UNDERSTANDING CLIMATE VARIABILITY AND LIVELIHOODS ADAPTATION IN RURAL ZIMBABWE: A CASE OF CHAREWA, MUTOKO

A Thesis Submitted in Fullfilment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY OF RHODES UNIVERSITY

BY

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January 2015

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ABSTRACT

Rural farmers in Zimbabwe have been grappling with various changes and challenges occurring in the country since the early 1990s. Amongst these, climate variability has emerged as one significant aspect. It has introduced new challenges for these farmers who are already facing various difficulties in maintaining their insecure livelihoods. Yet, current adaptation theories and inquiries have failed to sufficiently account for and analyse the capacity of these farmers to adequately respond to changing climatic conditions. In this respect, a number of studies have been heavily embedded in deterministic concepts that regard rural farmers as passive victims who play only a minor part in decisions and actions that affect their own livelihoods and well-being. Similarly, although some studies have acknowledged farmers' capacity to adapt and build elements of resilience, they have not adequately shown how farmers interpret changes in climate and the structures, processes and conditions underpinning adaptation. Following that, my study uses a case study of a rural community in a semi-arid region of Mutoko district in eastern Zimbabwe and Margaret Archer's sociological theory to understand and analyse how farmers problematise climate variability and respond to it. The study utilises a qualitative approach to divulge the subtleties on how rural people interpret processes of change and adapt to such changes.

The thesis found that farmers are encountering increasingly unpredictable and unreliable rainfall patterns as well as shifting temperature conditions which are inducing labyrinthian livelihoods conundrums. However, these climatic shifts are not being experienced in a discrete manner hence farmers are also discontented with the obtaining socio-economic circumstances in the country. Simultaneously, whilst farmers in large part conceived changes in rainfall and temperature to be caused by natural shifts in climate, they also ascribed them to cultural and religious facets. Importantly, the thesis reveals considerable resourcefulness by farmers in the face of nascent changes in climate variability. Farmers have therefore constructed versatile coping and adaptive strategies. What is crucial to mention here is that climatic and non-climatic challenges are negotiated concurrently. Therein, farmers are adapting to climate variability and at the same time navigating difficult socio-economic landscapes. All the same, the process of adaptation is ostensibly not straightforward but complex. As it evolves, farmers find themselves facing numerous constraining structures and processes. Nonetheless, farmers in this study are

able to circumvent the constraints presented to them and at the same time activate the corresponding enabling structures, processes and conditions.

ACKNOWLEDGEMENTS

I am genuinely grateful for all the help, support and encouragement I have received on the path to completing this thesis. First and foremost, I would like to thank my supervisor Prof Kirk Helliker for providing incisive and challenging comments and for all his very careful reading of the thesis. I am grateful to him for giving me the freedom to figure out my own path, at the same time supporting me when I needed guidance. His unbounded enthusiasm for sociological theory and Zimbabwean issues contributed to my confidence to complete this thesis. I also recognise the Department of Sociology, under the headship of Prof Helliker, for providing comfortable research funds and all the support they gave me during my stay at Rhodes University.

I would like to thank farmers in Charewa who shared with me their deepest life stories. Undoubtedly, without their willingness and eagerness to converse with me, the intricate stories I have presented in this thesis would never have materialised. I specifically want to thank Sabhuku Nyakanyanga and Sabhuku Pasirayi, for they not only received me with fervor but they repeatedly stated that they felt honoured to have me undertake my research in their villages. Exceptional mention also goes to my parents in the field, Baba naMai Mugambiwa from Gotora village. They opened their home and their hearts, lived with me and treated me as their first daughter for the entire time I conducted my fieldwork in Charewa.

I am grateful to Mutoko District Administrator, Mr Mudavanhu and Mr Nyamanzi, Councilor for Charewa A (ward 3) for granting me access to the study site. Mr Makonyere and Mr Kamuloni from AGRITEX and Mr Zinzombe from EMA Mutoko were very cooperative and ensured I got the important reports that I needed. From Plan Mutoko, my highest regards go to Mr Mukutiri, Mr Kwembeya and Mukoma Elisha Mutowo. They not only gave me important information but facilitated my entry into Charewa and offered me accommodation and transport on a few occasions. To Mr Mazai from COMMUTECH, thank you for your understanding.

There are people who provided great inspiration and insights that I cannot fail to acknowledge which are: Dr S.D Chingarande, Dr A.M Nyamwanza, Dr D.P Chimanikire, Cde Dr W.Z Sadomba, Dr L Maunganidze and Dr B Mukamuri. Dr Nyamwanza and Dr Chingarande, I drew great methodological insights from you. When I made the decision to write a PhD proposal in 2011, Cde Dr Sadomba gave me very important comments that I retained throughout the entire

journey to produce this thesis. Dr Maunganidze, who agreed to be my supervisor when I submitted my first proposal at the University of Zimbabwe, your high regard of Michel Foucault inspired me to bring sociology into climate change research. Dr Mukamuri re-introduced me to phenomenology and strengthened my belief in qualitative research. Dr Chimanikire, you have remained part of the struggle to complete this thesis and you supported me from the beginning to the end. You are one person who firmly believed in climate change when there seemed to be 'organised denial' of its reality and my research proposal was trivialised in 2011. You encouraged me to stand by my ideas, even though it meant I had to start all over at Rhodes University. You also gave me climate change literature form the START Climate Library that was sufficient to write my entire thesis.

In all honesty, the fieldwork in Charewa was not easy and I could not have managed without my research assistants Kingstone and Phiona. They endured the heat and long walks even though our food comprised roasted nuts, roasted maize, sugarcane and *masawu.* On this note, I also thank Godknows Chivige for assisting me with my quantitative data analysis and SPSS, and Dau for transcribing some of my life history interviews.

Special consideration goes to my family for their enduring love, support and understanding. Many thanks to my friends Loe Marongedza, Portia Munzeiwa, Mimi Kazembe, Ody Ganza, Evans Mushawevato, Taf Chevo, M.K Chiweshe, Ob Nyamucherera, K Kujinga and Biggy Chidzvondo. Tatenda Tats Nyadutu I can never thank you enough for checking on me whilst I was in the field. Tinashe, thank you for the times you agreed to take me to and pick me from Charewa. Along the way, I also met people who believed in me right away, namely Getrude Trudy T. Bvindi and Kumbirai Tudor Mazaiwana. Colleagues from Rhodes University and University of Zimbabwe: Takunda J. Chirau, Innocent Mahiya, E.J.R Mandizadza, N.Z Choguya, Ignatius Gutsa, Nelson Muparamoto, Hope Taderera and Ushe Kufakurinani, thanks guys.

Above all, I would like to thank God for 'in his heart man plans his course, but the Lord determines his steps' (Proverbs 16:9).

CONTENTS

List of Boxes

List of Figures

List of Maps

List of Pictures

List of Tables

CHAPTER ONE: INTRODUCTION

1.1 Introduction

One of the pressing problems in Zimbabwe is the way in which rural people can secure their livelihoods under changing climatic conditions. The endeavour to maintain and enhance livelihoods systems by farmers in arid and semi-arid regions of the country is complicated by the fact that it is not only change in climate that is driving perverse livelihoods tendencies and outcomes. A coalescence of factors such as economic decline, poverty and natural resources depletion deriving from the broader context in the country are therefore contributing to the livelihoods challenges of rural farmers. Still these factors are also not evenly distributed. Incidences of poverty, for example, are predominantly higher in rural than urban areas of Zimbabwe. Amidst these facets, adaptation is now conceived as rudimentary in debates on how the impacts of climate change and variability should be managed.

Fundamentally, the need to understand and analyse how communal farmers in a semi-arid region of Zimbabwe are adapting to changing climate variability is what ultimately propelled my research. As a matter of fact, my concern was to first comprehend how farmers problematise their circumstances, the specific circumstance being climatic changes, and then subsequently analyse their adaptive strategies. This is because scholars have indicated that there exists a lucid discrepancy between the conclusions of macro assessments and the experiences of local societies living with environmental change (Adger et. al, 2003). These assessments disregard the narratives of people living on the frontline of deteriorating water resources and shrinking arable lands, which are diminishing productivity among other unfavorable livelihood transformations. At the same time, although there are arguments that the idea of climate change has somewhat been 'universalised', people in local contexts possess complex ways of reading the climate and their concerns are much more variegated. Therefore, it is apt to reason that there is need for research that moves away from the essentialist discussions and categories *a priori* in the macro assessments of climate change impacts, to consider the complex ways in which climatic shifts are experienced and problematised by local people.

The thesis grapples with various questions and uses a case study from subsistence farmers in Charewa A (ward 3) in Mutoko district in Zimbabwe to respond to these questions. Through a predominantly qualitative research approach, the study explores farmers' concerns so as to comprehend how they problematise climate change and variability. In this case study, I capture the different changes occurring in climate variability in the study site as detected by farmers. All the same, these farmers do not live in a vacuum and their concerns are not confined to climate. Whilst change in rainfall emerges as the ultimate concern for farmers, they are simultaneously dissatisfied about the prevailing macro-economic climate in the country. Concurrently, the thesis also answers the question: what do farmers perceive as drivers of changes in climate variability? The intent of the study here is to demonstrate how farmers construe changes in climate variability.

Throughout history, presented by several crises, subsistence farmers have risen above the unfavorable conditions imposed on them by developing versatile coping and adaptive strategies. Therefore, after exploring the changes occurring in climatic conditions, the other question asked in the thesis is the following: what are farmers doing in view of these changes in climate variability? The preface to the answers to this question is provided by determining the different livelihood challenges farmers are facing in the context of climate variability. In the final analysis, in line with my conceptualisation of adaptation as a complex process, I ask: what nascent constraints and enablements are farmers facing in the adaptation process? By asking this question, the ultimate aim is to analyse the various structures, processes and conditions underlying farmers' adaptive strategies.

1.2 The Problem of Climate Change and Variability in Africa

The realities of climate change and climate variability are becoming increasingly difficult to doubt especially since scientists published findings in 2007 which depicted that the earth's climate had already tremendously altered. Climate change constitutes a shift in meteorological conditions that last for a long period of time (usually centuries) and climate variability is short-term fluctuations happening from year to year (Burroughs, 2001). There is mounting evidence indicating the fact that Africa is warming faster than the global average, a phenomena which is

expected to persist. Several reports produced by the Intergovernmental Panel on Climate Change (IPCC, 2001; 2007; 2012) conclude not merely that green-house gas emissions are already starting to change the global climate, but also that Africa will experience – on significant scales – increased water stress, diminished yields from rain-fed agriculture, increased food insecurity and malnutrition, and a growth in arid and semi-arid land.

Considerable reductions in precipitation over the past decades have been observed in Africa. Several studies which have documented precipitation trends in various parts of Africa suggest diminishing rainfall and scourging droughts in the Sahel during the last three decades, and such changes have been opined as among the greatest changes in climate everywhere. Other projections on rainfall in Africa show that rainfall along areas close to the Mediterranean coast, expanding north of the Sahara, is probably going to decrease by 20% during the period 2080-2099, with a 7% increase in rainfall in tropical and eastern Africa across the equivalent period (Boko et. al, 2007). Research has also pointed out that the African continent is currently warmer than it was 100 years ago. Based on an assessment of a number of studies, Hope (2009:452) ascertained that there has been decadal warming rates of 0.29 ºCelsius in African tropical forests and 0.10-0.30º Celsius in South Africa. At the same time, in Ethiopia and South Africa, minimum temperatures have risen slightly quicker than maximum or mean temperatures and, between 1961 and 2000, there was an increase in the number of warm spells and a diminution in the number of extremely cold days over southern and western Africa. Simultaneously, in eastern Africa there have been some diminishing trends in temperatures (Boko et.al, 2007).

Furthermore, a number of observations have been made specific to southern Africa. Studies have noted rainfall increases but also enhanced inter-annual variability and anomalies in the post-1970 period contributing to more extreme and widespread droughts (Fauchereau et. al, 2003). Other studies have identified temperature increase of up to 2º Celsius between 1901 and 1995 in southern Africa (Hulme et. al, 2001) and an increase of between 0.1 ºCelsius and 0.3º Celsius in South Africa. Profound increases in heavy rainfall and weather extremes in Angola, Namibia, Mozambique, Malawi and Zambia have also been shown to exist (Tadross et. al, 2005). As well, changes in seasonality have been registered in these same countries and rainfall reduction of up to 15% in Botswana, Zimbabwe and parts of South Africa.

Concurrently, the impacts of climate change and variability are becoming poignant in developing countries which have preponderantly agrarian economies. In fact, that climate change will impact developed and developing countries differently owing to their differing capabilities for responding to the changes is admitted in both theory and policy. There is a rising consensus that climate change will induce more damage to poor countries because poor people depend heavily on natural resources for survival and these natural resources are vulnerable to destruction by floods and drought (Hope, 2009). Research also hints that countries in Africa will be impacted the most because of their geographical and climatic circumstances, high dependence on agriculture and more significantly owing to the restricted capability to adapt.

Overall, climatic changes pose massive challenges to Africa, a continent where far-flung poverty, hunger and diseases already bear on millions. Climate change as such is anticipated to compound present problems and produce new combinations of risks, particularly in Africa, because of widespread poverty and dependence on the natural environment. Impoverishment, and the lack of adequate social, economic, political and technical resources, restricts adaptation capacities of communities and countries extremely vulnerable to changes in climate (IPCC, 2007; Eriksen et. al, 2008). It is now widely acknowledged that populations located in marginal ecosystems with very confined access to technologies for coping and adaptation are to a greater extent vulnerable to climate change and variability. Whilst the extent of and exact nature of the impacts of climate change on temperature and rainfall distribution patterns remain controversial, scholars broadly concur that the poor are the most susceptible to changes in climate (Cooper et. al, 2008; Eriksen et.al, 2008).

Climate change and variability are likely to dramatically modify the face of agriculture and intensify the vulnerability of hundreds of millions of poor farmers. Climate variability directly impacts agricultural production, as agriculture is inherently susceptible to climate conditions and is one of the most vulnerable economic sectors (Parry et. al, 1999). Agriculture is affected in numerous ways, one of which is the direct impact on crop productivity.Climate therefore is a decisive determinant of agricultural productivity and any unfavourable changes in it would probably have destructive effects in this sector stimulating crop failures and, simultaneously,

affecting the livelihoods of the bulk of the population that depend on rain-fed agricultural practices.

Related to above, the impacts of increasing droughts have been widely documented across Africa. Making reference to the numerous droughts that have occurred, including the Sahelian droughts in the 1970s and 1980s, scholars concluded that these droughts induced much human suffering, undermined the ecological equilibrium and had calamitous consequences on agriculture and livestock production with aftermaths that are ostensible even today (Adepetu and Berthe, 2007). In western Africa it is approximated that, because of projected yield declines and loss of forages, Mali will suffer economic losses in the range of 70-142 million United States dollars (Butt et.al, 2005). In eastern Africa, the floods of 2007 resulted in 65% of the population in north and east Uganda losing 90% of their crops and this further compounded food insecurity (Oxfam, 2008). Also in eastern Africa, the sub-Saharan El Nino rains have been stimulating floods and devastation while, in recent years droughts have also had catastrophic effects. Accordingly, harvest failure and incidents of food insecurity have become typical events occurring at least once or twice every decade and have been described as comprising an intersection of social and political as well as natural factors (Eriksen et. al, 2008). Climate change is also anticipated to disproportionately affect smallholder farmers in southern Africa and climate variability is already making their livelihoods even more precarious. In this respect, large parts of the region are already experiencing more regular and austere floods and droughts, and withering agricultural production.

Apparently, the damaging and devastating impacts of climate change and increasing climatic variability are not limited to agriculture. In West Africa, floods left 4,000 houses in Bamako, Mali, in ruins in 2002 (Dodman, 2008). In the city of Cape Town in South Africa, the combination of sea level rise, degenerated coastal zones, exceedingly high tides and the modified frequency and intensity of storm events have been estimated to endanger tourism revenue, public infrastructure and real estate. In Mozambique, heavy rains and cyclones in 2000 ensued in the ‘worst flooding' in 50 years and brought far-flung destruction to the capital city, Maputo, as well as the city of Matola. As if this is not enough, research has also hinted at negative trends on

water resources in the region which would impact negatively on both rural and urban populations.

Finally, the expansion of both arid and semi-arid lands by 5% and 8% respectively by 2080 in Africa may imply a decrease in large tracts of agriculturally productive land (Boko et. al, 2007). Consequently, this is anticipated to reduce cereal production in many countries in Africa. On another note, for the bulk of poor people living in communities exposed to the intertwinement of climatic risks such as floods as well as inadequate access to basic health services or infrastructure in Africa, increasing climate variability entails that their vulnerability is closely linked with poverty. In this regard, climate change and variability are more likely to magnify existent poverty through decreased food availability, augmented water scarcity, financial insecurity and heightened incidences of diseases. Similarly, climate change will accordingly exacerbate poverty levels among the poor who also have no access to safety nets or assets to use to cope in the wake of a climatic shock or natural disaster (Hope, 2009).

1.3 Why Adaptation Matters

Thriving human societies are characterised by their adaptability, as attested throughout human existence. The IPCC (IPCC, 2007) defines adaptation to climate change as the adjustment in natural or human systems in response to actual or potential climatic stimuli or their effects, which moderates harm or exploits advantageous opportunities. In Africa, rural households have adapted to such factors as droughts for decades using varied ways, among them indigenous knowledge. In some extremely dry parts of the Sahelian region, households have even moved beyond dependence on climate. Speranza et. al (2010) demonstrated how agro-pastoralists in Kenya used indigenous knowledge to monitor, mitigate and adapt to drought. Similarly, in Burkina Faso, Roncoli et.al (2004) unveiled how farmers utilised traditional forecasting knowledge to formulate seasonal expectations. In northeast Nigeria, Mortimore and Adams (2001) divulged how traditional adaptive strategies have evolved in response to crises in rainfall. And, in southern Africa, studies by Thomas et.al (2007), Ziervogel and Calder (2003) and Ziervogel et.al (2006) among others have investigated local adaptation strategies to climate change and variability.

However, the speed of contemporary climate change and variability is feared to transcend the limits of adaptation in many parts of the world. Climate change and variability introduce new challenges in Africa, not only because of the expected rise in temperature and decrease in rainfall, but also owing to the prevailing context of failure to address even non-climatic problems. At the same time, I have depicted above that climate change is already inducing tremendous problems which are resulting in major and negative livelihood transformations. Adaptation is thus regarded as especially fundamental for developing countries, where societies are already struggling to address the challenges posed by existing and increasing climate variability. One can therefore posit that adaptation is crucial to deal with the inescapable impacts of climatic changes. Basically, farmers in Africa and elsewhere need to maintain a livelihood to support their families and continue producing food. In addition, adaptation in Africa is crucial as it is the continent where the 'adaptation deficit' has been most evident (Tschakert and Drietcht, 2010). According to Osbahr et.al (2007), an adaptation deficit refers to the absence of an explicit and coordinated integration of livelihood adaptation to climate change and broader development issues.

Profoundly, adaptation matters because it is an indispensable development issue. In this respect, adaptation has been embraced not only by the climate change policy community, but also by the development assistance community to address the dynamics between risk and development (Schipper, 2006). In addition, current impacts are likely to continue which signifies that sustainable development is under threat. Therefore, the rationale for incorporating adaptation into development strategies and practices is underscored by the fact that interventions needed to enhance resilience to climate variability and change broadly promote development objectives. The specific goal in linking adaptation and development is to ensure survival of livelihoods, lives and cultures during environmental change; and this can thereby assist progress in development by strengthening resilience to climatic and environmental fluctuations.

In a related manner, adaptation appears to represent a pragmatic means of achieving sustainable development in the longer term. In this case, adaptation is conceived within the context of multiple stressors and vulnerabilities, and with concern for intra- and inter-generational equity, environmental integrity and poverty eradication. Adaptation hence becomes a paradigm to guide

long term development successfully in view of increased risk from climatic, social and economic change. In the context of Zimbabwe, climate change and variability are more likely to aggravate existing development challenges through reduced agricultural productivity and related challenges. It has also been mentioned that these challenges are taking place in the context of other developmental stresses, notably poverty, fluctuating oil prices and food insecurity (Food and Agricultural Organisation, FAO, 2006), as well as in combination with other environmental changes and land degradation. Similarly, Pielke et.al (2007) remarked that vulnerability to climate-related impacts on society is growing for reasons that have nothing to do with greenhouse-gas emissions, such as rapid population increases along coasts and in areas with constrained water supplies. In light of these caveats alone, adaptation matters.

Furthermore, the significance of adaptation is justified by the fact that climate change and variability are not only current challenges. Some degree of change will occur in the future regardless of what mitigation steps are taken to reduce greenhouse-gas emissions. Even the most encouraging emissions projections exhibit global greenhouse-gas concentrations rising for the foreseeable future (Pielke et.al, 2007). In a consanguine manner, adaptation matters in its own right, not as an after-thought following mitigation. According to Mendelsohn (2009), adaptation is crucial because no realistic mitigation policy can preclude the climate from changing. As others have argued, whatever actions ultimately contribute to the decarbonization of the global energy system, it will be many decades before they have a discernible effect on the climate (Pielke et.al, 2007).

Related to the above, studies have established the tendency within the United Nations Framework Convention on Climate Change (UNFCCC) and other platforms to 'marginalise' adaptation (Schipper, 2006) and have concluded that adaptation has not been accorded significant space. In this case, adaptation has been conjured as a secondary response option, after abatement of greenhouse-gas emissions. On a critical note, Pielke et.al (2007:597) remarked that 'for much of the past two decades the mere idea of adapting to climate change became problematic for those advocating emissions reductions, and was treated with the same aversion that the religious right reserves for sex education in schools'. This concentration on mitigation has created policy instruments that are biased against adaptation (Pielke, 2005). Therefore,

renewed concentration on and rehabilitation of the idea of adaptation is urgent. Policy makers need to understand the limitations of mitigation for reducing vulnerabilities, and give more urgent consideration to broader processes and strategies of adaptation.

On a different note, from an economic perspective, it is critical to adapt to climate change so as to limit the damaging effects on the economy, and to enable businesses to take advantage of opportunities for new markets and services. Certainly, adaptation has an extremely decisive role in reducing the economic costs of climate change and variability across Africa. This is because while adaptation has a cost, it significantly reduces the residual costs of climate change in the long run and will also reduce future damages, thus implying that less resources will need to be spent on mitigation (Climate East Midlands, 2014). Adaptation can assist people most vulnerable and reduce the need for compensation (Mendelsohn, 2009). As well, from an environmental perspective, adaptation is important to protect the natural environment. We depend upon healthy, resilient ecosystems to provide life-supporting ecosystem services, besides also recognising the intrinsic value of the natural world (Climate East Midlands, 2014). Arguing with thoughts consistent with the domain of sustainability science, people need to conserve the environment for the benefit of current and future generations.

Related to the above, and considering the rampant poverty in Africa, from a poverty reduction point of view adaptation has been stressed as an integral and exigent part of overall poverty reduction strategies. More so, though the field is still underdeveloped, some scholars have attempted to map the connections between climate change, human insecurity and violence (see Barnett and Adger, 2007; Eriksen and Lind, 2009). In this regard, climate change and variability threaten human security principally through potentially negative effects on people's well-being. Hence this is the *a priori* reason why adaptation matters.

1.4 Problem Statement and Significance of Thesis

Pielke et.al (2007:597) succinctly argue that '[n]ew ways of thinking about, talking about and acting on climate issues are necessary if a changing society is to adapt to a changing climate'. This quotation synthesises the constellations of my thesis and the problems it addresses. In the

preceding sections, I have drawn attention to the problems of climate change and variability particularly in southern Africa. I have also critically elaborated on why adaptation matters from various dimensions. In light of this background, in this section I explicate on how current studies on adaptation are marked by considerable debate and I then outline the contribution of my thesis to existing knowledge. In essence, the significance of my thesis emerges from a number of problems I have identified through extensive review of a wide array of studies.

Adaptation to the impacts of climatic changes is now at the vanguard of scientific inquiry and policy dialogues yet problems persist. More explicitly, sociological investigation into the social dimensions of climate change has increased substantively in recent years, but some prominent gaps remain (Davidson, 2012). Sociological theories and debates (including any with particular reference to Zimbabwe) have contributed surprisingly little to the understanding of local adaptation; yet rural communal farmers in Zimbabwe are regarded as highly susceptible due to their dependence on rain-fed agriculture. For instance, isolated sociological studies such as those by Gutsa (2010) and Gukurume (2012) contain no profound contributions for understanding adaptation processes in rural Zimbabwe. Basically, there is no consolidated sociological work on climate change in general and adaptation in particular in the country of Zimbabwe.

At the same time, the prime focus of analytical energies of some climate change studies have been on naming and categorising adaptive strategies. In other words, adaptation research in Zimbabwe has long been about classifying adaptive (and coping) options to alleviate projected impacts instead of the processes by which actual strategies are constructed. Related to the foregoing, I have also encountered a large body of literature on adaptive capacity and factors constraining it, mostly structural factors. Whilst there is nothing inherently problematic with this literature, it seems that much of the research tends to focus on measurements of adaptive capacity, with capacity presumed to be the primary stimulus for adaptation (and in these instances, adaptation tends to be treated as a one-dimensional aspect) (Davidson, 2012). Yet, meaningful contributions to understanding social responses to climate change require examining more than adaptive capacity. It is at least a prudent to analyse the very different ways in which people formulate the problem of climate change (Davidson, 2012) and the processes underlying their responses. At the same time, because some studies are not explicit on adaptation processes,

they assume adaptation is self-evident. Consequently, there is a misnomer between theoretical depiction and real processes and conditions underpinning adaptation in empirical terms in rural Zimbabwe.

Wolf (2011) contends that, although advances in climate projections have expedited a move from the study of climate change impacts to concrete adaptation strategies, research that focuses on the social process of adaptation has been comparatively disregarded, particularly in local contexts. International organizations such as the UNFCCC (UNFCCC, 2007) defines adaptation as the process through which societies enhance their ability to cope with an uncertain future, which involves taking suitable action and making adjustments to reduce the harmful impacts of climate change. The idea that adaptation is a process is quite a relief here. However, Klein and Juhola (2013) insist that much adaptation research reposes on a conceptual foundation developed in the 1990s by Smit et. al (1999; 2000).

Whilst this conceptual foundation has been viewed as useful and influential in structuring academic discourse and policies on climate adaptation, there are notable problems as the intricacies of the social processes underpinning adaptation are not taken into explicit consideration, thereby impacting not only on research but also policy. When properly regarded as a social process, the psychological, social and cultural aspects of adaptation are divulged, which at the same time conveys the effects that values and power dimensions have on actual adjustments and their consequences for adaptation (Wolf, 2011). In addition, there are many definitions of adaptation. However, a widely used one in Zimbabwe, as proposed by the IPCC (IPCC, 2007), emphasises – in a simplistic fashion – the linear nature of adaptation rather than considering adaptation as a complex process that involves interwoven strategies taken by specific actors (Eisenack and Stecker, 2012).

Furthermore, more generally, research has largely concentrated on predicting impacts on agriculture and other economic activities mostly on a national scale. Much adaptation research still conveys the impression that detailed knowledge of future climate conditions is indispensable for adaptation policy and decision-making. In this respect, the IPCC (IPCC, 2001) admits that there is increased confidence in predictions of climate change at global level. But, there is still

great uncertainty at local levels, where information is needed by farmers to reduce vulnerability. In many parts of Africa, the adaptation discourse is still preponderantly focused on responding to the predicted impacts of future climate change rather than addressing how people are currently experiencing the impacts and formulating responses to them. As a result, given that climate is ordinarily only one element driving adaptation decisions, the 'predict-then-act' approach to science in support of climate change adaptation becomes significantly flawed (Dessai et. al, 2009).

In light of the above debates, the major contribution of this thesis is to demonstrate how adaptation functions as a complex process underpinned by various structures, processes and conditions in contemporary rural Zimbabwe. To sketch the conceptual terrain of my argument, I suggest that the lives of farmers in rural Zimbabwe cannot be simplistically read from a grand narrative of social structure or political economy that constrains the adoption of adaptive strategies. What is needed is a much more robust theoretical stance to build an authentic and clear picture of farmers' concerns and how they respond to the changes in the world they live in. This takes me to the much neglected work of sociologist Margaret Archer who offers a social realist account of human agency. Using Archer, my position is rather counter-normative. I embrace reflexivity to analyse how adaptive strategies are constructed in relation to socio-structures, social interactions and local conditions and, explain how farmers are 'persons' showing an inventive capacity to circumvent the constraints imposed on them in the process of adaptation. After all, it is argued that adaptation is underpinned by societal perceptions, values and decision-making structures, and that these need to be deliberated on explicitly in adaptation research and practice (Wolf, 2011).

As alluded to, in trawling through Zimbabwean literature, I have encountered an under-theorised field of adaptation studies despite the fact that quite a number of local studies are empirical (see studies for instance by Moyo et.al, 2012; Mtambanengwe et.al, 2012: Mudombi-Rusinamhodzi et.al, 2012; Mapfumo et.al, 2010; Simba et.al, 2012a and 2012b). I have also expressed my discontent with the lack of sociological theories in adaptation research. This thesis therefore makes a contribution by offering a comprehensive sociological theorisation of adaptation which may extend current adaptation research beyond mere descriptions and categorizations of specific

actions. Certainly, to be able to fully understand how the process of adaptation evolves, there is need to go beyond mere categorisations. I argue that it is through analysing those structures, processes and conditions that other scholars have often disregarded that one may expand the understanding of adaptation in rural Zimbabwe.

Methodologically, by studying local level adaptive actions and practices of subsistence farmers, this study is a significant departure from current studies on adaptation. Through my continuous engagement with literature, I have noticed that a number of studies in Zimbabwe tend to dwell more on national level and sectoral adaptation. In general, research mirrors methodological dichotomies by focusing marginally on micro-level practices and predominantly on macro-level aspects. To a great extent, farmers' concerns and their adaptive strategies are omitted in these dominant, mainstream storylines (that is, macro-studies on climate change and variability). As a matter of fact, my thesis focuses on the micro-scale because it is now increasingly recognised that environmental knowledge, including those surrounding climatic issues, needs to be understood on a local scale (Brace and Geohegan, 2010). Therefore, the approach that I adopt in this thesis also emerges from what Ireland (2012) notes as an array of calls in the prevailing literature which evoke a need for additional exploration of discourses in local contexts in the realm of climate change adaptation. My thesis, as a result, fills an important gap by providing a more refined sociological understanding of how and under what structures, conditions and processes adaptation occurs in local scales.

Furthermore, my study exposes the significance of espousing a qualitative research approach in studying complex processes such as adaptation. The insularity from real lives and chronicles of local farmers evident in some climate change studies is a cause for concern. In general, the techniques used to plan adaptation have been intemperately shaped by positivist scientific narratives of gradual change and economic narratives of marginal adjustments to that change (Jones et.al, 2013). Connected to this, Glover (2006:69) pronounces that 'objective science has been and remains to be the foundation upon which the entire climate change discourse has been established, with quantitative data collection and analysis and, climate modelling being at the centre of gathering knowledge about climate processes, building scenarios of future climate as well as informing adaptive responses across different scales'.

Therefore, what have egressed are third person 'objective' perspectives that neglect local narratives associated with collaborative inquiries and community dialogues (O'Brien and Hochachka, no date). Subsequently, in this thesis, I emphasise research that shifts from the positivist fixation on such aspects as 'objectivity' and generalisation to actively bringing on board nuances on contextualised farmers' experiences of changes in climate and narratives on responding to that change. As such, a qualitative approach provides a different window on the study of processes of change by drawing attention to how local people understand, read and interpret the environment.

Besides taking a nuanced approach in studying adaptation, another point of departure, which Archer's theory allows, is capturing how adaptive strategies are evolving. Certainly, adaptation to climate change is a complex, multidimensional, and multi-scalar process that assumes variegated forms (Bryant et. al, 2000). In reflecting upon the literature on climate change in Zimbabwe, it is clear that there is an implicit presumption that adaptation is 'a once-off event'. Focusing on temporal scales, such as the period (1992-2014) covered in this thesis, allows one to effectively capture the dynamic nature of adaptive strategies as well as the structures, processes and conditions underpinning these strategies.

1.5 Research Questions and Goals

Following the significance of my thesis articulated above, the ensuing questions guided the organisation of methodological issues in the thesis:

- What changes are occurring in climate variability in the research site (Charewa)?
- What do farmers perceive as the drivers of these changes?
- What livelihoods challenges are farmers facing in the context of climate variability?
- What are farmers doing to deal with changes in climate?
- What are the constraining and enabling factors in adaptation process?

The main goal of the thesis is to *understand and analyse how farmers problematise climate variability and how they are responding to it in a rural community in contemporary Zimbabwe*. The specific goals are to:

- Explore and determine changes occurring in climate variability.
- Determine livelihoods challenges under conditions of climate variability.
- Investigate and establish the adaptive strategies being deployed by farmers.
- Critically analyse the constraints and enablements in adaptation process.

1.6 Background to the Case Study Area

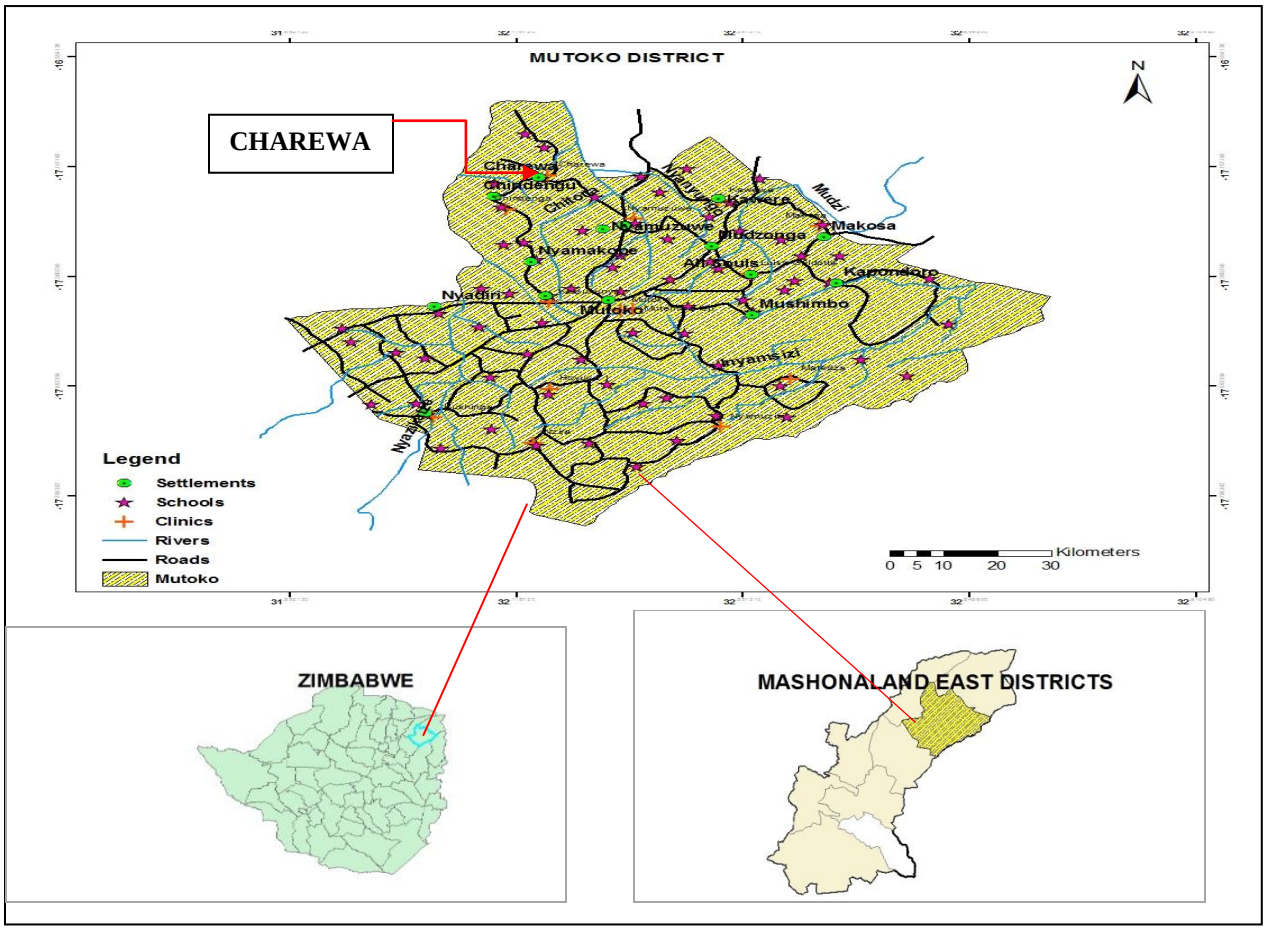
This study was carried out in Mutoko district shown in Map 1.1 below. Mutoko is a semi-arid district located in the north-eastern part of Zimbabwe; it lies within Mashonaland East province and shares boundaries with Murewa, Mudzi and Nyanga districts. Mutoko growth point is located 143 kilometers from Harare and 90 kilometers form the Zimbabwean border with Mozambique. The growth point was established as an administrative outpost for the British administrators in 1911 after it had been delimited as part of Mashonaland and placed under the Salisbury magisterial district in 1899. Mutoko spans over 428,916 hectares of land and it is divided into 29 wards, with 19 being communal wards, 4 small-scale commercial farming wards, 5 resettlement wards and 1 growth point ward. 149,000 hectares of land have been surveyed and categorised as follows: 54,000 hectares of arable land, 58,000 hectares of grazing land and 37,000 hectares waste land (bare rock and areas of shallow rocky soils) (Mika, 2010). Small-scale farm or farm plot sizes range from 0.2 to 9 hectares, with a mean of 2.5 hectares. Uncategorised land has over the years been set aside for resettlement of newcomers in the south of the district.

1.6.1 Demographic Characteristics

The district population amounts to 145,676, with 70,567 males and 75,109 females (Zimbabwe Statistical Agency, ZIMSTAT, 2012). In terms of age, 15.5% of the population in the district is under 4 years, 33.7% between 5 and 14 years and 50.8% above 15 years (Mika, 2010). In terms of population dispersion, 69% resides in communal areas, 23.3% in resettlement areas, 4.3% at the growth point and 3.4% in small-scale commercial farms. The growth point is densely populated at 198 people per square kilometer, followed by communal areas at 46, resettlement farms at 23 and small-scale commercial farms at 10. Rural-urban migration is viewed as high as

people move to search for work in the capital city of Harare. In addition, the incidence of single-parent headed homes is growing, ascribable to the AIDS pandemic.

Map 1.1: Map of Mutoko District



Source: Adapted from Mudowaya (2014).

1.6.2 Climate and Ecological Context

A large part of Mutoko falls within natural (or agro-ecological) region IV which receives only 450-600 millimeters (mm) of rainfall per year and is susceptible to regular seasonal droughts. Precipitation occurs principally between November and March, followed by a seven months dry season. Temperatures are fairly high with daily summer averages ranging from 27º Celsius to 32º Celsius while winter temperatures are moderate (14º Celsius minimum). Because of moderate winter temperatures, most parts of the district are frost-free. Significant yearly divergences in rainfall or rainfall variability are materialising such as during the 1982-1984 period. Mutoko was

severely hit by drought during this period, whilst in 1985 rainfall surpassed the usual yearly average (the total average for 1985 was 900 mm).

Another serious drought hit Mutoko in 1991/92 season. In fact, rainfall in the district is becoming more erratic and uncertain, as it is marked by the late onset and early cessation of rainfall season. Rainfall seasons are becoming shorter, with both extended dry and wet spells that are adversely affecting crop production. For example, in the 2012/2013 season, more than 600 mm of rainfall were received in January only, yet the entire season received just slightly more than 850 mm. On 18 January 2013, Mutoko experienced a flash flood with 94 mm of rainfall, surpassing the 74 mm record set in 1963.

Most of the 19 communal wards, including my case study unit (ward 3), are located in natural regions IV and V, with small scale commercial farming areas in region III and resettlement areas in region II. Comparatively speaking, the latter two regions are more suitable to agricultural production because of the soil and rainfall conditions. This arrangement in Mutoko is part of the colonial legacy of Zimbabwe. The majority of black subsistence farmers were pushed into marginal mountainous areas of region IV, with a few blacks settled in region III (a belt of Purchase Area Land) to form a buffer between minority whites in region II (now resettlement areas) and the majority blacks in communal areas. Resettlement areas have higher quality and bigger pieces of land situated in high rainfall areas.

More so, natural region IV is marginal for agricultural production attributable to unfavorable climatic circumstances (erratic rainfall and high temperatures) and low soil fertility. Although natural region IV is overly dry for productive crop production without irrigation, most communal farmers have no other alternative but to grow crops in these areas even without access to irrigation. Dominant soils in Mutoko are derived from granite rocks and are in general low in fertility. As noted by other scholars, the soils of the peasant (communal) areas of Zimbabwe, derived largely from granite and basement complexes, are by and large infertile (Campbell et.al, 1997). They are for the most part sandy, having low clay content, low moisture holding capacity and are easily erodible (Environment Management Agency, EMA Mutoko, 2014). Moreover, broadly, the vegetation in the district is defined by sluggish growing tree species such as thorn

trees with some *musasa* (acacia), *muwuyu* (baobab) and *masawu* (ziziphus mauritiana) trees distributed across the district. However, most of the original flora and fauna no longer exist owing to numerous factors such as settlement patterns and agricultural activities.

1.6.3 Economic Structure

Mutoko is marked by extensive rain fed crop production specifically food crops which include small grains (sorghum and millet), maize, groundnuts and bambara nuts as well as sunflower and cotton production on a small scale. Cropping patterns in most of the communal areas are biased toward self-reliance though cash cropping is also discernible. Groundnuts are generally grown for consumption and excesses are sold to supplement household income, especially as cotton production has been waning due to lower prices. In case of reasonable rainfall, the most significant source of income is sale of dry land crops. In this respect, subsistence farmers have diversified into tobacco production and horticulture. Horticulture, to a great extent practised in communal areas, is a vibrant farming system in the district. Tomatoes, leafy vegetables, onions, cucumbers and butternuts are widely grown in communal and resettlement wards. There are also a few formal irrigation schemes in resettlement areas where fine beans and carrots are widely grown.

Apart from crop farming, farmers rear livestock such as cattle, goats and poultry. In the wet season, major rivers, seasonal pools and shallow wells provide sources of water for livestock. Black leg, anthrax, and red and heart water are common diseases that affect cattle in the district, while pulpy kidney affects goats (Zimbabwe Vulnerability Assessment, ZimVac, 2011). The Department of Veterinary Services in the Ministry of Agriculture provides vaccinations either for free or through animal levies.

In addition, there are diverse economic activities at the growth point including formal and informal trade. As well, gold panning, petty trading and casual labour are used to supplement income and food deficits particularly by poor households. Forms of casual work engaged in include land preparation, weeding, harvesting, garden fencing and cotton picking. Agricultural casual work is done on farms in resettlement and small-scale commercial farming areas in the

district and outside the district in places such as Macheke. People in the district also go for gold panning in Makaha mainly during the dry season and Nyadire, one of the major rivers passing through the district, offers further opportunities for gold panning. Petty trading is done throughout the growth point but most activities are concentrated around the main market constructed by local authorities. Goods sold range from food-stuffs and electronics to second hand clothing obtained in Mozambique. Furthermore, sand abstraction for construction and brick moulding is also prevalent (EMA Mutoko, 2014). Numerous clay and sand abstraction sites have been established around the growth point. Nonetheless, illegal sand abstraction is also plethoric particularly along streams thereby accelerating erosion and siltation of rivers. Government departments, Non-Governmental Organisations (NGOs) and business enterprises provide most formal employment at the growth point. Some households also obtain remittances from relatives working in Harare, 140 kilometers away (Shumba et.al, 2012).

At the same time, the springs and water from the mountains are reckoned as critical to the economic survival of communal people in the area. The district has 37 mapped wetlands which are a cardinal part of livelihood activities of the agrarian population. Wetlands furnish water during dry spells common in the district and pastures for livestock. However, the local Environment Management Agency (EMA Mutoko, 2014) reports that roughly 80% of the wetlands are moderately degraded while some are poorly utilised. Conservation initiatives and indigenous knowledge have been noted as playing noteworthy roles in sustaining some of these wetlands.

Mutoko is well endowed with black granite minerals. According to the District Administrator (Key informant interview March, 2014), black granite mines in the northern and north-eastern parts of the district provide employment to almost 600 people. The granite is mined mainly for export purposes. However, most key informants concurred that the mining sector's contribution in economic terms is insignificant. There are also a number of mining claims still unexploited. The black granite miners have been involved in disputes with the Rural District Council (RDC) and the Environmental Management Agency (EMA) for not investing in the district and causing tremendous environmental degradation, respectively. Additionally, Benson mine and LaFarge cement plant also provide prospective employment opportunities (ZimVac, 2011).

1.6.4 Infrastructure and Social Services

In terms of education, Mutoko is serviced by 57 primary schools and 27 secondary schools. Most school leavers enroll at Nyadire, All Souls and Tabudirira Training Centre. There are 2 Mission hospitals in the district, Louisa Gudotti and Nyadire, 1 district hospital, 7 council hospitals and 9 government Rural Health Centres (RHCs). Mutoko is a malaria prone area, yet there is no adequate malaria medication to treat malaria. There is one growth point (Mutoko centre), 1 hotel and 3 lodges in the district. The centre is a hive of economic activities, providing an assortment of services, including a Grain Marketing Board, a hospital and a transport network connecting the centre to Harare and Marondera (Chiripanhura, 2010). The major roads in the district include one tarred and numerous gravel roads. These are serviced by the Ministry of Transport, District Development Fund (DDF) and Mutoko RDC. Most of these roads are in poor conditions due to lack of maintenance. The district has 22 dams; even so, their carrying capacity is heavily being impeded by siltation and increasing seasons of low rainfall.

1.6.5 Culture and Gender Relations

Mutoko is considered culturally homogenous in many respects. It is primarily inhabited by the Buja people, who have settled in Mutoko from various parts of what is now Mozambique. The dominant culture in Mutoko is shaped by the Buja people. The land, particularly the mountains, proffers material and cultural realms where the dead are buried. Hills are esteemed as repositories of cultural artifacts; caves, for example, are burial places for people such as chiefs. Furthermore, most of the households in Mutoko are male headed although female headed households are increasing. Cousins et. al (1992:14) established that ‘men serve as bread winners based on some form of non-agricultural employment whilst women may consider themselves as housewives with control over the household’s assets and greater obligation for subsistence tasks and the education of children’. Even supposing that, it is widely reckoned that Buja women do not control household assets such as land, cattle and farm implements. Women also tend to take the backseat in numerous affairs such as community governance. Nevertheless, women are progressively taking on active roles in ward development committees and civic associations that are becoming more prevalent in the district. They are therefore a formidable force that cannot be ignored in policy processes.

1.6.6 Key Developmental Trajectories

The central government and local RDC are primarily responsible for development in the district. Complementing the government and council attempts to develop the district are NGOs, central among them being Plan Zimbabwe (Mutoko Unit), Mother of Peace Orphanage, Mutemwa Leprosy Centre and Community Technology Development Trust (COMMUTECH). Food aid has been persistent in the district for a number of years. This has led to a high dependency for people in the district as they plan for aid as an annual food source. The consequence of this dependency is the diminution in coping capability and expansion of existing livelihood strategies; and this has grave and protracted implications on livelihood security for people in this area (ZimVac, 2011).

In terms of socio-economic development, Mutoko district is placed among the ten least developed districts in Zimbabwe in spite of the proliferation of granite mining. Before 1991, the granite rock was simply mined as a resource and not a mineral. Mutoko RDC controlled the granite mining activities and revenues. The RDC was also responsible for apportioning extraction licenses and collecting mining levies. It created a framework for dialogues between local communities on the one hand and miners on the other hand. When local land negotiations were still workable, royalties obtained by the council were invested in upgrading services in the district, for example, Mutoko High School and Tabudirira Training Center.

