughts. These include building barriers consisting of stone and pine suckers, which provide edible fruits and additional income. In Costa Rica and Ecuador, local communities have improved their housing design to better cope with floods and droughts (UNFCCC, 2007). Almost every year millions of people in coastal areas of Bangladesh are exposed to flooding. Floods can be beneficial at times, allowing for agriculture especially in drier regions but, in most cases, floods occur in Bangladesh on a catastrophic scale resulting in epidemics and in thousands of deaths, as well as causing serious damage to habitats, agricultural production, fisheries and livestock (UNFCCC, 2006). Bangladesh, therefore, has been developing more effective early warning systems through a system of flood monitoring and forecasting. This has largely helped as timely flood warnings can prompt communities to protect crops and livestock.

The situation for African nations, where poverty reigns, is even more critical but their capacity to adapt is open to question. In fact, Africa is anticipated to be the most negatively affected continent due to a combination of particularly severe projected climate change impacts and its relatively low adaptive capacity (Schaeffer et al., n.d.). Studies confirm that Africa is likely the most vulnerable continent to climate variability and change because of multiple stresses and minimum adaptive capacity, including at national levels (IPCC, 2007). Thus the need for identifying and pursuing adaptation is particularly acute in Africa in the light of the existing deficits in adaptation to current climate change (Muller-Kuckelberg, 2012).

African nations have responded to climate change with varying degrees of pace and ambition. Some have developed national climate change strategies while others have plans that relate to specific sectors such as agriculture or water (Shanahan et al., 2013). In the Democratic Republic of Congo, the national development strategy highlights the importance of forests as these are integral for soil fertility and conservation. Kenya has developed a National Climate Change Action Plan which focuses on adopting a low-carbon development pathway. Ethiopia, at national level, is stressing improvements in crop and livestock practices, as well as protecting and re-establishing forests. Gabon also unveiled its Green Gabon plan in 2011 aiming to consider climate change with reference to all sectors of the economy and reducing deforestation and land degradation. Other countries, like Nigeria and Rwanda but also South Africa (Kruger et al., 2012; DEA, 2011), are pursuing similar national climate change plans and policies.

However, for Africa, there is significant evidence which supports the view that, with appropriately-formulated adaptation strategies, the vulnerability of small-scale farmers reliant on rain-fed agriculture can be significantly reduced, and by farmers themselves (Gbetibouo, 2009; Kurukulasuriya and Rosenthal, 2003). In this regard, Mapfumo et al. (2014) point out that farmers in Africa have responded to climate variability through a variety of adaptive strategies, but with most examples suggesting reactive rather than anticipatory adaptation actions. However, Shanahan et al. (2013) bring to the fore a range of strategies of small-scale farmers in different parts of Africa, some of which are more anticipatory. These include the use of more drought-tolerant and early-maturing crops, the use of renewable energy, conserving and restoring vegetation in degraded and mountainous areas, reducing overall livestock numbers through sale or slaughter, cross-breeding livestock or acquiring smaller livestock like sheep or goats, adopting traditional methods to conserve forests and using community-based management programmes for forests.

In order to increase food production and minimise crop failure, farmers in Ghana are installing rain gauges to record monthly rainfall and to help in predicting longer-term trends. In some parts of Malawi, and because of floods that usually occur, farmers are switching from storing grain in ground-level granaries to using smaller harvest bags which they can easily move to higher ground in the event of flooding. In some countries**,** opportunistic gathering of wild products such as fruits, wood and honey for home consumption and for sale have also been used at times of crop failure (Kandji, 2006). The study by Kandji (2006) further shows that, in a survey carried out in Malawi and Zambia, as much as 80% of the 323 rural households sampled reported having faced severe food shortages, especially during the months of November to January. About 50% of these households in Malawi and 26% in Zambia resorted to fruit trees as a strategy to cope with the famine period in 2001 (Akinnifesi et al., 2002 in Kandji, 2006). Lake Olbollosat area residents in the heart of Kenya have focused on reforestation in order to slow down processes of deforestation on mountain slopes which had been exacerbated by rainfall. In Namibia, the main focus has been on battling desertification by using rain-fed pearl millet fields to produce a ground cover that holds the soil between rains.

Amongst the Konso of Ethiopia, living in one of Africa's harshest climates, inter-connected terracing systems have been constructed to preserve fertile lands (CGIC, 2009). In Ghana, Muller-Kuckelberg (2012) note how climate change and the resulting losses in productivity have resulted in a fatal downward spiral for farmers, with adaptation measures including changing from the cultivation of climate-sensitive crops to climate-resistant ones as well as finding other sources of income such as local formal employment or causal labour.

Beyond non-agricultural activities, some communities migrate as an adaptive strategy. In Western Sudan, for example, migration strategies have included sending an older male member to Khartoum to seek wage labour when drought conditions occur. Similarly, the migration patterns of young people in Northern Ethiopia appear to respond directly to patterns of drought. In dry rural areas, once drought becomes particularly severe and other adaptation options are exhausted, entire families and communities will move to places where relief is expected to be available (Mitchel and Tanner, 2006; Centre for International Earth Science Information Network, 2009, Besada et al., 2009). Clearly, this and other literature on small-scale farmers and adaptation to climate change in Africa indicates that adaptation strategies are often highly localised and tailored to address specific risks and challenges.

This brings to the fore the importance of farmers' perceptions and conceptions of climate change when it comes to considering the adaptation of small-scale farmers to climate change in Africa, though this is not a central theme in the small-scale farmer adaptation literature. Climate change perceptions are likely to translate into particular agricultural decisions under local conditions, though the ways in which farmers' respond may vary when faced with the same climate stimuli. Such varied responses, even within the same geographical area, are likely related at least in part to the variety of agricultural systems involved, different market systems in which farmers operate (Bryant et al., 2000) and differential capital and capacity amongst farmers to pursue adaptation. Thus, even if conceptions are similar across small-scale farmers in a specific locale, there are often differential responses amongst farmers for various reasons.

Thus, in a study done by Gbetibouo (2009), several adaptation measures were identified in the Limpopo River Basin as farmers' responses to rises in temperature. These included changing planting dates, increasing irrigation, pursuing crop diversification, changing the amount of land under cultivation or pasture, and investing in livestock by buying feed supplements. The possibility of adopting such measures, and the extent to which they were adopted, was subject to variation, as was the capacity to pursue particular measures. In this study, Gbetibouo (2009) noted that higher levels of education entailed in turn a higher probability of adopting new technologies, and that institutional factors enhanced the opportunity and effectiveness of technologically-based adaptation strategies. The most important institutional factors were access to information via extension services, access to credit, off-farm employment and secure land tenure. Access to credit was identified as crucial because any fixed investment requires the use of owned or borrowed capital.

In a similar vein, a study by Deressa et al. (2008) in Ethiopia considered the major methods used by small-scale farmers to adapt to climate change in the Nile Basin, as well as

the factors which affected their choice of methods and the barriers to adaptation. The adaptation strategies implemented included use of different crop varieties, tree planting, soil conservation, early and late planting, and irrigation. From their study, they discovered that the level of education, gender, age and wealth of the head of household, along with access to agricultural extension, credit, climate change information and social capital, influenced farmers' choices and possibilities. Thus, in terms of these dimensions, significant barriers to adaptation existed amongst specific categories of farmers. Likewise, a study by Nhemachena and Hassan (2007) of southern Africa concludes that female-headed households are more likely to take up climate change adaptation methods. As well, experience in farming increased the probability of uptake of adaptation options, as experienced farmers have wider knowledge and information on changes in climatic conditions and on crop and livestock management methodologies. Further studies have also identified numerous variables pertinent to adaptive capacity amongst small-scale farmers in Africa, including technical and economic factors (Reidsma et al., 2002), household wealth and livestock ownership (Yesuf et al., 2008), levels of climate change knowledge (Maddison, 2006), household size, social capital and agro-ecological settings (Deressa et al, 2008) and age (Wegayehu et al., 2003). It becomes important, then, to recognise and appreciate that local agricultural communities are invariably differentiated and heterogeneous, and this conditions climate change adaptation within such communities.

3.4 Conclusion

In conclusion, it is clear that climate change (which is increasingly human-induced) is having real tangible effects around the globe and perhaps more acutely across the African context. In the case of African countries, there is a heavy dependence on rain-fed agriculture as a basis for rural livelihoods, and any change or variability in climate is bound to drastic effects on these livelihoods. At the same time, as this chapter shows, there are international and national efforts to curb the extent of climate change as well as to reduce its potential impacts. However, what is of particular importance to the thesis is what is taking place within rural areas, and the ways in which small-scale farmers are not simply sitting idly back but are making strenuous efforts to adapt to climate change. Though they make lack certain capacities to do so, and despite the serious constraints undercutting their adaptation efforts, the review of the literature demonstrates significant agency on the part of small-scale farmers in this regard. The next chapter considers these matters with specific reference to Zimbabwe.

CHAPTER FOUR: ZIMBABWE'S POLITICAL ECONOMY AND THE PROBLEM OF CLIMATE CHANGE

4.1 Introduction

This chapter focuses on climate change, agriculture and small-scale farmer adaptations to climate change in Zimbabwe. In pursuing this, the first section (4.2) examines the political economy of Zimbabwe since 1980. Though this is provided in part for the non-Zimbabwean specialist, the focus in this section is on the development of the communal areas in the country in the context of broader changes to Zimbabwe's political economy; and hence this discussion becomes quite important. It shows (for example) the ways in which communal areas have remained largely marginal to the agrarian political economy and the livelihood challenges thereby faced by communal farmers, including the farmers who are the subject of this thesis. In the following section (4.3), the focus turns more specifically to agriculture in communal areas and the effects of climate change on these areas. The last section (4.4) extends this discussion by reviewing literature on small-scale farmer adaptation to climate change in Zimbabwe.

4.2 Zimbabwe's Economic and Political Trajectories since 1980

This section examines key economic and political developments which have taken place since the attainment of independence by Zimbabwe in 1980. The aim is to show dimensions of the economic and political terrain of the country which are, in the end, either directly or indirectly relevant to climate change and communal farmer adaptation to climate change.

Zimbabwe is a land-locked country in southern Africa and has a total area of 390,757 square kilometres. The country lies between latitudes 15^{o} and 23^{o} south of the equator and longitudes 25^{o} and 34^{o} east of the Greenwich Meridian (GoZ, Ministry of Environment and Natural Resources Management, First Draft, 2013)[2]. Zimbabwe is bordered by Mozambique to the east, South Africa to the south, Botswana to the west and Zambia to the north and north-west. The Zambezi River to the north and the Limpopo River to the south form Zimbabwe's borders with Zambia and South Africa respectively. Altitudes range between 197 metres and 2,592 metres.[3] About 80% of the land is higher than 600 metres and less than 5% is above

2www.ies.ac.zw/downloads/draft%20strategy
3www.ies.ac.zw/downloads/draft%20strategy

1,500 metres, with the highest part in the Eastern Highlands (Gambiza et al., 2006). Harare is the capital city and is situated in the northern part of the country while Bulawayo, as the second largest city, is located in the southern part. Chivi District, the case under study, is found in Masvingo Province which is situated in the south-eastern part of the country. Most of the country is elevated in the central plateau (Highveld) stretching from the south-west to the north-east at altitudes between 1,200 and 1,600 metres. The watershed is 650 kilometres long and 80 kilometres wide (Zimbabwe NCCRS, 2015)[4]. About 20% of the country consists of the Lowveld below 900 metres, with the Zambezi and Limpopo river valleys found in the north and south respectively having the lowest altitude of around 500 metres (NCCRS, 2015).

These details, though seemingly trivial, become quite significant when considering the racialised character of land and agriculture which was inherited by the Zimbabwean state in 1980, and the ways in which climate change has had differential effects across the countryside.

In outlining the political economy of Zimbabwe post-1980, a periodisation is provided as follows: the independence decade (1980s), the neo-liberal, structural adjustment decade (1990s), the crisis period (from 2000 to 2008), the recovery period (2008-2013), and the reversal period (2013 to present). In discussing these periods, it will become clear that economic and political developments are deeply intertwined with each other (Munangagwa, 2009; Zamponi, 2005).

4.2.1 Independence Decade (1980s)

After a guerrilla-based war of liberation in the 1970s (Ranger, 1985; Bratton, 2014), the new Zimbabwean government inherited a comparatively developed and diversified national economy but one which was deeply racialised as was rest of society (Hazzlewood, 1967; Moyo, 2004; Mazingi et al., 2011), including within the agricultural economy. The economic structure was in large part dualistic, with a white-dominated relatively capital-intensive modern sector (including within agriculture) on the one hand, and a largely neglected small-scale farming sector amongst blacks located within what was then known as Tribal Trust Lands (Mandaza, 1986). The post-colonial government sought, from the start, to address and rectify the immense racial imbalances existing throughout Zimbabwean society (Darnolf et al., 2003). For instance, the Zimbabwe government adopted a seemingly socialist-inspired policy of 'Growth with Equity' in 1981 which set out to achieve economic growth while, at the same time,

4www.ies.ac.zw/download/draft%20strategy.pdf

redistributing wealth to rectify the racial imbalances of the past (Chinake, 1997). This included measures to bring about free health care, education for all, rural development, land redistribution and the integration of small-scale black farmers into the market economy, along with increases in minimum wages and social protection for workers (Balleis, 1993; Bratton, 1987).

A few years later, the First Five-Year National Development Plan was set out (for 1986-1990) and it likewise emphasised economic growth, employment creation and poverty reduction (Dansereau, 2005; Kanyenze, 2007). These development frameworks were pursued with significant support (including loans) from bilateral and multilateral financial institutions such as the World Bank (Darnolf et al., 2003; Dansereau, 2005). Advances in the educational and health sectors were significant during the 1980s (Chinake, 1997) but, generally, the economic targets outlined in the frameworks were not met despite solid economic growth in the first few years of independence (Sibanda, 2017). Simultaneously, high levels of public expenditure led to problems with the national fiscus (World Bank, 1995) alongside growing levels of external debt. There was the recurrent mismanagement of parastatals, an over-sized state bureaucracy and increasing budget deficits (Darnolf, 2003). These problems were acknowledged by the government in the Second Five-Year National Development Plan (for 1991 to 1995) (Mazingi et al., 2011).

Prior to 1980, the colonial state had vigorously pursued land segregation, which led to the creation of Native Reserves in which indigenous black people were expected to engage in small-scale agriculture. Meanwhile, in so-called European areas, white commercial agriculture under freehold title expanded rapidly in large part because of massive state support and subsidisation, which was often at the expense of so-called peasant agriculture in the Reserves (later Tribal Trust Lands). In general, the Reserves were located within the more arid agro-ecological regions of the country, and the European areas in regions with greater agricultural potential particularly in relation to crop production.

Under the terms of the Lancaster House independence agreement, European lands could be purchased by the state on a willing seller-willing buyer basis, with indigenous people then being resettled on these redistributed farms. Despite land being so central to the liberation struggle, land redistribution did not take place on a significant scale during the 1980s. At the same time, the Zimbabwean state sought to enhance the productivity of peasant farmers (in what now became known as communal areas) with a diverse range of support, including irrigation schemes and agricultural extension services (Moyo, 2004). Communal area production did improve during the 1980s, with communal area farmers contributing to a greater

share of crop production and marketed produce (at least of maize and cotton) (Mazingi et al., 2011), but improvements fell short of expectations (Chikwanha-Dzenga, 1999).

While the Zimbabwean government under the ruling party (Zimbabwe African National Union – Patriotic Front, ZANU-PF) sought to de-racialise the economy, it also tended to maintain the repressive apparatus of the colonial state (as manifested in the *Gukurahundi* massacre in Matabeleland), with the emergence of a strong executive presidency in 1987 and attempts even to bring about a *de jure* one-party state (Coltart, 2008; Bratton et al., 2011; (CCJP/LRF, 1997; Sachikonye, 2011). This had led to a statist or command economy, which was seen as a source of many of the economic challenges. In this light, an Economic Structural Adjustment Programme (ESAP) was introduced in the early 1990s leading to what has become known as the structural adjustment decade (Chinake, 1997).

4.2.2 Decade of Neo-Liberalism (1990s)

Introduced in 1991, ESAP contained many of the typical market-led liberalisation measures of a neo-liberal adjustment programme, and it was supposed to stimulate economic growth. Hence, it sought to remove price and wage controls, reduce government expenditure, de-value the Zimbabwean dollar, and restructure parastatals and other public enterprises (Sichone, 2003; Zamponi, 2005). In line with this, the International Monetary Fund made a series of disbursements to bank-roll economic restructuring (Coltart, 2008). However, ESAP was largely a disappointment as the economy experienced significant declines in real incomes, limited employment creation, and reduced per capita levels of social expenditures; further, the budget deficit rose as a percentage of the Gross Domestic Product. Thus, real economic growth fell from an average annual rate of 4% registered between 1985 and 1990 to 1.4% during the adjustment period (Mazingi et al., 2011). Dansereau (2005) posits that persistent inflation (from 1991 to 1995) resulted in price increases as food rose by 516%, and medical care, transport and education by 300%. By then, 62% of households could no longer afford the basic necessities of food, clothing, shelter and transport. Improvements in health and education from the 1980s began to be whittled away under neo-liberal imperatives, including through the introduction of user-fees (Chinake, 1997).

With rising unemployment in the formal economy, the urban informal economy increased significantly throughout the 1990s as a survivalist livelihood strategy. At the same time, with urban poverty deepening, the main trade union federation started to flex its muscles through demonstrations and strikes, with its main focus on government intransigence and

mismanagement. Though the government sought to move away from structural adjustment in the late 1990s, other events were to deepen the economic (and political) crisis in Zimbabwe. These events included the Zimbabwean army's involvement in the conflict of the Democratic Republic of Congo and the unbudgeted disbursement of bonus and pension packages to the former guerrillas (war veterans), both of which entailed massive state expenditure (Coltart 2008; Bond et al., 2002) to the disadvantage of the economic plight of ordinary Zimbabweans. By the late 1990s, a vibrant opposition party (the Movement for Democratic Change – MDC) emerged by bringing together diverse groupings (from trade unions to white commercial farmers) in seeking to challenge the legitimacy and power of an increasingly authoritarian ruling party.

Neo-liberal restructuring also had differential effects on land redistribution and agriculture. Land redistribution continued to take place on a willing seller-willing buyer basis in line with the neo-liberal market mantra, such that only minimal redistribution took place. This was despite a seeming radicalisation of the Zimbabwean government in terms of a populist expropriation of land discourse arising. Additionally, the Zimbabwean government withdrew the significant support it was providing to communal farmers during the 1980s (such as the provision of seeds and fertilisers), as part of managing its public expenditure (Chinake, 1997). Hence, agricultural production at best stagnated in the communal areas and at worst went into decline. White commercial farmers though took advantage of neo-liberal reforms to diversity their activities (into wildlife and flowers), and by focusing increasingly on export markets.

4.2.3 Crisis Period (2000-2008)

The decade which began in 2000 was marked by the land occupation movement and the government's subsequent Fast Track Land Reform Programme (FTLRP), which put the agrarian and national economies in a tailspin. Before this, though, a constitutional referendum took place in February 2000. The changes to the constitution included clauses enhancing the power of the executive president and allowing for expropriation of land without compensation. While the ruling ZANU-PF party campaigned for a 'Yes' vote in the referendum, the MDC put forward arguments for a 'No' vote; in the end, the constitutional changes were rejected, which marked the first major defeat for the ruling party since 1980. Soon afterwards, occupations of white commercial farms and other landholdings took place, engulfing nearly the entire countryside. These occupations were led by war veterans but also consisted of large numbers

of communal farmers. In the parliamentary elections in June 2000, the MDC lost but only narrowly.

The FTLRP was then introduced as way of legitimising the occupations, consolidating rural support for the ruling party, and bringing about a massive land redistribution programme (Moyo, 2000; Raftopoulos, 2003). This top-down restructuring was part of a broader process of authoritarian restructuring of the state during this period, as the state sought to undercut the MDC's power base (as witnessed during the presidential election of 2002) (Sachikonye, 2011). Fast track proved to be highly controversial, condemned as it was by the MDC and its support base, but this controversy also extended into the scholarly literature – with most scholars critical of it, but others more sympathetic. Even the more sympathetic scholars though could not ignore the damaging effects of fast track, including undermining commercial agriculture. In this regard, there were immediate and massive drops in crop production and export earnings from agriculture. Mlambo et al (2010) highlights that annual wheat plummeted from a high of over 300,000 tons in 1990 to less than 50,000 in 2007. As well, tobacco had earned some US$600 million in 2000 but generated less than US$125 million in 2007.

As commercial agriculture and the manufacturing sector were intimately related through downstream and upstream linkages, urban manufacturing went into rapid declines in industrial output. This had obvious knock-on effects on urban employment and wages and further widened the existence of the urban informal economy. In June 2005, nearly 3 million Zimbabweans earned their living through informal sector employment, supporting another 5 million people, while the formal sector employed only about 1.3 million people (Coltart, 2008). By 2003, the population living below the total consumption poverty line (TCPL) stood at 72% and Zimbabwe's economy was the fastest shrinking in the world, at 18% per year[5]. The situation for those in the informal economy was disrupted significantly by the implementation of Operation *Murambatsvina* (Restore Order) when the government ordered the destruction of all illegal dwelling and trading units in urban centres in 2005 (Sachikonye, 2005; Mlambo et al., 2010); this took place possibly in part to punish the urban support based of the MDC (Kanyenze, 2006), as witnessed in the 2005 parliamentary elections.

The Ministry of Lands, Land Reform and Resettlement (2005) reported that 6,482 white commercial farms, measuring 10,449,359 hectares, were seized and allocated to new farmers under two models (A1 and A2) by 30 September 2005. Model A1 was for smallholders with

5http://www.cato.org/pub_display.php?pub_id=9294

an average size of 6 hectares while Model A2 was for commercial farming areas where sizes range from 30 to 5,000 hectares. A total of 140,866 families were resettled under the A1 model by 2005 and 14,500 benefitted under the A2 model (Moyo, 2004). With respect to the A2 model, in a form of elite land grabbing, beneficiaries included ruling party parliamentarians, cabinet ministers, army generals and senior civil servants (Raftopoulos, 2003). The A1 model consisted of mainly communal farmers but also members of the urban working classes. Tens of thousands of farm labourers on white farms were displaced because of fast track, as they were rarely recipients of A1 plots, with some moving to communal areas.

Officially, fast track – and particularly the A1 model – was meant to decongest the overcrowded communal areas and then allow for reorganisation of communal areas. But, despite the significant numbers of communal farmers entering into A1 farms, no fundamental decongestion took place (Marongwe, 2003; Scoones 2008). Further, the state's focus was on fast track farms and, even though these farms did not receive significant state assistance, this was even less so in the case of communal farmers during this period, so that on-going food insecurity continued to haunt communal areas.

In this regard, the government was mainly concerned about demonstrating the success of its resettlement programme, which explains why the bulk of Reserve Bank of Zimbabwe (RBZ) subsidies were channelled primarily to new A1 and A2 farmers (Dore, 2009). According to Anseeuw et al. (2012), during the period from 2004 to 2009, the RBZ provided mechanisation equipment and subsidised inputs (such as fuel) to these farmers. It did so by taking on a quasi-fiscal role and controlling and using foreign currency reserves in the country. However, there is a dearth of evidence showing how communal farmers benefited from the RBZ's interventions, despite claims from the RBZ that communal farmers used inputs that were made available to them (Dore, 2009). The government's direct involvement in the communal areas also included the provision of aid in the form of seeds and food by government schemes such as the Grain Marketing Board (GMB) Input Scheme, the Presidential Input Scheme, and Operation Feed the Nation known as '*Maguta*'[6].

The GMB Input Scheme (launched by the government from 2000) was an input credit facility scheme meant to assist farmers to buy seeds, fertilisers, machinery and agro-chemicals on credit terms. However, this scheme did not produce its intended results due to poor co-ordination in the distribution of these inputs, as the GMB did not have clear criteria for selecting the beneficiaries of these inputs (Manyeruke et al., 2013). The scheme was also affected by the

6 Literally translated it means, 'I am full'.

lack of fuel supplies, lack of transport and poor road infrastructure, and these factors affected the delivery of inputs to farmers and certain commodities to markets.

Operation *Maguta* and the Presidential Input Scheme were meant to assist the farmers in terms of access to inputs. However, the distribution of inputs was marred by political controversy as those in higher political offices looted many of the inputs (Ndlovu, 2011) at the expense of communal farmers and A1 farmers. The Operation *Maguta* programme was spearheaded by the Zimbabwe Defences Forces (ZDF) in collaboration with the Ministry of Finance. The programme targeted A1 farmers and communal farmers who were given inputs like fertilisers, seeds and herbicides so that they would grow targeted crops such as maize and wheat. Manyeruke et al. (2013) point out that the farmers were then expected to pay back loans at an interest rate of 50% after harvesting their produce. The programme was criticised for lack of proper co-ordination which contributed to failed goals. Farmers also failed to pay back the loans which led to the collapse of the programme. In this light, Bird et al. (2007) speak of programme failure due to corruption, shortage of inputs and lack of agricultural skills on the part of the army personnel. Overall, the "delayed delivery of inputs through Operation Maguta and the Grain Marketing Board (GMB) was one of the major factors that reduced agricultural productivity during the 2007/8 season" (FAO/WFP, 2008, in Dore, 2009:18).

In 2007, the government launched the Agricultural Mechanisation programme which was meant to support farmers by equipping them with farming implements (Manyeruke et al., 2013). Various farming machinery and implements like tractors, disc harrows, ploughs and combine harvesters were distributed to selected resettlement farmers. In this way, the scheme was meant to "transform … the equipment and productive landscape of the agricultural sector by mechanising both the communal and commercial farmers" (Manyeruke et al., 2013:10-11). Musodza (2015) also points out that the programme was meant to address labour shortages and expand cropped areas. However, the distribution of agricultural equipment was marred by corruption and most of the beneficiaries benefited because of their political connections, including A2 farmers. As Anseeuw et al. (2012:103) indicate with regard to all of these programmes, they "seem to follow an ad hoc approach, responding to very diverse objectives, some being political rather than focusing on people's needs".

4.2.4 Economic Recovery Period (2008-2013)

All these problems soon coincided with the parliamentary and presidential elections that took place in 2008, which led to a presidential run-off between ZANU-PF and MDC. The period

before the run-off was used by ZANU-PF to intimidate people and there was massive violence particularly in rural areas where opposition party members were beaten, tortured and killed. This led to the MDC pulling out of the presidential re-run, and the outcome being rejected by governments in the region. The controversy resulted in an external mediation of the Zimbabwean crisis, leading to the birth of the Government of National Unity (GNU).

On this basis, the three main political parties, ZANU-PF and two factions of the MDC, entered into the Global Political Agreement (GPA) which was meant to address the economic malaise and bring Zimbabwe back to stability. The national unity period, from 2008 to 2013, was also seen as a period of transition, "as to some extent the GNU helped in averting serious political and economic crisis" (Dodo et al. 2012:209). However, the post-2013 period was marked by uncertainty. The power-sharing arrangement entailed significant tension and trade-offs, with ZANU-PF seemingly having the upper hand if only because it controlled the presidency and the core instruments of coercion, notably the ministries of defense and justice as well as the intelligence services (Bratton, 2014). A number of economic programmes were formulated and implemented, such as the Three Year Macro-Economic Policy and Budget Framework 2010-2012, which were all designed to stabilise the economy through macro-economic reforms. Though the economy remained in crisis, some positive trends did emerge alongside the dollarisation of the economy. For instance, after a decline of economic growth in 2008, Zimbabwe recorded positive annual growth rates of up to nearly 11% from 2009 to 2012 (Kanyenze et al., 2017; Sibanda et al., 2017; Zimbabwe Country Analysis, 2014[7]). As well, inflationary pressures declined rapidly, price distortions in goods and foreign exchange markets were in large part removed, capacity utilisation in the manufacturing sector increased from about 10% to 40%' and GDP per capita increased from US$403.1 in 2007 to USD$499 in 2010 (Sibanda et al., 2017).

Nothing significant was undertaken by the government during this period so as to assist agricultural production in communal areas. Anseeuw et al. (2012) point out that, through the assistance of NGOs, the government implemented a public works programme in 2010 for food aid commonly known as a food-for work-programme in 2010. The programme targeted rural people including those who resided in communal areas whereby they received food aid in compensation for working to improve local infrastructure like roads, dip tanks and waterways. The programme, however, failed to yield positive results due to strained relationships between the government and NGOs.

7www.zw.one.un.org/.../Country%Analysis_FinalReview_3Oct2014.pdf

4.2.5 Reversal Period: Post-2013

In 2013, the country experienced harmonised elections in which ZANU-PF received a two-thirds majority in Parliament and Robert Mugabe, as president of the ruling party, was elected as state president for another 5-year term. The year 2013 therefore saw the end of the GNU and the re-emergence of ZANU-PF as the sole ruling party, now unhindered by any checks and balances contained in the GNU. In effect, and despite the adoption of a new constitution in 2013, ZANU-PF adopted a form of governance (post-2013) which was reminiscent of its rulership in the pre-2008 periods. Its macro-economic policies and strategies, notably Zimbabwe Agenda for Sustainable Socio-Economic Transformation (or ZimAsset), failed to address the economic malaise facing the country (Bratton, 2014). For instance, the economic gains from the GNU were undercut as the economic growth rates for 2013, 2014 and 2015 were 4.5%, 3.5% and 1.5% respectively. In this light, state expenditure became unchecked, company closures became common, business confidence and the stock market fell, unemployment rose, and the informal economy became more widespread (Sibanda et al., 2017).

In order to promote food security, the government implemented the Command Agriculture Scheme from 2015-2016, which was meant to mobilise sustainable and affordable funding for the agricultural sector. This was meant to also address the drought of 2015-2016 which had affected food security in the country. According to the World Bank, (2017:2), "to mitigate the drought's impact on the agricultural sector, the government launched the Command Agriculture Programme, expanded public food for work programmes, [and] distributed seed and fertiliser for the poor". Farmers, including communal farmers, were supposed to benefit from agricultural inputs so as to boost production and ensure adequate food and nutritional security. The inputs provided to the farmers were to be repaid by delivering a greater part of the farmer's yield to the GMB at the end of the growing season, which was condemned by most farmers. The programme was also criticised as the military was used in the mobilisation and distribution of the required resources to farmers.

During this period, the government also tried to rebuild and extend the state's agricultural extension services, including to commercial farmers as well. On this basis, AGRITEX extension officers have provided knowledge on agricultural practices that are particularly suitable to sustaining agriculture in the context of climate change. However, the capacity of AGRITEX had deteriorated significantly over an extended period, dating back to the 1990s under structural adjustment. Currently, AGRITEX is underfunded and there is a significant shortage of experienced extension workers, as most have left the department due to poor

remuneration. This has had serious knock-on effects for communal farmers in particular (Ndlovu, 2011).

4.3 Zimbabwean Agriculture and Climate Change: the Case of Communal Areas

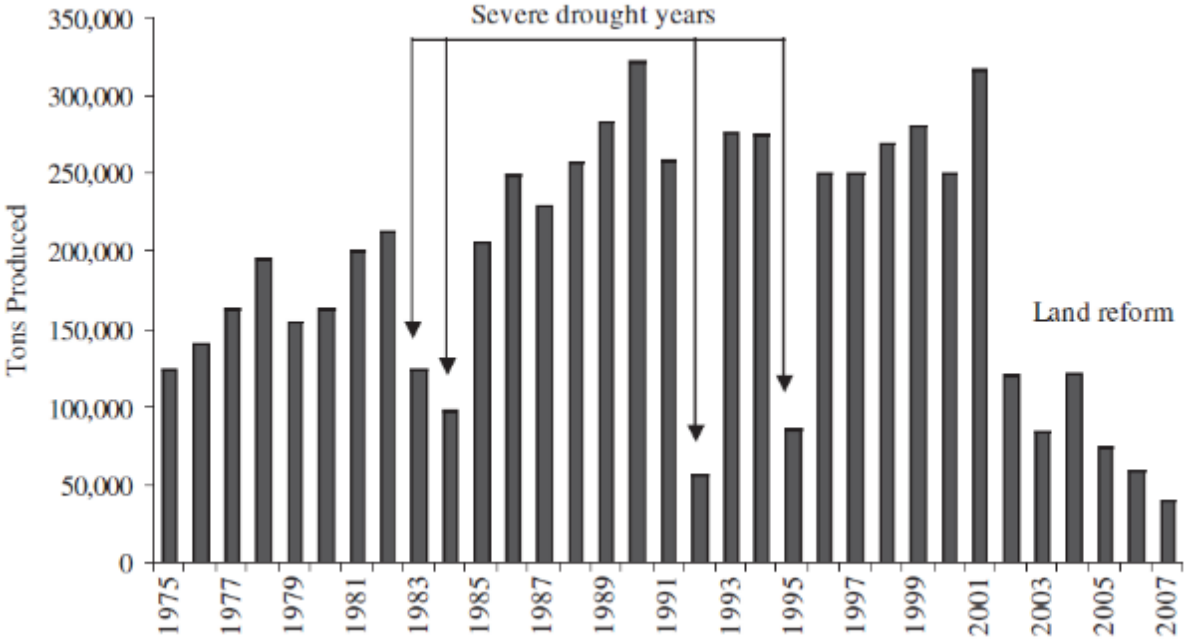
There is no doubt that agriculture in general (from commercial to small-scale farming) is very significant to Zimbabwe's national economy. In value terms, the agricultural sector (including commercial agriculture) has often been the largest single source of export earnings, contributing up to 40% of total exports at least before fast track (Mudimu, 2003; Poulton, 2002). Although Zimbabwe's agricultural exports fell between 54% and 74% during the period from 2000 to 2007, largely due to low production and productivity arising from fast track, in 2010 agricultural exports contributed US$487.4 million to the US$1,253.4 million total national export proceeds. This represented a contribution of 38.9%, as against 22.9% for the fuels and mining sectors and 33.7% for manufacturing. The main agricultural exports included tobacco, sugar, beef, horticultural produce, coffee, tea and cotton lint, with tobacco and cotton accounting for 83% in 2009 (Anseeuw, 2012). Kapuya et al. (2010) thus point out that the contribution of agriculture, in terms of food production and cash crop exports, has been the pillar of Zimbabwe's economic stability, with years of drought often coinciding with negative economic growth rates. The importance of the agricultural sector is thus reflected in the strong and direct positive correlation between agricultural performance and overall economic growth. Annual GDP for instance declined during bad agricultural years (the droughts of 1983, 1987, 1992 and 1995) and increased during years of good agricultural performance (including 1996 and 2009) (Kapuya et al., 2010; Poulton, 2002).

Contradictorily, given the significance of agriculture to Zimbabwe's economy, the agricultural sector has likely suffered more than any other sector. Reasons behind this include the effects posed by fast track, hyperinflation, capital constraints and government controls on markets (Anseeuw et al., 2012). For instance, wheat production (grown mainly by white commercial farmers) plummeted from a high of over 300,000 tonnes in 1991 to less than 50,000 in 2007 (Coltart, 2008). Figure 4.1 below shows how fast track land reform affected wheat production but also the ways in which drought can negatively affect even commercial farming.

Maize is the staple food for communal area farmers and it has always been grown by white commercial farmers (under irrigation) and communal farmers (typically, rain-fed). Following the FTLRP, large-scale commercial sector started to produce less than one-tenth of the maize that it produced in the 1990s. Figure 4.2 below shows maize production from all

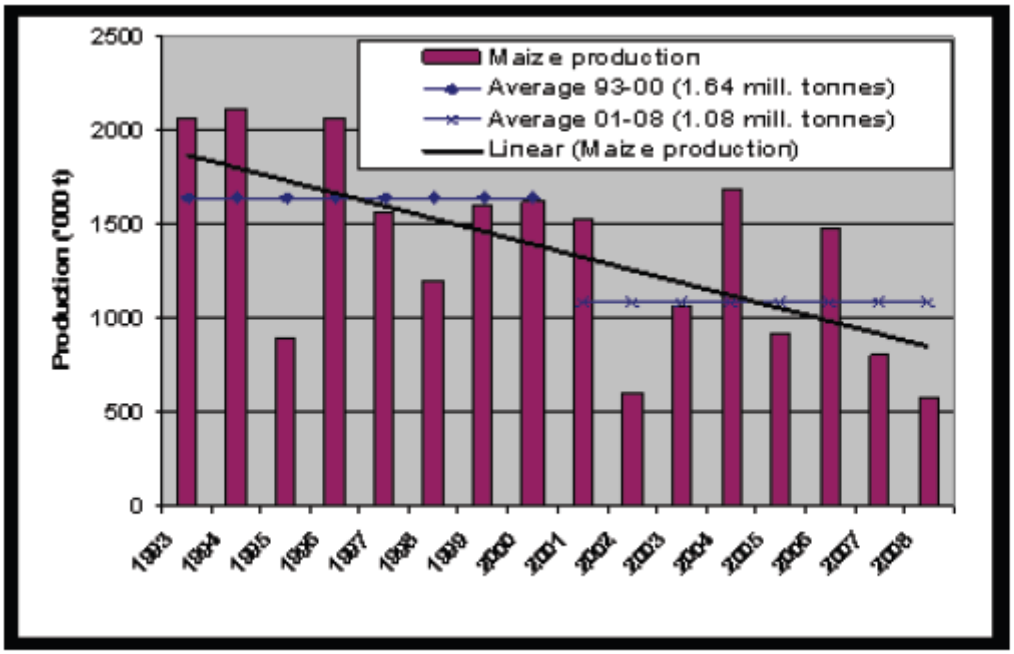
kinds of farmers for the 1993-2008 period, highlighting an overall decline since the early 1990s – this is a result of both fast track (and other political-economic variables) and climate change.

Figure 4. 1: Annual Wheat Production, 1957-2007



Source: Adapted from Coltart (2008).

Figure 4. 2: Zimbabwe Maize Production, 1993-2008



Source: Adapted from Chagutah (2010).

The political economy of Zimbabwe, as detailed in the previous section 4.2, has not been particularly conductive to enhancing the livelihoods of communal area farmers. As already implied in this section, when the question of climate change is introduced into the question, the challenges faced by communal farmers become even more pronounced. Climate change is having profound negative effects on the lives of communal farmers, particularly given that communal areas historically became located – comparatively speaking – in the semi-arid and arid regions of the countryside (agro-ecological zones IV and V) which are prone to drought. As it stands, deep poverty in Zimbabwe has been typically a rural phenomenon with high levels of poverty highly concentrated in the communal areas (Poulton, 2002; Chikwanha-Dzenga, 1999; Scoones, 2015). This of course is not to deny the extreme poverty which also exists in urban centres, particularly in the low-income high-density areas. In the case of communal areas, though there were significant efforts from the 1980s to enhance agricultural activities by means of small-scale irrigation schemes, the government has consistently failed to maintain irrigation and water management infrastructure (Thomas et al. 2016). This is despite the fact that the Zimbabwe Human Development Report (UNDP, 2017) points out that climate change is a major development challenge for Zimbabwe.

There is significant evidence that climate change, as evidenced by changing rainfall and temperature patterns, is very prevalent in Zimbabwe. Overall, the climate in Zimbabwe is tropical although markedly moderated by altitude. Mean annual rainfall ranges from 300mm in the low lying Limpopo Valley in the south to over 3,000mm per annum in some high mountain areas to the east. The rainy season normally occurs from November to March with a peak in January, during which rainfall exceeds 100mm over most of the country. The whole country is influenced by the Intertropical Convergence Zone during January. In years when this is not well-defined, there is below average rainfall and a likelihood of serious drought in the country (as happened in 1983 and 1992). When it is well-defined, rainfall is average or well above average, as in 1981 and 1985. However, such instances (as were experienced in 1981 and 1985) have been subject to change due to the effects of climate change – as the country is getting warmer, with dry hot days increasing. In this context, Unganai (2009) shows that rainfall in the country exhibits considerable spatial and temporal variability characterised by shifts in the onset of rains, increases in the frequency and intensity of heavy rainfall events, increases in the proportion of low rainfall years, decreases in low intensity rainfall events, and increases in the frequency and intensity of mid-season dry-spells.

Underlying all this is the fact that, decades ago, Zimbabwe was divided into five agro-ecological regions known as natural regions, on the basis of variables such as rainfall regimes,

soil quality and vegetation. The quality of the land resource declines from Natural Region (NR) I to NR V (Mafu, 2008). However, climate change has affected rainfall regimes, soil quality and so forth, leading to an increase in the sheer size of semi-arid and arid areas in the country and thus affecting crop production possibilities. This entails a shift in the location of Zimbabwe's five main NRs (Brown et al., 2012). Chikodzi et al. (2013) argues that, as a first step in addressing climate change in Zimbabwe, it is necessary to reclassify the NRs. The current zones developed in the 1960s have become redundant, out-dated and cannot be used to plan sustainable agriculture in the light of changing rainfall and temperature changes.

Rainfall and temperature patterns and crop production have progressively deteriorated from Region I to V. For instance, Chinhoyi and Chibero and their surroundings have shifted from natural region II to natural region III while Kwekwe and its surroundings have shifted from natural region III to natural region IV (Brown et al., 2012). Thus, for instance, what crops could be grown previously around Chinhoyi and Chibero has now become more difficult if not impossible. Sub-national studies have further shown the effects of climate change. For instance, Simba et al. (2012) show that climate change is a reality in Masvingo with temperature increasing and rainfall decreasing over time and the province being characterised by extreme events in form of droughts. They discovered that rainfall in Masvingo Province is insufficient to support crop production and this confirms other studies (UN, 1998) which demonstrate that province will be a non-maize producing region in the future.

There are several studies that provide evidence to the existence of climate change in Zimbabwe. Unganai (1996) has shown that annual rainfall has declined by 10% during the 1900-1994 period, and others have concurred though with some differences (Brazier, 2015; Chagutah, 2010). Others relate changing rainfall patterns to increases in average temperatures in the country (Mubaya, 2017). Records have shown as well that since 1900 average annual surface temperature has increased by 0.4^0C (Brazier, 2015; Chagutah, 2010). Also, it has been observed that, at the beginning of the agricultural season, more rain than average is occurring and less rain than average is being received between January and March. Droughts and floods have increased in frequency since 1990 and are occurring back-to-back with a flood year immediately following a drought year.

According to Mudzonga (2011), the Zimbabwe Department of Meteorological Services has shown that Zimbabwe is now experiencing more hot days and fewer cold days and that the amount of precipitation it receives is deviating from the mean more frequently than it used to be before 1950 (Brazier, 2015). By the end of the twentieth century, Zimbabwe was a warmer and drier country than it was at the beginning, and the 1990s are on record as the warmest and

driest decade of the last century. Rainfall variability has largely increased with late rains or very early rains. Extreme weather events, namely tropical cyclones and drought, have also increased in frequency and intensity. On average, one to three droughts occur every ten years, largely due to changes in the phases of the El Nino-Southern Oscillation (ENSO) phenomenon and periodic sea surface temperature changes (Chagutah, 2010).

Flooding and droughts are a common problem in Zimbabwe where they threaten the well-being and food security of Zimbabweans, especially in rural areas (Gwimbi, 2009; Mazzeo, 2011). In Zimbabwe, currently 75% of the population reside and practice agricultural production in semi-arid areas where they largely depend on rain-fed agriculture which is subject to failure about twice out of every five years due to low and erratic rainfall (Chitata et al., 2014). Between 1980 and 2010, PreventionWeb (2012) documented 35 natural disaster events, which resulted in 6,448 deaths, averaging 208 deaths from disaster annually. The report adds that, of the 35 natural disasters, 6 were drought occurrences, 7 were floods, 2 were storms, and 20 were epidemic occurrences. Zimbabwe was affected by droughts in 1982, 1991/92, 2001/2002 and 2007/2008, 2012 and 2014/2015. In the 1991/92 agricultural season, Zimbabwe experienced the worst drought in living memory, with complete failure of crops and devastation of the livestock sector that rendered most areas as semi-deserts.

In general, if agricultural production systems are affected by drought, rural people's livelihoods are heavily impacted upon as subsistence farmers fail to sustain themselves. Food shortages in Zimbabwe in fact have become a perennial feature resulting in a high prevalence of undernourishment estimated at between 30 and 54 per cent between 2006 and 2012[8]. Food security, which is a broad concept that encapsulates availability, access and utilisation of foodstuffs, has been undermined. Climate change and variability destabilises food production in Zimbabwe and – in 2011/12 season – the country was forced to import over 50% of maize from other countries in order to meet the needs of its citizens (Manyeruke et al., 2013). Agriculture's sensitivity to climate-induced water stress is likely to intensify the existing problems of declining agricultural outputs, declining economic productivity, poverty and food insecurity, with communal farmers particularly affected (Brown et al., 2012). However, small-scale farmers on A1 fast track farms are experiencing similar challenges.

Chikodzi et al. (2013) rightly argue that extreme weather events in Zimbabwe, notably droughts, floods and tropical storms, threaten any development gains pursued by the Zimbabwean government across a variety of sectors, as well as intensify existing natural hazard

8https://www.newsday.co.zw/2015/11/17/climate-change-ignorance-threatens-food-security-in-zim/

burdens for the vulnerable populations in both rural and urban areas. The occurrence of drought, in the past years, has had implications on the wider Zimbabwean economy as, for example, many people were laid off from their employment, which resulted in the erosion of income for the country (FAO, 2004). Thus, the economic effects of the 1991/92 drought were also felt outside the agricultural sector. Largely as a result of the drought, through water and electricity shortages, manufacturing output in Zimbabwe declined by 9.3% with a 25% reduction in volume of manufacturing output and a 6% decline in foreign currency receipts (SADC-IUCN-ZRA-SARDC, 2000). Serious reductions in agricultural output resulted in reduced economic growth and the loss of the much-needed foreign exchange normally derived from agricultural exports (Chagutah, 2010; CEEPA, 2006; Anseeuw et al., 2012).

The predicament caused by drought in Zimbabwe is extreme, contributing to underdevelopment of the country in most respects. Drought has its greatest impact on water supplies. Lack of water affects every aspect of environmental health and human activity, including agriculture, natural areas and development projects[9]. The 1991/92 drought in Zimbabwe killed more than one million cattle. Drought leads to overgrazing which furthers the degradation of pastures and arable areas and thus reduces livestock numbers. The severe 1991/92 drought in fact led to extensive commercial farm retrenchments, adding to ESAP-induced retrenchments, and increased pressure on arable land and natural resources in communal spaces (Moyo, 2000). Numerous droughts continue to affect the country. In May 2007, the Famine Early Warning System Network (FEWS NET) reported that prolonged dry spells during the 2006-2007 harvest season in most southern districts had contributed to low yields of maize in particular. Protracted economic decline, exacerbated by the poor 2006-2007 harvest, caused a significant decrease in Zimbabwe's food security, especially in the south-west of the country and in urban areas (FEWS NET, 2007).

The post-2013 period in Zimbabwe has been marked with droughts which took place during the 2014/15 season and the 2015/16 season. In 2014/15, delayed and inadequate rains resulted in late planting and wilted crops (FAO, 2016). The 2014/15 cropping season was poor, such that households had lower maize reserves and had to rely more on markets to access food (FAO, 2016). At that time, Zimbabwe's future appeared precariously poised on an edge as two consecutive years of poor rains, compounded by El Niño, have resulted in the worst drought in 35 years (Scoones, 2015). With at least 70% of the population relying on agriculture for their livelihoods, the effects of El Niño are increasingly having a direct and major impact through

9http://www.ess.co.at/GAIA/CASES/ZIM/drought.html

loss of income from crop and livestock value chains, as well as alternative income-generating opportunities for vulnerable people in communal areas and elsewhere (FAO, 2016). Drought conditions, in mainly the southern provinces of the country, have consequently had a negative impact on livelihoods and aggravated food insecurity (FAO, 2016). Scoones (2015) stipulates that, by January 2016, at the height of the 2015/2016 lean season, 30% of the rural population was reported in need of humanitarian aid and the country's Global Acute Malnutrition (GAM) rate for children under five had reached 5.7 %, its highest in 15 years. He adds that, more than 23,000 head of livestock perished due to lack of water, pasture, or drought-related disease. The government declared a disaster appealing for US$1.5 billion in national and international assistance (Scoones, 2015).

4.4 Climate Change and Adaptation in Zimbabwe

This section outlines literature on climate change adaptation studies in Zimbabwe and the gaps that this study seeks to fill. Certainly, there has been some important research undertaken on climate change adaptation in Zimbabwe, though the focus has been on macro-level (national) issues instead of micro-level studies. Numerous national studies of agricultural productivity risks arising from climate change and variability, and well as the importance of adaptation, have been undertaken in Zimbabwe and indeed in other southern African countries (Downing, 1992; Matarira et al., 1995; Kinuthia, 1997; Mano and Nhemachena, 2007; Buckland, 1997; Mendelsohn, 2000). As well, systematic research on Zimbabwe has been undertaken on key sectors through the United Nations Framework Convention on Climate Change (UNFCCC) planning process, but this research has tended to downplay the significance of micro-level vulnerability to climate change processes (Chagutah, 2010).

Though climate change and adaptation are universal phenomena, the indicators and manifestations of climate change are entirely local, and so are climate change perceptions and adaptation choices and practices. In other words, climate change is a global phenomenon but adaptation is a local phenomenon (Zimbabwe NCCRS, 2015). In this respect, as implied in the previous section and as noted as well by Simatele et al. (2012), certain areas of the Zimbabwean countryside and certain categories of farmers are particularly sensitive to the wide-ranging implications of climate change, making it therefore crucial to understand issues pertaining to adaptation at local levels (Hellmuth et al., 2007). Brazier (2015) adds that studies on adaptation to climate change must be localised as different forms and levels of vulnerability exist, with serious implications for the adaptation measures most appropriate for specific locales.

Chagutah (2010) further points out that, in comparison to climate change studies in general, more specific literature on actually-existing adaptation measures in Zimbabwe is quite limited. This is also the case when it comes to examining adaptation strategies at household level (Mtisi, 2012). Studies which seek to investigate climate change and variability at localised levels in Zimbabwe concur that climate change has altered rainfall patterns, amplified drought cycles, increased the frequency of severe weather conditions and increased agricultural pests and diseases (Makhadho, 1996; Unganai, 1996; Hewitson, 2010; Chikova et al., 2013). In a study done by Dube et al. (2013) in Matobo District of Zimbabwe, it was discovered that climate change (including declining precipitation and rising temperatures) had altered the ecological features of the area, leading for instance to the disappearance of certain flora and fauna and specific natural habitats which had, in the past, contributed to the livelihoods of the local people – the result was enhanced food insecurity.

Seeking to identify climate change specificities at local level and how, therefore, climate change has differential effects spatially, leads to a recognition of the necessity for understanding the relationship between climate change and localised forms of adaptation, including by communal farmers (Brazier, 2015). This also requires, as Chikodzi et al. (2012) note, considering the manner in which farmers perceive climate change as well as their capacity (and willingness) to do so. In this respect, there is only minimal focus in the Zimbabwe literature on the views and perceptions of small-scale farmers of climate change and how their adaptation activities are mediated by conceptions which arise from a deep historical knowledge and experience of their localised existence (Mazvimavi, 2010). Given this, place-specific research methodologies (such as life histories) are crucial for understanding the intricacies of climate change conceptions and vulnerabilities along with adaptation resources, capacities and activities (Hassan and Nhemachena, 2008; Deressa et al., 2011), as this thesis seeks to demonstrate. This entails an examination of local constraints and enablements in relation to climate change adaptation by small-scale farmers (Mutekwa, 2009; Nhemachena and Hassan, 2007).

Of course, to recognise the importance of climate change conceptions amongst small-scale farmers does not imply that these conceptions (in large part, based on lived experiences) necessarily capture the full complexities of climate change let alone the multi-faceted causes of climate change and variability. Communal farmers in Zimbabwe for instance may observe changes in weather patterns but they may interpret these as short-term fluctuations rather than as invariably part of long-termer trends in local climate (Moyo et al., 2012; Chikodzi et al., 2012). Hence, there may be a tendency for farmers to view the effects of climate change in the

light of normal seasonal climatic variability (Chagutah, 2010). Nevertheless, insofar as farmers pursue adaptation at least in part based on local knowledges, then their localised conceptions need to be prioritised in considering local-level adaptation (Chikodzi et al, 2012). Whether these conceptions are accurate or not, and whether or not these conceptions lead to inappropriate choices with regard to farming methods, and crop and seed varieties, becomes largely irrelevant for analytical purposes.

Some studies on Zimbabwe have sought to examine adaptation strategies of farmers in the context of climate change conceptions, noting the ways in which farmers construct and use knowledge of weather systems (such as rainfall, thunderstorms, windstorms and sunshine) to prepare for the agricultural season. In a study for example done by Zvigadza et al. (2010) in Munyawiri ward in Domboshawa, it was discovered that farmers interpret very cold winter seasons as leading to a proper rainy season. Elderly farmers in the area thus made reference to the flowering of certain wild fruits, the ways birds made their nests and the mating of certain animals as indications of how a particular season would transpire. If birds built their nests near to the ground it meant that the rains would be inadequate; if built high off the ground, the coming rains would be good. They prepared their agricultural activities by taking these factors into consideration.

In another study done in Ward 2 of Bikita by Mushore et al. (2013), it is shown that drought was a serious problem and local farmers were pursuing a range of drought mitigation strategies, including with the assistance of government and NGOs through the provision of food aid and food for work. These of course are mere coping strategies but other possible arrangements (including remittances and irrigation) were even less significant in ensuring that communal farmers could handle their climate-induced vulnerabilities. Whether or not communal farmers have the capacity to adapt without any outside intervention becomes crucial in this regard, as Masika (2002) points out. A crucial problem in this regard for communal farmers is the sheer dearth of institutional capacity amongst relevant state departments in Zimbabwe. Because of this, communal farmers often rely on their initiatives and capacities.