Research demonstrates that the district at some points in history was food self-sufficient (Makonyere, 2011). However the area is experiencing food shortages attributable to poor distribution of rain, unavailability of inputs and lack of draught power among households. Most communal households indeed encounter food deficits between March and October (Shumba et. al, 2012). Yields for the staple crop, maize, have declined from over 2,000 tons in the 1990s to about 600 tons at current. At the same time, tobacco (which was not previously popular in the district) is increasing; for example, in the 2012/2013 season, 1,100 bales were produced. More so, 99% of households in the area earn less than US$250 per month, an amount way beneath the poverty datum line (ZIMVac, 2012). In this case, households are impelled to make trade-offs between proximate household demands and sustainability both in production and consumption. The EMA in Mutoko (EMA Mutoko 2014) argues that, as a consequence of being impoverished,

people in the communal areas are inclined to over-utilise natural resources to fulfill needs such as firewood, agricultural production and water.

1.7 Research Methodology

The methodology adopted in this thesis responds to my conceptualisation of adaptation as a complex process underpinned by various structures, processes and conditions. As such, the thesis process began with a review of secondary literature and this lasted throughout the duration of the thesis. At a more empirical basis, I focus on a specific case study where I conducted a small survey, key informant interviews, life histories, transect walks, observations and informal group conversations. Before discussing these specific research techniques, I provide an overview of the philosophical basis and research design underpinning my research methodology.

1.7.1 Philosophical, Ontological and Epistemological Foundations

Margaret Archer aptly argues: 'No social theory can be advanced without making any suppositions about what kind of reality it is grappling and how to explain it. All social theory is ontologically formed and methodologically shaped even if these processes remain concealed and barely admitted by the practitioner' (Archer 1995:57-58). In light of this assertion, my thesis is disposed toward a research methodology which speaks to the ontological and epistemological arrogates underlying critical realism, specifically the variant propounded by Margaret Archer. Before I go into details, I need to highlight that one of the challenges of employing Archer's framework was that I was unable to locate many examples of endeavours to use Archer's morphogenetic approach in the field of climate change adaptation. As some scholars have discovered, the potential of this approach for empirical research is yet to be recognised (Quinn, 2006). In addition, notwithstanding the usefulness of her framework, it was inconceivable to incorporate all aspects of it in my thesis; therefore I extracted from it what I believed would practically guide my research intentions.

My research was underpinned by social realist ontology. A researcher's ontological posture governs the kind of explanations and theories that can be forwarded from within the context of what s/he conceives to exist socially (Archer, 1998). Social realist ontology is therefore

established on a stratified perspective of social reality in which both society and people have *emergent properties and powers* which are irreducible to one another. According to Archer, '[i]rreducibility entails that the different layers are *separable* by definition precisely because of the attributes and powers which belong to each of them and whose emergence from one another rationalises their distinction as strata at all' (Archer, 1995:13). In terms of epistemology, critical realists admit that our world is socially constructed but contend that this is not exclusively the case. They interpret rather than construct the world. Critical realism recognises that social phenomena are as such substantive and, hence, that substance is not only outwardly descriptive of them but constitutive of them (though of course there are generally embodied constituents too).

Methodologically, Archer proposes that the morphogenetic framework is a working methodology aligned with realist social ontology, which explains how emergence occurs. Archer (1996) reasons against what she calls the 'fallacy of conflation' (both the conflation of structure and agency and of culture and agency) in favor of what she terms analytical dualism. In essence, social realism admonishes against: 'One-level' accounts, founded on a uniform view of the social world, whether this represent the 'psychology' of the upward conflationist, the 'sociology' of the downward conflationist or the 'social psychology' of the central conflationist (Archer 1995:105). Social realism therefore postulates a methodology premised on the rationale of analytical dualism where explanation of why things social are so and not otherwise hinges upon an account of how the properties and abilities of the 'people' causally interlock with those of the 'parts' (Archer, 1995:15). Because structure/culture and agency are ontologically disparate entities, each with its own properties and powers, the methodology applied to analyse them has to enable the researcher to study the interplay between the two (Quinn, 2006). In the context of my study, this meant analysing the nexus between material structures and processes underpinning adaptation (the systemic level) and the farmers involved in the context of my case study. Archer's contention is therefore that this methodology is capable of permitting a researcher to untangle the dialectical interplay between structure and agency, and between cultural and agency, over time (Quinn, 2006).

As a whole, 'critical realism offers a programmatic alternative to numerous other philosophies of social science as it blends an ontology that discerns the existence of layered social mechanisms with discrete effects and a theoretically led, non-empiricist account of knowledge production' (Mills et.al, 2010). In this respect, the morphogenetic framework enables a researcher to give an account of how and why 'things' have either transformed (or been elaborated) or remained the same (been reproduced). It therefore opposes the traditional dualities of positivist and constructionist epistemologies and the related polarisation of quantitative and qualitative methods. Indeed, critical realism is comparatively tolerant with reference to diverse research methods: 'Compared to positivism and interpretivism, critical realism supports or is compatible with a relatively wide array of research methods, but it inculpates that the specific choices ought to hinge upon the nature of the object of study and what one wants to learn about it' (Sayer, 2000:19). All the same, as with all philosophical approaches, critical realism cannot be considered as the right answer and its adoption rests on whether one concurs with its basic premises. Therefore, in the context of my study, I concur.

1.7.2 Study Design

The study used a case study design. This is consistent with a critical realist ontology and epistemology. Critical realism 'respects several features of case study research design which are: investigation of actors' discourses and negotiated meanings; concern to set specific social processes in context, both within and surrounding the case; and attention to the sequencing and dynamics of social processes over time' (Mills et.al, 2010). A case study implicates an exploratory and in-depth inquiry into an issue in a real life situation while a case refers to an entity, event or unit of analysis. Case studies 'have all the components of a good story as they tell what happened, when, to whom, and with what results' (Patton, 2002). Case studies are preoccupied with how and why things happen, allowing the investigation of contextual realities. Additionally, the efficacy of the exploratory case study approach is explained by Baharein and Noor (2008), namely, that case studies become especially valuable where one needs to understand some specific problem or situation in great profundity and where one can distinguish cases with rich information. Therefore, these were critical considerations I made in settling for a case study research design.

One important factor in the case study approach is the selection of the individual unit of study and the determining of its boundaries. In this regard, I took the district (Mutoko) as the main case study, Charewa (ward 3) as the unit and households in the ward as the embedded sub-units placed within a multifaceted context including socio-economic, political and ecological processes. The case study approach for the most part permitted me to ground the study of the complex process of adaptation in natural settings. It enabled me to derive a context-bounded representation of the adaptive strategies farmers are pursuing and the structures, processes and conditions underpinning these.

Notwithstanding this, it is crucial to recognise that 'findings from case studies are not 'representative' hence further inquiry may be necessary in order to demonstrate the extent to which findings can be generalised' (Sayer 1992:249). Even supposing the quest for generalisation, Flyvbjerg (2006) postulates that formal generalisation is overestimated as a source of scientific development, whereas 'the strength of example' is undervalued. In light of these contestations, I present my case study in this thesis in a manner which recognises the similarities and divergences to cases in other contexts, appeals to tacit knowledge, provides insights into lived experiences, and is valuable in adaptation policy contexts and practices.

1.7.3 Sampling Techniques

The research utilised mixed sampling techniques. A variety of sampling techniques were employed at different stages of the research process depending on a number of factors encountered during fieldwork. The reasoning is that as any study progresses, new categories or nascent situations may arise which propels the researcher to decide on sampling in a particular dimension.

1.7.3.1 Selection of Main Case Study

The selection of Mutoko district as the case study area was done using a purposive sampling technique. Purposive sampling is a form of non-probability sampling where the researcher subjectively targets a certain area, group of people and/or respondents whom she/he conceives are most suitable (and possess sufficient characteristics) to be able to address the postulates of the problem(s) under study. According to Patton (1990), the logic on sampling termed

'purposeful' rests on choosing information-rich cases for studying in depth, with such cases being those from which one can learn a great deal about aspects of fundamental importance to the purpose of the research. The objective is therefore to obtain the greatest possible amount of evidence on a given problem or phenomenon, and the case is chosen on the grounds of its suitable information content (Nyanwanza, 2012).

Therefore, I considered a number of aspects in selecting Mutoko as a case study, which are:

- The major part of the area falls in semi-arid, agro-ecological region IV (the annual rainfall is between 450-650 mm);
- The area is found in a hot, low lying land and ecosystem which is marginal for rain-fed maize; it is however ideal for drought resistant grain, fodder crops and livestock production (Bird et.al, 2002);
- The area is susceptible to seasonal droughts and severe dry spells during the rainy season (mid-season droughts); and
- Livelihood strategies are dependent upon climate, marked by significant levels of poverty and complicated more specifically by climate variability.

1.7.3.2 Selection of Wards and Villages

The case study unit selected for the inquiry is Charewa A (ward 3) which has 20 villages. There were a number of considerations in selecting the number of wards and villages for this study. Significantly, these included the motive to uphold analytical rigor and develop research that is robust, and gathering a quality and amount of data sufficient to accomplish the main objective of my study. I also considered the fact that no scientific study of this nature has been conducted in the ward. The practical aspects of conducting robust research within the available time frame and with the available resources also counted in the selection of the ward and villages.

The ward selected provides generally an enlightening depiction of the features of most of the other 18 communal wards in the district. It has the following attributes: located in agro-ecological region IV like most of the communal wards; livelihood activities (communal

subsistence farming centered on maize, groundnuts and horticulture) which are common in all the communal wards; malaria prone as most wards in Mutoko; high population density (46 people per square kilometer, a common feature of Mutoko communal areas (Mika, 2010); poor road networks which makes it remote; and a virtually homogenous ethnically as most communal wards (as opposed to resettlement areas). Therefore, I was convinced I would obtain data from the ward that would allow me to do an analysis which is in line with the thought to provide as rigorous as conceivable an understanding of the issues under research.

The two villages selected for this study are Pasirayi and Nyakanyanga with 19 and 56 households respectively. As I mentioned above, the selection of these 2 villages from a total of twenty had more to do fulfilling the objectives of this study and conducting robust research as well as the practicalities of conducting research is such a distant area. It is also imperative to mention that my study dwells more on temporal properties regarding farmers' adaptive strategies rather than their spatial dimensions. Therefore, these two villages cannot be regarded as statistically representative but nonetheless 'represent' the authentic experiences of farmers in ward 3 and more general patterns and trends in climate variability and adaptive strategies.

1.7.3.3 Selection of Historical Timeline and Timing of Research

The period covered in this study is 1992 to 2014. It is critical to take temporal dynamics into account given that livelihood emerges out of past actions and livelihood decisions are taken within specific historical and agro-ecological conditions. However, establishing the appropriate temporal scale demands that one captures the time periods that are decisive to qualify change in the area under study. Several factors, including significant historical events and data availability, should be taken into account before ascertaining the temporal range and increments for a study (Buchanan and Acevedo, 2012). Therefore, factors considered in my study include the following: evidence that 1990-2000 was the warmest and driest decade of the century in the country; the debilitating 1992 drought, which was the country's worst in the 20th century; and, generally between 1992 and 2014, the country has experienced several severe droughts (1991/1992, 2000/2001, 2007/2008). I also took cognisance of increased extreme events such as floods and cyclones (Eline in 2000/2001, Japhet in 2002/2003 and Ernest in 2004/2005) under the same

timeline. Since climate variability denotes short term (5-10 years) fluctuations, this selection made it possible to trace and compare decadal changes in the 1990s and 2000s. In addition, the availability of meteorological data for Mutoko district contributed to my interest in selecting the aforementioned period.

Furthermore, in line with meeting my study goal, which is to provide an in-depth understanding and analysis of adaptation to climate variability, the 1992 to 2014 period was long enough to trace and capture in-depth adaptive strategies across time. I am confident that it would have been an analytical error to assume farmers' strategies are static. The period was also long enough for one to conduct robust research, obtain adequate data and make concrete conclusions.

My fieldwork was conducted between March and August 2014. I planned my fieldwork to coincide with the 2013/2014 agricultural season. The seasonal perspective greatly enriched my understanding of the issues under study. It was appropriate timing because it allowed me to observe farmers' livelihood activities in real life. As well, this enabled me to understand farmers' concerns on the particular season's trends in rainfall and temperature as well as livelihood challenges. Any changes in livelihoods strategies within the season were also probed.

1.7.4 Data Collection Methods

Based on the conceptualisation of adaptation as a complex process, my research methods were predominantly qualitative. In line with my goal to capture a deeper understanding of what Patton (1990) describes as the non-observable, inner perspectives, that is, farmers' thoughts about changes in climate variability and the strategies they are pursuing, I found qualitative methods to be more suitable for my thesis. Similarly, I found it necessary to use a method which is capable of giving an account of mechanisms and processes in terms of system properties, farmers' dispositions and farmers' actions 'within recognised social practice, in such a way that the effective linkages between these levels may be demonstrated' (Nash, 2002: 398). It therefore was of utmost importance to understand the perceptions, experiences and practices of the communal farmers under study.

In addition to qualitative methods, a survey technique was utilised as part of a quantitative methodology but only for the purposes of triangulation to complement the qualitative methods. The survey therefore provided the general picture by quantifying and summarising various issues under study. More importantly, it provided an entry point in conducting an in-depth study using qualitative methods.

1.7.4.1 Primary and Secondary Documents

My thesis commenced with a review of secondary and primary literature. The collection and examination of this was a continuous process and served a number of purposes. Firstly, it provided the context in which farmers' adaptive strategies are located. Secondly, perusing existing studies helped in identifying the lacunae in current climate change studies and subsequently framing the contributions of my thesis. Thirdly, it guided in the framing of questions used in conducting my fieldwork. Fourthly, some of the literature was used to support the analysis of findings in the thesis. Lastly, the review of literature provided data that for various reasons could not be obtained in the field. The review targeted both hard and soft data. Besides academic literature from different university libraries, the main sources of information were a wide range of internet databases with soft data and hard or paper-based data from government departments such as Environment Management Agency, Mutoko (EMA Mutoko) and Agricultural Research and Extension (AGRITEX) as well as NGOs.

The search for internet data bases on the internet did not follow strict systematic criteria. Both open access and subscription based databases were targeted including Hinari, Google Scholar, ScienceDirect and Springerlink. Within these data bases, relevant journals were purposively targeted and browsed for content. In searching for articles, various search terms such as climate change, climate variability, adaptation to climate change and impacts of climate change were applied broadly at first, and then narrowed down in order to obtain specific studies on Zimbabwe. From EMA Mutoko, I obtained the 2014 State of the Environment Report for Mutoko and from AGRITEX reports on crop production, yields/output, areas planted in the district under the study period and rainfall data for the ward. Rainfall data provided for ward 3 was however insufficient to allow any analysis of trends, hence I did not use it in the thesis.

1.7.4.2 Household Data Collection

The life history interview, which privileges the narration of personal biographies, was the principal data collection method in this study. This was supported by a survey, transect walks and observations. The choice of life histories as the main method was meant to ensure I collected the data I needed to respond to the nature of my study, the research questions and the objectives of the study. Such interviews can be used to identify key moments in an individual's life (shocks, pivotal moments and transition points) and how they responded (agency, coping strategies). Life histories provide a wealth of data about people and their experiences rather than aggregated classifications, categories and characteristics of adaptive strategies (Kothari and Hulme, 2004).

Life histories can be used to track changes in well-being at various points in an individual's past and to comprehend what has driven these changes. They enable a more complex and nuanced understanding of different realities while simultaneously revealing common themes and trends which reflect wider social characteristics and processes (Kothari and Hulme, 2004). Life histories therefore enabled me to trace changes in climate variability and farmers' livelihoods, and to understand adaptive strategies across time scales. This method was particularly useful in exploring livelihood changes in Mutoko in view of the existence of multiple drivers of change in rural Africa in general and Zimbabwe in particular. Several scholars have drawn attention to the complexity of drivers of change in the Sahel (Mortimore and Adams, 2001) and in southern Africa (Thomas et.al, 2007; Ziervogel et.al, 2006), hence singling out climate as a direct driver of changes is not a simple matter. In view of this, I took heed of the argument of Mushonga and Scoones (2012) that by combining the household survey and wealth ranking data, together with in-depth biographic interviews we can look in more depth at the patterns, causes and consequences of livelihood transitions.

I contend boldly, therefore, that life history was the most ideal method to identify how farmers negotiated the structures which constrained them (or enabled them) when they made their choices of action (adaptive strategies) at 'critical moments' or 'turning points' in their lives. Pledging my intention not to become overly defensive about life histories (at the same time, I am not being apologetic), I insist that without this method of understanding farmers' lives, our insights into how they adapt to climate variability can only be myopic. Life history interviewing

thus gives space to a more replete examination of the complex ways in which people negotiate the opportunities and constraints shaping their adaptive strategies. Since I was interested in reflexivity, life histories revealed that people cogitate upon their situation, they contemplate about their particular circumstances, they ruminate about their concerns, they ponder over their options, they mull over the choices available to them – in short they think about how they should act in the real world and this thinking brings with it powers that can be causally efficacious (Peterson, 2011).

Respondents for life histories were selected from the households engaged in the questionnaire survey. I used a general life history guide, shown in Appendix 1, to ensure I captured all the facets of my study. At the same time, I ensured minimum interruption to allow farmers in my study to fully narrate their life stories. The selection of 18 individuals (11 females and 7 males) who provided life histories depended on my subjective evaluation of the value of the individuals' contributions (as guided by their input during the questionnaire survey exercise) in relation to the goals of the thesis as well as their availability and willingness to offer personal interviews. On the number of interviews, I considered practical issues such as the availability of respondents and the amount of time I required to complete each in-depth life history. In any case, when it comes to how many qualitative interviews are enough, Baker and Edwards (2012) say 'it depends'.

A survey was conducted at the household level to complement the qualitative methods. I used a questionnaire (see Appendix 2) as a tool and this permitted the quantitative characterisation of household perceptions on observed and experienced climate and other changes, perceptions on changes in household livelihood strategies, perceptions on causes of changes in climate variability, adaptive strategies employed and the various constraints and enablements implicated in these strategies. Largely, the questionnaire provided the basis for selection of individuals for life history interviewing. However, my anxiety over the use of questionnaires in the thesis derived from the fact that they miss out phenomena because of the use of specific categories. It was also impossible to capture internal conversations that would allow me to extrapolate the dominant modes of reflexivity using questionnaires.

Bearing in mind my historical time line and the need to capture the temporal dimensions of adaptive strategies, the selection of households for the questionnaire followed purposive/judgmental sampling based on time lived in locality. Therefore, households targeted were those that had lived in the ward on or before 1992. I was convinced these households had lived long enough to have experienced, observed or witnessed considerable local and other critical climatic events as well as shifts in livelihood strategies. I therefore administered 60 questionnaires, to 10 qualifying households in Pasirayi village and 50 households in Nyakanyanga village. Six households participated in a pre-test survey that I conducted in order to identify potential problems associated with the interpretation of the questionnaires.

Transect walks were conducted focusing more on eliciting information on observed landscape. A transect walk is a method for describing and showing the location and distribution of resources, features and landscapes along a given transect and it involves in-field observation, conversations, and diagramming. Therefore, I took transect walks in the selected villages to observe crop fields, gardens, resource collection sites (such as water points), livestock and pastures, natural resources and features, present land use patterns, vegetation and other practices. These observations were augmented and clarified in conversations to capture changes in the physical features and cropping systems. At the same time I noted critical events that occurred in the field, for example, rainfall events between 18 and 20 April 2014.

I made use of local analysts *Makumbi* (local analysts) who were provided by the villagers during transect walks. Local analysts are people who provide an overview on the resources and resource use practices and structures in villages. Local analysts advised on the routes to follow during the transect walks and also provided explanations for some of the observations made. I used an observation guide presented in Appendix 3, to collect information for example, on what resources are abundant or scarce, which land use activities are evident and which resources have problems. Data gathered through observations enabled the verification of information gathered through other techniques and the checking of discrepancies between what people said in questionnaires and life histories, and what they actually did in practice.

1.7.4.3 Community and Institutional Data Collection

Although the household was the main unit of analysis, data was collected at community and institutional levels because these affect what happens at the household level. It was therefore important for the investigation to cover some key community events, actors, organisations and institutions within the larger environ of the in-depth study community.

In-depth interviews were conducted with key informants at the community level to provide expert information on data being sought. In the same manner that I complemented household data with transect walks and observations, I did the same at the community level. According to Diccico-Bloom and Crabtree (2006), key informants are selected for their knowledge and role in a setting and their willingness and ability to serve as translators, teachers, mentors and/or commentators for the researcher. They should have knowledge relevant to the study, be willing to share this knowledge, communicate well, and be unbiased or able to reflect upon their own biases. If appropriately situated in a social and community context, key informant interviews also render the opportunity to explore multiple positions on community relations pertaining to a given issue.

Therefore I selected the key informants for my study based on various categories which are: social position/standing (for example, selecting religious leaders); roles or responsibilities (for example selecting the farmers' chairperson, village heads and community representatives); and social cultural embeddedness based on their roles and age (for example, in selecting elders). The assumption on age in my study was based on the idea that those who have lived many years have heard, experienced and seen a great deal. A snowballing sampling technique was only used in isolated instances when the AGRITEX officer at Kagande (ward centre) referred me to a farmer who won the 2014 Agricultural Show and when one spiritual leader referred me to a leader in another church.

Therefore the 17 community key informants comprised 4 elders (selected on the basis of age only), 2 elders who participate in traditional ceremonies including those for rain, 4 spiritual

leaders (those who pray through *Vadzimu* (ancestral spirits) and those who pray through Jesus)[1], 1 farmers' leader, 2 outstanding farmers who won the 2014 Agricultural Show competition, 2 village heads and 2 community representatives[2]. Questions (see Appendix 4) included asking key informants to identify community concerns in relation to climate components or parameters that have changed, how these have changed, how they characterise the changes, what they attribute the changes to, what has happened to livelihood strategies in the ward and what the community members have done or are doing to offset livelihood challenges (adaptive strategies). In addition, a ward map was also obtained from villagers in ward 3.

I also conducted 10 interviews to gain expert information from stakeholders from government departments and NGOs working in the district. These operate at both community and sub-national (district) levels. The stakeholders were: the District Administrator; 2 AGRITEX officers[3], 1 Livestock Production and Development officer, 2 Veterinary officers[4], 1 officer from the District Development Fund (Water Division) and 1 health worker at Charewa Rural Health Centre (RHC). I interviewed stakeholders from both a local and international NGO working in the area which are COMMUTECH and Plan Zimbabwe (Mutoko Sub-Unit) respectively. Aspects covered in the key informant guide (see appendix 5) that guided interviews with these these stakeholders included agricultural practices and associated changes; vulnerability and livelihoods in the district; natural resources management and risk reduction in agriculture.

Additionally, a participatory method was used through several informal group conversations that were conducted with farmers and key informants. These were not planned but more of random encounters that I strategically utilised to discuss various issues. The groups comprised 3 or 4 elders depending on their availability. These conservations served three main objectives. Firstly, I deliberately used these conversations to seek clarity on some issues raised in key informant interviews and questionnaires as well as aspects that l observed about the landscape during my

[1] I used this analogy to avoid using the dichotomy of traditional versus modern religions.

[2] These are commonly known as CR, and were selected to represent their villages in NGOs projects.

[3] One was at district level and one based in the ward.

[4] One was at district level and one based in the ward.

transect walks. I had my first and second group conversations on the 17 April 2014 at Kagande Primary School where I met elders who had come for the United Methodist Church Easter prayers and 18 April with elders who had come to the same school for Independence Day Celebrations. From there I took advantage of various events and opportunities to have conversations with elders until I finished my fieldwork. Secondly, I used the informal discussions to establish an agricultural calendar (presented in chapter 6) crucial for understanding the livelihoods system of the ward as well as getting a detailed profile of the study site.

Thirdly, it was in these repeated group conversations that participatory wealth ranking was also conducted and the information fed into the wealth categories used in the survey I conducted at the household level. The variable of wealth was imperative as studies have established its influence on adaptation. Wealth ranking is a simple, participatory research tool that evolved from the 1980s alongside the growth of participatory rural appraisal (Guijt, 1992). It has been widely used in research to advance qualitative understandings of patterns of social differentiation within communities and to complement survey techniques. The method involves a group of local informants discussing what they mean by the term wealth in ways that tease out the multiple meanings.

In the local ChiBuja language in ward 3, wealth means *upfumi* and this is associated with assets such as cattle, food production, type of homestead and family well-being (like ability to send children to school and ability to hire labor). A person without wealth is therefore *anotambura* (one who suffers) and is called *murombo* (a person without anything). Therefore, insights from these conversations together with those from key informant interviews were used in designing the questionnaire for the study. After the questionnaire administration, four categories were extrapolated from the data, namely, *vanowana* (better off), *vari pakati* (middle) *vanoshaya* (poor) and *vanoshayisisa* (very poor).

1.7.5 Data Analysis

My presentation of findings in the thesis largely follows a reflective, narrative approach. I recounted critical field events, fused narratives from life history interviews with perceptions from key informant interviews, and illuminated these with pictures and numbers to tell a story about farmers living with change in Charewa. I am convinced that this was the best way to reliably draw the reader into the vignettes of my own observations and farmers' stories. Regarding data analysis, there is no agreed method in using qualitative data analysis techniques. The theoretical lens from which the researcher approaches the phenomenon, the strategies that the researcher uses to collect or construct data, and the understandings that the researcher has about what might count as relevant or important data in answering the research question, are all processes that influence the data analysis (Thorne, 2000).

In this respect, Archer's theory was used as a lens through which to view the data, understand the strategies adopted by farmers and develop my arguments. I use quite a number of quotations in my empirical chapters to illustrate my arguments. The use of quotations in this thesis was fundamental because presenting life history data allows the voice of the respondent to be heard whilst, at the same time, giving vent to researchers' own interpretations and analyses of data (Hubbard, 2000).

The process of qualitative data analysis was based on a thematic approach. A thematic analysis is one that looks across all the data to identify the common issues that recur and identifies the main themes that summarise all the views one has collected. I began the process with familiarisation, which involved immersion in the raw data (or typically a pragmatic selection from the data) by listening to tapes, reading transcripts, and sifting and sorting notes and other pieces of data in order to detect key ideas, concepts and themes. Secondly, I rearranged the data, building categories until all the emergent coherent, recurrent and sub themes were identified. Finally, I interpreted the data, which means attaching meaning and significance to the analysis (Taylor-Powell and Renner, 2003). This entailed conceptually interpreting the main thematic categorisations, searching for inconsistencies, contradictions and associations between themes, and generating conclusions using my theoretical framework.

For quantitative data, responses were fed into a computer using SPSS software. The analysis and presentation included descriptive statistics such as frequencies, percentages and averages. Finally, I note that qualitative data analysis ideally occurs concurrently with data collection so that investigators can generate an emerging understanding about research questions, which in turn informs both the sampling and the questions being asked (Dicicco-Bloom and Cabtree, 2006). Therefore, my research was an iterative process switching between data collection, analysis and interpretation, with literature being consulted throughout the process to help clarify emerging concepts and ideas.

1.7.6 Ethical Considerations

All research implicates ethical issues. I agree with what Berg (2001:39) postured that 'as a social scientist I have a great extent of ethical obligation to my colleagues, study population and larger society'. The Rhodes University Ethical Guidelines[5] first alerted me to the ethical dimensions of my research. Similarly, Birch et. al (2012) argue that ethical questions in the research relationship, the use of data and the interpretative and analytical processes have all become more significant as the landscape of qualitative research continues to change and researchers face new issues when using new tools to produce knowledge.

Entry into the Mutoko district and ward 3 was negotiated through gatekeepers that included the District Administrator, the ward councilor, village heads and traditional leaders. My initial contact with the leaders in ward 3 was facilitated by Plan Zimbabwe (Mutoko Unit). The NGO is working in the ward in the areas of livelihoods, food security and child education. I took advantage of one of their field visits (to conduct workshops on child marriages in the ward) in March 2014 to introduce myself to community leaders and seek permission to conduct my study in the ward. The process involved briefing the authorities on the purpose, procedures, outcomes and uses of my research. In doing this, I took heed of the fact that there is no excuse for keeping the fieldwork's true purpose secret, even if the potential informants may dislike the project when the agenda is revealed. Therefore my method of gaining access to the ward was through open and consensual negotiation with the gatekeepers.

[5] Found at: http://www.ru.ac.za/media/rhodesuniversity/content/ethics/Ethical_Guidelines_Human_Subjects.pdf

Access to the key informants, places of interest (such as fields and gardens) and household heads was negotiated at the community and household level. I took note of the fact that participants in research naturally have a right to decline to take part in and at any phase of the research process. Informed consent, then, is a fundamental element of ethical practice, alongside related concerns such as the avoidance of deception, harm and exploitation, and the principles of confidentiality and anonymity. I therefore sought verbal consent from each research participant and stressed his or her right to terminate the interviews. In line with what other researchers have done, the process of seeking consent was dynamic and continuous. Consent should be ongoing and renegotiated throughout the research process and researchers need to continually reflect on what it is that research participants have consented to (Miller and Bell, 2012). I hence did not assume that respondents who had agreed to participate in the survey would automatically give me their life histories.

Respondents were also assured of confidentiality in the use of a tape recorder and camera, and I gave them the chance to refuse their use. I was therefore conscious to the idea that researchers should use the tape-recorder judiciously and with consent. In addition, in obtaining qualitative data, I adopted the concept of active interviews, as suggested for critical realist researchers. I did this in order to fully interact with research participants in my study. Holstein and Gubrium (1997) developed the conception of active interview in opposition to a positivist model in which 'neutral interviewers simply extract information from interviewees, seen as mere carriers of opinions, sentiments and the unadulterated facts and details of experience'. Thus, my interviews were more similar to conversations than to situations where one of the parties (usually the interviewer) has the dominant position. I also answered to questions about myself, whenever research participants had some. In particular I was asked many times, *kumusha kwenyu ndekupi uye mutupo wako chii* (where do you come from and what is your totem?), to which I graciously answered. As stated by other researchers, it is important that participants have the sense of being listened to and they feel that they have been 'given voice'. Central to these concerns are the concepts of agency and competence. Research participants must be able to express their own agency within the research process, rather than being treated merely as subjects upon whom research is done (Heath et.al, 2004). It is therefore a truancy that the respondent remains an active agent, who not only holds facts and details of experience but, in the very process of

offering them up for response, constructively adds to, takes away from and transforms the facts and details.

As well, my data was collected and processed with stringent confidentiality to protect the identities of the farmers, especially knowing that some of their coping strategies are prohibited (such as cutting down trees and cultivating in stream/river banks). Participants were assured of privacy through the use of pseudo-names in my data analysis unless where consent to use actual names was granted. Informed consent included participants' consent to allow me to publish the research findings subject to the requirements in respect of confidentiality and anonymity espoused in the Rhodes University Ethical Guidelines. In my presentation, I also extensively use pictures from observed landscape aspects such as fields, gardens and streams. The use of full pictures of respondents is limited in the thesis and, in instances where I do so, consent was sought and granted.

Furthermore, in order, to give voice to the farmers in my study and present their views as authentically as possible, my thesis – as indicated earlier – used many quotations in presenting findings. However, I am aware of the complications involved in attempting to give respondents in my study voices through quotations. I realised during my data analysis, as I went through my transcripts many times, that I could not use everything I got on tape. This means that I left out some parts of the conversations, which may mean that whilst I gave 'voice' to respondents, these respondents, given a choice, may have chosen different quotations. I therefore got comfort in the notion that there is not one single right way to interpret data. In my chapters, my voice appears stronger than the voice of the farmers in Mutoko, yet I am aware that subjectivity is inevitable.

1.7.7 Methodological Limitations and Challenges

In this section, I outline methodological shortcomings and challenges encountered in undertaking this thesis as well as what my thesis does not do. I provide these so that I ease the mind of the reader and also establish a clear platform for suggesting areas for future research in my last chapter.

1.7.7.1 Limitations of Study

The major drawback of my thesis is that it does not provide an elaborated analysis on the dominant modes of reflexivity as espoused in the Archerian perspective. As I later highlight in the following paragraphs, the kind of data I obtained in Charewa did not allow me to reliably make conclusions on the dominant modes of reflexivity. Furthermore, although I made use of a small survey, my use of quantitative data in my empirical chapters is limited. For some readers then, the use of a survey as a data collection method may seem immaterial. I therefore reiterate that my use of a survey was predominantly intended to establish an entry point for conducting life histories and also portray an overall picture of various issues under study. In line with my thesis goal and objectives, I therefore draw primarily on qualitative data in presenting my empirical chapters and present quantified results to a limited extent.

1.7.7.2 Sampling and Data Collection Dilemmas

I had no illusions that undertaking this study would be easy. The main methodological challenges I encountered pertained to selecting key informants at community level, selecting villages for in-depth study, data collection on internal conversations and understanding the ChiBuja dialect and terms. Some of the key informants in my study are the elderly, who have been living in the ward way before 1992. As I stated before, the assumption on age in my thesis was based on the notion that old people have heard, seen and experienced a lot hence they can serve as key informants. Whilst this was true to great extent, a few elders could not remember some past issues. To counter this, I considered that in seeking knowledge from key informants, subjective perspectives and meanings also arise in these interviews. In conducting the rest of the fieldwork, I thus kept reminding myself of their potential bias in interpreting, understanding and translating the social meanings of and motivations for community members' behaviors. I rectified this methodologically by using informal group conversations in which respondents probed and reminded each other of events and issues.

Pertaining to the selection of villages, I initially wanted to use distance from main road as the selection factor, therefore I would select one village closest and one furthest. This is in line with the hypothesis by Maddison (2006) that, as the distance from input and output markets increases,

adaptation to climate change decreases. However, the reality in the ward did not allow that. In the end, I allowed the practicalities of accessing furthest villages to guide the selection of villages.

At the same time, qualitative data collection and the subsequent transcription and translation of interviews were not simple processes. One of the things Margaret Archer did not clearly articulate in her theory was how to access research participants' internal conversations. In the context of my thesis, these were self-dialogues which individual farmers had when they pursued particular strategies. While quite a number of the respondents remembered, some did not recall the exact details of those particular moments. Even though I continuously probed, repeatedly asked questions and followed up on respondent's responses, for some interviews I ended up obtaining disjointed accounts. At the same time, some of the accounts were thinner than I expected. It was clear that a number of respondents did not feel comfortable getting deeper into those private moments they 'talked to themselves'. In the end, it was impossible to reliably identify the dominant modes of reflexivity across time hence my thesis only recognises internal conversations about adaptation processes as presented in chapter 8.

On a different note, one of the issues that I underestimated in selecting Mutoko as a case study was the language. I admit my naivety to think that just because the Buja people speak Shona, language was not a problem. On the contrary, people in Charewa use the ChiBuja dialect, which to me is quite complex. I had to grapple with terms and phrases that I did not understand. Therefore, to resolve this challenge I had to repeatedly request respondents to deconstruct them for me during interviews. Although this clarified issues, at times this interrupted the flow of the interviews. This was more complicated in life histories where I intended to let respondents tell their life stories with minimum interruption. Whilst in some instances I sought clarity during the interviews, after my fieldwork I also found myself confronted by life history interviews on tape that ought to provide answers to the research questions that had spurned my fieldwork yet I did not comprehend some of the terms and phrases.

As a result, I sought assistance from a number of people in translating some of the terms and phrases. Simultaneously, in my empirical chapters, I have in many instances presented the actual

quotations in ChiBuja language for emphasis and then my English translation. Although I attempted to enmesh myself in the Buja context during my fieldwork and sought clarity from respondents and those knowledgeable in ChiBuja language, I boldly acknowledge that it was inevitable that what respondents actually meant was altered at times during translation. As a researcher guided by critical realism, I am aware that social actors, the research participants and (in the context of this thesis) myself are 'contingently positioned and therefore always observe the world from a fixed position, ultimately, resultant knowledge is, and will always be, fallible' (Scott and Morrison 2006: 107).

1.7.7.3 Ethical Dilemmas

I was aware that ethical dilemmas were inevitable in my research, but l was not sure of how these would play out in practice. These later emerged from gate keepers, access to respondents, seeking consent and respondents' expectations. To counter these ethical dilemmas, I adopted a contextual, situational and practice-based approach to ethics suggested by Birch et.al (2012).

One of the aspects which heightened my interest to conduct my fieldwork in Charewa is the Dzimbawe, where the chief resides and traditional ceremonies are conducted, including those involving rain. In this regard, I intended to either visit the place or interview the people (as key informants) directly responsible for the activities in Dzimbawe and also those who maintain the place. These are the chief's messengers and the chief's right hand man. Still, I did not manage to conduct these interviews. When I briefed these elders about my research and my intentions in April 2014, I was told to bring five dollars that I would use for *kuwombera mambo* (greeting the chief) and also wear dark clothes only (red clothing is prohibited) in order to get access into Dzimbawe. I agreed to this.

Nevertheless, during my subsequent field visits, I was told it was no longer possible to do so as the chief had a lot of disputes with which she was dealing with. In terms of interviewing key informants, I was informed that they were not sanctioned by the chief and Nehoreka (the tribal spirit) to reveal anything that goes on in Dzimbawe. This experience made me agree with the view that that key informants may serve as gatekeepers that can limit the population (and places)

to which researchers are able to gain access to. I also alerted myself to Broadhead and Rist's (1976) caution against confrontation with gatekeepers. Therefore, I resorted to selecting villagers who attend *mabira ekuteta mvura* (rain seeking ceremonies) in Dzimbawe but do not hold any positions of authority.

Some of the strategies I used to have access to respondents created ethical dilemmas. This proved the argument that the relationship between the ways in which participants are accessed and the data collected as well as the means by which decisions are taken around access to respondents, can be closely bound up with ethical questions. Farming activities in Charewa are systematically structured, such that from 1 June every year, farmers will be tending to their gardens and this means from around 10am every day, almost everyone will be in their gardens. The gardens are located kilometers away from homesteads. In Pasirayi village it was manageable because homesteads and gardens are clustered around the wetland. In Nyakanyanga, homesteads are far apart and this is further worsened by distant gardens. Therefore, to have access to villagers, the headman suggested that we met them at a central place. Although this made questionnaire administration easier, it presented ethical problems. My legitimacy was severely scrutinized because I had 'summoned' villagers to come for village meetings. As a result, I had to constantly assure the respondents of my position in the community and the fact that only their leaders have the legitimacy to call them for meetings. I also reiterated to them continually of their right to decline to participate in my research process.

Related to the above was the challenge of obtaining written informed consent from respondents. During the pre-testing of my questionnaire, I discovered clear reluctance to give written consent by participants. It then emerged in my continuous engagement with them that they did not feel comfortable signing their names because of political reasons. Generally, the support of opposition political parties is not tolerated in the ward and Mutoko as a whole. Therefore, respondents did not want to be put in vulnerable positions later on when their signatures somehow ended up being associated with the opposition party, specifically Movement for Democratic Change (MDC). In fact, they did not want to end up being accused of signing up for MDC. This is despite the fact that all the respondents gave me their full names. It turned out that because respondents had expectations of food aid (as I discuss below) they were willing to give

me their names. Not providing a signature (for political reasons) would protect them from any politics that would later come but, in the event of aid, this would not jeopardise their chances of getting aid. Although I assured respondents of confidentiality and kept on reiterating the purpose and uses of the research, most respondents were not forthcoming. I therefore resorted to obtaining verbal consent.

Furthermore, Charewa has a long history of food aid. From my interactions with villagers, it became obvious that they associated outsiders who come to the ward with food aid or projects. I admit that my association with Plan Zimbabwe (Mutoko Unit)[6], which currently works in the area and has provided food aid on a number of occasions, added to the respondents' expectations. Furthermore, the fact that I targeted specific households in line with my time scale, attracted discontent from some households that did not meet the criteria because they felt they were being excluded from the list of those to be given aid. More so, because respondents had expectations they were reluctant to provide information on household income, something I discovered during the pretesting of the questionnaires (and of course this was complicated by the use of multiple currencies in the country).

To manage these expectations, I had to continuously explain my position (university student), the nature of my research (academic research), its purposes (fulfilling the requirements of my degree programme) and their roles in my research. In addition, in such a context, one also needs to guard against epistemological fallacy, that is, failure to realise the effects of structural factors when there are such effects. Indeed, I discovered some inconsistences during questionnaire administration which may have been motivated by the expectation of aid. For example, respondents would say they did not own any livestock. In this regard, observations and probing were used to cross check some of these inconsistences. Pertaining to the reluctance to reveal household income during the pretesting of questionnaires, I follow up the issue in chapter 5 and explain how I ended up using other indicators of wealth.

[6] As indicated above, my entry into the ward was facilitated by Plan Zimbabwe, Mutoko Unit.

1.8 The Structure of the Thesis

This thesis is structured into nine chapters. I begin with the introductory chapter presented above which basically lays the foundation for what my thesis is all about.

Chapter 2 provides a review of scholarly literature on the concept of adaptation and draws attention to the theoretical framework employed in the thesis. It first focuses on the emergence of the term in various disciplines. Then, I locate the concept of adaptation in global climate change inquiry and engage with various debates on how it has been framed. From there, the chapter moves on to what I want to understand as the sociology of climate change. Here the chapter presents debates on one of the striking issues in the development of my thesis, that is, the 'trivialisation' of climate change adaptation in sociological theories and debates. After presenting the various arguments on how and why sociology is lagging behind in climate debates, the chapter proceeds to discuss the various analytical approaches on adaptation in Africa and again the absence of sociological theories is noted. Finally, on the basis on the studies reviewed, the chapter introduces the theory by Margaret Archer, which I use as the theoretical lens to understand and analyse how farmers problematise climate variability and how they are responding to it. In the chapter, the main ideas of Archer are articulated, the absence of Archer in climate change research is expressed and her relevance is sufficiently justified. The chapter also emphasises how the sociological theory of Archer provides both an intriguing and novel way of conceptualising adaptation in rural Zimbabwe.

Chapter 3 is a contextual chapter that offers an overview of climate change and variability in Zimbabwe and its impacts on agricultural livelihoods. This serves as the national context within which my study is situated. The chapter begins by outlining the key socio-economic and political trajectories in the country. Under this section, the emphasis is on the role of climatic risks and hazards in shaping and reshaping various events in the country, particularly the decline in agricultural production. The reasoning is that whilst factors such as the Economic Structural Adjustment Programme (ESAP) and the fast track land reform contributed to the economic decline in the country, the role of climate risks and hazards is equally important. By following that line of argument, the importance of climate change and climate variability as research issues is therefore illuminated in the chapter. Following these aspects, the chapter presents the patterns

and trends in climate change and variability and subsequently the impacts on agriculture in the country. In essence, the key aim is to explicate how these have been framed and the implications for adaptation theory and practice. Two key trends are extrapolated from literature, which are macro level, quantitative model based studies and micro-level, farmer-focused studies. Contrary to studies that view macro and micro level studies as simply antagonistic, I highlight the divergences and convergences, dwelling more on both theoretical and methodological issues. I also challenge the various tendencies in macro studies on several grounds. In the end, the chapter therefore provides a clear entry point for me to undertake a micro-level study on adaptation.

Chapter 4 looks at how adaptation has been framed and debated in climate change literature in Zimbabwe. To map the terrain for discussing the main issue, I begin the chapter by engaging with policy, institutional and legislative frameworks on climate change obtaining in the country. Fundamentally I highlight the weaknesses which characterise these frameworks. From there, the chapter is organised into various themes based on the observations I made in my critical review of literature. I therefore submit various arguments on the rise of adaptation as a research and policy issue, methodological approaches in adaptation research, theorising adaptation and the connections and disconnections between adaptation theory and practice. The various conceptualisations of adaptation are acknowledged as useful but the chapter finds it problematic that structures, processes and conditions underpinning adaptation in all its complexity have not been sufficiently considered in research. In particular, besides illuminating the theoretical inadequacies evident in the use of middle-level theories such as those focusing on vulnerability and the Sustainable Livelihoods Approach (SLF), the chapter also reiterates on the lack of sociological engagements with adaptation in Zimbabwe. In addition, various case studies presented towards the end of the chapter reveal that there are no explicit linkages between adaptation theory and practice in the country. Consequently, the conclusion makes it clear that there is need for further research that responds to some of the problems identified in adaptation research in the country.

Chapter 5 begins to introduce the empirical findings of my thesis. Using data from a small survey, qualitative interviews and observations, the chapter presents how farmers problematise climate variability in the study site. The chapter starts by outlining the local context of the study.

Here I describe the various aspects that enable the reader to have a clear picture of Charewa (ward 3). These aspects include the history of the area, the demographic aspects, leadership and authority structures and wealth. Then the chapter moves on reveal farmers concerns pertaining to changes in climate variability. The chapter emphasises that what emerged as the ultimate concern for farmers is rainfall and thus findings are presented on late onset of rainfall season, early cessation of rainfall season, rainfall distribution, extreme rainfall events, rainfall adequacy and rainfall quality. Notwithstanding that, I present concerns on changes in temperature and also extend the presentation to farmers' concerns beyond climatic issues. I proceed to discuss the perceived drivers of changes in climate variability with the intention of elaborating to the reader how farmers interpret changes in local climatic conditions. Therefore, the reader encounters a discussion on the cultural and religious aspects as perceived drivers of changes in climate variability.

Chapter 6 builds on the previous chapter and discusses the livelihoods challenges in the context of increasingly changing climate variability in the study site. These challenges however cannot be understood without a clear understanding of the livelihood systems and dynamics in the study site. Therefore, the chapter first presents various issues that comprise the livelihoods of farmers in this semi-arid rural area. These are the agricultural calendar, the farming systems and other non-agricultural livelihood strategies. From there, the chapter gets into the complex livelihoods challenges farmers are encountering in the context of changing climate variability. The challenges are organised under various themes namely: the disruption of the agricultural calendar; harvest failures and livestock losses; livestock and crop management challenges; water scarcity and depleted water resources; land degradation; and disruption of ecological aspects. In discussing the various challenges, the chapter emphasises that it is not only climate variability driving negative livelihoods changes in this semi-arid area. The chapter places changes in rainfall and temperature in the broader context in which farmers are located. Therefore, climatic issues are interacting with other processes such as economic decline, poverty, poor farming techniques and depletion of natural resources to escalate livelihood complications for farmers in Charewa.

It is in chapter 7 that one begins to understand how farmers are responding to increasingly changing climate variability. The chapter begins by acknowledging that farmers in my study do

not live at the mercy of climatic conditions discussed in chapter 5. The chapter then makes two arguments pertaining to how farmers are responding to multiple challenges in the process of adapting and how farmers' adaptive strategies are not necessarily new. From there, the chapter delves into the actual strategies adopted by farmers and these are organised under various themes as follows: re-organising crop production; supplementing household food and income deficits; intensifying and expanding micro irrigation and horticulture; increasing crop and livestock diversification; conservation agriculture; soil management in the context of climate variability; adapting water management practices in the face of adversity; livestock management in difficult circumstances; dealing with climate variability through formal and informal networks; using trees to deal with climate variability; and increasing the role of indigenous knowledge in the face of adversity. I also state in the chapter that whilst some strategies are novel, adaptive strategies in this thesis should be principally understood in terms of intensification, extensification and revival.

Chapter 8 is the last empirical chapter hence it links the findings in all the empirical chapters. In the chapter I argue and show that contrary to popular tendencies in existing research to present adaptation in a simplistic manner, adaptation is a complex process underpinned by various structures, processes and conditions. There in, the chapter proceeds to discuss the various constraints and enablements faced by farmers in the process of adapting to changes in climate variability. The innovation in the chapter is that it shows how farmers elude various constraints and actuate enablements presented to them. In the final analysis, the chapter shows that farmers are reflexive hence they do not remain entrapped in the various objective structures and processes they encounter in the adaptation process.

The thesis ends in chapter 9. In the chapter I start by reflecting on the main ideas, findings and conclusions drawn from the entire thesis. I proceed to link the thesis findings and the theoretical framework that has shaped the study. I then discuss the theoretical, empirical and policy contributions of my thesis. Finally I suggest areas for further research based on extrapolations from my research.

CHAPTER TWO: ADAPTATION TO CLIMATE CHANGE AND VARIABILITY: A THEORETICAL PERSPECTIVE

2.1 Introduction

The main reason for writing this chapter is to discuss the theoretical lens I used to analyse how rural farmers problematise climate variability and how they are responding to it. This chapter begins by examining a core entry point for the research underpinning the thesis, namely how adaptation has been framed and understood in existing studies. I trace the development of the concept of adaptation in versatile disciplines and the ways in which it has been specifically applied in climate change inquiry. Evolving thinking on adaptation to climate change and variability in Africa will be critically discussed centering on the contributions of different approaches and perspectives. I then introduce the theory by Margaret Archer, elaborate on her relevance and outline the strengths of her theory. The chapter closes by discussing how Archer's theory attempts to take adaptation research forward in the context of climate variability, in light of gaps and limitations in current research.

2.2 The Evolution of the Concept of Adaptation

The concept of adaptation is the cornerstone of this research yet its conceptualisation is not simple or clear. As such, faced with the acceleration and intensification of global environmental and socio-economic changes, research into the adaptation of systems keeps on growing. The concept is not a-historical and diverse competing theories on the concept have been developed over the years. Although adaptation research is assuming greater prominence on the scientific agenda, the interdisciplinary field of adaptation is still characterised by an evolving epistemological base (Eisnack and Stecker, 2011). The existing literature examines social, biological and cultural adaptation processes from a variety of perspectives, including anthropology, archaeology, biology, ecology, geography, political ecology, psychology, and global environmental change science. There are also competing views on adaptation such that the concept has multiple meanings. For example, adaptation can have meanings such as the process maintaining natural selection in genetics and the process sustaining social homeostasis in human ecology.

Following this, whilst the concept of adaptation is progressively becoming an integral component of contemporary discourses of global and local environmental change, its origins rest elsewhere. The common view is that its origins are in the natural sciences, namely population biology and evolutionary ecology. At the same time, adaptation claims its conceptual glory from the theory of evolution, a subject that for a long time has been skimmed over. From this perspective, adaptation concerns genetic characteristics which permit individual organisms to survive and procreate in the environment they populate. Ecological constructs such as stability, tolerance and resilience have been applied to depict the propensity of biological systems to adapt to changed conditions and the processes by which these changes occur (Holling, 1973; Smithers and Smith, 1997).

Indeed, the early formulations of the concept of adaptation with regard to evolution of humans and human societies can be traced back to Charles Darwin whose work defined the roots of the concept of biological adaptation. Darwin (1859) contended that speciation is founded upon the concept of adaptation to the environment and individuals with auspicious adaptations are most likely to endure and leave progeny. Other early contributions to the development of the concept of adaptation also derived from extreme genetic determinists and extreme environmentalists. Genetic or biological determinists included the Eugenics who popularised biological determinism and essentialism and perpetuated racism. These, and other scholars, maintained that European superiority was a result of racial admixture, not adaptation to the environment. Environmental determinism was fashionable amongst scholars such as Huntington whose work centered on the effects of climate and weather. Huntington (1915) concentrated on heat, cold and storms as shaping racial morphology, physiology and behaviour, and referred many times to forms of adaptation in human populations reacting to temperature, humidity and solar radiation. Nonetheless, biological and environmental determinism has been viewed as scientifically questionable and nothing more than a score to advance European racial superiority.

In social science as a whole, the concept of adaptation has been widely utilised in respect to human-environment interactions in human and cultural ecology, natural hazards research, ecological and cultural anthropology, sociology, psychology, geography and ecological economics. Smithers and Smith (1997) for example alluded to the fact that social and economic

systems, and individuals within them, can adapt to shifting environmental conditions and a crucial deviation from biological theories is that humans can plan and manage adaptation. Subsequently, in planning and managing adaptations, and as opposed to biological systems, people can assess and comprehend risks.

One of the cardinal themes on adaptation in ecological anthropology has been how people respond to environmental problems. As a result, numerous studies have been undertaken on the responses of people to environmental stresses through using socio-technological practices. For example, a study by Thomas (1973) among the Quechua Indians of the Nuinoa District of the southern Peruvian Andes, established that people use a mixture of manoeuvres and strategies in contributing to efficient use of the limited energy accessible. In a related manner, adaptation has also featured in cultural anthropological studies, for instance studies by German environmentalist and physicist Franz Boaz. Boaz concentrated on cultural relativism, and disqualified the utility and sufficiency of the concept of geographical determinism in explicating human life and diversity. In functionalist social anthropology, the rudimentary assumption is adaptationist, with the institutions of society allowing for continuation or development of groups by providing for the biological and cultural sustenance of the individuals in the group. In his cultural ecological approach, Steward (1973) considered culture as a primal adaptive technique among humans. The model of cultural adaptation underscores the collective behaviour of systems and the capacity of individuals as decision-makers in pursuing adaptation.

In psychology, adaptation is a complex dynamic that enunciates the different actions of the subject, as well as the divergent processes that enable the emergence of transformation perspectives (Jakubowicz, 2002). This field also highlights the faculty of adaptation, that is, the aptitude of an individual to alter his structure or behavior in order to respond to new situations. In the case of geography, the Chicago School of Geography adopted the concept of adaptation from ecology to define it as the fruit of adjustment and deliberate choice, so as to highlight escaping the constraints of the socio-spatial milieu. Hence, this school distanced itself from biological determinism which descended from natural selection and thereby leaned more on the notion of human adjustment. The object of geography is the adaptation of humans to the environment and less so the direct influence of the environment on humans (Barrows, 1923).

Finally, in sociology, the concept of adaptation loosely exists as social adaptation. In this case, Talcott Parsons formulated the function of adaptation in the context of the action-system represented by social actors and defined by the mutuality of varying systems (cultural, social, psychic, biological) and the system of action interacting with its environment (Simonet, 2010). Therefore, adaptation is traditionally interpreted in relation to acculturation, socialisation and integration.

2.2.1 Adaptation in Climate Change Inquiry

Throughout its trans-disciplinary polysemy, the concept of adaptation comprises pertinent standpoints for elucidating adaptation to climate change. This is true even for the environment sciences in general, as inter-disciplinarity, environment and adaptation can be easily connected (Simonet, 2010). But, to reiterate, adaptation to climate change is regarded as an ambiguous topic. Even with regard to responses to broad global environmental changes, adaptation has multiple definitions. The variations in these definitions point to the diverse approaches that are conceivable for understanding adaptation, even within climate change adaptation discourse. This section discusses the more contemporary renderings of adaptation to climate change and variability specifically. The current studies deliberate on the capacity of humans to respond to global climate change utilising the notions of risk, vulnerability, resilience and adaptation to understand the potential damage and responses.

Some of the definitions continue to echo the evolutionary-biology definition of adaptation as a process whereby the members of a population become suited over generations to endure and reproduce, though entailing human deliberation and practices (O'Brien and Holland, 1992; Schipper, 2007). For instance, Schipper (2007:5) says:

> As cognisance of harmful human impact on the environment as cause for risk to humans has superseded the idea that humans are at the mercy of the environment, adaptation has gone from being conceived as something done by plants and animals in evolution as a response to environmental changes, to being advanced [on the basis of human adaptation] as a concept for directing policy to ensure sustainable development, reduce vulnerability and minimise risk to humans from climate change.

In this light, common analyses have involved looking at impacts, technological adaptation and variations among regions in terms of risk distribution in the face of environmental changes.

Following that, the aim of adaptation to climate under the initial framing especially by the United Nations Framework Convention on Climate Change (UNFCCC) is to respond to ambiguous risk (arising from the impacts of environmental change), so as to bring the system back to its original state (Ayers, 2010). This has evolved at times into an impacts-based approach to adaptation (Burton et. al, 2002) which has ensued in what Klein (2008) specifies as technology-based interventions such as dams construction, early-warning systems, and seeds and irrigation schemes founded on specific knowledge and projections of future climate conditions. Such an approach calls for scientific climate change expertise to identify and quantify the existing or anticipated impacts of climate change, and then designing interventions to specifically target those impacts. However, an impacts-based framing of adaptation is problematic because it implies a response directed at an uncertain risk.

Furthermore, the manner in which climate change risks are defined has substantial implications for how these risks are evaluated, and consequently how adaptation policy decisions are made. For example, an impacts-based perspective connotes that a particular type of scientific or technological expertise is needed to assess climate risks for policy-making. This would involve codifying future climate change risks into defined climate impacts and producing calculated responses to these impacts (Pelling and High, 2005a). For instance, Klein (2008) describes a scenario where an impacts-based scientific risk assessment submits that the primary climate risk in an area is increasing drought, impacting on domestic and agricultural water supplies. Hence, an impacts-based adaptation response would be to install a water management system, to address the specific problem of water scarcity in that area (Ayers, 2010).

Besides the question of impacts and risks, vulnerability perspectives have been popularised in understanding adaptation and partly as a response to the impacts-based strand (though not inherently inconsistent with it). Vulnerability has found its place in the climate change lexicon, with both natural and social scientists anxious to measure and assess vulnerability, whether from the spatial level of regions, sectors, ecosystems or social groups (O'Brien et.al, 2007). Several

commentators from disaster risk reduction, famine and food insecurity and development studies draw attention to the nexus between the risks people face and the reasons behind their vulnerability to these risks in the first place (Adger, 1996; Bohle et. al, 1994; Chambers, 1989; Sen, 1981). However, even if it were achievable to isolate and assess the biophysical impacts of hazards and risks in physicalist terms, this disregards the ways in which local and wider circumstances influence peoples' vulnerability to these hazards. Therefore, when applied to climate change, instead of accepting that vulnerability is merely a function of the damage that climate change may do to a social system, this perspective underlines – and quite importantly – the social dimensions of vulnerability (Kelly and Adger, 2009).

Like the very notion of adaptation, the global climate change literature is marked by differential meanings and interpretations of vulnerability. O'Brien et.al (2007) highlight that these divergent meanings and interpretations are not only the consequence of the wide breadth and scope of climate change research and the various scientific communities involved, as they also arise because of contrasting framings and discourses of climate change. Essentially, these differing definitions are reflections of different discourses on climate change that not only symbolise distinguishable approaches to science, but also disparate political responses to climate change.

In this context, O'Brien et. al (2007) draw attention to the differentiation between outcome and contextual vulnerability. An end-point approach (outcome) reckons vulnerability as:

> [Th]e end point of a sequence of analyses beginning with projections of future emission trends, progressing to the development of climate scenarios and thence to biophysical impact studies and the recognition of adaptive option, whilst the starting point approach (contextual), in counterpoint, views vulnerability as a present inability to grapple with external pressures or changes, which in this case is changing climate conditions (O'Brien et.al, 2007:75).

As such, adaptation to climate change can be directed at altering contextual conditions or at reducing vulnerability. In a similar vein, a distinction is sometimes made between biophysical and social constructs of vulnerability. In this distinction, the biophysical approach focuses on degradation of physical conditions and extrapolates directly the impacts on human populations of these conditions (Liverman, 1990). On the contrary, the social constructivist approach dwells on the patterns of social processes that either contribute to or reduce vulnerability. The biophysical

approach has been regarded as the dominant approach employed in the studies of vulnerability to climate change. Nonetheless, whilst assessment of biophysical conditions is necessary, it is not sufficient for understanding the complex dynamics of vulnerability. Lambert (1994) specifically points out that it neglects structural factors and human agency in both producing vulnerability and adapting. Other shortcomings include its neglect of everyday social processes that influence differential vulnerability. In addition, Liverman (1990) contends that the emphasis on physical aspects has resulted in an over reliance on science and technological solutions.

Therefore, drawing upon food security and natural hazards scholarship, a social vulnerability perspective on climate change has emerged that concentrates specifically on how climate risks are experienced locally. As highlighted by Ayers (2010), this position is intimately tied to Sen's (1981) capabilities approach in which a natural hazard only becomes hazardous when it impacts people's capabilities to execute their desired tasks. In turn, other elements that constrain people's capabilities (be they financial, cultural, political, or physical) will affect their ability to deal with risky situations. At the same time, the perspective demonstrates that local people are not mere disaster victims but are able to respond to events and situations. In-and-of-itself, many advocates of a social-vulnerability approach to adaptation indicate that impacts-based risk assessments, and the ensuing adaptation measures, can only be partially effective if they do not also address non-climatic factors that are the fundamental drivers of vulnerability (Ayers and Dodman, 2010; Schipper, 2007).

Additionally, there is a broad body of theoretical literature that conceptualises adaptation to climate change by connecting in different ways the notions of vulnerability, adaptive capacity and resilience. As the IPCC (IPCC, 2001) sometimes claims, vulnerability is a function of sensitivity, exposure and resilience. At the same time, Brooks (2003) and Fussel (2007a) are of the view that the distinction between potential adaptation (adaptive capacity) and actual adaptation is also needed, in part to reflect the temporal dimension of climate change. Similarly, Nelson et. al (2007) also link adaptation to the resilience discourse and thus define adaptation as decision-making processes and actions that enhance adaptive capacity. In the end, though, resilience demands actual adaptation practices rather than mere adaptive potential. In a related point, Riebsame (1991) distinguishes between adaptation and resilience, in that the former entails

change and the later entrenchment of existing systems which may not be sustainable over the long-term. For other scholars, notably Kelly (2004), social resilience pertains to the actual capacity of a community to cope with disruptions or changes and to sustain adaptation measures (Kelly, 2004). Overall, a theoretical account based on resilience considers a resilient community as being able to respond to changes or stress in a positive way, and is able to uphold its core functions as a community in spite of stresses.

Beyond these approaches, it is important to note the emergence of a political economy of climate change (as coined by Tanner and Allouche, 2011). This approach affords attention to how climate change hazards are unequally distributed amongst nations, communities and groups, how vulnerability is thereby differentiated across the world and, significantly, how adaptation is also uneven. More so than other approaches, the political economy perspective considers climate change adaptation in political (or power) terms. Assuming this approach improves the understanding of the spatial complexities of climate change, and the divergences in risks and vulnerability distribution as well as the power relations mediating and animating adaptation strategies at different spatial levels. Similarly, adaptation is posited within existing poverty levels and income inequalities, therefore highlighting the uneven distribution of the impacts of climate change and the resultant inequity and unfairness in life-chances.

Arguments from within the political economy framework have also centered on global environmental justice, rights and compensation in relation to the need for climate change mitigation, adaptation and governance (Adger et. al, 2006; Jamieson, 2001; Roberts and Parks, 2007). Taylor (2014), in espousing an interdisciplinary approach rooted in the traditions of political economy and political ecology, contends that incumbent approaches to climate change adaptation need to engage more systematically with the diversity of power relations that determine the social and ecological parameters of agrarian livelihoods. Therefore, there is need to ask who has power to define and pursue adaptation in agrarian environments influenced by long-term processes of social and environmental change and characterised by persisting hierarchies based on class, gender and caste.

Concurrently, questions on whether adaptation ought to be interpreted as a process, action or outcome have likewise emerged in climate change research. Process arguments are evoked within a systems approach which gives attention to system properties, including evolving conditions and activities that might enable or constrain action. Action approaches dwell on the purposeful activities (namely, adaptations as singular actions that are taken by actors) which may curb harm from climate change (Eisenack and Stecker, 2011), while outcome approaches center on the end results or impact (in most cases measuring success, effectiveness or sustainability) (Eriksen et. al, 2011). In this way, actor-based analytic thinking considers the processes of negotiation in pursuing adaptation and the systems-based analysis examines the implications of these processes on the rest of the system. Hence, adaptive capacity, at least from a systems position, has been depicted as the ability to learn from mistakes (Adger, 2003), to engender experience of dealing with change (Berkes et. al, 2003) and the capacity for innovation in the face of vulnerability and risk.

A range of specific approaches (such as the resilience approach noted earlier) are sometimes framed within a systems perspective, in considering – from a dynamic perspective – adaptive capacity as a core feature of resilient social-ecological systems. In doing so, it makes the claim that social and ecological systems cannot be conceived in isolation from one another but must be understood as interrelated and coupled systems. The systems approach as well bears a temporal component that is significant to the concept of adaptation. It regards adaptation not in light of specific activities but instead by how activities feedback, either positively or negatively, into the system-at-large through time. Adaptation is therefore understood by attending not only to the characteristics of systems, but also to processes and outcomes of adaptation actions.

But systems-theory has broader resonance within the adaptation literature, as it privileges adaptation as both a process and its outcome. Generally, in this context, adaptation can be any process, action or outcome in a system (for example, ecosystem, household, community, group, sector or region) that facilitates the system to better cope with, manage or adjust to the changing conditions, stresses, hazards, risks or opportunities related to climate change (Smit and Wandel, 2006). In addition, adaptation relates to changes in processes, practices or structures to contain or offset possible damages or to possibly even capitalise on opportunities related to changes in

climate. From the IPCC's definitions and the analysis of Smit et al. (2000), adaptation is a response to (potential) environmental stimuli that impact given entities, subjects or systems. In this light, adaptations are processes within entities and systems, or adjustments made by human systems (Eisnack and Stecker, 2011).

Another key discussion point within the literature is what qualifies as adaptation and what differentiates adaptation from other existing responses. In this case, the connection between managed, policy-driven adaptation and autonomous, locally-driven adaptation, and the manner in which these play out in the context of environmental changes more generally, has been given attention. In most cases local-level adaptations are imagined as reactive, while policy-driven adaptations are said to be planned. In this regard, Glantz (1992) reasons that adaptations are unplanned reactive responses to a condition already experienced whilst mitigation requires some anticipatory planning. Burton et.al (1993) put a further twist on this by stating that short-term responses or measures are not adaptations. In relation to this, a key point becomes the question of temporality and whether actions are meant to buffer current activities or facilitate change. This therefore brings up critical questions about whether a process of adaptation entails immediate behavioural adjustments made to alter livelihoods in the face of changing climatic conditions or, alternatively, implies the longer-term development of technological and infrastructural changes necessary to sustain livelihoods over time (Schipper, 2007).

Besides temporality, the significance of different spatial levels is brought to the fore in the literature, although not necessarily explicitly. Certainly, the political economy perspective ostensibly addresses this. It is noticeable that, in terms of spatiality, macro-level studies concentrate on country-level themes climatic themes and on national policies and strategies, while micro-level studies centre on actions and decisions by local groups such as farmers. Attention though has also been focused on individual behaviour and strategies (Agrawal, 2008). Indeed, the focus on individual behaviour is rife in climate change and adaptation studies and is informed by psychological theories on people's risk perceptions and attitudes (Leiserowitz, 2006; Lorenzoni and Pidgeon, 2006; Whitmarsh, 2005). As I have indicated repeatedly, this thesis is positioned as a micro-level study (at community and household levels) but it avoids methodological individualism because of its emphasis on conditions, processes, and structures.

In the final analysis, as this review indicates, adaptation assumes varied understandings in global climate change inquiry. What is clear is that the initial framing of adaptation in climate change research concentrated on technological aspects, and social vulnerability and resilience were only later given attention. Besides attempting to create diverse linkages among adaptation, vulnerability, risk and resilience, studies also dwell on different spatial and temporal scales. At the same time, although studies do not agree on defining adaptation, they generally concur that it can be regarded as a process, practice and outcome. Having said that, my point of departure is that whilst these studies reflect how adaptation has been analysed at a global level, my thesis focuses on adaptation at the micro-level. Concurrently, my thesis is more inclined to positions that recognise human agency as well as to process-oriented arguments on adaptation found in this global climate change literature. However, though the above studies utilise various middle level concepts such as vulnerability and resilience, my thesis draws on a sociological theory to understand adaptation as underpinned by various structures, processes, and conditions.

2.2.2 Adaptation in Climate Change Sociology

Adaptation has also featured in recent sociological discussions and debates on global climate change. All the same, when it comes to the understanding of climate change adaptation, Mulligan (no date) highlights that sociology is lagging behind other disciplines. There is an indication that sociologists continue to fall behind for example geographers and psychologists in reflecting upon the social and cultural dimensions of climate change adaptation. Fundamentally, sociologists have been slow to pursue the topic of global climate change and the spaces for social sciences at the international climate change table have tended not to be filled by sociologists (Nagel et. al, 2008). Generally, most analytic thinking on climate change written by scientists (either for other scientists or for governments) are uninformed by the social sciences (Urry, 2010). Shove (2010) agrees that climate-change-related research in sociology (and geography as well) is accordingly patchy, with intellectual vigor being invested in some issues and strands of social analysis at the expense of others. Therefore, despite the urgency of what many take to be imminent environmental catastrophe on an unprecedented scale (Giddens, 2009), social theoretical consideration of climate change revolves around a handful of slow-moving, essentially classic problems.

McDonald (2007) traces the trivialisation of environmental and climate issues in sociology to the period of the Enlightenment. Even so, Beck (2010a) contends that it is not true (as many environmental sociologists lament, for example Lever-Tracy, 2008) that mainstream sociology ignores escalating climate change. Beck (2010a; 2010b) is of the persuasion that, in the writings of the first and second generation of classic sociological authors (in Max Weber, John Dewey, Herbert Mead, Emile Durkheim, Georg Simmel and many others), there are indeed animating insights and conceptual models for developing a sociological perspective of climate change. For example, Dewey, like Weber, talked about 'American capitalism compounding the "waste", "devastation" and potential "extinction" of natural resources' (Beck 2010a: 177). Thus Sunderlin (1995) highlights in fact that sociological writings on adaptation strategies to climate change, no matter how limited, focus on structural economic changes (informed by the radical, conflict, Marxist tradition), managerial approaches (informed by the bureaucratic, elite, Weberian tradition) and cultural/behavioral change (informed by the pluralistic, conservative, Durkheimian tradition).

Environmental sociologist Lever-Tracy (2008) contends that sociology has long been largely silent on climate change because sociologists are distrustful of naturalistic accounts and because they are suspicious of teleological claims, or discourses that identify definitive plans for the future. In explicit terms, she argues that 'the failure of sociology to address global warming is partly due to the "marginalisation" by the natural sciences'. But, at the same time, 'sociologists are reluctant to be interrupted by the voices of natural scientists, reporting from inaccessible upper atmospheres, ancient ice cores or deep oceans, where no social facts exist' (Lever-Tracy 2008:454). Grundmann and Stehr (2010) also speak about the relevance of methodological divergences between the natural and social sciences (indeed few sociologists would subscribe to the notion that social processes can be modeled), but these authors also emphasise that sociologists have been cautious due to the overly political nature of the public debates about climate change.

Arguably, sociologists have been slow in engaging with climate change because the IPCC has ascribed social sciences (including sociology) a subsidiary role in the construction of climate science. In this regard, it must be highlighted that IPCC has had a significant influence on

climate change knowledge, public discourse about climate change and climate policy development. Regarding this, Hulme and Mahony (2010) observed that the powerful prejudice against the social sciences in the construction of IPCC knowledge about climate change has been enunciated for many years. Yearly (2009:401), proffering a sociological critique of the IPCC, says 'the institutional premise of the IPCC is that the most relevant social science is economics'. Similarly, Godal (2003:247) says 'the structure of the work within the IPCC appears to be founded on the reasoning that the science of climate change follows a clear-cut "disciplinary line", from the natural sciences to the social sciences, where the latter is based on the former'

Contributions to climate change adaptation studies have been recognised in the work of sociologists such as Anthony Giddens (2009) and John Urry (2011). Even so, these contributions have been heavily criticised. For example, Lever-Tracy (2010) contends that Giddens is principally preoccupied with political rather than social and cultural adaptation. In this regard, Giddens (2009:4) categorically reasons that 'the challenge now is to consider climate change in a specifically political context since at present we have no politics of climate change'. In response to this, Grundmann and Stehr (2010:906) observed that 'Giddens makes very little use of sociological perspectives, including his own (structuration theory) or the notion of risk society'. Rather, he applies theoretical tools from political science (such as the notion of policy entrepreneurs) and public policy (institutional decision rules and incentives). Therefore, Giddens's emphasis is forthrightly on the national state as the central institution for delivering climate change mitigation and adaptation measures.

Therein, Giddens's work is considered to be addressing professional politicians, public administrators, policy wonks and anyone else who occupies the relatively select world of climate change politics. Attempts to use Giddens's structuration theory in climate change adaptation effectively entail researchers undertaking investigations of the transformative effects of actors' activities on the society in which they are embedded. However, an outstanding problem with his theory is (in my view) its over-emphasis on agency and its inability to delimit concepts through which to empirically identify and depict structures as external, causal and existent. As such, Archer (1982; 2003) argued that structuration theory conflates the concepts of structure and agency as though the two were indivisible.

Urry (2011), from his post-carbon sociology position, calls for a new sociology of climate change adaptation. He indicates that sociology needs to assume a decisive stance toward society as the latter has generated structures and processes that have contributed to climate change. This is critical because social thought, he argues, has become carbon-blind. Hence, a resource turn so to speak is required in sociology. Urry is optimistic that post-carbon sociology can dislodge preponderant economic models of human behaviour in climate adaptation. As noted by Mulligan (no date), Urry has his hopes on scenario-building and back-casting in terms of how future societies can be organised and sustained, and how low-carbon systems can be embedded in social life. Notwithstanding the usefulness of Urry's work, Hulme (2012) contends that it only works at a high level of abstraction and is isolated from the domain of embodied experience. In this regard, 'in engaging with what Urry calls "new catastrophism", it makes his work pessimistic and abstract' (Hulme 2012: 553), and 'by insisting that it is socio-biophysical systems that must change and not human beings, he disregards humanistic traditions' (Hulme, 2012: 554).

Apart from the above, contributions to climate change have also come from other sociologists. For example, Beck (2009) points to an understanding of current global changes in the context of an industrialism that has transgressed its system of logic and has begun a process of dissipation. Furthermore, Beck (2010a; 2010b) establishes the connection between social inequality and climate change, and he argues that climate change globalises and radicalises social inequalities. He also makes a contribution by way of the concept of social vulnerability. In this case, Beck (2010b: 171) says 'without the concept of social vulnerability, it is inconceivable to understand the catastrophic content of climate change'. Following that, a sociological discernment of vulnerability has not merely a decisive relationship to the future, but it also has historical depth. In line with this, Beck's adaptation solution therefore rests in what he calls local sustainability.

On another note, sociologist Delanty (2003) alludes to the significance of the community in adapting to climate change. He thus underscores the need to reconsider community and place in view of climate change adaptation. Mulligan (no date) broadens Delanty's point by remarking that individuals who are attempting to create practices of resilience to climate change can find inspiration by participating in communicative communities. However, although there is an

important realisation that community involvement plays a pivotal role in adaptation, Walker (2011) points to the need to problematise the notion of community insofar as it is understood as a unified and homogeneous entity. At the same time, Mathews (2009) noted that the sociology of education provokes inquiry into the construction of climate change science, knowledge and solutions, including at sub-national levels. As a result, sociology and education can help in the task of identifying alternative global and local social transcriptions founded on justice and equality and, which may go beyond the IPCC's more mainstream conceptions.

Furthermore, one of sociology's most substantial contributions to climate change research originates out of attention to the intersecting political and economic orders, at both global and national levels, as contributors and potential mitigators of global climate change (Nagel et. al, 2008). This is shown for example in Fischer-Kowalski and Harberl's (2007) social theory of social metabolism (by which they mean the manner by which human societies arrange the growing exchange of energy and materials with the environment). As well, sociological interrogation has been prompted by the human ecology perspective by giving emphasis to the socio-spatial dynamics of climate change and the variegated interactions between humans and their physical environments across spatial and temporal scales (Nagel et. al, 2008). Environmental sociologists, in addition, use quantitative and qualitative methods to research the social and cultural processes that configure attitudes, discourses and ideological dimensions of climate change in public debates and policy processes.

Moreover, sociological theories deeply concerned with the structure-agency nexus have been applied in environment-related studies but only marginally applied in climate change studies. These theories locate themselves midway between an over-emphasis on individualism in which social phenomena are deemed the outcome of individual actions, and theories of structuralism in which social phenomena are thought of as the outcome of social and economic systems in which individuals are simply located and embedded. An example from these climate change studies is the examination by Chappells and Shove (2005) of the socially-constructed character of indoor temperature comfort under conditions of climate change in Britain.

Of particular significance in this regard is the utilisation, though to a limited extent, of Bourdieu's conceptual tools. For example, while no explicit reference is made to Bourdieu, the notion of social capital has been adopted by Adger (2001; 2003), Pelling and High (2005b) and Pelling (1998). Sysak (2013) however explicitly adopted Bourdieu's theory of practice to identify how power structures underpin resilience in northern Victorian communities (in Australia). Similarly, Riera and Pereira (2009) deploy the concepts of habitus, field and capital to research farmers' perceptions and adoption of irrigation as an adaptive strategy in the context of climate change in the Argentinean Pampas. They noticed that it is the system of dispositions (habitus) that permit the perception of climate events in terms of risk and that the struggles the farmers' confront are connected to symbolic capital and, other field-based capitals.

Other Bourdieu-based works also exist. Thus Hughes (2011; 2013) uses Bourdieu's concepts of field and habitus to analyse respectively the practice of writing in the IPCC and the role of the IPCC in the climate field. On another note, Bohle et. al (1994) developed a notion of vulnerability from Bourdieu's theoretical perspective. They consider vulnerability as a multilayered and multidimensional condition regulated by the political, economic and institutional capabilities of people. This line of thinking is later advanced by Sakdapolrak (2007) who engaged with Bourdieu's theory to represent the field of social vulnerability. In this case, the social vulnerability field is structured by specific forms of capital and power, regulated by a particular set of rules, and defined by competition and struggle.

Insightful as these sociological studies, often, they do not fully account for the complexity of social adaptation particularly within micro-level systems and across temporal scales. And, of particular importance for this thesis, the use of Margaret Archer's reflexivity theory has been exceedingly limited (for example, Davidson, 2012).

2.2.3 Concluding Remarks on Global Adaptation Studies

In closing this section on studies of climate change adaptation (both sociological and other discipline-based studies), a point to underscore is that there is only minute consensus on the very notion of adaptation and what comprises it. Indeed, some scholars such as Bargatzky (1984)

criticise what they call the misuse of the concept of adaptation, particularly in ecological anthropology. Postmodernist critics also regard evolutionary-informed theories and concepts (including, they would claim, adaptation studies) as reductionist. As well, critical theorists such as Singer (1996) discount the validity of adaptation in both biological and cultural studies and claim that the phenomenon termed adaptation is best read as a dialectic involving nature and political economy (with the human species transforming their environment at the same time as the latter transforms the former).

In line with the argument on the dialectics between nature and society, Engels (1886:498) emphasised that 'there are both effects of nature on man and the change of nature by man'. Humans and nature interact dialectically in such a manner that, as societies evolve, humans tend to become less dependent upon nature directly, while indirectly their dependence grows. Political ecologists also frame nature-society relations as dialectical and underscore that the relationships between humans and the environment are never static, but are always shifting. A dialectical view on nature/society assumes that nature is the foundation of society, that there is a persisting metabolism between nature and society, but that society has emergent qualities that differentiate it from nature (Fuchs, 2006). Fuchs (2006:13) also contends that 'the dialectic of nature and society in modern society has become a profound antagonism that produces ecological problems'. Thus, nature and society are not strictly external to each other; on the contrary, they interpenetrate and reciprocally transform each other. Society not only adapts itself to nature but (and on an ever-increasing scale) society adapts and transforms nature to fit its needs.

The nature-society dialectic needs to be taken seriously when investigating adaptations to climate change and variability. Additionally, sensitivity to the possibility of mal-adaptation is important. The notion of mal-adaptation is generally missing from the IPCC reports which seek to offer a sanguine view of humanity's capability to respond to problems. Yet, some responses are positive, adapting to new circumstances in dynamic ways, while others collapse (Orlove, 2005). Another critical point made by Schipper (2007) is that the majority of the scholarship presently aspires to inform planned adaptation. However, responses to climate change can be planned (usually by interventions of public agencies) but, as this thesis shows, they can also be more autonomous (usually led by individuals, households or communities).

Clearly, with specific reference to sociology, the analysis of climate change adaptation is still patchy. Davidson (2012:638) says 'we not only need more sociology in the study of climate change, but more *innovative sociology'* (her emphasis). Similarly, there are calls for a paradigm shift in sociology. In this case, sociology needs to be involved in climate change debates and analyses and not, as at present, playing a minor fiddle to the physical sciences and even to economics (Urry, 2010). Over and above this, sociology of climate change adaptation needs to be more grounded and dynamic so as to able to capture changing structures, processes and conditions underpinning adaptation in specifically local contexts.

2.3 Analytical Approaches on Adaptation to Climate Change and Variability in Africa

In this section, I depart from global studies on climate change and adaptation discussed above to examine literature on adaptation in rural Africa. The study of adaptation is not new especially in semi-arid regions in Africa, where a poor and vulnerable population has always dealt with an extremely vacillating natural environment. Insights into adaptation to climatic change particularly in agriculture derive from a diversity of research approaches, which consider versatile scales and engage numerous positions. These studies include research on agriculture, environmental change and degradation; farmers' knowledge of climate change; climate change impacts; natural hazards; agrarian political economy; innovation adoption; agricultural systems and farm decision-making; risk management; and agricultural vulnerability and adaptation. In this section, these studies are probed with regard to their main positions, approaches and subjects, as well as their contribution to the understanding of adaptation in rural Africa. I also recognise some continuity in terms of how some approaches and framings adopted in African studies mirror dispositions embraced in global climate change research, while also highlighting clear divergences. After reviewing a range of theories, I then discuss – at the end of this section – the contribution of sociology to climate change adaptation studies in Africa, primarily to elucidate and reiterate my entry point in using the theory by Margaret Archer.

2.3.1 Environmental Change and Modernisation Theories

A number of theories appeared in the 1960s to understand agricultural shift, environmental change and degradation in rural Africa. The overriding narrative about productivity, growth and

modernisation (related to the green revolution) connected to the ravaging droughts and famines across sub-Saharan Africa, prompted increasing concerns around the nexuses relating to agriculture, climate and productivity. These trepidations contributed to researches on the drivers and dynamics of environmental and climate change and variability, and responses to these. Climatic and environmental factors were specifically contemplated in respect to land use by agrarian Sahelian societies. Malthusian theories on population increase were cogent to such an extent that, during the 1970s and 1980s, varied analyses painted a picture that human activity was the outstanding driver of environmental and climate change in the Sahel (Swift, 1996), and this directed peculiar interest in the connections between soil degradation and human activity. Discussion also escalated after severe droughts in the 1980s. At the same time, desertification persisted as a central concern on the agenda with new anti-desertification policies rising in the 1990s.

As such, carrying capacity and rangeland management models (which said that ecosystems tended to be in equilibrium and unrestrained human activity would contribute to environmental degradation) were employed to explicate environmental degradation as a human-evoked tragedy, especially attributable to over-cultivation, overgrazing and overstocking. Several studies by various organisations such as the United States Agency for International Development, United Nations Education and Scientific Council and United Nations Environment Programme, corroborated the belief that desertification was a consequence of population growing at a rate greater than the carrying capability of the land (thus drawing upon a kind of degradation pathway theory). Accordingly, anti-desertification projects became common in Africa with diverse measures advanced, principally concerned with soil and water conservation (Scoones et. al, 1996). In line with rangeland management models, famines were explained as an outcome of food insecurity and food availability decline. Therefore, global responses for Africa from 1974 and into the 1980s were on food production.

Nevertheless, in the late 1980s, the rangeland model was increasingly disputed after various case studies rendered evidence of the extreme intra-annual and inter-annual climate variability in many parts of sub-Saharan Africa. Therefore, the state-and-transition model emerged by proposing that the nature of ecosystems in several parts of this region did not concur with the

equilibrium model. Far from being stable, climate in the African dry lands was seen as dynamic, uncertain and in disequilibrium (Warren, 2005). In tandem with the state-and-transition model, social scientists acquired evidence of African farmers and herders' attempts to conserve soil fertility in disequilibrial ecosystems (Scoones et.al, 1996). Consequently, anti-desertification and ecosystem management policies were heavily criticised for undermining small farmers' efforts to attain sustainable land management practices (Swift 1996). At the same time, natural scientists were also criticised for labeling response strategies such as herder movements or migration as ascribable in a simplistic fashion to desertification.

2.3.2 Environmental Change and Farmer Focused Researches

In this light, opinions came forth around farmer-focused research which urged putting farmers at the center of development practice and agro-ecosystem analysis. Since the 1970s, the averred benefits of the modernisation project in Africa began to be interrogated as disparate studies furnished evidence on the systematic disregard of poor farmers' constraints with respect to agricultural policies. A growing body of literature offered evidence of the insufficiency of obtaining agricultural models and policies in pursuing adaptation given the environmental, socio-economic and cultural characteristics of sub-Saharan Africa. Traditional or indigenous knowledge, as well as farmers' role in agricultural sustainability, environmental management and innovation, was accentuated. This people-oriented development position had, as its starting point, the rural realities of poor people and advocated agricultural research and policy focusing on the perceptions and priorities of households of resource-poor farmers rather than those of scientists (Chambers 1989). This narrative highlighted that agricultural and environmental policies were normally commanded and directed by experts' suppositions about farmers' needs. In the final analysis, not only were poor farmers' constraints being largely disregarded, but likewise their traditional agricultural knowledge and practices.

2.3.3 Conventional Climate Change Impact Assessments

Early climate change impact assessments at the global level initially did not highlight the significance of adaptation and this is also reflected in literature on Africa. Conventional, scenario-based studies offering predictions of possible impacts of climate change in agriculture

addressed adaptation by and large by merely forming and positing premises about human responses (Smit and Skinner, 2002). This ensued because many studies did not go beyond approximating crop yield responses, thereby fundamentally ignoring human decision-making, experiences and responses. Evidently, early (first-generation) impact assessment models supplied estimates of the overall economic impacts or damages (mainly agricultural) of climate change often founded on the assumption that no adaptations would occur.

Following that, quantitative economic and productivity projections of future impacts founded on modeling of staple smallholder crops became common. According to Nhemachena and Hassan (2007), a number of economic impact assessment surveys in southern Africa utilised the Ricardian cross-section approach for assessing impacts of climate change on agriculture. These include, amongst others, Poonyth et al. (2002) and Benhin (2006) for South Africa and Jain (2006) for Zambia. Other studies employed agronomic research for investigations of the broader impacts of climate change for a particular country or region (Hulme, 1996; Onyeji and Fischer, 1994; Sivakumar, 1992a; 1992b). Crop yield impact assessments were conducted across Africa as well (Kurukulasuriya and Mendelson 2006a; 2006b). Subsequently, impact assessment models arbitrarily assigned adaptation to climate change, assuming or asserting specific adaptive responses on the part of agricultural producers. Similar to global climate change studies, technology-based adaptation was also underscored. On another note, some scholars (for example, Deressa, 2007; Maddison et.al, 2007) utilised a Ricardian approach which incorporated adaptation into the analysis of impacts of climate change, with the model implicitly accepting that farmers are logical and that they adapt to changes in climatic circumstances in terms of their own decision-making processes.

Following the above position, there is a current emphasis on climate proofing. Here in, climate proofing is defined as the integration of climate change risks into the design, operation and management of infrastructure. It implicitly presumes that, once suitable adaptation measures (normally technological in nature) are distinguished and applied, then development policies, plans and practices can be pursued (almost without haste) to ensure protection against harmful climate impacts (Brooks and Grist, 2008). Such a focus seems to be a one-dimensional, mostly self-limiting trajectory that privileges readily-recognisable and discrete adaptation actions, both

anticipatory (before shock) and reactive (after shock) responses (Tschaket and Dietrich, 2010). More problematically, this opinion blurs the real agrarian processes that configure adaptation and resilient livelihoods. However, of late, impact assessments have discerned the importance of the complexity of local adaptation processes. Therefore, it is noticeable that the biophysical impacts of climate change from agricultural scenario studies have been repositioned to include considerations of vulnerability and adaptations by producers. All the same, there is still little analysis in the impact assessment literature of actual farm level adaptation. It is also only recently that studies are beginning to consider the social processes embedded within adaptation.

2.3.4 Natural Hazards Researches

According to Smit and Skinner (2002), the realisation that the most significant features of climate change for most agricultural sectors are those linked to year-to-year variability and the frequency and magnitude of extreme climatic events has instigated consideration of adaptation in view of natural hazards. It has been acknowledged thus that climate change impacts induce interconnected chains of risks and hazards. Natural hazards research explores the fundamental interaction of humans and the environment by concentrating on the impacts of, and human responses to, extreme events. From the perspective of natural hazards research, those hazards most pertinent to climate change variability include flooding, drought, hurricanes, coastal storms and sea level rise. Indeed, climatic extremes, particularly droughts and floods, affect the state of food security in Africa.

A great deal of attention in natural hazards research has been channeled to the identification and characterisation of human adaptations to disastrous (extreme) events (for example, drought in the Sahelian region by Batterbarry and Mortimore 2013; Dai et.al, 2004; Mortimore 1989; Mortimore and Adams 2001). In this respect, Smit and Skinner (2002) note that features of the agricultural system being affected and the perceptions of hazard and risk by those impacted are critical in understanding human coping strategies and adjustments. These analyses have been pivotal in conjuring questions of how farmers comprehend the hazard-driven risks (associated with climate change and variability). Therefore, by conceiving that adaptation is directly

connected to the perception of risks, these studies highlight the role of conscious (planned) decision-making, including at local level.

2.3.5 Innovation Adoption Researches

On a different note, the adoption of technological innovations is one of the most frequently proposed strategies for adaptation in agriculture to climate change in rural Africa. Even so, such adoption goes in large part unheeded in practice, though it is a profound precondition for technological advancement in adaptation to climate change (Below et. al, 2010). Innovation adoption research renders insights into the decision-making process by which adaptations are implemented by producers and imbued among farming communities. Studies in this field center on the characteristics of producers that determine their decisions about adaptation strategies. There in, factors such as decision-maker (farmer) attitudes, values, motivations and perceptions of risk differentiate between farmers who are 'innovators' and those who are 'laggards' with regard to the adoption of particular innovations (Smit and Skinner, 2002). Much attention also has been aimed towards the properties of particular innovations that lead to their adoption.

Although agricultural adaptation requires much more than adopting a new technology, introducing new technology certainly plays a role in adaptation at the farm-level. In this regard, the literature on technology adoption provides some cardinal insights into the factors determining farmers' decision-making processes and constraining adaptation. For example, Below et al. (2010) adumbrated some leading adoption-related barriers in adaptation to climate change which generally include willingness and ability on the part of producers to adapt. In a related manner, a number of scholars concentrated on scientific forecasts (Grothmann and Patt, 2005; O'Brien and Vogel 2003; O'Brien, et.al, 2000; Orlove, et.al, 2004; Roncoli et. al, 2004; 2005; 2000). This literature goes on to identify a number of individual, household and farm characteristics, as well as institutional (market, policy, social) factors, which shape farmers' decisions about technology. Higher levels of education are related to access to information on improved technologies and the adoption of appropriate technologies. More so, studies also tend to agree that households with higher income and greater assets will be more likely to embrace new farming technologies, given

that they are afforded greater access to information and financial resources (Franzel, 1999; Knowler and Bradshaw, 2007).

Furthermore, gender of the head of the household is also viewed to shape the uptake of new technologies (Asfaw and Admassie, 2004; Tenge et. al, 2004; Nhemachena and Hassan, 2007). Nevertheless, contingent on the context, studies disagree on whether male or female headed households are more likely to adopt new technologies. Farming experience and age also come out as substantial determinants of technology adoption, although the direction of the consequence diverges across studies. Studies in Ethiopia have displayed a positive relationship between number of years of experience in agriculture and the adoption of improved agricultural technologies (Kebede et. al, 1990). However, a study by Shiferaw and Holden (1998) signaled a negative relationship between age and adoption of improved soil conservation practices, which indicates that older farmers may be less willing to take the risks related to new farming practices and technologies as part of agricultural adaptation.

2.3.6 Agricultural Systems, Farm Decision Making and Risk Management Studies

Agricultural systems research has provided a great deal of valuable information on the character and dynamics of agricultural production systems and their responses to a myriad of climatic and non-climatic stimuli. It qualifies agriculture as a complex system, within which changes are driven by the joint effects of economic, environmental, political and social forces. According to Smit and Skinner (2002), this approach underlines the interconnections among the different levels within the agricultural system (the farm, community, region and nation) and can account for change at multiple scales including the individual farm or farm plot scale. Models have been developed in this field of inquiry to evaluate the economic impacts of climate-related changes in agriculture based on computer simulations of farm decision-making.

Studies have also showed that decisions are made at different time-scales and that these are interconnected. Decision-making is construed as an on-going process, whereby producers are continually making short-term and long-term decisions to manage risks emanating from a variety of climatic and non-climatic sources (Bryan et. al, 2010). In this regard, agricultural change and

adaptation does not imply a simple linear relationship between changes in a farmers' decision making environment and farm-level change (Gbetibouo, 2009). Therein, adaptation emanates from individual decisions determined by forces internal to the farm household (for example, environmental perceptions) and the agricultural system as a whole (including macro-economic policy and institutional frameworks).

Furthermore, a number of studies look particularly at the factors that shape farmers' decisions to adapt to climate change at the farm level, including factors which constrain adaptation. A plethora of studies examine farmers' perceptions, use of information and related factors shaping the decision-making process (Bryan et. al, 2010; Hartter et. al, 2012; Mertz et.al, 2009; Ogalleh et. al, 2012; Slegers 2008; Thomas et. al, 2007). Furthermore, many studies emphasise the importance of local indigenous knowledge in decision-making concerning climate risk (Mbilinyi et. al, 2005; Mortimore and Adams, 2001; Nyong et. al 2007; Orlove et.al, 2010; Speranza et. al, 2010). Therefore, using local indicators, rural communities have observed changes in climate and their natural environment that have made them more vulnerable to food insecurity, health threats, water scarcity and disaster situations (like flooding) (Ziervogel et.al, 2008) and pursue adaptation practices on this basis.

Concurrently, farmers ground their decision to adapt their farming practices not only on changes in average conditions, but on a number of other climate factors observed through personal experience such as extreme events; rainfall frequency, timing, and intensity; and early or late frosts. For example, in Zambia, communities troubled by oscillating flooding and droughts have detected a shift in weather patterns over a number of decades (for example changes in the timing of the rainy season) that have negatively affected water availability and agricultural production (Ziervogel et. al, 2008). At the same time, from time to time, outside knowledge has merged well with local expertise to enhance agricultural resilience (Batterbury and Mortimore, 2013).

More so, scholars have also highlighted that the use of accurate climate forecasts can improve household well-being while poor forecast information can be detrimental in particular to poor farmers. The ability to respond to climate forecasts and obtain the benefits derived from their use are influenced in fact by a number of issues including prevailing institutional arrangements and

the socio-economic status of the household (Vogel and O'Brien, 2006; Ziervogel et. al, 2006). Given the potential for rural climate information to support adaptation and manage climate risk, there is a clear motivation to make climate data more accurate, accessible and valuable for farmers (Roncoli et. al, 2004). Clearly, though, advancing the use of climate information for adaptation among the poorest farmers also demands resources required to implement adaptation options (Vogel and O'Brien, 2006).

In addition, numerous studies underline the importance of formal and informal institutions and social relationships in facilitating or impeding decisions to adapt to climate change (Agarwal, 2008; Agarwal and Perrin, 2008; Boudoin, 2013); while other studies describe the ways in which institutions determine and influence adaptation in the context of specifically climate vulnerability. Overall, these studies highlight the potential for rural institutions to strengthen adaptive capacity and facilitate local level adaptation to climate change. For instance, agricultural extension services have the potential to influence farmers' decisions to modify their farming practices in response to climate change. At times, this involves employing household datasets to empirically analyse the factors influencing adaptation (Maddison, 2007; Nhemachena and Hassan, 2007).

Such studies of farm-level adaptation tend to corroborate that farmers respond not solely to climate stimuli but to a number of other factors as well in pursuing specific adaptation practices. Confirming the notion that personal and household characteristics and circumstances shape adaptation, various studies find that farming experience, socio-economic position, and access to resources, credit and extension services, increase the chance of uptake of adaptation measures in addressing climate change (see Deressa et. al, 2008; Maddison, 2007; Nhemachena and Hassan, 2007). Furthermore, given that the nature of farmers' responses to climate change and variability may hinge upon the socio-economic position of the household, poor farmers are likely to take measures to ensure their sheer survival while wealthier farmers make decisions to maximize or at least maintain profits (Ziervogel et. al, 2006). Again, gender has emerged as a focal point in the analysis of factors and conditions influencing decisions to adapt.