In certain cases, though, NGOs become quite central to farmers' adaptation strategies. Burns et al. (2007) undertook an impact assessment study of Zimbabwe's dams and gardens project using Chivi district as the case study. The Zimbabwe dams and gardens project is a community-based famine prevention implemented by the NGO Care in Masvingo Province. A key goal is to improve the quantity and quality of food that is produced by very vulnerable households in specific drought-prone areas of the country. The project uses an integrated community-based approach which includes repairing dams, establishing irrigated gardens,

training programmes in crop management issues and forming savings and loan groups. The project is said to have achieved, amongst other successes, improved food security at household level and enhanced water access for livestock. At the same time, like other NGO projects, the project's implementation led to local tensions, as other less vulnerable groups felt excluded and sometimes stole produce from the project (Burns et al. 2007). At times, these tensions exist for other reasons as well. Thus Zvigadza et al. (2010), in a study in Munyawiri, note a range of coping and adaptation strategies including growing drought-resistant crops, roof-top rainwater harvesting and the diversification of livelihood activities away from agriculture. At the same time, they note that traditional leaders in the area (possibly under instructions from the government's Environmental Management Agency) are promoted resource management practices which include protection of riverine vegetation and forests, and the prevention of wildfires. However, the communal farmers tended to ignore these instructions, in part because their interfered with their livelihood activities.

Possibly more often than not, communal farmers pursue adaptation strategies or their own or without significant outside interventions. In the case of Muzarabani situated on Zimbabwe's northern border with Mozambique, droughts and floods are common and the area is becoming drier. A study of this area by Chanza (2015) revealed that short-term coping practices and long-term adaptive strategies based on indigenous knowledge are being adopted. Drought-coping measures include wild fruit harvesting, dry planting, conservation agriculture, planting drought-tolerant small grains, and traditional food storage and processing techniques. Farmers are also implementing flood-coping measures which include traditional flood-proof building designs, dual-season cropping and temporary migration. Other studies (Mano et al., 2007; Chikodzi et al., 2007; Tshuma et al., 2012) focusing on specific communal areas (such as in Mangwe) likewise highlight a range of coping and adaptation strategies, including changing planting dates, growing drought resistant crops and water harvesting.

As early as ten years ago, Nhemachena et al. (2007) were able to identify a diverse range of adaptation measures pursued and implemented by communal areas around the country, such as: crop diversification, varying planting and harvesting dates, irrigation, different crop varieties, diversifying from farming activities to non-farming activities, shortening the length of the growing season, dry and early planting, using zero fertilizer, minimum tillage, multiple cropping, water harvesting, growing drought resistant crops, short season varieties of crops, irrigation and winter ploughing. One of the key issues arising from the Zimbabwean literature on climate change and small-scale farmer adaptation is its under-theorisation, particularly in relation to sociological theorising. In this respect, there is only one study available on

Zimbabwe which seeks to bring to bear on the subject, and in an explicit manner, insights deriving from sociological. This is the study undertaken by Bhatasara (2015) focusing on Mutoko district, in which she drew upon the work of Archer and examined the ways in which communal farmers frame, problematise and respond to local climate changes. Like her study, this thesis therefore seeks to strengthen the pertinent Zimbabwean literature by drawing upon the sociological insights of Archer.

4.5 Conclusion

In conclusion, this chapter has sought to consider small-scale farmer adaptation in the communal areas of Zimbabwe in the context of the broader political economy of the country and in the face of climate change trends and effects in rural spaces. The political economy was traced from independence up until the current situation as the thesis is a contemporary study of communal farmers in Ngundu, but one which considers their predicament with some historical depth. Likewise, when looking at climate change in Zimbabwe, trends and effects were traced historically. In this light, a review of literature was provided which indicates that, as with elsewhere, small-scale farmers in Zimbabwe (and communal farmers in particular) seek ways and means of defending their rural livelihoods by adopting climate change adaptations. Having presented the theoretical framing for this thesis, along with climate change and small-scale farmer adaptation globally and then with reference to Zimbabwe, the thesis now turns to the study of Ngundu farmers specifically.

CHAPTER FIVE: NGUNDU FARMERS AND THEIR LIVELIHOODS

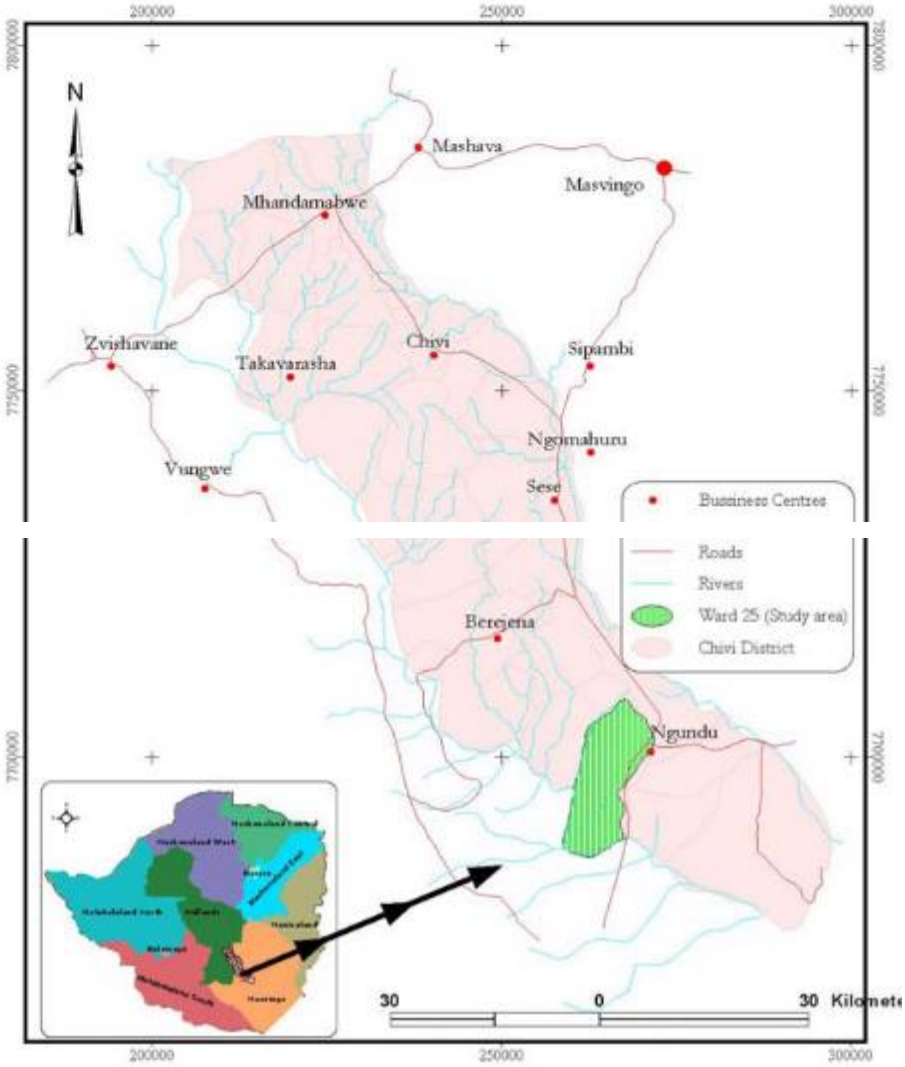
5.1 Introduction

This chapter is the initial empirical chapter of the thesis. Before examining climate change adaptation in Ngundu specifically, it is first important to provide an overview of the research site (Ngundu), including the way in which I became familiar with the area (section 5.2). Though Ngundu has many of the characteristics of any other communal area in Zimbabwe, specifying is history, culture and politics is important for the reader in order to more fully comprehend the lives of Ngundu farmers. In the next short section (section 5.3), I provide a profile of the Ngundu farmers who participated in this study. In section 5.4, there is a lengthy discussion of the livelihood activities of Ngundu communal farmers, including both their agricultural activities and non-agricultural activities, with this section showing some degree of diversification in livelihood strategies. Section 5.5 then goes on to highlight that, like all rural communities, Ngundu is heterogeneous. This is of significance as the effects of climate change and the capacity to adapt is likely to vary across households when wealth categories are considered. In this way, the chapter addresses the first secondary or subsidiary objective of the thesis, which is to examine the livelihood strategies of Ngundu farmers.

5.2 Overview of Ngundu Ward

The study area, Ward 25 and commonly known as Ngundu, is situated in Chivi District and it is one of the 32 wards that make up the District. It surrounds Ngundu Growth Point (GP) and the local people carry out their business at this centre. It is approximately 146km^2 (Mutekwa et al., 2006) and is comprised of 39 villages. The total population is 10,893 (ZimStat, 2012). The ward has the highest number of poor households in Chivi district (amounting to 1,544 households), with non-poor households amounting to 916 (Zimbabwe Poverty Atlas, 2015). Poverty prevalence in the ward is 62.8% and the ward has a total of 2,460 households (Zimbabwe Poverty Atlas, 2015). The average household size is 4.3 persons per household. The ward has more females than males following the national distribution pattern. There are 6,059 females and 4,834 males (ZimStat, 2012). Map 5.1 below shows where Ngundu is situated.

Map 5. 1: Map showing Ngundu (Ward 25)



Source: Mutekwa et al. (2014).

5.2.1 Ngundu Growth Point

This section outlines and details the ward from my own understanding. I begin by discussing one of the most famous places in Zimbabwe, which is Ngundu Growth Point (NGP) where significant commercial and other activity takes place. The NGP (also known as Ngundu Halt) is surrounded by villages in Ngundu which include Pedzisai 1, Nduna 1 and Guti which are the focus of the study. The popularity of the NGP cannot go unmentioned when seeking to understand the Ngundu area. Picture 5.1 below provides a photograph of the growth point.

Picture 5. 1: Map showing Ngundu (Ward 25)

Source: Fieldwork October 2015

NGP is one of the most well-known areas in Zimbabwe particularly to those who use the Beitbridge-Masvingo road. The major contribution to its popularity is its location. The fact that it is situated in the Beitbridge-Chirundu road corridor, which is a Trans-African highway network and one of the country's busiest highways and the gateway to neighbouring countries, makes it a point of stop for numerous travellers. In addition, the area was established as a Rural Highway Service Centre considering that it is the spot from which all routes to major cities such as Bulawayo, Harare, Chipinge and Mutare meet, therefore enhancing its popularity. The area is one of hyperactivity, a fully packed area filled with busy people as long distance buses, trucks and private cars all stop at NGP and conduct various business with the locals. Although the NGP is situated in a rural area, its strategic position ensures that it is not a remote area, as it provides opportunities for the local people to mingle with various people from different places and countries. Its proximity to South Africa (191km) has also made it possible for locals to become cross-border traders and bring goods from South Africa for resell in Ngundu. It therefore provides a ready market for informal traders to sell their wares by the roadside as well as flea markets as a way to supplement their incomes. One would presume from this that both the GP and the people surrounding it would be better-off materially, considering the opportunities of conducting business along the busiest highway intersection of the country. However, this is not the case as the area is considered to be one of the areas in Zimbabwe

affected by significant poverty and it is also ranked high in cases of HIV/AIDS and sexually-transmitted diseases in the country.

The popularity of the place entails a situation whereby most Zimbabweans have heard of the place one way or the other. I became aware of NGP through other people who passed by the area, especially the cross-border women traders who used the highway route on their way to South Africa. I became acquainted with the place in 2012, when I was coming from South Africa and stopped at NGP. My expectations from what I had heard from various people and what I saw on the ground were totally different. I observed how NGP was a busy place full of people conducting different kinds of businesses. Vendors were running to every vehicle that stopped, selling their goods including drinks, biscuits, drinking water, sweets, wild fruits and much more. Informal markets with plastic shades lined up the road with different commodities on display. Kombis, cars, trucks and buses were also in long queues along the main tar road facing different directions.

My other observation was the scorching heat that made a continuous chain of sweat run down my back. As I moved in search of a cool area to hide away from the sun, I observed that the area had lots of markets and vendors. The extent of the various market places reminded me why the place was popular among the people. On the left side of the NGP along the highway road to Beitbridge, there were men who were making and selling pillars, fence making, welding, and selling cement and bricks. As I moved further inside the growth point, I saw more flea markets and shops that sold several goods that ranged from buckets and electric gadgets to various types of clothes. Picture 5.2 below gives a highlight of what I saw.

I followed most of the passengers from the bus who were already moving around the markets. At some point I forgot about the scorching sun as I scrutinised the place in moving around the flea markets. However, as I looked at the flea markets, I saw the same items on sale all over the area i.e. clothes, buckets and electric gadgets as shown in Picture 5.2. Unfortunately, I could not bring myself to buy anything as I had seen most of these goods at Messina (along the South African border) and I had already bought some of the goods there. It was only through this observance that I came to notice that most of the goods that were being sold here were from neighbouring South Africa. If I was going to buy something from NGP, I had to buy something that I considered to be unique and maybe new to me. Hence, I decided to go in search of different markets that sold different kinds of commodities.

Picture 5. 2: Items Sold at the NGP Flea Markets

Source: Fieldwork.

As I come from an urban area, I have always been attracted to local farm produce that I could not get access to in cities and towns. As I looked around the area, I could not find any unique farm produce that was particularly found in Ngundu. This was a different scenario from what I was used to. Whenever I travelled other routes that passed through rural areas like Chipinge, Buhera and Nyanga, I would come across local people selling different farm produce that was associated with the area, for instance yams (*madhumbe),* goose berries, apples, bananas and so on. NGP was different since I realised that there was really no local farm produce. I wanted to understand the reason for the absence of such commodities, considering that rural people are known for their attachment to their land and their agricultural activities. It was only after asking one of the local women who was selling vegetables that my intrigue for carrying out research in Ngundu emerged. The woman explained that local farmers could not sell any of their farm produce as they failed to harvest anything from their fields. This was because of insufficient rainfall that they had been experiencing in the past few years, worsened by a chain of droughts and floods. She further explained that only a few farmers who had children or relatives who sent remittances back to Ngundu had access to financial capital and could open markets at the growth point. She also made me to understand that most of the people who were selling buckets, electrical gadgets and so forth were actually from other places like Beitbridge. Questions such as 'how the Ngundu people are surviving when they are having difficulties due to extreme weather events' stimulated my interest in the area and indeed triggered this research.

5.2.2 Oral History of Ngundu (Ward 25)

In trying to understand the history of Ngundu, I was fortunate enough to have an in-depth interview[10] with Chief Mutote Mutote[11] and his uncle Mr Madzivire. I was informed about the establishment of Ngundu through oral tradition as they had also been told by their grandfathers. Chief Mutote Mutote from the Madzivire family is from the *Beta* totem. The history of Ngundu can be traced from the Madzivire clan who were the first chiefs of the area. Madzivire and his two brothers, who were Shindi and Gororo, came to Ngundu in search of a place to stay in pre-colonial Zimbabwe. This was around the time of the Ndebele uprisings in 1869. They had an uncle, named Ngundu, who had already settled in the Chivi area (which is currently in Nyajena now and is about 30km from Ngundu). When they visited where he was staying, Ngundu pointed them to continue going south as there was a finer place where they could settle. The brothers continued and when they came across Chirongwe Mountain, they decided to occupy and settle around the area. However, they could not occupy all the land they wanted as they realised that some of the area was already occupied by the Ndebele people.

The two brothers Madzivire and Shindi together with their people decided to fight the Ndebele for the land while Gororo the eldest of the brothers decided not to join the war as he was satisfied with the piece of land he had already taken. The two (Madzivire and Shindi) brothers managed to drive most of the Ndebele[12] away from the area and occupy the land. They shared the land between the two of them leaving Gororo with a smaller piece of land than the other two. Madzvivire occupied all the surrounding area of what is now commonly known as NGP and in which Ngundu/Ward 25 is found. Shindi occupied another area bordering Madzivire's land to the east of NGP. Madzivire became the chief and he called himself Chief Mutote Mutote.

Noteworthy is that the area where Chief Mutote Mutote settled had four highway roads that met, making a crossroad that was strategic; and it later saw the development of a railway station in colonial Zimbabwe. The railway station catered for the white farmers who came from Triangle[13] to get their goods therefore making it a good place to conduct business. One man[14] from the Ngundu family, when he realised that Chief Mutote Mutote and his people had settled surrounding the crossroads, decided to take the opportunity to pursue a business. He opened a

10 Interview held with Chief Mutote Mutote and Mr. Mszivire in October 2015
11 Chief of the aea takes the title Chief Mutote Mutote.
12 Currently in ward 25 only one village is occupied by the Ndebele.
13 Triangle is a well-known place in Zimbabwe where sugarcane is produced.
14 A relative of Ngundu, an uncle, who was the one helping them to settle when they first came, and is also from Madzivire's grandfather's family.

shop and started selling commodities to the local people. He became popular among the local people and when the people went to the shop they would just say we are going *'KwaNgundu'* (to Ngundu). The area's popularity increased when a Greek man called Paul, locally referred to as '*SiPauro',* in 1939 also took advantage of the place and constructed some shops that still stand up to today. This began the development of the NGP, at least unofficially. Although Zimbabwe was colonised in this period, the white people who started the developments at NGP respected the traditional chiefs of the area and consulted the chiefs first before doing any construction in the area. During the time that Paul was developing the area, Mr Madzivire was doing standard 3 at Jaka School.

Paul would make it his mandate to meet with the local chiefs on a yearly basis and he would provide them with blankets among other things. The District Administrator at the time was a man called Tom, who the local people called '*mutandewachinganwa'* (a person who demanded respect) and, in Mr Madzivire's words '*waida kufamba achiuchirwa'* (he wanted people to clap for him when he was walking). As time progressed, Paul wanted to expand and clear the area but Chief Mutote Mutote refused. The chief told him that he had to consult '*majinda amambo'* (the Chief's men) who were living in the surrounding area. Paul respected this and *majinda amambo* were called and he had a three-day meeting with them. Chief Mutote Mutote and *majinda amambo* permitted Paul to clear the area except for the local mountain called Chirongwe which they said belonged to their '*tateguru'* (ancestral spirit). Paul also respected that and the mountain was preserved. Even today the mountain is sacred and no one is allowed to cut trees in the mountain. Then later on came another white man called TMP who constructed two stores. Chief Mutote Mutote during the time stayed near NGP but later on moved to Chamakwe Mountain where the current Chief Mutote Mutote resides. The area speedily developed as people continued to come and settle. Up to today, Ngundu has remained popular and NGP is a well-known stop over for travellers.

5.2.3 Ethnicity, Gender Relations, and Authority

The three villages I chose for this research (namely Pedzisai 1, Nduna 1 and Guti) surround NGP. Pedzisai 1 and Guti are about 1km walk to the NGP while Nduna 1 is a distance of about 4km. Map 5.2 below, drawn by the Councillor, shows Ngundu area with the three villages, Pedzisai 1, Nduna 1 and Guti.

Map 5. 2: Ngundu Map

Source: Fieldwork October 2015 (map drawn by councillor).

During an interview[15,] Mr Tinago (the councillor for Ngundu) pointed out that Pedzisai 1 is made up of 160 households, with Nduna 1 having 100 households and Guti having 96 households[.16]. The population in Ward 25 is mostly made up of the Karanga people, with an insignificant percentage of Ndebele people who occupy one village. There are also the Venda and the Shangani people, who again are an insignificant percentage, who came from South Africa due to the proximity between Ngundu and Messina. The dominant language in Ngundu is Shona. Ngundu is a patriarchal society with males dominating most leadership positions in the political and social arena. There are no female leaders in Ngundu and all village heads are males. The Ward faces the challenge of gender inequalities with females only taking the lead in ceremonies like beer making. However, non-government organisations like CARE are trying to assist in addressing the gender gap and undercut female inferiority. They are doing this by allowing women to lead in most of their development projects. This is giving women confidence and removing the situation in which women only participate in the social arena,

15 Interview held with the councillor in October 2015.
16 It is difficult to get the actual number as some households would be settling in the area without updating the records, so the actual number usually exceeds this official one.

thus trying to incorporate them into the economic and political arenas. The administration in Ngundu follows the Zimbabwean pattern found in all rural areas. At the apex is the District Administrator or DA (Mr Hlabati), followed by the Chief (Chief Mutote Mutote), then followed by the Kraal Head and the Village heads, with commoners at the bottom. The Chief interacts with the people at a ward level with the help of councillors (Councillor Tinago). He gets information pertaining to, for instance, development issues from the DA.

5.2.4 Natural Resources, Dynamics of Wealth and Infrastructure

As highlighted before, Ngundu is situated in Natural Ecological Region IV and V making it a semi-arid area. Ngundu is prone to poverty and food insecurity due to severe droughts and floods that occasionally occur. The area contains natural forests and common grazing areas which have become fragile due to over exploitation. Indigenous trees like musasa (*brachystegia spiciformis*), marula (*sclerocarya birrea*), mukwakwa (*strychnos madagasca-rensis*) and mupani (*colophospermum mopane*[17]) are found in the area. They are very limited minerals in the area, with gold being the only mineral found. There was the discovery of gold at Dare and Chasiya which has led people to engage in illegal mining in Ngundu. Some villagers also mine in Runde River looking for minerals like gold.

In terms of infrastructure, there is a hotel called Rocky Motel which is situated along Beitbridge road, as well as Lundi Motel. The area has 3 dams namely Mupfingu dam, which is 10km from NGP, Banga dam which is 6km from the growth point, and Dare dam which is 10km from the growth point. There are numerous rivers: Runde River which serves the whole of Ngundu, Chivake River which passes through Guti and Nduna 1, and Banga River which has more water carrying capacity than all other rivers. There is an irrigation scheme at Banga dam, called Banga irrigation, which is located in a nearby village but surrounding people including those from Pedzisai 1, Nduna 1 and Guti also benefit from the irrigation. All the three villages under study have boreholes but most of the boreholes are not working. There are 30 boreholes in the ward with only 23 boreholes properly functioning.

There is a District Development Fund (DDF) in Ngundu which is 10km from NGP. Tokwe Mukosi[18] dam is 29km from NGP. Ngundu Rural Health Centre Clinic is found at the NGP and is situated 800m from the main road. NGP is considered a health-hazard time tomb

17 Mupani is most popularly found in semi-arid areas due to the fact that it is drought-resistant.
18 This is a topical dam in Zimbabwe which was in the headlines recently due to political connotations that were aligned to it during its construction.

that has already begun to erupt. Its situational position has made it a zone of attraction including for sex workers, which adds to its popularity. The Health Centre is constantly attending to numerous HIV related illnesses along with sexually-transmitted diseases. There are organisations like Southern Africa HIV and AIDS Dissemination Service (SAFAIDS), Batanai HIV and AIDS Service Organisation (BHASO) and National Aids Council (NAC) which have operated in the area in trying to advocate for safe sex practices. Although the Health Centre's clinic is small, the people of Ngundu consider it as a hospital as it caters for significant numbers of people and it also has a maternity ward for pregnant women. There are other clinics like Gororo clinic which is 12km from NGP along the Chiredzi road, Chasiya clinic which is 23km from the growth point and Shindi clinic which is 12km away from the growth point. A single police station is situated at Ngundu business centre. Further, it is imperative to note that there is electricity at the growth point, which makes life easier for the people.

There is also a Depot for Delta Beverages making life entertaining for the Ngundu people. The depot caters for all the beer near NGP including those in the resettlement areas of Nyahombe. Truck drivers also stop for the night and are one of the frequent customers. According to one respondent during an informal conversation:

> *Doro rinotengwa pano chose. Pano ndipo pane mafaro ese*. [People buy lots of beer here and it is a jovial place.] (Informal conversation, October 2015).

In terms of education, there are 4 schools in Ngundu ward namely: Ngundu high school, which is 5km from the growth point; Madzivire primary school; Mutote primary which is 10km from the NGP and Runesu primary which is 23km away. Education is regarded as very important by the people even though there are many constraints which inhibit the possibilities of attending school. A significant number of children in the area though attend school and most of the residents one way or the other have some form of education.

5.2.5 Culture and Social Organisation

The ward still carries on many of its traditional beliefs which can be traced back to the pre-colonial era. Thus, beliefs such as the existence of sacred places are still present in the area. The people, with the elderly constituting a higher number, still believe in and carry out their traditional practices. According to Mr Madzivire, in an in-depth interview:

> *Tine gomo risingatemwi miti rinonzi Chirongwe. Ukatema muti haubudimo unoswera uchitendera.* [We have one sacred mountain called Chirongwe Mountain. It is forbidden

to cut any tree in the mountain and if you do so you will not find your way out of the mountain]. (In-depth interview with Mr Madzivire in October 2015).

The local people abide by these laws and the mountain is considered as sacred. Another mountain that carries a specific historic significance in the area is called *Dare*. *Dare* is a Shona name which depicts a place where men meet discussing important social, economic and political affairs in their area. The mountain carries historical significance as it was the mountain at which the first three brothers (Madzivire, Shindi and Gororo) used to meet and discuss important political and social issues. According to the Councillor:

> *Rakakwirira kudarika mamwe ese makomo, saka vaikwanisa kuona kuti vavengi vanokwanisa kubva nepi.* [The mountain is a strategic point because of its height. The height made it possible for people to see where their enemies might come from during the wars that they had back then]. (In-depth interview with the councillor in October 2015).

There are also deep wells that do not dry up. Villagers are forbidden to fetch water in these wells using metal cups as this will cause the wells to dry up. However, some people are not following these traditions which elders say has led to the drying up of some the wells. One deep well remains in the area which has never dried up and it is called *Chimwandawu,* as it is said to be protected by ancestral spirits of the land.

Traditions such as *kurova guva* are also being practiced, though to a lesser extent now as there is both established Christianity and African Traditional Religion (ATR) in Ngundu. Those who practice ATR, mainly the elderly, still follow the tradition of *kurova guva*. They consider it as an important element in today's world, as the dead and the living should be in communication with each other and, further, the dead should be honoured so that they will continue to look after the living. *Kurova guva* is a form of appeasement of the dead, with the living helping to send the spirits of the dead ones to the ancestral world. At such ceremonies, usually cows are slaughtered and beer is brewed by the elderly women of the village. Younger women are not allowed to do so as it is believed that they will sully the beer thereby making the ancestors angry.

Villagers also practice what is termed *mutoro* or *mukwerera,* whereby the people of the village gather at the village head's house and thank the ancestors for rain. The practice entails the making of beer by elderly women of the community. These elderly women are tasked with the work of brewing beer at the village head's house that will be used to celebrate the occasion. The beer is made from *rukweza* (millet) which is collected from villagers with every household contributing a certain amount. The people of the community gather at the house of the relevant

village head and pray to the ancestors, thanking them for rain and also praying for good rains for the next rainy season. This tradition is usually carried out in early February when people will be ready to harvest. If it fails to rain at the end of the year, it is believed that the tradition would not have been carried out properly and the chief is usually blamed for this. Currently, in the era of climate change, it is mostly the elderly (and particularly women) who are still reluctant to point to climate change as an actually-existing phenomenon. This point will be addressed more fully in a later chapter. During drought years, elderly women in Ngundu blame the chief in that he has failed in the past to thank the ancestors for the rain. The elderly women believe that the chief should continue to do *mutoro* up until the rain comes. According to Chief Mutote Mutote:

> *Ndichifamba izvezvi ndinenge ndichingoodzi nechembere mutoro hauna ka kuitwa zvakanaka ndosaka mvura isina kunaya*. [Elderly women in the community constantly blame me for poor rainfall as they believe that I would not have carried out *mutoro* correctly]. (In-depth interview with the Chief held in October 2015).

I thus discovered that many elderly women were reluctant to move away from their traditional beliefs of positing that the world is controlled by ancestors. They had grown up in a world where ATR was practiced by their parents and grandparents and hence their contemporary beliefs are rooted in an ancestral world. To think of another world, where the power of the ancestors has diminished and is no longer central, is difficult and impossible for them to accept. If ancestors are angry, then they will not give the people rain, pure and simple. They are also some elderly men who believe in the power of ancestral spirits in determining weather patterns. According to one elder man,

> *Vanhu vanouya kuzogara muno vakaita semamashangane vanenge vane zvavakabatawo izvo zvinoita kuti mvura isanaya.* [Outsiders who come and settle here, for instance, like the Shangane are causing poor rainfall as they would have been involved in certain practices that the ancestors are against, which causes a bad omen on us]. (In-depth interview with elder held in April 2017).

He believed that rain patterns had changed because outsiders who were coming into Ngundu were bringing bad luck, particularly considering that they had traditions which they practised that were different from those of the Ngundu people. Such practices did not please the ancestors of the Ngundu people and were leading to changes in rainfall patterns.

I thus observed throughout my research in Ngundu that cultural practices and rain making ceremonies were important to elderly people and they stood firm to their beliefs. Ancestors had to be constantly appeased so that they would not be angry with the people. If the rains failed to

come, then it is believed that the ancestors are not pleased with the people. Hence, people should brew beer and slaughter cattle or goats and perform what they call *bira* (a traditional ceremony) as a way of making the ancestors happy again. Anger of the ancestors is usually manifested in drought and lack of rainfall. Once the ancestors are happy, it is believed that rain will come. In Ngundu, it is the elderly who are keeping the ATR alive, and they try to pass traditions onto the younger generation in the area.

Rainfall beliefs though are not only limited to the ATR as Christians had their own set of beliefs with regards to rainfall. According to one female respondent:

> *Mwari vanenge vaona zvakakodzera kuti kusanaya*. [God would have caused it not to rain]. (Informal conversation, April 2017).

Ngundu church-going people, usually of the Apostolic sect, believe that they have to pray for good rains, and they usually prophesise on the upcoming rain season in terms of whether the rainfall would be adequate or not. Some members are even given holy water to use on their crops so as to have a good harvest. They are even told if the coming rains are going to be associated with lighting and thunderstorms and, if so, to be prepared to take cover from the storms. The prophets within the Church at times prophesise about the period when it is best to plant; for example, if they are to plant with the first rains or not. According to one Apostolic sect member:

> *We follow what our prophets tell us on issues to do with farming; if they say plant with first rains we do that. It works with us. When it fails it is God's doing*. (Informal conversation, April 2017).

Another common practice called *nhimbe* is also still popular among the Ngundu people. This practice calls for one individual who needs help in the provision of labour in his or her fields to invite villagers to come and help. The villagers will set aside one day to work in the field and beer will be brewed and food for the workers provided. This may involve a round-up of all the households in the area. The practice is considered very helpful in quickly completing tasks in a field and in saving time.

The cultural practices in Ngundu show that the people are involved in a series of social relationships or networks, though they are not reducible to cultural arrangements. Often, these social networks (or social capital) are determined by certain factors, such as age, the length of period residing in the area, church affiliation, and shared farming activities like gardening, along with kinship and marriage-based relationships. Such social ties involve assisting others materially in times of need (for example, during times of hunger) or they may involve offering emotional guidance and strength (as is the case with religious associations).

5.2.6 Non-Governmental Organisations

Non-governmental organisations (NGOs) began operating in Ngundu around the early 1990s, after the infamous 1992 droughts. The organisations have provided services which include poverty alleviation, rehabilitation of dams, promoting gender awareness, small-scale irrigation and food relief programmes. NGOs like Care moved into the area in providing food relief programmes as a way of assisting Ngundu's poverty-stricken households in the face of drought. On the basis of five-year programmes, Care has provided food for the vulnerable and porridge for children, while also helping in the construction of gardens and supplying pumps for irrigation. Red Cross also worked in the area, from 2008 to 2014, focusing on health issues. The organisation helped in constructing latrines for the villagers, nutritional gardens and boreholes, and also trained villagers in the maintenance and upkeep of boreholes. Other NGOs that operate in Ngundu ward include Lutheran World Federation which focuses on small dam rehabilitations, and Zvishavane Water Project dealing with environmental conservation.

5.3 Profile of Studied Ngundu Households

Among the Ngundu respondents who completed the questionnaire, 59.5% were household heads and 40.5% were not household heads but were members of the household. Among the respondents, 54.8% were female and 45.2% were male. In addition, 81% were married, 11.9% were widowed and 7.1% were not married. Those who were widowed, as will be seen, proved to be very vulnerable to climate change particularly females. Female household heads were also particularly vulnerable mainly because they were compelled to become the sole bearer of generating income in the household.

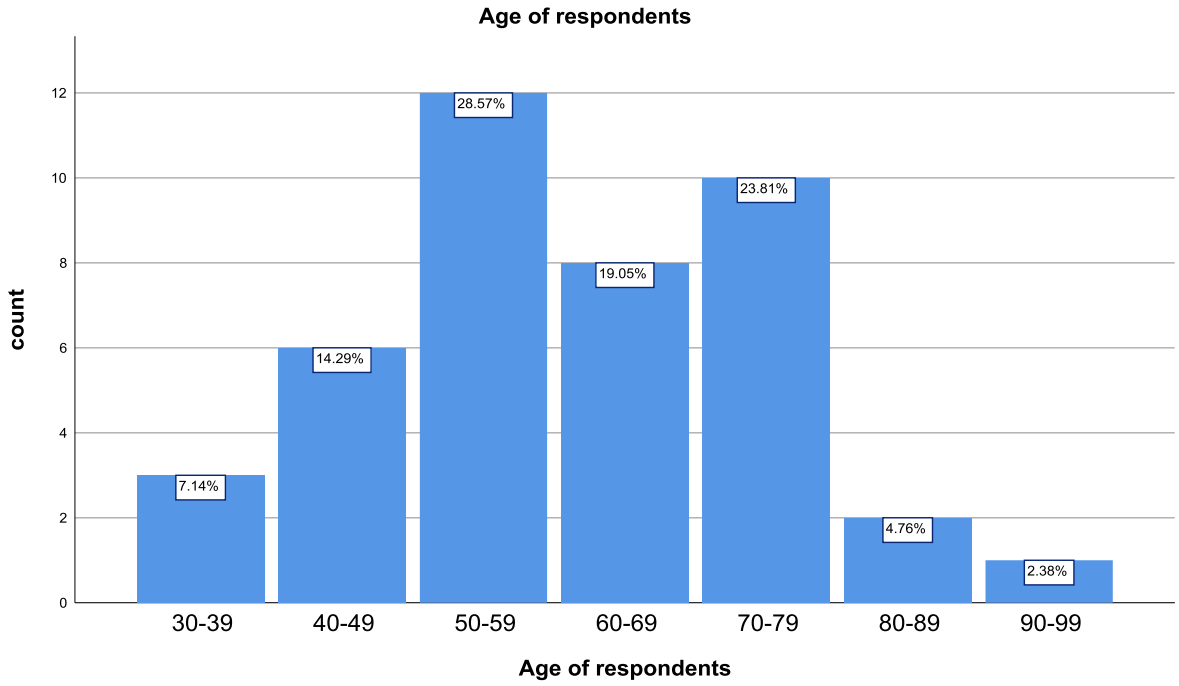
Among the respondents, 11% were in a polygamous marriage. Polygamy is a custom that is still being practiced in the area though it has decreased due to cultural dilution, the influence of Christianity and the problem of HIV and AIDS. Currently the practice is common among the Apostolic Church sect which still holds to the belief that the bible requires men to marry many wives, as it is said in the bible that *"zvaranai muwande"* (give birth and multiply). In Ngundu, being in a polygamous marriage is potentially both an advantage and a disadvantage depending upon factors such as the financial capital available and the land size of the household (for example, if the land size is large then a polygamous marriage enhances the availability of agricultural labour) (FAO, 2017).

A significant percentage of the respondents had some level of education: 43% had completed primary education, 14% had some form of primary education, 22% had completed

secondary education, 19% had no formal education and 2% were unknown. The elderly people in Ngundu had attained education during the colonial era and they typically only had primary education (which was named standard education under colonialism). The elderly males were more educated than the females as, during colonialism, the preference was to send male children to school. This trend though still exists today in Ngundu; more specifically, while girls are now sent to school, their education is not prioritised such that they often only finish primary school or less. Once they complete primary education, most parents tend to withdraw them from school and focus on ensuring financial resources are available for sending male children to secondary school. After all, the girl child is destined to move away and become part of another family (once married) while the boy child remains attached to the family of origin after marriage. Thus, among the young and middle-aged respondents, it was mostly men who had completed secondary education while most females only had attained primary education.

Since the study was on climate change and adaptation with historical depth, it relied mostly on respondents who had stayed for almost all their lives in the area. Thus the largest group of respondents for questionnaires and life history interviews were older residents and the elderly. I grouped the age group of respondents into the following categories: 30-39, 40-49, 50-59, 60-69, 70-79, 80-89 and 90-99. In this study, I considered the young to be between 30-35 years, the middle-aged from 35-59 while the elderly were between 60-99 years. The following Figure 5.1 shows the percentages of respondents per each age group.

Figure 5. 1: Age of respondents



Source*:* Fieldwork October 2015.

5.4 Farmers' Livelihood Strategies in Ngundu

Chambers and Conway (1992) define a livelihood as comprising the capabilities, assets and activities required for a means of living. A livelihood is considered 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 (Carney, 1998; Scoones, 1998). The SL framework is based on the understanding that livelihoods result from a complex and dynamic interaction of a set of factors that influence people's livelihood choices. Particular attention is placed on the physical, socio-political, economic, environmental, institutional, and historical context in which livelihoods occur. Poor rural households often derive a significant share of their incomes or direct consumption needs from natural resource-based activities such as livestock husbandry, crop cultivation and the utilisation of 'wild' natural resources (Shackleton et al., 2001).

A key strength of the framework, in the context of this study, is that it places a strong emphasis on natural resources as productive assets in supporting rural livelihoods. These natural resources are subject to the effects of climate change and variability, as are agricultural-based activities. Thus, the approach is particularly suitable for examining strategies of adaption by small-scale farmers in the context of climate change vulnerability, such as on-going

variations in climate and indeterminate climate patterns. In this context, this section details the changing combinations of modes of livelihoods in the dynamic and historical context marking Ngundu. The presentation of Ngundu farmer livelihoods is divided into two modes of livelihoods: on-farm activities which are strictly agricultural activities happening in farmers' own field and off-farm activities which do not fall under the realm of agricultural practices. After considering these sets of livelihood strategies, the chapter focuses on the question of wealth characteristics and rankings in Ngundu. In this sense, Ngundu villages are characterised by a degree of socio-economic differentiation, and livelihood strategies are conditioned by this differentiation and the assets and capabilities within the reach of particular Ngundu households.

5.4.1 Agricultural Activities

My first field visit, which commenced in October 2015, sought to understand the livelihoods of the farmers in Ngundu in light of climate change. Ngundu people rely on agriculture as the main livelihood and they spend most of their time practicing on-farm activities. On-farm activities are those activities that are pursued on the farmer's land i.e. in and around the homestead. The on-farm activities that Ngundu people practice include crop production and livestock production. In this regard, agriculture is the major livelihood strategy and it is an integral practice which in large part defines their very existence and around which their identities are constructed and confirmed. Ngundu farmers know no other way of surviving and their reliance on agriculture is threatened by climate change. Crop production will be looked at first, as it is the main livelihood strategy, being practiced by all Ngundu villagers in some form and to some extent.

5.4.1.1 Crop Production

To understand the importance of crop production, I begin by telling the life history of Rosie Bako born in 1932. I met her when I visited her homestead in Pedzisai village and she was all smiles and very happy to tell me her life story. She pointed out that, '*at least people will know my story and my name before I die'.* Box 5.1 provides her life story, in her own words:

Box 5. 1: History of Rosie Bako

I was born in Mutirikwi in Chivi and our family totem is Ndoro. My father died when I was young and this contributed to some of the dilemmas I faced in my life. My family was not well off and my father only had 3 cows. However, in as much as we were poor we never went to bed hungry as we depended on farming. Farming was the only thing we knew and we mainly used hoes to clear land and cultivate. We would plant crops like groundnuts, Bambara nuts, millet and sorghum. We did not know of maize during those times because we had not had any contact with the white man yet. My family's poor status compounded by my father's death explains the predicament I found myself in when I was just a little girl. I cannot remember my exact age because I have a problem with figures but I was still very young. I did not go to school mainly because it was considered a bad time to send girls to schools. When my father died, things got a little difficult for us and we had to sell our cows in order to cope. However, this affected our means of labour and my uncles and mother had to resort to marrying me off as a way of gaining the cows they had lost. I became a victim of the infamous tradition of kuzvarira*. I can say that, '*kare vasikana taitengeswa ka isu*'* (*'long ago we girls were sold off'*). *I was married off to a well-off man and I was sent to live at my future's husband's place while I was still but a child, awaiting to reach a marriageable age. My family was given about 5 cows and some grains. This was better as compared to some families who married off their daughters for only some food. My husband to be, was already married at the time so I was already looking to a polygamous marriage, another common practice back then. When I reached a marriageable age, my marriage was consummated and I had 9 children starting from around 1950s. Living in a polygamous marriage was difficult as it meant that each wife had to take care of her children. The husband could only help by providing tools for labour, such as ploughs and hoes. So this left only one thing that I was good at, which was farming. I knew no other life other than being in the fields and farming. So farming became a livelihood for me, that I depended on it and I was able to send my children to school. I farmed crops with the help of my children and I would like to say I was a little bit hard on them but I needed their help in farming. It did not hurt much at that time, since we received good rains during those years. When maize came in the 1950s with the white men who drove around distributing it to us, we started planting maize. I remember one year when there was drought, I would go with my children to a well that was about 3km. I would give the youngest children a 5 litre bottle and the older 10 litre bottles to carry back to the garden that was sustaining us during that time. That garden sustained us during that period. For me to be where I am right now with my children taking care of me, it is the life that crop production gave us. I sent my children to school and now they are able to take care of me. I am still farming if my body is feeling well. I have a garden at Banga irrigation where I am currently growing maize. I have already harvested some maize I planted last year at the irrigation scheme and I am planning to sell them.*

Source: Life history interview held in April 2016.

From this account, the significance of crop production to the people of Ngundu is clearly shown. Crop production has, for decades, provided people with a possibly bright future, as they carry out these activities in order to ensure food security for the household. Crop production continues to exist throughout the Ngundu villages and this I observed as I was taking transect walks around the villages during my fieldwork. Almost every household I saw had a piece of land although varying in sizes. The land size ranged from as little as 0.4 hectares up to 7 hectares. The majority of the farmers, especially in Guti and Nduna 1, have small pieces of

land that amount to only 1 acre (0.4 of a hectare); while an insignificant percentage of the farmers had larger pieces of land amounting to 7 hectares – these were located in Pedzisai 1. I realised that most of those households which had land sizes above 1 hectare were those with household heads in the age group of 60 years to 99 years. Those which had heads from 20 years to 39 years had about 0.4 of a hectare, and those with heads between 40 to 59 years had between half a hectare and one hectare. In addition, a significant percentage of the villagers had experienced a decrease in land size as compared to what they cultivated in the 1990s. This was a common feature amongst the older age-groups (60 to 90 years) as these elderly heads had been forced to divide their land and give some of it to their married children. I realised that, although the population was growing in Ngundu, new land is increasingly difficult to acquire which has led to young married couples relying on the land already in their parents' possession. According to 74 year old Mr Gwazai:

> *Our fields are getting smaller as we are forced to divide and give the land to our married children, as they can no longer get new land elsewhere.* (In-depth Interview with elder held in Nduna 1, April 2016).

The difference in land size among households in the area was explained by Mr Meki during a life history interview:

> *Only the elderly people have large pieces of land as they were the first ones to stay in the area. The Land Acts of 1951 saw them being given land depending on the size of the family. So people were given from 5 ha up to 10 ha. But now the same land is the one you share with your children when they get married. This will mean that the land will be reduced in size although it will remain the same for the whole combined family. The people in the household increase but the land is not added. Most people who have large land sizes are found in Pedzisai 1, considering it hosts some of the oldest people who have lived in the area. As you go to Guti and Nduna 1, you will observe that they have small pieces of land. Most of them have 1 acre; this is because they were getting married and were given land with new land sizes. Also new people in the area are now given small land pieces considering the increase of the population and the shortage of land.* (Life History Interview in April 2016, Pedzisai 1 village).

Mr Meki further explained how AGRITEX officers had allocated and divided land using contour ridges. When they reached a contour ridge, they would make a division leading to some households getting more land than others. He pointed out that:

> *Sometimes they would divide a smaller portion of land and sometimes a bigger portion. It was all about catching water.* (Life History Interview in April 2016, Pedzisai 1 village).

So land distribution differed in size allocation and depended on where the contour ridge would be found. This led to the people referring to their land size as *gandiwa* (contour). The villagers, when asked how much land they have, would say to me '1 g*andiwa*' or '2 *gandiwa*' – which translates to 1 acre and 2 acres respectively (or 0.4 and 0.8 of a hectare).

I also discovered that there were new resettlement areas that came into existence through the *jambanja*[19], that were associated with the Fast Track Land Reform Programme (FTLRP) from the year 2000. The new resettlement areas are called Mucheni, Chahoba and Nyahombe. Mucheni is 90km from NGP, Chahoba is 70km and Nyahombe is 20km**.** People in Ngundu and nearby communal areas were given an opportunity to move to those resettlement areas under FTLRP. But only an insignificant number of people from Ngundu moved to the new resettlement areas as they did not have the means and capacity to survive in a new environment that required construction of new homestead infrastructure; as well, they did not have the resources that would be required in farming the new land. So they chose to remain in Ngundu. There was also the reluctance to leave familiar ground which they see as the land of their ancestors, with their very identity wrapped up in the connection to their current land. They also believe that it is a bad omen to be separated from their ancestors as the latter are the ones who protect them, and are the ones whom they consult in times of family or general life crises. Ever since the people occupied Ngundu many decades ago (see earlier), they developed a strong bond with the land, particularly given the many struggles that they encountered in trying to carve out a life in the Ngundu area. In addition, as the Ngundu villagers bury their dead loved ones on their homesteads, they are reluctant to leave their graves there.

Like most subsistence farmers in Zimbabwe, farmers in Ngundu depend mostly on rain-fed crop production. This is where and how they are supposed to obtain food for consumption all year round till the next agricultural season. If it is a normal season and rains come as expected, **c**ultivation of crops in Zimbabwe in general and Ngundu in particular is largely known to start in October. In August, they would have received the rain they term *Gukurahundi*, which implies that, by then, they would have finished shelling off their grains (see below). This early rain is said to have the purpose of clearing the land and washing away all residue and dust, cleansing the land for the new season. This rain will pave way for the first rains of the planting season known as *Munakamwe* and this rain means that it is time to start planting their crops. Planting usually begins after this rain, which is around mid-October to

19 The violent occupations of land that spread across all over the country and became formally recognised under the Fast Track Land Reform Programme.

mid-November. In November, weeding of the crops begins with a second round of weeding in early January. April is largely known as harvesting time. The crops grown include maize, groundnuts, round nuts, cow peas, sweet potatoes and small grains. Table 5.1 below shows the percentages of farmers who grew particular crops covering the 2014-2015 season. While these percentages will vary across seasons, the table gives a sense of the different crops grown in Ngundu.

Table 5. 1: Crops grown by Ngundu Farmers (2014-2015 season)

	Count	YES%	Count	NO%
maize	42	100.0%	0	0.0%
groundnuts	32	76.2%	10	23.8%
Bambara nuts	28	66.7%	14	33.3%
cowpeas	21	50.0%	21	50.0%
sweet potatoes	28	66.7%	14	33.3%
sunflower	5	11.9%	37	88.1%
sorghum	18	42.8%	24	57.2%

Source: Fieldwork October 2015.

When asked the types of crops that they grow, 100% of the villagers indicated that they grew maize. When asked if they grew small grains (sorghum), only 42.8% of the farmers showed that they cultivated small grains, while the rest (57.2%) do not grow such a crop. As well, 76.2% grew ground nuts whilst 23.8 % do not; and 66.7% grew Bambara nuts while 33.3% did not. When asked if they grow cow peas, 50% answered that they do grow this crop while the other 50% indicated otherwise. These results show clearly that all the farmers focus on maize production, which is for household consumption given that maize is the staple crop in Zimbabwe. Other crops like ground nuts, Bambara nuts and cow peas were for homestead consumption and also for sale at the NGP. An insignificant number of villagers noted that they also grew other crops which did not even appear on the questionnaire (like sunflower and rice). Farmers in Ngundu are also involved in irrigation schemes, which I fully explore in Chapter 6. Those who are involved in irrigation schemes manage to boost their crop yields as compared to those who are not involved.

The table below (Table 5.2) shows the yield produced crop by crop during different seasons in Ngundu. It shows how maize yields used to be higher in the 1990s as compared to the 2000s, evidencing quite possibly the impact of climate change on crop yields. This becomes

particularly important when considering, later, the perceptions of climate change amongst Ngundu farmers.

Table 5. 2: Yields produced Crop by Crop in Ngundu

Crops	Year (1990s)	Year (2000s)	Year (2010-present)
Maize	30-80 bags	10-15 bags	2buckets-5bags
Groundnuts	12-8 bags	3-5 bags	2buckets-3bags
Bambara nuts	4-7 bags	2-4 bags	1bucket-1bag

Source: Fieldwork October 2015.

Maize seeds in Ngundu are either purchased or stored from last season yields. Most households store their seeds as they will need to prepare for the unknown, of whether they will find money to purchase seeds or not. The process involves setting aside last season's unshelled maize cobs, drying them, and hanging them up in the kitchen house, where smoke from the fire reaches the cobs to avoid rotting and kill insects that feed on maize. When the planting season comes, some households would have consumed this maize due to food shortages that might have occurred at some point; and better-off households usually get remittances to buy maize seed from the shops. Makuvaro (2014) shows that farmers retain seed even of hybrid varieties from previous harvests so as to plant the following year. As I did, she also discovered that at times the people are forced to consume the seed due to food shortages. Ngundu people also retain Bambara nuts and groundnuts for replanting. These groundnuts and Bambara nuts are not shelled but are stored as they are, for shelling will make them rot and become exposed to insects. The groundnuts and Bambara nuts are dried and stored in sacks or buckets only to undertake the shelling process when the planting season comes.

In relation to crop production, practices like *nhimbe* (as discussed earlier) are still common in the area. *Nhimbe* is meant to bring people together and work together on a particular field of one farmer in the area for a day. It is a kind of collective working that enables the farmers to put their labour together. The way they organise the event shows that crop production is considered as important to everyone. Crop production provides food for the whole family and, if the crop yields are high, some households even sell surplus. In Ngundu, those who sell surplus are usually found amongst the better-off households; poorer households

fail to have surplus to sell, and the very poor (with limited capital and assets) fail to produce enough to eat. Wealth differentiation, as detailed later, thus affects the capacity to generate a crop surplus for purposes of marketing. Findings in Ngundu show that those who failed to produce enough maize yields and did not sell any surplus amounted to 26%; those who produced enough food with nothing to sale were 48%; those who produced enough food and sold surplus locally were 19%; and those who produced enough and sold surplus locally and extra-locally were 7%.

Considering that the soils in the area have lost their fertility over time, as spoken about by the Ngundu villagers, most famers use manure as a way of increasing crop yields. Those who had resided in Ngundu for a long time spoke more vigorously about the loss of soil fertility, given how long they had been farming on the land. Reasons such as long farming periods on the same piece of land, dry spells, no fallow periods and floods were all cited as contributing to soil infertility. The villagers had to resort to the use of manure in order to compensate for the lack of soil fertility. Overall, 58% were dependent on using organic fertilisers only because they cannot afford to buy inorganic fertiliser; 25% used both organic and inorganic fertilisers, while 17% did not apply anything at all.

5.4.1.2 Livestock Production

I now turn to livestock production in Ngundu. Box 5.2 provides the life history of Mbuya Tanaka (an 85 year old woman) and her thoughts on livestock production.

It is from Mbuya Tanaka that it can be deduced that cattle was an important factor in Ngundu (and still remains the same even now). In pre-colonial times, a household's wealth was measured regarding the number of livestock the family owned. This tradition and way of thinking has been carried on to the present with livestock-rearing still considered an important part of agricultural life in Ngundu. The only difference is the fact that in pre-colonial, and even in colonial times, a household could own a large herd of livestock that could reach to 50 cattle or more. According to one elderly villager during an in-depth interview:

> *We used to have large herds of cattle amounting to over 50 and we could sell several of our cattle to white people at Maringire, and we would get money for schools fee and for other needs.* (In-depth interview with elder March 2016 in Guti)

Today, in Ngundu, livestock that are reared include cattle (which are considered the most important), goats, donkeys and chickens.

Box 5. 2: Life History of Mbuya Tanaka

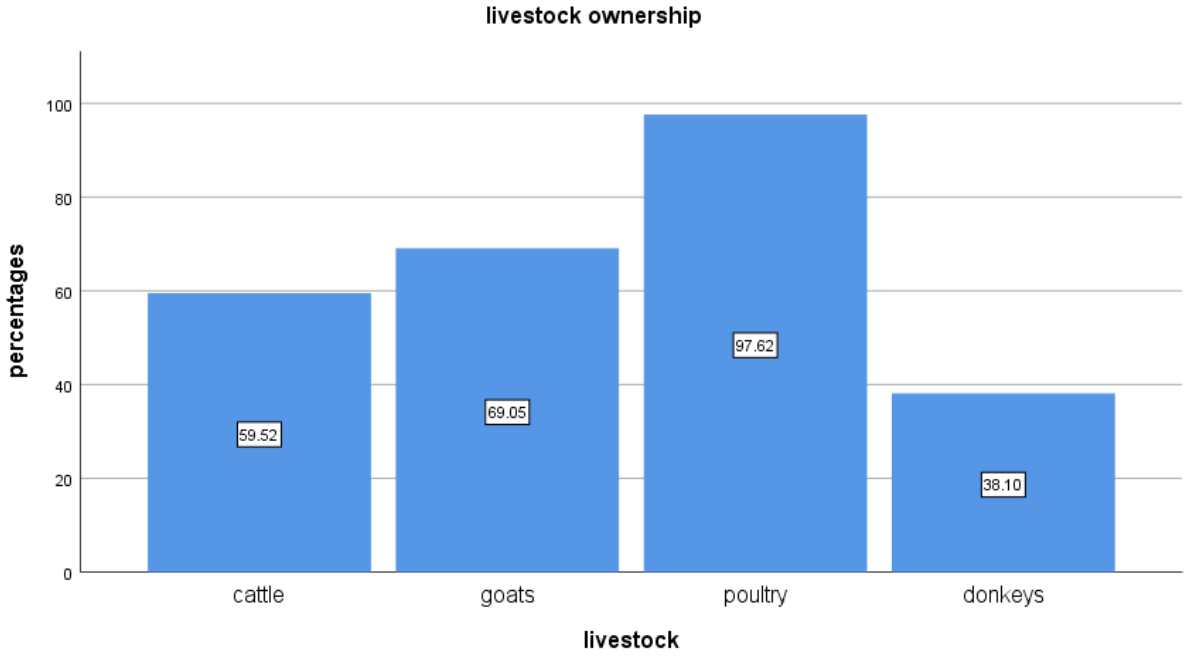
I was born in a family of 17. My father was a farmer and he was called 'hurudza' (*an excellent farmer*) *by the whole village because of the large number of herd of cattle he accumulated throughout my childhood which he used to cultivate his land. My father was the head of the family and he had 4 wives. My mother was the second wife. In my mother's family, I was the last child of my mother's womb, with 5 older sisters. There were many girls in my family as compared to boys. My father only managed to father 3 boys. Just like my older sisters and all the girls in the homestead, I did not get to attend school even if my father could have afforded it. During that time, especially in our family it was unheard of for a girl to attend school and a taboo to demand to go to school. My interactions with my father were few during all the time I resided at our homestead. Approaching your father and discussing issues of life with him was also unheard of. There are few times that I remember talking directly to my father and fewer times when he would address me. Life at our homestead revolved around farming and we survived through that. We had lots of food which included pumpkins, maize, nuts, sweet potatoes and many more. Our homestead was known for producing lots of surplus food which we would sell and sometimes give to those who did not have. Our work load was made easier because of the large number of cattle that my father had. We would plough using the cattle and our farm was 8 hectares and we managed to utilise all the land. Having many girls at the homestead meant that we would spend time in the fields as we did not have to go to school. The only problem was that as girls we would get married and move away from the house. However, this was a blessing in disguise to my father as it meant that each time one of us* [the girls] *gets married it would mean more cattle for him.* 'Apa pakuroorwa ndipo pakagonerwa baba vangu zvekuti vakabva vawedzerwa kuzikanwa nekuda kwemombe dzakawanda pamusha nekuda kwedu isu vasikana*''* [vakabva vaseka]. *(My father got rich from us because of the cattle that he accumulated over the years because of lobola payments for us girls [she laughed as she said this]). Cattle meant less work load for us in the fields and it was a strong symbol of wealth. They were also a source of food as it meant that we had plenty of milk at our homestead and sometimes my father would donate one cow to be used at traditional ceremonies. My father also loaned cattle to other villagers who did not have cattle so that they would use them in their fields* (kuronzera). *If my father had no cattle then we would have been a poor family. The importance of cattle has not diminished at all. Even today cattle are very important only that people here have less cattle now as compared to back then.*

Source: Life history held in March 2016, Guti Village.

Although the cattle numbers in Ngundu have drastically decreased (78% of households spoke about recent losses of cattle due to droughts), their importance in the day-to-day lives of the people cannot be underestimated. However, the distribution of livestock in Ngundu is uneven. Data collected from villagers shows that most people in the area have cattle. However, the difference in the number of cattle owned varies considerably. The advantage of having cattle is that they are used for farming in the fields, providing significant labour required during ploughing. They also provide manure, meat and milk for the people; and they are used as a form of payment of *lobola* (bride price). In most cases, young men in Ngundu are asked to pay around 4 cattle as bride price. However, in the event that the young man does not have cattle, money will always be used instead.

In general, 59.5% of households had cattle, 69% had goats, 97.6% had poultry while those with donkeys amounted 38.1%. Figure 5.2 below shows livestock distribution among the respondents in the ward.

Figure 5. 2: Livestock Distribution



Source: Fieldwork October 2015.

Among the villagers, the largest herd of cattle amounted to ten cattle, a figure much smaller than the size of herds in the past. Goats were more popular among the people, with some owning up to 16 goats. This is because of the fact that goats are not easily affected by drought as compared to cattle and also as they are cheaper to buy. Poultry raising seemed to be thriving in Ngundu with some villagers having between 30 to 50 chickens. Donkeys were rarer in the area as shown in Figure 5.2. When asked why there were very few donkeys during a focus group discussion, one villager had this to say:

> *Ko madhongi tomadii? haadyiwi, ane chinono pakurima uye anobiwa nembavha nyore.* [Why do we need donkeys? You cannot eat them, they are slow and they are not loyal as they can be easily stolen.] (FGD held in Nduna village in April 2016).

Most of the respondents had no grazing land near their homesteads and had to rely on and use the allocated community grazing land which was 1km away from their homesteads. The land at their homesteads only catered for crop production. The homesteads in Ngundu are

placed in a linear fashion with their fields inside their homesteads. Though there is communal grazing land, the cattle need to be herded especially during farming season as there is the danger of cattle wandering back and feeding on people's crops. If this happens, it is considered a serious offense and the owner of the cattle is sent to the chief and asked to pay for damages, depending on the damage done to the crops.

5.4.2 Non-Agricultural Activities

The people in Ward 25 are also engaged in non-agricultural practices. This section looks at the activities that are conducted by the villagers. Although it is acknowledged that agricultural production is important, the villagers also look for other means of survival. A significant number of people in Ward 25 are engaged in different off-farm activities. Usually these off-farm activities will be a way of gaining income or hard cash. Barret et al. (2001) also show that household reliance on off-farm income diversification is widespread, but households vary in the extent to which they are involved in such activities. Off-farm activities are mostly visible at NGP where people engage in activities such as fencing, pillar making, sculpture, selling at flea-markets and selling vegetables. The Ngundu villagers were only involved in selling vegetables and selling at flea-markets, as those who practiced fencing, pillar making and sculpture were from other areas in Zimbabwe like Mhondoro, Chivhu, Gweru and Beitbridge. They only came to Ngundu in order to widen their horizons as NGP provided a business opportunity because of its location, an opportunity that did not exist in their home areas. Most of the Ngundu villagers selling vegetables at NGP were women.

Other off-farm activities include cross border trading mainly to South Africa. Among the villagers, though, only an insignificant number of women practiced cross border trading due to the challenges associated with this activity. For one to partake in cross border trading, a passport is necessary – but many villagers do not have one because of the expenses incurred in applying for and receiving one. One female respondent said that:

> *Vanhu vanoshaya mari yacho yekutora passport yekuenda kuSouth. Zvakafanana neni nyangwe ndichida kuenda mari yacho ndinoiwanepi yekutora*. [People fail to get money to get a passport to go to South Africa. Even in my situation even if I want to, where will I get the money to have a passport?]. (FDG held in Pedzisai 1, April 2016).

The situation is worsened by the fact that passports are only processed in Masvingo which is 95km away from Ngundu. This is expensive for them as they require bus fare, accommodation and a passport fee whilst they are there. Cross border trading also requires

capital to buy the goods to sell which may include tablecloth covers, seat covers and embroidery clothing which is quite expensive to make. One female respondent who was involved in cross border trading stated that she became a cross border in the late 1990s when commodities for sale were cheaper. She managed to get a passport from selling her farm produce and also raised capital to buy goods to sell. Once she started it, it became easier to purchase goods for resale although, during some months, she would have nothing to sell. This was in large part because of cash flow problems, as her customers in South Africa may fail to pay for her goods on time. When they paid, sometimes they would give her second hand clothes in lieu of cash. She sometimes used these clothes to pay people who provided her with labour in her fields. During times of droughts, she would travel to neighbouring places where they had a better harvest and exchange the clothes for maize.

Remittances are another off-farm activity that many Ngundu people depend upon as a livelihood stream. However, the inflow of remittances into Ngundu has decreased over a number of years and, in some instances, it has disappeared due to the economic challenges in the country which has affected employment amongst urban-based relatives (who were the major providers of remittances). Remittances coming from South Africa are now more common as several people in Ngundu have migrated to South Africa so as to escape from economic decline and poverty. Among the respondents, 26% receive remittances and these remittances vary in significance depending upon their amount and frequency. Those who receive remittances in the area tend to be found amongst the better-off Ngundu households. Remittances in Ngundu are popular among the elderly who have children who reside out of Ngundu, either in urban areas or outside the country. They end up sending money back to their parents as a form of assistance:

> *Vatinoshandira vanenge vakura, vabva zera havachakwanisi kushanda saka dzimwe hama dzinobva dzvatumirawo mari kuti vatsvage vanhu vanovabatsira, vamwe vanenge vane mabasa avo kunze kwenyika voti tsvakai munhu anokubatsirai ndichatumira mari.* [I usually provide casual labour to elderly people as they can no longer do hard work because of old age. They have relatives or children who have jobs outside of Ngundu who will send them money and ask them to hire labour]. (In-depth interview with a casual labourer in October 2016).

There is a difference among those who receive remittances and those who do not, as those who receive are usually food secure since they can buy food or use the remitted funds in enhancing their agricultural activities. Remittances help to improve the livelihoods of these households as they can be used to buy farming equipment such as fertilisers, ploughs and seeds, all of which

greatly assist in producing higher yields. Access to remittances also determines the size of land that will be cultivated, as the money can be used to hire labour. I observed in Ngundu that remittances are usually given more during farming season as the villagers find more courage to ask for money from their relatives or children during this time. According to one respondent:

> *Ndinotomirira mwana wangu anogara kuHarare kuti anditumire mari kunyanya yekutenga mbeu uye dzimwe nguva yekutsvaga vanondibatsira kurima mumumnda.* [I wait for my child who stays in Harare to send me money especially to buy seeds and sometimes hire labour to help in the fields]. (Life history with an elder held in April 2016, Nduna village).

Another villager stated that:

> *It is only through farming that I demand money from my son. I just tell him that if he does not give me money to farm, 'where will I get money to buy mealie-meal on a monthly basis'.* (Informal conversation, April 2016).

An insignificant number of the villagers interviewed migrate and look for employment outside of Ngundu as a way to better their lives; though they may have relatives doing so. Reasons such as lack of education, fear of the unknown, fear of change, and lack of skills and expertise were cited as the major constraints that made the people not want to venture into migrant labour. They prefer to stay in their home area and look for work in Ngundu's surrounding areas. Those who migrate to countries like South Africa only do so after much consideration and knowing that they have someone who will be assisting them to go there. There are challenges involved when a villager just goes to South Africa without anyone whom they know who is established there already. There are high chances that the person will come back with nothing, becoming a burden on the people who were left behind. According to one respondent:

> *Avo vane mwana akabva joni asi haana chakauya akabata.* [There was a child who went to South Africa and returned with nothing]. (Informal conversation, April 2016).

Among the respondents, the Nduna family from Nduna 1 village had 3 brothers who had migrated to South Africa. It was easier for them to keep on going to South Africa as they had relatives already there, as compared to other people who do not have anyone there. Their household was better off as compared to other households in terms of income, with the earned income used to promote both crop production and livestock production.

5.5 Wealth Categorisation

In Zimbabwe's rural areas, wealth is measured by the assets that people have such as land, livestock, character of buildings at the homestead and farming equipment (such as ploughs, hoes). Based on a range of criteria, Table 5.3 below shows the wealth categorisation amongst villagers in Ngundu. Among the households, 16% were considered better off while 19% were 'middle' level households; 29% were poor and the remaining 36% were the very poor households. This is not an absolute characterisation of wealth, but a relative one. There tended to be a correlation between wealth categories in terms of homestead construction, farming equipment and livestock ownership, as Table 5.3 shows. There is no claim to the effect that each household falls neat and tidily within one of the wealth categories in terms of all the criteria.

Table 5. 3: Wealth Categorisation of Ngundu Farmers

Wealth Categorisation	Roofing material	Wall material	Floor material	Farming equipment	Livestock ownership	
					Cattle	Goats
Better-off 16.7%	Asbestos	bricks/cement	cement	ploughs	5-above	7-above
Middle 19%	Asbestos/Metal	bricks	cement	ploughs	3-4	4-6
Poor 28.6%	Thatched	mud/tree poles	mud/cow dung	no ploughs	1-2	2-3
Very Poor 35.7%	Thatched	mud/tree poles	mud	no ploughs	0	0-1

Source: Fieldwork October 2015.

A significant percentage of the people in Ngundu own cattle but the number of cattle owned varies considerably between the better-off and very poor households (as does the case with goats). Unfortunately, most villagers no longer have a high number of cattle due to drought occurrences in the area. As indicated earlier, a significant number of the respondents (78%) had lost some of their cattle mainly due to droughts. During my field work, I realised that some of those who were in the very poor category and without any cattle used to have 1 or 2 cattle at some point, but lost them due to severe droughts. Cattle are drastically affected by drought, and they struggle during periods of extremely high temperature; while goats are affected mostly by floods. This has also been confirmed in the study done by Phiri et al. (2014) carried out in Tsholotsho, Zimbabwe, where temperature extremes affects cattle livestock, with water scarcity brought on by climate change accounting for more than half of livestock deaths. This also means that, if the categorisation of wealth levels is kept constant over time, then there has been a marked shift over time of Ngundu households sliding into the poor or very poor

categories. There are also people who have moved from the better off category into the middle category.

Wealth in Ngundu is also determined by the type of houses that one constructs at the homestead, and the appearance or maintenance of the homestead. In Ward 25, the better-off had a fenced homestead, a main house made up of bricks and asbestos roofing, with a veranda and about 4 rooms inside; they also had a kitchen round hut made up from bricks and other round brick-structured huts. Their floors are made from cement. The way a cattle kraal was constructed and its size also speak to the relative wealth of a household. The better off households thus had a large kraal made up of oil-treated poles to avoid termites (while the poor had a very small poorly-constructed kraal). The middle households have a homestead sometimes fenced with barbed wire or made up of wooden poles. They would be one roomed or two roomed flat houses, made up of brick with asbestos roofing or a metal roof, a round kitchen made up of bricks and maybe another 1 round hut with floors made from cement. The kraal will be medium in size and some people in the group use oil treated poles and some do not.

It is noticeable that both better off and middle households tend to receive remittances, the former more often that the latter. The middle households use remittances to educate their children and people from this category usually complete secondary school. This group of households provides its own labour and in few cases they can hire labour when it is required. The better off can afford to send their children to school and sometimes they send them to college. They hire labour for their agricultural activities and make use of ploughs and draught power. Generally, in at looking at cultivation equipment, all households in Ngundu have hoes but not all households have ploughs. Those with ploughs amount to 43% and are mostly found in the middle level and better off households.

The poor category of households in Ngundu have one or two round grass-thatched huts usually made up of tree-poles; they use mud for plastering to avoid termites and they use mud and cow dung for their flooring. The homesteads might be unfenced but, if fenced, they make their own tree poles and use thorn branches (*ruzhowa*) to avoid animals from getting in. They also receive food hand-outs from local relatives and do not receive remittances. In terms of cultivation, they cultivate by hand as they tend not to have ploughs. In order to get cash income and food, they provide labour in other people's fields. They may simply share a small kraal with others because of their limited cattle holdings. The very poor households have one round hut made from poles and mud and thatched by grass. Their floors are made from mud and cow dung. They are often given food-hands depending on whether their neighbours, relatives,

NGOs or governments institutions have anything on offer. It is unfortunate that NGOs have moved away from food hand-outs at the time of writing, as they used to be of great assistance to the very poor people. This group of households does not have any livestock or, if they have, it is a single goat. They use traditional tools for cultivation like hoes as they cannot afford ploughs. These households provide significant casual labour for other Ngundu households. In, addition they cannot afford to pay school fees for their children. Their school-going children are usually turned away for not paying fees and this affects their learning; as a result, they end up dropping out of school and helping with household chores.

Levels of food security is thus linked to the wealth categorisation in Ngundu, as food secure households are found in the better-off and the middle category. As mentioned previously, the better-off category gets enough to eat and they sell surplus locally and extra-locally. This is mainly because they have access to seeds, farming equipment, remittances and fertilizers. The middle group gets enough to eat and can sell their surplus but only locally. The poor group gets enough to eat but they cannot sell any surplus as they do not get surplus in their fields. The very poor are food insecure and they do not get enough to eat in their homestead and do not sell any surplus.

The number of people in a household also conditions the availability of resources at hand and food security, as well as the wealth status of the homestead. In Ngundu, an average household among the respondents has 4 to 6 people. Those who had large numbers were in a polygamous marriage and could reach 12 to 15 people. However, there were other homesteads where there was no polygamy but they had a large number of people present. For instance, this could involve a three-generational family, with grandparents and grandchildren. More people per household meant more mouths to feed but it also meant more hands in the field, which also depended upon the age of the members of the household i.e. if they were old enough to provide labour.

It was also realised from the findings, as intimated earlier, that those who were in the better-off category were mainly in the elderly group due to a number of reasons. For instance, they had stayed in the area for a long period and were already well-established; they receive remittances from their adult children; they have more livestock as compared to the young; and they also have assets that their children bought for them. In addition, when the elderly began living in Ngundu, occurrences of droughts and floods were not yet frequent, such that they could obtain very high crop yields and sell the surplus – and purchase livestock and farming equipment, and construct homesteads, from their earnings. The Zimbabwean agrarian economy

was also more stable in the past, and farmers could sell crops and gain an ensured market price to generate a profit to plough back into farming.

Although land is a crucial resource, and there is variation in land sizes available for cropping between Ngundu farmers, I do not consider land as central in terms of the wealth categorisation in Ngundu. This is because of the sheer effect of climate change which has seen the increase in drought and flood occurrences which have contributed to the high loss of crop yields despite large farm sizes in many cases. As well, the average land size is on the decrease because of family sub-division of land. Whether the land is simply a 'dead' asset or not (irrespective of its size) is highly contingent on the capacity to cultivate and crop the land. This capacity is in large part determined by earlier factors, such as remittances, farming equipment and labour. Under conditions of severe climate stress, even these factors do not bring the lands 'alive' for utilisation and harvesting.

It is crucial not to treat rural villages in Zimbabwe or elsewhere as homogeneous social entities. Invariably, forms of heterogeneity, differentiation and inequality mark rural areas such as Ngundu. Wealth status may be of some significance when considering small-scale farmer adaptation to climate change and any possible diversity in adaptation measures. It may also be, though, that climate change has a levelling effect on rural villagers by for instance undercutting prospects for any accumulation whatsoever through agriculture.

5.6 Conclusion

This chapter provided an overview of the research site of Ngundu and then focused in some depth on the livelihoods and livelihood activities of Ngundu farmers, thereby addressing the first subsidiary objective of the thesis. The chapter clearly demonstrates the significance of agricultural activities for Ngundu farmers, both crop and livestock production, and thus the centrality of climate (and particularly rain) to their livelihoods, including the very crops which can be grown. The use of life histories enabled the chapter to trace agricultural activities in Ngundu over time, given long-term trends in climate change. But Ngundu farmers also engage in non-farm and non-agricultural activities, or at least can draw upon income deriving from these activities, such as remittances and cross border trading. Finally, it was brought to the fore that any comprehensive examination of Ngundu livelihoods must take into consideration differentiation in relation to wealth, in part because climate change effects on communal farmers are often mediated by differences in wealth. The next chapter focuses on climate change perceptions and concerns about climate change amongst Ngundu farmers.

CHAPTER SIX: FARMERS' PERCEPTIONS AND CONCERNS ON CLIMATE CHANGE IN NGUNDU

6.1 Introduction

After giving an understanding of the livelihoods of the Ngundu farmers in the previous chapter, this chapter proceeds to look at the Ngundu farmers' perceptions and their concerns about climate change. Farmers perceptions and concerns about climate change relate to rainfall patterns, temperature patterns and extreme weather events (including droughts and flood occurrences), all of which are detailed in this chapter. What becomes apparent from the discussion is also the significance of climate variability with particular reference to rainfall. In providing details about the different dimensions of climate change and variability, emphasis is placed on tracing these dimensions historically by drawing upon the experience-based knowledge and reflections of older members of Ngundu. In focusing on climate change perceptions and concerns, the chapter also considers the ways in which climate change has affected agricultural activities in relation to both crop and livestock production (such as when to plant seeds), and the overall implications of these changes for the lives of Ngundu farmers.

6.2 Farmers' Understandings of Climate Change is Ngundu

According to Ban and Hawkins (2000), a social perception involves a process in which people receive information or stimuli from the environment and transform it into a mental and psychological awareness. It may be though that people infer from (or interpret) a certain situation or phenomenon (such as a dimension of climate change) differently despite the seemingly same set of information presenting itself (Ban and Hawkins, 2000). This in part arises from the fact that the past experiences of people, and their current set of broader circumstances, impinge on their interpretations of the world around them. In this regard, it is important to pay particular attention to those factors which lead Ngundu farmers to observe changes in local climate patterns. These factors can be grouped into three broad climate change categories: perceptions and concerns about rainfall, about temperature and about extreme weather events. Concerns with reference to vegetation cover, land sustainability and water sources are discussed within the three broad categories. This is all meant to detail the ways in which Ngundu farmers grasp or make sense of climate change and the concerns which arise from their understandings. Such concerns, if they exist at all, form the basis of potential livelihood-based adaptation activities emerging locally.

Farmers in Ngundu are indeed observing that there are climate changes taking place, and over an extended period of time (literally, decades). Here, I largely depend upon the life histories of the elderly people who have been residing in Ngundu from the 1990s and even earlier, including those who were in fact born in the area. Such people have a robust understanding of the changes that have taken place. I wanted a clear picture of what has transpired including changes in temperature patterns and rainfall patterns over a number of years. The life histories of elderly people (who ranged from 70 years to 93 years in age), based on recollections of the past, were crucial in this regard. This was supplemented by evidence from in-depth interviews with key informants and focus group discussions which, collectively, facilitated a vivid understanding of the farmers' concerns in light of climate changes.

From the questionnaire I administered, it was also clear that most people in Ngundu perceive that the climate is changing. A significant number of villagers had difficulties in defining and conceptualising what climate change actually meant, but their lived experiences and everyday perceptions (in the past and present) enabled them to detect that climate-related phenomena were undergoing meaningful changes as manifested in livelihood possibilities. Therefore, villagers in Ngundu proved capable of understanding that climate change is taking place, as compared to how climate change may best be conceptualised, or argued for and against. This is confirmed by Chikodzi et al. (2012), Moyo et al. (2012) and Chaguta (2010), who all note that rural people have an experiential understanding of climate change rooted in their locality, and not necessarily a 'higher-level' intellectual understanding abstracted from local experiences and with cross-spatial reference. However, the clarity of local thought about climate change should not be underestimated, as is the case with a female villager who had a secondary school education:

> *Climate change is the change of seasons, rainfall patterns, and temperatures over years in time. Here in Ngundu it has negatively impacted on crop yields, especially on maize and tomatoes. People are now affected by false alarms being brought about by climate change. People are planting at the wrong time, either they plant early or late which is triggered by early rainfall which make people think that the rains have come only to realise that the rains will not return. At times the case is actually opposite; you plant and there is a continuation of rains and the seeds rot before they germinate* (In-depth interview held in March 2016).

Findings in Ngundu show that 82% of the villagers perceive that climate change is indeed taking place while 12% did not perceive that climate change is taking place. Those who perceived that climate change is taking place pointed out that:

Izvozvi kwakupisa zvinhu zvachinja, zvirimwa zvedu zvakungotsva. [It is now hot, things have changed, and our crops are drying up]. (In a questionnaire, October 2015)

Another respondent pointed out that:

Chibage hachichaiti. Takuwana goho shoma nekuda kwekushomeka kwemvura. [Maize production is no longer conducive. We are now getting very low yields due to low rainfall]. (In a questionnaire, October 2015)

Likewise, another villager highlights:

Kwakutonhora pakwakange kusingasimbotonhora. Uye kana kwatonnhora kunotonhoresa. [Things have changed, we are now getting cold spells during periods when it used to be hot]. (In a questionnaire, October 2015)

Another respondent said:

Mvura haichanayi payaisimbonaira. Yakunonokesa. Inogona kutotanga kunaya January. [We no longer receive rainfall during the period we used to. The rains are now coming very late. Rains might even begin in January]. (In a questionnaire, October 2015)

Finally, as one villager put it:

Taimbotanga kurima end of October, asi izvezvi takurima munaJanuary nekuti ndopakuuya mvura. [We used to begin our planting season in October but now we begin in January because that is when we are now receiving the first rains]. (In a questionnaire, October 2015)

It is also important to note that people in Ngundu considered rainfall to be more important than temperature in terms of climate change, as rainfall patterns were perceived as more critical than temperature variations to agricultural success. According to one villager:

Kukapisa zvako kuchizonaya hazvina hazvo basa. Mvura ndoyatinoda. [If it gets hot it does not matter as long as it will certainly rain. What we want is rainfall]. (In a questionnaire, October 2015)

As indicated, the older age groups (namely, 50-69, 70-79, 80-89 and 90-99), with vast livelihood experiences in the Ngundu area, were more fully aware of climate changes and hence were in a stronger position to identify and speak about climate trends and tendencies in a temporal sense.

The other pertinent issue that I wanted to understand was the ways in which Ngundu people came to their conclusions about climate change, beyond their day-to-day livelihood experiences. A significant number of the villagers, young and old, pointed out that they heard evidence about climate change from AGRITEX, Care and the Zimbabwean meteorological Services via either television or radio, while reference was also made to discussions with

neighbours. These sources of evidence were 'filtered' by and through their own experiences and no doubt in some way and to some extent became part of their collective understanding of climate change in Ngundu. The evidence from these sources also at times involved weather forecasts, but some villagers argued that their body predicts the weather. For instance, they could tell the kind of season it was going to be through how their bodies felt: a literal embodied understanding of weather patterns. Some felt pain in their bodies like "*kurwadziwa makumbo"* (leg pain) which signalled cold weather. According to a 55 year old woman:

> *Inini ndinonzwa nemuviri wangu kuti kunze kunenge kwakamira sei. Kana muviri wangu uchirwadza ndinobva ndaziva kuti kune chando.* [My body tells me when it is going to be cold or hot. When my body aches I know that it certainly is going to be cold]. (In a questionnaire, October 2015).

Other villagers turned to nature to understand the character of upcoming agricultural seasons. For example, a significant number of the villagers pointed out that the abundance of wild fruits was a signal of a drought year. Overall, villagers rely upon situated knowledge to make sense of the effects of climate change.

6.3 Farmer's Perceptions on Rainfall Patterns

As shown in the previous chapter, agriculture forms the major livelihood strategy in Ngundu, and most people follow 'traditional' cultivation practices that rely on seasonal rain water. However, as implied already, climate change has negatively affected crop and livestock production. This section relies on life histories of farmers so as to understand their perceptions on rainfall patterns in particular. Archer argues that people engage in internal conversations and reflexive monitoring, leading to the identification of problems and concerns and possibly practical projects as they seek to immerse themselves in – and 'handle' or manage – a changing world. Perceptions about rainfall in Ngundu, as captured at a particular moment through research, express the ongoing outworking of inner conversations, no matter how unclearly formulated they might at times appear to be.

In this respect, I start off with Mr Tobaiwa, who is an 83 year old man who stays with his 2 sons and his grandchildren. There are currently 10 people in the household and he is the household head. I asked him to relate and give his life experiences in relation to rainfall patterns in Ngundu, as outlined in Box 6.1.

Box 6. 1: Life History of Mr Tobaiwa

I was born in a different world than this one we are now living in. Things were not smooth but I can safely say that it was way better than what we are experiencing these days. Things are now a lot different from the way we lived long back. I was born in 1934 before all these developments at the growth point were there. 'Rese rawakatarisa iri ranga riri sango.' *(All of this was a forest). We would hear wild animals crying during the night and we would find many crocodiles in rivers like Runde and the rivers were always full. I remained at my father's homestead for a long time since I was the last boy child. My father had a monogamous marriage so there were no challenges and difficulties in inheriting his land. As the last born I inherited his land and my farm was 8 hectares but now I am left with 4 hectares as I have divided it among my children. I continued in my father's footsteps as I rely on farming. I farmed crops like cotton and millet and sorghum and later on maize. Rain would come when it was supposed to come. We did not need the weather report to inform us about when it will rain or when to plant like what is happening these days. We were in accordance with the weather and the seasons. Munakamwe* (first rain of the season) *would take place every year and that was all the sign we needed and we would know that it is time to start planting and we were never wrong.* 'Izvezvi kuti tiione zvinenge zvinotoshura.' *(But now it's a taboo to receive these first rains) When we saw the birds like 'Hwaya'* (rain-bird or blue bird), *it meant rains were coming. Then birds like nyenganyenga (*a bird similar to rainbird) *will tell us that it is about to rain.* 'Mwaka yaitaura nesu, nedenga ndiro rataitevedzera richitiudza zvekuita uye risingarasisi. Izvezvi takungorasika.' *(We communicated with nature and nature informed us about our seasons).We did not have to be told by the radio or TV or donors when to plant our crops as the seasons were normal. Now we have to rely on the radio and TV and AGRITEX to inform us when to plant which is difficult. Long back rains would come in October and we would know that it's planting time. My children would go to school in January already having mealies in their bags. Things are now different to what we used to see before.* 'Umwe mwaka unoona mvura chaiyo ichinaya muna December kana January.' *(Currently we see rains in November or sometimes December or January). Our planting dates have moved and we no longer know when to plant our crops. Last year I planted my fields late December after Christmas of which this was not the case when I was growing up. Maybe our ancestors are angry with us and they are punishing us by changing the seasons and giving us little rainfall. I am not saying that, there were no droughts way back; they were there but we would have mutoro* (rain calling ceremonies) *and rains would come. Right now since the 1992 drought, things have not been the same, even if we appease our ancestors, rains still do not come. If you look since 2014/15, and 2015/16 rains have been erratic and when they do come they are floods. These past 2 years I have not harvested more than 5 bags of maize. Way back in a good year I would get about 8 tonnes of maize which would push us to the next season and I would also sell surplus. I managed to send my children to school because of farming and sometimes selling a cow to add supplementary money. I had no formal employment but I knew I could depend on land to provide me with food. These days things are difficult. The rain is too erratic and there are many drought years. I remember the 1992, 2002, 2008 and recently the 2015/16. It no longer rains like it used to before. I remember that when I was growing up and we would be herding cattle, it would suddenly pour, that we were forced to hide in neighbouring houses and sometimes sleep at their houses as it will rain the whole night. These moments are now very rare, it no longer pours like it used to before. Rivers would get full that we were forced to stay at our side of the river as you would risk drowning if you crossed.* 'Dzimwe nguva taitofara nekuti zvaireva kusaenda kuchikoro. Zvino mvura yamazuva ano'(*At times we would be happy if the rivers overflowed for it meant we will not be going to school then) but now we are confused, we no longer know when to plant and when not to plant. We are now forced to depend on donors for*

help depending on whether they are present or not, they come as what we now get can no longer push us into the next season.

Source: Life History held in April 2016, Nduna 1 Village.

The life experiences of Mr Tobaiwa give significant testimony that what was transpiring well before the 1990s and now in the 2000s is very different. The Ngundu he was referring to when he was growing up was drastically different from what I observed. The people were witnessing major changes in rainfall patterns and many could see a change from the amount of rainfall they received in the 1990s to what they are currently receiving. One respondent in a questionnaire confirmed this by pointing out that:

> *Kuma1990 kwainaya chaizvo uye taikohwa. Zvasiyana izvi. Hatichakohwi isu. Taizadza tsapi kupfachukira mvura yanaya. Taisvika umwe mwaka chibage tiinacho.* [In the 1990s we received lots of rain. This is so different from now. We no longer harvest. Our granaries used to get full to the maximum. We would get into another season with our harvest]. (In a questionnaire, October 2015).

A significant number of villagers were extremely worried about the rainfall pattern changes as they disrupted the agricultural season. In the past, the rainfall season was known to begin in mid-October which is no longer the case. Nature, historically, would inform them that it is nearly planting season.

> *Taitoona mashohari toziva kuti mvura yakuuya. Asi izvezvi hatichamaoni. Akaguma kuma 1990s.* [We would see migratory birds then we would know it will start raining before long. Currently we no longer see them. They last came in the 1990s). (Mr Madzivire, in an in-depth interview held in October 2015).

According to Environmental Software and Services (2002), the migration patterns of wild animals including birds and mammals are determined by seasonal rainfall. In the event of a drought, migrations are disrupted and wildlife numbers decrease. In Ngundu, migratory birds are no longer seen showing the frequency of droughts in the area. Besides migratory birds, Mr Madzivire spoke of other signs of rain which no longer appear:

> *Chirongwe raipfuta moto kureva kuuya kwemvura, waitozodzimwa nemvura yanaya. Izvezvei rakudaro kure nakure, vamwe havatozvioni asi kare zvaionekwa nevazhinji.* [Chirongwe Mountain would show a burning flame at its top signalling that the rains are coming, the rains would then put out the flame. It does that now once in a while but only few people can see it, most people do not see the flame]. (An in-depth interview held in October 2015).

Many villagers were concerned about what was taking place with regard to the onset of the rainy season, which had become so unpredictable. A good example can be seen from one Nduna 1 respondent during an in-depth interview, who outlined her concern about the change in rainfall patterns and how this was affecting the main livelihood strategy of crop production. I met the respondent when I carrying out my fieldwork in Nduna 1 in April 2016, and she clearly remembered the previous 2014/15 season as it was very difficult for her. As she put it:

> *I remember last year as one of the most difficult years as I had a hard time because of poor rains. Rains came late and when they finally came in December the rain poured like a water tap that has been opened and if I am not mistaken this was between 27 December and 2 January. This was only an advantage in that rivers and wells became full but a great disadvantage to our crops because, after this, the rains only came back in early March. It appears as if it is about to rain but the cloud disperses and the scorching sun comes again. Only one woman I know, who lives two houses away, managed to get better yields that year because she planted with the first rains and she also had manure. I was reluctant to plant with the first rains because I was not sure when the rains would come again and that is why I got zero yields.* (In depth Interview held at Nduna 1 in April 2016).

The late onsets of rainfall and the early cessation of rains has confused farmers so much so that they no longer know when the planting season begins, distorting their agriculture calendar which under normal circumstances should begin mid-October. In this sense, uncertainty has become the new normal, as it has dramatically affected crop yields. Most respondents pointed out in the questionnaire that, quite simply, *"rainfall comes late and ends early".*

A study by Mutekwa et al. (2006) also showed how farmers become confused due to the unpredictable rainfall patterns. They point out that the unpredictability of precipitation presented more challenges to the farmers than any other climate change element. Another study by Simba et al, (2012), which looked at farmers' perceptions on climate change in Masvingo indicated that there are changes in the seasons with rainfalls beginning late and cessing early. Life histories in the Ngundu study show that rainfall in the 1990s began in October and would be evenly distributed up to February when the rains ceased, with harvesting time then beginning in April. This now is no longer the case. Maize crops take about 6 months to be harvested, after planting; but, considering that it is now often being planted in January, this means that the harvesting period would be June, a traditionally winter month. Maize though cannot grow properly in winter as maize is not a winter crop**.** This leads to low yields and poor quality maize.

One respondent during an informal conversation pointed out that "*kurima ava makasa".* (Farming is now like playing poker).

Many farmers in the area now consider farming as a win or lose scenario. Sometimes you lose and sometimes you win. It is not about knowing how to be a good famer like in the previous decades, but it is about luck in predicting the rainfall onset of a particular year. For example, in 2014/15 there were erratic rainfall; the same existed with the 2015/16 as there was the El-Nino triggered drought. However, in 2016/17, there were floods and those who planted early obtained good yields while those who planted late (like what they had been used to in the past drought years) lost out as their fields and crops were flooded. During an in-depth interview with an AGRITEX officer in April 2017, he pointed out that in the 2014/15 season farmers planted their fields in December and in 2015/16 they planted in January. This was a different scenario in 2016/17 in which some farmers had been informed by the Meteorological Services to plant their crops early as they were made aware of possible floods. Most farmers did not follow the advice of the Meteorological Services and planted later; hence when the floods came their crops were affected. The AGRITEX officer highlighted that the rain distribution is worrisome as it is not evenly distributed as per the requirements of maize production – maize requires certain levels of rain at certain periods in its growth cycle. The onset of rainfall has become very unpredictable (affecting farmers' crop yields), but the officer also notes that the sheer volume of rain has declined. He pointed out that in a 'normal season' (which, in effect, no longer exists), the area should get 500-600ml of rain but currently the area is getting 281ml which is also not evenly and properly distributed. The people in Ngundu are still reluctant to follow the advice from Meteorological Services as they have received wrong information at times from the official meteorological offices.

Crop production has been undercut by the changes in rainfall patterns and this has affected the crop yields that the villagers are harvesting. According to Mr Nevanji, in a life history interview:

> *I was born in 1928 and I have been cultivating my land since 1959. My wife passed away which made my life difficult. My daughter Emilia who is not married takes care of me. I once had 5 hectares of land but I am now left with 3 hectares as I gave some to my children. I once ploughed using cattle but considering that I now have 2, I am now facing labour shortages. Most of my livestock had died by the year 2008, some affected by drought and others by floods. I used to get 30-40 bags of maize in the 1990s but these started decreasing in the late 1990s. 1992 is the drought that affected me the worst and I got 1 bag. In season 2015/16 I only got 5-6 buckets as it did not rain. During the 2016/17*

*season I did not get anything as all my crops were flooded. The rainfall patterns have changed and are now confusing and unpredictable. "*Rimwe gore tinowana mvura rimwe gore toshaiwa*"* (*one year we receive rains then the other year we do not*). *Rain is now coming later than usual and I cannot keep track of when it will rain. My planting time has changed from what I have been used to and this is affecting my crops. I used to plant in mid-October but now I do not know when I should plant. It is all very confusing for me because sometimes I do dry planting and the seeds rot; sometimes I do early planting only for the crops to dry up because of the sun.* (Life history interview held in April 2017, Pedzisai village).

Maize, which is the main crop cultivated, has been greatly affected by the changes in seasons as it is not conducive for growth in hot dry weather. Villagers' yields of maize have been affected by erratic rainfall. One respondent in an informal conversation in April 2016 stated:

*Kana kukanaya zvakanaka pamunda wangu one gandiwa ndinowana 2 tonne asi kana mvura ikasanaya sezvayakaita makore maviri apfuura aya (*2014/15 and 2015/16) *ndinowana 3 bags kana kushaya chaiko.* [When it rains well I can get 2 tonnes of maize on my 1 acre piece of land. However, if it does not rain, like what happened in the past 2 years (2014/15 and 2015/16) I can only get 3 bags or nothing]. (Informal conversation, April 2016).

In another informal conversation, another respondent pointed this out:

Tinotoomerwa kuti todii. Kana isiri zhara yekushaya mvura izhara yekuwandirwa nemvura segore rino. [We are facing a difficult predicament and we do not know what to do. If it is not hunger caused by drought it is hunger caused by floods]. (Informal conversation, April 2016).

Pests have also come to be a major challenge with army worm being the most persistent. One respondent thus highlighted:

Chikonye chapinda umu chatitambudza. Chatanga kutodya mbeu dzichiri diki. Kutosprayer. [This army worm in this field has affected us. The army worms have already begun eating the crops at this early stage. We really need to spray]. (In-depth interview with Banga Irrigation farmer held in February 2017].

Picture 6.1 below shows maize that has been affected by army worm in Ngundu. Lack of financial assets to purchase pesticides has led to more destruction.

Picture 6. 1: Crops affected by Army Worm

Source: Fieldwork, February 2017.

Overall, Table 6.1 below shows that a significant number of villagers were aware that rainfall patterns had changed. Comparing the 2000s and the 1990s, 85.7% of the respondents pointed out that the 2000s had seen an increase in the number of seasons without enough rainfall (compared to 38.1% for the 1990s). From the respondents, for the 1990s, 35.7% felt that there was poor rainfall distribution during this decade's seasons while, for the 2000s, nearly all villagers (88.1%) perceived that there was poor distribution within the seasons. In terms of extremes in rainfall, 28.6% felt that there were extremes in the 1990s while more than double (64.3%) felt that the 2000s were marked by extremes in rainfall. On all the key variables, including when the first rains fell and when the rains ended, there was a clear recognition that the rainfall patterns had become more unpredictable from the year 2000.

Table 6. 1: Perceptions of Farmers pertaining to Rainfall Changes

	YES		NO		NO RESPONSE	
	Count	Row Valid N %	Count	Row Valid N %	Count	Row Valid N %
increased_number_of_season_without_enough_rainfall_1990s	16	38.1%	23	54.8%	3	7.1%
increased_number_of_seasons_without_enough_rainfall_2000s	36	85.7%	4	9.5%	2	4.8%
rainfall_starts_late_and_ends_early_1990s	17	40.5%	22	52.4%	3	7.1%
rainfall_start_late_and_ends_early_2000s	38	90.5%	2	4.8%	2	4.8%
rainfall_start_late_1990s	19	45.2%	21	50.0%	2	4.8%
rainfall_starts_late_2000s	37	88.1%	3	7.1%	2	4.8%
poor_rainfall_distribution_with ing_seasons_1990s	15	35.7%	24	57.1%	3	7.1%
poor_rainfall_distribution_with ing_seasons_2000s	37	88.1%	5	11.9%	0	0.0%
extremes_in_rainfall_1990s	12	28.6%	30	71.4%	0	0.0%
extremes_in_rainfall_2000s	27	64.3%	13	31.0%	2	4.8%

Source: Fieldwork October 2015.

6.4 Farmer's Perceptions and Concerns on Temperature Patterns

A study done by the Government of Zimbabwe (GoZ) as outlined in UNICEF (2014) shows that temperature has been increasing in Zimbabwe by around 0.1 ^{0}C a decade. According to UNICEF (2014), future scenarios predict increasing temperatures of around 2.5^{0}C by 2050. Ngundu villagers raised concerns on the increases in temperature as compared to previous decades. Thus, 83.3% of villagers pointed out that temperatures were rising while 16.7% did not notice any change in temperature increases. There was no local record of the actual changes in temperature which the farmers themselves could provide as justification for their claims. However, their perceptions and concerns were real, and these in large part concurred with findings from other studies and from records from meteorological centres which show temperature increases in areas such as Ngundu (Baseline Report of Zimbabwe, 2012). As one respondent in a questionnaire (held in October 2015) simply put it: *"Kupisa kwainge kurinani kunana 1990"* [It was not that hot in the 1990s]. Higher temperatures are affecting soil moisture content directly. Further, they lead to higher rates of evapotranspiration which, in turn, lead to

changes in the intensity and timing of rainfall and the occurrences of extreme weather events. This has also affected crop yields in Ngundu.

Local water resources in Ngundu are affected detrimentally by rising temperatures, and diminishing stocks of water sources raise particular problems for both homestead consumption and the water demands of livestock. Most of the rivers were drying up due to rising temperatures which drastically affected livestock. In my study, I sought to understand the concerns of farmers about water sources and thus farmers were asked about the availability of water resource. In this respect, 81% of the respondents indicated that there had been a sharp decrease in water availability, while 12% pointed out that there was an increase and the other 7% thought that there was no change. The results show, quite clearly, that a significant percentage of the farmers shared the same perception, namely, that water yields from water sources had decreased as a result of high temperatures. The farmers are concerned with the high depletion of wetlands. Wetlands in Ngundu are a source of water for livestock and sometimes gardens are established near the wetlands. According to one female respondent:

> *Long back we had several wetlands which has now become a thing of the past. These extreme temperatures have dried up the wetlands which were very helpful to us.* [Life history interview with an elder held in April 2016, Nduna 1 village].

This has resulted in the abandonment of such gardens.

Table 6.2 below clearly shows that people in Ngundu feel that temperature has drastically increased in the 2000s as compared to the 1990s. 85.7% felt that the heat has become more intense in the 2000s as compared to 14.3% who felt that it had not. In the case of the 1990s, only 42.9% felt that it was more intense while 57.1% felt that it was not intense. In terms of extremes in temperature, in the 2000s, 83.3 % felt that there are extremes in temperature while 16.7% did not feel this. For the 1990s, less than half of this (38.1%) felt that there were extremes in temperature while 61.9% felt that there were no extremes in temperature. In terms of winter season in the 2000s, 57.1% felt that the winter season had become shorter while 35.7% felt that it had not. For the 1990s, slightly less (47.6%) felt that there were shorter winter seasons while 52.4% felt that there were no shorter winter seasons. Generally, these statistics give evidence to the rise of temperature in Ngundu as felt by the people, with more dramatic changes taking place since the year 2000 compared to the previous decade.

Table 6. 2: Perceptions of Farmers pertaining to Temperature Changes

	YES		NO		NO RESPONSE	
	Count	Row N %	Count	Row N %	Count	Row N %
heat_is_more_intense_1990s	18	42.9 %	24	57.1 %	0	0.0%
heat_is_more_intense_2000s	36	85.7 %	6	14.3 %	0	0.0%
extremes_in_temperatures_1990s	16	38.1 %	26	61.9 %	0	0.0%
extremes_in_temperatures_2000s	35	83.3 %	7	16.7 %	0	0.0%
long_dry_heat_spells_during_rainy_season_1990s	19	45.2 %	16	38.1 %	7	16.7%
long_dry_heat_spells_during_the_rainy_season_2000s	37	88.1 %	5	11.9 %	0	0.0%
proloned_extende_winter_season_1990s	15	35.7 %	24	57.1 %	3	7.1%
prolonged_extended_winter_season_2000s	19	45.2 %	23	54.8 %	0	0.0%
short_winter_season_1990s	20	47.6 %	22	52.4 %	0	0.0%
short_winter_season_2000s	24	57.1 %	15	35.7 %	3	7.1%
rising_temperatures_1990s	12	28.6 %	26	61.9 %	4	9.5%
rising_temperatures_2000s	33	78.6 %	7	16.7 %	2	4.8%

Source: Fieldwork 2015.

Increases in temperatures are affecting crop yields, particularly maize. One respondent in the questionnaire aptly stated:

> *Kwapisisa mbeu dzikutsva nekuda kwezuva*. [It is now very hot and crops are dying due to heat spells]. (In a questionnaire, October 2015).

Another respondent in a questionnaire also pointed out that:

> *It appears the sun is now very close to us. Look at our crops; they directly feel the heat as if the sun is very close to them.* (In a questionnaire, October 2015).

The high temperature increases that were perceived by farmers were a major concern as they affected maize production, given the sensitivity of maize to high temperatures. This is in line with the findings from the Zimbabwe Baseline Report (2012) which say that maize yields are

particularly sensitive to increases in temperatures, because maize does not utilise higher CO_2 levels effectively. This is also supported by a study carried out by Matarira et al. (1995) who noted that yields of maize, the most widely grown crop in Zimbabwe, decrease dramatically under dry land conditions in some regions (even only up to 30%) even when under full irrigation conditions due to temperatures increases that shorten the crop growth period.

High temperatures which have resulted in heat waves in Ngundu have led to poor germination of crops leading to low yields. According to one respondent:

> *If you plant the crops they will not germinate due to extreme heat. If they do, they quickly dry up due to the heat; those that have grown begin to wilt and dry up too*. (Informal conversation, October 2015).

This was also found out in a study carried out by New et al. (2006) in examining Southern Africa. It was observed that there are glaring indications of decreasing total precipitation showing a gradual slide towards drier conditions. Gukurume (2013), in his study in Bikita, also points out that concurrent heat waves and poor rains have compounded the wilting of grown crops and poor germination of planted seed.

As well, vegetation cover has been affected by rising temperatures. Data gathered show that a significant number of people in Ngundu perceived a drastic increase in vegetation degradation and a decrease in vegetation stability. Diminishing vegetation cover was promoting land degradation and decreasing soil fertility, such that the soils in Ngundu have become sandier due to this. Picture 6.2 below shows the type of soil that is now found in most of Ngundu. Many respondents pointed out to the changes in land use which necessarily arise from this, with land for crop production now more suitable for simply grazing land. The formation of gullies has resulted in the reduction of farm size and the depletion of wetlands has affected livestock and gardens that were established near them.

At the same time, grazing land has also been reduced due to limited vegetation cover and soil erosion. There is now competition on limited grasslands therefore leading to further land degradation. The grass or vegetation cover that is now in Ngundu is different from the one they used to have. One male respondent argued as follows:

> *Sora rakumera mumunda mangu iri handicharizivi, hatina kukura tichiriona.* [The weeds that are now growing in our fields is a lot different from the grass we used to have]. (Life history held with an elder, April 2017, Guti village).

This is raised by Environmental Software and Services (2002), which point out that scanty rainfall in drier areas for a few years can kill vegetation permanently and poor land practices make it worse. There is no time for vegetation recovery in Ngundu due to continuous

occurrences of droughts in the area. It is difficult also for livestock to recover as the pasture continues to be limited and of low quality. Increases in temperatures have also led to more bushfires. The incidence of bushfires triggered by high temperatures had led to destruction and migration of wild life and decreased biodiversity in terms of plants and animals (Vorsah, 2015).

Picture 6. 2: Soils found in Ngundu

Source: Fieldwork March 2016.

Farmers also expressed their concern on cold and dry spells and the changes that have occurred because of this. In Ngundu, the success and failure in crop production during the rainy season are dependent on the frequency and length of dry spells and these have been on the increase in terms of both frequency and length. Most respondents pointed out that June, which used to be cold and marked the start of the winter season, is no longer cold. At times, the cold spells seemingly come at any period in the year, even as late as August. October, which used to be hot, has become much hotter but at times Ngundu farmers experience a cold period within the same October month. One respondent pointed out very simply that: *"Things have really changed".* From the respondents, it was discovered that 87.4% perceived long dry spells during rainy seasons while 12.6% did not perceive this. A significant number raised concerns over intense cold spells even though the winter season appeared to have shortened.

The following (Box 6.2) is a life history of Mbuya Toko aged 89 years who grew up in Ngundu. Her story speaks about many of the key points raised.

Box 6. 2: Life History of Mbuya Toko

When I first visited Mbuya Toko in 2016, she was busy occupied with her pottery work at her home. Her home is less than a kilometre from the main Beitbridge-Chirundu road. I was curious to know her age the first time I saw her. When I asked her age she did not really remember so much that she had to give me her national ID which showed the year she was born. She happened to be one of the oldest people in the area who really know the trends and trajectories of rainfall patterns. When asked about her life she had this to say: *"I stay alone with my house keeper who is a young man aged 17. Ndakaroorwa pakati pana 1940 ipapa* (I got married in the mid-1940s). *My husband was a loving hardworking person who knew how to take care of his family* [her face lit up as she said this]. *Kungoti chete Mwari vakangobva havo vamutora nguva yake yakwana* (only that God took him away from me). *We had eight children together, 3 boys and 5 girls. My husband died around early 2000s. I get sick at times that's why my children had to find a house worker for me. They are such lovely children. If only they could just give me one or two of my grandchildren to stay with. They have gone to the towns and are reluctant to come back to their roots. I once fell ill 2 years back that I did not cultivate for the whole year. I spent that whole year at my daughter's place. So when I recovered that is when I came back, however my health has not fully recovered and this intense heat is worsening me. Way back we did not experience such heat and the sun was meant to be a blessing and a reprieve from the coldness. However, these days, things have changed. We are now even feeling the sun in the month of June of which this never happened. These temperature increases make me sick at most times. Look at my age I cannot farm under this heat. Even if I plant, the crops will get burnt under this sun and it will be wasted time. Today crop yields are very low due to this endless heat that is here now. At times we have floods and these drastically affect our crops. I cannot stand the scorching heat, I think you can feel it too. Cattle do not survive under this heat. Temperatures are not good for cattle. I no longer have cattle as you can see, they could not survive in this heat.*

Source: Life history held April 2016, Pedzisai village.

The life history shows that temperatures have drastically increased and this makes it difficult for farming to take place and has also contributed to the death of livestock. Respondents complained of summer days getting hotter which has largely contributed to crop failure. One respondent in a questionnaire brought to the fore: *"Chibage chiri kukangiwa nezuva".* [The sun is roasting our maize crops]. Another villager in a questionnaire said:

Mazuvano kukupisissa zvekutoti hatitonzwisisi kuti todini. [Nowadays it is extremely hot; we do not know what to do]. (In questionnaire, October 2015).

Another villager during an informal conversation pointed this out:

Kwaimbopisa hako asi izvezvi zvave pamberi. [It used to get hot before but this is very extreme]. (In questionnaire, October 2015).

6.5 Extreme Weather Events

Extreme weather events like droughts and floods have become a common occurrence. For example, Mutasa (2008) note that extreme weather events, such as tropical cyclones and

drought, have increased in frequency and intensity. According to Orlove and Tosteson (1999), many of Zimbabwe's serious droughts have coincided with El Nino events (for instance, 1982-1983 and 1991-1992), reducing total rainfall to as little as 30% of the annual average. Zimbabwe also experiences extreme rainfall events and flooding related to La Nina events. The 2007 floods are a case in point, which resulted in extensive flooding in some parts of Zimbabwe as well as other Southern African countries.

People in Ngundu experience more droughts as compared to floods. Droughts have been more common in the area and their effects have been more drastic. When asked about the most severe droughts, a significant percentage of the farmers pointed to the 1992 drought as the most severe. During this drought, there was total crop failure and water sources dried up. It also witnessed the deaths of many livestock (cattle and goats), leaving many unpleasant memories. One female villager exclaimed:

> *Iii 1992 ranga riri pamberi. Ndiro gore rakatitangira zvese izvi zvatakuona makore ano. Mombe dzevanhu dzakafa zvekufa zviya.* [1992 was the worst year. It marked the beginning of all the seasonal changes that we are now currently facing]. (Life History held in April 2016, Guti village).

The drought of 1992 saw the ushering in of NGOs like Care in Ngundu, showing the severity that was associated with the drought. Other droughts which were mentioned included the 2002 and 2008 droughts. The 2008 drought was not so severe, but it was exacerbated by the 2008 Zimbabwean economic crisis. Drought severity is dependent not only on the duration, intensity and geographical extent of a specific episode, but also upon the demands made by human activities and vegetation on an area's water supplies. While drought is widely considered a natural and physical event, it has serious social components. The risk associated with drought for any region is a product of both the exposure to the event and the vulnerability of the society to the event (Wisner et al., 2003).

Farmers in Ngundu also perceived that there is too much rainfall leading to floods. They were aware that floods have increased in the past decade and most of them cited the 2000/2001 Cyclone Eline as the one they could remember. The effects of the floods triggered by Cyclone Eline are still very vivid in many people's minds in Zimbabwe more widely. The cyclone affected most parts of Zimbabwe in general and Ngundu in particular. There was total crop failure as the crops were affected by water logging. In 2002/2003, there was Cyclone Japhet which again resulted in the destruction of houses, death of livestock and low crop yields. Another cyclone, Cyclone Ernest, was experienced in 2004/2005. Cyclone Dineo in 2017 also affected crop yields. The farmers perceived the effects of heavy rains and lamented their loss

of crops. Crops like groundnuts and Bambara nuts are greatly affected by floods with the farmers in Ngundu complaining about the low yields during floods. Mbuya Musindo used to get 8 bags of groundnuts in the 1990s but the number of bags has been greatly reduced – to 4 buckets (1bag and 1 bucket) that she received in the 2016/17 season. She noted:

> *Nzungu hadzidi mvura yakawanda nekuti dzinowora. Zvino kubva patanga kuita mafloods muna 2001 nzungu dzangu dzakaderera. Izvezvi gore rino nekuda kwemvura yawandisa dzakawanda dzakaora.* [Groundnuts require normal rainfall, too much rainfall make them rot. If the rainfall increases like the floods of 2001 my crop yields also reduce. This year (2016/17) I had low yields of groundnuts because of too much rainfall]. (Life history held in April 2017, Nduna village).