Related studies also highlight that climate change, including variability and extremes, is a pervasive root of risk to agriculture (Smit and Skinner, 2002). Yet little attention has been directed towards farm-level risk management strategies as responses to the uncertainty related to changing and variable climatic conditions. Apparently, though, contingent on the subjective assessment of risks and vulnerability, farm households make certain adjustments in their selection of certain technologies, and in the character of their production and consumption decisions (Cooper et. al, 2008). At the same time, research on risk management admits that decisions in agriculture involve both risk assessment and particular activities taken to reduce, evade, shift or mitigate risk.

Furthermore, studies have identified sources and types of farm-level risk owing to climate change and discerned how these risks may be managed through adaptation. In this case, amongst other actions, crop diversification, share cropping, and rural credit and savings associations have been noted as household-level risk management strategies. Government-pioneered risk management options have also been observed. As a result, this body of literature offers useful insights into agricultural decision-making (at different spatial levels) with regard to adaptation in light of the uncertainties connected to climate change, particularly those associated with variability and extremes (Smit and Skinner, 2002).

2.3.7 Vulnerability and Agricultural Adaptation Research

Climate has been mentioned time and again as one explanation for vulnerability in rural Africa. As such, agricultural systems are vulnerable to variability in climate, whether driven by natural circumstances or due to human activities (see Barrio et.al, 2008; Challinor et. al, 2007). The preponderant vulnerability approach recognises that there are crucial climatic dimensions (such as erratic rainfall patterns) to which agricultural systems are sensitive, and that these dimensions can be utilised as platforms for analysing the implications of climate change. At the same time, vulnerability research distinguishes the climatic attributes and risks pertinent to specific agricultural systems and examines how these are experienced by farmers. It then considers adaptation strategies in light of these climatic conditions along with other circumstances that shape decision-making. In this context, Hahn et. al (2009) applied the Livelihood Vulnerability

Index, which integrates various indicators, to evaluate the impacts of climate change and variability among farmers living in two districts in Mozambique. Mongi et. al (2010), in their study in a semi-arid area of Tanzania, concluded that that there is substantial evidence confirming the vulnerability of rain-fed agriculture to negative impacts of climate change and variability. In several regions of sub-Saharan Africa, insufficient soil moisture and low soil fertility are leading to climate-induced challenges contributing to the vulnerability of rain-fed agriculture.

Vulnerability approaches, as likewise applied in global climate change research, describe the differing sensitivities of specific agricultural and human systems and show the types of adaptation that have been attempted with reference to climatic and non-climatic stimuli. In this way, the approach offers insights into the broader circumstances under which adaptive decisions might be made. Thus, it has been increasingly discerned that climate change impacts are mediated by social vulnerability, that is, the complex interrelationship of social, economic, political, technological and institutional factors that render a farming unit vulnerable or resilient in the face of a hazard (Vincent, 2004). Social vulnerability frameworks explicitly focus on those factors that amplify, modify or attenuate the impacts of hazards and risks on local agricultural populations.

Following that, for African farmers, climate-related risks do come entirely from direct exposure to natural hazards such as floods or droughts, but also from the vulnerability of social and economic systems to the effects of these hazards. In this respect, it has been observed that the past twenty years or more have witnessed the pronounced growth of extremely vulnerable peasant populations in many sub-Saharan countries (Ellis, 2006), in part because of the restructuring of the global agricultural regime along neo-liberal lines. Resultantly, climate changes are having greater negative impacts on poorer farm households as they have the least capacity to adapt to changes in climatic conditions in the face of broader political and economic restructuring (Nhemachena and Hassan, 2007). In a related manner, Eriksen et. al (2008) also allude to differential vulnerability across farming populations, which is linked not only to current climatic and geographic heterogeneity, but to a mixture of social-economic factors also shaping vulnerability.

Consequently, many people who are vulnerable are not in position to adapt in any meaningful way. In addition to the question of poverty, Eriksen et. al (2008:5) remarked:

> The most vulnerable are a great deal those who are incapable of specialising in a non-risky activity or not able to diversify their livelihoods, those who lack access to forests or productive land and those who have been uprooted from their homes due to floods, conflicts, or livelihood shocks without receiving sufficient humanitarian aid. The vulnerable often inhabit in areas that are marginal in terms of services contributing to health problems, difficulty accessing water, and crop and livestock disease, they are frequently exposed to a collapse of security in terms of theft and petty crimes during periods of climate-related stress and households that are affected by HIV/AIDS, malaria, and other infectious diseases are often more vulnerable to climatic events, as they may encounter labor shortages during decisive periods or a dissolution of the family.

Therefore, distinguishing between different forms and levels of social vulnerability is critical to comprehensively investigating local processes of adaptation to climate change and their synergies with non-climatic issues (Leichenko and O'Brien, 2002). Significantly, then adaptive decisions are not likely to be constructed in light of (or in response to) climatic conditions or risks alone, because such decisions are invariably propelled by the joint impacts of multiple natural and social forces (Adepetu and Berthe, 2007).

Furthermore, literature on vulnerability and agricultural adaptation demonstrates that adaptation occurs at two main scales: (a) the farm-level (here studies focus on micro-analyses of farmer decision-making), and (b) the national level (macro-level), where research is concerned with agricultural production at the national and regional scales and its relationships with domestic and international policies (and hence ultimately relates to strategic national-level decisions and policies). Of particular relevance to my thesis, micro-level analyses of adaptation center on tactical decisions made by farmers, as shaped by several socio-economic factors that include household characteristics, household resource endowments, access to information (including seasonal and long-term climate changes) and availability of formal institutions (such as input and output markets) (Nhemachena and Hassan, 2007). At the same time, farm-level decision-making happens over a very short time period ordinarily determined by seasonal climatic variations, local agricultural cycles and diverse socio-economic factors.

2.3.8 Agricultural Adaptation Dimensions and Processes

There are vast and diverse measures or actions that are undertaken in agriculture to adapt to climate change and variability. Researches on agricultural adaptation specifically have described several dimensions along which adaptations can be differentiated, and this serves as a cornerstone for a typology of agricultural adaptations. Common features that differentiate adaptive strategies in the literature include the type or form of adaptation, such as planned or unplanned, public or private, autonomous/indigenous or externally-driven adaptive strategies (Eriksen et. al, 2008; Mortimore, 2000). Also significant is the time-frame for adaptation (ex-ante, anticipatory, or post-ante, reactive), with some adaptive strategies being more pertinent for short-term rather than long-term climatic changes (Downing et. al, 1997). Additionally, adaptation actions are categorised with respect to their degree of effectiveness. Despite these typologies, any such differentiations (including between anticipatory, concurrent and reactive action) are much less unequivocal in practice. Nevertheless, they form a valuable basis for analysis and help draw out – for this thesis – the importance of the key distinction between managed policy-driven adaptations (for example, through drought early warning systems) and autonomous locally-driven adaptations (such as a modification to the dominant livelihood activity) (Stringers et. al, 2009). Adaptation in production systems may simply entail reformulating and altering the management of existing crops rather than more far-reaching crop diversification.

It is apparent that adaptation in agriculture assumes divergent forms at any given scale or with regard to any given agricultural community or group of farmers. Distinctions along this basis, by for example, Boko et. al (2007), are important in highlighting diverse responses to climate change and in understanding adaptation in agriculture more generally (Smit and Skinner, 2002). Nzuma et. al (2010) in fact identify a multiplicity of local adaptive strategies, including: (a) conservation and recovery of vegetative cover in degraded areas; (b) reduction of livestock numbers such as through sale or slaughter; (c) cross-breeding, zero-grazing, and acquisition of small livestock (notably sheep or goats); (d) adoption of indigenous practices of forest conservation and food use; and (e) community-based management of forests and rangelands. Likewise, Below et. al (2010) classify and describe adaptation practices, based on five overlapping categories involving action at different spatial levels: farm management and

technology; farm financial management; diversification of livelihoods on and beyond the farm; government interventions in for example rural infrastructure, the primary health care services and overall risk reduction for agrarian populations; and knowledge management and networks.

Importantly, adaptation research has also focused on indigenous adaptive strategies. Unlike studies that simply dwell on the application of indigenous knowledge to perceive climate risks, these studies (see Nyong et.al, 2007; Speranza et.al, 2010) focus on indigenous knowledge as a local 'resource' that facilitates adaptation. These studies concentrate on local knowledge systems that are used, as a basis for adaptation, to reduce vulnerability, for instance, in food production and enhance soil conservation. In line with this, Nyong et. al (2007) observed that farmers in the Sahel are known to make decisions on cropping based on local predictions of climate, while pastoralists' nomadic mobility in effect represents a local type of traditional ranching management system. Similarly, Mortimore and Adams (2001) indicated that indigenous adaptive strategies such as negotiating rainfall seasons have evolved in the Sahel.

Two problems exist though in the adaptation dimensions literature. First of all, in describing, categorising and analysing adaptive actions (and outputs) (Smit et. al, 2000), the existing literature too often reduces the individual to a rationalising economic actor in pursuing strategies focused on definitive pre-conceived end-points. In practice, adaptation practices are considerably more 'messy' and convoluted than this utilitarian framework permits. Secondly, though categorising adaptive strategies enables aggregated assessments of vulnerability under specific climatic scenarios (Smit and Skinner, 2002), it largely shuts off research on the structures, processes and conditions underpinning adaptive action in local scales.

In this context, social processes underlying adaptation in agriculture are seldom explored vigorously. Climate change impact studies often assume certain adaptations and there is only limited definitive examination of how, when, why and under what conditions adaptation actually occurs in specific agricultural systems (Gbetibouo, 2009). Smit and Skinner (2002:104) therefore claim that 'there has been very little research on the particular odds that specific adaptation measures would in reality be adopted or on the circumstances under which such adaptations might be applied'. As well these scholars raise issues which are crucial to the arguments in this

thesis. Most importantly, they say the following: a) decisions to adopt or modify measures or practices are seldom arrived at with reference to merely one risk, but in light of a complex mix of conditions and risks (not only climate, but also market conditions and social norms for instance) that influence decision-making; and b) decisions to adopt or modify measures or practices are normally not made in a 'once-off' manner, but in a fluid, on-going trial-by-error process.

2.3.9 Sustainable Livelihoods Research and Agrarian Political Economy

Finally, two well-known theoretical approaches are found in the adaptation literature, the Sustainable Livelihoods Framework (SLF) and the political economy perspective. The former, in the light of the notion of sustainability, considers the effectiveness and consequences of agricultural adaptation strategies in Africa. Thus a number of scholars allude to the SLF in analysing adaptation, whilst others simply deploy the notion of sustainability (Osbahr et. al, 2008; 2010) or speak of sustainable adaptation (Gachathi and Eriksen, 2011) or resilient adaptation (Speranza, 2010). Conceptually and methodologically, the nexuses between adaptation and development are also brought to the fore. Along these lines, Osbahr (2007) regards sustainable adaptation as a learned process in which the goal is not for farmers to be well adapted but to adapt well. At the same time, unlike the hard fixes entailing technological and infrastructural response options, adaptation is seen as a dynamic and ongoing process entailing the building of resilience to enhance adaptive capacity in the here-and-now, instead of simply targeting adaptation in the unspecified and indeterminate future (Tschakert and Dietrich, 2010).

Similarly, Eriksen et.al (2011) highlight the principles that ought to be acknowledged under the concept of sustainable adaptation, which include the following: acknowledging the conditions animating vulnerability, including multiple risks; recognising that values and interests are diverse and divergent and affect adaptation outcomes in unpredictable ways; incorporating local indigenous knowledge into adaptation responses; and focusing on interactions and feedbacks between local and higher spatial levels. As such, successful or sustainable adaptations are deemed to be those practices that address and lessen vulnerability and increase overall resilience over time, in response to a range of immediate needs, interests, risks and aspirations (van Aalst et. al, 2008). As a result, scholars focusing on sustainability have noted that, for dry land farming

populations, whose livelihoods are often tied to subsistence agriculture and the natural resource base, fruitful adaptations build resilience and decrease vulnerability in the face of multiple threats (Stringer et.al, 2009).

A political economy approach to climate change, agricultural systems and adaptation stresses the significance of macro-level forces, including economic and political structures, and the ways these impinge upon local agricultural production. In this regard, any decision-making processes around adaptation at farm level are invariably affected by political and economic variables. This literature therefore highlights, and quite correctly, that adaptation does not just occur in an isolated fashion at the farm level, but it is a process greatly shaped by wider economic, political and social dynamics (Smit and Skinner, 2002). In this respect, the role of government policies, institutional arrangements and macro-level social and economic circumstances are increasingly being incorporated into a diverse range of adaptation studies (including those outside agrarian political economy). As such, Crane (2013) specifically found that in Ethiopia and Mali local social institutions mediate people's adaptive processes, production practices, land and water governance, social support systems, gendered household dynamics, use of weather and climate information, and interact with external actors and interventions.

2.3.10 Concluding Remarks on Adaptation in Africa

The preceding sub-sections depict that approaches and frameworks on adaptation in Africa are incredibly diverse. Juxtaposed with global climate change inquiry previously discussed, more continuities than discontinuities are visible. As a fundamental point of departure, a significant number of studies in Africa center on the micro-level, and a broader climate change adaptation discourse (mainly informed and influenced by the IPCC) has been advanced at the global level. Similar to global climate change research, at first climate change research in Africa was quite conventional in giving credence to impacts (primarily quantitative) more so than adaptation itself, and this has eventually molded approaches to adaptation options that have been proposed and/or adopted. Clearly, the popularity of middle level approaches (based on for example vulnerability, resilience and sustainability) is also evident and this resonates with the inclinations in global climate change studies. However, the Sustainable Livelihoods Framework in climate

change adaptation discourse thus far has not paid sufficient attention to the particular trajectories that emerge over time, the power dynamics and the reflexivity underlying the adaptive strategies.

Having been engrossed with and reflected upon versatile studies above, it can be stated with some conviction by way of conclusion that sociological contributions in the analysis of micro-level adaptation in rural Africa are largely insufficient. This is also consistent with the fact that sociology is lagging behind in global climate change debates. A few studies have responded to this gap. For example, de Bruijn and van Dijk (2005a; 2005b) applied Pierre Bourdieu's concept of habitus to describe and analyse the cultural means utilised in decision-making by farmers in Mali in the context of climate variability. On a similar note, Lumosi (2014) incorporated Bourdieu's theory to understand the elements that constitute adaptation practices and the social context in which adaptation practices are situated in Kenya. In doing so, this scholar views adaptation practices as having a form of logic, namely, an everyday logic of practice as formulated by Bourdieu. In this context, and in view of the aforementioned revelations, the relevance of Archer's theory as employed in this thesis seems aptly justified.

2.4 Introducing Margaret Archer

In the preceding sections, I have discussed how adaptation has been theorised, analysed and understood from diverse standpoints particularly in Africa. These viewpoints are highly illuminating in as far as they give an understanding of what climate change and adaptation scholars have been concentrating on, as well as providing a platform for linking arguments and findings in the thesis with reflections from other contexts and perspectives. Although they do not allow for an adequate understanding of adaptation structures, processes and conditions, the above studies remain valuable and pertinent. My point of departure in this thesis is therefore on developing and extending an analysis of adaptation from the backdrop of an almost non-existent sociology of climate change generally in Africa and, as I articulate in the next chapter, particularly in Zimbabwe. My conceptualisation is prompted by my dissatisfaction with the manner in which mainstream academic conversations and policy debates have conceived adaptation in addition to the lack of engagement with sociological theories on Zimbabwe. In this

regard, using the empirical case of communal farmers in rural Zimbabwe, I attempt to operationalise Archer's theory in this section.

This thesis reasons for a focus on farmers' concerns and knowledge contributions, as well as analysis of adaptation strategies, from within the morphogenetic theory on structure and agency as formulated by the critical realist Margaret Archer. Archer's theory, despite its broad sociological appeal and significance, has not been deployed in any significant way with regard to climatic change adaptations (Davidson, 2012). Reflecting a relative dearth in the sociological literature on climate change, there has not been any sustained and concerted attempt to apply Archer's theory in understanding how rural people problematise their circumstances (the specific circumstance, for this thesis, being climate variability) and the conditions underlying their responses to them. As such, Archer's theory directs my thesis towards the notion of reflexivity which asks how individuals come to give attention to certain problems and formulate responses to them. Archer (2010) argues that scholarship that prioritises the role of the social in shaping agency, such as Bourdieu's (1977) habitus, offers an underdeveloped theory of agency, with little consideration for individual differentiation. Hence, there is a need to concentrate on the complex question of reflexivity in a nuanced manner.

Following that, reflexivity is 'the means by which people consciously develop and implement personal projects according to their individually-defined values and concerns, given their situation' (Archer 2007: 5). Reflexivity refers to a veritable exercise of mental power, shared by all normal people, to conceive themselves in respect to their circumstances while also acting on their circumstances. According to Archer's philosophy, the underlying axiom is: no reflexivity, no society. In effect, divergences in people's paths through life derive from human reflexivity, a faculty which is accomplished through internal conversations, where people ceaselessly contemplate their situation and redefine their interests and plans (Archer, 2010). Fundamentally, reflexivity acts as the mediator between societal structure and personal agency, explicating the disparate ways in which people make their way through (or negotiate) the world. Horrocks (2009) puts it that Archer says people have reflexive abilities, which means that conditioning is not a law or a force but a reason and we enjoy interpretative freedom in respect to this (without of course being free-floating entities). All the same, 'in exercising this freedom, and

consequently in reacting to the directional guidance that structural and cultural conditioning bestow into being, we are influenced by two further factors, vested interests and opportunity costs, which condition both interpretation and action' (Archer, 1995: 208). These, and other, factors influence how agents respond to the structured states of affairs in which they find themselves.

Archer draws attention to an analytical dualism which acknowledges the autonomous powers of both society and individuals (Archer, 1982: 1995). In this regard, the pursuit of any social practice implies interplay between the causal powers of subjects (agency) and those of relevant structural and cultural properties (structure). As such, through agential reflexivity, these two sets of causal powers interact and an active role is thus restored to the individual agent. In addition, structural properties are activity-dependent. This means that the causal power of structural properties is actuated by agents through social action. Simultaneously, individual agents cannot establish whatever they want from the situation (or pursue any line of action) but are bounded by the ideational and material resources available (Archer, 2000). Archer therefore understands structure to refer not only to material interests, but also to culture (including ideas, beliefs, values, discourses and ideologies). Both are important aspects of social life and they are parallel yet different from each other. Consequently, keeping in mind their autonomy, allows the sociologist to understand the interplay between them and thus between ideas and interests.

Furthermore, Archer asserts that the most important property possessed by people is intentionality which enables them to entertain projects and design strategies to accomplish them. Nonetheless, the systemic context (structure and culture) shapes the situations people find themselves in and provides strategic guidance and channels with regard to intended projects (Archer, 1995). It is therefore through acting in and through social projects that people engage with the restraints and enablements of given socio-cultural and economic circumstances (Kahn et. al, 2012).

What is critical to note here is that (Archer 2003) contends that the structural context does not determine, but merely orients or conditions agency. While agential abilities and actions are conditioned by social structures, these structures – to reiterate – are not conceived by Archer

(1995:209) to be 'forces but, instead as reasons for acting in particular ways'. This way, Archer institutes a hermetic barrier, which analytically protects agents from any determinist understanding of the structural environment. This barrier is erected by specifying the discrete constituencies of structure and agency (or analytical dualism). Social structures are therefore afforded specific attributes that account for the power they hold over people's practices. Concurrently, agency does not produce structures but only reproduces or transforms them. As such, structural properties do not just exist in-and-of themselves as they are activity-dependent (Archer, 1995). The pursuit of a personal project implies an endeavour to exercise agential causal powers through social interaction, which simultaneously activates the causal powers embodied in structures (Davidson, 2012). Therefore, for Archer, the realisation of a project leads to the establishment of a successful practice by a subject. Insofar as a project presupposes a concern, as articulated by a subject, Archer posits an incremental specification of practical courses of action involving the trajectory: concerns>projects>practices.

In addition, the need and capacity to engage in reflexive deliberation (or an inner conversation) and projects comprise a personal power that comes forth in substantial part from the practical requirements of manoeuvering within the world, and this plays a crucial role in ascertaining why different individuals act in a particular manner (instead of otherwise) within the same socio-cultural context (Archer, 2007). In this case, individuals (internally) debate on their forever imperfect discernments about the objective conditions or structures, and they act in light of their concerns and projects (Clegg, 2010). This position makes Archer's theory a non-reductionist perspective (with agency irreducible to structure) and a theory which does not presuppose any fixed determinant in social processes.

Archer (2000) goes on to posit that the existence of agents arises from the everyday experience of their practices and not from any enslavement to their social context. Following this, peoples' practices hinge ultimately upon their internal conversations, and this implies a human capacity to bracket themselves from the structured world around them and contemplate their situation (Archer 2003). Archer further indicates that the concerns, intentions and projects of agents are subject to change in the light of shifting perceptions of the surrounding dynamic context, therefore adopting an active position toward the realisation of personal projects. Again, to

emphasise, humans do not conform passively to their social circumstances as they actively make life strategies and reflexively assess what is (ethically and practically) significant for them.

Consequently, the prioritisation of different sets of concerns and projects in relation to experiences of social life produces distinctive modes of reflexivity. In this respect, Archer speaks of autonomous, meta-, communicative and fractured reflexivity (Archer, 2007). The mode of reflexive predisposition adopted, and the content of these predispositions, are not a-dynamic and are often situational or can change over time. Individuals predisposed to communicative reflexivity are inclined to seek reinforcement for their internal conversations from close friends and relatives, and may voluntarily relinquish upward mobility or improved life-chances in exchange for tranquility in social relations (Davidson, 2012). Autonomous reflexivity, as the name denotes, involves a comparatively higher degree of independence, with individuals spending a significant amount of time and energy in inner dialogue and designing projects that prioritize improving the conditions of life, even when this entails going contrary to surrounding normative forces and traditions. Meta-reflexivity also entails considerable investment in internal conversations, but this is guided by value-oriented reflection and problematisation of existing circumstances. Agents marked by this reflexivity (meta-reflexives so to speak) invariably lean toward political activism in line with their strongly-held values and ideals. In this sense, rather than conforming to dominant narratives and practices, they regularly scrutinise and contest them. Finally, fractured reflexivity pertains to an abiding incapacity to engage in internal conversation in any meaningful way.

Significantly, Archer's conception of reflexivity (and the specific modes of reflexivity) goes beyond psychological and essentialist conceptions of social practices, as it is firmly rooted in the contingent and fluid realm of the social (Lopez, 2009). Thus, it is the persistence of social context and intimate relationships with significant others (or members of community) that explains the tendency for the communicative mode of reflexivity. In the case of autonomous reflexivity, it is the exact opposite, namely, the tearing asunder of these contextually-important relationships that leads to quite different priorities and projects. Meta-reflexivity is the result of a contextual disjuncture if not conflict between the social context and strongly-held projects (with the disjuncture itself requiring explanation). Lastly, fractured reflexivity (involving the sheer

incapacity to be reflexive) has its own unique social conditions of emergence and existence (Lopez, 2009).

2.4.1 The Relevance of Archerian Thought

Compared to the scope and innovativeness of Archer's structure-agency (morphogenetic) theory, its scant application in climate change adaptation research is striking. Davidson (2012) affords Archer some space in her study, but this is very insignificant compared to what other frameworks such as vulnerability, resilience and the SLF are granted. Personally, I am even more mystified not by the mere lack of Archer but the lack of sociological theories more broadly in climate change debates in Zimbabwe.

Therefore, the greatest motivation and relevance in applying Archer's theory in my thesis is that it is scarcely deployed in climate change studies; not only in Zimbabwe, but regionally and globally. This can be attributed partly to the fact that climate change sociology is still underdeveloped therefore expecting to see Archer soundly applied in climate change research in Zimbabwe at this juncture is naive. At the same time, although others would argue that the lack of sociological theories in climate change research in Africa derives from their inapplicability, I boldly argue that the lack of widespread application of Archer especially by African scholars should not be explained through Eurocentricism. Although Archer is a British sociologist, the adoption of her concepts for example in education research in Africa (see Boughey and Niven 2012; Czerniewicz et.al, 2009; Makondo and Makondo 2014; Williams, 2012) is evidence of the applicability and relevance of her theory. Engaging Archer in this thesis thus should not be conceived as awkward or as plainly falling into the trap of Eurocentricism. If anything, it is intriguingly full of rich theoretical possibilities.

Archerian thought may have limits in the analysis of the broader circumstances in rural Zimbabwe, as it is not designed to provide for example, a political economy of agrarian communities. But, when I deliberated that I wanted to examine the ways in which people problematise their conditions and develop responses to them, I could not simply discard her notion of reflexivity. Although her theory was formulated in other contexts (mainly Britain), it

would be a crude misinterpretation of Archerian thought to say it is inapplicable in rural Zimbabwe. Her theory is adaptable enough to suit a range of historical and spatial contexts and adjustable enough to include and indeed incorporate complementary notions and insights from other scholars. As well, the available climate change studies have not contended adequately with Archerian thought. This thesis therefore evokes the need to bring Archer into climate change studies because she is largely missing. It also suggests that the current use of Archer in climate change research may be narrow and restrictive.

The strength of Archer's theory is also clear in that 'she has positioned herself critically vis-a-vis substantive theories that reduce social structures to the aggregate effects of individuals (for example, rational choice theory), reduce individuals to the position of bearers of structural relations (for instance, structuralism), and collapse the distinction between social structures and agents (such as Giddens's structuration theory)' (Lopez, 2009:173). Her theory is therefore one which is capable of linking structure, culture and agency in a nuanced and non-reductionist manner.

Archer reasons for the need for greater recognition and appreciation of the diversity of social subjects (or agents) and an empirically-based unpacking of how people construct, negotiate and manage risks under discrete conditions (Davidson, 2012) such as those risks posed by climate change and variability. This speaks directly to the concerns of this thesis. Furthermore, Archer (2007) brings to the fore the deepening of contextual discontinuities in the contemporary world, which relates to her emphasis on the prevailing morphogenetic condition entailing rupture and transformation (instead of a morphostatic condition marked by stability and continuity) (Archer, 1982). These discontinuities relate to the presence of 'excess' in the sense that there is no longer an abiding and lasting fit between habitual and routinised activities on the one hand and social conditions and context on the other. This implies, or at least encourages, greater prospects for human reflexivity irreducible to what exists. This likewise points to a world characterised by risk which cannot be negotiated through the realms of embodied knowledge and conventional practices alone. Late modernity for Archer (2010), then, is about de-routinisation as an essential condition of existence in which subjects typically reevaluate *modus vivendi* and prevailing social arrangements. This entails new contemplations, framings and practices, as subjects map a way in

their world through innovative and adaptive forms of agency irreducible to the past or the present *status quo* (Chalari, 2012).

The utility of Archer's theory also lays in its legitimatation, at least implicitly, of an ethno-methodology that allows the researcher to both observe outward behaviour and document socially-constructed meaning. In this case, I look in particular at how farmers give meaning to changes in climate variability. It also highlights the significance of tracking and questioning changes in patterns over time and, in the case of my thesis, tracking changes in climate variability over two decades. More so, Archer's approach privileges narrative history as the paradigmatic form of explanation with a focus on the specificities of both time and place (or space more broadly) (Porpora, 2013). Therefore the analysis of adaptation to climate variability by subsistence farmers in Zimbabwe cannot be frozen in time, and the particularities of the spatial location and processes within which the research site is embedded also become crucial. In this light, Archer's theory allows for a cross-scale analysis of adaptation. The reflexive predispositions of farmers (irrespective of the mode of reflexivity) are therefore not static or uniform, and can change over a life course or across communities. Hence adaptation becomes an evolving process under specific socio-spatial conditions.

In emphasising the potential for agents to mediate constraining and enabling powers through the adoption of particular framings and the pursuit of specific practices, Archer's theory provides a persuasive understanding for the fact that farmers (like all subjects) operating within a shared structural context may have different experiences and interpretations of that common context. In other words, framings and practices are irreducible to structure. Furthermore, in highlighting the ongoing and fluid links between context and the different modes of reflexivity that come to be expressed by means of dispositions and practices, the work of Archer highlights the importance of going beyond short-term considerations to fathom and explain the long-term 'impacts' of situational contexts on agents. All this is located within an emphasis on the dialectical relationship between structure/context and agency, each with their set of casual powers.

2.4.2 Conceptualising Adaptation from an Archerian Perspective

My argument starts from the premise that adaptation in agrarian societies is underpinned by various structures, processes and conditions. Adaptation can be understood by deploying the analytical dualism that underscores Archer's theory. By utilising analytical dualism, both structures and agency are given separate consideration as independent and irreducible – but related – entities in understanding social practices. This calls on the researcher to study the internal conversations, concerns, experiences, agential projects and interpersonal interactions of subjects along with the cultural and social structures related to these. By extension, from Archer's perspective, one can argue the following: changes in climate variability represent morphogenesis (a moment of transformation or structural change), farmers' concerns on climate change entail problem identification or formulation (where farmers have diverse concerns); and adaptation is an evolving complex process linked to contingent structures and conditions and broader social processes.

The relevant conditions, structures and processes are examined empirically in the thesis in light of the constraints and opportunities farmers face throughout the adaptation process. I need to clarify here that I am not trying to understand individual, rationally-made choices in the context of wider structures. Rather, the thesis seeks to gain a nuanced understanding of the complexities of the differential structures, processes and conditions that animate adaptation. If structures simply explained everything, then every famer would adapt and all farmers would adapt in the same way. In other words, adaptation could be 'read off' or posited simply by identifying the existing structure. In line with Archer's theory, I reject linear causation and recognise the muddy complexity of social systems.

As such, this thesis argues that, confronted by changing climate variability (morphogenesis), communal farmers deploy agential reflexivity – they are able to reflexively make sense of and evaluate their circumstances and create adaptive strategies in view of what matters to them most. In fact, adaptive strategies farmers adopt are a result of their reflexive deliberations such that adaptation practices exceed what can simply be read from structures (as a form of contextual discontinuity). In particular, Archer's notion of the internal conversation firmly establishes and grants personal powers to the agential or individual subject (farmers in this study) in relation to

their aims and aspirations. In subjectively creating responses to climate variability (influenced by their own concerns and capacities), farmers make these choices in relation to – but not determined by – their objective circumstances (contextual factors that are for example social-structural or social-interactional). Therefore, famers are evaluative beings, able to design and determine their responses to the structured circumstances in which they find themselves, and in light of what they personally care about most. Through their internal conversations, and alongside their personal circumstances and goals, farmers deliberate and then, using reason, intentionally commit themselves to particular courses of action that they deem worthwhile.

The thesis investigates actually-existing adaptive strategies but, taking into consideration that some farmers may not take any action whatsoever, hence the notion of fractured reflexivity becomes important. The reasoning is that not every farmer capable of engaging in internal deliberations necessarily initiates and pursues practices to address livelihood challenges. As humans, we evaluate what social factors restrain and enable our life projects, and how much endurance is required to remain on course and determine what to do next (Archer 2003: 2010). As Archer says, 'the exact outcome varies with subjects' personal concerns, degrees of commitment and with the costs different agents will pay to see their projects through in the face of structural impediments' (Archer 2007: 12). In this respect, reflexivity is a valuable vantage point into understanding adaptation to climate variability in rural agrarian economies.

2.5 Conclusion

This chapter began by discussing the development of the concept of adaptation in diverse disciplines and climate change research in particular as well as how adaptation has featured in climate change sociology. This was followed by an interrogation of different approaches to adaptation in rural Africa and their contributions, which is critical as it provides an entry point for my theory and the background for the development of my arguments in the thesis. The chapter ended by introducing the much neglected sociological theory of Margaret Archer and enunciating how it may advance adaptation inquiry in the context of gaps and weaknesses in current climate change adaptation thinking. With this theory, I do not attempt to do all the work that other theories and concepts fail to do (or fail to contribute), nor do I aim to replace the work

reviewed as if this work is of no value. Instead, what this thesis demands, and tries to show through the use of Archer's work, is the critical significance of an analysis of adaptation as a complex process as underpinned by various structures, processes and conditions in rural Zimbabwe.

CHAPTER 3: CLIMATE CHANGE AND VARIABILITY AND THE IMPACTS ON AGRICULTURAL LIVELIHOODS IN ZIMBABWE

3.1 Introduction

This chapter submits an elaborated national context for the study. The aim is to provide an encompassing background on climate change and variability and their impacts in the country. This is fundamental to the degree that it rationalises the understanding of adaptation in Mutoko under conditions of climate change in broader Zimbabwe across the selected study period, and it elucidates my entry point in so far as what my thesis attempts to address. Significant to note is what McDevitt (2009) observed, namely that minute research has been conducted on climate change in Zimbabwe over the past five years and therefore the literature is incomprehensive. The chapter deals with two principal themes. The first theme dwells on the patterns and trends in climate change and variability and the second on impacts on agrarian livelihoods in the country. Prior to the discussion of the main themes, I offer a discussion on climate hazards and risks as well as socio-economic and political developments that have occurred in the country in recent years. This suffices to depict the importance of climate variability as a critical research issue.

3.2 The Socio-Economic and Political Terrain

The socio-economic and political terrain in Zimbabwe is discussed in view of the fundamental socio-economic and political developments that have occurred in the country since independence in 1980. The purpose of this discussion is not merely to provide a fully comprehensive overview of this terrain, but to leave the reader with a strong sense of the mounting political and economic crises in the country (up to 2014) within which to later contextualise more specific issues pertinent to climatic change and risks.

Zimbabwe, at one time Southern Rhodesia, is a tropical inland nation in southern Africa with roughly 12,973,808 million people (Zimbabwe National Statistical Agency, ZIMSTAT, 2012). It adjoins with South Africa to the south, Botswana to the southwest, Mozambique to the east and Zambia (and Caprivi Strip) to the northwest. Zimbabwe is a country with a land area of 390,757

square kilometers of which 85% is farming land and the remnant national parks, state forests and urban land (Government of Zimbabwe, GoZ, 2004). Nearly a third of the country is below 800 meters above sea level, with the lowest elevation being 197 meters and the highest being 2,592 meters (in the eastern highlands of the country). Zimbabwe attained independence in 1980 through a negotiated settlement accompanying an anti-colonial armed struggle traversing more than two decades.

Following the first democratic elections in sovereign Zimbabwe in 1980, the Zimbabwe African National Union-Patriotic Front (ZANU-PF) assumed power. Since then, the government has swerved from one economic strategy to another in what turned out to be a game of hit-and-miss played with more exuberance than success (Kanyenze et.al, 2011). ZANU-PF held an unchallenged position in the political party system until the emergence of the Movement for Democratic Change (MDC) in 1999 and it reigned incessantly until a coalition government was formed with MDC in 2009. The country has experienced political upheaval compounded with remarkable economic collapse since the fast track land reform in 2000.

Politically, during the early years after independence, the government seemed to be 'devoted' to broad based democracy through various progressive reforms. These included the enactment of the Legal Age of the Majority Act of 1981, the economic and political integration of workers through the Labour Relations Act of 1985, decentralisation (through Ward and Village Development Committees) in 1984 and the acknowledgment of women as an exceptional group through the creation of the Ministry of Women's Affairs and Community Development in 1983 (Muzondidya, 2009). At the same time, the country's political terrain was increasingly marked by authoritarianism, coercion, repression and intolerance by the ZANU-PF government in an attempt to sustain a one-party state. This authoritarian restructuring came even more pronounced during the 1990s.

Behind the facade of constitutional democracy therefore rested a dictatorial political system defined by the prohibition of democratic space and severe infringement of human rights and the rule of law (Muzondidya, 2009). The deployment of pieces of legislation such as the Emergency State powers (until 1991), the 2002 Public Order and Security Act (Chapter 11:17) and the 2002

Access to Information and Protection of Privacy Act (Chapter 10:27) anchored ZANU-PF's overbearing rule. State coercion was also deployed in gendered terms as women were accused of loitering (under the 2001 Sexual Offences Act) and they were jailed regularly as 'prostitutes'. Repressive tactics, violence and intolerance toward political diversity were pivotal in the government's position toward political protest and opposition.

This became prevalent in urban areas, as in the state's response to rising trade union mobilisation in the 1990s (in response to a structural adjustment programme implemented from 1991). It was further demonstrated by the military-style Operation Restore Order in 2005, which targeted informal housing and trading in urban spaces. It entailed the destruction of illegal structures in towns and cities which produced a humanitarian crisis as an estimated 700,000 people across the country lost their homes or sources of livelihood. Vambe (2008:10) in fact contends that 'operation *Murambatsvina* (restore order) pronounced the authoring of a new political (im) morality where violence is instrumentally escalated to foil the manoeuvre of internal enemies'. The government's ruthlessness, political intolerance and disrespect for the rule of law were also made clear in the processes and events that characterised the fast track land reform.

In the midst of political repression in the country, voices of dissent came out. Resistance has certainly been noticeable within Zimbabwe's labour movement, coordinated under the Zimbabwe Congress of Trade Unions (ZCTU). During the 1990s it had a significant presence in urban-based struggles, often acting in concert with a broad coalition of civil society groups (Sutcliffe, 2012). As a result, the deepening political restlessness, disgruntlement and dissatisfaction starting in the mid-1990s culminated in the establishment of the labour-orchestrated and dominated opposition political party MDC (Mawere, 2011). The success of the 'No' vote (as propagated by the MDC) by the majority of Zimbabweans who voted in the constitutional referendum in 2000 was the first candid political endeavor at querying ZANU-PF's ongoing insistence on hegemony.

The MDC has sought since 2000 to weaken the *de facto* one party reign of ZANU-PF through involvement in general elections conducted between 2000 and 2013. These include the following: parliamentary elections in 2000; presidential elections, 2002; parliamentary and

senatorial elections, 2005; harmonised presidential and parliamentary/senatorial elections, 2008; and, most recently, harmonised presidential and parliamentary/senatorial elections in July 2013. Still, ZANU-PF has ceaselessly, ruthlessly and violently machinated state power to confront the challenge presented by the MDC, and the various elections since 2000 have been grossly manipulated to continue the ruling party in power. The 2008 election has been described by Sachikonye (2011:68) as 'the most violent in the annals of Zimbabwe's post-independence history'.

Following the March 2008 elections and the presidential run off in which the MDC declined to take part (following widespread violence and intimidation) a political impasse ensued. Nonetheless, after negotiations expedited by the Southern African Development Community (SADC) and the African Union (AU), a Global Political Agreement (GPA) was signed in September 2008 and accordingly a coalition government constituting MDC and ZANU-PF was forged in February 2009. Instability in the political and macro-economic environment existed before this, but some normalisation occurred subsequent to it. For instance, the national economy grew by 5.8% in 2009, 8.1% in 2010 and an estimated 9.3% in 2011; inflation, which had reached astronomical levels after the year 2000 (500 billion percent in September 2008, up from 15% in 1990) came under reasonable control; and agricultural production recuperated slightly after the significant downfall arising from the fast track land reform (Gasana et. al, 2011). These changes have been attributed to the signing of the GPA, which led to the formation of a transitional Government of National Unity (GNU) and adoption of a multi-currency regime (involving the dollarisation of the national currency) in early 2009 (Manjengwa et.al, 2012). The GNU however ended after the election on 31 July 2013 which witnessed an overwhelming defeat of MDC by ZANU-PF party. The MDC has thus far failed to transcend the regime's power.

In terms of the economy, the maximum levels of sustained economic growth in Zimbabwe were registered between 1980 and 1990 with an average Gross Domestic Product (GDP) growth rate of 5.5%, which was higher than the average for sub-Saharan Africa during the corresponding period (Brown et.al, 2012). Accordingly, the early 1980s were defined by economic growth and, additionally, a significant redistributive programme involving the delivery of social services and infrastructure to the antecedently deprived colonised sectors of society. With the assistance of

foreign donors such as the Scandinavian nations, the government extended the provision of health, sanitation and education to areas (notably rural areas) previously disregarded by the colonial state (Muzondidya, 2009). For example, significant social advances in such areas as education (for example, access to education and adult literacy), health (for instance, immunisation coverage, malaria control and contraceptive prevalence), and provision of water and sanitation to rural households were recorded. In terms of infrastructure, the government specifically constructed roads, clinics, schools and boreholes in rural areas that lagged behind urban areas.

Therefore, by the end of the 1980s, social indices of Zimbabwe were significantly better than for countries at parallel levels of economic development. While the country was marked by noteworthy progress, the government nevertheless came under criticism for its policies during this period. For example, Muzondidya (2009:202) asserted that 'the gains were non-comprehensive, unsustainable and ephemerally welfarist in nature'. More so, the gains accumulated were unequally dispersed by race, class and region. The period was thus characterised by persistent rural poverty, elitism, capital accrual by educated blacks (as well as white farmers), and a small black bourgeoisie who continued to own and command resources.

Major problems continued to exist in rural areas, notably the communal areas where subsistence agriculture prevailed. Historically, agriculture has been Zimbabwe's economic stronghold, at least in terms of white-dominated commercial agriculture. Sachikonye (1992) once depicted agriculture as the 'practically vaunted anchor' of the Zimbabwean economy. As such, agriculture accounted for 15-18% of Zimbabwe's GDP, approximately 60% of the raw materials demanded by the local manufacturing industry (mainly processing of agricultural commodities) and 40% of overall export earnings or revenues (GoZ, 2010). Combined, commercial and communal farming catered for employment and direct livelihoods for about 70% of the population, including 30% of formal employment (De Wit, 2006).

Importantly, the agricultural economy has been historically moulded by land questions rooted in British colonial rule. The ZANU-PF government inherited an economy grounded on white supremacy (Kanyenze et.al, 2011). Upon independence, white commercial farmers possessed

45% of the prime land in the country, and were supplying 90% of the country's marketed food. Blacks had been allocated land in tribal trust lands, now called communal areas, and were subjected to overcrowding, absence of state support and growing degradation of the land. The Lancaster House Constitution, which formed the basis of the post-colonial state in Zimbabwe, provided white farmers with the investment security they viewed as indispensable for their farms by the adoption of a 'willing-buyer-willing-seller' agreement (Southall, 2011). On this basis, the Zimbabwean state pursued land redistribution during the 1980s directed at ending rural poverty and the unequal racial land ownership.

Overall, the government embarked on restructuring the economy to integrate it into the world economy (after years of sanctions against the Rhodesian regime). This involved significant state intervention in the economy, including through the initiation of the minimum wage, positive commodity pricing, better access to loans and credits and the revitalisation of goods markets. Further, the state offered a range of support services to communal farmers, including the building of agricultural infrastructure such as irrigation schemes. Similar though to social policies of redistribution, the state's economic policies in the 1980s were problematic. Notably, there was insignificant radical reorganisation of the economy. As a result, immense income and wage differentials continued to exist, employment creation fell below expectations, and land reform did not impact upon the land inequality. In fact, land continued to be in the hands of white farmers and foreign-owned companies proceeded to dominate productive sectors. In this regard the Lancaster House Constitution became a stumbling block to significant economic and political reforms, as it embodied a series of compromises – including white representation in parliament and market-based restraints on land redistribution. Consequently, 'the legacies of enclavity and dualism remained intact' (Kanyenze et.al, 2011:18).

In this context, a structural adjustment programme known as the Economic Structural Adjustments Programme (ESAP) was implemented from the early 1990s. It purported to liberalise the economy and bolster economic growth but, significantly, it undermined many social and economic gains for workers and communal farmers attained during the first decade of independence. The implications of ESAP in the country were matched by the scourge of HIV and AIDS. Life expectancy at birth which averaged 56 years in the 1980s and had risen to 60 in

1990, diminished to 40 by 2000 and (and then to 33 years by 2008) (Nyazema, 2010). Worse still, infant mortality which had attenuated from 86 to 49 per 1000 live births between 1980 and 1990, increased to 53 per 1000 live births in 1994 (and 67 per 1000 live birth by 2009) (Parliamentary Portfolio Committee on Health, 2010). This situation was exacerbated by the massive exodus of health professionals from the country due to diminishing socio-economic and political circumstances.

More so, a cardinal weakness of ESAP was its failure to provide safety nets to buffer those who lost out (Raftopoulos, 2001). As well, because of the neo-liberal trajectory, land redistribution dropped considerably during the 1990s, and became more focused on maximising productivity on redistributed farms. Apart from detrimental effects on the social sector, there was de-industrialisation of the agro-industrial sector, rural poverty escalated, national and rural income inequalities amplified and the pressure on natural resources contributed to the flare of rural tensions that had not been settled in the 1980s (Muzondidya, 2009). Laakso (2003) contended that de-industrialisation and concomitant rising unemployment were not temporary or short-term problems with implementation of the adjustment but its logical and in-built end results. In a related manner, ESAP actuated a number of processes from the mid to late 1990s which included a tendency towards magnified state corruption, a slump in economic growth, an increase in the rate of inflation, growth of greater political aspirations by trade unions and civic groups, and the defeat of ZANU-PF in its intent to constitute a one-party state.

Following that, Zimbabwe's economy has gone through dramatic declines after the turn of the century in the face of the insufficiently planned fast track land reform. Muzondidya (2009) depicts the economic changes taking place from the 1980s through the 1990s and into the post-2000 period with the phrase 'from buoyancy to crisis'. By 1990, the real GDP growth rate had reached a peak of 7%, before entering into the period of steep descent – averaging 1.5% per annum between 1991 and 1995 (GoZ, 2010). From 2000, the economy was in free fall such that between 2000 and 2007 the GDP wilted by over 40%; and the GDP further plunged by 14% in 2008. It was only during the GNU that economic growth experienced some sort of turnaround, though massive problems pertaining to employment and poverty remain up to now. At the time of the formation of the GNU, the country was pronounced a net importer of food, with a large

proportion of the population banking on food aid. Poverty levels had risen markedly and, as economic growth slumped, so did formal employment. This ensued in considerable employment losses, the increased informalisation of the economy and growth in feminisation of poverty. Chagutah (2010) ascertained that humanitarian aid for 2008 was a monumental US$490 million, against a backdrop of over 90% unemployment and the worst crop failure in the country's history. More women (53%) were employed in the informal sector than men (47%), with 44% of those employed in the informal sector living below the total consumption poverty line, compared to 36% of the formal sector. Overall, poverty in the country increased from 30% in 1990 to 80% by 2008, and unemployment moved from 15% in 1990 to 94% by December 2008 (Tevera, 2008). Another outstanding consequence of the economic crisis was the massive migration of highly skilled workers to neighboring countries in southern Africa and beyond.

Most prominent in seeking to understand the so-called economic meltdown in Zimbabwe has been fast track land reform, which arose in the face of a nation-wide land occupation movement. The programme initially interrupted and then undermined the white commercial agricultural sector with regard to the production of key agricultural commodities, including maize, soya beans, wheat and tobacco. Resettled farmers, at least those living on the heavily subdivided A1 farms, received only minimal post-settlement support from the state. In the first seven years after fast track (2000 to 2007), the GDP fell by a cumulative 40%. Undoubtedly, fast track in-and-of-itself was a major causal factor in this respect, but it must also be noted that it had ripple effects including international sanctions imposed upon Zimbabwe and a fall in foreign tourists as the country was immediately labeled as a high risk destination (Nyamwanza, 2012).

The overall macro-level evidence is that fast track has been followed by a contraction of the Zimbabwean economy (Chikozho, 2010a), with a causal link often being made between fast track and economic contraction. At the same time, some micro-level assessments demonstrate that the amount of land planted under cereals had actually increased (for instance by 9% from 2001 to 2002), with the area planted with maize increasing by 14% mostly as a result of expansion in the fast track resettled areas (Mukherjee, 2002). In other words, though national agricultural production has declined, there may be enhanced agricultural production and hence rural livelihoods (if analysed at household level) particularly on A1 fast track farms.

Nevertheless, the main discourse is about agricultural shrinkage and collapse. As one author has argued, 'the height of this was the shrinking of the agricultural sector by an annual average of -7.1% as the cumulative agricultural output narrowed by -79.4% between 2002 and 2008' (Biti, 2009:14). Manyani (2011) likewise argues that agricultural output deteriorated by 51% and industrial production diminished by 47%, while the presence of agricultural products from Zimbabwe on the international market has been on the decline since the implementation of fast track land reform. Similarly, in the early years of fast track (between 2001 and 2002), maize output slumped from 800,000 tons to about 80,000 tons, wheat form 225,000 tons to about 100,000 tones, tobacco from 230 million kilograms to 70 million kilograms, and soya beans plunged by 50%. Because tobacco, soya beans and wheat were being produced by large-scale white commercial farmers, the perturbation induced by forced land acquisitions through fast track land reform played a major role in declines in these commodities.