Picture 6.3 below shows groundnuts and Bambara nuts affected by too much rainfall.

Picture 6. 3: Effects of floods on nuts

Source: Fieldwork April 2017.

The picture shows the poor quality and poor crop yields that were harvested in the season 2016/17 where there was Cyclone Dineo. In as much as many people pointed out that there was abundant water for drinking, the effects of the floods were drastic and all crops dried up because of waterlogging. A significant percentage of farmers also showed concern pertaining to other specific effects of continuous raining that occurs during floods. Once the floods begin, as what happened in 2016/17, they do not get a chance to weed, as the rain seldom ceases to stop. One respondent during an informal conversation hence stated:

> *Kana mvura yatanga kunaya haikupi mukana.* [When the rain begins it pours and does not give you a chance to weed]. (Informal conversation, April 2017).

Farmers were also concerned with the land degradation, as noted above, that is associated with both droughts and floods. Land degradation in Ngundu is rampant and gullies are a common feature that have also contributed to a very poor road network. Picture 6.4 below shows some of the gullies found in the area. Siltation and soil erosion have caused drastic problems that have led to land degradation.

Picture 6. 4: Gullies in Ngundu

Source: Fieldwork April 2017.

The period 1990-2017 clearly shows that the people of Ngundu were affected by extreme weather events. It is either they had a drought or flood, both of which affected their crops or livestock. Information gathered in Table 6.3 below shows the percentage of those who were affected and not affected by these occurrences.

Table 6. 3: Affected by Extreme Weather Events

Drought year	Affected %	Not affected %	Floods	Affected %	Not affected %
1991/1992	100%	-	2000/2001	55%	45%
1997/1998	75%	25%	2002/2003	48.3%	51.7%
2000/2003	82.5%	17.5%	2004/2005	52.5%	47.5%
2008-2012	88%	12%	-	-	-
2013/2015	69%	31%	-	-	-

Source: Fieldwork October 2015.

Most of the harvests that the Ngundu farmers had – between 1990 and 2015 – were accompanied by some degree of failure. Information gathered in the questionnaire to show the effects of droughts and floods outlines the numbers of kilogrammes of maize that were harvested during a particular period. Information from respondents show an ongoing and repeated reduction of yields harvested every year, as depicted in Table 6.4 below.

Table 6. 4: Calamities remembered by Ngundu people

Years	Event	Maize Yields (50kg=I bag)
1991-1992	Drought	0-2 buckets
1997-1998	Drought	1-4bags
2000-2001	Drought/flood	1-2bags
2002-2003	Flood	3-6bags
2004-2005	Flood	2-5bags
2008-2012	Drought	1-2bags
2014-2015	Drought	1bucket-3bags

Source: Fieldwork October 2016.

The people of Ngundu could also relate the changes of rain fall patterns to the status and condition of their livestock. Rainfall patterns could easily be seen when considering the effects on livestock, such as the reduction in the numbers of cattle and goats during droughts as their water sources and pastures had dried up. I also relate this back to the sentiments of Mr Moto in a life history interview I had with him, in trying to understand if rainfall patterns had affected livestock.

Box 6. 3: Life History of Mr Moto

Mr Moto was born in Ngundu in 1940 which means he has stayed in the area his whole life. He could see that rainfall patterns had changed compared to what he experienced as a young man, to what he is now experiencing as an old man. He pointed out that rainfall changes could be felt in the decreasing of livestock as the erratic rains had affected livestock. Long back when he was growing up at his father's homestead, livestock like cattle were many and they could easily be owned. This was because there was pasture and rains for the cattle and enough grazing land. His father had more than 40 cows and he could easily give his children cows when they were growing up as he knew that they would continue reproducing. When Mr Moto married in the early 1960s he was given 4 cows by his father as a starting point. He bought his first cow in the early 1960s after selling cotton. The cattle had enough water to drink and enough pasture. According to him it was not a burden to have cattle as they always had enough to drink and eat. He pointed out that although there were droughts, the drought would usually only take place one year and the following year rains get back to normal. So that meant the water sources would not have dried up. He remembers the 1968 drought which affected his cattle but it was not to a great extent as none of his cattle died as he managed to push their survival to the next season when rains came back again. Droughts took place usually in a 10 year interval and gave time for cattle to recover if they had been affected. However, the world he now is living in, is different as the livestock sometimes fail to get adequate drinking water as erratic rainfalls have affected water sources and pasture for the animals: '*These days we no longer have rainfall yearly and this means that our rivers dry up and most of our wells also dry up. So that means that our livestock will no longer have water to drink and sometimes this will mean for two years like the 2014/15 and the 2015/16 year. These erratic rains will also mean that grass for pasture will be affected and as our fields would have been affected by drought we would not have any fodder to also give our cattle.'* He pointed out that their cattle are no longer given adequate time to recover to these shocks due to an increase in number of droughts. Mr Moto used to have 16 cattle in the 1980s but now he only has 8 as 4 died in the 1992 drought, and he sold 2 in 2008 and lost 2 in 2015/16. Mr Moto could also see changes in rainfall patterns due to floods that take place and according to him it is these changes that are leading to diseases in their livestock: *'kare tanga tisingazvizivi zvemadhibha uye zvekubayisa mombe izvi, tanga tisingazivi kuti mombe inorwara. Ndinofunga kuti kuchinja kwemwaka ndiko kuri kukonzeresa nekuti zvinhu zvachinja shuwa'* ('when we were growing up we did not know that cattle are supposed to be dipped or get vaccinations. We were not even aware that cattle could get sick. I think it is being caused by these changes in the seasons because things have changed').

Source: Life History interview, held in April 2017, Pedzisai village.

The above sentiments from Mr Moto gave me a broad understanding on farmer's perceptions and concerns on climate change with particular reference to extreme weather events. Having stayed in the area for more than seventy years, Mr Moto could clearly highlight the differences that have occurred over the decades. The issue of pasture for livestock was a major problem that was raised by other respondents as well. The quantity and quality of grass in the area had deteriorated making it difficult for livestock to survive. According to one respondent:

Kuti utowana mafuro arinani unenge watofamba kuenda kunana Gororo kana ku Banga kune dhamu uko, anotinonokei kupera. Asi pane mufambo, mombe dzosvika dzaneta,

kuzodzoka kwacho unosvika manheru kumba. [Nowadays for you to find pasture for livestock you need to go to Gororo or Banga dam. Because of the dam, there the pasture's availability is high. The problem is only that when you get to Banga dam the cattle and goats would be exhausted and worse still you will have to come back home at night]. (In-depth interview with a livestock owner held in March 2016).

Such views show that what Mr Moto had highlighted concerning lack of pasture was a shared problem among the people of Ngundu. I observed that, what intensified the problem of pasture was the limited land size that the farmers had initially, alongside the population increase over the years, leading to land shortages when it came to sufficient pasture grasses. The continuous occurrences of drought was also resulting in the sheer deterioration of pastures. Mr Moto made me to understand the drastic changes that have occurred over the decades, as he outlined the depletion of his cattle stock due to water shortages and the poor state of pastures. A significant number of respondents indeed expressed grave concern about the effects of droughts, with the 1992 drought being spoken about most vividly. Chief Mutote Mutote spoke about this at length. In one snippet, he noted:

It was during the 1992 drought that we had to travel into the mountains with our cattle and feed our cattle tree bark. It was not even allowed but our cattle were dying so we were left with no choice. I managed to save 5 of my cattle through this, while the rest [10] *died from this drought. I will never forget that year, it was unbearable. If another drought like that comes, I am not sure I will be able to survive it.* (In-depth interview held in October 2015).

The sheer calamities associated with the drought of 1992 are well-known in Zimbabwe. Indeed, Environmental Software and Services (2002) point out that – in 1992 – all of Southern Africa, excluding Namibia, experienced the worst drought in living memory. In Ngundu, the frequency of respondents mentioning the 1992 drought showed that it was the most severe and will be forever remembered. The villagers pointed out that it was during this period when they began to be supplied with yellow maize meal which was commonly referred to as *"Kenya"* (Zimbabweans use white maize meal for making *sadza*).

Important to note also is that, during a drought, overgrazing leads to even further degradation of pasture and arable areas as part of a vicious cycle entailing the deterioration of both pastures and livestock. The deterioration of grazing capacity also further reduces livestock numbers (Zimbabwe Humanitarian Needs, 2016). Hence, extreme weather events have drastically affected livestock production in the area and have resulted in the hunger and

starvation of livestock. Picture 6.5 below shows the lack of pasture and the poor quality of pasture found in Ngundu, as cattle spend significant effort looking for quality pasture.

Picture 6. 5: Pasture Decrease in Ngundu

Source: Fieldwork, April 2016.

During droughts, people in Ngundu have been forced to sell their livestock due to lack of pasture to feed the cattle and diminishing water sources, and at a time when the condition of their livestock does not allow for solid market prices. If these distress sales are not undertaken, then death of livestock may be forthcoming. In this regard, the 1991/1992 drought killed more than one million cattle in Zimbabwe (Environmental Software and Services, 2002). The study by Gukurume (2013) in Bikita highlights the devastating effects of lack of pasture and its poor quality on livestock condition and ensuing deaths of livestock. This was also confirmed by Giridhar et al. (2015) in their study of the impact of droughts on livestock productivity by causing heat stress directly and indirectly by compromising the availability of feed crops and quality of forages. Further, Nardone et al. (2010) point out that extreme weather events such as cyclones, floods, and droughts directly impact animal stocks by increased morbidity and death rates.

The majority of Ngundu farmers were also concerned with the floods (and not just the droughts) that have occurred over the past years with the most recent one in 2016/17 mainly triggered by Cyclone Dineo. As pointed out by many respondents, floods resulted in the death of goats as goats are easily affected by excess water. Several respondents pointed out that the

death of many goats in the area is mainly experienced during floods. According to one villager during an informal conversation:

> *I had 16 goats in 2013/14 but most of them died during the flood between 2016/17. I now have only 2 goats out of 16, the loss is huge.* (Informal conversation, April 2017).

This respondent was in a sorrowful state as she pointed this out: and it showed me how drastic the floods that occur in the area can be and how they affect livestock production which is a major livelihood for the people.

Most villagers also showed their concern about pests and diseases due to extreme weather events that had increased over the decades. As Mr Moto highlighted, most of the people who were in the area in the 1950s and 1960s did not dip their cattle since there was no need. This was mainly attributed to the good quality and high quantity of pasture that existed. Now the livestock are easily attacked by diseases such as anthrax, sores, and foot and mouth among others. The Ngundu villagers argued that such disease outbreaks amongst their cattle are attributable to reoccurring droughts and floods, and had also contributed to the death of livestock. One male villager spoke about this:

> *It no longer rains like it used to in the 1960s when I was a little boy. The cattle had enough drinking water; there were no chances for disease outbreak. Drought and floods that are now occurring year after year are a result of this. Its either there is a drought or a flood every year. When we do not have a drought or a flood, it is only one year. So how can our livestock survive? How can we get rid of the diseases? Now we are told to dip our cattle numerous times, but the diseases can be stubborn at times* (Life history held in April 2016, Pedzisai village).

6.6 Conclusion

Rural livelihoods in Zimbabwe, particularly in communal areas, mainly depend upon rain-fed agriculture as concurred by several researchers (Unganai 2009; Mano and Nhemachena 2006; Mubvuma 2013; Chikodzi et al. 2012). This puts farmers such as in Ngundu in the direct path of the climate change storm, and this chapter clearly shows the ways in which local farmers are cognisant of the changes and of the effects they have had on local agriculture in terms of both crops and livestock. This was shown – in turn – with reference to changes to rainfall patterns, temperature patterns, and extreme weather events. Changes along these three dimensions have had profound effects on the consciousness and experiences of Ngundu

farmers, with certain events (such as the 1992 drought) being ongoing talking points and points of reference for happenings in people's personal histories in Ngundu.

In this sense, climate change is, by its very character, a factor which enhances the vulnerability of communal farmers like those in Ngundu. In particular, the heavy dependency on rainfall by Ngundu farmers make them to be inherently vulnerable to climate change. Understanding the vulnerability context, as shown in the SL framework, is thus crucial for understanding the lives and livelihoods of Ngundu farmers. Vulnerability in their specific case is a function of exposure to natural hazards, including water-related hazards such as floods, rainfall events, droughts and water borne epidemics, in terms of both their extent and frequency. This chapter has shown that Ngundu farmers have an acute awareness of their vulnerabilities based on their own experientially-based perceptions and understandings of the ecological history of the area. Responses from Ngundu farmers also show the real lived effects of climate change, such as uncertainty about when to plant crops, decreases in crop yields, loss of livestock and ultimately levels of food insecurity. These findings are similar to the study conducted by Dube et al (2013) in Matobo District.

Vulnerability, or at least the effects of vulnerability, are mediated by a range of factors such as the presence or absence of mitigating factors, including technological interventions, policy platforms and local resources. In the absence of such factors, climate change vulnerability is liable to have maximum negative repercussions on rural livelihoods. In this context, it becomes important to consider the ways in which Ngundu farmers, often through their own locally-crafted capacity and own resources, have sought to handle the effects of climate change and to re-position themselves so as to at least weather the storm. In the following chapter, I focus specifically on the adaptive strategies formulated and pursued by Ngundu farmers in the face of climate change vulnerability.

CHAPTER SEVEN: FARMERS' ADAPTATION STRATEGIES IN THE CONTEXT OF CLIMATE CHANGE IN NGUNDU

7.1 Introduction

In building on the previous two chapters, which focused on Ngundu farmers' livelihoods and their perceptions and concerns about climate change and variability, this chapter focuses on the adaptation strategies which Ngundu farmers have developed, pursued and implemented. As such, this chapter addresses the third subsidiary objective of the thesis. Perceptions and concerns about climate change provide a necessary – but not sufficient – foundation for subsequent adaptation measures, as there is no direct correlation between perceptions and concerns on the one hand and adaptation practices on the other hand. In other words, perceptions and concerns condition adaptation, but do not invariably lead to adaptation or the adoption of specific adaptations. In large part, this is because Ngundu farmers simply may not have the capacity to pursue particular adaptation measures or adaptation more generally. Nevertheless, this chapter does detail a diverse array of adaption (and coping) processes underway amongst Ngundu farmers, including activities unrelated to agricultural activities (such as sex work).

7.2 Overview of Ngundu Villagers' Adaptive and Coping Strategies

The problem of climate change in Ngundu raises the question of human agency on the part of villagers in coping and adapting to this change. Broadly speaking, agency encompasses the reflection-based activities and practices of people as they seek to negotiate their way through the uncertainties of daily life. As Chenje and Solar (1998) point out, the challenges and risks brought about by climate change (as manifested for instance in drought), if perceived and recognised as some significance, are bound to encourage and condition some form of mitigating response to minimise the detrimental effects of this change. This often takes place at different spatial levels and through different organisations and processes but, for this thesis, localised responses by Ngundu villagers through adaptive and coping strategies are central to the analysis; these localised responses though do often interconnect with broader local and national processes and structures.

There is a thin line between adaptive and copying strategies that has made it difficult to differentiate the two. Some scholars see adaptive and coping as one and the same, given that something that begins as a coping strategy will end up being an adaptive strategy depending

now on how much the people under study have adopted it. To reiterate points from earlier in the thesis, coping can be understood as the manner in which people act within the confines of existing resources and range of expectations to achieve various means (Wisner et al., 2003). When people know an event may occur in the future in a similar pattern as it has happened in the past, they set up ways of coping with it. Such coping strategies are guided by the assumption that the event will follow a familiar pattern and that people's earlier actions will be a reasonable guide for similar events. Adaptation is the process through which societies or communities increase their ability to cope with an uncertain future, which involves taking appropriate action and making the adjustments and changes to reduce the negative impacts of climate change (UNFCC, 2007). In simpler terms, coping is usually a strategy that is used to survive a current shock while adaptation can be used to show a situation where people are trying to manage potential impacts in advance. At the same time, adaptation can be divided into two, i.e. reactive adaptation and proactive adaptation. What is understood as a coping strategy to one farmer can be actually an adaptive strategy to another farmer.

To deal with these terminological issues, I grouped those strategies that farmers implemented as survival means during a particular shock as coping strategies and those strategies which the farmers implemented yearly to be adaptive strategies. There are indeed many strategies that the Ngundu people have developed which, at times, appear to be coping strategies but have in fact matured into adaptive strategies. This I noticed after realising the significant numbers of people who have resorted to such practices and also given the years they have used such a strategy. Noteworthy is that successful adaptation must be accomplished through actions that target and reduce the vulnerabilities poor people now face, as these vulnerabilities are likely to become more prevalent as the climate changes (Task Force on Climate Change, Vulnerable Communities and Adaptation, 2003).

Table 7.1 below shows the adaptive and coping strategies that are being implemented by the people of Ngundu.

Table 7. 1: Adaptive and Coping Strategies in Ngundu

Strategy	Type
Conservation Agriculture ["*dhiga udye"* (dig and survive), mulching/manuring, crop diversification, mixed cropping, contour ridges]	Adaptive
Gardening	Adaptive
Irrigation	Adaptive
Small grain production	Adaptive
Early/ Dry planting	Adaptive
Replanting	Adaptive
Soil Management	Adaptive
Water harvesting	Adaptive
Livestock	Adaptive/Coping
Casual Labour (weeding, harvesting, brick moulding, carrying sand for construction, fetching water for house construction, thatching huts)	Coping
Selling at the market place (at a vegetable market or at a flea market)	Adaptive
Eating wild fruits	Coping
Reduction of meals per day	Coping
Food hand-outs	Coping
Commercial Sex work	Coping

Source: Fieldwork.

7.3 Agricultural Adaptive/Coping Strategies

Adaptive/coping strategies in Ngundu can either be agricultural based or non-agricultural based. This section pays attention to agriculture based adaptive/coping strategies that are being implemented by the Ngundu people. In line with the Table 7.1, I look at each of the adaptive and coping strategies as I discuss the evidence collected which involve the views of the people

who practised such strategies. Agriculture is of great importance in Ngundu as shown by the strides that have been taken by the people in order to continue crop and livestock production under a changing climate.

7.3.1 Conservation Agriculture (CA)

Natural Agro-Ecological Regions IV and V in Zimbabwe receive below 650mm annual rainfall making areas in semi-arid regions like Ngundu to be suffering from water stress. Although the sheer volume of rainfall might be possibly sufficient, this rainfall is not capable of sustaining sufficient crop growth over the growing season since much of the precipitation falls over a short period of time. The resulting low moisture content within the soil means that the crops have very little moisture reserves to tap from during prolonged dry spells, leading to increased incidence of crop failure (Marongwe et al., 2012). In this context, the need for some kind of Conservation Agriculture (CA) has arisen, as a means of conserving soil fertility and water moisture.

CA advocates for conservation of soil and water by using surface cover (mulch) to minimize runoff and erosion and in turn improve the conditions for plant establishment and growth. Thus, CA is a way of farming with its chief component involving moisture conservation and management of natural resources like soil to reach sustainable agriculture aimed at improving yields. According to Gukurume et al. (2010), CA has been widely embraced as an antidote to the perennial food insecurity situation bedevilling drought prone regions in Zimbabwe. CA has been seen as a technology option that can increase the yields of a wide range of crops by resource-poor farmers, even in drier agro-ecological regions (Mazvimazvi et al., n.d.). Marongwe et al. (2012) concurs that CA addresses a wide range of agricultural production challenges that include declining soil fertility, increasing production costs, climate induced erratic rainfall patterns and increased demand for food production against severely reduced production capacities of agricultural lands.

CA is premised on some principles that need to be followed. The principles are minimal soil disturbance by promoting minimum tillage to zero tillage of land, maintenance of soil organic cover and crop rotation. All these methods are meant to conserve moisture, enhance soil fertility, and improve soil structure and to reduce soil erosion, diseases and pests. Thus, CA promotes methods that improve soil fertility which include increase in organic matter that can be achieved through mulching or manuring, as these help in improving soil fertility and structure. The objectives of promoting CA in Zimbabwe is to contribute to food security,

improve profitability of agriculture and enhance the economic well-being of communities dependent on agriculture (Marongwe et al., 2012). Not only is it claimed that CA benefits the farmers concerned but also the environment and the larger population. The main institutions that promote CA are AGRITEX and Care in Ngundu. According to an AGRITEX official:

> *We have been advising the farmers here in Ngundu to implement CA because of its numerous advantages. The soil here is no longer fertile making minimum or zero tillage a requirement that will make it regain fertility. We emphasise on the need to implement strategies that increase soil fertility and we have taught farmers numerous strategies which include* dhiga udye *[dig and survive], mixed cropping among others.* (In-depth interview held in April 2017).

CA practices being done in Ngundu include the use of mulch, manure, crop rotation, crop diversification, *dhiga udye*, mixed cropping and minimum or zero tillage. In Ngundu, 88% of the sampled villagers are one way or the other implementing the methods under CA. Notably, CA is not a new phenomenon in Ngundu as some of its methods were already present in the area. Practices such as using manure, crop rotation and crop diversification are not new in Ngundu as the villagers were already practicing them through their 'traditional' conventional farming, mainly as a means for conserving soil and limiting soil erosion. Currently in the era of climate change, people in Ngundu are constantly being encouraged to implement these on a constant basis even though they are now more difficult to pursue because of for instance the absence of organic manure and limited land sizes. The frequent references to these CA practices by Ngundu people during my field work is evidence to testify how the strategies have become frequently pursued as, in the face of climate change, they condition the success of agricultural production. Notably, other CA practices such as *dhiga udye* and minimum or zero tillage are not part of the agricultural history of the Ngundu people. The farmers in Ngundu largely believe in their 'old ways' of farming, a situation which explains in part the reluctance that they have shown in implementing *dhiga udye* – which, though, is also regarded as too strenuous in terms of labour requirements.

Minimum and zero tillage is being promoted in Ngundu as it reduces destruction of the soil structure, limits water erosion, improves water infiltration rates and in turn conserves water in the soil. Thus, Harford et al. (2009:3) note that disturbing soil layers by ploughing or turning the soil damages the structure of the soil, "which makes it harder for rainwater to infiltrate into the soil, as natural drainage pathways are disrupted". However, although some Ngundu people are aware of the benefits of practicing this method in a time of climate change, the practice is still limited among the people. Minimum tillage and zero tillage are not well comprehended by

the people as their conventional ways (which they are used to) of farming require total clearing and tilling of land before planting. Weeds are removed either by ploughs for those with draught power and with hoes for those without. It is only after the land is cleared that planting can commence. This method has been used by the farmers for so long that they fail to understand the practice of planting crops in a field full of weeds. This has also been confirmed by Kassam (2010) who argues that many people have questioned the feasibility of merely growing without ploughing the land first. This has seen many farmers disregarding this farming method and sticking to their old ways of tilling the land either using hoes or ploughs. According to one respondent:

> *Isu takakura tichiziva kuti munda unotanga watimbiwa wabviswa masora tozochera makomba. Izvi zvekuti tidzvare mumunda mune masora hatizvizivi, anozosakura mune bundo rakadai ndiani nekurwadza kwazvinoita.* [We grew up knowing that we till the land first then we dig holes and plant. We do not know this method of first planting in a field full of weeds]. (Informal Conversation, April 2017).

These sentiments were confirmed by most of the villagers with only an insignificant number practicing this CA method. It was discovered that practicing zero or minimum tillage was hard work as digging holes in land that has not been tilled takes so much time and requires a lot of labour. Even though the farmers were informed that the weeds and labour needed will decrease in the long run, few were willing to leave their traditional way of farming because of the aforementioned reasons.

Digging planting basins locally known as *dhiga udye* (dig and survive), is a type of CA methodology that has become prevalent in drought-prone areas. This practice has become popular in Ngundu with almost all respondents aware of such a practice. Despite Ngundu people's reluctance to implement *dhiga udye,* the frequency of the mentioning of the practice among the respondents evidenced how well known it is in the area with responses like,

> *Ehe dhiga udye ndiyo yatinodzidziswa nemadhumeni.* [Yes, *dhiga udye* is what we are taught by AGRITEX officers]. (Questionnaire, October 2015).

In explaining their understanding and meaning of *dhiga udye,* one respondent in an informal conversation indicated:

> *Dhiga udye zvakangofanana nekuti ukadhiga uchawana kudya, dhiga ugowana kudya. Ukadhiga unodya.* [*Dhiga udye* is the same as saying if you dig you will have food, dig and get food.] (Informal conversation, April 2017).

Respondents constituting 65% of the sample have one way or the other practiced *dhiga udye* since its introduction in the area in 2008. According to a village head:

Vanhu vanokurudzirwa kuti vatange kuita dhiga udye muna September, vachiita gomba gomba pazuva kuitira kuti vasarwadziwa nebasa. Panozosvika nguva yekudzvara munda unenge wapera. [People are encouraged to begin *dhiga udye* in September since it is labour intensive so that when the rains start they would have finished the whole field.] (In-depth interview with Guti village head held in October 2015).

NGOs like Care have managed to promote *dhiga udye* and they have provided farmers with inputs such as seeds and inorganic fertilisers to help in implementing the practice. AGRITEX has also provided knowledge and information to the farmers on how to carry out the practice. Those farmers who practice *dhiga udye* in their fields appreciate the role that Care and AGRITEX were playing as they also noted how *dhiga udye* promotes soil moisture despite the labour with which it is associated:

Dhiga udye kubatsira inotibatsira chaizvo. Ukasanzwa usimbe, ukateedzera zvavanoita unokohwa. [*Dhiga udye* helps us. If you follow the instructions it will improve your yields.] (In-depth interview held with Pedzisai 1 village head in October 2015).

The process involves digging dip basins or holes that are able to collect lots of water when it rains. Maize is planted in the hole, usually 1 or 2 seeds per basin. When it rains, water collects in the basin and takes time to evaporate. This keeps the soil moist and avoids the plant from wilting. The Pedzisai 1village head also added that:

Anochengeta mvura nekuti igomba kana pasina gomba mvura inongoyerera posara pooma kunyanya paya mvura painenge iri shomane. Paya panenge pasina gomba panokurumidza kuita chikwakwa". [They retain water since they are basins; without these basins the water just flows and the soil gets dry again especially when the rainfall is very low. Where you do not put basins the soils extremely dry up.] (In-depth interview held with Pedzisai 1 village head in October 2015).

However, the practice still has its setbacks as it is associated with excessive labour making only a minority of the Ngundu people (38%) to be constantly practicing it. The labour associated with digging the basin proves to be too much for farmers, with most females and elderly people in particular complaining about the practice.

Mulching is another CA method that the villagers are being urged to practice. Due to climate change, the emphasis to use mulching on a constant basis is being encouraged among farmers, with 36% of respondents currently implementing it. Care and AGRITEX have helped in the promotion of this practice and it aims at stopping rapid evaporation, storing moisture and improving soil fertility whilst at the same time minimising soil erosion. In relation specifically to mulching, Marongwe et al. (2010) point out that CA addresses the problem of low and erratic

rainfall through the use of technologies that reduce water losses from runoff and soil evaporation and increase infiltration and soil moisture holding capacity, and improve low soil nutrient status by increasing soil carbon and nitrogen through the use of organic soil cover. Land tillage has been seen to affect soil fertility and in the long run negatively impact on crop yields. Therefore, mulching restores soil fertility and locks moisture by covering the crops so as to promote minimum soil disturbance. It is also particularly important for increasing water infiltration and this increases crop yields. In mulching, farmers in Ngundu use grass, stover and crop residues which they spread between crop lines.

Manuring is another method which falls under CA which the Ngundu villagers have been encouraged to practice, or at least to continue to practice. Picture 7.1 below shows manure being applied at Banga Irrigation scheme (discussed later)[20]. Manuring in particular is preferred by the Ngundu people as it is cheap and mainly determined by the availability of suitable resources. It involves using manure from livestock such as cattle dung and spreading *termitaria* from anthills. This increases soil fertility particularly in areas that have sandy soils. As one Ngundu villager noted in an informal conversation:

> *Ivhu racho iri harisisina simba. Rinotoda kuiswa churu kunyanya isu tisingakwanisi kutenga fertilizer.* [The soil has lost its nutrients; we put *termitaria* from anthills given also that we cannot buy inorganic fertilizer.] (Informal conversation, April 2016).

Another respondent concurred on this as he pointed out that: *"Ivhu racho rakuda ku feediwa iri".* [This soil requires feeding]. Another villager reiterated this:

> *Ini ndinoisa matoto ehuku. Ndinotora matoto muchirugu ndoisa mugomba redhiga udye. Manure aya anondichengetera unyoro.* [I put chicken droppings which I collect from the chicken coop and put them in the basins [*dhiga udye*]. This manure also conserves moisture for me.] (Informal conversation, April 2016).

20 Banga irrigation is the largest irrigation scheme in ward 25.

Picture 7. 1: Manure Use at Banga Irrigation

Source: Fieldwork, February 2017.

Farmers in Ngundu also practice crop diversification and mixed cropping. Crop diversification is the planting of different crops in the same field but planting them separately or part from each other. The advantage of planting them apart is that it allows for crop rotation across seasons and the improvement of soil fertility and control of pests and diseases. Further, it enables the farmers to harvest a combination of different crops, planting for instance maize in one portion and groundnuts in another portion, therefore improving the household diet. It is also aimed at avoiding total harvest failures as the failure of one crop does not mean the failure of the other. Crop diversification has been practiced in the past by Ngundu farmers and is perceived as one of the most ecologically feasible, cost effective and rational ways of reducing uncertainties in agriculture especially among smallholder farmers (Makate, 2016). But it is practiced by a minority of Ngundu villagers (40%), mainly because of the small farm sizes that most people have. One respondent thus declared:

> *Munda wangu mudiki saka ndinotoshaya kuti kana ndikada kurima nzungu padzo dzega, chibage changu chinozoita chishoma. Saka ndinongorima chibage pamunda wese pane zvekukamura.* [My field is small, so if I plant my crops separately and divide my field into planting different crops, it means that my maize portion will become smaller affecting my maize yields. Maize is the staple food, so I prefer just growing maize.] (Informal conversation, April 2016).

I discovered that farmers are in fact actually confused as to what to plant, due to the continuous occurrence of droughts. So given their small farm size, they end up settling for maize. If climate

change was not a problem, and despite their small land sizes, they would opt to undertake crop diversification as it means that none of their crops would be affected by drought.

Mixed cropping is a type of crop production that involves planting two or more different crops simultaneously in the same field interdigitating the crops so that they grow together. A significant number of respondents in Ngundu practice mixed cropping. Crops like maize and usually beans, groundnuts or Bambara nuts are mixed and grown together. This helps in utilising ground cover and saving space and producing more crops on small land. According to one respondent:

> *Hautambisi land uchisiya yakashama, unoutiliser land yacho.* [You do not waste land leaving space with nothing]. (Informal conversation, April 2016).

Another villager pointed out that:

> *Zvinonyanyobetsera isusu zvedu tisina mari yekuzonotenga kumashop saka tofanira kuwana sadza, mafuta, towana muto pagoho rimwe. Saka ndorima nzungu ndoziva kuti mafuta ndavanawo uye ndatowana margarine angu edovi, mabage ndoita sadza. Saka ndorima ndoziva kuti kuma shops ndotenga zvishoma.* [It mostly helps us who do not have the money to buy from supermarkets. From mixed cropping we get sadza, oil, we also get soup from a single harvest. So from groundnuts I get peanut butter for our bread and I get maize meal from maize]. (Informal conversation, April 2016).

A Care official argued that mixed cropping is a type of mulching called "life mulch". With regard to mixed cropping, one villager thus pointed out:

> *Inotoita sefertilizer. Nzungu dzobatsira kuti dzipe feeding kumabagwe. Ndinodzvara pakati pemabage hapana zvadzinotora kumabage asi dzinotopa chikafu kumidzi yemabage.* [Mixing crops acts like fertilizer. Groundnuts help in feeding maize crops and I plant them between maize crops. Groundnuts do not take anything away from maize, only that they give nutrients to my maize crops.] (In-depth interview with CA farmer held in February 2017).

Nutrients are the best feeding that maize obtains from legumes through a process known as nitrogen fixation (Hirst, 2017). Benefits of mixed cropping thus include balancing input and outgo of soil nutrients, increase in soil fertility, the repression of weeds and insect pests, resistance to climate extremes, the suppression of plant diseases, the variety of produce to the household (like cereals, vegetables and legumes) and increase in total productivity. Given land scarcity in Ngundu, mixed cropping enables the utilisation and management of land to the maximum potential. Mixed cropping also requires fewer nutrient inputs such as fertilisers and pest control. In the end, mixed cropping is done to reduce the competition between component

crops for light, nutrients and water. If one crop fails due to shortage of moisture or insufficient availability of nutrients, the other crop can cover the risk of complete failure. The Nduna 1 village head therefore highlighted:

> *Mixed cropping is such a relief for us given the limited land that other farmers have. It means on the same piece of land they can grow maize, groundnuts and Bambara nuts. They can also plant numerous crops just like what the other farmers in the village with huge land do.* (In-depth interview with Nduna 1 village head in October 2015).

In this regard mixed cropping produces high yields compared to mono cropping.

7.3.2 Gardening

Ngundu people are also involved in gardening as an adaptive strategy. From the data collected, 66.6% of Ngundu farmers are one way or the other involved in gardening either at irrigated land or at some of the communal boreholes in the area. Gardening is mainly done by women and vegetables which include tomatoes, rape, spinach and cabbage are planted. Vegetables in the area are very crucial and a necessity as they are eaten together with sadza. They are cheaper compared to meat which people rarely buy due to lack of money. Those who do not have gardens and cannot afford to buy vegetables can sometimes be forced to eat sadza with no vegetables, a terrible experience known locally as '*kutemura sadza'*. Gardening sites are located where there are water sources like boreholes, rivers, dams and wetlands. An insignificant number of respondents who have wells in their homesteads have placed gardens there. However, these gardens are mainly meant to produce vegetables for that particular household as they are produced on a low scale in order to conserve water, given that the water levels are shallow. Most popular are gardens that have been established at various communal boreholes in Ngundu. This makes it easier for the farmers to water their gardens as they will be near water sources. According to Mr Madzivire,

> *Ma garden ndiwo akutovapa upenyu, pangori nechibhorani ndipo pavanoisa magarden, vamwe vanoshaya nekuti vanhu vakawandisa saka kuti vatapudze vanhu vakazopedzisira vaita majoining fee.* [Gardens are the ones that are now helping Ngundu people to survive. The gardens are placed near communal borehole areas. To reduce the competition they put a joining fee, leading others to fail to get into the scheme.] (In-depth interview held in October 2015).

In these gardens, each individual beneficiary (after paying a joining fee) will be allowed 2 beds which will be 5 metres by 1 metre. However, the gardens are few as they are determined

by the number of water sources, hence not everyone can join the scheme. I observed that those who have stayed longer in the area, those with financial capital, and those who are related to village heads and chiefs usually get first preference in these gardens due to power relations (or political capital). Also, usually those who support the ruling party (ZANU-PF) are likely to benefit more showing the influence of local power relations at village level.

Gardens provide food to the households and reduce expenses as there will be no need to buy vegetables. However, for village gardeners to be able to always have fresh vegetables they constantly need to water their gardens (nearly three times a week), weed the plants and apply manure. Depending with the distance to the water sources particularly at communal boreholes, sometimes it is hard for women, particularly those who are older, to carry buckets to and fro in order to water the vegetables. This becomes an advantage to those women who live in larger households where there is polygamy, as more people cater for the garden. The councillor informed me about a woman who was famous for producing rape vegetables as she was from a polygamous household and would get help from other wives in managing their gardens. The councillor pointed out that:

> *Vanhu vechipostori ndivo vari pamberi kurima mavegetables nekuti rudzi rwavo runoshanda, inyaya yekuti vakaroorwa pabarika saka vanenge vatori cooperative pavari*. [Those who are from the apostolic sect are the ones who are at the forefront in vegetable cultivation because they are hardworking. Also because they are from a polygamous marriage they are a cooperative on their own given the large household they usually are]. (In-depth interview with the councillor held in February 2017).

The gardens are surrounded by a fence made up of wooden poles and thorn branches to protect the vegetables from livestock. Gardening has proved to be an adaptive strategy in times of climate change as the garden's produce like vegetables are sometimes sold both to the villagers and at NGP. One villager involved in gardening noted:

> *Inini ndinotoona kuti ndarima mavegetables nekuti anondibatsira. Ndine macustomer ari pa NGP anobikira vanhu sadza rekudya. Saka zuva nezuva vanotoda mavegetables.* [I make sure that I plant vegetables in my garden as they assist me greatly. I have customers at NGP who are in the cooking business, so they need vegetables on a daily basis.]. (Informal conversation, April 2017).

In times of low yields of maize, vegetables are used to bring income to the household, which can be used to buy maize from other villagers across Chivi who would have acquired better yields. As one respondent put it:

Chibage chikasaita ndotenga, ndine garden rangu randinodiridza ndotengesa zvirimo ndotenga one bhaghedhi. [If my maize yields are low, I sell my vegetables from my garden and buy one bucket of maize.] (Informal conversation, April 2017).

These gardens come handy in times of droughts as they are less affected, considering that they are small and are well placed near water sources like boreholes and rivers which may take time to dry. The councillor thus highlighted:

Pane garden riri kuPedzisai risingamiri kushaikwa mvura nekuti pane rwizi runonzi Chivake runodarika nemugomo rinonzi Tafira runotora nguva kupwa. [There is a garden in Pedzisai that gets water all year round because it is placed near a river called Chivake that passes through a mountain called Tafira. The river seldom gets dry.] (In-depth interview with the councillor held in February 2017).

Gardens in Ngundu increase during the rainy season as most homesteads take advantage of the rains and place gardens at their homesteads. One male respondent said:

Magarden anotibatsira kunyanya nguva yekunaya tinorima mavegetables pamba totengesa. [Gardens are a great help especially during rainy season as we plant vegetables at our homestead and sell them.] (Informal conversation, April 2017).

From the interviews held, I was also informed that, after the rainy season, the villagers remove the vegetables and dry them to become dried vegetables locally known as '*mufushwa'.* These dried vegetables can be cooked anytime and they last long periods saving households from buying vegetables. In case the villager has a surplus, the dried vegetables can sometimes be sold at NGP.

The benefits of gardens among households have also been acknowledged by NGOs and they have become involved in the gardening schemes as a way of further capacitating the villagers. Care International in partnership with AGRITEX has assisted in the promotion of gardens by helping in the implementation of a nutritional garden in Ngundu which was locally named "*Wasarira",* which largely comprises women. The name came from the villagers and it literally means "you have been left out from benefiting the project". The garden is placed near Runde River and it is an irrigated garden. The construction of the garden, which took 3 months to complete, was an initiation made by the villagers who submitted their intention to Care as they required assistance in the provision of equipment and materials such as pumps and fences as well as expertise on how to manage a garden efficiently so as to get profits. Although villagers in Ngundu had their own gardens they wanted an irrigated garden that would be less laborious and help in giving profit to the villagers. Care thus worked with the farmers from the initial stages of the project which involved the establishment of the garden on the ground.

During the establishment of the garden, Care provided building materials and AGRITEX officers offered extension services. The villagers played a significant role as they provided the labour required to implement the project. Provision of labour is used as a way of empowering those individuals who are poor.

Those who provided labour in the making of the '*Wasarira',* garden were chosen from 5 villages within a 5km radius and these villages included Pedzisai 1, Nduna 1 and Guti. The 5km radius is there to make sure that villagers who are chosen to provide labour will not get to *'Wasarira'* already tired or have to travel during the night at the end of the day. Those who are chosen to provide labour are identified by looking for households that are food insecure, with only those who are willing and with able bodied people; only one individual per household is chosen. A process called community ranking is used to identify the households that are food insecure. The process involves the villagers being tasked to identify the most vulnerable as they are believed to know themselves and their village better. The number of individuals chosen from each village depends on the number of households in a particular village. The individuals who are chosen are given 50kgs of cereal after working for 4 hours a day for 20 days.

Given that the garden is 1.8 hectares, and that there is a large number of people who want to join the scheme, an entry fee is required so as to reduce conflicts that emanate when people want to join. The garden has 96 beneficiaries and the beneficiaries divide amongst themselves a piece of land (for each of them) from the 1.8 hectares, with the beneficiaries having their own plot individually. Vegetables such as rape, cabbage, carrots and buttercups and sometimes crops such as sweet potatoes and maize are grown in the garden. The garden is proving to be successful as it provides food security to the beneficiaries' households, also increasing their nutrition and generating income. Vegetables are sold to other villagers and at markets at NGP. From the three villages under study, 47.6% of the respondents are involved in the scheme. Considering that a garden in considered an asset, households that are involved in the scheme had better food production as the production from the gardens provided new avenues for them.

7.3.3 Irrigation

Irrigation schemes in Zimbabwe are significant and desperately needed in areas that are dry especially semi-arid areas like Ngundu. Due to the dryness of regions IV and V in Zimbabwe, most irrigation schemes are found in these areas. Chazovachii (2012) points out that small-scale irrigation schemes in the country were established as a precaution against the inconsistent rainfall that is affecting the country and also to allow year round cultivation. Irrigation can

simply be understood as the operation of causing water to flow over lands, for nourishing plants. Mutsvangwa et al. (2006) define irrigation more specifically as the ministering of land through the artificial application of water to ensure double cropping as well as a steady supply of water in areas where rainfall is unreliable. For Burke and Lobell (2010), irrigation increases yields and returns on investments in farm inputs; and it also allows farmers flexibility in planting dates, crop species and varieties, and length or number of growing seasons.

Given the concerns of farmers on rainfall outlined in chapter six, irrigation schemes can be a productive option for farmers in Ngundu. Irrigation projects have been set up in Ngundu and among them is the Banga irrigation scheme which incorporates beneficiaries from 2 wards, including Ward 25. It is the main irrigation scheme that most of the people from Ngundu depend upon and it has become an adaptive strategy that has assisted them particularly in drought years. The irrigation scheme contains individual plots, is well cared for, and each member provides labour on his or her plot and is responsible for maintaining it. The scheme, which is 5km from NGP, is 61 hectares in size and has been running continuously since it started in 1972. It gets its water from Banga dam and the dam seldom dries up due to measurements taken by the people, which include stopping irrigation when the water level decreases. The overall size of the scheme has not changed but the garden has been rehabilitated by the provision of a new fence which was donated by Care and also the construction of toilets for hygienic purposes. Sometimes the beneficiaries voluntarily provide labour to watch over the fence, monitor the pipes and to make sure that the gate is always closed to protect the crops from livestock. The irrigation has 360 beneficiaries from 2 wards and, among the Ngundu respondents, 21.4% were involved.

Those who joined did so when the irrigation scheme was opened and it was the chiefs who were tasked with providing beneficiaries for the scheme. During that time, there were few households in Ngundu as compared to now which explains why most households that were close to Banga irrigation were included. Those that resided far from the scheme with a distance of more than 5km decided not to join as the distance was too long. According to the councillor:

> "*Madzishe akakomberedza Banga akanzi tipei varimi vanoda kuuya ndobva vanhu vauya saka tangova vazukuru vari kungojoiner vanenge vachembera vanopawo vazukuru vavo".* [The Chiefs who were surrounding Banga irrigation were told to bring farmers who were interested to join. Currently many are now grandchildren of those farmers who first joined as some retired due to age or died and passed their own plots to their relatives]. (In-depth interview with the councillor in February 2017).

There are some farmers who give up their own plots from Banga irrigation either due to age or illness or death meaning that new slots may come up. In order to limit the number of people who want to join, given that the irrigation scheme cannot integrate everyone, a joining fee has been established. To avoid conflict that might arise on gaining membership to the scheme, the beneficiaries agreed that interested farmers must provide their names to the councillor and then, when a free slot emerges, they join but on a first come first basis scenario.

The irrigation is divided into three sections, A, B and C, and each member has 0.1 hectares from each section. This was done as a way of allowing the people to grow different crops at different times all year round. In other words, the crops are available all year round as their growing periods must differ. Each person attends to their own section individually and the profits are theirs to keep. When I visited Banga irrigation scheme (see Picture 7.2), the section A had maize crops while section B had beans and section C was being cleared. This has the advantage of producing yearly yields and avoiding food shortages making it a significant adaptive strategy.

Picture 7. 2: Banga Irrigation

Source: Fieldwork February 2017.

The people make use of the gradient to drain water from the Banga dam into the canals where pipes are placed to draw water from the canal into the fields. Picture 7.3 shows the canal where water from the dam is drained into. The water will move into the canal which connects all the fields in the irrigation scheme. Picture 7.4 shows the pipe that is used to water the crops.

Picture 7. 3: Water Canal **Picture 7. 4: Pipe Watering the Crops**

Source: Fieldwork February 2017.

The scheme has given benefits to the individual beneficiaries, as it allows them to sustain themselves in times of drought. A significant number of the beneficiaries sell their surplus and get income to use for household expenses. The surplus crop yields that are from the irrigation are sold by the beneficiaries at the NGP or among the local villagers themselves. The scheme has thus come as a way of improving agricultural production for the farmers. It enables farmers to deal with mid-season droughts in particular. One villager during an informal conversation brought this to the fore:

> *I am a member of the Banga Irrigation Scheme and it has helped me in sustaining my family in difficult times.* (Informal conversation, April 2017).

Respondents from Pedzisai 1, Nduna 1 and Guti who are involved in the Banga irrigation scheme have to walk about 5 km to get to their pieces of land. When I asked some of the respondents about the distance, their responses showed that – although the distance was a problem – the benefits accrued from Banga irrigation outweighed the distance issue:

> *Kufamba kunorwadza asi hapana zvatingaita nekuti tinoda kurarama. Banga yacho ndiyo ikutotiraramisa nemhuri dzedu kunyanya munguva dzenzara.* [Walking long distances is difficult but there is nothing that we can do because we want to survive. Banga Irrigation is the one that is helping us to sustain ourselves in drought years]. (In-depth interview with Banga irrigation member held in February 2017)

According to the councillor, Banga irrigation is a saviour to those who are involved as it can sustain them even in times of the worst drought. He pointed out that,

Kana ukakohwa pa0.1 ha unowana 15 bags or 18 bags, unotogona kubuda almost a tonne. [If you get good yields you may get 15 to 18 bags of maize on the 0.1 ha which is nearly one tonne]. (In-depth interview with the councillor held in February 2017).

He gave an example of how during the drought of 2015/16, the Banga dam was able to sustain the whole irrigation scheme up until the next rainy season, showing how irrigation as an adaptive strategy can help in sustaining Ngundu livelihoods. This therefore means that there is a difference between those who are involved in the Banga scheme and those who solely depend on dry land cultivation of their own farms. Those who are involved in the scheme will not get zero maize yields in drought periods as they will not solely depend on dry land cultivation. This is different to those who are not included in the irrigation scheme as they depend solely on the crop yields from their farms of which, if there is drought, they do not have the opportunity of getting good yields elsewhere.

7.3.4 Small Grain Production

Small grain production is one adaptive strategy that the people in Ngundu are implementing. Small grain production is not a new phenomenon in the ward as most people who grew up in Ngundu used to cultivate small grains before the introduction of the maize crop. One key informant alluded to this when she said:

Ndicho change chiri chikafu tichikura. [This [referring to small grains] was our food when we were growing up]. (In-depth interview with elder held in April 2017).

Mr. Madzivire also referred to this as he pointed out that:

Before 1950s we only knew of small grains. That was our food and we would plant sorghum and rapoko. We knew nothing of maize. Maize only came in the 1950s. (In-depth interview held in October 2015).

Small grains, such as sorghum and millet were the main staple crops, and they could sustain households on a regular basis.

However, small grain production began to decrease in Ngundu from the 1960s after the introduction of maize as people started favouring maize. The major reasons that led to the decrease of small grain production in Ngundu (up to the present) include the taste of small grains, the issue of farm size, the labour intensiveness associated with small grains production and the problem of birds. Before the introduction of maize, people were used to the taste of sorghum and millet as they had nothing with which to compare the taste. The introduction of maize saw a major shift as households started preferring maize mainly because it tasted better

than sorghum or millet. Farmers had found a crop that tasted better than small grains and this saw Ngundu farmers dedicating the larger portion of their fields to planting maize, leaving a small portion for small grains. This behaviour was then carried to the next generation up until now, with most villagers who are currently in Ngundu now preferring *sadza* cooked from maize. Hence, with time, most households in Ngundu stopped altogether producing small grains and cultivated maize. According to one respondent:

> *Nevana vedu vatinavo avo ndikabika sadza racho remapfunde kana zviyo nekapoto kadiki hapana anodya.* [If I cook sadza with small grains even using the smallest pot I have, none of my children will eat it because of its taste]. (Informal conversation, April 2017).

Another respondent pointed out that their children regarded sadza from sorghum as *'mavhu'* (sand), showing how people do not enjoy its taste.

Another major reason for the reluctance to plant small grains in Ngundu is farm size. As highlighted earlier, farm size in Ngundu has been decreasing due to the increase in population with no expansion of overall land size area. This is forcing parents to share their land with their children. So land is shared with children, grandchildren or relatives, each land plot becomes too limited to cater for a large household. Farm size also affects the yields of small grains due to the problem of birds that feed on small grains. Smaller land sizes mean that that the whole field can be eaten by birds. Before the introduction of maize and before the population increased, small grain production was done as there were large farm sizes. This meant that even if there was the problem of birds, due to large land size, the birds never finished the whole field. The councillor put it this way:

> *Small grains require large pieces of land as there is a problem of birds. When you plant them you also plant to feed the birds. So if you have a small piece of land, birds will finish the whole field and you will be left with nothing.* (In-depth interview with the councillor held October 2015).

The reduction of farm size means that farmers are now afraid to plant small grains as their grains would fall victim to birds which heavily reduces their yields. I observed that the few villagers who had planted small grains had larger fields, where they dedicated the larger part to small grain and would leave a smaller portion to maize (while those with small fields only planted maize). The birds that eat the small grains are known as the quela birds. Small grains attract the quela birds which feed on the grain of the crops considering how their grains are exposed, as compared to the grain of maize which is covered by leaves.

When the small grains start producing grain in the field, the crops should be watched continuously to chase away the birds. This is a strenuous activity that requires one to move from one end of the field to the other banging empty bottles to make noise so as to chase the birds away.

Picture 7. 5: Effects of Birds on Sorghum

Picture 7. 6: Comparing Maize and Sorghum

***Source**: Fieldwork April 2016*

Picture 7.5 above shows the drastic effects of the quela birds on small grains and picture 7.6 shows how maize is protected with leaves compared to small grains. Picture 7.5 shows three sorghum plants with the first one showing a plant with all the grains, the one in the middle which is in the process of being eaten by the birds and the last one with all grains eaten. This generates a huge problem to those few farmers who grow these small grains, as it means that their crops are targeted by birds. One respondent pointed out that:

> *Masmall grains haanyanyokurimiwa kuno, zvoda vanhu vakawanda vachirima kuitira shiri, zvikarimwa nevashoma zvinonetsa haukohwi*. [The problem is that few people cultivate small grains. It will be better if a significant number of people cultivated them for it will resolve the bird issue. If few cultivate small grains, they get low yields]. (Informal conversation, April 2017).

This was reiterated by AGRITEX official in an in depth interview:

> *The challenge that they have is to do with birds. But this challenge can only be overcome if all of them cultivate small grains. That way, no particular field will be targeted by birds.* (In-depth interview, April 2017).

The problem of birds, worsened by the reduction of land size, explains why most households are reluctant to plant small grains.

The labour intensiveness associated with small grain production was another reason given by the respondents. Small grains are laborious compared to maize production during the weeding process and the harvesting time. The weeding process of small grains particularly the finger millet requires someone with skill and expertise. The weed (*Eleusine Indica)* that grows in the fields of finger millet is almost similar to the finger millet such that an inexperienced eye will not be able to differentiate the two. When weeding the crop, great attention needs to be paid so as to avoid weeding out the finger millet and leaving the weed. This proves to be strenuous to Ngundu farmers.

Harvesting sorghum and millet is also laborious as the seeds are small and they need so much manual work. During harvesting, the small grain stocks are cut and are put in sacks and threshed manually which is labour intensive. After this the villagers proceed to do winnowing which again is strenuous. These factors were highlighted by the respondents as reasons why there were reluctant to produce small grains on a large scale like what they did before the introduction of maize. This meant that small grains production in the three villages was limited with only 19% among the respondents cultivating them on a large scale; 24% growing both small grain and maize but paying more attention to maize production; and 57% not growing small grains at all.

The few who planted small grains in the area knew the problems associated with small grain production but were willing to deal with the problems of birds and taste considering the fact that they had a large land size. I observed that households that were headed by the elderly were more inclined to grow small grains considering that it is an old practice that is not new to them. They grew up eating sadza from these small grains, and they were willing to recognise that small grains were more beneficial to grow compared to maize in their drought prone area. The younger generation, who had grown up eating white sadza from maize, were unwilling to plant small grains driven by their dislike of the small grains taste. They also complained of small land size given the fact that their land had been handed down to them by their parents after it was divided. The few young people who planted small grains had comparatively large land sizes and the manpower to chase away the birds. Those who grew small grains pointed out that they had done so because they realised the benefits, as the risk of zero yields was low as compared to maize as long as they chased away birds. Picture 7.7 below shows a field of one of the farmers who had prioritised the cultivation of small grains and the other illustrates a farmer who planted maize. The two pictures clearly show the benefits of growing small grains as compared to maize which cannot stand high temperatures and low rainfall.

Picture 7. 7: Good Quality Sorghum and Maize Failure

Source: Fieldwork March 2016.

Among those who cultivate small grains is Sekuru vaTobias, as he sees the importance of small grains. I quote him at length because of his clear and forceful expressions. This is what Sekuru vaTobias had to say about his life in relation to small grain production:

> *People in this place do not fully comprehend the significance of small grains. They want to be pampered so that they grow small grains. The issue here is that the young people do not know the seriousness of the problems that we are going through. They think we are lying when we say we used to plant small grains in this area. Birds were there at that time too. I remember I was a young boy then. We would chase the birds away till the harvest season. What else will you be doing in the rural area when you are not formally employed*, "unodzinga shirika" (you chase away birds). *To my surprise these youths do not want to do that now. They are used to be given hand-outs that's why. These NGOs spoiled things for us. Now they have ceased giving food to everyone yet everyone is now dependent on them. I started to plant small grains again from 2010 when I realised the diminishing yields of maize. I have 2 hectares. On that land I always make sure I dedicate half of the land to small grains. It has always worked out for me. I have grandchildren; they try to chase away the birds. But I feel sorry for my grandchildren. It is now strenuous to chase away birds given that most of the farmers do not plant the small grains. This makes my field to be the major target, but my grandchildren are still young, they are not so stubborn like those other youths so they try their best to chase away birds. In such a case I harvest better yields as compared to maize and I am so happy with this. We* [him and his family] *are used to the taste that many people in this area are complaining about. The young people in this area have been affected by this white sadza. They compare small*

grains with white sadza and do not like the taste. 'Ukaera wajaira kudya zvine shuga kuzodya zvisina konetsa nyangwe kuchikuraramisa'. (*If you are used to the sweet taste of sugar, you will never enjoy tea without sugar even though it is just meant for you to survive.* (In-depth interview with small grain elder farmer held in April 2016).

However, although villagers are reluctant to plant small grains, frequent drought occurrences in the area might eventually force them to revert back to planting small grains on a larger scale in the future to come. NGOS like Care have also been urging villagers to go back to producing small grain on a larger scale due to the benefits associated with small grains in drought prone areas like Ngundu. Care, at some point, also distributed small grain seeds to the farmers while AGRITEX provided information on the benefits of producing small grains. Small grains like sorghum, pearl millet and finger millet are being promoted because of their drought-resistant component and their potential of stabilising food security. These crops are viable in drought prone areas and they thrive in high temperatures compared to maize which is not drought-resistant (Taylor et al., 2006).

Considering that Ngundu is in Chivi, a district which is in region IV and V, it therefore becomes a necessity for the farmers to move back to small grains in order to reduce poverty and food insecurity that is being caused by the frequent occurrence of droughts in the area. The erratic rainfall in the area which is less than 650mm and the increase in extreme weather events like drought have affected maize yields, emphasising the need to adopt small grain production as an adaptive strategy. FAO (2008) stipulated that while maize is the major staple crop that is grown in the Southern African region as a whole, sorghum and millet were found to be important crops in the driest regions where rural farm households have limited production capacity and low income. This is further propounded by Leuschner and Manthe (1996), who point out that sorghum and millets are some of the most important cereal crops for communal farmers in Natural Regions IV and V of Zimbabwe. Since 1990, as shown earlier, the Ngundu area has experienced droughts resulting in declines in maize yields. Small grain production is therefore an adaptive strategy that would prevent many farmers in the area from getting zero crop yields.

Small grains come with many benefits which include their capability of providing many nutritional value. They are very healthy and are commended for their ability to boost the immune system. They are recommended for young children as they provide nutrients that contribute to a balanced diet, leading to a reduction in diseases like kwashiorkor. They are also recommended for those suffering from HIV/AIDS. In addition, small grains are not prone to diseases when they are harvested and they have a long storage life when compared to maize.

Unlike maize, they do not require additional expenses of using pesticides during storage. This is supported by Mukarumbwa et al. (2010), noting that some farmers report storing small grains for up to 20 years. Typically, maize cannot be stored beyond eight months (unless pesticides are continuously used).

Although the planting of small grains production is low in Ngundu, most respondents were aware of the benefits of planting and consuming small grains: the most known being the fact that the crops thrive in hot climatic zones and only need little rainfall. One villager stressed that:

> *Mapfunde haadi mvura yakawanda, ndiwo anosvika kana kuchipisa, mvura isinganayi.* [Sorghum does not require a lot of rainfall and it can ripen even when it is hot and when there is no rainfall]. (In-depth interview with elder held in April 2017).

This elderly women, who grew small grains, was not the only one who had such knowledge. A significant percentage of the respondents, even if they did not grow small grains, actually knew about small grains being an appropriate adaptive strategy. They could see the benefits of reverting back to small grain production as they were aware that their maize yields were reducing because of recurrent droughts and the change in seasons. A respondent in an informal conversation had this to say,

> *Ehe tozviviva kuti mapfunde nezviyo ndozvatakufanira kurima. Tinodzidziswa nemadhumeni kuti tiarime.* [Yes we know that we should now plant small grains. AGRITEX officers provide information regarding the need for planting small grains]. (Informal conversation, April 2017).

Hence, small grain production as an adaptive strategy is known in the area but the problem is in implementing the strategy due to problems associated with the production of the crops.

It is difficult to get actual statistics for maize and small grain crop yields at a ward level in Zimbabwe. I could only get statistics at the district level, as in the table below. In a study done by Simba et al. (2012), the importance of small grains at district level (Chivi) were confirmed as an adaptive strategy to climate change. Table 7.3 below shows the findings from Simba et al. (2012) for maize yields in the light of annual rainfall. Table 7.4 provides the same annual overview with reference to small grains production in Chivi.

Table 7. 2: Variation of Seasonal Rainfall and Maize Yields for Chivi District

Season	Rainfall (mm)	Maize (tonnes)
1996/1997	729.4	3009
1997/1998	389.6	3458
1998/1999	817.1	15807
1999/2000	1134.8	28569
2000/2001	675.5	891
2001/2002	712.2	37032
2002/2003	929.3	11047
3003/2004	949.6	12754
2004/2005	515.3	22841
2005/2006	965.8	676
2006/2007	466.6	4953

Source: Adapted from Simba et al. (2012).

Table 7. 3: Variation of Seasonal Rainfall and Small Grains Yields for Chivi District

Season	Rainfall (mm)	Sorghum(tonnes)	Pearl millet (tonnes)	Finger millet/rapoko (tonnes)
1996/1997	729.4	3132	2270	760
1997/1998	389.6	5120	210	390
1998/1999	817.1	2333	1373	1085
1999/2000	1134.8	6828	2430	1458
2000/2001	675.5	1878	82	627
2001/2002	712.2	15900	719	2629
2002/2003	929.3	13574	1200	1200
2003/2004	949.6	2506	910	627
2004/2005	515.3	15894	1968	2056
2005/2006	965.8	1646	299	253
2006/2007	466.6	3582	328	493

Source: Adapted from Simba et al. (2012).

Table 7.2 shows that maize production in the whole district of Chivi varies considerably in that production is very sensitive to rainfall trends; and Table 7.3 shows how small grains are

not affected by low rainfall. Simba et al. (2012) shows that high rainfall results in high maize yields and low rainfall leads to low yields. Yields for small grains are less controlled by rainfall trends. Thus, in their study they recommended that farmers grow small grains as opposed to maize as an adaptive measure. Although the people of Ngundu were aware of this need to adapt to small grains, many respondents were reluctant to stop or limit maize production mentioning – as indicated – the problems of birds, taste, labour intensive and land size**.**

7.3.5 Soil Management and Water Harvesting

Soils in Ngundu have lost their fertility and soil management is crucial in the area if soil fertility is to be improved. Considering the state of soils that now exists in Ngundu, the soil requires manure and fertilisers for purposes of high yields. This therefore means that soil management is crucial in the ward so as to increase crop yields. Hence, beyond conservation agriculture initiatives, soil management is being encouraged as a way of improving soils and reinvigorating their fertility. Old practices such as avoiding cutting down trees are now increasingly encouraged in order to avoid soil erosion and soil disturbance. Only certain trees are allowed to be used for domestic purposes such as the Musasa tree (*brachystegia spiciformis*), which can be used for firewood but this is to be done on a minimal bases so as to avoid deforestation. Villagers are also encouraged to do agro forestry by planting a tree locally known as *mubvumira* (a type of Marula tree) on their homesteads or surrounding their fields for vegetation and land reclamation. A significant number of the respondents had these trees in their homesteads and fields and this helped in keeping the soil intact.

This kind of agro forestry has been promoted by Care with the assistance of AGRITEX. Agro forestry is the growing of both trees and agricultural or horticultural crops on the same piece of land (Brazier, 2015). Trees can produce a wide range of products, including food, livestock fodder, firewood and timber. In Ward 25, NGOs have encouraged agro forestry more directly by the planting of new trees through a project called 'producer groups'. The project is being done by members of the "*Wasarira"* garden collective who, in small groups, become involved in what they term "*mukando*" (income cooperatives) to buy trees for planting. The project is in fact a community initiative suggested by members from the garden as they looked for ways to improve their garden produce.

Exotic trees are also being planted as they grow fast compared to indigenous trees. This will be of benefit to the villagers as these trees will produce fruits, as trees such as orange, mango and guava are planted. The trees are planted around the "*wasarira*" garden as long as

they do not hinder the growth of crops grown. In line with this, Brazier (2015) points that planting of these trees leads to soil management as they can improve the soil, protect it from erosion and increase the water content of the soil. As one villager emphasised:

> *Michero yatodyara iyi inotibetsera pakuidya uye kutengesa kuNgundu towana mari yekuzvibatsirawo mudzimba.* [The trees that we plant help us increase our household income as we can sell them [or the fruits] at NGP.] (Informal conversation, April 2016).

The benefits of agroforestry has been mentioned in many studies like Zoysa (2014) who points out that agroforestry has an important role in climate change adaptation by enhancing the resilience to climate impacts of farming systems.

In addition to this, Ngundu people have also planted vetiver grass for vegetation reclamation which is a programme that was implemented by Care. Gulley reclamation is also practiced whereby villagers close gullies that would have formed due to extreme weather hazards like floods. They do this through food-for-work programmes whereby they work and are given food by Care. This has assisted in resuscitating the soil and allowing it to regain its texture. However, I noticed that the extent of which gulley reclamation was being done in the area was low, as farmers cited the arduous labour that is involved in filling the gullies with soil.

The Forestry Commission is the major state institution that provides the knowledge on how to grow the trees and grass to avoid gullies caused by land degradation. It has assisted in giving Ngundi people trees to plant in their gardens and this has greatly assisted them, particularly given that buying trees to plant is a financial burden on Ngundu people. As one farmer put it during an internal conversation,

> *Forestry Commission has assisted us in many ways by disseminating information on how to plant trees and their importance in conserving soil.* (Informal conversation, April 2016).

The Forestry Commission has also advised people on how to prevent veld fires. Reduced burning and land clearance is promoted and it is an offence to burn forested areas. Several pieces of legislation have been enacted in Zimbabwe aimed at preventing veld fires and among these is the Traditional Leaders Act of 1998 in Zimbabwe, where chiefs are expected to prohibit veld fires in their community. Traditionally in Ngundu, fires were used as a way of clearing the fields. However, there is a high risk of these fires becoming uncontrollable and end up being veld fires. In order to avoid such incidences, villagers are now being urged not to start unnecessary fires and those that are caught are reported to the Chief. Veld fires affect soil fertility as they destroy micro-organisms found in the soil (therefore reducing soil nutrients) and they tend to increase soil erosion.

Considering the erratic rainfall experienced in Ngundu, water conservation has also become crucial among the people. The late onset of rainfall and its early cessation has meant that the area obtains minimum rains and the crops do not receive proper rainfall. This has been worsened by the increase of dry spells in the Ngundu area. The challenge faced by communal farmers is to enhance the water productivity of rain-fed agriculture by mitigating intra-seasonal dry spells through the adoption of new technologies such as rainwater harvesting (Kahinda et al., 2011). As a way of trying to conserve water for later use, the Ngundu people are being encouraged to practice rainwater harvesting as an adaptive strategy. Rain-water harvesting has been commended because of its potential to provide enough water to supplement rainfall and thereby increase crop yields and reduce the risk of crop failure (Oweis et al., 2001; Critchley et al., 1991).

Care has encouraged water harvesting in Ngundu through what are commonly known as infiltration pits. Villagers are encouraged to dig infiltration pits along contours in their fields. Water collects in the pits during the rainy period; when the rain ceases earlier than expected or desired, then the captured water will at least spread underground and is used by plants. The water percolates into the crops and the crops can reach an advanced stage waiting for more rain to come, up until they reach maturity. Infiltration pits are being used by a significant number of Ngundu farmers as they have proved to be beneficial to them. Even though they are labour intensive and time-consuming, farmers have tried to implement them so as to increase their crop yields. According to one respondent,

> *Infiltration pits are strenuous as they require so much labour. At times households come together and help each other dig them in one field then move to the next field. That somehow makes it better.* (Informal conversation, April 2016).

7.3.6 Early/Dry Planting and Replanting

Noteworthy is that adaptation to climate change involves the use of early maturing varieties of seeds. Planting early maturing seeds can help as an adaptive strategy given the shortened rainy seasons that Ngundu people are experiencing. Early maturity seeds are however expensive, which contributes to farmers resorting to using seeds saved from a previous harvest. This negatively affects the crop yields as shown by reduction in mainly maize yields. The most common early maturing maize variety available on the market is the 4Series popularly known as *tsoko* (monkey). Though many Ngundu villagers are knowledgeable about the 4Series, and have used it, they complain about the low yields emanating from it; though it provides better

yields compared to saved seeds. According to one respondent during an FDG held in Pedzisai village in April 2016:

> *Early maturity haina goho, shango dzeearly maturity idiki. Ndechekungoti vanhu vakasike zvavo kudya asi hachina weight*. [Early maturity crops produce very low yields; they are only meant to avoid starving but they really do not yield much]. (FDG, April 2016)

Changing planting dates is relatively inexpensive and easy to implement, and it is particularly important for farmers in rain-fed systems. The onset of the rainy season is crucial to the timing of planting rain-fed crops: if a farmer plants too early, soil moisture will be insufficient for seed germination; if a farmer plants too late, intense rain might wash the seeds away (Reason et al., 2005). In order to address concerns about crop production, Ngundu farmers have changed their planting calendar in response to year-to-year variability in rainy season onset. In this respect, they largely depend on advice they receive from agricultural extension services. As the ZANU PF youth leader put it:

> *Every year we have made it a must to seek for advice from AGRITEX. They are the ones who are assisting us on when to plant and when not to. If you fail to listen to their advice, in most cases it is difficult to get any harvest. They are well informed and understand these issues more that we do.* (Interview held with the ZANU PF youth leader in October 2015)

Early dry planting and replanting are seen by Ngundu farmers as practices that help in avoiding crop losses. The late onset of rainfall has made farmers to resort to dry planting so that when it rains the seeds will easily germinate. However, this is not always the case as at times the rainfall tends to be too low, therefore making it impossible for seeds to germinate. The farmers will then have to replant new seeds which might have a high success of germinating when it rains again. Farmers have also promoted staggered planting as a way of avoiding total crop loss. Showing his internal conversation one respondent pointed out that:

> *I do not have any choice I always tell myself that every season. I have to replant if the first planting fails. I encourage my whole family to plant for the second time. Whenever we do that at most times we get lucky and we end up getting some yields which we would not have managed to if we did not replant.* (Internal conversation, April 2016).

7.3.7 Livestock Adaptive/Coping Strategies

With specific reference to livestock, people in Ngundu have also implemented some adaptive and coping strategies. Due to the threat of climate change for livestock, some farmers are taking measurements in protecting their cattle. During drought years, respondents with livestock herd their cattle near dams and also near trees so that they can get in the shade and avoid heat stress. One villager noted:

> *Kana kwapisa kwaita drought ini ndinofudzira mombe dzangu kumiti iri mugomo inotonhorera uye mombe hadzizonyanyotsva.* [If it is a drought year, I herd my cattle in the mountain where there are tress. The trees provide shade to my cattle and this will lessen the heat for them.] (Informal conversation, April 2016).

Others resort to placing drinking water for the cattle in dishes at their homesteads or where they are herding the cattle. A few villagers have planted trees at their kraals to provide shade. They also keep stover to feed the cattle when pasture becomes limited. In really severe droughts it has proved difficult to implement strategies that save their livestock, which largely contributes to the death of high numbers of livestock. Some respondents indicated that, during drought years, the cows are also fed *Bauhinia thonningii* (musekesa) as the tree is in abundance during drought years.

7.4 Non-Agricultural Adaptive/Coping Strategies

Beyond the many and diverse coping and adaptive strategies pursued by Ngundu people with regard to agricultural activities, they are also involved in non-agricultural adaptive/coping strategies that have enabled them to continue surviving under a changing climate. Non-agricultural strategies have been implemented at times as a means of getting income that can be used for household consumption needs. These strategies also compensate for agricultural activities in the event of droughts and floods that have become common in the area. This section thus discusses the non-agricultural adaptive/coping strategies in Ngundu showing their importance to the people.

7.4.1 Casual Labour

I understood casual labour in Ngundu to be a coping strategy as it is primarily a strategy that a significant number of people implement in the event of a shock occurring and with basic survival in mind. However, casual labour may also turn into an adaptive strategy as some

people will come to continuously depend upon it. Since crop production is deteriorating in Ngundu (as shown earlier), Ngundu farmers see casual labour as a survivalist mode strategy which can take them through particularly difficult times. Due to the continuous occurrences of droughts and floods in the area, I came to note that casual labour can become an adaptive strategy which the people will largely depend upon because of ongoing hard times. One respondent said,

> *Unokwanisa kuwana umwe anoti huya undiisire mufudzi mumunda, ndotoenda ndinoita local, ukawana munhu ane chibasa chake akati huya uite ndinotoenda.* [You may find some people who ask you to come and put manure in their fields. If I find someone who wants me to provide labour, I go.] (In-depth interview with a casual labourer held in October 2016).

Evidence gathered from the respondents show that 71.4 % of the households were involved in casual labour at some time, and as a practice that helped them during hard times. Casual labour is commonly known as '*maricho'* in the Shona vernacular, meaning a piece of work performed for other villagers in exchange for food, soap, sugar, old clothing or even money. The possibility of casual labour is in part conditioned by the relations that exist in a local community. More specifically, for an individual to provide labour to those who require it, he or she needs to have cordial and trusting relations. For instance, those known to drink heavily in Ngundu find it difficult to obtain casual work as they are considered as unreliable.

Those who provide casual labour are usually from poor and very poor households and their labour is typically provided to the middle and the better off households who often receive remittances from relatives. I divide casual labour activities into two categories: agricultural activities and non-agricultural activities. Considering that agriculture is the main livelihood strategy in Ngundu, the agricultural season is the period during which casual labour is frequently required. Agricultural casual labour activities involve pre-harvest activities which include land preparation, planting, weeding, spraying and applying fertiliser on crops. Post-harvesting activities include harvesting, shelling and threshing, winnowing and packing. Those who provide casual labour will search for work in their neighbours' farms around the Ngundu village or go to nearby resettlement areas like Nyahombe which is 20 km away from Ngundu. According to one female respondent,

> *Tonoita maricho kunyahombe kana ukachera gomba remufudze unopiwa gaba rimwe rechibage wofanokunopa vana iwe uchudzokera zvakare*. [We do casual labour at Nyahombe, where we are given one bucket of maize for digging one hole of manure. We

then give the maize to our children and go back again.] (Informal conversation, October 2016).

Casual labourers are either paid in cash or in kind which includes clothes or food. However, some respondents pointed out that they preferred to be paid in cash, in order for them to go and buy seeds and fertilisers to use in their own fields.

Droughts or floods may affect the need for agricultural casual labour throughout the entire agricultural season. However, agricultural casual labour is not affected in the early stages of crop production as activities like land preparation and planting will still be done as villagers continue with farming, even if they are informed that a drought or flood season is forthcoming. As such, land preparation, planting and weeding will still require labour meaning that casual labour will still be carried out in the early stages of crop production. This could be seen by statements such as,

> *Kuti tirege kurima zvinonetsa nekuti hatizivi zvinenge zvaronga Mwari anokwanisa kuzotinzwira tsitsi mvura ikanaya.* [We cannot stop farming because we do not know what God has planned for us as maybe he will feel our sorrow and bring good rains.] (Informal conversation, October 2016).

Casual labour activities will only be affected in the last stages of harvesting, whereby most crops will either have wilted after being undermined by drought or by floods, resulting in low yields or no yields at all. Hence, the need for agricultural casual labour is itself affected by climate change, and sometimes inhibits it as a coping or adaptive strategy vis-à-vis climate change.

Non-agricultural casual labour activities include fetching water and carrying sand for construction. Fetching water for construction now includes both men and women. The dire circumstances in which the people of Ngundu find themselves have compelled women to partake in strenuous activities that were once regarded as male work (like fetching water for construction). According to one female respondent:

> *Ndiko kutoti tirarame kunyanya kana zvinhu zvakatsva muminda. Kuti tiwane chibage tinotochera mvura kune vaya vakuvaka tovati vatipe chibage kana vasina votipa mari totsvaga chibage togaisa towana sadza.* [When we get low yields we fetch water in order to survive. In order to get maize for sadza we fetch water for those who are constructing houses and we ask to be paid in maize. If they do not have, we ask for money and then buy maize.] (In-depth interview with casual labourer held in October 2016).

Again, most of the people hiring casual labour for these purposes are better-households. As articulated by one casual labourer:

Vakawanda ava vatinoshandira vanenge vatori nemari vakatumirwa nevana vavo vakaenda kuSouth Africa. Saka unenge uchitoziva kuti unokwanisa kuwana mari wonotengawo chibage chako chesadza wotorarama. [Most of those who we provide labour for have money as they receive remittances from their children who are in South Africa. So there is a high chance of getting paid in cash and then we go and buy maize for sadza.] (In-depth interview with casual labourer held in October 2016).

Among the respondents, 45% were participating in this activity. They would be paid in cash and in kind depending on the person they would be providing labour for. Particularly those worse affected by drought and floods would be involved in this laborious activity. Carrying sand for construction is another laborious activity that is also being undertaken by both women and men. In fact, it appeared that more women than men were involved in this labouring work. More specifically, it was mainly prevalent among widowed women who were the breadwinners at their homesteads and were forced to find ways of survival.

7.4.2 Sex Work

As mentioned in Chapter five, the NGP is a popular place in Zimbabwe mainly because it is situated along the Beitbridge-Chirundu road corridor which is a Trans-African highway network and one of the country's busiest highways; it is in effect the gateway to neighbouring countries which makes it a resting point for numerous travellers. This has contributed greatly to the rise of sex work in Ngundu, making it a well-known place nationally for sex work. Most of the women involved in sex work in Ngundu are not married and climate-related risks are one the factors leading them to end up providing sex as a survival strategy. In line with this, Natrass (2002) points out that, following destruction of livelihoods assets and possibilities, women (and children) are at danger of turning to sex work. But sex workers in Ngundu come from all corners of the district and the truck drivers – who are mainly in transit coming or going to South Africa, Zambia, Malawi and the Democratic Republic of Congo (DRC) – are the major customers. The economic hardships, persistent droughts and high disposable incomes of truck drivers (as well as gold panners) all provide a conducive environment for sexual activities thereby increasing the chances of HIV transmission.

Unfortunately, I failed to carry out interviews with any sex workers as they refused to participate in the research given the sensitivity of the issue and how hesitant people are to be questioned about such a practice. This also meant that I could not obtain accurate statistics of the number of Ngundu women who are involved in this activity. I had to rely on information

given to me by the villagers who knew some of these sex workers. One male respondent indicated:

> *Masex workers vanoda kufara vaya, havafi nenzara vanoda kufuma chaiko pakatogutiwa pano vanowanda chaizvo.* [Sex workers just want to enjoy life that is all they think of; they never starve, and they aim to get rich. When travellers with money come here at NGP, the sex workers increase in numbers.] (Informal conversation, April 2017).

To him, sex workers were there not because they were destitute but because they wanted to become rich and they were too lazy to work in a more respectful manner like what other villagers were doing. His views were shaped by the fact that there were some sex workers who stayed at NGP who managed to buy expensive property, with one of them having bought a car from this business.

However, other respondents had different views as they argued that there were some women they knew who were practicing sex work because of hunger and the need to send their children to school. One villager said,

> *Varipo vakuita izvozvo nekuda kwenzara, achitoti akawana mari anobhadharira vana kuchikoro, poita vanotenga nyama zvosiyana.* [There are some who do sex working because of desperation and the need to take care of themselves and send their children to school and some who do so because of the need to buy luxuries]. (Informal conversation, April 2017).

For some Ngundu women, sex work has become a coping strategy that they are implementing in order to survive due to climate change. The failure to get any income from farming or not having goods to sell at the flea market prompted some women to venture into sex working. To such women, sex work therefore becomes a livelihood strategy that they use in order to survive and send their children to school if they have any.

Young girls also are involved in sex work as some run away from their homes due to poverty. The failure by parents to get enough crops yields to sell and their inability to send their children to school has led to many school drop outs who seek other means of living for themselves. According to one elder,

> *Vana vamwe vanobva Mwenezi vamwe Mutare asi vemunowo tinavo vatinenge tichitoziva asi vamwe vanobva kure zvekuti vabereki havatozvizivi, isusu madhara tikaona chana chidiki todonha mate.* [Small girls come from Mwenezi and even Mutare but we have girls that reside here in Ngundu whom we know. When older men see young girls they cannot control themselves due to the lust that they have for these young girls]**.** **(**In-depth interview with elder held in April 2017**).**

Some young girls in Ngundu thus have been forced to become sex workers as a way to escape hunger. Residing near a place that is popular for sex work has contributed to the decision by young girls from Ngundu to join this practice. According to the Chief, sex work has become a problem in the area, in part because of the involvement of young girls. He cited an example whereby he pointed out that,

> *Ndakasangana nezvana zviviri zvakapfeka uniform zvinenge zvanga zvatiza kumba asi ndakashaya kuti nei vasina kubvisa unform zvichida kupinda mubhawa asi zvichitadza nekuda kwezera. Ndakabvunza kusvika zvareva kuti tatiza kuMatsveru hanzi zvatova nemazuva matatu zvichingoti panze dhora.* [I came across two young girls who were wearing school uniforms having run away from home. They were failing to get in the beerhall because there were underage. I asked them where they came from and they said they were from Matsveru. They were conducting sex work outside the beerhall charging only a dollar per person.] (In-depth interview with the chief in October 2015).

The practice of sex work for young girls raises many concerns given how older men in Ngundu have a preference for young girls as compared to older women. In this respect, one respondent in an informal conversation said that:

> *Some women were now wearing high school uniforms so as to appear as young girls and attract more customers.* (Informal conversation, April 2017).

The preference of young girls makes it easier for younger girls to be involved in sex work. Those girls who come from afar are taken under the wing of older women who provide homes for them; they find customers for them and then share the benefits. One elder mentioned this in particular:

> *Chikauya chiri chanana mai vakuru vanochigamuchira chinotokasika kuwana mari vogovana mari namai vakuru kana chazokura chotiza mai vaya kana kuti chokasika kubva kana chawana chikomba.* [If a young girl comes here and enters into sex work, she is taken by an older woman who provides shelter for her. The older women will share the income that the young girl gets in exchange for shelter. When the young girl gets older or finds a man who takes her in, she leaves that older woman]. **(**In-depth interview with elder held in April 2017**).**

However, there are some girls who, due to being young, face challenges such as rape and charging less money due to desperation and poverty in order to just survive daily.

Sex work increases the risks of contracting diseases such AIDS and other sexually-transmitted diseases. This has led to organisations such as National AIDS Council (NAC), Southern Africa AIDS Dissemination Service (SAFAIDS), Batanai HIV and AIDS Service

Organisation (BHASO), all of which are involved in HIV and AIDS programmes, to be active at NGP as a way of controlling the spread of diseases. Their activities include advocacy and awareness in the communities especially at beerhalls, growth points and schools. These organisations have also specifically targeted sex workers with SAFAIDS educating women on safe sex, like the use of the female condom. SAFAIDS even sponsored local sex workers to go to Pretoria for a workshop on sharing information with their counterparts in South Africa. Critical to this workshop were their rights as workers. The workshop's theme was "Give me a voice and I will do it myself", meaning educate me on my rights and supply me with the right information and I will stand up for myself. Ngundu was chosen because, according to SAFAIDS' records, it has about 114 sex workers who receive most of their business from truck drivers coming from South Africa. According to the councillor,

> *Sex work pano ndopamusha payo patori negroup pano, pane donor rinonzi SAFAIDS rikuvadzidzisa kuti vaite basa ravo zvakanaka, pane vamwe vakatoenda kuSouth Africa ne kuharare vachinodzidzisiwa kuti ibasa sevenzai zvakanaka uye kudzidziswa kureducer HIV.* [Ngundu is home to sex work and there is a group of sex workers here. SAFAIDS is teaching the sex workers to conduct their business in a safe way. They were even sponsored to go to South Africa and Harare where there were taught that sex work is a job and they need to take precautions in conducting it in order to reduce HIV.] (In-depth interview with the councillor held in February 2017).

7.4.3 Selling at the Market Place

People in Ngundu are also involved in selling at the NGP in order to earn income which in most cases they use to pay school fees for their children, buy food and invest in agriculture. Market places have been established at NGP for vendors who want to sell their goods. But, for one to secure a market stall at NGP, he or she needs to pay rent to the municipality on a monthly basis. The villagers who manage to secure a market stall have an advantage over those who do not, as they can sell their items to bus passengers who stop at the NGP and also to various shop business owners. However, they are disgruntled by some other villagers who do not pay for stalls as they sell by the roadsides of the NGP and earn income without paying any rent. This creates tension between the two groups as those who pay the municipality for designated market areas consider it to be unfair that others can sell unrestricted. In situations like this, the police in conjunction with the municipality sometimes intervene and chase away those without

designated stalls; but they also chase away those who have failed to pay for their allocated stands.

Most Ngundu households at some time try to sell different goods at the market as, in doing so, they can take advantage of the significant flow of travellers through the growth point. Thus, a significant number of respondents (78.6%) spoke about selling vegetables, maize, beans, sweet potatoes, groundnuts, Bambara nuts and fruits, along with clothes and electrical gadgets. Those who sell vegetables are mainly women and their produce comes from their gardens which include leafy vegetables such as rape, spinach, tomatoes and onions. During a poor maize harvest season they use the money they get from selling to buy maize from those involved at Banga irrigation scheme. In cases where they fail to get the maize, they travel to places like Chivhu to buy.

Those who sell maize are usually from Banga irrigation scheme as they have higher chances of obtaining a surplus on a regular basis. An insignificant number of farmers sell their crops from their own farm plot because most people prefer to save and store their maize, given the uncertainty brought about by the continuous droughts and floods in the area. In addition, despite having poor yields, some respondents sold their green mealies which were meant for their own consumption. As one respondent admitted:

> *Tokohwa padiki nekuti ndipo patinodya zhizha asi dzimwe nguva tinotengesa zhizha remumunda kune avo vanoda mabage manyoro kuitira kuti tiwane mari, saka goho rinotapudzika.* [We get low yields because we also eat green mealies from our fields before harvesting time. In desperate times we even sell green mealies straight from the fields at NGP so that we get income]. (Informal conversation, October 2015).

The mealies are either sold as uncooked or cooked mealies, especially to bus passengers. Roasted maize is bought by bus travellers on a significant scale and the farmers quickly get income from this. Roasted groundnuts are also packed in small plastics and sold to travellers. Although the Ngundu people get most of their food from agriculture, they need money to process some of the farm produce; for instance, grinding maize into mealie meal to cook sadza. Income is required for other household consumption needs, and this explains the compulsion to sell different farm produce even if they have not produced enough to have a surplus.

There was one widow who said that she sold firewood to travellers and also to those who have cooking ventures at the NGP. The woman lives with her grandchildren who are orphans and who need to be looked after. She therefore required income that would assist her, especially

when she got low crop yields. Selling firewood, though difficult and risky, was what she highlighted as a copying strategy that helps her take care of her grandchildren. As she said:

> *Ini ndinokwira mugomo ndichitema huni ndotengesa.* [I cut trees from this mountain and I sell the firewood.] (Informal conversation, October 2015).

When I asked her if she was not afraid of being reported to the chief, she pointed out that that,

> *Unless the villagers are willing to take care of my grandchildren, then no one will report me.* (Informal conversation, October 2015).

I observed that sometimes the authorities pretend not to see such actions as they are aware of the vulnerabilities faced by other households especially those headed by females. I also discovered that this is due to the strong social ties which exist in the community, and these ties allow people to understand the desperate situations that others face at times.

Depending on the season, some respondents also sell fruits such as guavas and mangoes to bus passengers. Several homesteads in Ngundu have guava and mango fruit trees which help them in earning income. During school holidays, children are the ones who sell these fruits as their parents will be working in the fields. These fruits are usually sold along the roadside to attract motorists who pass by. During times of drought, Ngundu people also sell wild fruits which are often in abundance. One respondent revealed her internal conversation in this regard:

> *Ini ndakatofunga kuita zvekutengesa michero kuvanhu vemabhazi ndaona kuti ndikasadero ndinofa nenzara. Ndakaona kuti vamwe vanokwanisa kucherera mvura yekuvakisa asi ini ndaisakwanisa kuzviita nekuti ndinorwara.* [I thought of selling wild fruits to passengers on buses who will be travelling and taking a rest here. I realised that if I do not do this I will starve and die from hunger. I also realised that others are able to fetch water for constructions but I could not do that since I do not feel well at most times.] (Internal conversation, October 2015).

An insignificant number of the respondents sold non-farm produce such as electric gadgets, clothes and buckets at NGP. I discovered that those who are selling such commodities are cross border traders who hoard goods bought in in South Africa and then resell them at NGP for profit. These villagers are mainly from the better-off households, as they had access to capital which is required to begin such a business. But most of the people who sell such commodities at the NGP ware not originally from Ngundu; rather, they are business people who have come from neighbouring parts of the country, given the strategic location of NGP. According to Mr Madzivire,

> *Vanotengesa vakazara ndevekumhondoro, kanzuru inoda vanhu vane mari saka vakawanda vemuno havana mari.* [Many of the vendors here are from Mhondoro. This

is because the municipality wants people with money and most of the Ngundu people do not have]. (In-depth interview with Mr Madzivire held in October 2015).

This was supported by the councillor who said that many people who sell at Ngundu are not from around the area, but from other parts around the country.

7.4.4 Wild Fruits

Ngundu people have seen the consumption of wild fruits as a coping strategy during times of drought. Wild fruits are a feeding supplement in good times and a coping strategy during droughts, when most of the wild fruit trees surprisingly bear a lot of fruits. This is supported by Ndlovu (2010), who points out that the *Mukwakwa* tree (*strychnos madagasca-rensis*) bears considerable fruit these times. Indigenous wild fruits become popular among the people as an important addition to their diets in times of droughts and hunger**.** All households depend upon these fruits in times of drought and 65% go a step further and process them. The wild fruits like the Marula fruits, *Muchakata* fruits (*Parinari curatelifolia*) and *Mukwakwa* fruits can be processed to make cooking oil, butter and beer. *These* also can be sold and add income to households making this a good coping strategy. The picture 7.8 below show the Marula tree and its fruits.

Picture 7. 8: Marula Tree and the Fruit

Source: Fieldwork February 2017.

The Marula tree locally known as '*mupfura'* is the most popular and cherished tree in Ngundu. Its importance is shown by the existence of laws seeking to protect the tree. It is forbidden to cut down the tree and those who do so are reported to the Chief and are made to pay a fine. The tree provides the Marula fruits which have a bitter-sweet taste. People in Ngundu do not really enjoy this taste but the tree is associated with numerous benefits. The flowering season of the tree is between October and February with January and February being the ripening months. The main purpose of the fruits is to brew beer and this is done after the crops are completely ripe. The beer called '*mukumbi',* made from the fruit's juice, is processed by the older women in the village. Since the beer is highly intoxicating it is not allowed to be sold. The Ngundu people however enjoy this beer and use it during traditional ceremonies. What is interesting about the Marula tree is that every part of the fruit is useful and nothing is thrown away. The seeds of the fruit for instance are useful in making different products. The seeds are collected and dried, then they are squashed and used to make home products that include peanut butter, cooking oil and body oil. The Councillor actually stated that

> *In the 1980s I would go to school after applying body oil made from Marula fruits. We did not need to buy Vaseline and we would actually save* [money]. (Interview with the councillor, October 2015).

However, during those years and in the 1990s, the home made products from the tree were used only for home purposes and not for commercial purposes. Currently, in this difficult era of climate change, the home made products of the Marula tree are being used as an income-based coping strategy. Ngundu women now produce cooking oil from the Marula seeds and sell it. They have formed a self-help group and they have managed to go into a partnership with an NGO called '*Regai Dzive Shiri',* which supports them and buys the cooking oil for resale in different towns.

Another wild fruit tree that becomes popular during drought years is *Muchakata* or *Muhacha.* The fruits are used as a supplementary diet during droughts and they are also used to make peanut butter. The peanut butter is sold but has few buyers because its taste is secondary to that of the Marula tree. Livestock also become more dependent upon the tree during drought years; hence it is used as a coping strategy for providing forage for cattle and donkeys too. Just like the Marula tree, *Muchakata* is protected by the law.

The *Mukwakwa* tree shown in Picture 7.9 below is also another wild fruit tree that is conducive for various uses during drought periods. According to one respondent in an informal conversation,

Tinoona kukosha kwawo kana kune nzara [We see the tree's importance during drought years.] (Informal Conversation, October 2015),

The fruits of the tree grow in abundance when there is a drought and fruits are available from August to December. The fruits can be eaten as soon as they are ripe or they can be dried and stored to be eaten during the maize planting season. The dried fruits can also be sold at the market and this increases household income and becomes a great assistance in drought areas when food and money is scarce.

Picture 7. 9: Mukwakwa Tree Fruits

Source: Fieldwork February 2017.

Other fruit trees that are drought-resistance and are more conducive to high temperatures are shown in Picture 7.10 below. The fruit trees include *Mukashu* which is mango-like; *Makosvo* which is grape-like; *Nhunguru*; *Muhute*; *Mbambara* with fruit that turns purple when ripe; *Munzvirimombe* which turns brownish when ripe; *Musekesa* which is eaten by both people and cows; and *Muchecheni* which is eaten by goats. Animal diseases which spread during droughts are treated using the *Chisvosve* tree which has become a very important tree because of its medicinal capability of healing cattle eyes.

Picture 7. 10: Wild Fruits found in Ward 25

Source: Fieldwork February 2017.

7.4.5 Reduction of Meals per Day

The major effect of extreme weather events such as droughts is a major hindrance in crop production which affects food security leading to hunger. This has been the case in Ngundu which has the largest number of poor households (331) in all of the 32 wards and also the highest number of poor people (1434) (The Food Poverty Atlas, 2016). This shows the severity of food insecurity among the people in the ward, which has been worsened by a decline in crop yields. Drought years in the area mean that a significant percentage of the farmers and their households will become food insecure as they obtain low yields in maize production on their farms; this is at least the case with those who are not involved in any irrigation scheme. Their diet during the period will be limited as affected households will be lacking adequate food. As a coping strategy, some families in Ngundu have resorted to cutting back on the number of meals per day in order to preserve the little food available in their households. According to Corbett (1988), people may choose to go hungry in order to preserve their productive assets and future livelihoods. This has become a coping strategy as households preserve their limited food in drought years as a way of prolonging their food granaries. During an FDG held in Guti in April 2017, one respondent lamented that:

> *Ukapinda mumba umu hamuna chirimo. Takutongodya makuseni nemanheru kana zvichiripo asi kana pasisina isu vanhu vakuru tinenge takutodya chikafu chakasimba kumanheru uko. Pamwe pese apa kungononga nonga zvakaita semichero.* [There is no food inside the house. We now have resorted to eating only two meals a day; when our food decreases more, we the adults will only eat one heavy solid meal around sunset and

give the children two meals. We resort to picking up light foods like fruits waiting for the meal.] (FDG held in Guti, April 2017).

Getting low yields on farms means that households will not be able to finish the year, until the next agricultural year, with their current yields for home consumption. Some households in fact indicated that in drought years they usually got one bag of maize which will not last even a month. So in order to preserve maize, they will stop eating sadza twice a day like they usually do when they get high yields; they will resort to only eating sadza in the evening. This will mean that the amount of maize that is being used daily by the household will be reduced and last a little longer. Also, when their maize and other farm produce do finish, it means they have to buy mealie meal from the shops which is expensive as they do not have steady incomes they depend upon. This forces them again to reduce their meals and eat only when necessary.

7.4.6 Food Hand-Outs

Climate change has posed a serious threat to food security in developing countries in Africa. This has led developing countries to heavily rely on foreign aid in the form of food hand-outs to avert hunger (Manyeruke et al., 2013). Food aid, popularly known as food hand-outs, is a coping mechanism that has helped the Ngundu people to survive under a changing climate. Droughts and floods certainly have affected yields leading to food insecurity in Ward 25. The most affected households are the poor and very poor households, which have minimum yields during droughts; with 29% receiving food hand-outs. These households do not receive remittances and, in terms of their own efforts, mainly depend on casual labour as a coping strategy, especially in times of drought. At times, casual labour opportunities though are few and far between.

As well, based on local social networks, food hand-outs are also distributed amongst Ngundu households. Poor households are at times assisted by wealthier households when the situation becomes particularly dire. The councillor thus noted that:

> *Unoti ungafa here, unenge uchitiwo ukarara nhasi mangwana woendawo kune umwe okupai mundiro. Munoti munhu angafa munyika mune vanhu.* [You cannot die in a world full of people. You will just go seeking for assistance to people and they will give you food.] (In-depth interview with the councillor held in February 2017).

The poor and the very poor households are known amongst the Ngundu villagers and, generally, they are seen as hard-working people worthy of assistance. People in the villages

may assist others without being requested to do so. Considering that it is embarrassing to ask for food for free, people ask for food handouts as a last resort. The most basic commodity that the poor people ask from other villagers is mealie meal to cook the staple food of sadza.

In some instances, local tensions might emerge as there are a few individuals who take advantage of the generosity of others and continuously ask for food hand-outs. Maize in Ngundu is usually dried outside in a granary locally known as '*ngarani',* and people can easily see how much a household cropped from a particular harvest. This means that those who have a good harvest are visibly known and may be inundated with requests for help. To avoid such a situation from arising, those who obtain high yields quickly complete the shelling process and put their maize in in-built granaries so that the quantity of maize in storage is unknown to other villagers. When I visited one respondent's house, she had maize in her outside granary and this attracted many to come asking for maize. She noted that:

> *Vamwe vanouya vachichema vachiona ngarani vachichema kuti zvokwadi vana vangu vakufa nenzara zvino kuti urambe wakaomesa moyo hazviite ungazoda kuenda kurufu here.* [Some come here begging for food, crying that their children are dying from hunger. There is nothing you can do except to give them food. You would not want to go to their funeral because they died from hunger.] (Informal conversation, April 2017).

During my presence at this homestead, a woman came and asked for one bucket of maize. She felt embarrassed to ask for the maize in the midst of my conversation with the owner, she and shyly pointed out that:

> *Ini ndatouyawo ndichitoda kutokumbirawo (achiseka achinyara).* [I have also come to ask for maize. [She said laughing nervously]. (Informal conversation, April 2017).

Food hand-outs from donors have been mainly given by Care and Red Cross in Ngundu. When food hand-outs first came, all households were benefiting from them, since everyone was affected by drought and later poverty. In this regard, Munro (2006) shows that food aid is a regular drought coping strategy in Zimbabwe as the majority of rural households at one point in time have benefitted from food aid during drought because of food shortages. However, food hand-outs have proven to be a problem in Zimbabwe as, it is argued, they have largely led to the dependency syndrome. Ngaira et al. (2012) thus point out that Red Cross and Food and Agricultural Organisation in the end do not provide a permanent solution to the problems of agriculture, climate change and famine; rather, they encourage a sense of hopelessness and sustained dependency on food hand-outs.

Ngundu people started receiving food hand-outs from NGOs like Care after the 1992 drought when crop production was affected leaving households very food insecure. They were

meant to help the people cope with food insecurity and to survive the hunger brought about by the drought. This practice continued as droughts persisted in the area due to climate change affecting crop yields. The villagers would receive mealie meal, cooking oil, beans and barley. It was a blanket feeding as everyone benefitted. However, the frequent distribution of food fostered a dependency syndrome among the villagers according to the NGOs and they then decided to hopefully rectify the situation by targeting only the most destitute households. Further, individuals who require nutrition the most are also benefiting, including pregnant mothers, lactating mothers and children who are below three months old. This is to make sure that they get proper nutrition and avoid stunted growth among children.

7.5 Household Cases of Adaptive/Coping Strategies

Clearly, as discussed in this chapter, there is a diverse array of coping and adaptive activities pursued by Ngundu villagers in the face of climate change. I have not sought to weight them in terms of their significance to Ngundu households as a whole, but certainly those which are more geared towards forward planning or proactive adaptation are most likely to have significance over the long haul if the effects of climate change are to be addressed in any meaningful manner. The extent to which they are used in fact varies across households and some are drawn upon at particular times of the year while others are all-year activities.

This chapter ends with short stories of two households in Ngundu that practice multiple coping and adaptive strategies, in order to provide a more holistic and integrated overview of the activities of Ngundu villagers. The stories also show how Ngundu people engage in internal conversations as they try to construct strategies that they can then implement. The first story is of Mr Chaminuka (Box 7.1) who practices adaptive strategies such as dry/early planting, *dhiga udye* and water harvesting. It shows, as does the second story, the great strides that are being undertaken by Ngundu people in their endeavours to continue surviving under climate change.

Box 7. 1: Mr Chaminuka

My family and I depend on farming so I invest in farming. I see that things are bad now and I try to think about what to do so that I survive. Things have changed and I need to change my farming ways. No matter how difficult it is I tell myself that I am going to survive. The way that we are farming now was not the way we farmed when we were growing up. The time for cultivating fields has changed; where previously we would start planting in October now I wait for the AGRITEX officers to inform us planting dates first. When we were growing up we would know that if we practiced our traditional conventional farming we would get good yields. There was nothing special we would do except apply inorganic fertiliser. These days you ask yourself when I should plant, what should I plant and how should I plant it. These days we have to change our farming because of these recurrent droughts and floods. I do dry/early planting

*depending on the information from AGRITEX officers. "*Kana ndisina mari yefertliser ndakamirira kuita zvinenge zvataurwa nemadhumni ndinofanokura munda wangu ndoisa manure emombe". [*Whilst I am waiting for the information from AGRITEX officers, I clear my fields and put cattle manure]. They inform us not to clear our fields and to place stover in our fields but I do not do that because I believe in tilling the land and also stover may lead to termites attacking your maize. Sometimes I implement* dhiga udye *but not yearly. I implement it when I know that it is a drought year as it is strenuous. My wife has a garden at Wasarira garden and one at the communal boreholes. I encourage my wife to work hard in these gardens so that we can produce from them so that we do not starve. Our children help her to take care of the garden. If the produce is well she sells the surplus to neighbours and sometimes at NGP. During rainy season I place a garden at my homestead where I plant various vegetables which sometimes my wife sells at NGP. I also do water harvesting and I have dug infiltration pits in my fields. I harvest water at my homestead in dishes and drums and I use that water for my homestead garden. As for my cattle during drought years, I provide them with drinking water at my homestead which I put in dishes. I do this so that they do not have to travel in hot weather and also sometimes the rivers would have dried up. All this assists my family so that we are able to survive in this era of climate change.*

Source: In-depth interview April 2016.

The second story is of Mr Mararike (Box 7.2) who practices *dhiga udye,* casual labour, selling wild fruits and water harvesting. His household is part of the younger generation at Ngundu and is not as well off as Mr. Chaminuka's household.

Box 7. 2: Mr Mararike

A lot of things go through my mind as I feel this heat that we are experiencing. Even if you try not to think, you end up just doing so because we are human: we need to eat, to feed our children and to clothe ourselves. I have observed how quickly our fields become dry even after we receive rains due to the high temperatures. This is the situation that we are having so it means we will not harvest anything in the following harvests to come. In my household we are only 4, since we are a young family comprising of my wife and my two boys aged 10 and 6. For me to survive I do casual labour. I look for piece jobs from my neighbours. When it comes to farming in my fields, I have told myself to practice dhiga udye *and minimum tillage. My wife is hard working just like me so I have encouraged her that we dig the planting basins* [dhiga udye] *as they conserve water. Our field is small so I have seen that if we use the conventional ways of farming, we will not harvest anything. We begin digging the planting basins in August so that we have ample time to finish them when the rains come. Starting early also ensures that we do not overwork ourselves, given that we are only 2 people in my family who can dig the basins. Each time I go to sleep every night after a day of digging, I feel happy that even though my wife and I are tired, we have done a great job that will see us getting something during the harvest season. I know a lot of people complain about these planting basins but to me and my family, although they are labour intensive, they help us achieve better yields in the end. I look for* termitaria *to put in my field. Sometimes I work in other people's fields in return for cow manure to put in my fields. We also practice water harvesting and infiltration pits. During drought years our children look for wild fruits and sell them at NGP. We also dry the fruits like marula and my wife makes peanut butter. I will continue thinking of ways to survive. As I relax and during my sleep I continue thinking and it makes me continue with life.*

Source: In-depth interview April 2016.

7.6 Conclusion

In the light of the significant concerns about climate change expressed by Ngundu farmers (as outlined in chapter 6), this chapter has considered the coping and adaptation measures pursued by these farmers. It has shown, at the same time, some variation in specific measures pursued by different households. The coping and adaptation strategies implemented by Ngundu people were grouped into two broad categories, namely, agricultural activities and non-agricultural activities. Agricultural activities adopted as adaptive and coping strategies include gardening, crop diversification, conservation farming and irrigation. Non-agricultural activities include selling at the market place, processing and selling of wild fruits, reduction in meals per day and sex work. In this context, many of the livelihood activities discussed in chapter 5, or at least the form they take and their significance to Ngundu farmers, must be understood as being informed by concerns about climate change and variability. However, climate change perceptions and concerns are not directly translated into climate change coping and adaptation strategies. In part, this is because this 'translation' is mediated by a range of constraints and enablements which channel these concerns into particular strategies. The next chapter, in addressing the fourth (and last) subsidiary objective of the thesis, focuses on these constraints and enablements.

CHAPTER EIGHT: CONSTRAINTS AND ENABLEMENTS UNDER CLIMATE CHANGE ADAPTATION

8.1 Introduction

The preceding chapter has shown how communal farmers are coping and adapting their livelihood activities to climate change in Ngundu. Ending there would imply that adaptation is an easy and straightforward process such that, when implemented, positive livelihood outcomes emerge. This however is not the case with regard to the situation on the ground, as both constraints (challenges) and enablements (opportunities) add considerable complexity to processes of adaptation. In identifying the range of constraints and enablements, the chapter draws upon the Sustainable Livelihoods framework quite explicitly, both in terms of the framework's emphasis on capitals (or resources) or lack thereof, and the effects of institutional processes and structures. Again, consideration of wealth categories is relevant as internal differentiation amongst Ngundu farmers leads to differences in the kinds and degrees of constraints and enablements characterising the livelihoods of Ngundu households.

8.2 Constraints and Enablements in Adaptation in Ngundu

This section begins by giving a story of a very poor household in Ngundu which is lacking in terms of assets and therefore faces several constraints in the light of establishing a basis for climate change adaptation. In so doing, the story brings to light the reflexive moments and internal conversations that Ngundu villagers go through given the particular problems they are facing. Noteworthy is that the availability of assets or lack of assets condition the success or failure of adaptation strategies. As Winters et al. (2002) show, the implementation of adaptive strategies are characterised by a range of assets or resources. Though not using the same categories of assets as identified in this thesis, they speak about the allocation and importance of natural (land area, irrigation, soil productivity), physical (working tools, ploughs, livestock), financial (access to credit), public (roads, schools, public services), social (civil organisations, migration networks) and human assets (education, household size, training). Those households without adequate assets are more vulnerable to any shocks or stresses which might arise, including climate change shocks.

Box 8. 1: Mrs Muromo's story

Mrs Muromo is a 42 year old widow who lives with her 3 children and 1 grandchild. Her husband died 10 years ago and left her alone to take care of her children. Her children are aged 18, 15 and 14 with the first two being girls. The first girl is not married but she has 1 child who is 3 years old. The older 2 girls do not attend school as there is no money to send them to school. According to Mrs Muromo, *"I got married when I was 18 years old but I only got pregnant after 6 years. My husband did not work so we largely depended on faming and casual labour. When he was alive I had someone who would assist me in reducing the workload and also share ideas on how to survive. When he died, life at this homestead changed as I was forced to become a household head and take care of 3 children. My oldest girl made bad decisions in life and got impregnated early and unfortunately she got infected with HIV/AIDS and can no longer help me as she is always sick. I think I am to blame because due to too much work, I did not give her adequate attention and follow her movements. My young daughter no longer goes to school as I was forced to remove her when she was in form 2 as I could no longer afford to pay her fees. The only one who is going to school is the boy who is doing from 1 but I do not know for how long I will be able to pay his fees as things are getting more difficult. I depend on farming and casual labour so that I can feed my family and pay school fees. Casual labour is now difficult to get because of continuous drought occurrences and the economic decline that is facing the country. Farming has also been affected by these droughts, which are drastically affecting my yields. I used to start my farming towards the end of the year, when rain would come and I would limit my casual labour and concentrate on faming. However, this is no longer the case as droughts have continuously affected the farming season. Currently, there is* dhiga udye *which people say, if practiced, can help crops during times of low rainfall. I tell myself that I cannot practice it because it is too laborious for me and my children. They tell us that we can avoid the labour associated with* dhiga udye *if we start digging the holes early in the middle of the year. I cannot do that as, during the year, I will be involved in casual labour so that I can provide food for my children. I go with my young daughter to provide casual labour and when schools are closed, I take my son as well. I cannot leave them to do CA practices because I need them more when I am practicing casual labour. The people we work for sometimes need you to finish the piece job quickly, so I need an extra pair of hands, given that certain jobs are sometimes hard and time-consuming if you do them alone. So I end up doing traditional farming, as I start to prepare my fields at the end of the year, so that I can maximise casual labour. When Care used to give us food, it was better as it meant that I would use the money from casual labour to buy seeds and fertilisers for my field. These days they no longer give us food, which means that I now divert my money to first of all cater for food and then afterwards buy the seeds and fertilisers. I do not have any livestock except for a few chickens. This affects me as I do not have manure and draught power to assist me in the fields. So my farming is affected especially in this era of droughts and floods as most times, I get minimum yields that only last a month. I have a garden but it is not an irrigated one as I do not have money to pay for the joining fee required at the irrigated gardens. I only have 2 beds in the garden and they produce enough for my family but not enough to sell. If I was involved in irrigated schemes like Banga and Wasarira, my life would change but I failed to get in both schemes because I lacked financial capital to pay the joining fee. During difficult times I am forced to go and ask for food from my neighbours. At times I fail to give it back, for instance maize meal, so I end up asking them to offer me work*. "Upenyu hwakandiomera zvekuti ndinombotongera Mwari kuti akatorerei murume wangu" [*Life is so difficult for me and I do not know why God took my husband away from me.*] *We helped each other in taking care of the family. I know things would have been different if he was alive. I stay up at night thinking about ways that can make me get money and food to provide for my family. At times I*

get lucky and some better-off people whom I go to church with, give my children and me clothes.