Still on fast track land reform, Mukherjee (2002:10) claims that 'drought notwithstanding, Zimbabwe is the most conspicuous case of government mismanagement and policy failure ensuing in the implosion of the agricultural infrastructure…no amount of bad weather can explicate the magnitude of the deficit'. Furthermore, waning economic performance between 2000 and 2008 has also been attributed to economic mismanagement, public management and governance issues (including authoritarian restructuring leading to an insensitive stance to democratic input) and the general loss of international support. Additional grounds for the significant economic decline, when examining trends over the long-term, include the unbudgeted-for gratuities disbursed to war veterans of the country's independence struggle in 1997, which debilitated the fiscus and led to the immediate crash of the Zimbabwean dollar (Nyathi, 2004). The Zimbabwean dollar lost more than 70% of its value overnight on what became known as 'Black Friday' on 14 November 1997. Also of significance is the engagement in 1997 by the government in the equally unbudgeted-for military intervention in the Democratic Republic of Congo to bolster the army of the then president Laurent Kabila, which has been termed 'a misguided foreign adventure' by Games (2002). On a different note, Bond (2007:153) says 'Zimbabwe's long term economic crisis set in around 1974 when imperialism, globalisation and postcolonial politics were not factors functioning with the equivalent intensity as they are today'. In general, Bond (2007) believes that the explanation of the Zimbabwe's systemic

economic crisis lies in the over-accumulation of capital, and that this dates back to the pre-2000 period including during ESAP.

Although there are clearly competing discourses in explicating Zimbabwe's economic decline (including within agriculture), I contend that the place of climate-related hazards and risks is in the main underestimated and their role is greater than the existing literature allows for. In this respect, despite the claim by Mukherjee (2002) about the comparative insignificance of climate change in accounting for mounting agricultural problems in Zimbabwe, he does nevertheless refer to this as a contributing factor. As well, the International Monetary Fund (2009) speaks about the contraction of agricultural outputs in Zimbabwe as induced by rainfall variability and drought (International Monetary Fund, 2009). In the following sub-section, such claims are examined more specifically as they bring to the fore critical themes pertaining to this thesis.

3.2.1 Socio-Economic Decline and Climate Hazards and Risks

Many scholars have indicated that Zimbabwe is confronting several climate-related disasters and risks arraying from recurring droughts and floods, which have jeopardized the country's food security (Chikoto and Sadiq, 2012). Rockstrom (2003) therefore maintains that the striking deficit of food appeared to be stimulated by a combination of a critical decline in social and ecological resilience actuated by erratic rains leading to floods and dry spells. Likewise, Likewise, Chagutah (2010) underscores that the period of economic decline and political instability (as outlined above) corresponded with temperature increases, erratic rainfall patterns and recurrent drought, which aggravated suffering, particularly for people living in rural areas where close to 62% of the population lives. Therefore, the country's encounter with droughts, in particular, compounded with economic and political challenges, has besmirched the country's former position as the breadbasket of southern Africa.

Indeed, Zimbabwe is prone to a number of natural and man-made hazards such as droughts, floods, storms and HIV and AIDS amidst other epidemics. Between 1980 and 2010, PreventionWeb (2012) attested that 35 natural disaster events took place in the country, which led to 6,448 deaths, averaging 208 deaths from disasters annually. From the 35 natural disasters,

6 were drought occurrences, 7 were floods, 2 were storms and 20 were epidemic occurrences. It has been observed that flooding is a frequent problem in Zimbabwe where it jeopardises the well-being and food security of Zimbabweans, particularly in rural areas. Flooding can be induced by heavy precipitation during the rainy season (November to April) or by tropical cyclones that emerge from the Indian Ocean (Madamombe, 2004). Consequently, it contributes to losses of life, destroys livestock, crops and properties, and engenders eruptions of diseases such as cholera and malaria. In a related manner, the country endured cyclone Bonita in 1995/1996, Japhet in 2002/2003 and Ernest in 2004/2005, stimulating excess in rainfall resulting in flooding of low lying areas (Tsiko, 2008). In 2000, Tropical Cyclone Eline induced flooding in the Zambezi Basin, killing 700 people, rendering over 500,000 people homeless and ruining infrastructure worth US$1 billion (Gwimbi, 2009a). Tropical Cyclone Japhet induced flooding in Guruve and Muzarabani districts, also in the Zambezi basin. In general, the lower Zambezi has been depicted as extremely vulnerable to flooding. Vulnerability to floods is caused by many factors including, but not confined to, the location of homes in floodplains (Gwimbi, 2009a).

Furthermore, numerous droughts have hit the country in past and recent years. Reckoning that the country is for the most part an agrarian economy, droughts have had ravaging impacts on the nation's food security. It has been noted in particular that the droughts in the country are induced by El Nino-Southern Oscillation (Mazzeo, 2011). The drought occurrences of 1946-47, 1960, 1972-73 and the early 1980s contributed to decreased production of maize, which is a staple food in Zimbabwe. It has been shown that the austere droughts that came about in 1982/1983, significantly decreased cereal production in Zimbabwe and other countries of the southern Africa region by almost half the accustomed production levels. Specifically, the 1982/83 drought ensued in a US$360 million loss in direct agricultural production and US$120 million in drought relief costs (Nyabako and Manzungu, 2012). The 1991/1992 drought is one of the severest droughts to hit Zimbabwe. This drought contributed to the uptake by the Grain Marketing Board of only 13, 000 tons of maize that year, sufficient to last Zimbabweans for two days (Maphosa, 1994). Additionally, more than a million cattle were killed because of starvation hastened by the drought. It led to a 45% drop in agricultural production, 62% slump in the stock market, a 9% reduction in manufacturing output and 8% decrease in GDP in the country (Chimhou et. al, 2010). Overall, it has been observed that the drought affected around 5 million people.

More so, the drought years of 1993/94 and 1994/95 exacerbated the economic problems induced by structural adjustment and fed into the strikes and disruptions occurring at the time; and the 2001/02 drought came in the first year that new farmers had land under the fast track land reform, making it tougher for them to become agriculturally-grounded (Manjengwa et.al, 2012). In fact, Zimbabwe went through the longest mid-season drought in 20 years from the end of December 2001 until February 2002, contributing to widespread maize crop failures in the communal areas that ordinarily produce half of the country's maize (Lambrechts and Barry, 2003; Mukherjee, 2002). On a similar note, as a result of the drought in 2008, the estimated national maize production in Zimbabwe deteriorated from the domestic maize demand of 1.1 million tons to merely 475,000 tons (World Bank, 2008).

Overall, the above discussion is imperative as it establishes how climate hazards and risks form a decisive part of the development trajectories that have occurred in Zimbabwe over the years. These developments expose the broader context in which my study is posited and are therefore significant parts of the arguments underlying this thesis.

3.3 Understanding Climate Change and Variability in Zimbabwe

By the end of the twentieth century, Zimbabwe was a warmer and drier country than it was at the beginning. This section ponders on the patterns and trends in climate change and variability in the country. Prior to the main discussion, for the sake of clarity, it is pivotal to first afford attention to the country's climatic conditions. To reiterate definitions provided in the first chapter, climate change is normally defined as the significant variation in the mean state of climate relevant variables such as temperature, precipitation and wind in a certain period of time, generally over 30 years (Intergovernmental Panel on Climate Change, IPCC, 2007). Climate variability corresponds to climate fluctuations across a shorter time period which can be annually or every decade (Sanchez-Cortes and Chavero, 2010). In my study, I therefore separate climate change and climate variability grounded on the conceptualisation of temporal scales alluded to in the preceding definitions. My study is interested in observed and experienced changes in variability paying exceptional attention to rainfall and temperature over a decided historical past, which is, 1992-2014.

3.3.1 Zimbabwe's Climatic Context

Zimbabwe rests in a semi-arid and arid region in which rainfall is inconsistent and unreliable thus impacting on rain-fed agriculture and other sectors of the economy. Rainfall totals on average diminish from northern to southern parts of the country. Unganai (2009) elaborates on this by noting that rainfall displays substantial spatial and temporal variability defined by changes in the onset of rains, increases in the frequency and intensity of heavy rainfall events, increases in the proportion of low rainfall years, reductions in low intensity rainfall events, and increases in the frequency and intensity of mid-season dry-spells. Aside from the overall effects of global climate change and various local factors, rainfall over Zimbabwe is also determined by El Nino - Southern Oscillation (ENSO) (Ministry of Environment and Tourism- Climate Change Office, MET-CCO, 2004).

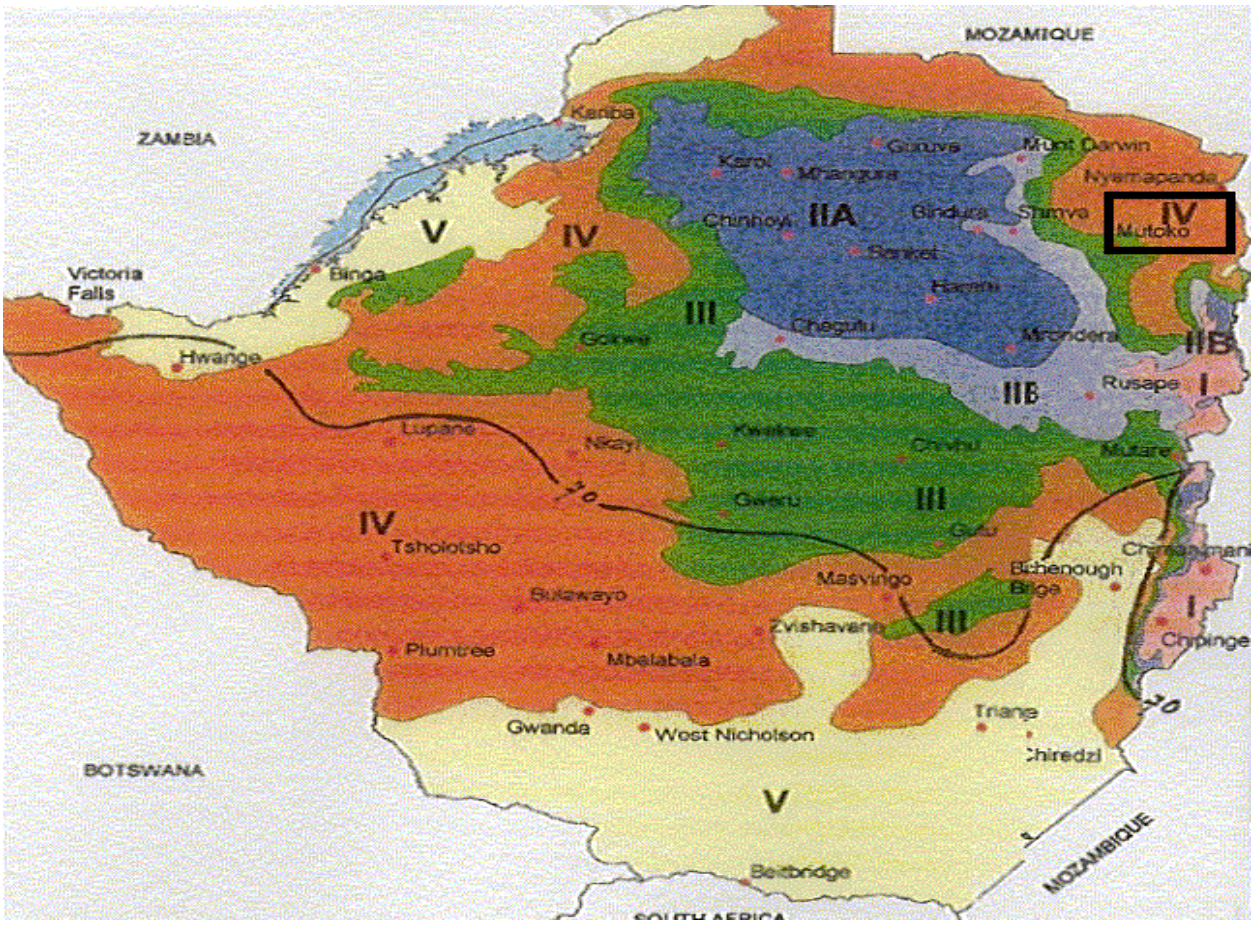
Apparently, the climate of Zimbabwe does not present the conventional summer-autumn-winter-spring seasonal cycle as in mid-latitude weather regimes. As indicated by the relevant Zimbabwean state ministry (MET-CCO, 2004), the country's climate is traditionally defined by the following seasons:

- Hot season (September to mid-November). High temperatures characterise this season with low humidity particularly in September.
- Main rainy season (mid-November to mid-March). The quality of the rainy season is mostly hinged on the behaviour of the Intertropical Convergence Zone (ITCZ), a consequence of the convergence of the Congo Air and the southeast Trade winds. Tropical cyclones as well convey significant rains into the country now and again.
- Post-rainy season (mid-March to mid-May). This is the conversion period between the main rainy season and the cool season. Days become increasingly hotter during the first half of the conversion period.
- Cool season (mid-May to August). The lowest temperatures in Zimbabwe are registered during this season. The season is also qualified by cold nights with sporadic frost, clear skies and dry air. It is the least rainy time of the year.

While the country incurs nearly all of its rain during the five summer months from November to March, the significant characteristic during the rainy season is its unreliability in terms of

amount, duration and distribution. Mean annual rainfall across the whole country is 655 millimeters (mm) but this deviates greatly from as little as 325 mm per annum near Beit Bridge in the south to over 1858 mm at Stapleford Forest on the east facing gradients of the eastern highlands. Overall, the south and southwest of the country are more inclined to droughts (Unganai and Murwira, 2010). As such, Chagutah (2010) highlights that, on average, one to three droughts occur every ten years, for the most part due to changes in the phases of the ENSO phenomenon and intermittent sea surface temperature changes. Mean annual temperatures are greatly regulated by altitude and are 18-19º Celsius at 1400 metres above sea level on the central Highveld, 23º Celsius in the Limpopo Valley and 15º Celsius at 1800 metres in the eastern mountainous parts of the country. The highveld receives some frost in June or July in most years and temperatures rise up to 30º Celsius around October while, in the lowveld region, temperatures seldom fall below 2º Celsius in winter but can increase to over 40º Celsius in summer (MET-CCO, 2004).

Map 3. 1: Natural Regions of Zimbabwe



Source: Adapted from http://reliefweb.int/sites/reliefweb.int/files/resources/EB61BB18A19B597385257664007D14A9-map.pdf

In addition, Zimbabwe has been traditionally categorised into five natural regions (or agro-ecological zones or regions) based on soil type, rainfall, vegetation and climatic conditions. As shall be disused later, the nature of these regions has shifted over the years instigating the need for re-classification. Map 3.1 above shows the established characteristics of the five agro-ecological regions of Zimbabwe and Figure 3.1 provides the descriptions of these.

Figure 3. 1: Description of Main Agro-ecological Regions

Characteristics of the different agroecological regions
Natural region I: Rainfall of over 1,000mm per year. Land is susceptible to soil erosion when devegetated. Suitable for diversified or specialised farming. 18% of the 703,000 hectares is communal land.
Region II (sub-regions A and B): Between 750 and 1,000mm rainfall per year. Intensive cropping and livestock production. 1.2 million of the 5.8 million hectares is communal farmland.
Region III: Between 650 and 800mm rainfall per year. Infrequent heavy storms, though characterised by mid-season dry spells. Semi intensive farming, best for livestock production and fodder crops. 39% of the 7.3 million hectares is communal land. The whole of Chikomba and northern parts of Buhera are in Region III.
Region IV: Between 400 and 650mm rainfall per year. Subject to seasonal droughts (and always vulnerable). Semi-extensive farming, mostly suitable for livestock production and drought resistant crops. 62% of the 14.8million hectares is communal land. Middle part of Buhera is in this category.
Region V: Below 450mm per year (erratic rainfall). Extensive farming, mostly suitable for cattle and game ranching. 45% of the 10.4million hectares being designated communal area. The southern part of Buhera falls under Region V.

Source: Mutasa (2011:5).

3.3.2 Patterns on and Trends in Climate Change and Variability

Preponderantly, climate change in Zimbabwe is envisioned on a national scale and as a national and quantifiable phenomenon, at least in mainstream academic research and policy documents in the country. In depicting the patterns and trends in climate change variability in the country, it seems that there has been trivial focus on the positions and perceptions of smallholder farmers with regard to climate change and variability and the consequences of these for particular agricultural activities (Mutekwa, 2009). Therefore, in my discussion below, I detect two main trends in existing literature which are: a plethora of model-based quantitative climate change studies at national level which I regard as conventional or mainstream studies; and a few micro-level studies at local levels which I construe as farmer-focused inquiries. It is also imperative to point out at this juncture that, due to the nature of available studies that do not explicitly differentiate climate change from climate variability, it is problematic to do the same in the following review.

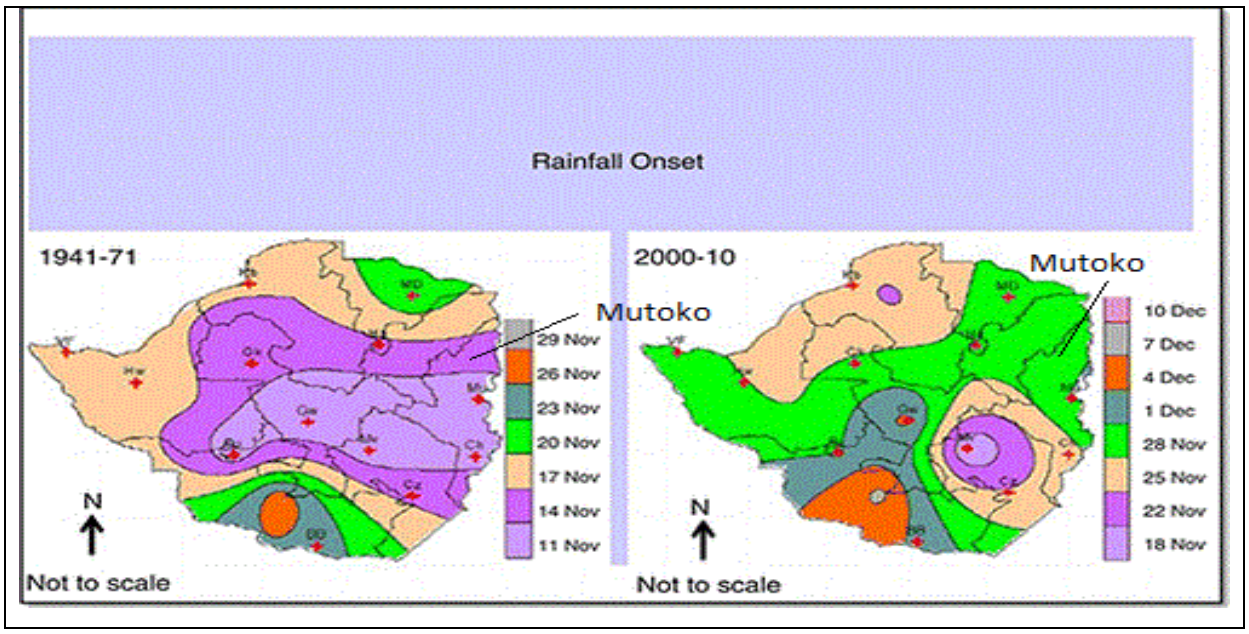
3.3.2.1 Climate Change and Variability in Conventional Studies

Based on the existing studies and climate projections employing diverse quantitative models, Zimbabwe is experiencing climate change and increasing climate variability. Increased variability of rainfall levels, number of rain days and temperature are considered as realistic pointers of climate change and variability. For instance, historic and future climate change scenarios have been examined using observed climate data and seven global climate models (Unganai, 1996; Hulme and Sneard, 1999; Hulme et. al, 2001; IPCC, 2007). Overall, studies show that even though the climate in Zimbabwe is regionally distinguished, it is by and large getting warmer with numerous erratic rainfall patterns. Concurrently, some parts of Zimbabwe are becoming warmer and drier.

A coherent conclusion is that the frequency of the country's annual rainfall variations has expanded since the early 1980s, ensuing in iterated droughts and floods. On a similar note, findings indicate that annual rainfall will wane by 5% to 18% of the 1961 to 1990 average by the 2080s. In addition, the decade 1986-1995 has been discovered as 15% drier than average. During the twentieth century, there has been a general decline in rainfall of 5% nationwide (Ministry of Environment and Natural Resources Management, 2008). The timing and amount of rainfall received are becoming progressively ambiguous and the last thirty years (from 1980) have witnessed a tendency toward decreased rainfall or heavy rainfall and drought occurring in the same season (Mudombi and Muchie, no date). Precipitation has also declined by up to 10% on average over the period 1900 to 1993, which is approximately 1% per decade (Simba et.al, 2012a). In addition, there are changes in rainfall onset, as illustrated in Figure 3.2 below.

In a related matter, there have been periods that have been considerably wetter than average as a result of tropical cyclones. There is also evidence of increased frequency of floods particularly in the low-lying areas of the Zambezi and Limpopo basins. Mutasa (2008) agrees that intense weather events, namely tropical cyclones and drought, have magnified in frequency and intensity. Mutekwa (2009) concurs with the foregoing and also highlights that Zimbabwe has lately been experiencing regular droughts interchanged with points of very high rainfall; in some cases, floods and mid-season extended dry spells are being experienced in the same season in the same location.

Figure 3. 2: Changes in Rainfall Onset in Zimbabwe

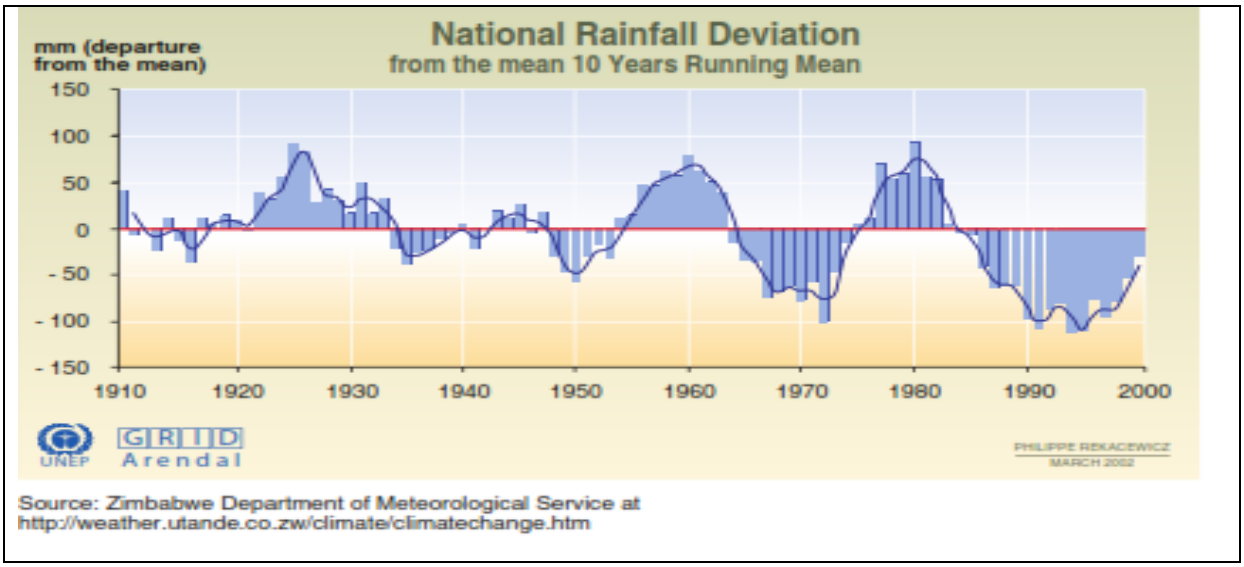


Source: Adapted from Meteorological Services Department (2012).

Zimbabwe has an average seven-month dry period yearly but has in recent years experienced frequent droughts. Increasing frequency and severity of droughts, sporadic shift in onset of the rains and deepening intensity of mid-season dry spells in fact over the last 50 years have been acknowledged in the Initial National Communications on Climate Change (1998)[7] and other recent studies, as important consequences of climate change (Unganai, 2009). There is also evidence that droughts are rising in southern African dry lands (including in Botswana, Namibia and Zimbabwe) and are anticipated to increase because a result of rising temperatures and reduced rainfall. To support these claims, Figure 3.3 below shows rainfall deviation at the national scale in the country.

[7] Under the United Nations Framework Convention on Climate Change, countries are required to provide National Communications on Climate Change and the initial one for Zimbabwe was done in 1998. See GoZ. (1998), Zimbabwe's Initial National Communication on Climate Change, Harare, Ministry of Mines, Environment and Tourism.

Figure 3. 3: National Rainfall Deviation

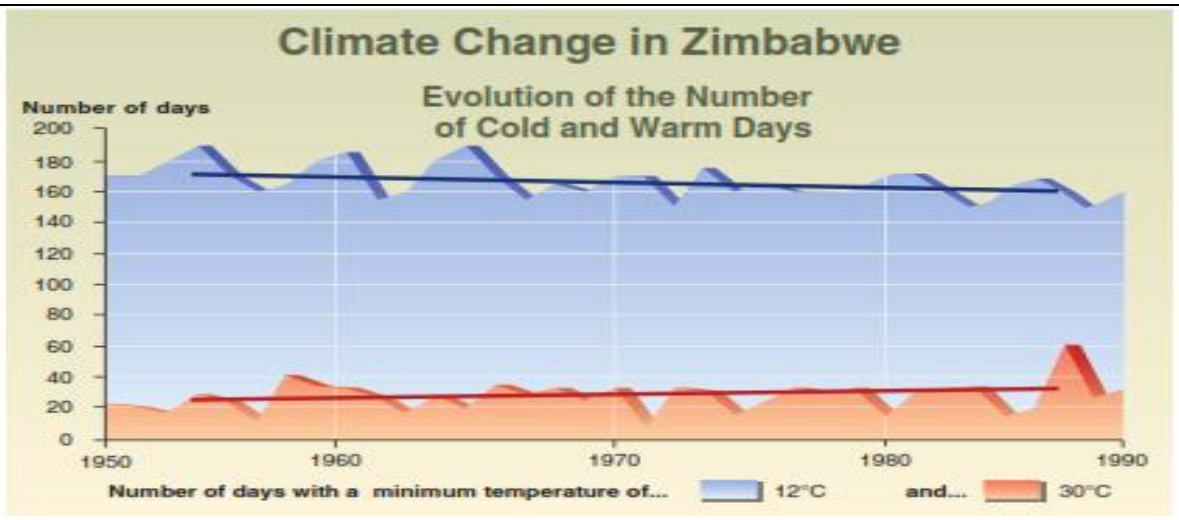


Attempts have also been made to analyse temperature changes in Zimbabwe and the results tend to agree with the regional and global warming trends. Three models employed to examine climate data anticipate a temperature rise of 2-4° Celsius and an average rainfall decrease of 10-21% by 2100 (Mano and Nhemachena, 2006). What is distinctly coming out from studies is that minimum temperatures are gradually increasing as the number of cold days is decreasing. A comparable result was detected for Africa from the 1980s to the year 2000. Correspondingly, Brown et. al (2012) report that, according to the Meteorological Service Department, daily minimum temperatures have increased by approximately 2.6° Celsius over the last century while daily maximum temperatures have risen by 2° Celsius during the same period. Furthermore, daytime temperatures over Zimbabwe have risen by up to 0.8°C from 1933 to 1993, which translates to a 0.l° Celsius rise per decade. Likewise, analysis of temperature trends for Zimbabwe from 1933 to 1993 demonstrates a rise in maximum temperatures, a decrease in minimum temperatures and a considerable rise in the diurnal temperature range in rural areas.

In a similar vein, studies have also envisioned that Zimbabwe will warm more quickly in future than the global average due to its continental interior. Already, annual mean temperatures have increased since 1900 and the 1990s were on record as the warmest and driest decade of the

century. In addition, the average surface air temperature is also projected to increase by over 2° Celsius across the interior plateau of southern-central Africa (which includes western Zimbabwe) and this is primarily attributable to an even more extended dry season. As well, rising temperatures are expected to heighten evapo-transpiration by 5-20% across southern Africa with the greatest increase likely taking place over the interior plateau of Angola, Zambia and Zimbabwe. Therefore, it can be likely concluded that both night-time and day-time temperatures are moving upwards on a national scale (Simba et.al, 2012a). To support the foregoing assertions, Figure 3.4 below shows temperature trends in Zimbabwe within ten year intervals.

Figure 3. 4: Temperature Trends in Zimbabwe



Source: Zimbabwe Department of Meteorological Service at http://weather.utande.co.zw/climate/climatechange.htm

At a sub-national scale, for example in Masvingo province, analyses of meteorological climate records establish that there was an increase in variability of seasonal total rainfall from 1950 to 2007. Rainfall patterns in Masvingo province prove extreme digressions from the mean, with years in which there was profound rainfall above normal including 1973 to 1978 and also 1996 to 2000 (Chikodzi, et.al, 2012). Similarly, long-term climate scenarios for all seven districts in Masvingo province demonstrate waning rainfall amounts. Years in which below-typical rainfall patterns took place include 1963/64, 1967/68, 1972/73, 1982/83, 1986/87 and 1991/92, all of

which indicates critical drought periods in the province (Simba et. al, 2012a; 2012b). In the same region, dry spells analysis indicates increases in dry spells and length of dry spells with time. Other scholars state that the annual rate of rainfall decline for Masvingo is lower than the national decline figure (Chikodzi et.al, 2013). At the same time, while the rainfall trends demonstrate a decrease with time, temperature trends are signaling an increasing trend as winters (the May to July period) are evidently becoming warmer (if examined from 1950 to 2002).

Related to the above, downscaled future climate change projections for one district in Masvingo (that is in Chiredzi district) expose that temperatures have warmed by up to 0.6° Celsius between 1966 and 2005, which is aggravating water balance challenges related to heightened evaporative water loss. Specifically, these projections show a rise in surface annual temperatures of between 1.5 and 3.5° Celsius by between 2046 and 2065 across the district (Brown et.al, 2012). Nonetheless, it has also been observed that rainfall projections are less reliable, with seven models indicating rainfall increases during the first part of the agricultural season accompanied with decreases in other parts of the year, and three models hinting to drier conditions throughout the year. Even supposing the former rainfall projections, probability estimates demonstrate that moderate, severe and extreme droughts are highly probable in January to March in two out of every ten years (Unganai and Murwira, 2010).

In other areas, almost similar research approaches reveal consistent trends. Temperature analysis results from meteorological stations in Beitbridge, Bulawayo and Harare suggest an increase in daily minimum temperatures of around 2.6° Celsius, matched with a rise in daily maximum temperatures of about 2° Celsius, in the last century and the number of cold days is diminishing at a rate of nearly fifteen days per 100 years (Chagutah, 2010). In a different part of the country, Gwimbi (2009b) notes that, for Gokwe, data indicate more dry years with rainfall below the long-term mean of 819 millimeters and wet years with rainfall above the same long-term average. Three extreme dry points have been highlighted for Gokwe, which are the 1981/2, 1991/2 and 2001/2 seasons during which the rainfall was well below normal. Data also reveals that the wettest recent periods were in the 1980s and during cyclone- related floods of 2000 and 2003 (respectively the Eline and Japhet cyclones). In addition to this, there were anomalies in the

mean temperatures in the district (particularly from 1980 onwards) and temperature increases in the district are projected to be 0.4° Celsius per annum (Gwimbi and Mundonga, 2010).

Finally, for north-eastern Zimbabwe, studies show that predictions from downscaled model simulations indicate that the 2046 to 2065 period will be warmer by between 1-24° Celsius and, in the case of rainfall, climate change will produce times of both excess and deficit. In a similar vein, rainfall data recorded for 100 years at Chipinge Meteorological Station in ecological region I display increased mean annual rainfall and rainy days, and this is understood to contrast with over 100 years of rainfall data from Vermont farm on the Zimbabwe/Mozambique border.

Overall, what is observable from the above studies (both national and sub-national) on rainfall and temperature is that nearly all of them are founded on systematic disaggregated observation and various quantitative models. They fundamentally dwell on the macro-scale using statistical analysis. While this is illuminating in itself, it is not without problems. As noted by some scholars, 'such indexes cannot admit the ways in which climate is imagined through cumulative sensory experiences, mental assimilation, social learning and cultural interpretations' (Hulme et. al, 2009:197). At the same time, Demeritt (2001) argues that even the most advanced climate model is a form of abstract thinking that reduces reality to the terms of its own analytical abstractions. Therefore, the above studies largely disregard how climate, climate change and variability are read and construed by local people in the context of their everyday personal, cultural and social lives. I therefore now discuss the more localised, farmer-focused studies as an important counterweight to these macro-studies.

3.3.2.2 Climate Change and Variability in Farmer Focused Researches

Each scale of climate and climate processes (global, regional, and micro) is significant for understanding the biophysical and social contexts that influence how people comprehend changes in climate variability. Therefore, local peoples' narratives on change are significant because people dynamically structure and orient multiple possibilities for actions in view of perceived changes in climate and climate variability. Nonetheless, thus far, studies that dwell on local narratives are limited, isolated and fragmented in Zimbabwe. All the same, the few studies

that concentrate on local people's perceptions provide valuable evidence on climate change and variability in diverse localities in the country.

One notable study is by Mapfumo et. al (2010), done in natural region I of the country. In their study in Wedza (eastern Zimbabwe), they highlighted that most farmers were cognisant that climate was changing in their localities as virtually all of them observed varying trends in weather patterns, notably changing rainfall distribution, increased drought incidences and irregular wind movements and cyclones. Again, in Wedza and Makoni, Mtambanengwe et. al (2012) in using participatory research approaches discovered that most of the farmers experienced changing trends in weather patterns. As such, farmers singled out increasingly unpredictable trends in rainfall distribution as the outstanding change they had witnessed during their lifetime. Furthermore, farmer-oriented studies reveal that farmers in semi-arid regions of the country have made profound observations in their climate. In Masvingo and Hwange, some of the observations made by farmers reported by Moyo et.al (2012) include changes in the onset of the rainy season, the rainy season ceasing suddenly and early, effective rains now falling within one month and an increase in temperatures. Such changes compromised viable crop production.

Comparable reflections have also been made by farmers in other provinces, for example, in Midlands. Smallholder farmers in Mazviwa (in Zvishavane) recounted that rainfall patterns have become extremely unpredictable in the recent years, to the effect that they could not predict the time of onset of seasonal rainfall for purposes of planting. These farmers noted that the prevalence of mid-season dry spells was increasing and below-normal rainfall years were becoming more regular, thereby intensifying food insecurity throughout the area (Mutekwa, 2009). Additionally, farmers have been experiencing mid-season droughts and excessive precipitation during the same agricultural season, in addition to increasing trends in temperature since the 1990s. In the same province, cotton farmers in Gokwe reported a rise in temperature and a decline in rainfall, greater frequency of water-deficit years, later onset of the rainy season and premature end of the rains (Gwimbi, 2009a).

On a different note, some studies compare farmers' perceptions and meteorological data or other scientific observations. In their studies, for example, Simba et.al (2012a; 2012b) discovered that farmers' perceptions on climatic conditions are in line with scientific observations in terms of climate and environmental changes. To the contrary, Moyo et.al (2012) noticed contradictions in farmers' perceptions and meteorological data, leaving them to contend that farmers are experiencing increasing variability more so than climate change. However, regardless of the positions of these studies, what is clear is that farmers' discourses, observations and experiences have been largely sidelined in mainstream studies on climate change and variability in Zimbabwe. There is also an implicit assumption that farmers' perceptions need to be tested for their reliability and validity against meteorological data, as if these are not valid or reliable in their own right. This supposed lack of trust in farmers' perceptions may also contribute to their marginalisation.

3.4 Observed and Predicted Impacts on Agricultural Livelihoods

Although there is a surfeit of reasons for Zimbabwe's economic woes, there is no doubt that the economy as a whole and agro-based livelihoods in particular are under threat from climate change and variability. Several studies discussed below demonstrate that Zimbabwe is already beginning to encounter the impacts of climate change, notably rainfall variability, extreme events and warming trends, which are anticipated to render land increasingly marginal for rain-fed agriculture, posing a significance menace to the agrarian economy and the livelihoods of the rural poor. With now, after fast track land reform, more than 90% of small farmers in Zimbabwe depending on rain-fed agriculture for their livelihoods, the effects of changing rainfall patterns and increasing frequency of droughts could be ravaging, unless tangible steps are considered to enhance the resilience of rain-fed agriculture (Unganai and Murwira, 2010). It is anticipated that farmers, who represent approximately 62% of the total population of Zimbabwe, will endure incommensurate negative affects if adaptive capacity is restricted or unable to cope with climatic changes.

This section discusses how impacts of climate change and variability on agricultural livelihoods have been framed and understood in the country. It is however claimed that considerable

research on the impacts of climate change has been done, but little has been done on the specific impacts on agriculture in Zimbabwe (Mano and Nhemachena, 2006). Arguably, whereas available studies offer valuable insights, most of them center preponderantly on national level impacts, disregarding local level impacts. In terms of approach, it is *prima facie* that there is no integrated body of knowledge that recognises and unpacks narratives of local farmers in rural Zimbabwe. The apparent dispositions in the existing literature include quantitative, economic and productivity projections of future impacts from modeling studies at the national scale, concentrating primarily on staple smallholder crops, or reviewing of data from such studies at sub-national level (Mutekwa, 2009). Assessment of effects and risks by farmers on the frontier of diverse changes are thus far not widely appreciated.

3.4.1 Macro Level Impact Studies

Broadly speaking, quantitative models and scenario-based studies claim that climate change has modified the rainfall patterns, magnified drought cycles, raised the frequency of severe weather conditions and enhanced agricultural pests and diseases. Studies also suggest that climate change has resulted in slumping farm productivity not merely in Zimbabwe but in the whole of the Southern African Development Community (SADC). The maize crop across most of southern Africa already experiences drought stress on an annual basis. This is expected to worsen with climate change and stretch further southwards, possibly making maize production in many parts of Zimbabwe and South Africa very challenging if not unattainable (Conway, 2009).

Furthermore, it has been noted that smallholder farming in particular has become susceptible to climate change. Cotton production, maize production and the other small grains such as sorghum, for example, have been on the decline primarily due to climate change and variability (see Gwimbi, 2009a; Makadho, 1996; Mutekwa, 2009). Similarly, in earlier studies, Magadza (1994) and Muchena (1994) both established that a 2° Celsius increase in ambient temperature and a rise of mean temperature by 4° Celsius has significantly lowered crop yields amongst small-scale farmers in Zimbabwe. In addition, Figure 3.5 below provides a summary of the general impacts on various sectors, with the details under agriculture, rangelands and water being of particular significance for this thesis.

Figure 3. 5: Summary of Sectoral Climate Change Impacts in Zimbabwe

Sector	Projected Impact
General	• Projected Impact of around 2° Celsius by 2080. • Present southwest-northeast-east rainfall gradient will become steeper.
Agriculture	• General vulnerability of communal agriculture to climate change and variability. • Generally, maize suitable areas will decrease by 2080, while cotton and sorghum suitable areas will increase by 2080. • In the south western parts of the country, sorghum and maize will become increasingly vulnerable to climate change while cotton will become less vulnerable. • In the north central and eastern parts of the country, maize, sorghum and cotton will become less vulnerable.
Water	• Overall, surface water resources are projected to be reduced significantly by 2080 irrespective of the scenario used. • North eastern and the eastern parts of Zimbabwe are predicted to experience a surplus in surface water while the western and southern parts of Zimbabwe are projected to experience a drying up. • Runoff will decrease significantly in the Umzingwane, Shashe, Nata, and Save catchments.
Health	• The area under high to extremely high malaria hazard will tend to increase by 2080. • High malaria hazard will be concentrated in the low lying parts of the country including the Zambezi valley, and the South-east lowveld.
Forestry and biodiversity	• Expected minimum pressure on plant diversity for best and worst case scenarios is 42%.
Rangelands	• Net Primary Production (NPP) will decrease from the current average maximum of over 8 tonnes per hectare per year to just over 5 tonnes per hectare per year by 2080. • This translates to decreased rangeland carrying capacity for both livestock and wildlife. • Southwest and north-western parts of Zimbabwe will experience more reductions in NPP than in other parts of the country.
Human settlement	• Any reduction in available water will lead to increased water scarcity.
Tourism	• With decreasing rainfall and rising temperatures, significant declines in biodiversity are expected to occur in most parts of the country especially the western regions where most of the park estates are located. • Lower resilience of ecosystems to other global environmental changes.

Data Source: Brown et.al (2012:4).

Besides the impacts shown in the figure above, studies generally speaking demonstrate that climate change is adversely affecting staple crops, subsistence production, cash crops and livestock production. It has been highlighted that between 1993 and 2000, mean annual maize production stood at 1.64 million tons before falling to 1.08 million tons between 2001 and 2008 attributable at least in part to climate change. The average yield for maize during the 2009-2010

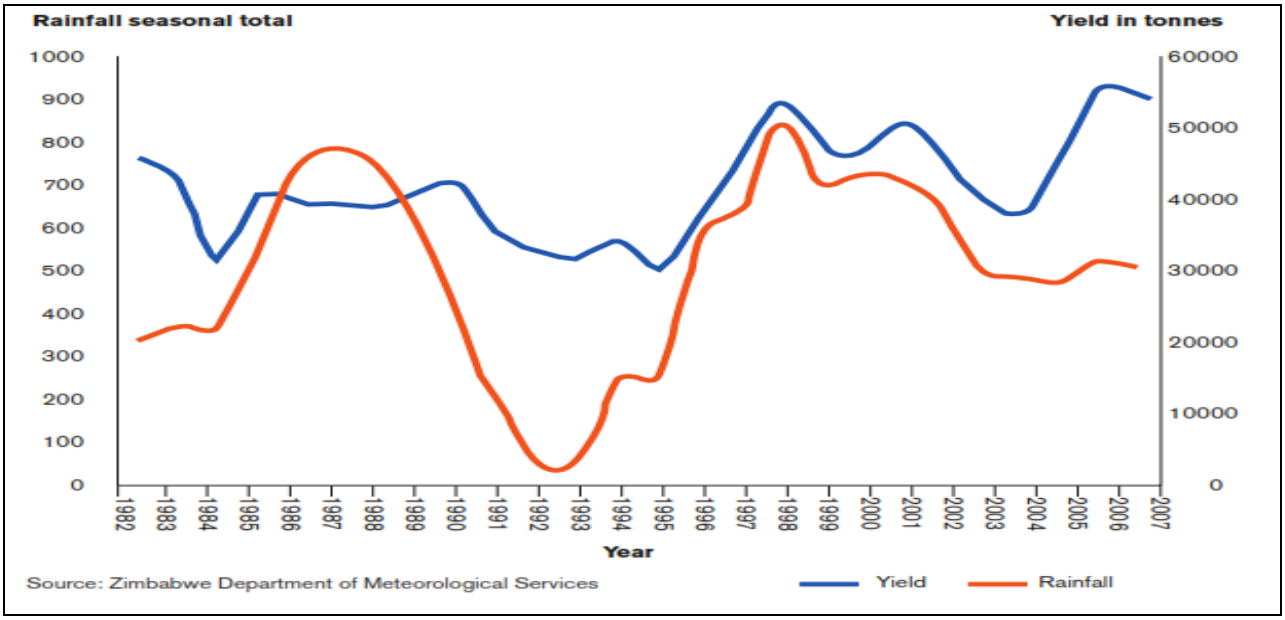
farming season was 0.7 tons per hectare, down from 0.85 tons per hectare in 2008-2009. It has been established that only 45% of national cereal demands were produced in the country, resulting in a shortfall of over 610,000 tons to be addressed by imports in 2007 (Brown et.al 2012). On a similar issue, the cattle population went down from roughly 6.1 million in 2000 to 5 million in 2011, while dairy production deteriorated from over 100,000 cows in 2000 to about 22,000 cows in 2010. Admittedly, fast track land reform had a pronounced impact in this regard. Nevertheless, the report by the IPCC (IPCC, 2007) divulged that rising temperatures and increasing rainfall variability are anticipated to aggravate declining agricultural outputs, which will further compromise economic growth and stability, employment levels, food insecurity, demand for other goods and poverty alleviation.

Related to the above, natural resources and environments are also endangered by climate change and variability, thereby impacting on agricultural production. Matarira and Mwamuka (1996) concluded in their study under the scenario of the Goddard Institute for Space Studies (GISS) that there is a climate transformation in Zimbabwe toward decreased annual precipitation and high ambient temperatures across the diverse agro-ecological regions of the country. In this respect, scholars have observed that changes in climate have led to more arid environments unsuitable for agricultural production, which has tilted the country's five main agro-ecological zones towards semi-arid zones (Brown et.al, 2012). Consequently, rainfall patterns and crop production are anticipated to increasingly degenerate, leading to shifts in the zonal location of specific rural sites. For example, it has been established that Chinhoyi and Chibero and their environs have changed from natural region II to natural region III while Kwekwe and its milieu have changed from natural region III to natural region IV. As well, natural region I has contracted in size, natural region II has been repositioned further east and natural region III has shifted to the north. This has clear localised implications. For example, north-eastern Zimbabwe becomes more suitable for vegetation found under the subtropical moist forest conditions (in the GISS climate change scenario) contrary to the warm temperate moist forest which exists under the prevailing climatic conditions (Matarira and Mwamuka, 1996).

Besides these caveats, maize suitable areas are likely to diminish by 2080. As such, in the south-western parts of Zimbabwe, maize will become more and more susceptible to the ravages of

climate change while cotton will become less vulnerable and more suitable for agriculture (Brown et.al, 2012). In a similar sense, in the north-central and eastern parts of the country, maize, sorghum and cotton will all become vulnerable to varying extents (Murwira, no. date). More so, in the low-lying areas of southern Zimbabwe, for instance, it is plausible that climate change will convert the region into a non-maize-producing area as illustrated by decreased maize production in Masvingo specifically; hence, the region (of which communal areas represent 42%) will become increasingly peripheral for maize production (GoZ, 1998). To support such claims, Figure 3.6 below illustrates the declining agricultural output commensurate with reduction in rainfall in the country.

Figure 3. 6: Trends in Rainfall and National Agricultural Output



Apart from the above, the withering in size of natural regions II and III (which are the principal food producing areas in Zimbabwe) generally point to potential declines in food production and consequently increased problems of food insecurity. Likewise, the significance of the shifts in natural regions is that the area appropriate for cash plantation cropping (involving large commercial estates) in natural region I is now bigger but marginal areas in region IV and V have

simultaneously expanded to a considerable extent (Mugandani et.al, 2012). Smallholders in these latter regions are particularly vulnerable because of their dependence on rain for crops.

Importantly, the impacts of climate change and variability have been appreciated from various scenarios and productivity projections used for crops such as maize. For example, Matarira et. al (1995) employed global climatic models and dynamic crop growth models, and demonstrated that yields of maize (the most widely grown crop in Zimbabwe) declines dramatically under dry land conditions in some regions (sometimes up to 30%) and even under full irrigation conditions. This is attributable to temperature rises that shorten the crop growth period. The work by Mano and Nhemachena (2006), who utilised the Ricardian cross-sectional model, demonstrated that higher summer temperatures have by and large negative effects on net farm revenues – with an increase in summer temperature contributing to a net farm revenue loss of about $86 (Zimbabwean) per hectare for all farms and about $98 (Zimbabwean) for rain-fed farms. In a related study, Nyabako and Manzungu (2012) employed the FAO's Ecocrop Model to evaluate the suitability of early, short, medium and long season maize varieties grown under rain-fed conditions in different agro-ecological regions (I to V) under changing climate conditions. They concluded that the currently-available maize germplasm in the country is not desirable for the predicted climate change conditions.

However, although studies widely establish that crop performance will vary by natural region, Matarira et. al (2004) concluded that maize shows sensitivity to shifts in temperature and precipitation changes in all the regions. Maize is especially susceptible due to its intolerance to drought and accordingly food insecurity will be aggravated, particularly during sustained drought events which are becoming more regular and extreme. At the same time, although studies mainly portray unfavorable impacts and show that land suitable for maize production is supposed to generally diminish, land appropriate for other crops (for example, sorghum and cotton) is expected to increase in some areas. Chikodzi et.al (2013) actually contend that 'climate change introduces numerous opportunities such as early crop maturity and rising temperatures can increase the rate of organic matter decay rates and provide a conducive environment for micro-organism activity in the breakdown of the matter that increases soil fertility'. In a similar vein,

there are opinions that an increase in temperature may enhance crop production in areas where temperatures are low and restrictive.