Source: In-depth interview April 2016.

The story above shows the many problems faced in particular by low-asset households with reference to climate change and adaptation possibilities. Households in Ngundu endowed with more significant assets are more able to pursue climate change adaptation. Hence, both constraints and enablements exist in pursuing adaptation, with the circumstances of some households marked more by constraints than enablements. Ultimately, though, certain constraints exist for all Ngundu households, such that the prospects for (and success of) adaptation processes are often in uncertainty and doubt.

In light of the case study, I now discuss both the micro and macro constraints and enablements which condition and affect – hindering and promoting – climate change adaptation processes in Ngundu. In doing so, I make reference to the SL framework because of its recognition of the importance of resources in structuring the livelihoods of small-scale farmers such as those in Ngundu.

8.2.1 Natural Capital

Issues to do with natural capital focus on for example land, soil fertility, and drought or flood occurrences. For Ngundu villagers, the importance of land and the livelihood possibilities which arise from access to land, cannot be underestimated. Farmers in Ngundu constantly complain about the limited size of their farm plots and the restrictions this places on crop production, while at the same time realising that practicing rain-fed agriculture is increasingly difficult. Hence, the key problem is not land in-and-of-itself but the quality of land available. Such land deficits (quantity and especially quality) inhibit the capacity of Ngundu villagers to engage in adaptation activities, a point which Fadina et al. (2018) note has broader resonance. But, for villagers in Ngundu, sheer farm size and thus land shortages have some significance. For example, respondents spoke about restricted land size preventing the implementation of agro-forestry measures and crop–livestock diversification. Due to cross-generational distribution of land in Ngundu, virgin land is now almost impossible to access. Those who once had significant farms were forced to divide their land and give a portion to their male children. According to one elder:

Isu taimbova neminda mikuru yaisvika kuma 8 ha asi nekuda kwekushaikwa kweminda minyuwani takutokamurira vana vedu zvikamu paminda yedu, izvi zvikutapudza kukura kweminda yedu. [We once had huge farm size amounting to about 8 hectares but because of shortage of virgin land to give to our children, we are now dividing our land and giving it to our children. This reduces our farm size and leaves us with small farm size.] (In-depth Interview with elder held in Nduna 1, April 2016).

I observed in Ngundu that, although the population was increasing, the overall land available for cropping remained the same. Farm size has affected the adoption of adaptation strategies, such as the cultivation of small grains in the ward. A significant number of respondents pointed out that they are not cultivating small grains due to small farm size. Small grain production requires large farm size in order to obtain good yields due in part to the problem of birds. When asked why villagers do not cultivate small grains, one respondent had this to say:

We do not have enough land to plant them. Look at my field it is only an acre. I put maize, bambara nuts, groundnuts and pumpkins there. Where can I put sorghum or millet? My land is too small if I had more than this I would surely plant small grains. (FGD held in Nduna village in April 2017).

Another villager added that:

Our land is way too small, so I end up settling for maize production as compared to sorghum or finger millet [rapoko]. *You will not get anything if you cultivate small grains in a small piece of land, for it requires huge land for more yields.* (FGD held in Nduna village in April 2017).

In a questionnaire response, a villager also noted:

Maize can be harvested and you can get some yields but when it comes to small grains, bird challenges and small farm size drastically lowers the yields. (Questionnaire, October 2015).

Another respondent reiterated this, adding that:

I do not follow advice given by NGOs and AGRITEX to plant small grains because I have small land. (Questionnaire, October 2015).

I realised then that land was a major constraint to many respondents, especially those who wanted to plant small grains. The only villagers who are cultivating small grains on a significant scale are those who have large farm sizes as they are able to diversify their crops, such that farm size shapes the capacity to combine multiple strategies to cope with climate change (Fadina et al., 2018). As a constraint, the sheer shortage of land in Ngundu means that

the choice of planting a variety of crops is outside the realm of possibility for many villagers; many thus opt to mono-crop, focusing specifically on a crop (maize) which struggles under hot and dry conditions.

As people in Ward 25 largely depend upon agriculture as their main livelihood strategy, respondents complained about the problems they encountered on an ongoing basis in adapting and pursuing new methods pertaining to crop production. As mentioned earlier, there has been a reduction in soil fertility in Ngundu due to constant farming on the same piece of land for many years, and without proper care. Floods in the area have also increased soil erosion, washing away the soil's nutrients and leaving sandy soils. Thus, the soil can no longer produce good crop yields on its own and requires feeding. Constantly feeding the soils, either using inorganic and organic fertiliser, proved to be a constraint to 41.2 % of the respondents, as it was either laborious or expensive. A significant number of respondents could not afford to buy inorganic fertiliser, as it was expensive, so they had to resort to using organic fertiliser which was also laborious. Getting organic fertiliser, which comprises of cattle dung, is particularly difficult for those without cattle. Those who fail to get cow dung resort to *using 'termitaria'* which is strenuous to gather and is also determined by the presence of '*termitaria'*. One respondent recounted that:

> *Ini handina kuwana nekuti handina fertiliser yekuisa mumunda mangu. Ava vandakavakidzana navo vakawana nekuti vakati mvura yanaya ndobva vafeeder chibage chavo. Churu chishoma kuno chinonetsa kuwana.* [I did not get any yields because I had no fertiliser to feed my soil. My neighbour managed to get yields because when it rained she applied fertiliser. *Termitaria* is difficult to find here.] (Informal conversation, April 2016).

This therefore, made farmers to sometimes plant their crops without putting any inorganic or organic fertilisers, which affected their yields.

8.2.2 Human Capital

As shown in the SL approach, human capital is very important in promoting sustainable livelihoods. I observed that in Ngundu, human capital was both a constraint and an enablement depending on the household composition. In this study, human capital involve labour, knowledge, skills, education, health, age and gender. Most of the agricultural practices require human labour and, without this, crop yields will be negatively affected**.** Labour issues are crucial in carrying out adaptive strategies and inadequate labours affect the implementation of

these strategies, as some of them can be very labour intensive. Labour is required from the time of clearing fields, planting, weeding, harvesting, shelling and then packing crops. The use of adaptation strategies was in fact highlighted to have increased agricultural labour intensiveness among households, with 75% respondents pointing out that labour was a constraint in farming adaptation, as some of the CA practices proved to be strenuous.

Methods of CA that were pointed out to be labour intensive were *dhiga udye*, mulching and zero or minimum tillage. The digging required under *"dhiga udye"* proved to be too extreme for many Ngundu farmers, explaining why few farmers practice it. A significant number of the older people in Ngundu complained about this and showed me visibly that they did not practice this type of CA. Despite the increase in crop yields often associated with the practice of *dhiga udye*, farmers were hesitant to pursue it because of the labour required. I observed that most people in Ngundu were disgruntled with the labour intensiveness associated with *dhiga udye*. To them, it is not worth working hard like what is required under the "dig and survive" methods, which they were now calling "dig and die". Mazvimavi et al. (2010) also revealed that high labour requirements for digging planting basins, weeding and sourcing mulch, have been cited by many communal farmers implementing manual CA systems as a major deterrent. As one respondent brought to my attention in an informal conversation:

> *Ukadhiga unogona kufa. Zvotoda kuti utore time yako uchimaita, kuti aite gomba chairo.* [If you dig you might die [literally speaking]. The basins require you to take your time so that they are perfectly done.] (Informal conversation, April 2016).

Another respondent had this to say:

> *Basa racho rakatiwandisira apa tinenge tambonotsvaga mvura kure, toenda nemombe kumafuro apa tozouya toenda kumunda. Zvinoreva kuti tinenge tisisina zororo.* [The work is way too much for us. First we would have gone to fetch water to use at home, then we go with our livestock to find pasture, then we go to the fields [to undertake CA methods]. It means we will no longer have rest.] (Informal conversation, April 2016).

Although *dhiga udye* can be seen to be sustainable (given the yields obtained from implementing it), it is laborious. According to the ZANU PF youth leader:

> *We are told by AGRITEX to start digging basins* [dhiga udye] *in July, so that when the planting season comes around November, December or even January these days, we will be prepared. So you see we never rest. We are working all year round. Given the limited number of people that might be living at a household, it is difficult to get the labour required to dig the pits.* (In-depth interview held in October 2015).

This is in line with a study carried out by Makuvaro (2014), which confirms that *dhiga udye* is laborious to farmers, as it did not allow for rest between harvesting of one crop and establishment of the crop in the next season, since basins had to be maintained and weeds controlled soon after harvest of the previous crop.

Mulch to put in the planting basins and in the fields is also a challenge for Ngundu people, as it means that they had to look for mulch – which in large part could be dry grass, leaves and dead plants, which can be difficult to find and collect in this semi-arid area. This proved to be laborious as it meant dedicating their time to searching for the required material. Marongwe et al. (2012), also found out that there are constraints associated with mulching, as they observed that farmers were faced with challenges in getting mulch (grass, leaves). Although Ngundu villagers could use stover, I noticed that a significant number of respondents were reluctant to use stover for mulch as it meant that their cattle could no longer get enough food. Respondents who owned livestock gave sentiments such as:

> *Tikashandisa majanga mumunda ko mombe dzedu dzinozodyei?*. [If we use stover in our fields, what will our cattle eat?] (Informal conversation, April 2016).

Grazing grounds are becoming limited and the grass is becoming difficult to find for mulch. In addition, if it does not adequately rain, the mulch may attract termites which might end up attacking their crops. One respondent stated that,

> *Ini majanga ndinomatya kumashandisa nekuti kukasanaya zvakanaka ndiwo anoita mujuru unozoenda kuchibage.* [I am afraid of using stover because if it does not adequately rain, then they will attract termites that will attack my maize.] (Informal conversation, April 2016).

The farmers in Ngundu were also being urged by AGRTEX officers not to clear their fields but to use the crop residues as mulch. A significant number of the respondents were reluctant to leave their fields not cleared, as it is against their conventional farming methodologies. CA promotes the proper management of crop residues, where they are placed carefully between rows during land preparation in the dry season. This is in contrast to conventional farming in Ngundu, which required the fields to be clear of crop residues and weeds. A good farmer was expected to have a clear field by the time the farming season began. It is difficult for the people to move away from such time-honoured traditional practices, which they grew up practicing. Adesina and Zinnah (1993) mention that it is generally believed that, as farmers grow older; they are less amenable to change from their old practices. This was confirmed during my fieldwork, as I observed that most farms were cleared with no crop

residue remaining in the fields. There was resistance especially by older farmers to move away from their ways of farming and embrace new farming techniques.

A significant number of farmers also complained about the labour associated with small grain production. The small grains demanded considerable labour as compared to maize production. Household size and age were the major constraints in the cultivating of small grains among the respondents, as these factors affected labour capacity and input. As pointed out earlier, small grain production requires skill, experience and time in weeding. Overall, the planting, weeding and harvesting of small grains is labour intensive, which make farmers prefer maize production. A respondent showing her internal conversation had this to say:

> *To tell the truth, small grains are the way forward but I tell myself that I will never plant them. The work that is involved is way too strenuous for me. I am still trying to come up with appropriate ways for me to survive.* (Informal conversation, April 2017).

Labour intensiveness associated with small grain cultivation affected the elderly, the sick and the widows who lived in households that lacked adequate labour and financial capital to hire labour. One respondent lamented,

> *Handichakwanisi kudzvara mhunga nemapfunde nekuda kwekukuvara kwandakaita neaccident saka handichakwanisi kudzinga shiri.* [I can no longer plant small grains because I got injured in an accident so I can no longer chase away the birds.] (Informal conversation, April 2017).

Although the elderly complain about small grains being laborious, they possess knowledge on how to cultivate and weed them. Knowledge is an important factor in adopting strategies. My research took this into consideration as most of my respondents were the elderly, who had lived in the area for a long period. They have knowledge of the area and are aware of the changes and happenings that took place in the area historically. They have played a facilitating role in the adoption of some adaptive strategies, for instance the re-adoption of small grain production on a reasonably large scale. On the whole, small grain production is being practiced by elderly people in Ngundu, who normally have the necessary manpower mainly through a large household that comprised of older children, who are able to chase away the birds. The planting of small grains is popular among the elderly because of their age and knowledge, which gives them the necessary skills on how to weed the crops and how to chase away birds effectively. They in particular possess the skill that is required in weeding finger millet, as the weeds that grow in this crop are similar to it and only a skilled eye can differentiate between the two.

According to Mudzonga (2011), the older the farmer, the more experienced he or she is in farming and the more he or she has been exposed to past and present climatic conditions

over a long time horizon. So age and knowledge, in the case of small grain production as an adaptive strategy, is an enablement to elderly people who grew up during the time of (pre-maize) small grain production. Unfortunately, these skills and knowledge are lacking among the young and middle aged respondents who are only familiar with maize production. They regard farming small grains to be time-consuming especially the weeding process. One middle aged female respondent thus stated:

> *Ini handidzvari rukweza nekuti ndinonetsekana pakurisakura nekuti sora racho rakandifananira nerukweza rwacho. Ndinenge ndichingotema irwo rukweza dzimwe nguva ndichitosiya sora.* [I do not cultivate millet because I have challenges when it comes to weeding. The weeds almost look similar to millet. At most times I leave the weeds instead of millet.] (Informal conversation, April 2017).

Thus, the lack of knowledge and expertise in distinguishing the weed-crop differences is a constraint in cultivating small grains in Ngundu, among the middle and young aged groups. Extension officers are in the process of disseminating the knowledge to all age groups and are encouraging the planting of small grains on a larger scale. With the major work that AGRITEX is doing, it appeared to me that people in Ngundu will begin to realise and appreciate such efforts and embrace small grains production more fully in the future.

In this study, age of the household head was either a constraint or an enablement depending on the type of adaptation strategy. In this respect, Mudzonga (2011) notes that young farmers are more willing to adapt to climate change, compared to older farmers who are less willing to adapt given their set ways or the labour time required. This was the same in this study as, for the elderly, their age was a constraint in terms of the hard work required in some of the adaptive strategies such as *dhiga udye*, zero or minimum tillage which were laborious to them. The elderly themselves could not partake in these methods as they required hard work, comprising of hand digging and constantly working in the fields. However, household composition conditioned the effects of old age on labour capacity. The elderly who lived in large households that comprised of people who are able to provide labour, practiced some CA strategies. The elderly who had income to hire labour also practiced some of these strategies. The problem was with those elderly who had no income to hire labour or who lived with people who could not provide labour, for instance young children. As Onyeneke et al. (2010) highlight, if farmers do not have sufficient family labour or the financial means to hire labour, it is difficult to adapt. Lack of financial capital combined with the absence of human capital affected the elderly farmers in my study and it was difficult for them to implement laborious strategies.

Thus, they preferred to continue with their conventional farming which was less laborious. According to one elderly respondent:

> *Ini handikwanisi kurima kwavanotaura nekuti muviri wakundiremera*. [I cannot farm the way they tell us to because I am now older and my body cannot allow it]. Informal conversation, April 2017).

Even if their household size is small and lacks income, households headed by young and middle aged groups can do more work compared to the elderly. Among the respondents, the few who constantly practiced *dhiga udye* were in the younger age groups.

The study also discovered that the gender and educational dimensions of households in Ngundu conditions the success of adaptive strategies implemented. Dodman (2008) points out that climate change exacerbates the gender dimensions of vulnerability**.** Climate change has the effect of reducing female headed households' economic opportunities therefore jeopardising their livelihoods. Deressa et al. (2009) also discovered that gender of the household head is an important variable affecting adaptation at farm level. In Ngundu, I discovered that women adapt more frequently with reference to gardening strategies while men adapt more in relation to activities that require significant labour like *dhiga udye,* as they are better able to provide manpower; the point is that gardening work typically requires less work than practices such as *dhiga udye*. From the few who practice *dhiga udye* regularly in Ngundu, it became clear that this was through the influence of a man in the household. This meant that female headed households who lacked labour and financial capital were unlikely to be involved in laborious adaptive strategies. According to one widow,

> *Kana kukasanaya ndinotoita zvemaricho sekusakura, nekuti dhiga udye inondirwadza.* [If the rains fail I provide casual labour like weeding because *dhiga udye* is too strenuous for me.] (Informal conversation, April 2016).

Education also proved to be significant in climate change adaptation in Ngundu, as those who were educated quickly understood climate change issues. The educated people would value the information that they receive and follow it. Particularly if educated and young, it is easier for farmers to access information from modern information technologies like the internet, WhatsApp and so forth. Thus, Mudzonga (2011) notes that education has proven to be related to the early adaptation of measures introduced into a community. In the case of Ngundu, those who lacked education tended to be sceptics, as they did not believe the information that was provided by outside agencies such as meteorological services and AGRITEX in regard to climate change. They rather believed their ancestors and church prophets.

As highlighted earlier, (less educated) elderly women in particular blamed the chief for failing to carry out the *mutoro* ceremony properly; hence, the problems with regard to climate change and addressing climate change rested on the relationship between villagers and ancestors as mediated by the chief. There is also a tendency to wait on the word of the prophets for guidance in pursuing livelihoods. According to one respondent,

> *Isu tinomirira kuudzwa nguva yekudzvara chibage kubva kumaporofita*. [We wait to hear from prophets to tell us when to start planting our crops]. Informal conversation, April 2017).

Hence, information emanating from secular state agencies was not considered worthy of consideration. Thus, quite often, such people tended to ignore the advice given by state institutions which is meant to improve their situation. The ones who are educated in Ngundu understand better the disadvantages of conventional farming practices, as compared to those who are not educated. The importance of education is confirmed in a study done by Fadina et al. (2018), who point out that all adaptation strategies are influenced by the educational level of the farmer.

8.2.3 Financial Capital

Financial capital is very important for rural people, even if the agrarian economy is not fully monetised. As Mendelson (2004), Abidoye et al. (2017) and Deressa et al. (2008) all show, adaptation to climate change is costly**.** Thus, lack of financial capital hinders farmers from accessing the necessary resources and technologies that facilitate climate change adaptation (Onyeneke et al., 2010). In Ngundu, low financial capital was a constraint to adaptive strategies as a significant number of the respondents complained about lack of sufficient financial capital to undertake adaptive methods such as irrigation and gardens. As noted, gardening and irrigation schemes require a joining fee. For instance, Banga irrigation and Wasarira garden both require a joining fee as a way of limiting the competition among interested farmers. Considering that a significant number of the respondents are poor and lacked access to any meaningful income, their involvement in these schemes was affected detrimentally. One such villager highlighted:

> *Inini handina kukwanisa kupinda muWasarira garden nekuti panguva yacho ndanga ndisina kana mari yekujoiner*. [I failed to get in the Wasarira garden scheme because during the time of joining I had no income to pay the joining fee.] (Informal conversation, April 2017).

Thus, lack of financial capital limited greatly the involvement of poor and very poor households in the major gardening and irrigation schemes available, thus further limiting their adaptive capacity by limiting crop production and yields. I noticed that the schemes in the ward ended up supporting the already better-off and the average at the expense of the poor. This is the same predicament that the poor are facing in getting access to designated markets at NGP. The required monthly fee to be paid to the municipality has become a constraint for poor Ngundu villagers, as they cannot access the markets as they do not have capital.

Lack of capital has also made it difficult for farmers to get pesticides for army worm. During my field work, I observed that there were farmers who could not afford to buy pesticides to get rid of the army worm. In the sentiments of one respondent:

> *Hatitorina mushonga tinotofamba bage nebage tichitswanya.* [We do not have pesticide to treat the army worm. We have to go plant by plant squashing the worms manually.] (Informal conversation, April 2017).

This was time-consuming as it meant checking every maize crop and making sure that the worm is dead. Crop yields were thereby reduced, affecting the food security of those households that failed to purchase pesticides. The better-off manage to buy pesticides and do not need to spend extra-time in the fields destroying these worms manually.

Overall, in Ngundu, I noted that that better-off households were more likely to adapt successfully as compared to poorer households. This was because they had financial capital which enabled them to be involved in various adaptive strategies, a point which Mudzonga (2011) also raises. In the case in Ward 25, farmers who had access to income (remittances, irrigation schemes, and gardening schemes) could adapt more easily even if they had a small household size. This was mainly because they used their income to hire labour and this assisted them in carrying out some strenuous adaptive methods that required hard labour and time. As well, access to financial capital meant that better-off farmers could get access to new technologies and use inorganic fertilizers. To better understand the advantage of financial capital in implementing adaptive strategies, I refer to Mrs Tagwirei's story.

Box 8. 2: Mrs Tagwirei's story

Mrs Tagwirei is a 65 year old widow who lives in Nduna 1. When I visited Mrs Tagwirei's homestead, she was not around so I met her daughter instead who was visiting her. The first thing I noticed was that the homestead was well cared for and was different from the other homesteads I had visited. The houses had a coat of paint that was not peeling off and the homestead had a wired fence. I counted one big veranda house and one flat house and 2 round huts which included the kitchen. I could see that the life of the people at this homestead was different from the many homesteads that I had passed by and visited. Her daughter informed

me, that her mother had gone to attend to her plot at Banga irrigation and she will be back shortly. In the meantime, she informed me that she is a teacher in Masvingo, which answered some of the questions that I was already asking myself. I began to understand why the homestead was properly maintained, given that her daughter is formerly employed. In her own words she pointed out that, *"pano mama vanowana maremittances nekuti pane vanhu vakaenda kuchikoro vari pano. Tinovabatsira zvakawanda kwazvo*". [My mother gets remittances because people from this household are educated and they are employed in towns. We assist her in many of the activities she undertakes here]. She informed me that her mother depends on farming as a livelihood strategy and her farm is 4 ha. When she fails to get good yields, they buy her food which will push her to the next season. Mrs Tagwirei farms at her homestead and the farm produce was usually not sold. She sells produce she got from Banga irrigation. Mrs Tagwirei came during the interview and I was glad as I could now understand more about her from her own perspective. She confirmed that she largely depends on farming, which is made easier by the help of her children. When I asked her the crop yields she received, she informed me that if rains were good she received good yields. Her reason for this was that she has cattle and she manages to get both inorganic and organic manure. She could not manage to farm on her own, so her daughter and her other 3 children sent her remittances so that she could hire labour. She also sells vegetables at her homestead, as she had a deep well. "*Ndakabva ndati kuvana vandicherere mugodhi kuitira kuti ndisanetsekana nemvura, saka ndine garden randinopota ndichitengesa muriwo*". [I told my children to dig a deep well for me, so that I could have easy access to water. So I have a garden here and I sell vegetables to other villagers.] She lives with one of her female children and 3 grandchildren. She practices crop diversification and she sometimes cultivates rice, depending on the amount of rainfall. Her children are behind her success as a farmer, as they give her income to buy seeds and fertilisers. In drought years, she would be given money to hire labour and do CA practices like "*dhiga udye*". She also could afford to buy pesticides for her crops. Another advantage of having children that worked in towns and assisted her, is that she can sell her produce extra-locally during her visits in towns, especially when she fails to get reliable customers at NGP. She sells peanut butter, Bambara nuts and groundnuts. Sales from her crops increase her income and help her to sustain herself and not solely depend on remittances from her children.

Source: In-depth interview April 2016.

From Mrs Tagwrirei, I deduced that financial capital is a crucial requirement in the climate change era, as it opens up significant opportunities to farmers. As the soils in Ngundu have been affected negatively, Mrs Tagwirei managed to adapt by constantly applying fertiliser to her soils and crops. In addition, she could incorporate CA strategies despite her age as she could hire labour. Her inclusion at Banga irrigation meant that her chances of getting zero yields were low, as she did not depend on dry land cultivation alone. Therefore, financial capital is a necessary asset in promoting sustainable livelihoods as shown by the SL approach, including in the age of climate change.

8.2.4 Lack of Markets

Poor access to commodity markets entail weak linkages to both input and output markets, and hinders farmers' adaptation to climate change (Onyeneke, 2010). A significant number of respondents, who were trying to sell their agricultural produce, complained of lack of markets to sell. There are limited markets now in Ngundu, especially the government organisations which historically bought crops from communal farmers. The Grain Marketing Board (GMB), which used to buy maize from the farmers, has been criticised because of the way it operates. Government markets like the GMB are no longer considered reliable as sometimes they buy crops and sometimes they do not. I was given an example by one respondent during an informal conversation, where farmers were told by the GMB to send their maize bags to NGP, so that GMB could then buy them. However, GMB officials failed to come and pick up the bags of maize, to the extent that the maize became affected by pests. He stated that:

> *Vanoti unganidzai chibage vorega kuuya kutosvika dzimwe nguva chibage choshata.* [They tell us to bring our bags of maize so that they come and pick, but sometimes they fail to come and our maize get affected.] (Informal conversation, April 2016).

This has compelled the Ngundu people to rely on private buyers and to sell their crop produce at NGP through these buyers. But, again, there is a problem with private buyers as they are also unreliable, often taking advantage of the farmers by setting prices well below expectations of Ngundu villagers. One respondent put it this way:

> *Kutengesa kwakunetsa nekuti ava vatinotengesera vanobatira dzimwe nguva. Isu nekuti takawanda unopedzisira wakungotengesa ne price iri pazasi nekuti unenge wotya kuti ukasadaro vachanotenga kune umwe.* [Selling is now difficult because our buyers sometimes take advantage of us. We are many sellers here so that we end up selling our produce at a lower price because if we do not do that, the buyers can approach another seller and negotiate a different price with that person.] (Informal conversation, April 2017).

Considering that most respondents did not have designated market stalls at the Ngundu growth point, they simply resorted to selling at the roadside and sometimes were chased away by the municipality. One villager thus noted,

> *Deno musika wacho waikwanisa ku accomodater vanhu vese uye usingabhadhariswi zvaizotibatsirawo isu.* [If only the market place was able to accommodate a larger number of people and without any monthly fee charges, it would help us]. (Informal conversation, April 2017).

Therefore this proved to be a major constraint, as the attempted sales of their produce involved either no sales at all or sales at sometimes rock-bottom prices. This undercut the capacity of Ngundu villagers to generate financial capital.

8.2.4 Social Networks

Adaptive capacity is also influenced by social networks**.** Social networks are crucial at local levels and people in Ngundu try by all means to interact and assist each other during times of need. Ngundu people are connected through their clans, totems, marriages, friendships, churches and spirituality. As much as possible, Ngundu villagers – despite their heterogeneous character –try to live in a harmonised relationship with their neighbours and other villagers. In the face of such significant food insecurity arising in part from climate change, it is in fact rare for a person to sleep on an empty stomach in Ngundu, at least when there are other villagers who have food. Although there are divisions in wealth distribution, the better-off and the average households try where possible to assist the poor and the very poor in the Ward. This is made possible especially for church goers who in their churches pledge that either food or clothes to be given to the less fortunate.

Churches therefore are a way of social networking as people come together in different groups and worship God. Being a part of a church promotes oneness and the members see each other like a family. This means that when they are faced with a particular problem, they help each other solve the problem. Joining a church is an enablement as it gives security amongst the people and ensures that they will get some assistance during times of need. Even if death comes, the remaining family members will be assisted by church members, especially if it involves a widow –as the church considers them to be more vulnerable. One church-going respondent insisted that:

> *Vanhu vekuchechi vakafanana nevehukama chaivo. Ukawirwa nedambudziko vanokubatsira nekuti munenge matova hama. Ini kwangu kuchechi vanotondibatsira kudarika hama dzeropa.* [Church mates are like blood relatives. When you are faced with a problem they will help you. Members of my church assist me more than my own blood relatives.] (Informal conversation, April 2017).

Pledging shows how important church social networking becomes, as it aims at giving assistance to the poor and very poor members of the church. Pledging occurs when people give to the church what they have (such as food), or no longer need (including clothes), which can help those who are poor and very poor. During the year, local churches also attend country-

wide gatherings where church leaders and members make pledges. In Ngundu, the main churches that carry out this practice include the Roman Catholic and the Methodist churches.

It is through the church that church members also gather and pray about rain or other life crises they will be facing. The coming together heightens the possibility that their prayers will be answered and assist them during times of difficulties. A Ngundu villager thus noted:

> *Isu tinotenda kuna Mwari kuti kana tikatambudzika tinoenda kunonamata tichikumbira kuti Mwari vatibatsire. Mwari vanotibatsirawo zveshuwa nekuti unoona umwe munhu akutokupawo chekuti ubatsirikane usingatombofungidziri*. [We believe that God, when you are suffering and you pray to him, He will answer you. God really helps us, as at times you surprisingly find someone giving you something to assist you.] (Informal conversation, April 2017).

Social networks also help the people to come together in a group and work under the custom of *nhimbe,* whereby they help each other work in one person's field, then go to the next field, up until they exhaust all the people's fields in that group. This enables the farmers to finish working in the fields on time (such as planting) and it makes the work more enjoyable, as they would be singing songs as they work, cook and eat together. This strengthens their ties and makes them understand one's problems better. In the words of one villager:

> *Nhimbe inonakidza inoita kuti basa rifambe musina kumbozviona. Unozonzwa hako kuneta paunozoenda kumba mapedza asi panguva yekushanda munenge muchinakirwa nenyaya hamuzonyanyorwadziwa. [Nhimbe* is enjoyable as it makes people cover so much ground in the field without even realising it. You will feel tired afterwards when you go home in the evening to rest but not during the exercise since you will be sharing stories as you work.] (Informal conversation, April 2017).

Among the respondents, 48.2% mentioned *nhimbe* as a custom that they enjoy but its practice has been reduced due to frequent droughts and floods that affect crops, therefore leaving no crops that require assistance in weeding and harvesting.

Other cultural interactions are very important in the area as, likewise, they bring people together. *Mutoro,* which is a rainfall ceremony, shows the importance of social networks and their relevance to the land-based activities amongst Ngundu villagers. According to one respondent:

> *Mutoro unotibatanidza tose sevagari vemuno munzvimbo tichichemera kunaya kwemvura kana kutenda kunaya kwayo. Kubatana kwedu ikoko kunoita kuti matateguru edu anzwe zvichemo zvedu uye anofadzwa zvikuru nekubatana kwakadai.* [*Mutoro* makes us get together as we plead for rain to our ancestors or at times we could even be thanking

our ancestors for the rain. That unity pleases our ancestors and it makes them respond to our needs.] (Informal conversation, April 2017).

It was also through social networks that people in Ngundu come to know about climate change issues or any other issues going on in the area. Women usually go in teams as friends when they fetch water and tell each other the gossip circulating in the area. During such interactions, they talk about weather patterns and what kind of an agricultural season they think it will be. This is the time they give each other ideas on how to cope or adapt, including harvesting water or joining practices like gardening. Women also tend to go together to their gardens and they give each other strength to keep on working, despite the high temperatures that contribute to their feeling exhausted. Those women who are in the Banga Irrigation scheme have also joined through encouragement and social interaction. As they walk the 5km to Banga Irrigation, they give each other strength and talk about their lives and the need to carry on with their irrigation garden. Interactions like this help even later when people look for casual labour, for they will know who is particularly committed to working hard and should be hired on a causal basis when necessary.

Men also have their own modes of social interaction and it is during such incidents that they share information among themselves. These interactions often entail going out to drink beer at NGP. Men usually encourage each other on ways of improving crop production and putting into practice strategies like CA. For CA to be practiced at a particular household effectively, it mostly depends on the capacity to mobilise male labour. They often talk about common challenges that they face and either come up with solutions or even propose projects which they highlight to NGOs like Care. Through such interactions, men form strong ties that also enable them to borrow farming equipment like ploughs during the farming season. Such interactions also enable other men to borrow money from those who have, so that they can buy fertilisers, seeds or pay fees for their children. This signifies the importance of social interactions in the area.

There are some constraints that present themselves in social networks in Ngundu. The constraints include the hostilities that frequently exist between those who believe in African traditional religion and those who are Christians. Those who consider themselves to be God-fearing regard traditional religion as an almost evil institution which is against their Christian principles. Issues to do with political affiliation also affect relationship patterns in the area. Given that communal areas in Zimbabwe are strong holds of ZANU-PF, those who are found supporting the opposition parties are negatively affected. For instance, they may not benefit

from certain government schemes. According to one respondent during an informal conversation:

> *Here political issues are dominant. No one wants to associate with those from the opposition party. You need to be in support of ZANU-PF in order for you to benefit.* (Informal conversation, April 2017).

Considering all the issues discussed in this section, and with reference specifically to the kinds of assets spoken about in the SL approach as a middle-level theory, it is clear that assets are quite crucial when it comes to understanding the capacity of Ngundu villagers to cope and adapt in the light of climate change. All Ngundu villagers are faced with the challenges associated with climate change, and all seek to mitigate its negative implications. But the form and extent of the challenges of climate vary across households, as does the capacity to adapt. The fact that the SL framework is household-focused but also considers inter-household relationships enables a recognition of the heterogeneity and indeed socio-economic inequalities characterising Ngundu. At the same time, the SL approach recognises that 'the local' (such as Ngundu villages) as a particular socio-spatial realm does not exist in a vacuum, as there is a wider social, economic and political context within which the local exists. Strictly speaking, this is not pure context, as the local is in part (and often in large part) constituted by wider social, political and economic forces and exists only in and through these forces. Nevertheless, the SL framework does highlight broader institutional processes and structures impinging on local lives. Though such processes and structures have been noted in passing in this section, I now turn (in the next section) to a more focused discussion of these in relation to constraints and enablements.

8.3 Institutional Constraints and Enablements

The idea of adaptation being local has been emphasised throughout this study. However, the effectiveness of adaptation depends upon local and extra-local institutions, as it is through them that for instance incentives for individual and collective actions are structured. As much as it is Ngundu people themselves who carry out adaptive strategies in their own fields locally, the ability and efficiency of implementing adaptive strategies are shaped by institutions. The Ngundu people on their own are vulnerable and they need the support of these institutions in order to be empowered and capacitated. As Agrawal (2008) highlights, it is crucial to understand the role of institutions if adaptation is to address the needs of vulnerable people. This is supported by Engle et al. (2011) and Lebel et al. (2006), who point out that, even if a

place is endowed with resources that promote adaptation, access to these resources and options for their deployment are strongly structured by institutions**.** Institutions are thus significant in shaping adaptation strategies for they can be an enablement or a constraint. The importance of these institutions is shown by how they might contribute by disseminating information, training, giving funds and introducing technologies among other aspects. Such interventions, at least potentially, are significant in enhancing adaptive capacity. However, the question as to whether they in fact increase adaptive capacity depends on the manner in which they become available, the people who gain access to them and the institutional means of their provision (Agrawal, 2008).

The main local institution that is operating in Ngundu is the AGRITEX Extension services. AGRITEX is the Zimbabwean government's principal extension agency and the largest public rural intervention agency with representatives at the national, provincial, district and village levels. The Government of Zimbabwe has realised the need to disseminate information to farmers on how they can adapt to climate change and bring new technologies that can be adopted so as to promote and improve crop and livestock production. Hanyani-Mlambo (2002) point out that, through agricultural extension, farmers' problems can be identified for research and policies formulated and crafted to address rural people's climate-related problems. The presence of AGRITEX has indeed proven to be a major enablement to the people in Ngundu. AGRITEX has provided extension services to the farmers by disseminating information on climate change and how they can adapt. In the area, AGRITEX is well known in particular for providing information and teaching farmers on CA practices. Among the respondents, the most popular adaptive strategy that they were being taught is *dhiga udye*; though, as noted, it is not without its local critics.

Farmers in Ngundu appreciate the advice that they are given by AGRITEX, especially on strategies such as agro-forestry, *dhiga udye* and on soil management. On agro-forestry Ngundu residents are responding well as they have begun to plant trees in gardens as a way of conserving soil. The planting of vetiver grass has also been received well by the Ngundu people. According to one respondent:

> *Agritex inotidzidzisa zvakanaka zvikuru nekuti izvezvi kumagarden uko kwakadzvarwa miti inoita kuti ivhu riite zvakanaka. Agritex inotidzidzisa zvekuti tidzvare masora zvakare anobata ivhu akaita se vetiver mese munoratidza kukukurwa nemvura.* [AGRITEX teaches us good ways of adapting. Right now in our gardens we are growing trees so as to improve soil fertility and avoid soil erosion. We are taught to grow vetiver grass as a way of improving soil fertility as well]. (Informal conversation, April 2016).

One respondent pointed out that:

> *Tinokurudzirwa kudzvara miti yemichero muminda medu uye padzimba nekumagadheni medu.* [We are encouraged to plant fruit trees in our fields, at our homesteads and our gardens]. (Informal conversation, April 2016).

These methods are viewed as enablements as they improve soil fertility and also increase the availability of fruits, to be sold possibly to people and thereby enhance household income for those involved.

AGRITEX also carries out field days, demonstrations and the master farmer approach in promoting adaptation and in disseminating information on climate change. Organisations like Care as well as the Forestry Commission have partnered with AGRITEX so as to carry out field days. A field day in Ngundu is an event that is selected on the calendar to demonstrate agricultural activities. According to the councillor, a particular farmer is chosen to show how he managed to master a particular farming method, for instance under the CA approach. Farmers on their own try to select the best farmers in the area to show their expertise in particular areas of adaptation. The farmers make financial contributions of their own in order to give a price to the best chosen farmer in the area. It is also during such events that farmers are taught by various institutions about new farming practices. One respondent pointed out that during field days they are exposed to significant information and learning experiences that contribute to better farming practices. The respondent also pointed out that:

> *Murimi anenge adarika vamwe vese anotopiwa mubairo wekuratidza unyanzvi hwake uye kumukurudzira kuti arambe achidero.* [The farmer who would have mastered the farming practices and implemented them well and with high crop yields is given a price so as to promote his or her good work]. (Informal conversation, April 2017).

Another villager indicated that demonstrations are very crucial, for it makes farmers better able to follow what they are being shown, therefore improving their skills**.** Thus the field days assist in disseminating information to farmers in Ngundu about climate change and also about adaptation. However, as highlighted earlier, there are challenges in implementing certain CA methods that are being promoted by AGRITEX officers. Due to the labour intensiveness involved, CA practices like *dhiga udye* proved to be constraints no matter how much information the officers imparted to the people, and no matter how many demonstrations were conducted.

AGRITEX is also itself faced with challenges that constrain its work. The extension service is poorly funded and this has affected its efficiency. Due to challenges of limited manpower, since there is only one AGRITEX officer in Ngundu, efficiency is minimised and

coverage of area is also limited. The fact that the government only provides Ngundu with one extension officer is clearly problematic and acts as a constraint considering the large numbers of farmers in Ngundu. The officer who resides at the NGP cannot afford to give all the farmers his adequate time, which affects the understanding of adaptive strategies amongst the farmers as a whole. In an in-depth interview with the AGRITEX Officer in Ngundu, it was admitted that:

> *At most times we fail to execute our duties due to limited resources that encompass lack of transport to visit the farmers in different villages and share climate change information with them.* (In-depth interview with AGRITEX Officer, April 2017).

Another constraint was budget issues which affected the effectiveness of AGRITEX, as the government is failing to even distribute seeds to poor farmers. The AGRITEX head office in Zimbabwe is experiencing increasing operational difficulties due to dwindling resources, despite the fact that farmers heavily rely on the extension services that they offer.

NGOs are an important institutional actor as well and their role is shown in the promotion of adaptation strategies. There are numerous NGOs that have operated in Ngundu, for instance Red Cross, SAFAIDS, Care among others. Some of the NGOs have since exited from the area once they had completed their programmes. Of all the NGOs that have worked in the area, Care has operated for the longest time, beginning in the early 1990s soon after the drastic 1992 drought. Care has worked in Chivi District in general and in Ngundu in particular and has partnered with the Rural District Council, AGRITEX, Forestry Commission, Meteorological Services, Disaster Management and ZINWA in promoting climate change adaptation programmes. Before Care operates in an area in Zimbabwe, it receives information from the District Relief Committee (DRC). The District Relief Committee carries out research in Zimbabwe to find out areas that require assistance; for instance, areas that would have been affected by droughts or floods. Chivi District was identified by the DRC as in need of assistance, which saw the entrance of Care in Ngundu.

When Care first operated in Zimbabwe in the 1990s (including in Ngundu), it implemented (as noted previously) a blanket feeding and food aid scheme where all people in an area that had been affected by a particular drought or flood would be given food hand-outs. This was a coping mechanism that assisted a significant number of starving people. The feeding scheme began as a way of enabling the people to be food secure and assist them to survive under extreme shocks. However, the scheme ended up being a constraint that brought about the dependency syndrome in the area. According to Mr Madzivire:

Madonor akaita sana Care ndiwo akatiresva akaita kuti vamwe vanhu vasafarira kurima nekuti vanhu vakapiwa havachadi kurima. [Donor organisations like Care are the ones who caused this problem as some people no longer wanted to farm expecting to be given food]. (In-depth interview with Mr Madzivire, October 2015).

I similarly observed this to be a constraint as, in some homesteads I visited, I had to explicitly explain that I was not a donor but a student carrying out research. This prompted me to question a Care official in an in-depth interview and understand the organisation's view on this problem, that is, of people wanting to always be given hand-outs. He was also of the view that a dependency syndrome had emerged because of blanket feeding. In this light, Care moved to only targeting specific vulnerable people like infants and pregnant mothers. Care is still in the process of undercutting any dependency; nevertheless, many Ngundu villagers retain the hope that blanket feeding will return and they will all be given food hand-outs once again.

Care was the NGO mentioned most frequently when it came to the presence of NGOs in the Ngundu area. Research findings also show that 78% of the respondents in Ngundu saw or experienced the benefits of Care and its programmes. In this regard, Care makes use of what it calls the Lead Farmers Approach. This approach is meant to disseminate information through a cascading effect, in that each lead farmer has a group of farmers under his wing so to speak. Lead farmers have a plot where demonstrations are shown and implemented in the presence of the other farmers who are being led by the lead farmer. At the demonstration plot, improved agricultural technologies are showcased, for instance CA. In this context, one lead farmer brought to the fore that:

Kubva Care zvayapinda muno muNgundu yatibatsira chaizvo. Ini saLead Farmer ndinodzidza zvakawanda ndonoudzawo vamwe varimi vandotungamirira. Kushanda kwedu saizvozvo koita kuti vanhu vese vave neruzivo pane zvinofanira kuitwa. Zvipoka zvipoka zvevarimi zvinoita kuti vanhu vanzwisise zvakanyanya sezvo munenge muri vashoma. [Since Care came here it has greatly assisted us. Myself as a Lead Farmer I learn quite a lot of things and I go and teach farmers in my group whom I lead. Having teams of farmers led by Lead Farmers like this is helpful in making farmers easily grasp new methods of farming, since we will be a reasonable number making us understand more as compared to being taught as a large group]. (Informal conversation, April 2017).

Due to the lack of funds available to AGRITEX as a government agency, Care has intervened and assisted farmers by also disseminating information and implementing participatory methodologies in seeking to bring about climate change adaptation.

The use of participatory methodologies by Care in Ward 25 has gone a long way in making farmers participate in agricultural activities. The use of bottom-up initiatives enables farmers to take the initiative and to make practical decisions which will assist them in responding to climate change. Care has tried by all means to avoid taking on full responsibility for all important decisions about climate change strategies. Hence, farmers are given platforms to try to solve their problems on their own, with Care assisting where there is need. The logic behind this is to undercut even further any dependency syndrome that had been planted among Ngundu people during the years Care was using the blanket feeding approach. As the Care official articulated it:

> *What we want is to create a society where people can make plans and think on what they can do so as to go on surviving under hardships. We no longer give them projects to do but they are the ones who can bring a project to us, identify strengths and weaknesses, then we as an organisation can assist them. We now aim to capacitate them. That way it will make them participate and own the project. One of the projects we have assisted them to implement is the Wasarira Garden.* (In-depth interview, November 2016).

A significant number of the beneficiaries were happy with the Wasarira garden as they realised its numerous advantages. One respondent pointed out that,

> *Ndoziva hangu kuti ndingangoshaya hangu kumunda chibage chatsva asi kugadheni kwangu handitomboshayi zvangu.* [I know that I might fail to get any yields from my field due to droughts but I know I will get something from my garden]. (Informal conversation, April 2016).

Care also introduced the Disaster Risk Reduction programme in Ward 25 which is meant to reduce emergencies and to capacitate the community to identify the problems that they have. In terms of this programme, farmers in Ward 25 are asked to list the problems that they have in the area. The Care official detailed this programme as follows:

> *At times the farmers are able to provide solutions for certain problems that they would have identified but there are certain problems they are not able to solve. From those problems they are unable to solve, they are ranked into three categories which are High, Medium and Low risk. Care then assesses the capacity that they have in trying to reduce those problems and they get involved in problems that require our assistance. There is a process that is done first before the implementation of a project. For instance feasibility studies are carried out first to see the need of the project. Care works with other institutions in all these projects for instance AGRITEX, Veterinary Services, ZINWA, the*

councillor and local leaders. They all examine the kind of resources that will be required for a project to be implemented. . (In-depth interview, November 2016).

Alongside this initiative, Care established committees which have helped in addressing climate change issues. Three committees have been established in Ward 25, namely, the Disaster Management Committee (DMC), the Environmental Sub-Committee and the Watershed Management Committee (WMC). The DMC disseminates information on flood and drought occurrences among farmers and how best they can respond to them. The Environment sub-committee in partnership with the state's Environmental Management Agency (EMA) investigates environmental problems like land degradation and gully formations and how to address such problems. The WMC pays attention to water sources and how they can be protected, for instance the wetlands in the area. Noteworthy is that the committees are made up of farmers in Ward 25. Care also recommends Ngundu villagers who want to undergo training on Disaster Risk Reduction DRR. Further, they committees have information platforms like *WhatsApp* groups linked with the Meteorological Services where they can quickly disseminate information among themselves.

8.3.1 Information Service Institutions

The construction and distribution of information is a pre-requisite for climate change adaptation as it is through information that farmers become equipped with the know-how of climate change and how best to respond to it. People in Ngundu thus often depend upon knowledge dissemination in order to know when to plant or whether to dry plant. Chikodzi et al. (2012) emphasise the significance of knowledge about the impending character of a rainy season to allow farmers to minimise risks and maximise benefits in rain-fed agricultural regions. They also point out on how settling for a suitable crop variety of maize for example is contingent on knowledge about dry spell distributions**.** The Meteorological Services has been of significance in disseminating information among Ngundu farmers in cases where droughts or floods are likely to occur.

In addition, the District Drought Relief Committee (DDRC) is a committee comprised of district level stakeholders such as the District Administrator's office (DA), AGRITEX, Department of Veterinary Services (DVS), Department of Social Services (DSS), the Rural District Council (RDC), NGOs and other relevant agencies. The DDRC is focused on the prospects of droughts and addressing drought-driven emergencies for communal farmers. The Forestry Commission also disseminates information on climate change to Ngundu people and,

in cooperation with villagers, promotes tree plantations as a way of resuscitating the land that has become degraded over the years. Finally, SAFAIDS has assisted in numerous activities which involve information dissemination on HIV and AIDS. HIV-affected villagers suffer dramatically in times of droughts and floods because of their nutritional needs, and SAFAIDS seeks ways and means of minimising the effects of climate change on their condition.

8.4 Conclusion

The chapter has highlighted the very troublesome constraints which inhibit the capacity of Ngundu farmers to adapt to climate change and variability in meaningful and significant ways. At the same time, it has shown certain enablements or opportunities which allow these farmers to adapt. It became clear that Ngundu households are placed differently in relation to both enablements and constraints, such that different capacities to adapt are likely to deepen differentiation amongst Ngundu farmers. Further, enablements and constraints are not merely localised conditions, as they exist because of conditions (institutions and processes) which exist beyond the local and over which vulnerable and marginalised Ngundu farmers typically have minimal or no control. Insofar as state capacity has been undercut in contemporary Zimbabwe, including in relation to support and assistance to communal farmers, the capacity of Ngundu farmers to adapt to climate change so as to maintain or improve their livelihoods is deeply compromised. Now that this and the previous three chapters have addressed the subsidiary objectives of thesis, I turn now to provide a comprehensive overview of the thesis in the final chapter (chapter 9), focusing in particular on the main objective of the thesis and how the theoretical framing (set out in chapter 2) facilitated the addressing of this objective.

CHAPTER NINE: CONCLUSION

9.1 Introduction

This last chapter seeks to show the ways in which I was able to address the main objective of the thesis and draws upon the theoretical framing of the thesis in doing so. In addition to this, the chapter outlines the contribution of the thesis to the existing relevant literature and identifies areas for future research.

In this context, it is worth mentioning the main and subsidiary objectives of the thesis as first set out in the introductory chapter. The main objective was to *understand livelihood adaptation to climate change by Ngundu farmers in Chivi communal area, Zimbabwe.* In seeking to address this main objective, the main subsidiary objectives were as follows:

a) Understand the major livelihood strategies pursued by Ngundu farmers.
b) Identify the climate changes that have occurred in Ngundu as perceived by the farmers.
c) Understand and analyse the adaptive and coping strategies constructed and pursued by Ngundu farmers.
d) Examine the enablements and constraints facing Ngundu farmers in the adaptation process.

9.2 Addressing the Subsidiary Objectives

In the context of an understanding of climate change and adaptation globally (including Africa) and in Zimbabwe (chapters 3 and 4), chapters 5 to 8 addressed the subsidiary objectives of the thesis in turn. As well, chapter 4 noted the marginalisation of communal farmers in Zimbabwe historically, as examined with reference to political and economic restructuring since independence in 1980. As such, in considering the different dimensions of climate change and livelihood adaptation in Ngundu, as encapsulated in the subsidiary objectives, the vulnerability of Ngundu farmers came to the fore. One issue though, which was not considered in formulating the subsidiary objectives, was the importance of differentiation and heterogeneity within the Ngundu area. This dimension was also brought to the fore when considering the subsidiary objectives.

After detailing the area under study, chapter 5 went on to identify the livelihood activities of Ngundu farmers which have arisen and developed over time, including both agricultural and non-agricultural activities. Though agriculture (and hence natural capital) remains the

foundation of Ngundu farmer livelihoods, it is clear that many Ngundu farmers have diversified their livelihood portfolios, including relying upon remittances and cross border trading (as forms of financial capital). The decline in the Zimbabwean economy, including at the time of the research, served though to minimise the possibilities of accessing sources of financial capital. As well, this diversification may be a desperate attempt by certain households to make up for failures pertaining to agriculture but, at other times (and for other households), the additional income stream allows for some form of asset accumulation. In this regard, the chapter also noted the significance of wealth differentiation within Ngundu.

Chapter 6 brought to the fore the perceptions and concerns of Ngundu farmers pertaining to climate change and variability. It was observed that local farmers have an acute awareness of changes in the climate, with elderly people in particular being able to identify such changes – with reference to rainfall patterns, temperature patterns and extreme weather events. Rainfall, more so than temperature, seemed to be of particular concern to Ngundu farmers, in terms of rainfall timing but also because of ongoing droughts in the area. In fact, years of severe drought are remembered with great emotion and intensity. A sense of loss is also embedded in these memories, including the absence of any crop yields and the death of livestock. While their perceptions and concerns about climate change may not tally with scientific measurements of local climate change and variability, they are based on an intimate and deep understanding of the area, involving considerable historical depth. These perceptions and concerns, at least implicitly, involve internal conversations on the part of Ngundu farmers as they seek to make sense of, and come to terms with, their changing conditions of existence.

Chapter 7 focused on the strategies of adaptation and coping being pursued and implemented in Ngundu, some of which are based on their own indigenous local knowledge of past tried-and-tested agricultural practices and others transmitted to them by both the government and NGOs. In cases where the two sources of strategies were in conflict with each other, many Ngundu farmers (at least the older farmers) tended to rely upon their localised knowledge. In seeking to cope and adapt, each Ngundu household had to rely upon existing resources (capitals), though there is also some reliance upon inter-household cooperation and assistance (social capital). As well, and as the SL framework notes and as indicated above, broader institutional processes (focusing on the government and NGOs) offered some level of support in pursuing particular adaptation activities.

Chapter 8, in considering the last subsidiary objective, focused on the constraints and enablements affecting the capacity to adapt. Many constraints were identified in this chapter, including land shortages and labour shortages. But other factors were enablements, including

the existence of irrigation and the presence of CARE and AGRITEX. Again, adaptation measures of most Ngundu households were conditioned more by constraints than enablements while, for some households, the opposite was the case. Nevertheless, as an overall tendency, it is clear that the vulnerability of Ngundu farmers is quite severe and that the future prospects of rain-fed agriculture in Chivi District more broadly are bound to deteriorate even further with ongoing climate change and variability.

9.3 Addressing the Main Objective

The main objective of the thesis was pursued in and through the subsidiary objectives. In other words, in order to have a comprehensive understanding of livelihood adaptation to climate change amongst Ngundu farmers (as with other communal farmers), it is necessary to explore, identify and understand: farmer perceptions and concerns about climate change; livelihood activities of the farmers and the ways in which these are modified by adaptation measures (in part conditioned by perceptions and concerns about climate); and the capacities to adapt and cope in the context of both constraints and enablements. To ignore any of these issues (as encapsulated in the subsidiary objectives) in understanding climate change and small-scale farmer adaptation is to provide an incomplete analysis.

Despite the range of criticisms of the Sustainable Livelihoods framework, as a middle-level theory it has proven its worth its terms of investigating livelihoods at localised levels. Certainly its emphasis on 'the local', though perhaps appearing somewhat mundane, is of great significance given that climate change adaptation practices amongst small-scale farmers are open to considerable spatial variation – and thus cannot be read-off from a national-analytical template. In-depth research at the local level is fundamental, as its shows the complex and convoluted (and indeed 'messy') lives of small-scale farmers as they go about pursuing livelihoods. Additionally, the SL approach was of significance in terms of its focus on livelihood strategies, vulnerabilities, resources (or capitals) and broader institutional and structural conditions. In this sense, my understanding of Ngundu farmer livelihoods drew quite extensively from these different aspects of the framework.

However, in considering the main thesis, the macro-level sociological theorising of Archer is important. I do not claim in any way that I have provided a full-blown Archerian perspective on climate change and small-scale farmer adaptation. The sheer complexity of Archer's work is beyond the scope of this thesis. I sought rather, particularly given that Archer's work has not been significantly used in climate change adaptation studies, to point

out at least the potential of Archer's work within this realm of studies. As noted, Archer seeks to address questions of structure and agency as part of her morphogenetic approach to society. She argues for analytical dualism by separating out agency and structure and speaking about both agential and structural powers, in order to inhibit any possibility of simply reducing agency to structures in some version of structuralism. In addition, her particular version of agency focuses on reflexivity (based on internal conversations and the development of concerns), with reflexivity being relational in the sense that internal conservations speak to the world as it exists, or at least subjective interpretations of the world. As Archer (2007:6) argues, internal conversations are:

> The manner in which we reflexively make our way through the world. It is what makes (people) active agents, people who can exercise some governance in their own lives, as opposed to passive agents to whom things simply happen. Being an active agent hinges on the fact that individuals develop and define their ultimate concerns.

The outcome of the dialectical interaction between structure and agency are the construction of personal projects.

On this basis, I suggest that, in seeking to engage in livelihood adaptation to climate change, each Ngundu household is in effect pursuing its own climate change adaptation 'project', to use Archer's notion. In this way, projects become embedded in practices (such as adaptation activities), and only have existence and effects by way of these practices. In the end, these projects are a complex combination of structure (including constraints and enablements) and agency (internal conservations, reflexivity and concerns) which are often quite specific to particular households; as well, they are fluid over time. Archer (2007:6-7) thus declares that "no one can have an ultimate concern and fail to do something about it. Instead, each person seeks to develop a concrete course of action to realise that concern by elaborating a project in the belief that to accomplish this project is to realise one's concern." Such a concrete course of action (or project), however, is conditioned by structural factors, such that there is no direct translation of concerns into projects. At the same time, as Archer (2007:6) also highlights, "objective structural … powers are reflexively mediated", so that projects are not determined in a hard sense by structural powers. In this way, constraints and enablements mediate the relationship between climate change concerns on the one hand and actual adaptation and coping activities (or projects) on the other hand. Simultaneously, climate change concerns mediate the relationship between constraints and enablements on the one hand and actual adaptation and coping activities (or projects) on the other hand.

Added into this analytical mix is the question of capacities, such as the assets which the SL approach highlights. These capacities (such as access to financial resources, land, labour and social networks) are, ultimately, only potential capacities. Drawing upon potential capacities and infusing them into projects depends upon the presence of concerns in the first place, as how (or if) a household uses its available resources depends on what it seeks to prioritise; but this also depends, secondly, what capacities are even available to a particular household, and this is conditioned by structural factors such as vulnerabilities, constraints and enablements.

In the end, each farming household (such as those in Ngundu) is characterised by a different set of concerns, capacities, and enablements-constraints which, combined, affect their climate adaptation project. This in part accounts for the variation identified amongst Ngundu farmers when it comes to adaptation strategies. As Archer (2007:6) again notes, it is crucial to examine "the variability in the actions [projects] of those similarly socially situated". It is highly probable as well that the character of this specific combination at household level is dynamic and open to fluctuation for each household, such that livelihood pathways for Ngundu farmers are not necessarily linear in some sort of pre-determined manner. For this reason, this thesis pursued a *longue durée* approach to climate change adaptation by, for example, focusing on the lives and livelihoods of elderly members of the Ngundu communal area.

Finally, I consider the question of morphogenesis. Overall, it seems that the climate change adaptation projects pursued by Ngundu farmers tend to reproduce the existing situation rather than to transform it. Certainly, there is some reconfiguration – through adaptation – of the livelihoods of Ngundu farmers in the face of climate change and variability, but their heightened vulnerability inhibits the capacity to bring about many meaningful changes to their lives. Over time, this vulnerability has become re-inscribed (in new forms) in the conditions of existence of Ngundu farmers, and there appears to be no doubt that this will continue to occur given ongoing climate change and variability.

9.4 Contribution of Thesis and Areas for Further Research

It is hoped that this thesis has made a meaningful contribution to the prevailing literature on climate change and small-scale farmer adaptation in Zimbabwe and beyond. The two main contributions, beyond the rich empirical evidence offered about Ngundu farmers and the ensuing analysis, appear to be the following.

First of all, the thesis has reiterated the importance of considering temporal and spatial scales when investigating small-scale farmer adaptation to climate change. Localised studies of small-scale farmer adaptation are crucial for further heightening the recognition of spatial diversity across the agrarian landscape, and in order to avoid blanket approaches to the topic based on national-level studies. Likewise, small-scale farmer adaptation as studied synchronically is necessary but insufficient, as the status of adaptation at a particular time is simply a moment in an ongoing process of adaptation subject to dynamic contingencies; hence, as this thesis shows (through for instance life-histories), diachronic analysis must complement synchronic analysis.

Secondly, at a more theoretical level, the thesis sought to use the sociological work of Margaret Archer, as detailed in the previous section. In this way, this thesis makes the case for ensuring that, in future, sociological theorising is brought more fully to bear on the topic of small-scale farmer adaptation to climate change. Sociology has not been at the forefront in analysing climate change adaptation, yet there is a diverse away of rich sociological theorising which needs to be considered in deepening our collective understanding of the topic. At the same time, the use of sociological theorising in this thesis is a call for sociologists (and those from cognate disciplines) not to rely exclusively on the Sustainable Livelihoods framework. While its weaknesses are not fundamental, it provides an insufficient basis for theorising.

Areas for further research, indirectly at least, arise from these two points. Thus, there needs to be further localised studies in Zimbabwe about small-scale farmer adaptation to climate change to show the sheer diversity across the countryside. This would include for instance focusing on variation across the different natural or agro-ecological regions amongst communal farmers; studies amongst A1 farmers on fast track farms; and more refined research on the gender dimension to climate change adaptation amongst both A1 and communal farmers. In terms of theory, focused studies for example on internal conversations, reflexivity and internal conversations in relation to small-scale farmer climate adaptation may refine the use, and more fully demonstrate the importance, of Archer's work in studying this topic. Hopefully, this could be part of the long-term debate about structure and agency within the discipline of Sociology.

Ultimately, I hope that this thesis stimulates other sociologists to pursue these lines of inquiry so that a stronger sociological footprint is stamped within studies on small-scale farmer climate adaptation in Zimbabwe and indeed globally.

References

Abidoye B O, Kurukulasuriya P, Mendelson R. 2017. South East Asian Farmer Perceptions on Climate Change, Climate Change Economic 8.3 174006. DOI; 10.1142/S2010007817400012

Adams, W.M. 2006. The future of sustainability: re-thinking environment and developmentin the twenty-first century. Report of the IUCN renowned thinkers meeting, 29–31January 2006. The World Conservation Union (IUCN), Gland, Switzerland.

Adesina A.A and Zinnah M.M. 1993. Technology Characteristics, Farmers Perceptions and Adoption Decisions: A Tobit Model Application in Sierra Leone. Agricultural Economics

Adger, W. N., Huq, S., Brown, K., Conway, D. and Hulme, M. 2003. Adaptation to Climate Changes in the developing world. Progress in Development Studies, vol. 3.

Adger, N. and Vincent K. 2005. "Uncertainty in adaptive capacity," Computers Rendus Geoscience 337: 399-410.

Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, Smit and K. Takahashi. 2007. Assessment of adaptation practices, options, constraints and capacity. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P.Palutik of, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743.

Agrawal, A. 2008. The Role of Institutions in Climate Change Adaptation. Paper prepared for the Social Dimensions of Climate Change, Social Development Department, The World Bank, and Washington DC.

Akinnifesi et al., 2002 in Kandji S.T, Verchot L and Mackensen J. 2006. Climate Change and Climate Variability in Southern Africa: Impacts and Adaptation in the Agricultural Sector, World Agroforestry Centre

Akram S and Hogan A. 2015. On Reflexivity and the Conduct of the Self in Everyday life: Reflections on Bourdieu and Archer, British Journal of Sociology, Research gate

Arnell, N. W., 2006b. Climate change and water resources: a global perspective. In: Schellnhuber, H.J., Cramer, W., Nakićenović, N., Wigley, T., and Yohe, G., (eds.) Avoiding Dangerous Climate Change. Cambridge University Press, Cambridge.

Anseeuw, W. Kapuya, T., Saruchera, D. 2012. Zimbabwe's Agricultural Reconstruction:Present State, Ongoing Projects and Prospects for Reinvestment, Development Planning Division, Working Paper Series No.32

Archer, MS. 1982. Morphogenesis versus structuration: on combining structure and action. Br J Social 33(4)

Archer, MS. 1988. Culture and agency: the place of culture in social theory. Cambridge University Press, Cambridge

Archer, MS. 1995. Realist social theory: the morphogenetic approach. Cambridge University Press, Cambridge

Archer M, Sharp R, Stones R, Woodiwiss T. 1998. Critical Realism and Research Methodology, CCR Conference, Essex

Archer, M. S. 2000. Being Human: the Problem of Agency. Cambridge, UK: Cambridge University Press.

Archer, M. 2003. Structure, Agency and the Internal Conversation. Cambridge, UK: Cambridge University Press.

Archer M S. 2007. Making our Way through the World, Human Reflexivity and Social Mobility, Cambridge University Press, UK

Archer, M. 2012. The Reflexive Imperative in Late Modernity, New York: CUP

Aydinalp C and Cresser M.S. 2008. The Effects of Global Climate Change on Agriculture. American-Eurasin Journal of Agriculture and Environmental Science, 3

Balleis, P 1993. A Critical Guide to ESAP, Mambo Press, Gweru.

Bakari M. 2015. Climate Change Impacts and Adaptation Strategies Of Small Scale Agriculture Production In Micheweni District Pemba, Tanzania, A Dissertation Submitted In Partial Fulfilment Of The Requirements For The Degree Of Master Of Science In Management Of Natural Resources For Sustainable Agriculture Of Sokoine University Of Agriculture. Morogoro, Tanzania.

Ban, A.W. Van den and H.S. Hawkins. 2000. Agricultural Extension, second edition, Blackwell Science, UK

Baseline Report on Economic Development and Climate Change. 2012. Towards Sustainable Inclusive Growth, Human Centred Development, Transformation and Poverty Reduction, Minstry of Economic Planning and Investment Promotion, Republic of Zimbabwe.

Bhaskar R, 1998. Facts and Values: Theory and Practice. In Archer M, Bhaskar R,Collier Lawson T, and Norrie A, (Eds)< Critical Realism Essential Reading, London, Routledge.

Bhaskar R, 1989. The Possibility of Naturalism. Hemel Hempstead: Harvester.

Bhatasara S. 2015. Understanding Climate Variability and Livelihoods Adaptation in Rural Zimbabwe: A Case of Charewa, Mutoko, A Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor Philosophy of Rhodes University

Bebbington, A. 1999. Capitals and Capabilities A Framework for Analysing Peasant Viability, Rural Livelihoods and Poverty. World Development, 27 (12): 2021: 2044

Beall, J. 2002. Living In the Present, Investing In The Future - Housing Security among the Poor. In Urban Livelihoods: A People-Centred Approach To Reducing Poverty. C. Rakodi and T. Lloyd-Jones. London: Earthscan Publications Ltd

Besada H and Sewankambo N. 2009. Climate Change in Africa, Adaptation, Mitigation and Governance Challenges.

Biggs R. et. al 2008. Scenarios of biodiversity loss in southern Africa in the 21st century, Global Environmental Change, Vol. 18, Issue 2, pp 296–309

Bird K and Shepherd A. 2003. Chronic Poverty in Semi-arid Zimbabwe, Overseas Development Institute, CPRC Working Paper No 18, ISBN Number: 1-904049-17-8

Bird K and Busse S. 2007. Re-thinking aid policy in response to Zimbabwe's protracted crisis: A Discussion Paper [Online]. London: Overseas Development Institute. Available form http://www.odi.org.uk/pppg/poverty_and_inequality/Events/2007_Zim_Roundtable/Zim DiscussionPpaer.pdf.

Black R. 2001. Environmental Refugees: Myth or Reality? In New Issues in Refugee Research. Geneva: United Nation High Commissioner for Refugees. Working Paper No. 34

Bratton M. 2014. Power Politics in Zimbabwe, Lynne Rienner Publishers

Braun V. & Clarke V., 2006. Using thematic analysis in psychology. Qualitative Research in Psychology 3, pp.77-101. www.QualResearchPsych.com

Bowyer, P., Bender, S., Rechid, D., Schaller, M. 2014. Adapting to Climate Change: Methods and Tools for Climate Risk Management, Climate Service Center, Germany

Boko, M. I., Niang, A., Nyong, C., Vogel, A., Githeko, M., Medany, B., et al. 2007. Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working group II to the fourth assessment report of the Intergovernmental Panel of Climate Change.

Bond P., and Manyanya, M. 2002. Zimbabwe's Plunge, Exhausted Nationalism, Neoliberalism and search for Social Justice, 2002

Boyd, E., Grist, N., Juhola, S., & Nelson V. 2009. Exploring Development Futures in a Changing Climate: Frontiers for Development Policy and Practice, Development Policy Review, 27 (6): 659-674

Bosello F, Carraro C, De Cian E. 2012. Climate Change, Adaptation, Copenhagen Consensus

Bratton, M. 1987. The Comrades and the Countryside: The Politics of Agricultural Policy in Zimbabwe.

Bratton, M. and Masunungure, E. 2011. The Anatomy of Political Predation: Leaders, Elites and Coalitions in Zimbabwe. 1980-2010, Development Leadership Program, Australia.

Brazier, A. 2015. Climate Change in Zimbabwe, Konrad-Adenauer-Stiftung

Bryant, R.C., B. Smit, M. Brklacich, R.T. Johnston, J. Smithers, Q. Chiotti, and B. Singh. 2000. Adaptation in Canadian agriculture to climatic variability and change. Climatic Change 45

Brock, K. and Coulibaly, N. 1999. Sustainable Livelihoods in Mali, IDS Research Report 35

Brown D., Chanakira R R., Chatiza K., Dhliwayo M., Dodman D, Masiiwa M., Muchadenyika D., Mugabe P., Zvigadza S. 2012. Climate Change Impacts, Vulnerability and Adaptation in Zimbbawe, IIED, Working Paper no. 3

Brooks, N. and Adger, N. 2004. Assessing and Enhancing Adaptive Capacity: Technical Paper 7. New York: UNDP (http://ncsp.undp.org/docs/717.pdf).

Byg, A and Salick, J. 2009. Local perspectives on a global phenomenon-Climate change in Eastern Tibetan villages. Global Environmental Change, 19, 156-166.

Buckland, R. W. 1997. Implications of Climatic Variability for Food Security in the Southern African Development Community. Internet Journal of African Studies, Issue No.2 – March; Using Science against Famine: Food Security, Famine Early Warning, and El Niño

Burns J.C and Suji O.W. 2007. Impact Assessment of the Zimbabwe Dams and Garden Project. Medford, MA: Feinstein International Center & CARE International, (http://fic.tufts.edu/).

Bunce M., Rosendo S. & Brown K. 2010. Perceptions of climate change, multiple stressors and livelihoods on marginal African coasts, Environment, Development and Sustainability Vol. 12, pp407–440

Burgess, R.G.1982. Styles of Data Analysis Approaches and Implications. In R.G. Burgess,Field Research a source Book and Field Manual. London: Routledge.

Burton, 1. 1992. Adapt and Thrive. Downs view, Ontario: Canadian Climate Centre.

Burton, I. 1997. Vulnerability and adaptive response in the context of climate and climate change.' Climatic Change, 36: 185-196.

Burton I, Diringer E and Smith J. 2006. Adaptation to Climate Change: International Policy Options, Pew Center on Global Climate Change

Burke, M. 1997. (eds.) Climate Change and Food Security http://link.springer.com/book/10.1007%2F978-90-481-2953-9

Burke M and Lobell D. 2010. Food security and adaptation to climate change: What do we know In Lobell D, Burke M (eds.) Climate Change and Food Security http://link.springer.com/book/10.1007%2F978-90-481-2953-9

Carney, D. 1998. Implementing the sustainable rural livelihoods approach. In: Carney, D. (ed.) Sustainable rural livelihoods. What contribution can we make? Department for International Development, London. pp. 3-26.

Carter, T.R., M.L. Parry, H. Harasawa, and S. Nishioka. 1994: IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations. University College, London, United Kingdom, and Centre for Global Environmental Research, Tsukuba, Japan.

Carter B and New C. 2004. Making Realism work: Realist Social Theory and Empirical Research, London, Routledge

Chagutah, T. 2010. Climate Change Vulnerability and Preparedness in Southern Africa: Zimbabwe Country Report. Heinrich Boell Stiftung, Cape Town.

Chambers, R and Conway G. 1992. Sustainable Rural Livelihoods: Practical concepts for the 21st Century. IDS Discussion Paper 296, IDS, Brighton, UK.

Chambers R. 1997. 'Responsible well-being – a personal agenda for development', World Development, 25: 1743- 1745

Chanza, N. 2015. Indigenous Knowledge Practices Related to Climate Change: Case of Muzarabani, Zimbabwe. Personal communication, senior lecturer, Department of Geography, Bindura University of Science Education: nchanza@gmail.com

Chazovachii, B. 2012. The impact of small scale irrigation schemes on rural livelihoods: The case of Panganai irrigation scheme Bikita District, Zimbabwe. Journal of Sustainable Development in Africa, 14 (4), 217–231

CEEPA. 2006. Climate Change and African Agriculture, Policy Note No. 11 Center for Integrative Environmental Research University of Maryland (CIER). (2008). Downloaded at www.cier.umd.edu/climateadaptationCentre for International Earth Science Information Network (CIESIN). Mapping the effects of Climate Change on Displacement and Migration.

Centre for International Earth Science Information Network (CIESIN) (2009). Mapping the effects of Climate Change on Displacement and Migration.

Chenje, M & Solar, L. 1998. State of the Environment. The Zambezi Basin, University of Zimbabwe. Harare.

Critchley, W., Siegert K. 1991. Water harvesting. Food and Agricultural Organisation of the United Nations.

Chikwanha-Dzenga 1999, Rural Folks- The Neglected Lot of Zimbabwe, Journal of Social Development in Africa, 14, 2,39-49, Michigan State University.

Chikodzi D, Zinhiva H, Simba FM and Murwendo T, 2013. Reclassification of Agro-ecological Zones in Zimbabwe- The Rationale, Methods and Expected Benefits : The Case of Masvingo, Journal of Sustainable Development in Africa (Volume 15, No. 1).

Chikodzi D, Simba F.M, Murwendo T.M. 2012. Perceptions, vulnerability and adaptation to climatic change and variability in Masvingo Province, Greener Journal of political sciences, www.gjournals.org

Chikova H. and Kangalawe R. 2013. Institutional Framework and Climate change Adaptation: The case of Sustainable Land Management in Chivi District, Zimbabwe: LAP LAMPERT Academic Publishing

Chinake H. 1997. Strategies for Poverty Alleviation in Zimbabwe, Journal of Social Development in Africa

Chitata, T., Mugabe, F.T. and Kashaigili, J.J. 2014. Estimation of Small Reservoir Sedimentation in Semi-Arid Southern Zimbabwe. Journal of Water Resource and Protection, 6, 1017-1028. http://dx.doi.org/10.4236/jwarp.2014.611096

Clay, E., Bohn, L., der Armas, E. B., Kabambe, S., and Tchale, H. 2003. Malawi and Southern Africa: Climate Variability and Economic Performance. Working Paper Series No. 7, Disaster Risk Management.

Cline, W.R. 2007. Global Warming and Agriculture: Impact estimates by country. Center for Global Development, Peterson Institute for International Economics. Washington, DC

Cohen, S., D. Demeritt, J. Robinson, and D. Rothman. 1998. Climate change and sustainable development: towards dialogue. Global Environmental Change, 8(4), 341–371.

Cooper, P. J. M., Dimes, J., Rao K. P. C., Shapiro, B., Shiferaw, B., and Twomlow, S. 2008. Coping better with current climatic variability in the rain-fed farming systems of sub-

Saharan Africa: An essential first step in adapting to future climate change? Agriculture, Ecosystems and Environment, 126,http://dx.doi.org/10.1016/j.agee.2008.01.007
Coltart, D. 2008. A Decade of Suffering in Zimbabwe, Economic Collapse and Political Repression under Robert Mugabe, CATO Institute.
Corbett J. 1988. Famine and Household Coping Strategies World Development, Vol. 16 (9)
CCJP/LRF. 1997 Breaking the Silence, Building True Peace: A Report on the Disturbances in Matabeleland and the Midlands 1980 to 1988, Harare: CCJP and LRF.
Creswell, J.W. 2003. Research Design: Qualitative, Quantitative, and Mixed Method Approaches. Sage Publications, Thousand Oaks
Dansereau S. 2005. Zimbabwe- the Political Economy of Decline accessed at www.pambazuka.net/en/category.php/books/27103
Darnolf S and Laasko L. 2003, Twenty Years of Independence in Zimbabwe, From Liberation to Authoritarianism, Palgrave Macmillan
Darwin, C.1859. On the Origin of Species. London: John Murray.
Davidson, D. 2012. Analysing Responses to Climate Change through the Lens of Reflexivity. The British Journal of Sociology 63 (4):616-640.
Davis, C.L. 2011. Climate Risk and Vulnerability: A Handbook for Southern Africa. Council for Scientific and Industrial Research, Pretoria, South Africa.
Denzin, N., and Y. Lincoln. 2005. Introduction: The discipline and practice of qualitative research. In The Sage handbook of qualitative research, 3rd edition, eds. N. Denzin and Y. Lincoln, 1–32.Thousand Oaks, CA: Sage Publications.
Deressa,T. T., Hassan, R. M., & Ringler, C. 2011. Perception of and adaptation toclimate change by farmers in the Nile basin of Ethiopia. Journal of Agricultural Science, 149, 23-31. http://dx.doi.org/10.1017/S0021859610000687
Deressa, T.T. and Hassan, R.M. 2009. Economic Impact of Climate Change on Crop Production in Ethiopia: Evidence from Cross - Section Measures. Journal of African Economies 18(4).
Deressa, T.; Hassan, R.M.; Alemu, T.; Yesuf, M. and Ringler, C. 2008. Analyzing the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia. International Food Policy Research Institute (IFPRI) Discussion Paper No. 00798. Environment and Production Technology Division, IFPRI, Washington D.C.
Devereux, S., & Maxwell, S. 2001. Food security in Sub-Saharan Africa. London, UK: Intermediate Technology Development Group Publishing. Döös, B. R. and Shaw, R. 1999. Can we predict the future food production? A sensitivity analysis, Global Environmental Change, 9:261–283.
DEA (Department of Environmental Affairs). 2011. South Africa's Second National Communication under the United Nations Framework Convention on Climate Change. Department of Environmental Affairs, Pretoria.
DFID (Department for International Development). 2004. Climate change in Africa. Key sheets on climate change and poverty. http://www.dfid.gov.uk/pubs/files/climatechange/10africa.pdf.
DFID. 2000. Sustainable Livelihoods Guidance Sheet. Department for International Development.
DFID. 1999. 'Sustainable Livelihoods Guidance Sheets: Framework'. DFID. Department for International Development, London, UK.
Dinar, A., Hassan, R., Kurukulasuriya, P., Benhin, J. and Mendelsohn, R. 2006. The policy nexus between agriculture and climate change in Africa. A synthesis of the investigation under the GEF/WB Project: Regional climate, water and agriculture: Impacts on and

adaptation of agro-ecological systems in Africa. CEEPA Discussion Paper No. 39. Centre for Environmental Economics and Policy in Africa, University of Pretoria

Dixon, J, Gulliver, A and Gibbon, D. 2001. Farming systems and poverty: Improving farmers' livelihoods in a changing world. FAO (Food and Agriculture Organization), Rome, and World Bank, Washington, DC.

Dodo O, Chipaike R, Ngwerume E.T and Etiya E. 2012. Four Years into Zimbabwe's Government of National Unity: Assessing the Challenges and Successes from the Civil Society's Perspective, LWATI: a Journal of Contemporary Research, 9(3), 202-215. P209

Dodman D. 2008. Against the tide: climate change and high-risk cities. London: International Institute for Environment and Development (IIED) Briefing.

Dore M.H.I. 2005. Climate Change and Changes in Global Precipitation Patterns: What do we know? Climate Change Laboratory, Brock University, St Catharines, ON, Canada L2S 3A1

Dore D. 2009. The Recovery and Transformation of Zimbabwe's Communal Areas, United Nations Development Programme Comprehensive Economic Recovery in Zimbabwe, Working Paper 4.

Douidiche, M., Ezzrari, A., Ferré, C. and Lanjouw, P. 2007. Poverty Dynamics in Morocco's Rural Communes: Tracking Change via Small Area Estimates. Department of Statistics, Observatoire des Conditions de Vie, Rabat.

Donati, P. 2011. Relational Sociology: A New Paradigm for the Social Sciences. London Routledge

Downing, T. E. 1992. Climate Change and Vulnerable Places: Global Food Security and Country Studies in Zimbabwe, Kenya, Senegal and Chile. Oxford, UK: Environmental Change Unit,Oxford University.

Dube T and Phiri K. 2013. Rural Livelihoods under Stress: The Impact of Climate Change on Livelihoods in South Western Zimbabwe, American International Journal of Contemporary Research, Vol. 3. No5

Easterling, D. R., Mehl G. A. 2000. Climate extremes: observations, modelling, and impacts, Science, 289: 2068-2074.

Easterling W .E. 2007. Food Fiber and Forestry Products In Climate Change: Impacts Adaptation And Vulnerability, Contribution Of Working Group 11 To The Fourth, Assessment Report Of The Intergovernmental Panel On Climate Change, Cambridge University Press Cambridge.

Ellis F. 1998. Household Strategies and Rural Livelihood Diversification. Journal of Development Studies, 35 (1)

Environmental Software and Services GmbH AUSTRIA. 2002. Land-Use in Dry Tropical Savannas. Available from: http://www.ess.co.at/GAIA/CASES/ZIM/soils.html.

Étienne, J. et al. 2005. Dictionnaire de sociologie, Hatier. http://www.fao.org/docrep/008/y5744e/y5744e00.html

EPA 2010 adapted at www.epa.gov/climatechange

Fadina A.M.R and Barjolle D. 2018. Farmers Adaptation Strategies to Climate Change and their Implications in the Zou Department of South Benin, 5,15,doi:10.3390/environments5010015

FAO. 2016. Southern Africa El Nino Response Plan 2016/17, Rome.

FAO/WFP 2008 in Dore D, 2009, The Recovery and Transformation of Zimbabwe's Communal Areas, United Nations Development Programme Comprehensive Economic Recovery in Zimbabwe, Working Paper 4.

FAO. 2007. Adaptation to Climate Change in Agriculture, Forestry and Fisheries. Perspective, Framework and Priorities. Food and Agriculture Organization of the United Nations, Rome. Interdepartmental Working Group on Climate Change.
FAO. 2005. "Impact of Climate Change, Pests and Diseases on Food Security and Poverty Reduction." Special event background document for the 31st Session of the Committee on World Food Security. Rome.
FAO. 2004. Drought and climate variability in the Limpopo River Basin. FAO Corporate Document Repository.
Farrington, J., 2001, 'Sustainable livelihoods, rights and the new architecture of aid', Natural Resource Perspectives 69, London: ODI
Fauchereau N, Trzaska S, Richard Y, Roucou P, Camberlin P.2003 Sea surface temperature co-variability in the southern Atlantic and Indian Oceans and its connections with the atmospheric circulation in the southern hemisphere. Intl J Climatol. 2003; 23:663–677.http://dx.doi.org/10.1002/joc.905
Fleetwood, S. 2005. The ontology of organisation and management studies: A critical realist approach. Organization, 12 (2). pp. 197- 222. ISSN 1350-5084 Available from: http://eprints.uwe.ac.uk/6386
Fankhauser S, Smith JB, Tol RSJ. 1999. Weathering climate change: some simple rules to guide adaptation decisions. Ecol Econ 30(1):67–78
Frederick, K.D. and Gleick P.H. 1999. 'Water and Global Climate Change: Potential Impacts on US Water Resources', Washington, DC: Pew Center on Global Climate Change.
FEWS (Famine Early Warning Systems Network). (2007). "Zimbabwe Food Security Emergency: Economic Decline, Poor Harvest Cause Significant Decrease in Food Security." Washington, DC. Available at: http://v4.fews.net/docs/Publications/1001381.pdf.
Fischer G., M. Shah, H.v. Velthuizen, 2002: Climate Change and Agricultural Vulnerability. IIASA, Laxenburg, Austria.
Food Poverty Atlas, 2016. Small Area Food Poverty Estimation, Statistics for Addressing Food and Nutrition Insecurity in Zimbabwe, UNICEF, Zimbabwe National Statistics Agency
Füssel, H.-M.; Klein, R.J.T. 2006. Climate change vulnerability assessments: An evolution of conceptual thinking. In: Climatic Change. vol. 75.
Gallup. 2009. in Simba FM, Chikodzi D, Murwendo T 2012. Climate Change Scenarios,Perceptions and Crop Production: A Case Study of Semi-Arid Masvingo Province in Zimbabwe. J Earth Sci Climate Change 3:124. doi:10.4172/2157-7617.1000124
Gambiza J and Nyama C. 2006. Country Pasture/ Forage Resource Profiles, accessed at www.fao.org/ag/agp/agpc/doc/counprof/zimbabwe/zimbab.html\
Gbetibouo, G. A. 2009. Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa IFPRI Discussion Paper (Washington, DC: International Food Policy Research Institute, forthcoming).
Geological Society of America Position Statement (GSA), 2015, Climate change, 3300 Penrose Place, P.O Box 9140, Boulder, Colorado. www.geosociety.org
Giddens A. 1984. The constitution of society. University of California Press, Berkeley
Giddens A. 1981. A contemporary critique of historical materialism. University of California Press, Berkeley
Giddens A. 1979. Central problems in social theory. University of California Press, Berkeley.
Gillham B. 2000, Case Study Research Methods, Bloomsbury Academic.

Giridhar, K.; Samireddypalle, A. 2015. Impact of climate change on forage availability for livestock. In Climate Change Impact on Livestock: Adaptation and Mitigation; Springer: Berlin, Germany: pp. 97–112

Gwimbi, P. 2009. "Linking Rural Community Livelihoods to Resilience Building in Flood Risk Reduction in Zimbabwe." Journal of Disaster Risk Studies. 2(1): <http://web.ndmc.gov.za/docs/publications/Jamba.pdf#page=82>.

Green, M & Hulme, D .2005. From Correlates and Characteristics to Causes: Thinking about Poverty from a Chronic Poverty Perspective. World Development vol. 33 no. 6 pp. 867-879.

GoZ, Ministry of Environment and Natural Resources Management, First Draft, 2013.

Gukurume S, Nhodo L and Dube C. 2010. Conservation Farming and the Food Security-Insecurity Matrix in Zimbabwe, A Case of Ward 21 Chivi Rural, Journal of Sustainable Development in Africa (Volume 12, No. 7, 201

Handmer, J. 2003. Adaptive Capacity: What Does It Mean in the Context of Natural Hazards? 10.1142/9781860945816_0004.

Hanyani-Mlambo B T. 2002. Strengthening the Pluaralistic Agricultural Extension System, A Zimbabwean Case Study, Agricultural Research Council

Hanson-Easey, S, Bi, P, Hansen, A, Williams, S, Nitschke, M, Saniotis, A, Zhang, Y & Hodgetts, K 2013, Public understanding of climate change and adaptation in South Australia, National Climate Change Adaptation Research Facility, Gold Coast.

Harford N, Le Breton J, Oldreive B. (eds). 2009. Farming for the Future, A Guide to Conservation Agriculture in Zimbabwe, Zimbabwe Conservation Agriculture Task Force.

Hassan, R. and Nhemachena, C., 2008. Determinants of climate adaptation strategies of African farmers: multi- nomial choice analysis. African Journal of Agricultural and Resource Economics 2

Hazzlewood, A. 1967. The Formation of Federation and Dissolution in Central Africa. In African Integration and Disintegration. Case Studies in Economic and PoliticalUnion. London: OUP

Held IM, Delworth TL, Lu J, Findell KL, Knuston TR. 2005. Simulation of Sahel drought in the 20th and 21st centuries. Proc Natl Acad Sci USA; 102:17891–17896. http://dx.doi.org/10.1073/pnas.0509057102

Healy K, 1998, Conceptualising Constraint: Mouzelis, Archer and the concept of Social Structure, Sociology Vol. 32 No. 3

Hellmuth M E., Moorhead, A., Thomson M C., Williams J eds., 2007. Climate Risk Management in Africa: Learning from Practice. International Research Institute for Climate and Society (IRI), New York: Columbia University.

Hewitson, B. C. 2010. Climate Change Scenario Development in Sub-Saharan Africa, SARUA Leadership Dialogue Series, Vol. 2, No.4, pp. 46-67.

Hirst K.K. 2017. Mixed cropping; History of the Ancient Farming Technique, Accessed https://www.thoughtco.com/mixed-cropping -history-171201

Horrocks I. 2009. Applying the Morphogenetic Approach, Outcomes and Issues from A case study of Information Systems Development and Organisational Change in British Local Government, JOCR 8.1, issn1572-5138

Houghton J. 2011. Global Warming, Climate Change and Sustainability, Challenge to Scientists, Policy Makers and Christians, JRI

Hulme, M., (ed.). 1996. Climate Change in Southern Africa: An Exploration of Some Potential Impacts and Implications in the SADC Region. United Kingdom. Climatic Research Unit, University of East Anglia, Norwich

Hulme, M., Doherty, R., Ngara, T., New, M., & Lister, D. 2001. African climate Change: 1990-2100. Climate Research

Hussein, K., Nelson, J. 1998. Sustainable Livelihoods and Livelihood Diversification IDS working paper 69, Brighton, IFPRI Discussion Paper No. 00798. Environment and Production Technology Division, IFPRI, Washington D.C.

IPCC, 1996: Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change [Watson, R.T., M.C. Zinyowera, and R.H. Moss (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. 2001. Climate Change 2001: Synthesis Report. Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

IPCC. 2007a. Summary for Policy makers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge.

IPCC. 2007b. Climate Change Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change, Parry, M.L., Canziani, O.F. Palutikof, J.P. van der Linden, P. J. and Hanson, C.E. (Eds.), Cambridge University Press, Cambridge, UK.

IPCC. 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK

IPCC. 2007a. Climate Change 2007. Synthesis Report on Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Inter-governmental Panel on Climate IPCC (1995). The Science of Climate Change: Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change, Houghton, J.T., Meira Filho, L. G., Callender, B. A., Harris, N., Kattenberg, A. and Maskell, K. (Eds), Cambridge University Press, UK.

Jain, S. 2006. "An Empirical Economic Assessment of the Impacts of Climate Change on Agriculture in Zambia" CEEPA DP27, University of Pretoria, South Africa.

Jodha NS, Singh NP, Bantilan MCS. 2012. Enhancing farmers adaptation to climate change in arid and semi-arid agriculture of India: evidences from indigenous practices: developing international public goods from development-oriented projects. Working paper series no. 32. ICRISAT, Patancheru, AP, India

Johnson, 2008. National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council.

Jones, P.D., and Moberg, D. 2003. Hemispheric and large-scale surface air temperature variations: An extensive revision and an update to 2001, Journal of Climate, vol. 16.

Kahinda J.M. Rockstrom J. Taigbenu A. E and Dimes J. 2011. Rainwater Harvesting to enhance Water Productivity of Rain-fed Agriculture in the Semi-Arid Zimbabwe,7th Waternet, warfsa, GWP Symposium, Malawi

Kanyenze G. 2006. Economic Policy Making Processes, Impleentation and Impact in Zimbabwe, Paper Prepared for the Centre for Rural Development, 42 Mount Pleasant Drive, Mount Pleasant, Harare Kanyenze, G., Kondo, T., Chitambara P., and Martens J. 2011. (eds), Beyond the Enclave: Towards a Pro-Poor and Inclusive Development Strategy for Zimbabwe, Harare: Weaver Press.

Kanyenze, G. 2007. The Labour Market, Sustainable Growth and Transformation in Zimbabwe, Paper prepared for the Zimbabwe Institute.

Kanyenze G. Chitambara P. and Tyson J. 2017. The Outlook for the Zimbabwean Economy, Supporting Economic Transformation

Kandlinkar, M. and Risbey, J. 2000. Agricultural impacts of climate change: If adaptation is the answer, what is the question? Climatic Change 45.

Kandji S.T, Verchot L and Mackensen J. 2006. Climate Change and Climate Variability in Southern Africa: Impacts and Adaptation in the Agricultural Sector, World Agroforestry Centre

Kane, S.M., Shogren, J.F., 2000. Linking adaptation and mitigation in climate change policy. Climatic Change 45 (1).

Kassam, A. 2010. The Spread of Conservation Agriculture: Justification, Sustainability and Uptake. Reading: University of Reading, UK.

Kates, R. 2000. "Cautionary Tales: Adaptation and the Global Poor." Climatic Change 45: 5 – 17.

Kapuya T, Saruchera D, Jongwe, A, Mucheri, T, Mujeyi, K, Ndobongo, LT & Meyer, FH, 2010. The grain industry value chain in Zimbabwe. Unpublished draft prepared for the Food and Agricultural Organization (FAO). www.fao.org/fileadmin/templates/est/AAACP/eastafrica/UnvPretoria_GrainChainZimbabwe_2010_1_.pdf.

Krantz L. 2001. The Sustainable Livelihood Approach to Poverty Reduction, Division for Policy and Socio-Economic Analysis, Swedish International Development Cooperation Agency

Kollmair, M. and Gamper, S. 2002 The sustainable livelihoods approach. Input Paper for the Integrated Training Course of NCCR North-South Aeschiried. Development Study Group, University of Zurich, Switzerland.

Komba C. and Muchapondwa E. 2012. Adaptation to Climate Change by Smallholder Farmers in Tanzania, Economic Research of Southern Africa.

Klein T, A., Wijngaard, J., and van Engelen, A., 2002. Climate in Europe. Assessment of Observed daily temperature and precipitation extremes. European Climate Assessment, the Netherlands. KNMI, the Bilt.

Klein, R.J.T., 1998. Towards better understanding, assessment and funding of climate adaptation. Change 44

Kinuthia, J. H. 1997. "Global Warming and Climate Impacts in Southern Africa: How Might Things Change?" Internet Journal of African Studies, Issue No. 2 – March; Using Science against Famine: Food Security, Famine Early Warning, and El Niño.

Kurukulasuriya, P. and Mendelsohn, R. 2008. A Ricardian analysis of the impact of climate change on African cropland. CEEPA Discussion Paper 8. African Journal of Agriculture and Resource Economics 2(1)

Kurukulasuriya, P. and Mendelsohn, R. 2006. Crop selection: adapting to climate change in Africa. CEEPA Discussion Paper No. 26. Centre for Environmental Economics and Policy in Africa. University of Pretoria.

Kurukulasuriya, P., and S. Rosenthal. 2003. Climate change and agriculture: A review of impacts and adaptations. Climate Change Series paper no. 91. Environment Department and Agriculture and Rural Development Department, World Bank, Washington, DC.

Kruger, A.C. and Sekele, S. S. 2012. Trends in extreme temperature indices in South Africa: 1962 – 2009. International Journal of Climatology, in press

Laborit, H. 1976. Éloge de la fuite, Robert Laffont, Paris.

Leary, N.; Adejuwon, J.; Barros, V.; Batimaa, P.; Biagini, B.; Burton, I.; Chinvanno, S.; Cruz, R.; Dabi, D.; de Comarmond, D.; Dougherty, B.; Dube, P.; Githeko, A.; Hadid, A.A.; Hellmuth, M.; Kangalawe, R.; Kulkarni, J.; Kumar, M.; Lasco, R.; Mataki, M.; Medany, M.; Mohsen, M.; Nagy, G.; Njie, M.; Nkomo, J.; Nyong, A.; Osman, B.; Sanjak, E.;

Seiler, R.; Taylor, M.; Travasso, M.; von Maltitz; G., Wandiga, S.; Wehbe, M. 2007: A Stitch in Time: Lessons for Climate Change Adaptation from the AIACC Project. AIACC Working Paper No. 48.

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P. and Wilson, J. 2006. Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems. Ecology and Society, 11.

Leiserowitz, A. 2006. Climate change risk perception and policy preferences: The role of affect, imagery, and values. Climatic Change, 77

Leiserowitz, A. 2007. Public perception, opinion and under- standing of climate change - Current patterns, trends and limitations. United Nations Development Programme, New York.

Lemos MC, Boyd E 2009. The politics of adaptation across scales: the implications of additionally to policy choices and development. In: Boycoff MT (ed) The politics of climate change: a survey. Taylor and Francis, London

Leuschner, K and Manthe, C.S., 1996. Drought Tolerant Crops for Southern Africa. Proceedings of the SADC/ICRISAT Regional Sorghum and Pearl millet Workshop, 25-29 July 1994. Gaborone, Botswana.

Lincoln Y S and Guba E G 1985. Naturalistic Enquiry, Newbury Park CA: Sage Publications

Lobell D, Burke M, Tebaldi C, Mastrandrea M, Falcon W and Naylor R. 2008. Prioritizing climate change adaptation needs for food security in 2030. Science 319(5863):607–610

Lyon, Christopher & Parkins, John. 2013. Toward a Social Theory of Resilience: Social Systems, Cultural Systems, and Collective Action in Transitioning Forest-Based Communities. Rural Sociology. 78. 10.1111/ruso.12018.

Maddison, D. 2007. The perception of and adaptation to climate change in Africa. Policy research working paper 4308. The World Bank, Washington DC.

Maddison, D. 2006. The perception of and adaptation to climate change in Africa. CEEPA. Discussion Paper No. 10. Centre for Environmental Economics and Policy in Africa. Pretoria, South Africa: University of Pretoria.

Mafu V. 2008. Focus on the Masvingo Province, Zimtrade.

Makate et al. 2016. Crop diversification and livelihoods of smallholder farmers inZimbabwe: adaptive management for environmental change. SpringerPlus .:1135

Makhadho, J.M. 1996. Potential Effects of Climate on Corn Production in Zimbabwe, Climate Research Vol 6

Makuvaro V, 2014, Impact of Climate Change on Smallholder Farming in Zimnbabwe, Using a Modelling Approach, Submitted in FulFillment of a PhD Degree in Agricultural Meteorology Department of Soil, Crop and Climate Sciences, Faculty of Natural and Agricultural Sciences, University of the Free State, Bloemfontein, South Africa.

Malhi Y, Wright J. 2003. Spatial patterns and recent trends in the climate of tropical rainforest regions. Phil Trans Roy Soc B. 2004;359:311–329. http://dx.doi. org/10.1098/rstb.2003.1433

Matarira, C. H.; Makadho, J. M.; Mwamuka, F. C. 1995. "Zimbabwe: Climate ChangeImpacts on Maize Production and Adaptive Measures for the Agricultural Sector" in Ramos-Mane, C. and Benioff, R. (Editors) Interim Report on Climate Change Country Studies, US Country Studies Program, Washington, DC.

Mano, R & Nhemachena C., 2007. Assessment of the economic impacts of climate change on agriculture in Zimbabwe: A Ricardian approach. CEEPA Discussion Paper No. 11. Centre for Environmental Economics and Policy in Africa, University of Pretoria.

Mano, R. and Nhemachena, C., 2006. Assessment of the economic impacts of climate change on agriculture in Zimbabwe: a Ricardian approach. CEEPA Discussion Paper No. 11.

Centre for Environmental Economics and Policy in Africa. Pretoria, South Africa: University of Pretoria.
Mandaza, I. 1986. Zimbabwe: the Political Economy of Transition 1980-1986, Codesria, Dakar.
Manjengwa, J., Matema, C., Mataruka, J., Tirivanhu, D., Mufaro, T. and Feresu, S. 2014. "Children and Climate Change in Zimbabwe". UNICEF and Institute of Environmental Studies, University of Zimbabwe: www.unicef.org/zimbabwe/Children_and_Climate_Change_in_Zimbabwe_Report_2014.pdf.
Mapfumo P, Jalloh A and Hachigonta S. 2014, Review of Research and Policies for Climate Change Adaptation in the Agriculture Sector in Southern Africa, A fricaInteract: Enabling research-to-policy dialogue for adaptation to climate change in Africa.
Marongwe N, 2003. Redistributive Land Reform and Poverty Reduction in Zimbabwe, A working paper for the research project on 'Livelihoods after Land Reform'.
Marongwe L.S, Isaiah Nyagumbo, Karsto Kwazira, Amir Kassam, Theodor Friedrich. 2012. Conservation Agriculture and Sustainable Crop Intensification, A Zimbabwe Case Study, FAO, Vol. 17.
Marongwe, L.S., Kwazira, K., Jenrich, M., Thierfelder C., Kassam A. and Friedrich, T. 2010. An African Success: The Case of Conservation Agriculture in Zimbabwe. International Journal of Agricultural Sustainability 9(1) 2011pages 153–161, doi:10.3763/ijas.2010.0556 # 2011 Earthscan. ISSN: 1473-5903 (print), 1747-762X (online). www.earthscan.co.uk/journals/ijas.
Masika, M. 2002. Climate Change Vulnerability and Adaptation Assessments in Swaziland. UNFCCC African Regional Workshop on Adaptation, Accra, Ghana.
Mawere, M. 2011. Moral Degeneration in Contemporary Zimbabwean Business Practices: South Africa: Langaa.
Moussa, K. M. and Amadou M. 2006. Using the CROPWAT Model to Analyse the Effects of Climate Change on Rainfed Crops in Niger, CEEPA DP32, University of Pretoria, South Africa
Mazzeo, J., 2011. "Cattle, Livelihoods, and Coping with Food Insecurity in the Context of Drought and HIV/AIDS in Rural Zimbabwe."Human Organization. 70(4): 405-415.
Mazingi L and Kamidza R. 2011. Tearing Us Apart: Inequalities in Southern Africa, osisa.org accessed at www.osisa.org/sites/default/files/sup_files/chapter_5_zimbabwe.pdf
Mazvimavi K, Nyathi P, Murendo C, (undated) Conservation Agriculture Practices and Challenges in Zimbabwe, ICRISAT)
Mazvimavi, K., Ndlovu, P., Nyagumbo, I. and Dimes, P.J. 2010. CA Panel Study Report prepared for ICRISAT, GRM, and FAO.
Mazvimavi D. 2010 Climate Change, Water Availability and Supply. SARUA Leadership Dialogue Series 2: 81-97.
Mlambo A and Raftopoulos B. 2010. The Regional Dimensions of Zimbabwe's Multi-Layered Crisis: An Analysis, Election processes, Liberation movements and Democratic Change in Africa Conference Maputo 8-11 April 2010, CMI and IESE.
Meizen-Dick R, Adato L, Haddad L, Hazell P. 2003. Impacts of Agricultural Research on Poverty: Findings of an Integrated Economic and Social Analysis, Intl Food Policy RES Institution
Mendelsohn, R. 1998. Climate-change damages. In Economics and policy issues in climate change, ed. W.D. Nordhaus. Resources for the Future: Washington, D.C.
Mendelsohn, R.; Dinar, A.; Dalfelt, A. 2000. Climate Change Impacts on African Agriculture.
Mendelson R, (2004) Climatic Critique, Harvard International Review 26.3
Meehl, Gerald, Claudia Tebaldi, and Doug Nychka. "Changes in frost days in simulations of 21st century climate." Climate Dynamics, Vol. 23, No. 5, 495-511, 2004.

Mingers, J. 2004. Real-izing information systems: Critical realism as an underpinning philosophy for information systems. Information and Organization 14, 87 – 103.
Mitchel and Tanner, 2006; Centre for International Earth Science Information Network.
Mtisi, S., and Prows, M., (Ed) 2012. Baseline Report on Climate Change and Development in Zimbabwe, Government of Zimbabwe
Mouton J. 1996, Understanding Social Research, Van Schaik Publishers
McMillan J H and Schumacher S. 2001, Research in Educational. A Conceptual Introduction 5th Edition, New York Longman
McCarthy J, Canziani O, Leary N, Dokken D.,& White, K. (Eds.). 2001. Climate change 2001: Impacts, adaptation and vulnerability. Cambridge, UK: Cambridge University Press. Contribution of Working Group II to the Third Assessment Report of the IPCC
McElroy M and Baker J. 2012. Climate Extremes: Recent Trends with Implications for National Security
Morin, E. 1985. La méthode : la vie de la vie, t2. Paris, ed Seuil, Coll Points Essais.
Moser, S.C., and Ekstrom, J.A., 2010, A framework to diagnose barriers to climate change adaptation, PNAS, http://www.pnas.org/content/107/51/22026
Moser, C. 1996. Confronting crisis: a comparative study of household responses to poverty and vulnerability in four poor urban communities. World Bank, Washington.
Moyo S., 2004., The Land and the Agrarian Question in Zimbabwe, Work in Progress Paper Presented at the Conference: "Agrarian Constraint and Poverty Reduction: Macroeconomic Lessons For Africa", Addis Ababa, 17-18 December, 2004, accessed at www.sarpn.org/documents/d0001097/P1211-Moyo_
Moyo, S. 2000. 'Land Reform under Structural Adjustment in Zimbabwe; Land Use Change in Mashonaland Provinces, Nordiska Afrika Institutet Uppsala.'
Moyo, S., Robinson, P., Katerere, Y., Stevenson, S. and Gumbo, D. (1991). Zimbabwe's Environmental Dilemma: Balancing Resource Inequities. ZERO, Harare.
Moyo, M, Mvumi, M, Kunzekweguta, M, Mazvimavi, K, Craufurd, P and Dorward, P. 2012. Farmer Perceptions on Climate Change and Variability in Semi-arid Zimbabwe in Relation to Climatology Evidence. African Crop Science Journal 20 (S2):317-335.
Molua, E. L. and Lambi C M. 2006b. The Economic Impact of Climate Change on Agriculture in Cameroon, CEEPA DP17, University of Pretoria, South Africa.
Mubaya C.P. 2017. Local-level Climate Change Adaptation decision-making and Livelihoods in semi-arid areas in Zimbabwe, Environment, Development and Sustainability: A Multidisciplinary Approach to the Theory and Practice of Sustanable Development. Vol 19. Issue 6, 2377-2403
Mubaya, C.P. 2010. Farmers Strategies towards Climate Variability and Change in Zimbabwe and Zambia. Thesis submitted for Doctor of Philosophy University of Free State. (Unpublished Thesis).
Mubvuma M.T. 2013. Climate Change: Matching Growing Season Length with Maize Crop Varietal Life Cycles in Semi-Arid Regions of Zimbabwe, Greener Journal of Agricultural Sciences.
Mudavanhu C., Zinyandu T., Mudavanhu N., Mazorodze S., Chinyanganya T. P, Manyani A.,Maponga R., Pedzisai E., Phiri S. 2013. Smallholder gardening as a sustainable livelihood strategy in Chikwanda communal lands, Gutu Zimbbawe, Global Advanced Research Journals.
Mudimu, G, 2003. Zimbabwe Food Security Issues Paper. Forum for Food Security in Southern Africa. London: Overseas Development Institute (ODI). www.odi.org.uk/ projects/03-food-security-forum/docs/ZimbabweCIPfinal.pdf.
Mudzonga E. 2011. Farmers' Adaptation to Climate Change in Chivi District of Zimbabwe, Trade and Development Studies Centre, Belgravia Harare, Zimbabwe.

Mukarumbwa, P. Mushunje, A. 2010. Potential of Sorghum and Finger Millet to Enhance Household food Security in Zimbabwe's Semi-Arid Regions: A Review Contributed Paper Presented at the Joint 3rd African Association of Agricultural Economists (AAAE) And 48th Agricultural Economists Association Of South Africa (AEASA Conference, Cape Town, South Africa.

Muller-Kuckelberg K. 2012. Climate Change and its impact on the Livelihood of Farmers and Agricultural workers in Ghana, General Agricultural Workers' Union of GTUC, Friedrich Ebert Stftung, Ghana Office UNISDR, 2011).

Munangagwa, C.L. 2009. "The Economic Decline of Zimbabwe," Gettysburg Economic Review: Vol. 3 Article 9. Available at: http://cupola.gettysburg.edu/ger/vol3/issl/9

Murambadoro M.D. 2009, How the sustainable livelihoods framework can contribute towards sustainable social development: where are we going?, Council for Scientific and Industrial Research, South Africa, Natural Resources and Environment CSIR, Pretoria.

Mutekwa,V. 2009. Climate Change Impacts and Adaptation in the Agricultural Sector: The Case of Smallholder farmers in Zimbabwe. Journal of Sustainable Development in Africa 11:237-256.

Mutekwa V and Kusangaya S, 2006, Contribution of rainwater harvesting technologies to rural livelihoods: The Case of Ngundu Ward in Chivi District, ISSN 0378-4738 = Water SA Vol. 32 No.3, Available at website http://www.wrc.org.za

Mushore T.D. Muzenda-Mudavanhu C. Makovere T. 2013. Effectiveness of Drought Mitigation Strategies in Bikita District, Zimbabwe, International Journal of Environmental Protection Policy

Musodza C, 2015, Zimbabwe's Fast Track Land Reform Programme and the Decline in National Food Production: Problems of implementation, policy and farming practices, A thesis Submitted to Saint Mary's University, Halifax, Nova Scotia in Partial Fulfilment of the Requirements for the Degree of Master oF Arts in International Development Studies.

Mutasa, C., 2008. Evidence of climate change in Zimbabwe. Paper presented at the Climate Change Awareness and Dialogue Workshop for Mashonaland Central and Mashonaland West Provinces Held at Caribbea Bay Hotel, Kariba, Zimbabwe, 29-30 September, 2008.