3.4.2 Farmer Focused Impact Studies

The importance of farmers' narratives in understanding the impacts of climate change and variability is still not adequately appreciated in Zimbabwe. As highlighted above, most of the impacts are derived from studies founded on quantitative models, projections and observations made at the national scale. Crop assessments are also popular. These studies remain very important in the development of climate change knowledge and policies. However, there is need to move beyond the quantifiable indicators and statistical impacts of climate change to draw on cultural and psychological understandings and interpretations that unveil a new set of climate imaginaries and narratives (Geohegan and Leyson, 2012).

In this light, there are studies that reveal some of the impacts directly experienced by farmers who rely on rain-fed agriculture. For example, in Chiredzi district, it has been observed that smallholder farmers have been exposed to one of the most brutal impacts of climate change and variability (Brown et. al, 2012). During the 1991/92 rainfall season, Chiredzi district received a seasonal rainfall total of only 127 millimeters such that most crops were an absolute failure and livestock perished in the thousands. Even drought tolerant crops such as sorghum and millet provided only meagre yields under these climatic conditions.

In addition, studies by Gwimbi (2009b) and Gwimbi and Mundonga (2010) in Gokwe district uncovered the local level impacts of climatic variability on cotton production and the vulnerability of cotton farmers. In this regard, correlation tests established a significant relationship between increases in temperature, decreases in rainfall and declines in cotton outputs. Cotton production levels decreased as precipitation declined and temperatures increased across the district (Gwimbi and Mundonga, 2010). Furthermore, the drought conditions of 1981-1982, 1991-1992 and 2001-2002 were the leading determinants for the declining yields (Gwimbi, 2009b). In the 1991 to 1992 season, for instance, more than an 80% decrease in precipitation led to a 38% decrease in cotton production in the district.

Again in semi-arid areas of Masvingo province, local level studies highlight impacts consistent with the above. Moyo et. al (2012) highlight that farmers perceived climatic changes as contributing to modifications in agricultural productivity (by and large a decline) in parts of semi-arid Masvingo province. The farmers also reported substantial morbidity and mortality rates amongst their livestock, which were ascribed by them to the climatic changes the farmers had experienced over a number of years. This further restricts their livelihood options as livestock is a leading source of livelihoods aside from cropping. Climate change has therefore affected staple crops and livestock production, and subsistence production in general in the area (Chikodzi et. al, 2012). More so, with climate change and variability in Masvingo stimulating droughts, and sustained hot and dry periods, Bikita district in particular has suffered from endemic agricultural stagnation because of heavy crop failure and death of livestock resulting in chronic food crises and, poverty (Gukurume, 2013). Fusing climate change scenarios and farmers' perceptions, Simba et.al (2012b) also noticed that the rates of evapo-transpiration are very high, crops are easily moisture stressed, forests are vanishing and there is general strain on biodiversity in Masvingo.

Indeed, the impacts of climate change and variability on farmers are also long term. Brown et.al (2012) discovered that in Shurugwi district (in Midlands province), although cyclone Japhet happened ten years ago, Chirume community in this district is still experiencing its negative impacts. Heavy rainfall during the cyclone ruined a nearby dam, which had sufficed as the community's central water source and also provided water for a one-hectare communal garden plot (which provided the majority of the community's income and protected its food security). Again, during the 2008 and 2010 seasons, the same community experienced an extended mid-season drought in January that damaged most crops. In a similar vein, Dube and Phiri (2013) found the effects of climate change over time on farmers' livelihoods in Matopos (in south-western Zimbabwe) alarming. Declining precipitation and rising temperatures were making farming more and more difficult therefore making food insecurity in the area persistent and endemic.

Furthermore, in natural regions that have been traditionally characterised as conducive for crop farming (regions I, II and III), studies that analyse farmers' perceptions reveal that climate

change and variability are having negative impacts as well. For example, in Wedza district, the bulk of maize cultivars are vulnerable to soil moisture stress and are susceptible to regular droughts and extended mid-season dry spells that are adversely impacting on agricultural production. In comparatively drier areas, smallholder farmers in Zvishavane reported that weather patterns were affecting their farming systems and cycles and subsequently their livelihoods. The high frequency of excessive rainfall and drought since the early 1980s has been the leading challenge eroding farmers' assets, leaving them more vulnerable to the vagaries of these climatic events (Mutekwa, 2009). Eventually farmers are subjugated to incessant hunger and deeper cycles of poverty and vulnerability.

Clearly, then, a number of studies have sought to examine the connections between climate change and agricultural livelihoods from a localised perspective. Although these studies have improved our understanding of the complex and interwoven spheres of climate change and variability on the one hand, and agricultural production and practices on the other, gaps continue to exist at the micro-level of impact analysis (Tol et. al, 2004). Knowledge about local impacts of climate change is still considered to be uneven and incomplete. As highlighted above, most of the impacts are derived from studies based on nation-wide quantitative models and projections with insufficient consideration of how impacts are construed at the local level. I am not arguing that national-level, model-based impact studies are fundamentally flawed but, rather, that it is problematic that climate farmers' discourses are largely neglected. Therefore, my thesis seeks to contribute to addressing this comparative neglect.

3.5 Convergences, Divergences and the Implications for Adaptation

In this section, I pursue the debates beleaguering macro-model (and natural science) based studies on climate change and variability, and farmer-focused studies, reviewed above. I draw attention to their similarities and divergences. In essence, I seek to reiterate the position I have assumed in this thesis, which is a qualitative, localised analysis of climate variability, its impacts and adaptation. Notwithstanding that position, I do not postulate that localised analysis forms a superior mode of knowing to that of macro-studies, nor that in practice (through qualitative methods) it achieves a super-ordinate representation compared to models. My argument is that

farmers' narratives or discourses have a commensurate place alongside 'scientific' models. In discussing this, I close this section by identifying and considering the logical implications for adaptation policy and practice.

3.5.1 Defining Climate and Change

What is ostensible from the above review is that both macro- and micro-level studies agree that there are changes in climate and that these are affecting agricultural livelihoods. All the same, how this change is defined and interpreted differs. Another point to note is the fact that not all micro-level studies necessarily highlight farmers' narratives and that quantitative models have also been applied to local contexts. Following that, I regard quantitative models and predictions, on their own, as circumscribed when it comes to understanding climate variability and its causes. The reason is that climate change and variability are being construed within a dominant and narrow framework largely shaped by the so-called 'arbiters' of climate change knowledge such as the IPCC (see Boykoff et.al, 2007). Within this framework, the actual meaning behind what is conceived as climate change is rather fixed or even viewed as apparent. Hulme (2008) queries this approach as producing a hegemonic discourse of climate change.

Following that, although scientists point (though without certainty) to the anthropogenic factor as the primary cause of change, farmers interpret climate change and variability in versatile ways. From the studies I have reviewed above, the notion of climate has for the most part been universalised. Therefore, climate is defined in stringently physical terms, constructed from meteorological observations and predicted inside the software of Earth System Science models (Hulme (2008). Hulme (2008:10) further cautions against this when he enunciates that 'by stripping climate of its flowing cultural and psychological symbolism, by disregarding the multiple meanings of climate, we are in danger of letting the idea of climate change get out of control'. Expert and technical language is often deployed in the formulation, use and treatment of terms such as climate, and this effectually sidelines local actors' (notably small-scale farmers') views in shaping the development and trajectory of knowledge on climate change and variability.

Studies that capture local people's narratives mostly capture the multiple meanings of climate and the supposed causes of change. Byg and Salick (2009) thus contend that climate change is not a purely physical or even entirely an environmental phenomenon, but it is also social, cultural and economic – in some contexts, is has been further demonstrated as deeply spiritual and moral. Similarly, Hulme (2008) reasoned that the phenomenon of climate change is simultaneously a physical transformation and cultural object. As such, Mararike (2011) found that Shona-speaking people of Buhera (in Masvingo province) base their readings of changing seasons upon observations of natural phenomena such as trees and birds. Some farmers in rural Zimbabwe also ground their explanations of substantial changes in daily temperatures, extended winter seasons and delay in the onset of rains on direct experience (Mapfumo et.al, 2010). The non-occurrence of antecedently experienced rainfall events often marking the onset of winter (*mavhurachando*), end of winnowing of small grain cereals (*gukurahundi*) or the starting of spring (*bvumiramitondo*) was a striking observation made by farmers in their attempt to make sense of climate change. In other contexts, similar observations have been made[8].

As I alluded to above, studies that dwell on the local level in terms of scale do not necessarily take cognisance of farmers' narratives. Even in local level studies on climate change and variability in Zimbabwe (for example, in Masvingo and Midlands discussed earlier), modelling, prediction and scenario-building have been pursued and sustained. Therein, as a point of departure and vantage point, my thesis explores local farmers' narratives and discourses on changes in climate variability to determine their concerns and how they construe the changes in climate. This was done in the circumstances of their everyday lives and livelihoods. Therefore, in contrast to positivist science, which pretends to uphold the position of a neutral observer located outside the system and without shaping it, I realise that local people's reflections are themselves embedded in fluid cultural and social contexts that are so critical in influencing the outcome of environmental and climatic changes (Laidler, 2006).

[8] See Boillat and Berkes (2013) who note that among the Quechua of Bolivia, climate change is regarded as an expression of extra-human intentionality. See also Sanchez-Cortes and Chavero (2011) who argue that the perception of climate variability of the Zoque of Mexico is organised according to cultural and individual experience, connected to agriculture and the annual weather calendar.

3.5.2 Quantitative versus Qualitative Approaches

My argument here centers on the importance of micro-narratives in local contexts across space and time. A significant number of studies on climate change and variability in Zimbabwe, as presented, are firmly founded on a positivist and predictive-empirical epistemology. Although logical positivism is now mostly exhausted as a philosophical project, the devout reverence for science it advanced endures (Demmeritt, 2006). I contend that the realm of climate change and variability is far from being unambiguous and is much more complex and ambivalent to allow for the perpetuation of the so-called 'rational' and 'objective' methodologies. However, I am neither being overly critical nor do I find predictive and quantitative model-based studies useless.

Renowned rational and statistical contributions are discernible. As mentioned by Oppenheimer (2013), such studies have observed for instance that geographical information systems and datasets render a new level of detail to the study of the impacts of change. Concurrently, advances in dynamic statistical approaches to downscaling have permitted advancement in quantifying impacts in diverse spatial domains such as thermal bleaching of coral reefs and runoff changes to watersheds (Donner et. al, 2005). Furthermore, statistical modeling of crop productivity in the context of climate variations has availed important insights into crop temperature sensitivity (Mendelsohn et. al, 1994; Parry et. al, 2004).

Nonetheless, I restate that the construction of narratives around climate change and variability and their impacts as expressed in studies I reviewed above remain strongly colligated to the positivist, natural and atmospheric sciences which underline predictions about climate change. Similarly, the positivist studies concentrate on quantitative indicators of change such as annual rainfall amounts and mean temperatures, which may not be of critical significance to farmers themselves, who may be more anxious over aspects like season onset and cessation. Burton and Lim (2005) are of the view that variables from global climate change models are in fact not the most pertinent for the agricultural sector. Similarly, Hulme (2008:7) explicitly argues that 'a rainstorm which offers an African farmer the visceral experience of wind, dust, thunder, lightning, rain – and all the ensuing social, cultural and economic signifiers of these phenomena – is reduced to a number, say 17.8 mm'. At the same time, there is a misfit between the temporal scale of quantitative climate change models and studies on one hand and, the temporal scale of

interest of farmers on the other. Farmers for instance require information on short-term seasons, intra-seasonal and inter-seasonal variability.

Therefore, while these complex, numerical and predictive models are useful in comprehending current and future trends of climate change and variability, local interpretations of observed changes are much more multifarious and all-encompassing (Boykoff et. al, 2007). These contextual and multiple local interpretations cannot be captured quantitatively. In this case, interpretive methods fundamentally come to the fore, even so without laying claim to principled epistemological privilege.

3.5.3 Implications for Adaptation

The implications of quantitative, macro-level and predictive model-based studies are discernible. Indeed, how climate change and variability and the resulting impacts are understood has an important bearing on the framing of responses, including adaptation responses. What is problematic is not only disregarding local concerns or sidelining interpretive approaches, but the implications of this on adaptation strategies and practices. As noted by one scholar, 'policy responses to climate change/variability have been principally pushed by argumentations among scientists, whilst the insights of poor people living on the frontline have been largely left out' (Mutekwa, 2009:240). Therefore, Wayne (1994) contends that risk assessments can function to define and propagate power dynamics between 'experts' and 'lay' people where risks are construed as universal. Ayers (2010) also argues that the supposedly neutral language of science and risk assessment may reinforce the role of external and state experts in determining policy solutions, thereby suppressing the more contextualised knowledge of the farmers and bringing forth mistrust in, and ultimately failure of, the policy-making process.

Assessments of impacts, and processes of adaptation, are not neutral because they can entrench inequitable power relations within communities. For instance, the notion of vulnerability to climate change impacts used in studies discussed above, has occasionally depicted communities in semi-arid and arid regions of Zimbabwe as victims thereby neglecting their agency. At the same time, representations of vulnerability or low adaptive capacity like any other

representations are neither harmless nor innocent. In some of the studies I have reviewed above, these representations are devoid of contextual meaning and fail to take into account existing resilience and adaptive strategies at community and household level. Furthermore, the vulnerability notion is usually accompanied by notions of empowerment through incorporating local farmers into a universalising and totalising discourse of climate change.

In addition, macro level assessments may misdirect adaptation policy. The problem is that many globally-sanctioned programmes targeted at addressing the impacts of climate change – such as mega-dam projects constructed under the Clean Development Mechanisms (CDM) framework – further aggravate the effects of climate change on indigenous peoples and their livelihoods (Raygorodetsky, 2011). Similarly, it could be argued that applied climate change adaptation programmes such as Reducing Emissions form Deforestation and Degradation (REDD/REDD+) undermines the customary rights of indigenous peoples to their lands and natural resources, thereby impairing their livelihood resilience. In this way, globally-framed adaptations are imposed upon local situations in very insensitive ways. As a result, local peoples are confronting mounting pressures at a time when their knowledges, cultures, experiences and practices are already exposed to the substantial stress of escalating natural resource depletion in their traditional territories, due to factors such as neo-liberal globalisation.

As a way forward, the very subject under study (that is, climate, climate knowledge and climate change) needs to be unpacked and reframed by formulating new and bold ontological and epistemological positions (Petts et. al, 2007). In this context, documenting and highlighting local narratives of climate change is crucial from adaptation and policy points of view as local perceptions reflect local concerns and entail local practices. This re-centers the analysis of climate change and adaptation on arguably where it belongs – on local people's lives which cannot be approximated through models (Laidler, 2006). Local knowledge and perceptions shape people's decisions in deciding whether to act or not, and in terms of what adaptive measures are adopted both in the short and long term (Berkes and Jolly, 2001). I therefore argue that local people's observations and discourses cannot substitute for scientific measurements and models, but they certainly provide a range of insights which indicate the necessity of studying them if a

comprehensive understanding of climate variability and livelihood adaptation is to be forthcoming.

3.6 Conclusion

In this chapter I have submitted the national contextual background within which my research was accomplished. Within this national context, I provided valuable insights into the trends and patterns of climate change and variability as well as their impacts on agricultural livelihoods. I underscore that the chapter exposes how the current understanding of climate change and variability, as well as the impact studies, are problematic. Overall, although these studies are very important, a number of them are rather normative because they largely ignore localised analyses and concerns. They fail to consider that climate change is both a narrative and material phenomenon and in so doing they have submitted to global knowledge claims on climate change thereby uncritically borrowing various models, methods and 'universal' indicators. Consequently, research in Zimbabwe is concentrated on the macro-level and is predominantly based on quantitative models, predictions and crop assessments. Fundamentally, both national and sub-national assessments miss out on aspects that matter to the everyday lives and livelihoods of farmers. There is an implied assumption that local perceptions follow after climate models to understand the patterns of change in climate, particularly when models are downscaled to fit particular local contexts and then farmers' perceptions are sought at the end.

Following that, although the views from macro-studies in the country may look persuasive, experiences and practices from local scales or peripheries are important. Therefore, my thesis is premised on the view that fully understanding climate variability and its impacts requires broad conceptualisations that incorporate voices of farmers living on the frontiers of various changes. I reiterate that climate change has local meanings, impacts are experienced in very specific ways, and adaptation is embedded in cultural, socio-economic and, political realities of farmers confronting various changes. In this regard, these meanings, experiences and realities can only be fully captured through analysing narratives, stories and observations by farmers themselves. This epistemological and philosophical underpinning ensures that climate change and variability are understood in a multidimensional manner, and complexity and heterogeneity are recognised. On

this note, I proceed to the next chapter to critically examine what Zimbabwean studies generally have to offer in understanding adaptation and specifically how they have framed it, in order to establish a solid foundation for developing arguments in the thesis.

CHAPTER FOUR: ADAPTATION TO CLIMATE CHANGE AND VARIABILITY IN ZIMBABWE

4.1 Introduction

The evidence of increasing climate variability and its impacts demonstrates the need for adaptation in Zimbabwe. Therefore, the primary thrust of this chapter is to understand the current state of climate change adaptation literature on Zimbabwe and broader thinking about climate adaptation in the country. I commence this chapter by describing the institutional, legislative and policy issues, as well as challenges, pertaining to adaptation in Zimbabwe. I then proceed to examine how adaptation has been addressed in mainstream literature. Methodologically, existing literature exhibits a noticeable duality in terms of the scale of investigation. Both small-scale (micro-level) studies and national, sector-wide (macro-level) studies have been accomplished. However, very little work has centered specifically on micro-level adaptation by distinct social groups in rural Zimbabwe. In terms of theory, there are numerous contentions that can be made regarding trends that have been perpetuated in existing studies. Firstly, nearly all macro-level studies have a strong disposition towards positivist epistemology. Secondly, there is conceptualisation of adaptation from a narrower position which concentrates on sectoral vulnerability. Thirdly, theorising adaptation using sociological theories is still not appreciated. Fourthly, merely identifying and categorising adaptive strategies is a fundamental self-limiting trajectory as it neglects to analyse the structures, processes and conditions underpinning adaptation. Therein, I expose such gaps and strengths in order to set the stage for developing an analytic thinking of adaptation as a complex process underpinned by various structures, processes and conditions in rural Zimbabwe.

4.2 Adaptation Policy, Legislative and Institutional Frameworks

The motivation to develop public policies to adapt to the impacts of climate change has been underscored since the beginning of the United Nations Framework Convention on Climate Change (UNFCCC) dialogues in the early 1990s. It is also widely recognised that adaptation to climate change demands strong institutional, legislative and policy frameworks to be effective

(Agrawal, 2008; Chagutah, 2010). As such, these shape vulnerability and adaptation in decisive ways. They structure climate change impacts and vulnerability, they intercede between individual and collective responses to climate impacts and thereby determine outcomes of adaptation, and they act as the means of delivery of resources to facilitate adaptation and thus also regulate access to such resources.

Nonetheless, whereas institutions, policies and legislation can facilitate adaptation, they can also be restraining. Legislation can restrict the pursuance of adaptation policies in the same manner that inflexible institutions can contribute to policy failure. Hence, there must be flexibility for purposes of dealing with the uncertainties of current and potential climate change affects. In addition, 'climate change adaptation demands the combined attempts of decision makers in diverse institutions across multiple scales' (Agrawal, 2010:179) because 'the impacts of climate change are induced by public and private actors, and costs are socialised at a global scale and experienced at a local scale' (Baird et.al, 2014:2).

4.2.1 Policy Challenges

The government of Zimbabwe admits that climate change is a critical issue and, to demonstrate its responsibility to dealing with climate change challenges, the government signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and consented to the Kyoto Protocol on Climate Change in June 2009. Nevertheless, this ratification of international instruments has not transformed into substantial climate change policies. The country currently has no specified policy response to climate change. Rather, disconnected responses are inculpated in a number of sectoral policies, including those pertaining to environment and natural resources management, water resources management, agriculture and food security, and disaster management.

Furthermore, the country still does not have national adaptation programmes of action. More so, whilst sectoral vulnerability (versus community or household vulnerability) is comprehended, sectoral adaptation plans are absent. Indeed, currently, climate change is handled by environmental policies and it is widely discerned that such policies are deficient in light of the

projected impacts of climate change and the scale and scope of vulnerability. Although the process of designing a national climate change response strategy has commenced, it is continuing slowly. More specifically, the Draft Zimbabwe National Climate Change Response Strategy was only consolidated in May 2013. By and large, climate change adaptation still persists on the margins of mainstream policies and the sectoral programmes of respective government ministries. Climate change is largely handled as a petty issue in the policy domain; hence it does not invite sufficient emphasis in terms of policy direction or resource allocation (Brown et.al, 2012).

However, whereas the country has no climate change policy, several policy instruments are housed in different government ministries managing the environment and climate change, in one way or another. For instance, there are the National Environmental Policy, Agriculture Policy framework, Drought Mitigation Policy and Disaster Management Policy which cover climate change issues, though not explicitly, across several sectors. Zimbabwe's Agriculture Policy acknowledges that the country is vulnerable to repeated droughts, a trend expected to be accentuated by climate change. The policy intends to replace the prevailing dependency on food aid with an all-encompassing approach requiring the development of substantial strategies and schemes to help families to cope with the impacts of drought (Chagutah, 2010). Apart from that, most of the polices are in ministries that do not have a climate change focus and this has ensued in a lack of mainstreaming of climate change in the implicated departments' activities, except for the Ministry of Environment, Water and Climate where the climate change office is housed.

In addition, there are also policies that directly affect rural farmers' ability to adapt which are blind to climate change and the changing vulnerability context (for example, the Water Management and Land Policy and, Agricultural Marketing and Pricing Policy). The Agricultural Policy, typified by the land reform agenda, concentrates more on land redistribution without handling the post-transfer support needs of the new farmers (Chikozho, 2010a), which are critical in the context of climate change. Similarly, the water system, essential in climate change adaptation, is very hierarchical with successively lower and more local levels having more active responsibilities in the management and apportionment of water, but inferior or no legal standing (Levina, 2006). In a related manner, there are no clear policy implementation guidelines on the

utilisation of water harvesting technologies and management of water in wetlands that could heighten utilisation of water in rain-fed systems (Nyagumbo and Rurinda, 2012).

Simultaneously, the country has also a very weak climate change and environmental governance framework. Generally, Zimbabwe's environmental policy-making process has involved marginal engagement between civil society, policy-makers and the public (Mtisi, 2010). Another significant dimension of the adaptation policy discourse and practice is that the rural poor are to a great extent shut out from policy-making processes and, as a consequence, policies developed at central government level are not sufficiently responsive to the policy needs of citizens at the local level. As a result, such policies are not conducive to local livelihoods and adaptation strategies.

All the same, though the country has no climate change policy, it has responded in a number of ways to the climate change problem. Firstly, the country accomplished the first or initial National Communication on Climate Change in 1998, detailing sector-specific climate change impacts and adaptation. Secondly, the second National Communication on Climate Change in 2009 listed vulnerabilities and adaptation needs for natural resources, water, public health, human settlements, wildlife and agriculture. Thirdly, the National Drought Policy specified the importance of mitigating impacts of drought through the provision of financial aid to provinces and districts. In addition, through the regional early warning and drought monitoring centres, pre-season forecasts are released in the form of bulletins (Chagutah, 2010). Finally, through the Climate Change Office, the government completed the National Self-Assessment for the three Rio conventions[9] on climate change, biodiversity and land degradation and recognised the need to build adaptation capabilities. Thereafter, the capacity gaps identified would encourage cross-sectoral dialogue and promote environmental management.

[9] The three Rio conventions agreed in 1992 are United Nations Framework Convention on Climate Change, United Nations Convention on Biological Diversity and United Nations Convention on Desertification.

4.2.2 Legislative Fragmentation

Despite the importance attached to climate change by the government of Zimbabwe, the country's policy response is implicit rather than declared as there is no encompassing and specific national legislative framework for climate change adaptation (Chagutah, 2010). There are merely numerous pieces of legislation that simply reckon with environmental issues in the country without coming to terms with the complexities of climate change and climate change adaptation. One of the renowned pieces of legislation is the Environmental Management Act (2002) for which implementation is across several government departments. Other legislation includes the National Water Act (1998) and the Zimbabwe National Water Authority Act (1998), both produced as a response to the 1990 to 1992 drought; the Civil Protection Act (1989) which factors in climate change in disaster management; and the Meteorological Services Act (1990) concerning the production and dissemination of climate change related data. Distinctly, then the country's legislative architecture is fragmented and marked by silos. This is further complicated by the decrepit linkages between legislation and policy making such that in some cases legislation tends to constrain policy space.

In particular, the National Water Act of 1998 concentrates more on sustainable water resources management without fully addressing the practical realities of making more water available to poor farming communities in the context of climate change (Chikozho, 2010b). Furthermore, such all-encompassing environmental resources management frameworks, without a particular directive for climate change, tend to mystify and underestimate the practicalities demanded for sufficient adaptation policy response. For instance, the content of the local environmental action plans allowed for in the Environment Management Act are not prescribed in the act, other than to say that the minister shall prescribe these when deemed necessary (Chagutah, 2010). In a related manner, Mtisi (2012) observes that the National Capacity Self-Assessment report disclosed that current legislation is founded on 'command and control' rather than incentives and penalties. The country is also restrained by a lack of human, institutional and financial resources to put pertinent measures in place which can respond to the challenges brought forth by climate change.

4.2.3 Institutional Weaknesses

There are versatile institutional frameworks prepared to assist in handling climate change in the country which include a National Climate Change Committee, chaired by the Ministry of Environment, Water and Climate. It comprises representatives from respective government ministries and was founded with the aim of offering a forum for the discussion of climate change issues, to provide consensus on national perspectives on climate and advice government when required. The roles of the committee also include assistance with the designing of climate change policies and the coordination of national climate change projects, aligning climate change activities across divergent ministries and organisations (including the private sector) and representing the country at numerous international forums on climate change, including climate change dialogues with other stakeholders.

Related to the above, other institutional frameworks underpinning climate change adaptation include the Disaster Risk Management Department, the Meteorological Services Department and the Environmental Management Agency. The Environment Management Agency and the Institute of Environmental Studies (at the University of Zimbabwe) have been important in most of the research and training on climate change issues in the country. Community oriented research institutions are also actively involved in building resilience to climate change amongst rural communities largely in susceptible areas, including training.

Nevertheless, although there is a multiplicity of institutions as mentioned above, Zimbabwe is marked by a weak institutional framework. Basically, the prevailing institutional scenario is characterised by insufficient capacity to implement policies and strategies concerned with climate change adaptation (Chagutah, 2010). This has complicated not merely the capacity to respond but the very implementation of policies on climate change adaptation. Tracking and measuring adaptation progress is also compromised if not non-existent. Often, lack of coordination between state and non-state actors has led to the duplication of interventions and a competition for much-needed funding. To expand on the foregoing, the functions and obligations for climate change are not distinctly and clearly apportioned and there is a disjuncture in coordination between national and local level institutions. Similarly, ‘the absence of a discrete, overarching climate change policy makes it challenging for the Ministry of Environment and

Natural Resource Management [now called Ministry of Environment, Water and Climate] to insist on compliance or on the submission of compulsory data on climate change indicators, since it does not have the mandate or authority to be effective across sectors' (Mtisi, 2012: 53).

Furthermore, climate change mitigation and adaptation activities are not coordinated, but rather implemented on an *ad hoc* basis which results in overlaps and gaps. A diversity of projects and research activities are being implemented on climate change issues, with different sources of funding and partnerships, but it remains unclear as to how this all links to the national coordinating institutions (Mtisi, 2012). On the same note, while climate change is regarded as a grave issue, as evidenced by the signing and ratification of the UNFCCC, not much is being done at the national level in terms of research or responses to climate change, with most research and data available for specific sectors founded on unconnected studies. Others have also contended that, although the Zimbabwe Vulnerability Assessment Committee has been created to produce vulnerability assessments in the country, it does not obtain funds from the national budgets (Mutasa, 2011). As well, the vulnerability and adaptation assessments carried out also assume a noticeable sectoral approach, which is in fact consistent with the fragmented way in which policies presently address climate change in Zimbabwe (Brown et.al, 2012).

In addition to government institutions, Non-Governmental Organisations (NGOs) – and United Nations agencies – are also playing an important role in climate change adaptation projects undertaken in the country. For instance, government institutions receiving training on climate change include the Department of Agricultural Research and Extension, in a project funded by the Nuffield Foundation on mainstreaming climate change adaptation in Zimbabwe's agricultural extension system. Even so, it can be argued that the NGO community also lacks coordination of activities pertaining to climate change adaptation, thereby contributing to potential duplication of roles, challenges in targeting programme beneficiaries and assessing broad-based impacts of climate change. Basically, 'there is disconnection between capital-city-based policy NGOs and project implementing NGOs at the community level as well as poor co-operation between environmental and development NGOs, and social and grassroots movements' (Reid et.al, 2012: 43).

Despite all the challenges discussed above, several targeted projects on climate change adaptation have been undertaken through coaction between different institutions (both local and international). Some of the projects are:

- *Coping with Drought and Climate Change in Zimbabwe*, as implemented by the Environmental Management Agency (EMA) in the Ministry of Environment and Natural Resources Management and financed by United Nations Development Programme, UNDP-Global Environment Facility (2008-2012).
- *Lack of Resilience in African Smallholder Farming: Exploring Measures to Enhance the Adaptive Capacity of Local Communities to Pressures of Climate Change*, implemented by the University of Zimbabwe and the Soil Fertility Consortium for Southern Africa, and funded by the International Development Research Centre (IDRC) (2007-2010).
- *Building Capacity to Adapt to Climate Change in Zambia and Zimbabwe*, as implemented by the Midlands State University and supported by International Development Research Centre, IDRC (2007-2010).
- *Community Based Adaptation to Climate Change in Africa*, as implemented by the African Centre for Technology studies and funded by IDRC (2008-2011).
- *An Assessment of Vulnerability and Adaptation of Maize Production to Climate Change in Zimbabwe*, executed by the Climate Change Office under the Ministry of Environment and Natural Resources Management.
- *Support for Strengthening National Capacity for Disaster Management in Zimbabwe*, implemented by the Department of Civil Protection and the Ministry of Local Government, Public Works and National Housing from 2004 to 2009, with funding from the UNDP.

4.2.4 Pitfalls in Disaster Management

Responses to climate change in the country can also be appreciated from the perspective of disaster management. Chikoto and Sadiq (2012) are of the persuasion that the country's disaster management system seems to be organised and impressive. However, disaster management in Zimbabwe is for the most part biased toward emergency responses instead of mitigation or adaptation, as the inclination has been to wait and then start scurrying around for resources after

a flood or cyclone has already hit communities. Following this, climate change responses are also dampened by the fact that disaster management and environmental management are handled as distinct entities. For example, under the current arrangement presided over by the Civil Protection Unit, the central government pioneers hazard reduction measures through relevant ministerial sectors. The problem here is that the Department of Civil Protection is housed under the Ministry of Local Government, Public Works and Urban Development rather than the Ministry of Environment and Natural Resources Management (Musarurwa and Lunga, 2012). In a related manner, disaster risk management is further hampered by the absence of an effective information management system to enable knowledge generation and networking; accordingly, there is no capacity for information management and sharing, public awareness activities, education, training and research (Chagutah, 2010). In addition, the Department of Civil Protection, that is supposed to be spearheading disaster management, is to a great extent underfunded similar to other public-funded institutions in Zimbabwe.

4.2.5 Concluding Remarks

Clearly, policy, institutional and legislative frameworks with regards to responding to climate change are imperative. The capacity to adapt successfully by rural farmers hinges upon functioning and flexible legislative, institutional and policy frameworks. But, instead of building farmers resilience in responding to climate change, these frameworks can also be huge impediments. The piecemeal nature and fragmentation of policies and legislations dispersed across government ministries and sectors are producing difficulties for effective responses in Zimbabwe; and, within the existing institutions, legislations, and policies, there is no a clear and nuanced adaptation perspective with regard to climate change. Against this background, I now examine the academic literature on climate adaptation in Zimbabwe.

4.3 Understanding Adaptation to Climate Change and Variability in Zimbabwe

Adaptation research in Zimbabwe has evolved over the years. Significant contributions have come from scholars who have applied methods for assessing the vulnerability of various sectors and communities, documented broad strategies for adaptation, and identified opportunities for and barriers to adaptation as well as ways to enhance adaptive capacity. Nonetheless, broadly

speaking, studies that dwell on adaptation are still insufficient. According to Chagutah (2010), despite the reliance of the bulk of Zimbabweans on rain-fed agriculture and its sensitivity to climate change, insignificant research has been undertaken on climate change especially adaptation. As such, while communities themselves have often formulated responses, these have not been systematically recorded and any data available is from isolated studies. Therefore, in the following discussion, I pose a number of arguments in order to make sense of and evaluate the incomplete literature. Similar to what I did in my previous chapter, I do not distinguish between climate change and climate variability in my discussion because it is practically impossible. This is attributable to the fact that most of the studies refer to climate change and climate variability interchangeably, which of course muddies the water.

4.3.1 Rise of Climate Change Adaptation Research

Trawling through climate change and variability literature, I have identified the early 1990s as the starting point in the discussion of adaptation. This is the time that climate change began to be given serious consideration in the country more broadly, after the government ratified the UNFCCC in 1992 and, coincidentally, my study also empirically starts from 1992. Studies around the early 1990s on climate change in Zimbabwe reflect three primary trends. Firstly, some studies underscored mitigation rather than adaptation. Secondly, another set of studies that paid attention to adaptation were oriented toward crops (mainly maize) rather than human and social adaptation while, thirdly, others (in discussing climate change) did not mention adaptation at all (see Hulme, 1996; Magadza, 1992;1994;1996; Makadho, 1996; Matarira and Mwamuka, 1995; Matarira et.al, 1995; Matarira et.al, 1996; Muchena, 1991; Unganai, 1996). Apparently, this Zimbabwean tendency mirrored global debates that considered mitigation – and not adaptation – as a pertinent solution to climate change.

As a consequence of the dominance of the mitigation discourse, Matarira et.al (1996) in their vulnerability and adaptation assessment in which they combined a crop model (CERES-Maize) with climate scenarios, suggested drought resistant varieties of small grains and certain agricultural technologies as mitigation strategies. Likewise, Kamukondiwa (1996) proposed that drought tolerant cassava may be an acceptable alternative to mitigate climate change. Similarly,

MET-CCO (2004) proffered mitigation strategies such as better digestibility of animal feed, enteric fermentation, manure management, improving production efficiency and carbon sequestration in agriculture. In the end such approaches, in producing examinations of climate change and generalised mitigation strategies (and ensuing recommendations), appear to have failed to appreciate the complexity of the problems at local scales that may have demanded adaptation.

Besides being initially relegated to the periphery in terms of research (and indeed policy), adaptation has faced definitional problems. Numerous studies do not define adaptation but the irony is that they provide adaptation strategies (such as Dube and Phiri, 2013; Mtambangengwe et.al, 2010; Mudombi-Rusinamhodzi, et.al, 2012; Simba et.al, 2012a; Unganai and Murwira 2010). The distinction between mitigation and adaptation is also not always espoused although these two concepts have different connotations and implications. In addition, few scholars also endeavour to independently define adaptation (such as Chikozho 2010a; Mutasa, 2011), with some of the studies either adopting the global IPCC definition in verbatim or slightly modifying it. For instance, Chikodzi et. al (2012) utilise the IPCC (IPCC, 2007) definition in their study in Masvingo province and, in this case, adaptation is conceptualised as the adjustment of natural or human systems in response to actual or expected climate change which moderates harm or exploits beneficial opportunities. At the same time, Chikozho (2010a) assumes an understanding of adaptation that concentrates on the motivation and intentions of adaptation efforts and the expected outcomes. Lastly, Mutasa (2011) pursues the thinking that adaptation is linked to putting measures in place to withstand pressure in the long term, while coping is primarily implicated with managing the imminent crisis.

Indeed, the different definitions on adaptation affect how the concept might be applied in a practical way. What is indispensable to realise is that definitions are normally linked to social and cultural values, with different contexts leading to different meanings and consequently different implications for adaptation goals. In reality, the actual meanings behind what are considered adaptation should not be rigid. Yet, some definitions tend to prioritise technical over social responses. By so doing, they draw attention away from the profound causes of vulnerability and from the wider context in which adaptive responses happen (Wise et.al, 2014).

In light of this discussion, I define adaptation in my thesis as a complex, localised process of responding to the impacts of climate change and variability, underpinned by different structures, processes and conditions. Mitigation on the other hand involves strategies that reduce greenhouse gas emissions such as carbon sequestration in agriculture.

4.3.2 Methodological Approaches in Adaptation Research

There has been a great deal of focus on adaptation in Zimbabwe based on quantitative data and taking the depiction of impacts as generally straight forward tasks (Morton, 2007). Subsequently, farmers' perceptions are not adequately captured. This occurs because climate change adaptation science is dominated by a positivist philosophy of science and, adaptation research has perpetuated this positivist and, in recent years, post-positivist meta-theoretical orientation (Pataki et.al, 2011). A positivist stance proceeds from 'a belief in an independent and objectively accessible world, and by the pursuit of explanation through general laws describing regularities in nature and/or society' (Connelly and Anderson, 2007: 213).

Following from this, adaptive and coping strategies and options are proposed from assessments based on scientific predictions, probability estimates, downscaled models and scenarios, and analysis of meteorological climate data. However, while such models are useful at addressing climate issues at global and regional levels, they are less useful at lower socio-ecological units such as community levels. In the same vein, assessments founded on globalised and universalistic arguments of climate change problems (mainly informed by the IPCC's thinking) might lead to adaptation solutions that do not meet the needs of people vulnerable to risks in local contexts. Therefore, as I have argued in the previous chapter, rural people in Zimbabwe are shut off from the adaptation policy arena, making them appear as (and become) helpless victims of externally-driven adaptive solutions.

Fortunately, studies interested in localised responses to climate have emerged in Zimbabwe. But though these recognise farmers' perceptions of climate change, no clear nexus is demonstrated between perceptions and adaptation (see Chikodzi et.al, 2012; Mapfumo et.al, 2010; Moyo et.al, 2012; Mtambanengwe et.al, 2012; Simba et.al, 2012a; 2012b). My argument here therefore is

that this is counterproductive to the goal of understanding the complexity of adaptation processes. Furthermore, although there is no consummate correspondence between perceptions and actions, individual responses to environmental problems cannot be predicted without recognising how environmental threats are perceived and framed (Fischhoff, 1985). In other words, local forms of awareness of climate change are a cardinal determinant of farm-level adaptation.

Therefore, examining farmers' perceptions is decisive for understanding why adaptation actions differ among different localised groups of famers (Speranza et.al, 2010). This approach guards against the loss of cultural and social readings of adaptation and reframes adaptation as a contextual process. It is in these frequently complex and unquantifiable relationships with climate and landscape that farmers make sense of and respond to climate change (Geogehan and Leyson, 2012). In a related manner, these local ways in which knowledge (of climate and the ways it might change) develop may offer the antidote for those scholars who, in criticising climate change and adaptation models, seek to encourage appropriate strategies of adaptation (Miller, 2001). In the final analysis, actually-existing adaptive and coping measures hinge upon households' perceptions of extreme climatic events and the problems associated with them.

Related to the above, the implications of perceptions on adaptation policy are clear in the literature. Perceptions of environmental problems are pivotal because, as some researchers concur, what the public thinks has considerable influence on policy-making either directly or indirectly (Bostrom et. al, 1994; Kempton et. al, 1995; Read et. al, 1994). In this regard, public perceptions of climate change risks shape national and international support or resistance to policies, such as legislation, regulations and treaties designed to lessen the harms of global change. In addition, Bryant et. al (2000) propose that farmers' perceptions on climate change and variability are significant to adaptation as these perceptions influence decisions in agricultural planning and management by the farmers. Over and above this, local knowledge of climatic perceptions and adaptations are indispensable entry points for decision makers and policy makers to learn how and where to raise the adaptive capacity of smallholder farmers.

Besides farmers' perceptions, scholars writing on Zimbabwe have in large part paid marginal attention to indigenous knowledge (see for example, Mararike, 2011; Mavhura et.al, 2013). Considering that it has taken a massive effort (for instance, from climate justice movements and indigenous people's movements) for local knowledge to be integrated into the global climate change discourse, this is not surprising. However, the downgrading of the value of local knowledge, especially in the South, ostensibly creates a classic case of science deficit, such that 'climate literacy' training and decision-support tools such as seasonal forecasting (provided by external experts) for example, are regularly defended as the most appropriate answers (Rickards et. al, 2011).

4.3.3 Assessing Adaptive Capacity

Adaptive capacity or people's ability to cope with the impacts of climate change has invited considerable attention. Whilst, in many instances, existing studies are very informative, scholars simply list factors or sometimes refer to the aspect of vulnerability to understand adaptive capacity (see Gwimbi, 2009a; Gwimbi and Mundonga, 2010; Mutasa, 2011; Unganai and Murwira, 2010). At the same time, whereas social scientists tend to regard vulnerability as symbolising the set of socio-economic factors that influence people's ability to cope with stress or change, climate scientists often view vulnerability in a more technicist fashion, namely, in terms of the likelihood of the occurrence (and negative impacts) of weather and climate-related events (Chikozho (2010a). In Zimbabwe, then, the concept of vulnerability has been employed in various ways in terms of factors or circumstances inhibiting farmers in taking suitable actions to offset the impacts of climate change. For instance, Mutasa (2011) modifies the IPCC's (IPCC 2007) conceptualisation of vulnerability and regards it as pertaining to an individual's or group's level of exposure and susceptibility to the impacts of disasters. Therefore, risk and vulnerability to climate change in the semi-dry agro-ecological zones of Zimbabwe is likely to be aggravated by diverse challenges that include the following: poverty; restricted institutional capacity; restricted access to capital, markets, infrastructure and technology; ecosystem degradation; low levels of resilience to disasters and resource-based conflicts.

Farmers' responsiveness and the determinants of their options for adaptation are receiving attention in the literature. Scholars highlight diverse ways to enhance adaptive capacity, for instance, by increasing access to total land and draught power, improving infrastructure and supporting community-based strategies. Mudombi-Rusinamhodzi et. al (2012) thus observe that productive assets and access to other resources shape farmers' responsiveness. Grothmann and Patt (2005) reveal the influence of cognitive biases and the perception of farmers of the absence of adaptive capacity on their part. Socio-cognitive factors thereby shape people's intentions and actions in predictable ways such that, in conditions of low-perceived adaptive capacity, farmers are disinclined to conceive that their actions can really protect them from harm. Household characteristics, household headship, educational levels, gender, farm household size, farming experience, involvement in social networks and access to credit are all cited as having profound influences on adaptation to climate change and the specific strategies adopted. For instance, in their study, Zivanomoyo and Makarau (2013) highlight that the fundamental determinants of selecting the variety of sorghum crop as a climate change adaptation option in arid regions of Zimbabwe are such factors as the price of existing crop variety, level of education of farmers, the size of the farms; government policies, and credit availability. Additionally, Mavhura et.al (2013) discover from their study in Muzarabani that adoption of a specific set of strategies against flooding hinged upon the characteristics of the flood, socio-economic conditions, level of education, availability of external assistance and distance from river bank.

In addition, access to information has emerged as a significant measure of adaptive capacity. Patt et.al (2005) for example, document the results of a pilot study carried out in Zimbabwe that identified numerous barriers to utilising El Nino forecasts to inform farmers' decisions. In this regard, farmers often learn of the forecasts after they have already made their planting decisions, and they claim that they neither understand nor trust the new (forecast) information (Chikozho, 2010a). Studies by Gwimbi (2009a) and Gwimbi and Mundonga (2010) reveal that farmers highlighted the lack of access to timely weather forecasts and climate change information as important obstructions to their adaptation strategies.

Furthermore, analyses of adaptive capacity indicate that vulnerability also variegates spatially across agricultural societies. Hulme (1996) predicted that drought-prone areas of Zimbabwe such

as areas in the Lowveld are expected to be more susceptible to climate change than the more humid ones in the Eastern Highlands. Overall, most agrarian communities located in agro-ecological regions IV and V are conceived to be extremely vulnerable to climate variability. Nevertheless, there is a temporal dimension as well, because patterns of vulnerability are remolded as economic changes modify the conditions for agricultural production in the country (Chikozho, 2010).

4.3.4 Characterising Adaptation Strategies

Existing scholarship has also typically attempted either to identify and classify various coping strategies or suggest adaptive options. This predisposition mimics the global and regional scholarship on mitigation and climate modelling. As such, Unganai and Murwira (2010) proposed coping strategies for farmers in Chiredzi district such as developing and deploying drought resistant crop varieties, improving soil-moisture management, weather monitoring and forecasting, making land-use congenial with existing climatic conditions, and averting farming on marginal soils. Likewise, MET-CCO (1998) refers to anticipatory adaptation measures at the national level such as infrastructure development, research and development, water resources management and product pricing as well as reactive strategies such as introducing irrigation schemes, diversifying agriculture and planting drought-resistant crops. And, in a related manner, Makadho (1996) observes that tactical adaptation choices include staggered planting dates on the same farm or farm plot to manage risk of drought at different times of the cropping season.

Furthermore, Mutekwa (2009) categorises responses to climate change into adaptive strategies (managing potential impacts in advance) and coping strategies (managing impacts post-impact). Murendo et al. (2012) are more specific in mentioning ex-post adaptation strategies such as sale of livestock (which are often distress sales) whilst ex-ante strategies might include conservation agriculture, crop diversification and utilisation of drought-resistant crops. Notwithstanding such arguments, the differentiation between these two categories is very unclear since what starts off as a coping strategy in particular years can turn into adaptation strategies over the longer-term for households or whole communities (Morton, 2007). Therefore, others emphasise that coping strategies are activities that remedy short-term fluctuations in stresses and shocks while adapting

strategies occur over extended periods and are expected to be more resilient (Mutami and Chazovachii 2012). Concurrently, some scholars classify coping strategies into structural or non-structural, and indigenous or modern (Mavhura et.al, 2013).

In distinguishing between types of responses to climate change, Downing (1992) establishes a more differentiated typology of strategies such as accommodation, planned resiliency, purposeful adjustment and crisis response. With accommodation, socio-economic systems can gradually adapt to small changes in climate; planned resiliency implies a set of adjustments that can be projected for any economic sector and caters for greater resiliency to climatic variations, heedless of the eventual climate change; purposeful adjustment are specific practices that are configured principally to cope with anticipated climate change and are not rationalised by other social and economic benefits; and crisis responses imply carrying the full cost of the impact and the additional cost of emergency actions that may or may not alleviate vulnerability to additional impacts.

4.3.5 Theorising Adaptation

Besides identifying the conditions conducive to adaptation and the various kinds and levels of adaptation, there are theoretical articulations about adaptation in the Zimbabwean literature. In this regard, I make a number of observations. Firstly, there seem to be insufficient theoretical developments on adaptation in Zimbabwe. Besides studies grounded in quantitative conceptual or theoretical models, the remaining studies are barely theorised at all. Secondly, a number of studies that consider adaptive strategies are strong on empirical associations but lack gainful theoretical insights. For instance, studies by Moyo et.al (2012), Mtambanengwe et.al (2012), Mudombi-Rusinamhodzi et.al (2012), Mapfumo et.al (2010) and Simba et.al (2012a; 2012b) are all empirically-based but are devoid of any theoretical comprehension. Thirdly, the lack of middle-range theories of adaptation practices to help frame policy debates and the absence of comparative empirical studies of adaptation to support policy interventions and, to articulate themes more theoretically, are discernible (Agrawal, 2008). Furthermore, sociological theories have not been widely applied in climate change studies on Zimbabwe. Lastly, the current climate

change debates pay little attention to processes and conditions underpinning adaptation in contemporary agrarian societies in the country.

4.3.5.1 Middle Level Theories

In examining the Zimbabwean literature on adaptation to climate change, I first consider existing middle level theories with regard to the questions of vulnerability, sustainability and conservation, and the prevalence of a Sustainable Livelihoods Framework.

4.3.5.1.1 Concept of Vulnerability

Visibly, the concept of vulnerability has been alluded to in some studies but it is still not clearly articulated as the basis for a conceptual framework in adaptation studies (Chikodzi et. al, 2012; Downing 1992; Gwimbi, 2009a; Gwimbi and Mundonga, 2010; Shumba et. al, 2012; Unganai and Murwira, 2010). Chagutah (2010) contends that a great deal of emphasis has been on vulnerability, but on sectoral vulnerability rather than more localised household or community vulnerability. In line with this, more systematic inquiry has been done on macro-level sectoral impacts and vulnerabilities through the UNFCCC National Communications process and government-led economic sector planning and energy generation policies.

Sectoral studies which dwell on sectoral vulnerability underscore sectoral adaptation for example, in the agricultural sector. Common adaptation strategies suggested for agriculture are optimising rain-fed crop production, improved short-season seed varieties particularly for maize, drought-tolerant small grains and efficient use of available moisture irrigation. As agriculture-specific strategies, Magadza (2000) highlights innovative cropping practices and optimising water utilisation for water resource management systems. In addition, Nyabako and Manzungu (2012) refer to adaptability of maize crop systems under climate change conditions in the country. Therefore, 'if maize production is to be successfully grown in Zimbabwe under the projected climate change conditions, the germplasm that is available to farmers needs to be broadened' (Nyabako and Manzungu, 2012:36). More so, Rufino et. al (2011) allude to the need to increase crop and livestock consolidation to facilitate adaptation to climate variability in north-eastern Zimbabwe. In arguing along the same lines, Mupangwa et. al (2011) mention the

necessity to enhance rainwater management technologies and conservation agriculture in rain-fed cropping systems in smallholder agriculture.

Based on the kind of studies discussed, I find it critical to question the sector-wide adaptation studies and their theoretical lacunae. As a result of the emphasis on sectoral vulnerability and adaptation, there is a large gap in research and understanding of vulnerability and responses to climate variability and change at the household and community level, and particularly from the affected communities' perspectives (Chagutah, 2010). Basically, little work has been conducted by the academia specifically on vulnerability of diverse social groups (at a disaggregated level) to climate change in Zimbabwe, except a couple of uncoordinated works by non-governmental organisations (Chikodzi et.al, 2012). This is despite the imperative that assessing the vulnerability and perceptions of communities to climate change is the first step toward crafting pertinent adaptation options based on intimate and grounded knowledge of communities. On a similar note, Nath and Behera (2011) also reason that local assessment of vulnerability enables us to understand why and how different communities respond to the same type of environmental stress in disparate ways.

Importantly, for studies to contribute to knowledge to the field of adaptation as a whole, there is need for a clear theoretical ground to be achieved; yet, the articulation of vulnerability as a conceptual framework in the Zimbabwean literature is currently fragmented as the following examples indicate. To start with, Chikodzi et. al (2012) considered vulnerability in terms of annual rainfall patterns, dry spell events and extreme temperatures – as these are the factors which determine farm productivity. Unganai and Murwira (2010) also carried out a vulnerability assessment of crop and livestock production systems in rural Chiredzi district and, in doing so, adopted the conceptual framework as espoused in the IPCC Third Assessment Report (IPCC 2001). They demonstrated what they termed 'vulnerability hot spots' for livelihood systems in the southern and south-eastern parts of Chiredzi district where these systems depend on rain-fed crop and livestock production.

In addition, in understanding vulnerability and responses amongst smallholder households in Chivi district, Mapfungautsi and Munhande (2012) employed the risk chain analysis framework.

This framework pursues the notion that all households are vulnerable to risks while vulnerability is specified as a forward-looking state of expected outcomes. The scholars argue that vulnerability is influenced by such factors as: the assets of a household; timing and severity of shocks; and the risk management instruments applied. The same framework was employed by Murendo et.al (2010) to examine the household risk management strategies utilised by different socio-economic groups including women and youth. In drawing upon the work of Fussel (2007b), Gwimbi and Mundonga (2010) regard vulnerability as the likelihood of rural communities suffering adverse climate change impacts and their inability to respond to stresses resulting from such impacts. Zvigadza et.al (2010) assume Robert Chambers' (1989) conceptualisation of vulnerability which relates to defenseless, insecurity, and exposure to risks, shocks and stresses. And, in his study, Gwimbi (2009a) speaks simply of vulnerability indices which are manifested in levels of agricultural productivity, such as cotton output and farmers' livelihoods from cotton farming.

Clearly, there is no unanimity when it comes to the vulnerability theme as understood theoretically. Perhaps the early work by Downing (1992) most clearly reveals the complexity of coming to terms with vulnerability. Downing contends that the term vulnerability has three connotations. First, it pertains to a specific consequence (such as food shortage or famine), instead of a cause (for example, drought or climate change). Second, vulnerability connotes an adverse consequence, contrary to the more neutral term sensitivity. Thirdly, it is a relational term distinguishing between socio-economic groups or regions in terms of their conditions existence, rather than a conclusive and objective measurement of deprivation.

4.3.5.1.2 Sustainable Livelihoods Framework

Adaptation is also conceived using the Sustainable Livelihoods Framework (SLF). The SLF pays attention to how people develop livelihood strategies to attain certain livelihood outcomes in response to a specific vulnerability context. Mudombi and Muchie (no date) analysed the nexus between information/knowledge and adaptation using the SLF. In terms of their conceptual framework, information communication technologies are assets (or a form of capital) that play a significant livelihood role by facilitating communication between people in rural areas and

outside groups, including transferring climate change information from climate change and adaptation researchers to rural people and vice versa. Mutami and Chazovachii (2012) also embraced the SLF to explore livelihood strategies in distressed environments in Mudzi district. In mapping the vulnerability context, the scholars highlight that stresses and shocks stimulated by climate variability include exceedingly high temperature, late onset of rains, unpredictable rainfall, moderate and severe droughts and dry spells, crop failure and livestock losses. In this context, households are diversifying their livelihoods (through petty business, market gardening and rural-based industrial activities) as a basis for adaptation.

Still within the same framework, Muruviwa et.al (2013) considered the livelihood strategies of the elderly in Mubayira where climate change is inducing repeated droughts, depletion of pastures and crop failure. Nonetheless, their study paid more attention to vulnerabilities than to adaptation. In her study using the SLF, Mubaya (2010) observed that fundamental responses to climate variability and change involve re-organizing agriculture and related practices rather than switching to off-farm initiatives. She concluded that 'while selection of coping and adaptation strategies to climate variability and change, and the related outcomes may be intrinsic, this selection tends to be overwhelmingly determined by various factors such as demography, access to information and assets and vulnerability level' (Mubaya, 2010:187).

4.3.5.1.3 Concept of Sustainability

A number of other scholars have made assessments of the successes, effectiveness and consequences of diverse adaptive strategies by alluding to the concept of sustainability. Such strategies involve changes in farming practices such as concentrating on new crop varieties and farming technologies, and expanded investments in water security in specifically semi-dry agro-ecological zones of Zimbabwe. However, these scholars have pursued their work without reference to any sustainability framework. Although these scholars allude to the lack of sustainability, the consequence of such *ad hoc* approaches without rootedness is any substantial theory is a loose coalition of studies that does not contribute systematically to the sustainability discourse. For instance, Burton et. al (1993) highlight that the development and implementation of adaptation choices demands both short- and long-term visioning in addition to considering the

impacts of the options implemented. As a result, there is need to examine the consequences of adaptive strategies, including their sustainability. Gwimbi and Mundonga (2010) discovered that current adaptation strategies adopted by farmers to deal with the negative effects of climate change are by and large reactive, selective and protective, and therefore not sustainable in the long term. In another study, Bola et. al (2014) concluded that coping strategies adopted by households in Mbire district were rigid and ill-fitted in adapting to floods and droughts. At the same time, the sustainability of diversification strategies, such as gold panning in Zvishavane (in Murowa ward), is problematic given that they may be illegal and environmentally harmful (Mutekwa, 2009). In another study in Muzarabani, again it was noted that adaptive strategies appear to be short-term measures which are not sustainable (see Mavhura et.al, 2013). In similar fashion, Murendo et.al (2012) mentioned that crop diversification, conservation agriculture and fodder conservation are creating conflicts that tend to jeopardise the sustainability of adaptation strategies.

Essentially, considering sustainability is imperative because coping strategies may fail for various reasons, and not necessarily because farmer's ability to cope is absent (Mavhura et.al, 2013). These reasons may include alterations in the size and character of the local population, changes to the agrarian economy including access to local markets and the unavailability of livelihood options, all of which make any possible coping mechanisms effectively obsolete (Few, 2003). More so, although adaptation may be effective for one community, it may undermine the ability of others to adapt through spatial spillovers and negative externalities (Osbahr et.al, 2010). Following that, sustainable adaptation options are more likely to involve reducing the cumulative impacts of climate change and variability, thereby assuring that adaptive measures implemented in a specific geographical location do not adversely compromise future adaptation efforts. In this regard, as set out by Adger et.al (2005), the understanding of adaptation from a sustainability perspective likely entails focusing on three processes: reducing the sensitivity of the livelihoods system to climate change, modifying the exposure of the system to climate change, and increasing the resilience of the system to cope with changes. Concurrently, the spatial scale over which these three dimensions or processes of adaptation can be implemented variegates, as does the significance of international and national climate change policies and the role of individual, household and collective action (Chikozho, 2010b).

The notion of resilience would seemingly play a decisive role in theoretically understanding and measuring the successes or effectiveness of adaptation strategies, yet it has been marginalised in the sustainability literature on adaptation in Zimbabwe. Currently, a few scholars gloss over the concept and therefore its utility is not clear. But the usefulness of any paradigm based on resilience lies in that it construes local communities as central points of activity when dealing with challenges and stresses presented by climate change and variability (Chikodzi et.al, 2012). It follows that resilience of localised social and ecological systems enables them to absorb disruptions while retaining the same basic ways of operating and the capacity to adapt to change. In this respect, Gwimbi (2009b) argues that genuine resilient strategies imply that communities are not only able to cope with (and recuperate from) stresses, but they are able to alter their livelihood practices to reflect the changing and diverse priorities rising from the shock. Importantly, indigenous knowledge systems at times have been presented as indispensable elements of disaster resilience building. This is because these systems can promote participation and empowerment of affected communities, as well as improve adaptation in local contexts because of their nuanced understanding of the locality and its environmental history (Mavhura et.al, 2013).

4.3.5.1.4 Concept of Conservation

Adaptation research in Zimbabwe is to some extent being shaped by a conservation discourse. For instance, Nyamadzawo et.al (2013) espouse a conservation discourse on adaptation with specific reference to the agricultural sector. These scholars claim to be extending the water conservation approach, which emerged during the colonial period in Zimbabwe. In particular, with regard to semi-arid regions of the country, they speak about the significance of farmers adopting in-field water harvesting integrated with other strategies such as enhancing soil fertility management, timing of agricultural operations, pest management and choice of cropping system (Nyamadzawo et.al, 2013). Similarly, in their study in Zimbabwe (and Zambia), Thierfelder and Wall (2010) contend that Conservation Agriculture (CA) grounded on minimal soil disturbance, crop residue retention and appropriate crop rotations provides possible solutions to mitigate the impacts of seasonal drought. In addition, Rurinda et.al (2013) assessed cropping adaptation options in the face of climate variability in Wedza and Makoni districts, using on-farm

experiments. In this case, soil nutrient management is said to have a predominant effect on crop production. More specifically, although the quality of within-season rainfall is falling, nutrient management should be a priority option for adaptation in rain-fed smallholder cropping systems (Rurinda et.al, 2013). Lastly, CA is also supported by NGOs in rural communities to help farmers reduce vulnerability, adapt to climate change and increase their food security.

Upon critical reflection, most of the studies have an optimistic view of the conservation discourse. Basically, Conservation Agriculture (CA) is deemed the most appropriate technology for farmers in the context of climatic change. Many of the advocates of CA such as NGOs indicate that it is well suited to micro-garden plots and fields typical of communal areas in Zimbabwe. Nonetheless, whereas most case studies on CA presented above are derived from communal farmers, climate change is affecting farmers irrespective of the type of land holding or ecological region. Therefore, Scoones (2012) questions its appropriateness for new resettlement areas and concludes that the advocates of CA have not thought hard enough about the contexts into which it is supposed to fit.

4.5.5.1.5 Summarising Middle-Level Theories

Reflecting on the concepts of vulnerability, sustainability and SLF, and how they have been applied in climate change studies, one cannot easily establish their linkages. Essentially, current studies have employed them in a fragmented manner. For example, there are those studies that utilise the notion of vulnerability outside the SLF and concentrate on sectoral vulnerability. At the same time, there are those scholars who consider vulnerability within the SLF. However, the way the SLF is applied appears disjointed, as some studies dwell more on vulnerability of various social groups and list adaptive strategies, some gloss over capitals whilst others completely ignore the sustainability part of the framework. In a related manner, there are studies that employ the notion of sustainability without alluding to any theoretical or conceptual framework. Lastly, studies also slur over the concept of resilience. In the end, what adaptation really entails is not clear.

This is in sharp contrast to how the SLF is applied in other rural contexts in Africa. Studies that employ the SLF holistically (see for example, Elasha et.al, 2005) conceive adaptation as a process focused on reducing vulnerability. Based on this, scholars seek a detailed understanding of who is vulnerable and why. They proceed to analyse adaptation through identifying the core assets needed to cope or recover from shocks and examining the influence of policies and institutions on adaptive strategies.Finally, they look at livelihood outcomes by determining whether strategies are able to reduce vulnerability and enhance livelihoods (capabilities and assets) now and into the future, and guard against additional climatic shocks.

Furthermore, unlike studies reviewed above, other studies have analysed the successes of adaptation by drawing on ideas from resilience theory (see Nyamwanza, 2012; Osbahr et.al, 2010). They critique the concept of sustainability and the SLF. For instance, Nyamwanza (2012:49) asked 'sustainable for whom and to what?' and also says 'the term has not been qualified to suit different contexts'. It has also been argued that the SLF dwells on idealised outcomes, for example, increased income and improved food security. Fundamentally, dynamic vulnerability changes, reinforcing risks and the related increasing of livelihood uncertainties, all make thinking around specific idealised outcomes untenable (Nyamwanza, 2012). Furthermore, the framework does not adequately address social and political processes, and therefore institutions of exchange, extraction, exploitation and empowerment (Scoones, 2009).

Therefore, studies which draw on resilience theory pay attention to the ability of individuals and communities to cope with climate shocks (that is, to maintain function and withstand shocks) and the ability of communities to self-organise through individual agency, collective networks and formal institutions. They also emphasise adaptive capacity, which is related to the existence of mechanisms for evolution of novelty or social learning. In view of the focus of my thesis (structures, processes and conditions underpinning adaptation), I found respite in the fact that resiliency theory is process-oriented.

4.3.5.2 Sociological Theories

Though middle-level theories and theoretical precepts are of some significance in studying climate variability and adaptation theories, this thesis is particularly interested in a theoretical analysis more firmly grounded in the discipline of sociology. As indicated already, attempts to understand climate change adaptation using sociological theories are very minimal in Zimbabwe, and this emulates the relative dearth of sociological contributions in global and regional climate change research. Evidently, climate change sociology is almost non-existent in the country. There are very few, and disconnected, studies on climate change adaptation that utilise or refer to sociological theories and concepts.

For example, Gukurume (2013) refers to the importance of social capital among other adaptation strategies in his study in Bikita district. In this study, social capital is simply regarded as an adaptive strategy, and not as theoretical/conceptual framework as propounded by for example Bourdieu (1977) or Putman (1995). Hence, though not without value, the study is largely immaterial as a sociological contribution to climate change adaptation research. Gutsa (2010) employed the structuration theory of Giddens (1984) in his study on how the elderly, who are also affected by HIV and AIDS, are responding to climate change in Chivi district. Gutsa comes to conclusions consistent with Giddens's structuration theory about the dual importance of structure and agency. In particular, it is argued that elderly people in Chivi call upon their stock of knowledge as well as their social networks in order to overcome the twin challenges of climate change and HIV and AIDS that are negatively impacting on their livelihoods. Even so, Giddens's work is not drawn upon in any detail such that a nuanced theoretical framing of local level adaptation is not forthcoming or clearly articulated. For this reason, this thesis seeks to provide a theoretical understanding of climate variability and adaptation based on the work of the sociologist Margaret Archer.

4.3.5.2.1 Adaptation Structures, Processes and Conditions

What is also clear is that most studies in Zimbabwe ignore structures, processes and conditions underpinning adaptation particularly from a sociological perspective. This is despite the fact that effective adaptation should be informed by a deeper discernment of the social processes of

adaptation (Wolf, 2011). Thus, the focus of existing studies on purposive, material modifications (or adaptive and coping strategies) is appropriate but insufficient alone. In this regard, Chikozho (2010a) admits that the processes of human adaptation to climate change are still poorly understood. Clearly, adaptation cannot be treated as an isolated event divorced from embedded, structural and interactional social imperatives. This is because it takes place in the context of demographic, cultural, environmental, political and economic changes as well as rapid transformations in technological innovations and global policy processes (Adger et. al, 2005; O'Brien and Leichenko, 2000). MET-CCO (2004) for instance emphasises technology-based adaptation alone and not social adaptation *per se*, thereby side-lining the social processes of adaptation – yet, as an emergent property of social systems, adaptation to climate change is continually being shaped and reshaped through social relationships. This buttresses the idea that climate change adaptation is an inherently social process, underpinned by socio-cultural characteristics of the society, group or even household that is adapting (Wolf, 2011).

I am not suggesting that a focus on structures, conditions and processes – from a specifically sociological perspective – is non-existent. Rather, these social phenomena are underplayed in the existing literature. Hence, I acknowledge, for example, the research by Shumba et.al (2012) who employed a vulnerability framework in which adaptation strategies are considered as processes conditioned by socio-economic, political and policy environments (as well as by producers' perceptions and elements of their decision-making). In this case, understanding the relationships between adaptation choices and the existing structures and processes in place, in order to ameliorate the impacts of climate change, is bound to be a central element of any evaluation of adaptation options and of analyses of the likelihood of the implementation of adaptation options (Smit and Skinner, 2002). There is simply no doubt that decisions about adaptation are attained in the context of existing social, cultural and economic conditions, institutional and regulatory arrangements, technology innovations and social norms (Bryant et. al, 2000). Similarly, adaptation processes are enunciated and pursued through the institutional and regulatory mechanisms of prevailing agricultural, socio-economic, financial, management, political and technological systems (Bryant, 1994). Failure to recognise this in full weakens any sociological examination of climate variability and farmer adaptation measures.

4.3.6 Adaptation Theory and Practice

Case studies on actually-existing adaptation projects, as found in the Zimbabwean literature, also provide insights on broader adaptation thinking in the country. Visibly, these projects are disconnected and scattered across the country. Few of these projects are founded on any systematic and clear-cut conceptualisation or theory of adaptation. This is not surprising considering the fragmentation of current adaptation studies and the theoretical gaps discussed above. Certainly, the bulk of the case studies and recommendations are anticipatory, directed at building coping capability through behavioural changes (Dodman and Mitlin, 2011). However, apart from these problems, a key strength of these case studies is that they focus on micro-scales. For example, important projects on coping with drought and climate change in Chiredzi district exist, and these are grounded on three adaptation approaches, namely: addressing vulnerability, building response capacity and managing climate risk (Unganai, 2009). In addition, Lutheran Development Services (LDS) espouses a community-based approach to handling climate variability (Brown et. al, 2012).

Furthermore, so as to integrate climate change adaptation and disaster risk reduction at local levels, an NGO called Practical Action has been enforcing an action-learning research and development project which mainstreams livelihood-centered approaches to disaster risk reduction (Brown et.al, 2012). This links livelihood approaches with broader institutional structures, and seeks to raise food and livelihood security among vulnerable communities in drought-prone environments. In addition to this, adaptation projects among people living with HIV and AIDS have been employing a Community Systems Strengthening (CSS) approach in Mutoko and Muzarabani districts. The aim is to build the capability of affected populations and communities and to integrate the public or private sector into community-based processes regarding the conception, delivery, monitoring and evaluation of development (specifically health services) projects (Brown et.al, 2012). Over and above this, some of the adaptive strategies portrayed in these case studies are based on downscaled climate projections and not the appreciation of various structures, processes and conditions actually underpinning adaptation.

4.4 Conclusion

In this chapter I examined what existing studies in Zimbabwe on climate change and variability have to offer in understanding adaptation. I elaborated on how adaptation has been framed in research in order to establish my entry point in undertaking this thesis. I started by discussing the legislative, policy and institutional mechanisms existing in the country in relation to responding to climate change. Fundamentally, adaptation is implied in the existing frameworks whilst responses in practice are very limited and isolated. I then expressed my dissatisfaction in various ways regarding how adaptation has been framed and I argue that climate change literature in Zimbabwe does not offer convincing insights in fully understanding adaptation. The use of middle-level theories is evident and commendable but still marginal. At the same time, whilst a number of empirical studies exist, even at localised scales, they are devoid of any major theoretical contributions. Overall, one can neither locate any coherent response framework on climate change nor a systematic body of knowledge on climate change adaptation in the country. What is abundantly clear is the fragmentation of both response frameworks and scholarship. What is also clear is the disjuncture between theory and practice.

The urgent need for serious theoretical advances, particularly innovative theorising on climate change adaptation in the country is thus evident. Adaptation in agrarian societies is neither self-evident nor can it be reduced to a list of strategies or responses to identified impacts. Vulnerability is a useful framework but the overemphasis on sectoral adaptations is problematic. The SLF is also a valuable approach but it is insufficient to be relied on to make concrete conclusions on what underpins adaptation in agrarian societies. In addition, the marginalisation of sociological theories is not particularly fruitful. Therefore, the understanding driving my thesis is that adaptation is a complex process such that a sociological theory is particularly needed to capture the structures, processes and conditions underpinning it within dynamic socio-economic, ecological and political contexts.

CHAPTER 5: TOWARDS UNDERSTANDING CHANGES IN CLIMATE VARIABILITY IN CHAREWA, MUTOKO

5.1 Introduction

It was on Independence Day in April 2014. Villagers, young and old were jovial. Women cooked on the other side of the sports field as men sat in groups chatting. Men had slaughtered goats and women had prepared chickens that were already boiling on the fire. Children chased each other on the sports field and others were singing. Little boys stood watching women cooking, smiling and looking forward to the food. For farmers in Charewa, it was an ordinary April day. Uprooted groundnuts and beans were drying on mesas or buttes (locally known as *maruware*). Some were spread on top of big plastic papers kept on yards in their homes. But a lot of groundnuts, beans, bambara nuts and cowpeas were still in the fields. Most maize crops were still in the fields as well, drying under the April sun.

I watched as people enjoyed sadza, chicken and goat meat. Other villagers were having Mazoe (juice) and bread that were served in one of the classrooms at Kagande Primary School. I waited for the two elders I had been referred to, to finish their food. These two elders were the chiefs' messengers. I was going to brief them about my research agenda and discuss with them about visiting Dzimbawe and also interviewing the chief. It was almost 4:30 pm when the celebrations were over and I had the chance to approach the elders. It was a hot day and I already felt tired, so when I finished the meeting with the elders I set to go home and rest. By this time clouds were forming but, I did not think it would rain. As I learnt later on, neither did the farmers I talked to think it would rain because it had not rained since early March. When I crossed Marowo River, raindrops were already falling. Other villagers coming from the day's celebrations picked up speed in front of me. The rain was getting heavier when I ran to catch up with three women in front of me. They were carrying pots and dishes that had been used at the celebrations, so they were walking slowly.

We had not walked for long when the rain turned into a downpour. I was still far from home so there was no point in running hence I walked with the three women. At first they were not

talking and we continued walking in silence as rain poured on us. Silence was broken by one of the women who had just remembered she had forgotten to tell her husband that she had put shelled beans to dry in the scotch-cart at home. She had not thought it would rain. Others joined in expressing shock and disappointment at the rain. As one of the women put it, it was raining '*kunge mvura yandotumwa kundonaya munhu wese asiri paumba'* (it was like rain sent by someone when everyone was not home). The conversation carried on, touching on *kuworesa nyimo* (the rainfall was going to make bambara nuts rotten) and how they were going to move things at home to accommodate harvested maize affected by the downpour. They asked each other how long the rains were going to last and why it was raining like that in April. They reminded each other it had happened in April the previous year. The conversation continued touching on how that kind of rain contributed to too much cold during winter. Then, I had to go my own way and the women continued their own way. The downpour still continued.

The above experience was the beginning of the development of this chapter. I had already commenced my fieldwork and interviewed some key informants from government departments at Mutoko growth point in March 2014. I had also talked to some key informants at the community level. However, this experience was a turning point in my data collection. It was a moment I witnessed farmers experiencing what they perceived to be manifestations of changes in climate and at the same time listened to their concerns. Intriguingly, the findings in this thesis therefore commence with seemingly helpless women on an unexpected rainy day in April in Charewa and end with versatile and ingenious coping and adaptive strategies.

That being the case, in the following paragraphs I provide a description of the study site. This is crucial in so far as providing the local context within which Archer's social theory is operationalised. From the description of the study site, the chapter provides a lengthy but interesting discussion on farmers concerns on climatic changes that were derived from fieldwork in Mutoko. At the beginning of the discussion, I make it clear that even though both rainfall and temperature matter to farmers, increasing unpredictability and unreliability of rainfall were identified as the ultimate concerns. With this in mind, most of the paragraphs dwell on rainfall issues. I then deliberate on concerns that farmers had pertaining to temperature. From there I draw attention to other concerns raised by farmers during data collection with the understanding

that climate variability is not disconnected from the prevailing socio-economic and political context. As I approach the end of the chapter, I concentrate on how farmers in the study interpreted changes in climate variability. Notwithstanding the survey results, here I deliberately direct my attention to religious and cultural factors. At last, I provide the concluding section in which I draw attention to the fact that climate variability is increasingly changing in Charewa.

5.2 Overview of Local Context of Adaptation

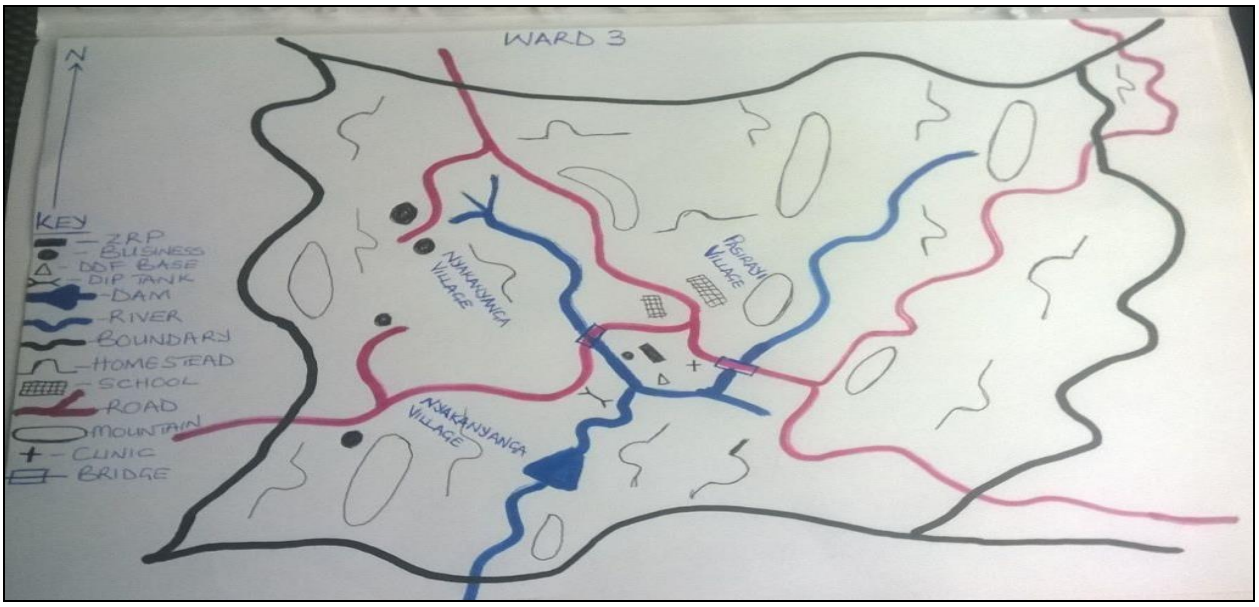
This section provides a description of the study site, which in principle is the local context of adaptation. I dwell on the history, authority structures, natural resources, wealth, gender issues, social organization and health issues. Charewa is located approximately 50 kilometers from Mutoko growth point. It has a total land size of 14,320 hectares, making it one of the biggest areas in Mutoko. Before independence in 1980, Charewa was one administrative ward and comprised Danda, Chindenga and Kagande among other areas, with the later being the ward centre. During the war of liberation, which was intense in this area, people in Charewa were moved into 'protected villages' or 'keeps' located at Kagande to cut their interaction with freedom fighters. After independence in 1980, Charewa remained as one ward until 1984. The government decided during decentralisation in 1984 that an area with more than four Village Development Committees (VIDCOS) would be a ward with its own Councilor hence the establishment of Charewa A (see Map 5.1 below) and B. Charewa A[10] (also known as ward 3) has 20 villages, a population of 5,435 and 1,293 households (Zimbabwe Statistical Agency, ZIMSTAT, 2012).

Conversations with key informants and elders in the ward on the history of the ward show that the area now incorporating Charewa, i.e Mutoko district, once belonged to a man called Makate, a great chief and warrior. Nehoreka, one of the leaders of the Buja, envied the land and was determined to possess it. To this end, he married off his sister, Njapa to Makate. The idea for the marriage was for Njapa to spy on Makate's war tactics and steal *gona rehondo* (it was believed Makate used some form of magic and sorcery to defeat his enemies during wars). Subsequently, Nehoreka went to war with Makate, defeated him and took over his land. Makate fled to the east,

[10] For the purposes of simplicity in this study, I shall refer to Charewa A as Charewa or ward 3.

where he is believed to have disappeared into mesa or butte (locally known as *ruware*). Following this history, Murphree (1969) highlights that the Buja men regard Buja as meaning: 'great land taken by the conqueror'. After conquest, Nehoreka and his brothers (Zvimbiru and Nyakutanda) shared the land, with Nehoreka taking the western (including Charewa) and central areas.

Map 5. 1: Charewa A (Ward 3)



Source: Fieldwork, April 2014.

Description: The map was originally drawn by one of the farmers from Gotora village in ward 3. It was not drawn to scale. The roads shown are gravel roads. In between households are fields and depleted bushes. Footpaths cut around these fields and vleis. The Zimbabwe Republic Police and District Development Fund offices shown in the map were established after independence at the business centre. The business centre (also the ward centre) was established in 1956. In 1974 a sub-office for the Registrar General (not shown on map) was opened at the centre. However, it was disbanded in 1976 when the war of liberation intensified in the area.

5.2.1 Ethnicity, Demography and Gender Relations

Charewa is ethnically homogenous. About 91.7% of the respondents are Buja, whilst maZezuru constitutes 3.3%. Other ethnic groups including Korekore, Manyika and those from Malawi and

Mozambique constitute 5%. These ethnic minorities are found largely because of inter-ethnic contact that generally existed in pre-colonial Zimbabwe as well as the effects of British occupation. It was also noted by key informants that people of Malawian origin came from Stondan farm in Shamva, Mashonaland Central. The Buja are one of the Shona tribes, a group of people who live immediately south of the Zambezi river, most of them from Zimbabwe and Mozambique (Murphree, 1969). The Buja people of Mutoko are believed to have originated from Mhingari in Tete. Historically, the name Buja refers to Nehoreka's people who originally settled at Charewa, the present *muzinda* (chief's homestead). The Buja in Mutoko exhibit sufficiently marked linguistic and cultural traits that set them apart from other Shona tribes and their language is ChiBuja.

Ward 3 has 2,678 men and 2,757 women (ZIMSTAT, 2012). From my survey in Nyakanyanga and Pasirayi villages, 20 (33%) of respondents were females and 40 (67%) were males. Among the 60 respondents, a significant number (70%) were heads of households and 30% were not. Most of the respondents who were not heads of households were found in Nyakanyanga village. In this case, the main reason was that most heads of households had already gone to wait on their gardens (that were far from homesteads) during the time of questionnaire administration. As a result, a member of the household who was available and also above the age of legal consent was interviewed. In addition, when some questionnaires were administered at a central place in Nyakanyanga village, some of the people who turned up were not heads of households. However, the fact that some of the respondents interviewed were not heads of household did not have a bearing in understanding the dynamics of household headship. The questionnaire inquired on the type of household and whether the respondent was the head of household or not in separate questions.

Therefore, in terms of gender dynamics in household headship, the majority (66.7%) of households were male headed, 13.3% were *de facto* female headed (headed by women because of absentee, aged or sick husband) and 20% were *de jure* female headed. The dominance of male headed households discovered in this study is not surprising as it is a characteristic of communal areas of Zimbabwe. In addition, the majority (68%) of respondents was in monogamous marriages, 20% were widowed, 5% were divorced or separated, 4% were in polygamous

marriages and 3% had never married. Among the 20% who were widowed, almost 75% were women. Furthermore, regarding the age characteristics of the respondents, 20% were aged between 21-35 years, 30% aged between 36-50, 30% aged between 51-75 and 20% over 76 years. At the same time, 78.3% of the respondents were Christians, 11.7% followed traditional religion, 5% were Moslems whilst 5% were not affiliated to any religion.

Simultaneously, the study revealed the subtleties on household size. The average household size in the study is 1.7 and, in terms of range, quantitative data analysis shows a minimum of 2 and a maximum of 3 people in the 60 households that participated in the survey. Nonetheless, the average household size in my study significantly varies from that of ZIMSTAT (2012) which was 4.6. In addition, in my questionnaire, I did not directly ask for household composition, that is, the type of members making up the households. However, various diminuendos emerged when respondents were asked on constraining and enabling factors in adaptive strategies during the survey and qualitative interviews. A significant number of respondents cited household labor as a constraint in undertaking various adaptive strategies. Besides simply highlighting that they were 'too few' to engage in a number of strategies, respondents' elaborations divulge that households were labor constrained because they had young children and elderly members who were not productive. More so, although the issue was not pursued at length in the study, some households were also taking care of young and orphaned children.

Additionally, to map the gender terrain in the study site, I investigated land and livestock ownership in the ward. '*Kubvira kare, mukadzi anondowana nhakaba'* (since a long time ago, women cannot inherit property), said one key informant. It was established that it is a long tradition that women in the ward do not own land in their own right. Land has always been allocated to men by *Mambo* (chief) and *Sadunhu* (headmen) or *Sabhuku* (village head). Women cannot own land because *havasi masamusha* (they are not head of households). Even during the whole process of settler colonialism, men were recognised as owners of land. Women had no primary rights over land and those married had only userfruct rights over their husband's land. Widows lost land and other property to their deceased husband's paternal relatives. Daughters were allocated small pieces of land by their fathers upon returning home (usually as result of divorce) but did not inherit the land.

Regardless of the various land reforms, key informants in Charewa concurred that even now land belongs to the male members of the family. According to customary law, the male head of the household is the one who is recognised as the holder of the land. This precludes women from holding primary land rights, relegating them to holding secondary rights derived from and negotiated through the husband or male relatives. Livestock ownership is also skewed in favour of men. The few cases where livestock is said to belong to the wife or female member of the household in the study site is when there is '*mombe ye humai*', which is a special cow given to a woman at the marriage of her daughter. This special cow and her progeny are traditionally and culturally submitted to the woman. Women also receive a goat called '*mbudzi yemasungiro'*, which is a goat given to the mothers during their daughters' first pregnancy. However, it was clear in the conversations that while women can secure livestock during their daughters' marriages, the large part of *roora* (bride wealth) accrues to men.

Gender disparities are also reflected in access to leadership positions. Few women are elected into or inherit leadership positions. The ward has had 3 female Councilors since independence. There are, however, quite a number of female Community Representatives selected with the guidance of *Sabhuku* (village head) at the village level, to work with Non-Governmental Organisations (NGOs). Interventions on *kugovewa kwenhaka* (inheritance) by NGOs were also said to have contributed to the reduction in cases of widow's disinheritance and violence against women in the area.

5.2.2 Authority and Leadership Structures

Charewa has complex structures of land administration, authority and leadership. Both modern and traditional structures co-exist, although the former supersede the latter when it comes to what is recognised by the government. Each village is administered by a village head (locally known as *Sabhuku).* Village heads, all males, normally inherit their positions from their fathers. However, there are cases were some males can become village heads not necessarily through inheritance. A common practice known as '*kubatira*' was cited by key informants. In this case members from the clan that is supposed to provide the village head can choose '*sekuru*' (uncle), '*muzukuru'* (nephew) and in some cases '*sahwira*' (friend) to act as *Sabhuku* until a time when a

substantive one is chosen. It emerged that these people can act as village heads for a number of years. One case that was cited was pertaining to the village head for Tirihumwe village. The current head for the village, known as Sabhuku Tirihumwe, is a nephew to the ruling clan and he has been the acting village head for several years. In fact, he lives in Nyakanyanga village whilst he administers Tirihumwe village.

From the village head, there is a headman (locally known as *Sadunhu*) who operates at the ward level. The current headman is Kawazva, regarded as the young brother to Nehoreka[11]. In terms of traditional structures and systems on land administration, Kawazva administers 11 villages. The headman works with a village committee comprising eight people known as chief's messengers. These messengers also traditionally administer their own land. The first messenger is Kaukonde, the grandson of Nehoreka. He administers 6 villages. Then there is Negomo or Nyakanyanga, also known as Dokoro with 8 villages. Danda is another messenger, with 26 villages under him. Next is Samatanda who administers 4 villages. Masarira is a sister to Nehoreka and has 2 villages. Another messenger is Nyamhimbi, Nehoreka's grandson with 4 villages under his authority. Chireka administers 6 villages and the last messenger, Nyarukokora, has authority over 11 villages.

These traditional villages make up Charewa A and B. Those who traditionally oversee these villages did not randomly choose the villages they administer, but were allocated the land by Nehoreka. The boundaries of all these villages are rivers or mountains, which are the boundaries designated by *Vadzimu* (ancestral spirits). This was done to avoid boundary disputes or one leader encroaching into another leader's land. For example, key informants cited that if trees were used to demarcate boundaries, they would be easily chopped down and disputes would ensue. Again, interestingly, in the traditional system, these messengers are regarded as wives of Nehoreka, except the sister Masarira, grandsons Kaukonde and Nyamhimbi and the son-in-law Samatanda. Samatanda was married to Nehoreka's sister.

[11] Here it does not mean that the current headman and Nehoreka are siblings, but the clan, Kawazva, in which the headman belongs to is the one that makes him Nehoreka's young brother.

Furthermore, an intriguing story told by the key informants and also found in literature (see Murphree, 1969) is about the chieftaincy, unique among the Shona tribes. Charewa is led by a female chief. More so, unlike most chief-doms in Zimbabwe, chieftaincy is not hereditary. Apparently, Nehoreka decided that his relatives cannot become chiefs. A *Masakadza* (stranger) and also female, should be ordained as the chief. According to key informants and other elders I talked to, Nehoreka is believed to have been a kind man. He welcomed strangers, such as *vaiuya kuzopotera* (people running away from wars) into his home and they were treated well. This led to jealousy from his brothers, particularly Mapatwe, who felt that they – and not strangers – deserved all the kindness. From this experience, Nehoreka believed that his brothers would easily become greedy and even kill him or be sell-outs[12]. Ultimately, he decided before his death that women, particularly those not related to him, were better off as his successors and *masvikiro* (guardians) of his spirit. Nehoreka believed women would not betray him. As a result, the current female chief comes from Mudzi district. Nehoreka rules the land (Charewa) through this female chief, who is the *svikiro* (guardian) of his spirit.

Chief Mutoko is the one responsible for finding the *Masakadza* who becomes the chief. He pays *lobola* (bridewealth) for the woman as if it is his wife and then the woman is ordained as the chief. Once the woman becomes the chief, she is not allowed to go back to her family. When she dies, she is buried in a cave in Maizi Mountain in Charewa. The male *Masakadza* are also the ones who rotate to become the chief's right hand men. They come from four clans, namely, Chinomona, Kajongwe, Chikwasha and Kazizi. Their duty is to do work on behalf of the chief. The chief resides in the sacred place, Dzimbawe[13] and is not allowed to travel, for example to attend meetings at the District Administrator's office at Mutoko growth point. Therefore, *Masakadza* does this and brings feedback to the chief. At the meetings, the *Masakadza* also speaks as the chief. The male *Masakadza* also works with the messengers to maintain the chief's homesteads (traditional huts in Dzimbawe) and cultivate the chief's fields of millet and sorghum.

[12] There are variations to this history. Written sources say Nehoreka abdicated his position in favor of Mapatwe and fled to the far western parts of Mutoko. However, when he died there he assumed superiority as the tribal spirit of his area.

[13] Dzimbawe is located in a hill, adjacent to Gurupira village.

Unfortunately, traditional land administration and leadership structures were put down during British colonial rule. The power of the chiefs was weakened as they were stripped of their administrative and judicial functions (Murphree, 1969). Simultaneously, centralisation took place through the creation of reserves exclusively for Shona settlement. Again, immediately after independence in 1980, chiefs were sidelined. The Communal Lands Act of 1981 changed Tribal Trust Lands to communal areas and switched authority over land from traditional leaders to District Councilors who were supposed to allocate land. Nonetheless, the chief and headman continued to allocate land. To rectify the marginalisation of chiefs, the Traditional Leaders Act of 2000, reinstated the authority of the chiefs in communal areas and subsequent recognition of chiefs' courts took place. Still, whilst the administration of land by chiefs, headmen and village heads is officially recognised, traditional land administration by messengers discussed above is not.

5.2.3 Natural Resources and Infrastructure

Visible natural resources in the ward include black granite hills and mountains, rivers and streams, wetlands and vleis, wildlife and bushes. Major rivers, both seasonal and perennial, are Chitora, Nyamasanga, Chishande and Marowo. A number of farmers draw water from Marowo to irrigate their gardens and fields during the dry season. Wild fruits include *mazhanje* (uapaca kirkiana*), hacha (*parinari curatellifolia), *shenje* (diospros mesplifomis) and *mbumi (*strychnos cocculoides). The ward is also well known for the famous *muwuyu* (baobab) tree. Some of these fruits such as *mazhanje* (uapaca kirkiana) and *mawuyu (*baobab*)* fruits are sold on roadsides and at Mutoko centre. However, this was traditionally a taboo because it was believed this would stop the rains from coming. Rabbits and bucks are hunted for meat. Primates such as baboons are everywhere. Snakes such as black mambas, *mhungu* (cobra) *and rovambira* (black mamba) are common in the mountains. Perennial and sacred springs such as Kakanda and others dotted over the ward are valuable water resources for the community. Grazing lands are also valued. Some of these were pegged by the Natural Resources Board in 1985 for paddocks. The project did not materialise but still the villagers maintained the areas as grazing lands. The grazing areas are also demarcated according to the traditional land administration system I alluded to before. Notably,

grazing lands are exclusive, only villages falling under a particular messenger can graze their livestock in a particular area.

Charewa is serviced by two Rural Health Centres (RHCs), namely Charewa and Kawazva. There are also three business centres namely Kagande, Tareva and Kawazva. There are also offices for the District Development Fund (DDF), Agricultural Research and Extension (AGRITEX) and Veterinary Department at the ward center. Three grinding mills are operational. The ward has one secondary school and 3 primary schools. Electricity is currently being installed at the schools and Charewa health centre. The ward is serviced by two gravel roads, Charewa-Nyarukokora and Charewa-Rukwenjere, constructed by the District Development Fund (DDF). There are two diptanks, one serving Tareva and Kawazva and the other located at Kagande. There is also one dam, Dorongoma and 2 big weirs (reservoirs), Marowa and Nyandiya (Environment Management Agency Mutoko, 2014). Twelve boreholes are found in the ward but seven are defunct. There are also 17 dip wells.

5.2.4 The Dynamics of Wealth in Charewa

As noted by Mushishi (2010), the major economic challenge of the Buja today is poverty. Essentially, poverty is multifaceted. It is understood in terms of material (such as income or assets) deprivation and lack of entitlements, as well as other aspects such as lack of freedom or capability failure. As such, these aspects were taken into consideration in the methodology used in this thesis. However, during the pre-testing of the questionnaires, it proved very difficult to get levels of income from respondents. Two reasons hindered this, firstly, the existence of multiple currencies used in the ward and countrywide. Secondly, households were not really forthcoming in revealing their incomes because of the expectation of assistance. Nevertheless, this problem is not peculiar to my study, as other studies (see Nyamwanza, 2012) have encountered the same problem in aid dependent rural communities.

As a result, household assets, nature of food production and family wellbeing locums were used to ascertain the level of poverty and wealth in the ward. These enabled placing the respondents into the four categories, namely, better off, middle, poor and very poor. In terms of assets,

ownership of livestock such as cattle, goats and chickens was considered. Food production entailed describing those producing enough staple food and selling surplus formally as better off whilst those regarded as very poor do not produce enough food and do not sell any food crops. Pertaining to family wellbeing, the highest level of education attained by the head of household and the school going statuses of children in households were used as pointers. Subsequently, from the data, 39% of the respondents were very poor, 33% poor, 18% middle and 10% better off. This is further illustrated in Table 5.1 below.

Table5. 1: Wealth Characteristics in Charewa

Wealth Category	**Roofing Material**	**Floor Material**	**Walls material**	**Livestock Ownership**		
				Cattle	**Goats**	**Chickens**
Very Poor, 39%	Thatch	Mud	Wood	0	0-1	4-8
Poor, 33%	Thatch	Mud/cement	Wood	0-2	3-6	5-12
Middle, 18%	Asbestos/Thatch	Cement	Bricks	2-4	5-6	7-15
Better off, 10%	Asbestos	Cement	Bricks and cement	4-6	6-12	9-more than 15

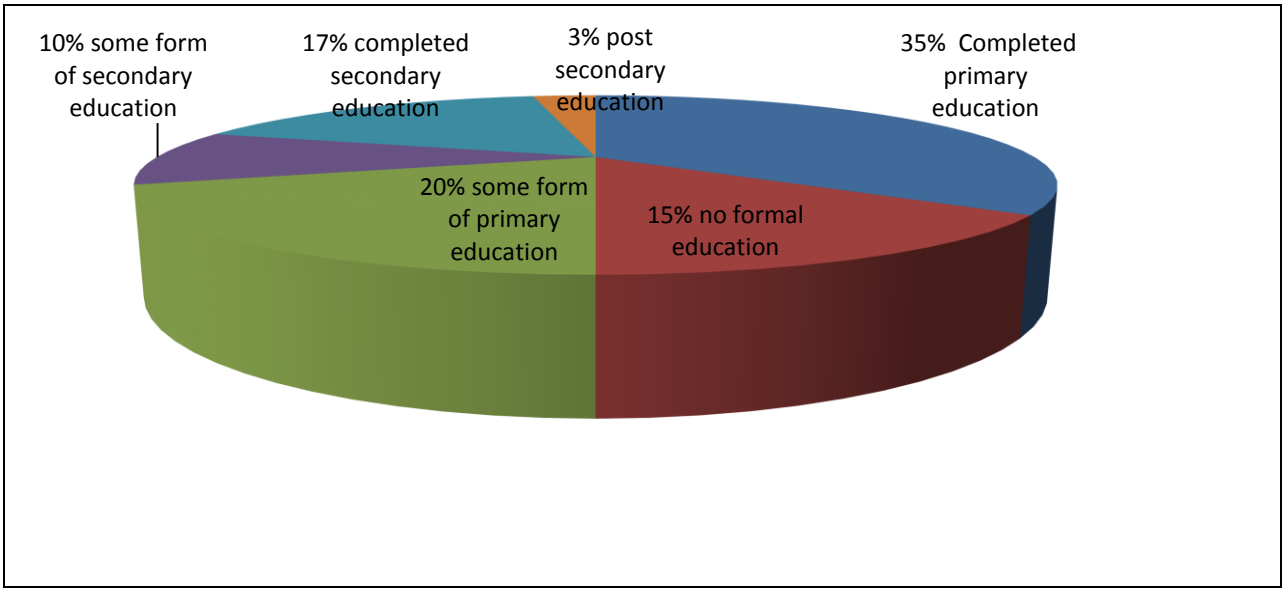
Source: Field Survey, July 2014.