Mutsvangwa T and Doranalli, K. 2006. Agriculture And Sustainable Development, Netherlands,The Hague University Press

Mdee, A. L. 2002. Sustainable Livelihoods Approaches - Can they transform development? University of Bradford. Bradford Centre for International Development. BCID Research Paper No.2.

Myers, M. D. 2009. Qualitative research in business & management. Thousand Oaks, CA: Sage Publications Ltd.

National Research Council. 2012. Climate Change, Evidence, Impacts and Choices.

Nattrass, N. 2002. AIDS and Human Security in Southern Africa: In the Journal of Social dynamics, 28:1 (2002). 1-19.

Nardone, A., Ronchi, B., Lacetera, N., Ranieri, M. S., & Bernabucci, U. (2010). Effects of climate changes on animal production and sustainability of livestock systems. Livestock Science, 130(1–3), 57–69.

Ngaira J K.W, Musiambo M. 2012. "Climate Change and Agricultural Development In Africa: Solutions and Challenges to Persistent Famine" International Journal of Asian Social Science, Vol.2, No.2.

Nautiyal S. 2011. Macro to Micro Viewpoint of Climate Change- Linking Karnakata to Global Issue, Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Bangalore, India

New, M., Hewitson, B., Stephenson, D. B., Tsiga, A., Kruger, A., Manhique, A., Gomez, B., and Coelho, C. A. S., 2006. Evidence of trends in daily climate extremes over southern and West Africa. Journal of Geophysical Research.–Atmos., vol. 111.

Newton, J., Paci, C.D., and Ogden, A. 2005. Climate change and natural hazards in northern Canada: Integrating indigenous perspectives with government policy. Mitigation and Adaptation Strategies for Global Change 10:541–571.

Nhemachena, C. and Hassan, R. 2007. Micro-level Analysis of Farmers' Adaptation to Climate Change in Southern Africa. International Food Policy Research Institute (IFPRI) Discussion Paper No. 00714. Environment and Production Technology Division, IFPRI, Washington, D.C.

Niang I, Ruppel OC, Abdrabo MA, Essel A, Lennard C, Padgham J, Urquhart P. 2014. Africa. In: Climate change 2014: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.

Nicholson SE, Selato JC. 2000. The influence of La Niña on African rainfall. Intl J Climatol. ;20:1761–1776. http://dx.doi.org/10.1002/1097- 0088(20001130)20:14<1761: AID-JOC580>3.0.CO;2-W

Ndlovu. 2011 Drought copying strategies at Mutasa district in Zimbabwe, Submitted in partial fulfilment of the requirements for the degree Masters in Disaster Management In the Disaster Management Training and Education Centre for Africa, University of Free St

Nkomo JC, Nyong et al. 2006. The impact of climate change in Africa. Available at: www.hm.treasury.gov.uk/d/chapters5.

Odgen A .E and J.L Innes. 2008. Climate Change Adaptation And Adaptation And Regional Forest Planning In Southern Yukon, Canada, Mitigation and Adaptation Strategies For Global change Vol13, No8, pp833-861.

Okonya J.S, Syndikus K. and Kroschel J. 2013. Farmers' Perception of and Coping Strategies to Climate Change: Evidence from Six Agro-Ecological Zones of Uganda Received: OnlinePublished:July15,2013doi:10.5539/jas.v5n8p25.

Olvitt L L. 2012. Deciding and doing what's right for People and Planet: An Investigation of the Ethics-Oriented Learning Novice Environmental Educators, PhD Thesis submitted at Rhodes University

OFDA/CRED. 2012. Top 10 Natural Disasters in Zimbabwe. Retrieved from The OFDA/CRED International Disaster Database: www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium".

Onyeneke, R, Madukwe, D. 2010. Adaptation Measures by Crop Farmers in the Southeast Rainforest Zone of Nigeria to Climate Change, Science World Journal Vol 5 (No 1).

Orlove B, and Tosteson J. 1999. The application of seasonal to inter-annual climate forecasts based on El Niño-Southern Oscillation (ENSO) events: lessons from Australia, Brazil, Ethiopia, Peru, and Zimbabwe. Berkeley Workshop Environment and Policy Working Paper 99 (3), Institute of International Studies, University of California, Berkeley

Oweis, T.Y, Prinz, D, Hachum, A. 2001. Water Harvesting Indigenous knowledge for the future of the Drier Environments. International Center for Agricultural Research in the Dry Areas.

Parry J, Hammill A, Drexhage J. 2005. Climate Change Adaptation, International Institute for Sustainable Development, Canada

Parry, M. L., (ed.) 2000. Assessment of potential effects and adaptation for climate change in Europe: The Europe Acacia Project, Jackson Environmental Institute, Norwich, UK. University of East Anglia.

Patz, J., Gibbs, H., Foley, J., Roger J. and K. Smith. 2007. "Climate change and global health: quantifying a growing ethical crisis," Eco-Health. Vol. 4.

Peng W, Zheng H, Robinson B.E, Li C, Wang F. 2017. Household livelihood strategy choices, impact factors, and environmental consequences in Miyun Reservoir Watershed, China, Sustainability 2017, 9, 175; doi:10.3390/su9020175, www.mdpi.com/journal/sustainability,

Piya L, Maharjan V., Keshav L., Joshi, N. P. 2012. Perceptions and Realities of Climate Change among the Chepang Communities in Rural Mid-Hills of Nepal, Journal of Contemporary India Studies: Space and Society, Hiroshima University.

Phiri K, Ndlovu S, Chiname T.B. 2014. Climate Change Impacts on Rural Based Women: Emerging Evidence on Coping and Adaptation Strategies in Tsholotsho, Zimbabwe, Mediterranean Journal of Social Sciences

Plant M. 2001. Critical Realism: A Common Sense Philosophy for Environmental Education? London South Bank University (Formerly At Nottingham Trent University) Paper Presented At the 26th ATEE (Association For Teacher Education In Europe) Conference, Stockholm 27 August- 1 September 2001

Preston, B. L., and Jones, R. N., 2006. Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions A consultancy report for the Australian Business Roundtable on Climate Change. PreventionWeb. 2012. "Zimbabwe - Disaster Statistics." <http://www.preventionweb.net/english/countries/statistics/?cid=193>.

Prevention Web. 2012. "Zimbabwe - Disaster Statistics." <http://www.preventionweb.net/english/countries/statistics/?cid=193>.

Porpora D.V 2013. Morphogenesis and Social Change, Department of Culture and Communication, Drexel University, Philadelphia, USA.

Poulton C, Davies R, Matshe I and Urey I. 2002. A Review of Zimbabwe's Agricultural Economic Policies: 1980-2000.

Prowse M. 2008. Locating and extending Livelihoods Research, Overseas Development Institute, Westminster Bridge Road, London,UK.

Prowse M. 2010. Integrating Reflexivity into livelihoods Research, Institute of Development policy and Management, Sage Publications

Raftopoulous, B. 2003. "The State in Crisis: Authoritarian Nationalism, Selective Citizenship and Distortions of Democracy in Zimbabwe", in Hammar, A., Raftopoulos, B., and Jensen, S. (eds), Zimbabwe's Unfinished Business: Rethinking Land, State and Nation in the Context of Crisis. Harare: Weaver Press.

Ranger, T. 1985. Peasant Consciousness and Guerilla War in Zimbabwe: A Comparative Study.Oxford: James Currey.

Rakodi C. 2002. A Livelihoods Approach. Conceptual Issues and Definition. In Urban Livelihoods: A people Centred Approach to Reducing Poverty. C Rakodi and T Lloyd Jones (Eds) London: Earthscan PublicationsLtd

Rahamah Hj, Bakar A and Abdullah MYHJ .2008. The Life History Approach: Field work Experience Volume 3. No 1 ISSN:1823-884X.

Rayner, S. and E.L. Malone (eds.), 1998: Human Choice and Climate Change Volume 3: The Tools for Policy Analysis . Battelle Press, Columbus, OH, USA.

Reason CJC, Hachigonta S, Phaladi RF. 2005. Interannual variability in rainy season characteristics over the Limpopo region of Southern Africa. Int J Climatol 25:1835

Riebsame, W. E., Strzepek, K. M., Wescoat Jr., J. L., Perrit, R., Graile, G. L., Jacobs, J., Leichenko, R., Magadza, C., Phien, H., Urbiztondo, B. J., Restrepo, P., Rose, W. R., Saleh, M., Ti, L. H., Tucci, C., and Yates, D., 1995. Complex river basins. In: Strzepek, K.M. and Smith, J. B. (eds.) As Climate Changes, International Impacts and Implications Cambridge. Cambridge University Press.

Reidsma, P., Ewert, F., Lansink, A.O. and Leemans, R. 2002. Vulnerability and adaptation of European farmers: a multi-level analysis of yield and income responses to climate variability. Regional Environmental Change 9: 25–40.

Reid, P.; Vogel, C. 2006. Living and responding to multiple stressors in South Africa--Glimpses from KwaZulu-Natal. In: Global Environmental Change. vol. 16, pp. 196-206.

Richard Y, Fauchereau N, Poccard I, Rouault M, Trzaska S. 20th century droughts in southern Africa: Spatial and temporal variability, teleconnections with oceanic and atmospheric conditions. Intl J Climatol. 2001;21:873–895. http://dx.doi.org/10.1002/joc.656

Ritchie J and Lewis J. 2013. Qualitative Research Practice, A Guide for Social Science Students Researchers, Sage Publications

Rosenzweig, C., Casassa, G., Karoly, D.J., Imeson, A., Liu, C., Menzel, A., ... and Tryjanowski, P. 2007. 'Assessment of Observed Changes and Responses in Natural and Managed Systems', in Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK: Cambridge University Press, pp.79-131

Sawyer K.R. 2005. Unresolved Tensions in Sociocultural Theory: Analogies with Contemporary Sociological Debates, Washington University in St Louis, Department of Education.

Sachikonye L., 2011. When a State turns on its Citizens, Jacana Media (Pty) Ltd, Sunnyside, Harare.

Sachikonye L. 2005. Land is the Economy: Revisiting the Land Question. African Security Review, 14(3).

Sakdapolrak, Patrick. 2014. Livelihoods as social practices. Re-energising livelihoods research with Bourdieu's theory of practice. Geographica helvetica. 2014. 1-10. 10.5194/gh-69-19-2014.

Sandelowski, 1994 in Thorne S, 2008, Data analysis in qualitative research. 68 Volume 3 July 2000 EBNAccessed at http://ebn.bmj.com/cgi/content/full/3/3/68#otherarticles

Schaeffer M, Baarsch F, Adams S, Bruin K, De Marez L, Freitas S, Hof A and Hare B, (ud), Africa's Adaptation Gap, Technical Report, Climate change impacts, adaptation challenges and costs for Africa

Schneider SH, Easterling WE, Mearns LO. 2000. Adaptation: sensitivity to natural variability, agent assumptions and dynamic climate changes. Clim Change 45(1):203–221.

Schipper ELF. 2007. Climate Change Adaptation and Development: Exploring the Linkages, Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia

Scoones, I. 1998. Sustainable Rural Livelihoods. A Framework for Analysis. IDS Working Paper 72, Institute of Development Studies, University of Sussex

Scoones, I, 2008. A new start for Zimbabwe? ' commentary/september-2008.

Scoones I. 2009. Livelihoods perspectives and rural development, The Journal of Peasant Studies, 36:1, 171-196, DOI: 10.1080/03066150902820503

Scoones, I. 2015. Sustainable rural livelihoods and rural development UK Practical Action Publishing And Winnipeg, CA: Fernwood Publishing. 137pp. ISBN: 9781853398759;

Schaffer, P., 1996. 'Beneath the poverty debate: some issues', IDS Bulletin 27(1): 23-35 SEERISK 2014. Guideline on climate change adaptation and risk assessment in the Danube macro-region.

Seo, N. and Mendelsohn, R. 2006. Climate change impacts on animal husbandry in Africa: A Ricardian analysis. CEEPA Discussion Paper No. 9. Centre for Environmental Economics and Policy in Africa, University of Pretoria.

Serrat O. 2008. The Sustainable Livelihoods Approach, Knowledge Solutions, Asian Development Bank, Philippines.

Senga, H., Sanga, G. J., Mziray, N. and Hella, J. P. 2013. Climate parameters variability and its impacts on crop type, cropping pattern and crop diseases: Evidence from Tanzania In Bakari M.S, (2015) Climate Change Impacts And Adaptation Strategies Of Small Scale Agriculture Production In Micheweni District Pemba, Tanzania, A Dissertation Submitted In Partial Fulfilment Of The Requirements For The Degree Of Master Of Science In Management Of Natural Resources For Sustainable Agriculture Of Sokoine University Of Agriculture. Morogoro, Tanzania.

Shanahan M., Shubert, W., Scherer, C., Corcoran, T. Ed: Banda F. 2013. Climate Change in Africa: A Guidebook for Journalists. UNESCO: www.unesco.org/new/en/communication-and-information/resources/publications-and-communication-materials/publications/full-list/climate-change-in-africa-a-guidebook-forjournalists.

Shackleton, C.M., Shackleton, S.E., and Cousins, B. 2001. The role of land-based strategiesin rural livelihoods: the contribution of arable production, animal husbandry and natural resource harvesting in communal areas in South Africa. Development SouthernAfrica, 18.

Serdeczny O, Adams Sophie, Baarsh F, Coumou D, Robinson A, Hare W, Schaeffer M, Perrette M, Reinhardt J. 2016. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions, Regional Environmental Change, Research Gate

Sibanda V and Makwata R. 2017. Zimbabwe Post Independence Economic Policies: A Critical Review, Research Gate.

Sichone, O. 2003. Zimbabwe's Economic Policies 1980-2002. DPMN Bulletin: Volume X, Number 2.

Simatele D, Binns N. & Simatele M. 2012. Sustaining livelihoods under a changing climate: the case of urban agriculture in Lusaka, Zambia, Journal of Environmental Planning and Management, Vol. 55, No. 9,1175–1191.

Simba FM, Chikodzi D, Murwendo T. 2012. Climate Change Scenarios, Perceptions and Crop Production: A Case Study of Semi-Arid Masvingo Province in Zimbabwe. J Earth Sci Climate Change 3:124. doi:10.4172/2157-7617.1000124

Simonet G, (2010) The Concept of Adaptation: Interdisciplinary Scope and Involvement in Climate Change, S.A.P.I.EN.S [Online], 3.1 | 2010, Online since 19 July 2010, connection on 17 December 2017. URL: http://journals.openedition.org/sapiens/997.

Singh NP, Byjesh K, Bantilan C, Rao VUM, Venkateswarulu B, Niranjan F, Jayatilaka W, Deb UK, Ha PQ, Suddhiyam P, Nedumaran S. 2015. Changing climate-responding to the inevitable. In: Singh NP, Bantilan C, Byjesh K, Nedumaran S (eds) Climate change challenges and adaptations at farm-level: case studies from Asia and Africa. CABI Private Limited, Boston

Smit B., and M.W. Skinner. 2002. Adaptations options in agriculture to climate change: A typology. Mitigation and Adaptation Strategies for Global Change 7: 85–114

Smit, B., Pilifosova, O., 2001. Adaptation to climate change in the context of sustainable development and equity. In:McCar thy, J.J., Canziani, O.F., Leary, N.A., Dokken.

Smit B., I. Burton, R.J.T. Klein, and J. Wandel, 2000: An anatomy of adaptation to climate change and variability. Climatic Change, 45.

Smit, B., I. Burton, R.J.T. Klein and J. Wandel. 1999. 'The anatomy of adaptation to climate change and variability.' Climatic Change, forthcoming.

Smith, J.B. 1996. Using a decision matrix to assess climate change adaptation. In Adapting to climate change: Aninternational perspective, ed. J.B. Smith, N. Bhatti, G. Menzhulin, R. Benioff, M.I. Budyko, M. Campos,B. Jallow, and F. Rijsberman. New York: Springer.

Smith, J. B., & Lenhart, S. S. 1996. Climate change adaptation policy options. Climate Research.

Smithers, J and Smit, B. 1997. Human adaptation to climatic variability and change. Global Environmental Change. 7. 129-146. 10.1016/S0959-3780(97)00003-4.

Sunday C.E, undated, Qualitative Data Analysis (QDA) Division for Postgraduate Studies (DPGS) Post-Graduate Enrolment and Throughput Program (Pet)

Szwed M. Karg G. Pinskwar M. Graczyk A. Kedziora A. Kundzewicz Z.W. 2010. Climate change and its effects on Agriculture, Water Resources and Human Health Sectors in Poland. Nat. Hazards Earth Syst Sci., 10,1725-1737, www.nat-hazards-earth-syst-sci./10/1725/2010/ doi:10.5194/nhess-10-1725-2010

Tadross M, Jack C, Hewitson B. 2005 On RCM-based projections of change in southern African summer climate. Geophys Res Lett.2005;32:L23713.http://dx.doi.org/10.1029/2005GL024460

Task Force on Climate Change, Vulnerable Communities and Adaptation. 2003. Livelihoods and Climate Change, International Institute for Sustainable Development, Winnipeg, Manitoba, Canada

Taylor, J.R, Schober, T.J Bean, S., 2006. Novel and non-food uses for sorghum and millets. Journal of Cereal Science, 44: 252-271.

Thorne S. 2008. Data analysis in qualitative research. 68 Volume 3 July 2000 EBNAccessed at http://ebn.bmj.com/cgi/content/full/3/3/68#otherarticles

Thornton, N. 2011. Climate Change Financing and Aid Effectiveness. Tanzania Case Study.

Thomas P.Y. 2010. Towards developing a web-based blended learning environment at the University of Botswana, University of South Africa, Pretoria, http://hdl.handle.net/10500/4245

Thomas A and Hollingsworth. 2016. From Bad to Worse: Deepening Impacts of Zimbabwe, Refugees International, Field Report.

Trenberth K.E., Jones P.D., Ambenje P., Bojariu R., Easterling D., Klein Tank A., Parker D., Rahimzadeh F., Renwick J.A., Rusticucci M., et al. 2007. Observations: surface and atmospheric climate change. In Climate Change 2007. The Physical Science Basis, Contribution of WG 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon S., Qin D., Manning M., Chen Z., Marquis M.C., Averyt K.B., Tignor M. and H.L., Miller (Eds.), Cambridge University Press, Cambridge, New York.

Toner AL 2003. Knowing Poverty: Critical Reflections on Participatory Research and Policy. Journal of Development Studies 40 (1)

Tompkins, E. L. and W. Neil Adger. 2003. Building resilience to climate change through adaptive management of natural resources. Tyndall Working Paper 27.

Tierney S. 2008. Qualitative Research: An Overview and General Issue.

Unganai L. (2009), Adaptation to climate change among agro pastoral systems: Case for Zimbabwe, IOP publishing Limited, Zimbabwe

Unganai, L. S., 1996. Historic and Future Climate Change in Zimbabwe. Climate Research. Vol. 6.

United States Agency for International Development (USAID). 2009. Adapting to Coastal Climate Change. A guidebook for development planners. Washington, DC.

Usman MT, Reason CJC 2004. Dry spell frequencies and their variability over southern Africa. Clim Res.; 26:199–211. http://dx.doi.org/10.3354/ cr026199.

UN Economic Commission for Africa African Climate Policy Centre. 2011. Working Paper 4. Climate Change and Water in Africa: An A nalysis of Knowledge Gaps and Needs.

United Nations Development Programme (UNDP). 2009. The impact of climate change on the development prospects of the least developed countries and small island developing states.

UNISDR. 2011. Global assessment report on disaster risk reduction 2011: revealing risk and redefining development. Geneva, Switzerland, United Nations.

UNEP, 1998: Handbook on Methods for Climate Impact Assessment and Adaptation Strategies, 2 [Feenstra, J., I. Burton, J. Smith, and R. Tol (eds.)]. United Nations Environment Program, Institute for Environmental Studies, Amsterdam, The Netherlands.

UNFCCC. 2007. Climate Change: Impacts, Vulnerabilities and Adaptations in Developing Countries. UNFCCC. 2009. Least Developed Countries under the UNFCCC.

UNFCC. 2006. Technologies for Adaptation to Climate Change, Bonn, Germany.

Van Dijik T. 2009. A Critical Realist Livelihoods Approach Conference Paper-RC21,ISA Conference, San Paulo, Brazil

Vorsah R V. 2015. Climate change Effects on Small holder Framers' Livelihoods: The case of Ejura-sekyedumasi Municipal of the Ashant Region of Ghana, Thesis Submitted to the University of Ghana in the Partial Fulfilment of the Requirement for the award of Master of Philosophy Degree in Climate Change and Sustainable Development

Washington RM, Kay G, Harrison M, Conway D, Black E, Challinor A. 2006. African climate change: Taking the shorter route. Bull Am Meteorol Soc. 87:1355–1366. http://dx.doi.org/10.1175/BAMS-87-10-1355.

Watson, R.T., Zinyowera M.C and Moss R.H. 1996. Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press

Wegayehu, Bekele, and Drake, L. 2003. Soil and water conservation decision behavior of subsistence farmers in the Eastern Highlands of Ethiopia: A case study of the Hunde-Lafto area. Ecological Economics, 46: 437–51. World Bank, 2003. Africa rainfall and temperature evaluation system. World Bank, Washington, DC.

Wamari J. D., Isaya S. V., Kheng L. H., Miriti J. M. & Obutiatia E. A. 2012. Use of Aqua Crop model to predict maize yields under varying rainfall and temperature in a Semi-arid environment in Kenya. J. Meteorol. Rel. Sci. 6:23–32.

Wang G, Eltahir EAB. 2002. Impact of CO_2 concentration changes on the biosphere-atmosphere system of West Africa. Glob Change Biol.;8:1169–1182. http://dx.doi.org/10.1046/j.1365-2486.2002.00542.x

Wheaton, E.E. and D.C. Maclver 1999. A Framework and Key Questions for Adapting to Climate Variability and Change, Mitigation and Adaptation Strategies for Global Change 4

Wigley TML, Barnett TP. 1990. Detection of the greenhouse effect in the observations. In: Houghton JT, Jenkins GJ, Ephraums JJ (eds) Climate change. The IPCC scientific Assessment. Cambridge University Press, Cambridge, UK.

Williams A.P and Funk C. 2011. A Westward extension of the warm pool leads to a westward extension of the Walker Circulation, Drying eastern Africa. Climate Dynamics, 37(11-12),2417-2435 In Olsson, L., M. Opondo, P. Tschakert, A. Agrawal, S.H. Eriksen, S. Ma, L.N. Perch, and S.A. Zakieldeen, 2014: Livelihoods and poverty. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J.

Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 793-832.

Winters P, Davis B & Corral L. 2002. Assets, activities and income generation in rural Mexico: factoring in social and public capital. Agricultural Economics 27(2)

Wisner, B., Blaikie, P., Cannon, T.Y. & Davis, J. 2003. At Risk. 2nd ed., Wiltshire, UK: Cromwell Press.

Wilhite, D.A., Hays, M.J., Knutson, C. & Smith, K.H. 2000. Planning for drought: Moving from crisis to risk management. Journal of the American water Resources association 36:697-71

World Bank 1995. Towards Environmentally Sustainable Development in Sub-Saharan Africa: A Framework for Integrated Coastal Zone Management Building Blocks for Africa 2025.Paper 4, Post UNCED Series, Environmentally Sustainable Development Division, USA. Washington, DC. Africa Technical Department, World Bank.

World Bank. 2002. Linking poverty reduction and environmental management. Policy options and challenges. Joint publication of the World Bank, Department for International Development, European Commission and the United Nations Development Programme, Washington DC.

World Bank 2013 in Serdeczny O, Adams Sophie, Baarsh F, Coumou D, Robinson A, Hare W, Schaeffer M, Perrette M, Reinhardt J. 2016. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions, Regional Environmental Change, Research Gate

World Bank 2015 In Serdeczny O, Adams Sophie, Baarsh F, Coumou D, Robinson A, Hare W, Schaeffer M, Perrette M, Reinhardt J. 2016. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions, Regional Environmental Change, Research Gate

Wood G and Solway S. 2000. Securing Livelihoods in Dhaka Slums, Journal of International Development, 12:669—688.

Yamin, F., Rahman, A. & Huq, S. 2005. Vulnerability, adaptation and climate disasters: a conceptual overview. IDS Bulletin 36, 1-14.

Yesuf, M., Falco, D. S., Deressa, T., Ringler, C. and Kohlin, G. 2008. The Impact of Climate Change and Adaptation on Food Production in Low-Income Countries. Ethiopia Development Research Institute. International Food Policy Research Institute. Discussion Paper No: 828, Washington D.C. IFPRI.

Zamponi M. 2005. Zimbabwe- The Political Economy of Decline accessed at www.pambazuka.net/en/category.php/books/27103

Zhai PM, Sun A, Ren FM, Liu X, Gao B, Zhang Q. 1999. Changes of climate extremes in China. Clim Change;42:203– 18.

Zimbabwe National Climate Change Response Strategy 2015 accessed at www.ies.ac.zw/download/draft%20strategy.pdf

Zimbabwe Human Development Report. 2017. Climate Change and Human Development: Towards Building a Climate Resilient Nation, Government of Zimbabwe.

Zimbabwe Humanitarian Needs Overview, (2016) Humanitarian Needs, UN and Humanitarian Partners in Zimbabwe,www.humanitarianresponse.info/operations/Zimbabwe

Zimbabwe Poverty Atlas. 2015. Small Area Poverty Estimation, Statistics for Poverty Eradication, Zimbabwe National Statistics Agency, Harare, Zimbabwe.

ZimStat, 2012, Preliminary Report, Census 2012, Harare Zimbabwe

Zimstat. 2013. Poverty and Poverty Datum Line Analysis in Zimbabwe 2011/12. ZIMSTAT, Harare.

Zvigadza, S. Mharadze, G., Ngena., S. 2010. "Communities and Climate Change: Building Local Capacity for Adaptation in Goromonzi District, Munyawiri ward, Zimbabwe". African Centre for Technology Studies: http://africanclimate.net/en/node/6553,

Appendices

Appendix One: Ethical considerations

Like any other academic research, the research took into consideration that informants were informed about the research for instance the purpose of the research among other issues. The informants were told about the length of the data collection which started in December 2014 and expected to end mid-year 2017. Respondents were also informed of their right to withdraw from the research at any time they saw necessary or whenever they felt uncomfortable. The researcher also informed the respondents about refreshments that would be provided to those who would participate in Focus Group Discussions and Interviews. A certain fee was given to key informants comprising of Chiefs, Village Heads and Youth Leader. This encouraged participation and was a way of making the respondents feel that their work was appreciated. The respondents did not worry much if what they were pointing out was to be known by other people. Despite this fact the researcher maintained **privacy and confidentiality** as a prerequisite of any academic research. The **do no harm principle** was maintained to the highest degree.

Appendix Two: Questionnaire

Chivi District, Ngundu Ward (Pedzisai 1, Nduna 1 and Guti Villages) Individual Questionnaire

The information captured in this questionnaire is strictly confidential and will be used for research purpose. Participation is not compulsory but voluntary and no financial or non-financial benefits are paid during or after participation. The respondent should be the (actual) household head or any one well informed about the household. Respondents may withdraw their participation at any time, should they so wish.

Signature of interviewee: .....

1. Identification

- Village

……

2. Questionnaire number

……

3. Time

……

4. Date

……

2. Demographic Characteristics

1. Name

……

2. Sex

……..

3. Age

……

4. Marital Status

1= married monogamous 2=married polygamous 3= never married 3= widowed 4= divorced/ separated 5= Other (specify)……..

5. Highest Level of Education Attained

1= some form of primary education 2= completed primary education 3= some form of secondary education 4= completed secondary education 5= post-secondary education 6= No formal education

6. Number of people permanently residing in household most part of the year

1= less than 5 2= 5 3= more than 5

7. Is respondent head of household?

1= Yes 2= No

3= If not explain below:

……
……
……

3. Land Usage

1. How big is your land?

……
……

2. Does your land combine cropping and grazing land?

1= Yes 2= No

3. If it does not combine, do you have access to grazing land elsewhere? Please explain below

……
……
……
……

3.1. In relation to the above question, how big is the grazing land and how far is it from your homestead?

……
……

……

……..

4. What agricultural practices do you do on your land? (Circle were appropriate)

1= Farming

2=Livestock Production

3= any other explain below

……

……

……

……

……

5. For how long have you been cultivating your land?

…….years

6. Comparing the 2000s with the 1990s, has there been an increase /decrease in the area that you cultivate?

1= Increase 2= Decrease 3= No Change

6.1 If there has been an increase please explain below

……

……

……

……

6.2 If there has been a decrease please explain below

……

……

…….

7. Are the crops that you cultivate the same as you cultivated in the early 1990s?

1= Yes 2=No

3= If no please explain the change

……

……

……

…….

8. As compared to the 1990s, to what extent do you currently grow the following crops?

a) Maize

1= Higher 2= Lower 3= Average 4= same as 1990s 5= Do not grow such a crop

b) Sorghum

1= Higher 2= Lower 3= Average 4= same as 1990s 5= Do not grow such a crop

c) Millet

1= Higher 2= Lower 3= Average 4= same as 1990s 5= Do not grow such a crop

d) Rapoko

1= Higher 2= Lower 3= Average 4= same as 1990s 5= Do not grow such a crop

e) Sugar beans

1= Higher 2= Lower 3= Average 4= same as 1990s 5= Do not grow such a crop

f) Cow peas

1= Higher 2= Lower 3= Average same as 1990s 4= same as 1990s 5= Do not grow such a crop

g) Groundnuts

1= Higher 2= Lower 3= Average 4=same as 1990s 5= Do not grow such a crop

h) Round nuts

1= Higher 2= Lower 3= Average 4= same as 1990s 4= Do not grow such a crop

i)Other (Specify)

……..……
……
……..

8.1 From the crops above which ones do you currently consider to be your main crops?

……
……
……
……

8.2 If there are any main crops that you currently grow but are not showing on the list above please discuss them in the space below:

……
……
……

8.3 If you do not cultivate any of the crops above, what could be the reasons?

……
……
……
……..

8.4 May you explain below why you grow the crops you do.

……
……
……
…….

4. Farmers' Perceptions on Climate Change

- In relation to crop production, what are you mostly concerned with from the list below:

1=rainfall 2=temperature 3=both rainfall and temperature are equally important 4= none of these 5=other (specify)

……
……

- In relation to livestock production, what are you mostly concerned with from the list below:

1=rainfall 2=temperature 3=both rainfall and temperature are equally important 4= none of these 5=other (specify)

- Do the following explain the changes in rainfall patterns in the past 20 years (you can circle even more than one)

1. Rainfall coming late than usual

2. Rainfall coming early than usual

3. Rainfall causing floods

4. Not raining leading to drought

5. Nothing has changed

6. Any other please explain below:

……
……
……
……

3.1 Have the changes noted above been negative/ positive in your own perspective?

1= Positive 2= Negative

3.2 If it has been negative, why do you say that?

……
……
……
……
……

3.3 If it has been positive, why do you say that?

……
……
……
…

4 Do the following explain changes in temperature patterns for the past 20 years? (you can circle even more than one)

1. Temperature increases leading to more drastic hot days than cold days

2. Temperature decreases leading to more drastic cold days than hot days

3. Temperature increases leading to drought

4. Nothing has changed

5. Any other please explain below:

……
……

……
……

4.1 Have the changes noted above been negative/ positive in your own perspective?

1= Positive 2= Negative

4.2 If it has been negative, why do you say that?

……
……
……
……

4.3 If it has been positive, why do you say that?

……
……
……
……

5 What is your level of concern on rainfall?

1= High 2= Moderate 3= Low 4= indifferent 5= other

6. What is your level of concern on temperature?

1= High 2= Moderate 3= Low 4= indifferent 5=other

7. Specific Climate Drivers and Effects on Livestock and Crop production

Climate Component	1990s 1=Yes 2=No	Effects on Crop and livestock rearing	2000s 1=Yes 2=No	Effects on crop and livestock production
Increased number of seasons without enough rainfall				

Rainfall starts late and ends early				
Long dry spells during the rainy season				
Rainfall starts late				
Prolonged/extended winter season				
Short winter seasons				
Heat is more intense				
Cold spells reduced in length and intensity				
Erratic rainfall (Too much rain)				
Erratic rainfall (Too little rainfall)				
Poor rainfall distribution within seasons				
Rising Temperatures				
Extremes in Temperatures				
Extremes in rainfall				
Long dry spells during the rainy season				
Rains no longer at the time they used to				
Are rains coming too early				

The rains are late at times and early at other times				
Winter does not come at the time it used to				
Heat spells increased in length				
Cold spells reduced in length				
Intense rainfall events				
Any other (specify)				

8. Comparing the period 2000-2009 with the period 1990-1999, how were the production yields for the following crops like?

1. Maize

1=Higher 2= Average 3=Lower 4= No Change

a. If there were variations please explain below:

……
……
……
……

2. Sorghum

1=Higher 2=Average 3=Lower 4=No Change

b. If there were variations please explain below:

……
……

……
……

3. Millet

1=Higher 2=Average 3=Lower 4=No Change

b. If there were variations please explain below:

……
……
……
……

4. Rapoko

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……
……
…..

5. Sugar beans

1=Higher 2=Average 3=Lower 4=No Change

b. If there variations please explain below:

……
……
……
…...

6. Cowpeas

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……

……
……

7. Groundnuts

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……
……
……

8. Round nuts

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……
……
……

a. If there are any other issues in relation to the above please explain below:

……
……
……
……

8.2 From the crops discussed above, if crop yields were mostly lower what were the reasons (please refer to specific crops)

.....
.....
.....
.....

8.3 If crop yields were mostly average what were the reasons (please refer to specific crops)

……
……
……
……..

8.4 If crop yields were higher what could be the reasons (please refer to specific crops)

……
……
……
……..

9. Comparing the period 2010-2017 with the period 2000-2009, how were the production yields for the following crops like?

- Maize

1=Higher 2= Average 3=Lower 4=No Change

b. If there were variations please explain below:

……
……
……
……

- Sorghum

1=Higher 2=Average 3=Lower 4=No Change

b. If there were variations please explain below:

……
……
……
……..

- Millet

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

- Rapoko

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

- Sugar beans

1=Higher 2=Average 3=Lower 4= No Change

b. If there variations please explain below:

……
……
……
……

- Cowpeas

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……
……
…….

- Groundnuts

1=Higher 2=Average 3=Lower 4= No Change

b. If there were variations please explain below:

……
……
……
……

- Round nuts

1=High 2=Average 3=Low

b. If there were variations please explain below:

……
……
……
……

9.1 If there are any other issues please explain below:

……
……
……
……

9.2 From the crops discussed above, if crop yields were mostly lower what could be the reasons (please refer to specific crops)

.....
.....
.....
.....

9.3 If crop yields were mostly average what could be the reasons (please refer to specific crops)

……
……
……
……

9.4 if crop yields were higher what could be the reasons (please refer to specific crops)

……
……
……
……

10. State the number of bags or kilograms that you got in the following table:

Crop (in kgs, tonnes)	1990-1993	1994-1997	2008-2011	2012-2015
Maize				
Sorghum				
Millet				
Rapoko				
Sugarbeans				
Cowpeas				
Roundnuts				
Groundnuts				
Tomatoes				
Vegetables				
Other				

11. Livestock Ownership in the following years

Livestock (in numbers)	1990-1993	1994-1997	1998-2011	2012-2015
Cattle				
Goats				
Pigs				
Sheep				
Poultry				
Donkey				
Other				

12. What are you mostly concerned about for your livestock survival?

1= Rainfall (drinking water) 2=Temperature 3= Pasture

4=Other (Specify)

……
……
…….

13. Comparing the period 2000-2009 with the period 1990-1999, have the numbers of the following livestock been increasing or decreasing?

1. Cattle

1= Increasing 2= Decreasing 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

……
……
……
……

2. Goats

1= Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase , decrease or no change?

……
……
……
……

3. Pigs

1= Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

……
……
……
……

4. Sheep

1=Increase 2=Decrease 3=No Change

b. Explain below the reasons for the increase, decrease or no change?

……
……
……
……

5. Poultry

1=Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

……
……
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……

6. Donkey

1=Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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……

7. Any other

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……

14. Comparing the period 2010-2017 with the period 2000-2009, have the numbers of the following livestock been increasing or decreasing?

- Cattle

1= Increasing 2= Decreasing 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Goats

1= Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Pigs

1= Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Sheep

1=Increase 2=Decrease 3=No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Poultry

1=Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Donkey

1=Increase 2= Decrease 3= No Change

b. Explain below the reasons for the increase, decrease or no change?

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- Any other

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15. What is your source of water for your livestock?

1= Dam 2=Well 3=River 4= Borehole

5= Other (specify)……..,…….

15.1. Have your livestock been having enough water for the past 26years?

1= Yes 2=No

15.2. If not what could be the reasons

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16. Have the following sources of water been decreasing in water levels between 1990s and 2000s?

16.1 Dam 1=Yes 2=No

16.2 Well 1=Yes 2=No

16.3 River 1=Yes 2=No

16.4 Other (specify)…….

……

……

16.5 Has this change been drastic?

1= Yes 2=No

17**. Comparison of the following factors between the 1990s and 2000s**

Factor	**Period : Early 1990s to late 1990 1= Increase 2=Decrease 3= No Change**	**Effects on Farming, Livestock Production, and any other**	**Period : Early 2000 to 2017 1= Increase 2=Decrease 3= No Change**	**Effects on Farming, Livestock Production, and any other**
Productivity 1. a				
Incidences of crop diseases				
Crop failures				

Animal Health (Livestock)				
Livestock Production				
Quantity of grazing land				
Quality of grazing land				
Morbidity/mortality of livestock				
Overall animal health				
Incidences of pests and diseases on livestock				
Overall livestock losses				
Soil Fertility				
Soil Aridity				
Waterlogging of soils				
Vegetation Degradation				
Vegetation Stability				
Wetlands Depletion				

Stability of wetlands				
Water source availability				
Flooding frequency				
Ground water table				
Incidences of drought				
Any other				

18. In your own understanding what is leading to low crop and low livestock productivity?

1= Droughts 2= Floods 3= No inputs 4= Other specify

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……

19. What is your own understanding of a drought?

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……

20. How often has your area experienced drought since the 1990s?

1= Every year 2= After 2 to 5 years 3= After 5 years 4= Never

5= Other (Specify)

21. Which drought years do you remember, that affected you the most?

……
……
……

22. How serious would you rate these droughts?

1= Very severe 2= Quite severe 3= Not very severe

4= Other (specify)

23. During drought years did the following happen to your family? (Circle were appropriate)

1= The crops failed completely

2= we got a low yield

3= we did not have enough to eat

4= Streams dried up

5= Our water source dried up

6= we had to travel further to collect water

7= there was no enough water to use at the household for drinking, washing and cooking

8= we did not have enough grazing for livestock

9= Livestock had to graze further away

10= Other (specify)

24. Have you ever been affected by a flood in this area?

1= Yes 2= No

25. How severe were these floods?

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……

26. Do you receive information on climate change?

1 = Yes 2 = No

27. What is your understanding of climate change?

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……

28. Do you realise that the climate has changed?

1= Yes 2 = No

28.1 If Yes explain……

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28.2. If No explain

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……

29. What is the source of weather forecast information?

• = Radio 2 = TV 3 = Newspaper 4 = Neighbour 5 = None

30. Who accesses the information at your household?

1 = Father 2 = Mother 3 = Children 4 = All 5 = None

31. What is the source of technical advice on climate change?

1 = Extension staff 2 = Radio 3 = TV 4 = Neighbour 5 = People at home 6 = None

7= Other

Specify……

……

……

5.Implications on livelihood strategies

a. Currently, what are your Livelihood Strategies?

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……

b. From the ones you listed above, which ones do you consider to be your main livelihood strategies?

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…….

c. Are there any changes in your livelihood strategies in the following periods?

Early 1990s……
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Late 1990s

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Early 2000s

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Late 2000s

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After 2010

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……

d. Are your livelihoods mainly dependent on climate parameters (rainfall and temperature)?

1= Yes 2=No

e. Which of the following describes your household food production in the early 1990s?

1=Did not produce enough food and did not sell any surplus

2=Produced enough food with nothing for sale

3= Produced enough food and sell surplus locally

4=Produced enough food and sell surplus locally and extra-locally

f. Which of the following describes your household food production in the late 1990s?

1=Did not produce enough food and did not sell any surplus

2=Produced enough food with nothing for sale

3= Produced enough food and sell surplus locally

4=Produced enough food and sell surplus locally and extra-locally

g. Which of the following describes your household food production in the early 2000s?

1=Dd not produce enough food and did not sell any surplus

2=Produced enough food with nothing for sale

3= Produced enough food and sell surplus locally

4=Produced enough food and sell surplus locally and extra-locally

h. Which of the following describes your household food production in the late 2000s?

1=Do not produce enough food and does not sell any surplus

2=Produce enough food with nothing for sale

3= Produce enough food and sell surplus locally

4=Produce enough food and sell surplus locally and extra-locally

i. Which of the following describes your household food production after 2010?

1=Do not produce enough food and does not sell any surplus

2=Produce enough food with nothing for sale

3= Produce enough food and sell surplus locally

4=Produce enough food and sell surplus locally and extra-locally

j. Are you facing the following challenges regarding your main livelihood strategies right now?

Livelihood Strategy	Challenge	Yes/No
Farming	Increased prices of inputs	
	Increased transport cost	
	Crop failure	
	Labour shortages	
	Increased land aridity	
	Declining crop productivity/yields	
	Reduced Vegetation	
	Water scarcity	
	Poor soil Fertility	
	Increased incidences of crop diseases	

	Depleted Wetlands	
	Excessive water resources	
	Increased productivity	
	Leaching	
Livestock Rearing	Loss of Livestock due to climate related hazards	
	Labour Shortages	
	Increased Land Aridity	
	Declining pasture	
	Increased deforestation	
	High morbidity and mortality of livestock	
	Poor pastures for livestock	
	Reduced vegetation	
	Water scarcity	
	Poor soil fertility	
	Reduced livestock reproduction	
	Poor livestock health	
	Degraded vegetation	
	Depleted Wetlands	
	Excessive water resources	
	Depleted water resources	
	Increased incidences of livestock diseases	
Selling Firewood	Reduced forestry	
Small Grain Production	Increased prices of inputs	

	Increased transport costs	
	Crop failure	
	Labour intensive	
	Declining crop productivity/yields	
	Birds	
	Marketable	
Casual employment (agricultural related	Increased prices of inputs	
	Increased transport cost	
	Crop failure	
	Labour shortages	
	Increased land aridity	
	Declining crop productivity/yields	
	Reduced vegetation	
	Water Scarcity	
	Poor Soil Fertility	
	Increased incidences of crop diseases	
	Depleted Wetlands	
	Excessive water resources	
	Depleted water resources	
	Increased Productivity	

k. If there are any other challenges that affect the strategies in the table above but are not appearing please discuss them below:

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…….

l. If there are other challenges faced on any other strategies not mentioned above please discuss below:

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m. What were your livelihood challenges on your strategies in the following years?

Years	Strategy	Challenge
Early 1990s		
Late 1990s		
Early 2000s		

Late 2000s		
After 2010		

6 Adaptive Strategies

- Are you doing anything differently to deal with changes in rainfall and temperature?

1= yes 2=No

- What kind of adaptive strategies have you implemented? (Start with the most practised and please write all of them)

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- From the list above, which ones do you consider to be the most appropriate adaptive strategies to climate change to you?

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- Are there any challenges that you are facing in implementing these adaptive strategies?

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- When did you begin to implement these strategies?

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……
……

- Are there any NGOs operating in your village?

1 = Yes 2 = No

- Please name the NGOs operating in your area?

……
……
……
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- What form of assistance do they offer?

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…….

- Are there any Agricultural Extension Officers working in your area?

1= Yes 2=No

b. If yes please name them below:

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……

- If yes may you name them below

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- What form of assistance do they offer?

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- Ifthey are no longer operating have they given you some assistance in previous years?

3. = Yes 2 = No

- What form of assistance were you given?

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- Have you received information on adaptation from an NGO?

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- If yes explain……
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- Have you received information on adaptation from an Agricultural Extension Officer?

1= Yes 2=No

If yes please explain:

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- Do NGOs provide any food hand-outs?

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- Do the NGOs provide information on small grains?

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- If yes please explain further

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- Do people follow advice given by NGOs?

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- Do they provide seeds for small grains?

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- Do NGOs carry out field works on how to farm small grains?

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- Do you think the role played by NGOs on small grain production is significant?

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- Have you ever considered migrating?

1=Yes 2= No

- If yes please explain further

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Appendix Three: Key informant interviews (1)

Key informant interviews were carried out with the district administrator, chief, village heads, and councillor and NGO staff members who were purposively selected. The table below shows the period of the interviews:

DATE	KEY INFORMANT
September 2015	District Administrator (Chibi office)
October 2015	Chief (Ngundu Ward)
October 2015	Sabhuku Pedzisai (Pedzisai Village)
October 2015	Sabhuku Nduna (Nduna Village)
October 2015	Sabhuku Guti (Guti Village)
October 2015	Councillor (Ngundu township)
March 2016	Youth Leader
November 2016	NGO Official
April 2017	AGRITEX Officer

The following is the list that guided the interviews carried out with the NGO staff members

1. For how long have you been living or operating in the area?

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2. Would you say the climate has changed in the past 20 to 30 years?

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3. What could be the general views on the rainfall situation for the past 20 to 30 years?

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4. How frequent is the occurrence of droughts in this area

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5. What role does your organisation play on climate change issues in the community?

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6. What are the impacts of climate change on agricultural and livestock production in Ngundu ward?

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7. What are the adaptation strategies that have been implemented in this area?

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8. How effective are these strategies?

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9. Are there any challenges faced in adapting to these strategies?

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10. Are there any ways that can be implemented to address these challenges?

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11. Do you carry any field work with community members?

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12. To what extent are the community members/farmers understand that climate is changing?

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13. To what extent do community members/farmers implement the strategies you advise them?

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14. IN your view, would you say natural ecological regions in Zimbabwe have shifted?

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15. If yes please explain

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16. In your view would you say Ngundu has become a non-maize growing area?

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17. If yes please explain further

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18. Why do you think small grains are suitable for this area?

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19. Do you give community farmers support like seeds or food aid?

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20. If yes please explain further

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21. What role is the government playing in addressing climate change in this area?

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Appendix Four: Key informant interviews (2)

The following is the list that guided the interviews carried out with the DA, Chiefs, Village heads, and Youth Leader

1. Do you think that the climate is changing?

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2. If yes, kindly explain why you think so?

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3. From your own understanding, what do you think are the causes of climate change?

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4. What are your general views on the climatic conditions (rainfall/temperature) of your area for the past 10 to 30 years?

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5. What are the effects of climate change on agricultural production in your area?

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6. What are the coping strategies being implemented by farmers' in your area so as to adapt to climate change effects?

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7. What influences farmers' choice of adaptation strategies?

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8. How effective are these adaptation strategies?

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9. What are the challenges that farmers are faced with?

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10. Are there any ways that can be used to curb these challenges?

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11. Do farmers receive support from the government?

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12. If yes, please explain further

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13. Do farmers receive support from NGOs?

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14. If yes, please explain further

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15. Do NGOs provide information about climate change to farmers?

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Appendix Five: Focus group discussions

The following is the list of questions that guided FGDs held in the three villages which are Nduna 1, Guti and Pedzisai 1

1. Is farming your major livelihood strategy?
2. Do you have any other livelihood strategies besides farming?
3. What are these? And how sufficient are these?
4. Are the rainfall patterns in Ngundu, Nduna and Pedzisai 1 changing?
5. Are temperatures increasing over the past years?
6. How is that so?
7. How frequent are drought occurrences in these villages?
8. Are there any water sources in these villages?
9. Where do you get your water from in times of droughts?
10. Is maize production still suitable for this area?
11. Do you notice that the climate is changing?
12. My you please explain further on these changes if you see any
13. What do you think is the way forward in this changing climate/
14. What role is the Government of Zimbabwe playing in addressing climate change?
15. What role are NGOs playing in addressing climate change
16. As a community is there anything that you are doing to address climate change?
17. Do you produce small grains as a strategy?
18. How suitable is small grain production in addressing the effects of climate change?
19. Are there any challenges that you are faced with as farmers in producing these small grains?
20. How do you overcome such challenges?
21. Have you ever considered migration as a strategy of addressing climate change?

Appendix Six: Agritex interview

The following is the list that guided the interview carried out with the AGRITEX staff member

1. For how long have you been living or operating in the area?

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2. Would you say the climate has changed in the past 20 to 30 years?

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3. What could be the general views on the rainfall situation for the past 20 to 30 years?

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4. How frequent is the occurrence of droughts in this area

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5. What role is the Government of Zimbabwe playing on climate change issues in the community?

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6. What are the impacts of climate change on agricultural and livestock production in Ngundu ward?

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7. What are the adaptation strategies that have been implemented in this area?

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8. How effective are these strategies?

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9. Are there any challenges faced in adapting to these strategies?

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10. Are there any ways that can be implemented to address these challenges?

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11. Do you carry any field work with community members?

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12. To what extent are the community members/farmers understand that climate is changing?

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13. To what extent do community members/farmers implement the strategies you advise them?

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14. In your view, would you say natural ecological regions in Zimbabwe have shifted?

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15. If yes please explain

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16. In your view would you say Ngundu has become a non-maize growing area?

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17. If yes please explain further

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18. Why do you think small grains are suitable for this area?

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19. Do you give community farmers support like seeds or food aid?

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20. If yes please explain further

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Appendix Seven: Life histories

1. Can you tell us about yourself and your childhood years (General life story) answering questions such as:

a. Where and when were you born?

b. Your life as a child in relation to your experiences at living at your household and living in the locality of your area.

c. Your teenage life experiences and activities that you and your household partook.

d. Events you remember during these years and how was life compared to what it is now

e. Events that happened when you were young that are no longer taking place giving emphasis to cultural practices, weather patterns, vegetation

f. How is life different from when you were young and are they any changes in the way of life ?

2. Can you tell us your early adulthood years answering questions such as:

a. How did you get married explaining the events and the process that led to your marriage?

b. If you did not get married then may you explain why?

c. What did the lobola process entail during those days and what was crucial in the payment of lobola?

d. Did marriage change your livelihood as compared to your previous life living with your parents or guardian?

e. What livelihood strategies did you carry out in your adult life and were they any challenges that you faced in terms of weather patterns.

f. What crops did you grow and do you still grow such crops?

g. Explain cultural practices that you practiced paying particular attention to weather patterns?

h. May you describe the 1990s period and how it differs compared to the 2000s?

i. Are there any events that stand out during these periods (like droughts and floods) and how did they affect agricultural production?

j. Currently are there any events that stand out and if so what do you think is causing them?

k. Have they been any changes in your livelihood strategies and if so what caused them to change?

3. Can you tell us about your current life answering questions such as:

a. How is your life different now from your past?

b. Looking at your early childhood years, young adult life up until now what major changes are you seeing in terms of weather patterns and agricultural production.

c. How is the trend of rainfall in the past 10 to 20 years in Ngundu?

d. How is the trend of temperature in the past 10 to 20 years in Ngundu?

e. Are they any changes in terms of cultural practices?

f. Has age affected your livelihood strategies and if so how and if not why?

g. Are they any adaptive strategies that you practice?

h. In terms of food shortages where do people get assistance from?

i. How is your social relationship with other villagers in the area?

j. Explain your social networking locally and with organisations such as Care? AGRITEX.

4. Internal conversations

a. How are you feeling about the changes you are witnessing?

b. What are your thoughts and feelings pertaining to changes and climate change?

c. Do you carry conversation on you own on how you can address the challenges that come with climate change?

d. What actions go through your mind before you implement strategies that you think are suitable?

Appendix Eight: Informal interviews

Mr Madzivire

1. Early life history explaining relation to the Madzivire and Chief's family (totem and clan)
2. History of Ngundu
3. Traditions and cultural practices in the area
4. Vegetation cover in the area paying attention to trees found in the area
5. Rivers and water sources in the area
6. Changes in the climate of Ngundu
7. Adaptation strategies being done by Ngundu people
8. Small grain production in the area
9. Institutions working in the area

3 Elderly farmers

1. Explain life experience of living in Ngundu
2. Rain-making traditions and cultures practices
3. Agricultural production in Ngundu
4. Small grain production in the area
5. Changes in terms of agricultural production in the area

3 Casual labourers

1. What are your livelihood strategies?
2. What influenced you to partake in casual labour?
3. To what extent are you involved in casual labour activities?
4. Where do you practice casual labour activities i.e. in the neighbouring farms in Ngundu or surrounding areas of Ngundu. If it's the latter how further away from your home do you travel?
5. In which season do you practice casual labour?
6. Is casual labour affected by drought and floods?
7. To what extent is casual labour benefiting you and your household?
8. Does it affect your household in terms of crop production during the farming season?
9. Does social networks affect find casual labour piece jobs?

1 Small grain farmer

1. How do you know about small grain production?

2. For how long have you been producing small grain?
3. Why do you farm small grains?
4. What prompted you to cultivate small grains?
5. Is cultivating small grains and adaptive strategy to you?
6. How do you manage the challenged faced with cultivating small grains?
7. What are the benefits of cultivating small grains?

Conservation Agriculture farmer

1. Why do you practice CA?
2. What C.A practices do you practice?
3. What challenges do you face implementing C.A and how do you overcome the challenges?
4. For how long have you been practicing C.A and what benefits have it brought you so far?
5. Who assist you in carrying out C.A methods?
6. Which institutions assist you and to what extent have they been of assistance?

1 Farmer: livestock production

1. What kind of livestock do you have?
2. How do you take care of your livestock during times of droughts and floods
3. What challenges are you facing in livestock production in Ngundu
4. How important is livestock production to you and how has it benefited you
5. How

2 Members of Banga Irrigation

1. How did you become involved in Banga irrigation?
2. What is Banga irrigation and how far is it from your homestead?
3. What are the major benefits of being involved at Banga irrigation?
4. Is there a difference between those who are members of the irrigation and those who are not?
5. What type of crops do you cultivate at the irrigation?
6. Do you get surplus and if so do you sell it?
7. Does it sustain you during drought years?

2 women with deep knowledge on climate change issues

1. What is your level of education?
2. How long have you lived in the area?
3. Why do you understand about climate change issues compared to others?

4. What do you understand by the term climate change and climate variability?
5. Is there climate change in Ngundu?
6. What events do you remember that showed that the climate is changing?

Thank you!!!!!