Furthermore, livestock ownership has traditionally been regarded as a measure of wealth in rural Mutoko. The survey results show that livestock holdings are generally low in the ward. However the better off households comparatively own more cattle and goats while the poorer households typically own very small numbers of livestock, mostly goats and poultry. Land allocation, usually done by *Sabhuku* (village head), is not based on wealth status. But the amount of land cultivated and food produced is higher among better off households who have draught power and are able to purchase inputs. As other scholars have also found, the wealthier households are able to cultivate larger areas, buy inputs, and use animal draught power and hired labor (ZimVac,

2011). The poorer households on the other hand use own labor and therefore are restricted in terms of land cultivated.

Related to the above analysis of wealth in Charewa, I also used education to understand wellbeing. As shown in Figure 5.1 below, the highest number of respondents (35%) had completed primary education and only 3% of respondents (both male) had post-secondary education.

Figure5. 1: Levels of Education



Source: Field Survey, July 2014.

Regarding the highest level of education by wealth category, most people in the very poor and poor category had some form of primary education and completed primary education respectively. This is also consistent with the study by Chiripanhura (2010) who found a correlation between educational endowment and poverty in communal areas of Mutoko. There are however notable gender disparities in educational attainment, which are also signs of poverty in Charewa. Amongst the 15% of respondents with no formal education, 66.6% were women whilst 33.4 were men. More so, women were over-represented among those who had some form of primary education (58%) and amongst those who completed primary education (62%); while

men (67%) dominated among those with some form of secondary education and amongst those who completed secondary education (70%).

During the course of the fieldwork, it emerged that some of the reasons for low levels of education among women in the ward are early marriages and low appreciation of and investment in girls' education by parents or guardians. Most girls drop out of school because of early marriages in Charewa. In addition, I also attended a meeting on early marriages at Kagande Secondary School conducted by an NGO, Plan (Mutoko Unit) on 12 March 2014. Both parents and teachers concurred that children's education was being tremendously disrupted by early marriages. It also emerged that some parents supported some of the marriages, particularly because of the need to acquire *lobola* (bride wealth).

Similarly, the issue of early marriage was also confirmed by Mushishi (2010) who found that Buja women are expected to be married from the age of 15, otherwise they would be viewed as having *'pfure'* (some sort of curse) if they wait until their twenties. In the same area, others found that there is a chance that households with low education endowments invested less in the education of their children as well, pointing towards entrapment in poverty; as such children will probably fail to have the necessary skills for employment in high wage sectors (Chiripanhura, 2010). At the same time, school drop-out among boys in the ward at secondary school level is also evident. Poor performance and the humdrum of travelling long distances to the only secondary school in the ward were pointed out as driving this drop out, in some informal conversations with villagers.

In addition, I also considered household staple food (maize) production status to capture the dynamics of wealth in Charewa. As indicated in the survey results, most households (36%) in the ward do not produce enough staple food and do not produce surplus, 22 % produce enough staple food to survive on but with no surplus, 27 % produce enough food to live on and sell surplus food crops locally to other households and 15% produce enough food and sell surplus food crops locally and formally to government and private buyers. Surplus food crops sold are mainly groundnuts, bambara nuts and beans. During the time of the fieldwork, a bucket of shelled groundnuts was being sold for roughly US$23 at *Mbare Musika* (a market located

approximately 5 kilometers outside Harare Central Business District). The few households that sell maize either sell to the Grain Marketing Board immediately after harvest or conduct dry season sales locally, when the price is high. During the time of the fieldwork, the average price for a bucket of maize was approximately US$4.

In a related manner, the very poor and poor households, who were the majority in the survey, supplement most of their food from casual agricultural employment. They are paid either in kind (given maize) or cash which they use to purchase maize. However, the reliance on local employment makes the groups susceptible to exploitation in bad years when labour rates drop given increased demand for work (ZimVac, 2011). At the same time, since poor people's main asset is their labour, few job opportunities and low wages cause them to be trapped in poverty (Chiripanhura, 2010). In the meantime, the better-off households in Charewa are vulnerable to drops in producer prices of main field crops sold, particularly groundnuts, bambara nuts and beans as well as horticultural crops such as tomatoes.

To add, following what other studies have done (Deichmann, 1999; Nyamwanza, 2012), I also considered geographical location as an indicator of impoverishment in the study. Poverty can be found where 'geographic capital' (the physical, natural, social, political and human capital of an area) is low (Bird et.al, 2010). Geographical factors such as agro-ecological resource endowment, access to input and output markets, and availability of educational and health facilities all determine the well-being of households. Versatile forms of geographical capital in the context of my thesis constrain or enable adaptation. In terms of natural capital, most parts of ward 3 are located in ecological region IV. The region endures low and erratic rainfall with relentless droughts and frequent mid-season dry spells.

Charewa is also generally a remote area. Remoteness is also a key factor in explicating concentrations of poverty in rural Africa as it limits access to markets, increases the price of inputs and makes both economic and social services less accessible (Bird et.al, 2010). Besides its location in mountainous terrains, the remoteness of the Charewa is compounded by low political capital. This means that 'patterns of poverty and well-being are partially determined by differences in government spending, particularly on infrastructure and services' (Bird et. al,

2002: 26). The ward is located in an area characterised by poor infrastructure and low investment in rehabilitation of infrastructure. Transporters carrying farmers' produce struggle to maneuver the poor roads, compounded by the rugged terrain. Most bridges are low lying, making it highly difficult to transport produce during the rainy season. There is no local market in or near the ward. The market at Mutoko growth point is too small to absorb the horticultural produce from the ward such that the only option is *Mbare Musika*. Respondents also highlighted that, due to high transport costs, a 50kg bag of fertilizer that costs around US$40 at Mutoko growth point is resold for US$50 at the ward center. Certainly the price is too high for most households in the ward. Consequently, lack of fertilizer adversely affects household food production.

5.2.5 Culture and Social Organisation

There are two discernable religious structures in the ward. These are however not mutually exclusive. Contrary to what appeared as strict religious differences in the questionnaire, in which 78.3% of respondents said they were Christians, 11.7% followed traditional religion and the rest were either Moslems or not affiliated to any religion, it appeared that people who worship in churches also participate and believe in traditional religious activities and vice versa. This was more evident when respondents were asked on the drivers of changes in climate variability and their explanations pointed to both traditional religious facets and God, regardless of their own religion. Churches prevalent in the study site are United Methodist, Johanne Masowe and Vadzidzi.

At the same time, people of Charewa also conduct various *mabira* (ceremonies) that involve traditional beer brewing, songs and dance. These can serve *kuteta mvura* (rain seeking), *kuwombera Vadzimu kana pane zvakanganiswa* (appease ancestral spirits if there are wrongs committed) and also show appreciation to spirits for good rains or harvests. The ceremonies are conducted in the sacred place of Dzimbawe, also the chief's palace. Ceremonies called *ekutsvaira* (sweeping) Dzimbawe are also conducted annually in October. During these ceremonies, dances called *mafuwe* and *tsotsa* are performed. On a similar note, people of Charewa also observe *chisi*. On this day, everyone, regardless of religion, is not allowed to perform any tasks on dry land (tasks include ploughing, planting or weeding in the fields), but

they can work in gardens and wetlands. This day comes on the basis of observations made on the movement of the moon; hence, when there is a new moon the chief declares *chisi*.

Apart from the above, the system of social organisation is quite complex. Social identity is primarily derived from *madzinza* (clans). The clans are represented by the chief's messengers alluded to above. Each clan has its own totem and practices that are taboo. These totems include but are not limited to *shumba* (lion), *soko* (monkey), *shava* (eland), *mbeva* (mice), and *nhari* (elephant). In addition, each clan has sacred places where they bury their dead. For example, if anyone of the *shumba* (lion) totem dies, they cannot be buried in Charewa, which is Nehoreka's land, but across Chitora River. It was perceived that Nehoreka gave the instruction that his relatives should not be buried in his land. On another note, those of *soko* (monkey*)* totem and the chief are buried in the mountain called Maizi. The chief is buried during the night by the eight messengers discussed earlier.

Furthermore, social networks are crucial during bereavements and religious ceremonies as well as other activities such as Independence Day celebrations. There was also general agreement among key informants at the community level that *nhimbe/mukwerera* (labor associations*)*, farmers' cooperatives and credit associations had weakened. Nevertheless, when conducting *mabira ekuteta mvura* (traditional rain seeking ceremonies) or ceremonies to appease ancestral spirits, villagers under each messenger provide rapoko used to brew the beer. Villagers also provide labour. Women in their menopause phase are the ones who brew the beer. In the event these are not available, young women who are not breast feeding take over and these should not be sexually active during this period. Also striking in these social activities are the systems of privilege and exclusion. For example, those of the *shumba* (lion) and *nzou* (elephant) totems do not take part in brewing the beer. In this case, brewing beer is a task that is lowly regarded to be undertaken by Nehoreka's relatives and *vanatezvara vaNehoreka* (Nehoreka's in-laws). Strangers (*Masakadza*) are also regarded as outsiders in ceremonies that have something to do with ancestral spirits but may be invited to drink and dance. However, they freely participate in any other village activities.

5.2.6 Health and Wellbeing

Charewa is regarded as one of the malaria burdened wards in Mutoko. The terrain is harsh, prone to malaria transmitting mosquitoes and is susceptible to drought. February-April is considered as malaria peak period in the ward. In April 2014, a malaria outbreak was recorded such that 80% of every ten patients who visited Charewa RHC were diagnosed with malaria. However, although the RHC receives many malaria patients, several problems have been noted such as lack of tests kits, high work load and shortage of drugs. With the lack of test kits, health workers resorted to clinical testing. The key informants at the RHC reported that this is very problematic and wastes resources. The high prevalence of malaria was attributed to several factors by the key informants, among them the fact that anti malaria chemical is not administered to all households in the ward. Malaria is also at its peak between February and April because of the presence of open water bodies which serve as palatable breeding grounds.

As noted by the key informants, with excessive rainfall, such as that received between January and February 2014 and corresponding high temperatures, mosquitos find palatable breeding grounds. High temperatures were also linked to diseases such as diarrhea in the ward. It was established that in times of low rainfall, mosquito are less because breeding areas will be limited. Other scholars have also found that climate is another major factor that determines the extent of malaria transmission in Zimbabwe, and its variability may work with or against efforts to bring malaria under control (Hartman, et.al, 2002). Mabaso et.al (2006) also found that high annual malaria incidences in Zimbabwe coincide with high rainfall and relatively warm conditions while low incidence years coincide only with low rainfall. However, scholars have also noted the influence of other factors, such as deterioration of malaria control efforts, development of drug and insecticide resistance and a rise in co-infection with HIV and AIDS.

The key informants were of the view that HIV prevalence rate and other sexually transmitted infections are lower in the ward as compared to other mining areas (where black granite is extracted). HIV has been recorded highest among women because of mandatory testing of pregnant women. However, with the introduction of Prevention of Parents to Child Transmission (PPTCT), men in the ward are now forthcoming as they accompany their wives to the health centre for maternity bookings. According to key informants, almost 285 HIV positive men and

women are on Anti-Retroviral Treatment (ART) at Charewa Rural Health Centre. There has been a notable reduction of AIDS deaths rates since Anti-Retroviral drugs are now provided at the RHC. The provision of ART has also significantly lowered default rates although some people are still reluctant to be initiated on ART. Challenges also still persist regarding non-disclosure of HIV status between spouses and non-adherence to ART.

Other health challenges include malnutrition and diarrhea among young children. The RHC at the ward centre provides plumbnut (nutrition supplement) in sachets and monitors growth to reduce malnutrition. In addition, both health and veterinary officials highlighted that dog bites reached alarming levels in March 2014 and subsequently some people got rabies. One death was recorded. The drug for rabies is expensive for many households. It was US$ 100 in March 2014, then US$ 75 in April 2014 for the full course for rabies. Normally the dog owner is required to pay the costs of treatment but many fail to do so such that the victim's family ends up struggling to cover the costs.

5.3 The Problem of Climate Variability in Charewa

The main of thrust of this empirical chapter is addressed in this section. I set out to present the climatic changes occurring in Charewa through elaborating on farmers' concerns. What I do here is in line with Archer's sociological theory. Archer contended that everyone had concerns in the natural, practical and social order of reality. The idea is therefore to first understand how farmers problematise climate variability (problem identification) before I elaborate on livelihood challenges in the next chapter. The understanding driving this approach is that peoples' courses of action (farmer's adaptive strategies) are rooted in their concerns. Farmers have an in-depth knowledge of climatic variability, which they use to inform their coping and adaptation strategies (Ogalleh et.al, 2012).

Just to reiterate, climate variability in this thesis refers to climate fluctuations across a period of time which can be annually or every decade. However, although climate variability is a significant factor constraining farming systems in arid and semi-arid areas of Zimbabwe, I did not assume that farmers were equally concerned about rainfall and temperature. Because my

study dwells on how farmers problematise their circumstances and formulate responses to it, respondents were asked to identify the current most important thing visa-a-vis the two climate parameters under study. In this case, I acknowledged that people can design and determine their responses to the structured conditions in which they found themselves, in the light of what they personally care about most (Archer, 2007). As such, courses of action are anchored in the concerns of the individual and taken forward through their reflexive calculations.

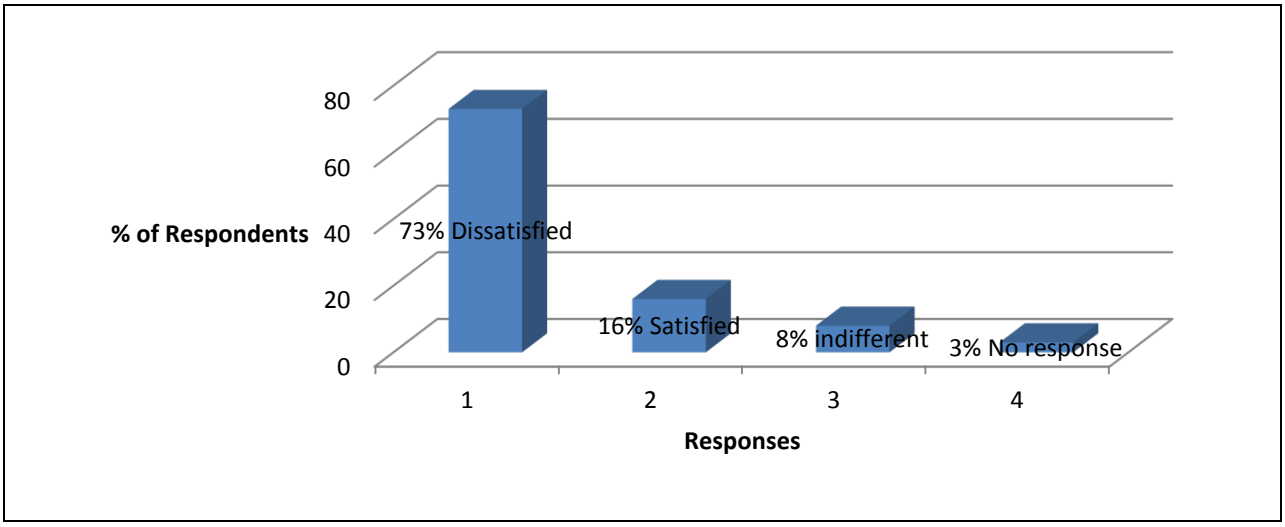
Following that, from the survey, the majority of farmers (58%) selected rainfall patterns as the current most important thing, 29% considered temperature, 9% said both rainfall and temperature were equally important and 4% said none of the two. These findings were corroborated during life histories, key informant interviews and informal conversations. It was common to hear respondents saying '*ko pasina mvura tingandorarama here?'* (If there is no water, can we survive?); and '*handiti kutoboya chikafu kunge kwandonaya'* (To be able to get food, it would have rained) during interactions and conversations. In the end, what is emerging from the findings is that what is of ultimate concern for farmers is rainfall. Still, trends in temperature also matter to farmers' livelihoods. All the same, it would be a gross misrepresentation of research findings to discuss concerns on rainfall and temperature and end there. I found that it was almost impossible for respondents not to allude to other issues during interviews. In the end, it was clear that farmers did not experience climate variability in a discrete manner. Therefore, it is against this background that the following sections are organised.

5.3.1 Farmers Concerns on Rainfall

Rainfall is regarded as the most significant climate parameter affecting human activities. As such, one fundamental factor which cannot be ignored is the rainfall variability both within and between seasons and the underlying uncertainty that it imposes on production (Cooper et.al, 2008). It is therefore not surprising that 60% of respondents had a high level of concern, 36% moderate, 2% low and 2% were indifferent over the trends in rainfall in the field survey in Charewa. When asked on what best described their feelings regarding general patterns of rainfall since 1992, most farmers (73%) said they were dissatisfied as shown in Figure 5.2 below.

At the same time, in contrast to other seasons, farmers were generally satisfied with rainfall amounts in the past two seasons (2012/2013 and 2013/2014). Nonetheless, even if farmers were satisfied with the amount of rainfall, this is not necessarily sufficient to fully capture the dynamics and characteristics of climate variability in the study site. Therefore, within the general phenomena of rainfall variability, rainfall onset, reliability, distribution, quality and cessation as well as extreme rainfall occurrences were primary concerns that intruded into the livelihoods of farmers in Charewa.

Figure5. 2: Feelings Regarding Rainfall Patterns Since 1992



Source: Field Survey, July 2014.

That being the case, one common thread throughout my data was that respondents perceived that rainfall patterns have become more unpredictable and unreliable. What differed were the narrative descriptions of these changes. Even so, farmers were overwhelmingly anxious about the unpredictability and unreliability because of the complex intricacies between their livelihoods and how the rainfall season behaves. In general, farmers in Charewa want certainty; therefore it was important for rainfall patterns to be predictable. Farmers observed that rainfall seasons were distinct but, over the past years, inter-annual rainfall variability has become more unpredictable. Farmers also pointed that it is becoming more and more difficult to predict rainy season onset, cessation and amounts. In addition, there are certain types of rainfall that farmers use to determine season onset that have become progressively more erratic to the extent that

some farmers believe these do not exist anymore. Consequently, farmers cannot predict the onset of rains for planting when these rains do not come.

At the same time, nuances on rainfall reliability revealed that what farmers consider as reliable rainfall is the one that takes their crops to maturity and falls on expected times. Respondents stated that their farming systems are based on *mvura inotembeka* (rainfall that can be trusted). The following statement extracted from the data bear concern that rainfall is growing more unreliable in Charewa:

> *…During my young years, before I got married in 1997, rain used to come in October but now it comes in November or December. These rains cannot be relied on, they cannot be trusted* (Life history interview, August 2014, ward 3).

Another female respondent noted that:

> *…The problem we have these days is that the rains are not giving us the actual dates we used to know. Tanga tino madate omvura* [we used to have dates for rainfall]. *I would know that rains would come this season and by October we would have planted our seeds already in these fields. We would know that around 15 October, mvura inonga yandorova pasi* [it would have rained].*I would know that I would get food. These days I do not have dates. Mvura yakujambira madate* [rainfall is skipping dates]. *It is postponing to November but it used to come in October, which is a difference. I cannot do my farming well* (In depth interview with elder, July 2014, ward 3).

In a related manner, another respondent expressed her concern as follows:

> *…Segore rino mvura yakandirasisa, yakanaya January na February, chibage chakuda kuita zvakanakawo yakabva yatiza. Chibage chakazosara chikatadza kukora* [Like this year, rains let me down. It rained in January and February, then when maize was about to mature it stopped. Maize failed to mature] (Life history interview, August 2014, ward 3).

Still on the same issue, a key informant noted that:

> *Mvura haichatembeka, iri kunaya mbesa pamaburiro* [Rainfall cannot be trusted, it is raining on our harvested crops in temporary holdings] (In depth interview with winning farmer, 2014 Agricultural Show, July 2014, ward 3).

Again, another responded added that:

> *We used to know the type of rains, coming from certain directions. We could tell if the rains were good or bad if they came from a certain direction. Now rain comes from whichever direction* (In depth interview with elder, July 2014, ward 3).

A point which was reiterated by some respondents was that farmers have always expected some post-harvest rainfall, usually around June, which they call *mvura yechando* (winter rain), but not heavy rains during harvesting time or at a time when they had harvested but had not yet put crops in *mumatura* (granaries). I had also the chance to witness downpours during my time in the field on 18, 19 and 20 April 2014. From the interactions I had with respondents after the downpours, many farmers were surprised and worried. The rains were coming at a wrong time (time of harvesting) and that is why they were worried. Farmers were surprised because rainfall had ceased early March and most of the crops had wilted, therefore they did not think it would rain again that season. In short, it was too late for wilted crops to recover and it was also inconveniencing their harvesting, particularly of groundnuts. They feared that ripe bambara buts were going to start germinating. One female farmer summed everything up in an informal group conversation as follows:

> *It rains when it should not and it does not when it should* (Female farmer, Informal Group Conversation, IGC, April 2014, ward 3).

Having said the above, I proceed to the next section in which I elucidate on some of the specific experiences farmers have encountered in the study site regarding rainfall onset, season cessation, rainfall distribution, extreme rainfall events, rainfall adequacy and quality.

5.3.1.1 Rainfall Season Onset

The onset of the rainy season was raised as a significant issue in view of the rain dependent livelihood system of farmers in Charewa. The majority (78.4%) of respondents in the survey in Charewa agreed that the rainfall season does not start when it normally used to and 21.6% disagreed. It emerged that farmers observe versatile aspects to determine the onset of the rainy season. They constantly referred to rainfall termed *bumarutsva and mvura yepfumvudza* as signaling the coming of the rainy season. *Mvura yepfumvudza* is rainfall that allows trees to grow new leaves (*pfumvudza*). During the time of *bumarutsva*, farmers would be clearing fields and *kupisa mavivi/majanga* (burning crop residues). These times were also marked by cultural events such as rainfall seeking ceremonies conducted in Dzimbawe and visits to Mutimuchena in Mt Darwin and Dzivaguru. However, most farmers said they do not refer to *bumarutsva* or *mvura yepfumvudza* these days because these types of rainfall have become erratic. It is also now

difficult to tell the difference between these and the actual rains that enable planting because *mvura irikunonoka kuturuka* (because rains are delaying in coming). For some farmers these rains are simply extinct.

I have presented that farmers give rainfall names to determine the onset of the rainfall season. Concurrently, farmers also indicated that they assess soil moisture so as to determine whether the amount of rainfall they had received *ichimeresa chibage* (is sufficient to make seeds germinate). These locally based, farmers' methodologies differ from other 'scientific' criterions that are used in coming up with the onset of the rain season. One method determines the onset of the rain season following a cumulative rainfall exceeding 25 mm occurring during a maximum time span of 7 days whilst the other method determines the onset of the rain season following a cumulative rainfall exceeding 40 mm but having been received in a maximum of 15 days (Raes et. al, 2004).

In Charewa, it was widely stated that the usual rainfall season starts around 15 October by farmers in Charewa, therefore what they are experiencing suggests that there is a significant shift in the onset of the rainy season. Whereas farmers' responses were heterogeneous to the extent that I could not establish the exact years when farmers started noticing delayed rainy season onset from their descriptions, what is discernable is that they indicated to have been observing this regularly since the early 2000s. Farmers also made specific reference to the 2011/2012, 2012/2013 and 2013/2014 seasons in which rains sufficient to make seeds germinate were only received in December. For most farmers, this is a significant shift because they used to receive rainfall that enabled them to plant crops in October. However, whilst this finding is consistent with other studies, it also differs with official statements and other studies on rainfall season onset. For example, similar to my study, Moyo et.al (2012) noted that farmers reported that over the years the onset of the rainy season had shifted from around the third dekad in October to end of November and early December. On a different note, Makonyere (2011) says the official normal rainfall season starts on 19 November yet the overwhelming majority of farmers in Charewa said 15 October.

In my study, the shift in rainfall onset was almost always recalled and described in conjunction with other meaningful activities and occurrences, typically in individual life histories and key

informant interviews. In many instances, it was difficult for respondents to remember exact dates, hence they referred to critical moments, such as during their childhood years and before they got married. The following response illustrates in detail the concern on onset of rainfall:

> *....I can say that from the 1980s when we were growing up here, rain used to start falling in October. By the second week of October the rains would be falling in this area. The amount of rain was average and enabled people to plant in gardens because that is where we start with. People would grow crops like maize and rice. By February or March crops like maize or sweet potatoes would be ready for consumption and helped to alleviate hunger. The rain started falling in October until March. During the season, we used to receive more rain in January and February. During that period we would have a lot of rain to the extent that places like gardens would become water logged, wells and rivers had lots of water. There were lots of pastures in grazing areas for livestock during that time. During that time people used to plant early and would know that by October they should have prepared for the season and have seeds, at the same time the land should be have been prepared. Whereas when we compare with the past years and even now, rain is now coming late and we do not know what is happening. When it starts late it is falling only for a short period* (In depth interview with Community Representative, April 2014, ward 3).

Another respondent narrated as follows:

> *……I started staying permanently in this village in 1996. It used to rain well, at the expected time around 15 October. Zvino yazotaramukawo, yozopotawo ichiti chwa chwa zvakanaka kusvika chikafu chaita* [Then it would stop and then it rained bit by bit until crops matured]. *Things started to change, from my own understanding when we were getting to 2000. Ikozvino yatosiyana manje, tane dambdudziko romvura* [Now it is really different, we have a problem with rainfall], *now it comes in November, at times December. Or when it starts in October, it is just a bit, then, it goes for good. Then it comes back sometime in December. Macheredzero anguwo hakusisina bumarutsva* [My observation is that there is no longer rainfall that signify the coming of the rain season] (Life history interview, August 2014, ward 3).

The farmers' chairperson also said:

> *....My family was still small then. We used to plant crops like maize and groundnuts between 5 and 15 October. By the time we got to Christmas our maize in the gardens were ready for consumption. In February we would harvest from the gardens and dry the maize in the sun. When we eventually harvested from the fields we would have more than enough* (In depth interview with farmers' chairperson, April 2014, ward 3).

Although respondents shared the view that rainfall season onset had shifted since 1992, they were also of the perception that seasons characterised by delayed rainfall onset have increased since 2000. Farmers maintained that rainfall patterns have changed, especially *matangiro ayo makore ano* (especially its onset in current years[14]). It was generally agreed that even with the droughts between 1992 and 1995, the 1990s had seasons with rainfall starting on time. To elaborate on what farmers have been observing since 2000, I draw attention to the following extract from field data:

> *In the 1990s mvura yainaya chose* [it rained a lot]. *The rain season used to be longer. The way it rains now is different, rains come very late and leave very early, leaving crops do die* (In depth interview with village head, April 2014, ward 3).

Furthermore, a key informant commented that:

> *Rain has been coming late since 2004. Last season that actually happened, then the rains disappeared and some of our crops failed. By the end of February it had stopped raining* (In depth interview with key informant, April 2014, ward 3).

5.3.1.2 Rainfall Season Cessation

Rainfall season cessation is of great concern to farmers in Charewa. This is consistent with the idea that determining the start, end, and duration of the rains is important to people in agrarian economies (Hartter et.al, 2012). Most farmers agreed that they were experiencing the problem of early rainfall cessation. The rainy season is therefore increasingly becoming shorter, with less rain. For farmers, a normal rainy season occurs between October and March. This period was regarded as *mwaka wakakodzera* (adequate rainfall season) for crops to fully mature and also enable farmers to grow some crops towards the end of the rain season (around the 3rd week of February) as well as organise their activities such as harvesting. However, whilst it remains very common in literature to characterise a season as normal based on the total amount of rainfall, farmers in Charewa construe a normal rainy season based on its length, amount received and the implications of received rainfall on crops. Therefore seasons with officially normal and above normal rainfall are viewed as 'bad' seasons when farmers experience crop failures induced by poor seasonal rainfall distribution. Overall, although there were respondents who insisted that the

[14] The period referred to as current years is after 2000.

length of the rainy season is still the same and it was only the onset that was delaying, a number of farmers mentioned that they had noticed over the years that rains are increasingly ceasing in February. To explicate on this, I refer to the following quotation:

> *For the past 5 years we have started receiving rainfall in November and it ends the first week or second week of February. It has been years since we had a normal, good season with rainfall starting normally and ending the last week of March* (In depth interview with spiritual leader, April 2014, ward 3).

Another key informant added that:

> *…Yes, if we do not have good rains sometimes by February or end of it the rains would have disappeared. Last season by end of February it had stopped but this season it extended a bit* (In depth interview with village head, April 2014, ward 3).

Still another respondent mentioned that:

> *From around 2006/2007 up to 2012, there were problems. It was only last year, 2013, that the rains started to be good but it stopped quite early, in February. Some of the crops failed to mature properly* (Life history interview, August 2014, ward 3).

These findings from farmers in Charewa are not isolated. Shumba et.al (2012) argue that there is now a higher probability of experiencing shorter precipitation seasons of less than 110 days in Mutoko district. The end of the rainfall season has also been inconsistent in Mutoko, with the extreme cases being 1991/92, 1994/95 and most recently 2007/2008 when the last rains were received in mid-February (Makonyere, 2011). It has been acknowledged that in February 2008, the rains tapered off causing extreme dry weather conditions in several provinces of the country.

5.3.1.3 Rainfall Distribution

The seasonal amounts of rainfall are as important as the distribution within the season. As highlighted by Cooper et.al (2008), whilst seasonal rainfall totals and their season-to-season variability are in themselves important, the nature of 'within season' variability can also have a major effect on crop productivity. Farmers in Charewa are therefore concerned about increasing and prolonged dry spells occurring during the rainy season. Sporadic wet spells were also cited as occasional menaces by respondents in the study site. Although respondents mentioned that they have experienced dry spells mostly during drought years, a number of farmers used the

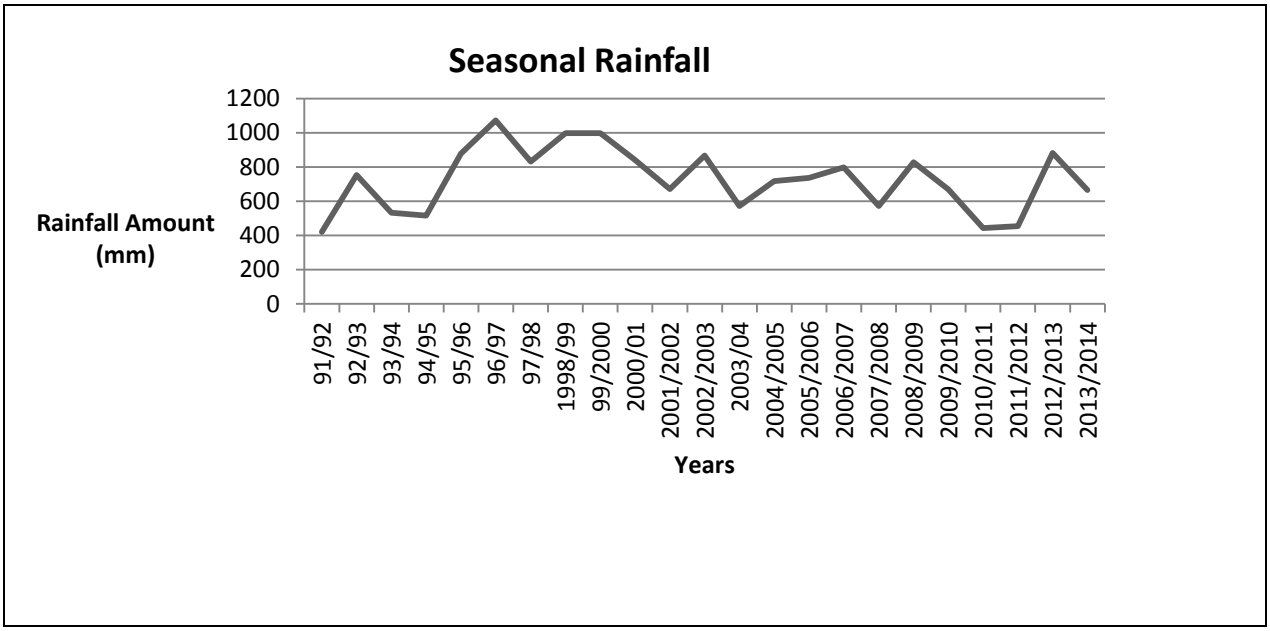
2013/2014 rain season for reference. In general, they highlighted that in the season there was an extended wet spell in February and this was followed by an extended dry spell that marked the early cessation of the rainfall season.

At the same time, farmers also thought that inter-seasonal rainfall is highly inconsistent. They did not remember receiving the same amount of rainfall in consecutive years. Although respondents were not able to specify seasonal amounts, a consistent pattern that was presented by respondents on rainfall distribution between 1992 and 2014 was that there were droughts in early 1990s, and then rainfall started to increase *zvirinaniwo* (a bit better) until 2000. Then, there was drought around 2002, followed by good rains between 2003 and 2006, then dry years between 2007 and 2011, and finally in 2012/2013 and 2013/2014 seasons rainfall had improved. Therefore, what is discernable from these views is that rainfall is becoming highly variable.

As I alluded above, farmers were not able to specify seasonal amounts because all of them do not have rain gauges but still they indicated that inter-seasonal rainfall variability had increased. The farmers' chairperson used to keep a rain gauge but it does not function anymore. Even supposing that, this pattern established by farmers is consistent with what other scholars in Mutoko district realised and also meteorological rainfall data. The study by Shumba et.al (2012) in Mutoko district established that local people's perceptions on climate change show that there is now an uneven distribution of rainfall. Furthermore, Figure 5.3 below illustrates uneven rainfall distribution in Mutoko district between 1992 and 2014[15].

[15] The reason for using the district climate data is because I encountered challenges in getting data for ward 3. The local AGRITEX office at the ward centre did not have rainfall records. I only managed to obtain climate data for a nearby area, ward 2 (Chindenga) from the AGRITEX district office. The years provided, 2011 to 2014 were however too few for analysis of climate variability and trends.

Figure 5. 3: Seasonal Rainfall Distribution in Mutoko



Data Source: University of Zimbabwe Geography Department, 2014.

Farmers had a lot to say in describing their concerns about the increasing dry spells and the sporadic wet spells they were experiencing. The following response bears concern on these spells:

> *....Aaah.....this season God performed some miracle for us. We had very good rains, but, they eventually became too much. Even the groundnuts did not bear any nuts* (In depth interview with farmers' chairperson, April 2014, ward 3).

A key informant also stated that:

> *As compared to other seasons, this season had a lot of rain between January and February, then, there was a dry spell. Most crops did not do well* (In depth interview with District Agricultural Research and Extension Officer, March 2014, Mutoko growth point).

Still on the same issue, another respondent said that*:*

> *Rain this year was adequate at first, then it became too much. It did not give us a chance to work the fields….yes, it was too much in January* (In depth interview with village head, April 2014, ward 3).

Another farmer added that:

> *...Eeeh, rains last year started end of November, yakandoti wara wara ndokubva yamira, nekubva yaenda* [it rained a bit, then it stopped and then it was gone]. *Then it rained in December and it was*

gone again. Then I said ahhhh, is it going to rain this year? Then I saw in January it rained but iiiiiii, it continued to rain for weeks. Like on 19 January, the rain on that day yanga yakaipa, dzimba matenga dzakadzutsa [the rain on that day was bad, roofs of houses leaked]. *But from that day chibage chakazotiziwa nemvura muna Febraury, kana kudzokaba kundokoresa chibage* [rains stopped in February and did not even come back so that maize would mature] (Life history interview, August 2014, ward 3).

As I have highlighted above, most respondents made reference to the 2013/2014 season. However, regardless of the season, farmers still pointed to the incidences of dry and wet spells. There was a common sentiment extrapolated from life history interviews that there are increasing seasons in which farmers are getting to December without much rain and even so, if it rains, it then stops for long a time. Prolonged dry spells were therefore highlighted as common. Similarly, studies done in arid and semi-arid areas of Zimbabwe also point towards similar patterns. Mugabe et.al (2003) observed that poor rainfall distribution within the growing season was the main cause for crop failure, due to dry spells at critical stages of crop growth. More so, Makonyere (2011) noted that mid-season droughts in Mutoko that used to occur for 10 – 21 days in January have progressively extended to February.

In addition, farmers in Charewa are finding the changes in the spatial distribution of rainfall problematic. This finding is a significant departure from a number of Zimbabwean studies based on farmers' perceptions that dwell much on seasonal rainfall distribution only thereby neglecting spatial dimensions. In Charewa, the understanding of spatial distribution was expressed by farmers in terms of rainfall at times evading the area within the season. This is clearly illustrated in the following account:

Mvura iri kundotuka tuka, yakada kundonaya pamwe, pamwe yondonaya ichidai nokoko, ichibva yandoenda kwemazuva akadaro.Mvura inozotora nguva isati yasvika kuno [Rains are getting to some areas but not others. It sometimes rains that side, then stops for some time. It then takes time for rains to get here] (Elder in IGC, July 2014, ward 3).

Another respondent added that:

We used to know the type of rains, we would know that rain that comes from a certain direction is good, that rain covered all our area. Now rain comes from whichever direction, that rain is not reliable, inotitsvenga [it evades our area] (IGC, July 2014, ward 3).

The general perception among respondents was that *mvura yavakuita zvemana-mana* (rainfall is getting to other areas and skipping some areas). Those who alluded to spatial variability continuously compared how it was raining in the ward to other areas such as Chindenga, Danda and Nyamuzuwe. In the informal conservations I had with some of the villagers, they were convinced that that they had observed a number of seasons when it looks like it is about to rain or rain is coming, but still *mvura inondovanyenyeredza yonaya kumwe* (but still rainfall evades their area and rains somewhere else). Linked to this, Meze-Hausken (2004) found that people in her study in Ethiopia repeatedly alluded to the Afar saying which goes, 'while it rains on one horn of the ox, it can be dry on the other'. This indicated the importance of localised rainfall, which can benefit one farming area while leaving the neighboring area completely dry. Similarly in central Malawi, Simelton et.al (2011) found that farmers stated that, during the past few years, rains come on one side of the farm and not the other.

5.3.1.4 Extreme Rainfall Events

The fieldwork data shows that the majority of farmers alluded to a trend towards extreme and intense rainfall events and occurrences. These are extreme events in the sense that these are rainfall conditions that are significantly deviating from the conditions farmers are used to. They are also extremes because farmers perceive them as not desirable for their crops. Rainfall that was either too low or too much thereby having severe impacts on crops qualified as an extreme event. Most farmers (64%) pointed out they had experienced occurrences such as *mvura ine dutu* (rainfall with intense winds) at some point since 1992 and 36% had not. At the same time, 48% noted that extreme events had increased since 2000, 34% said they had decreased and 18% said there was no change. In addition, a significant number of farmers (86.7%) said they had witnessed increasing incidences of droughts since 2000, 9% said they had not and 4.3% said there was no change from what they had observed in the 1990s.

Almost all farmers in my study who said they had witnessed increased incidences of droughts pointed to droughts in 1992, 2002 and 2008 as extreme events. However, the 1992 drought was remembered and described as the worst in their lifetime. Those who did not remember this drought in great detail were mostly young at the time. On the same note, when asked to note

critical rainfall events other than droughts since 1992, some farmers recalled episodes of heavy rains in the 1998/1999 season and cyclones, especially cyclone Eline as well as incidents of heavy rains between 2012 and 2014.

Some of these extreme occurrences were remembered vividly, particularly the drought in 1992 whilst some events such as cyclone Eline were cited but not recalled in detail. The respondents came up with several descriptions of the 1992 drought but the common theme that emerged was that it was as good as if did not rain at all. From what the majority of the respondents mentioned, the rainfall season lasted until January 1992 and, by February, livestock were set free to graze in the crop fields because the crops had wilted. As one respondent remarked:

> *I was still a child during the hunger of 1992, around 12 years. I still remember it was hard. There was no rain* (Life history interview, August 2014, ward 3).

The respondents also commented about drought events in other years. One respondent had this to say:

> *In 2002 there was drought. It rained for two weeks in December then it was dry for an extended time. When the rain came back sometime in January, some of my crops did not germinate, some wilted in early stages* (Life history interview, August 2014, ward 3).

Others commented on the drought in 2008. A key informant made the following remarks:

> *There was hunger in this ward in 2008, only little amounts of rainfall were received in January and February 2008. It was a short season. Rains came in December and then disappeared; only a few people had planted. Some people in the villages did not even manage to plant* (In depth interview with Community Representative, April 2014, ward 3).

In corresponding studies, Kinsey et.al (1998) also described the 1991/92 drought as the worst in this century as the exceptionally dry conditions in January and February 1992 crippled agriculture when crops withered and livestock died in their thousands. Bird and Shepherd (2003) as well noted that the 1991–92 drought was the worst experienced in Zimbabwe during the 20th century, and struck just as structural adjustment was beginning to bite. Others regarded the 2001–2002 drought in Zimbabwe as the longest in 20 years. Mupangwa et.al (2011) found that drought and erratic rainfall patterns over the 2002/2004 growing seasons constituted the main

externally induced problems that affected livelihood systems in Guruve and Muzarabani communities.

Concurrently, although respondents mentioned cyclone Eline during interviews, quite a number of them did not remember in detail the cyclone events. They just pointed to heavy rainfall and wind that destroyed houses sometime between January and March 2000. However, although farmers in my study did not provide in depth descriptions, cyclone Eline is well documented in the country. In her description, Davis (2008:143) said 'a gigantic flood ripped through southern Africa for three months, from February through to April 2000. Fed by monsoons and two cyclones, its wrath was visited upon Mozambique……in Zimbabwe 80 000 were rendered homeless, over 7000 in the region died, the majority children'. Similarly, February 2000 will long be remembered for devastating floods in Mozambique, Zimbabwe and South Africa, brought about by Tropical Cyclone (TC) Eline in late February and a tropical depression early in the month (Reason and Keibel, 2004).

Furthermore, the discussions of extreme events included perceptions on increasing episodes of heavy rains, sometimes accompanied by strong winds which are not necessarily cyclones. These episodic heavy and windy rains did not only come in seasons in which rainfall was too little or too much but in any season. These heavy rains included *mazimvura nhando* (bad rainfall) that disrupt the growth of crops unnecessarily. Farmers in Charewa opined that the episodic heavy rains are unpredictable, they emerge from whichever direction and they cannot tell in specific terms how long these last. To augment the foregoing, I refer to the descriptions in Table 5.2 below[16]. One respondent also said the following:

> *…….The rain season started in October and that is when I would start ploughing our fields. I could afford to grow millet which is difficult to grow in this area. But, after the death of our parents in the 1980s up to the 1992 drought, I started to experience less amounts of rain. But, I can remember that we then had heavy rains in 1999. Most of the rivers were damaged. I was quite scared by this kind of rainfall. It spent three days and three nights raining continuously* (Life history interview, August 2014, ward 3).

Another respondent stated that:

[16] It was common for farmers to have multiple descriptions for a season during interviews.

Rainfall is becoming heavy and windy. It is difficult these days. These houses had their roofs blown off. Asbestos were blown off. Roofs over classrooms were blown off. But, during the days I was younger, I did not experience that, I never saw that. I do not know where this is coming from; maybe it is evil spirits causing that (Life history interview, August 2014, ward 3).

In addition, another respondent made reference to rainfall received on 19 January 2014 and said:

Wind started from the western side to the east. It was raining and the wind was strong. The rainfall looked like it was going to uproot houses; it was bad. Even now, am just saying, that rain and wind were likely to kill someone. That is why you hear people saying there were houses that were destroyed, the rain and wind was bad (Life history interview, August 2014, ward 3).

5.3.1.5 Rainfall Adequacy and Quality

Farmers in Charewa are grappling with inadequate rainfall and increasing number of seasons with low rainfall. Interestingly, when I compared farmers' perceptions with results of analysis of meteorological data done for Mutoko district, there were contrary indications of annual precipitation increasing in the district. This was also confirmed by Mudowaya (2014)[17] that there is a positive trend in annual mean precipitation for Mutoko district from 1978-2010 which therefore indicated that precipitation has been increasing during this period. Notwithstanding this contradiction, a significant number of respondents in my study were of the view that rainfall has only been substantial since 1992 during two recent consecutive seasons, which are 2012/2013 and 2013/2014. The years 2007-2011 were regarded as dry years that followed the drought in the 2007/2008 season. However, this discrepancy between farmers' perceptions and meteorological data is not unusual. Moyo et.al (2012) and Hartter et.al (2012) realised the same incongruities in Zimbabwe and Uganda respectively.

[17] The author analysed rainfall data for the district using a non-parametric test, Mann-Kendall and linear regression.

Table 5. 2: Extreme Rainfall Events

Years	**Farmers' perceptions on events or occurrences**
1998/1999, 2000-2004, 2012/2013,2013/2014	Episodes of heavy rains termed *mazimvura nhando* (bad rainfall) that disrupt the growth of crops.
1991/1992,1993/1994,1994/1995,2001/2002, 2003/2004, 2007/2008, 2007-2011	Too little rainfall, leading to either drought that induced *nzara* (hunger) or drought like conditions that induced *nzara nzara* (hunger like situations).
2000-2001	Heavy rains, accompanied by intense winds that blew off roof tops and collapsed houses. Intense storms in particular cyclone Eline.

Source: Fieldwork, April and July 2014.

Without getting into comparisons between meteorological data and farmers' perceptions, my position is that am not seeking to validate farmers' perceptions in this thesis. I just need to clarify two issues. Firstly, my observation from the interactions and conversations I had with farmers is that they are sensitive to droughts and other extreme events. In particular, the drought of 1991/1992 seemed to have left a lasting impact on farmers' lives. Droughts that followed were also negatively perceived as having caused hardships in their lives. Overall, farmers are sensitive to rainfall amounts. Therefore it is likely that farmers blended the seasons and years of droughts together to form their own perceptions on rainfall amounts. Secondly, the issue of rainfall adequacy, which I pursue at length in the following section, suggests that it is not enough to rely only on average annual rainfall to conclude that rainfall is increasing. It may therefore be important to conduct a qualitative inquiry to understand the nuances surrounding the meanings of rainfall amounts.

Following that, adequate rainfall was described by farmers during interviews and informal conversations to mean *mvura yakakodzera kuti mbeswa dzibereke* (rainfall that is appropriate for crops to mature). Therefore, it is possible that there can be increasing rainfall but, when characterised by poor intra-seasonal distribution or if it is of poor quality, it can fail to meet farmers' expectations of adequacy. The majority of farmers highlighted that they had received *mvura zvinji* (a lot of rain) for the past two seasons. They were thrilled for the rains. However, they pointed out that for the 2013/2014 season there is *nzara yemvura* (rainfall induced hunger). This is because incessant rains in January and February 2014 washed away fertilizer and also caused *kundondovera* (leaching) in both gardens and fields. In this case, rainfall was inadequate for farmers. From what the respondents in the study said, *nzara* (hunger) – which many people usually associate with drought – can therefore be induced by little, low or excessive rainfall. Therefore, whilst official livestock and crop assessments of the 2013/2014 season in the country did not point to hunger, for farmers in Charewa there was rainfall induced hunger.

Reference made by some respondents to the 1998-2000 seasons also clarifies this finding. After *makore enzara* (years of hunger) caused by drought between 1991-1995, farmers said they were relieved to see the seasons bringing a lot of rain, but continuous downpours eventually caused harvest failures. This is also consistent with observations by Bird and Shepherd (2003) that the rain failure prevalent in the 1980s and 1990s was reversed in 1999–2000 but El Ninno brought Cyclone Eline and devastating floods. Consequently, what is emerging from my findings is that it is not the amount received that is of concern to farmers all the time, but what the rainfall means for their crops. Therefore, whilst meteorologists are presenting that rainfall is increasing, farmers do not perceive it that way because what also matters is *mvura yakakodzera* (adequate rainfall). It may therefore be useful to talk about rainfall as a process rather than as a quantity (Roncoli, 2006). Meze-Hausken (2004:22) also said 'in order to understand why people may declare one year as a drought year, it is important to recognise their needs in terms of rainfall'.

Notwithstanding the above discussion, farmers persistently pointed to increasing frequency in the number of *makore emvura shoma* (seasons with low rainfall). Regardless of other droughts before, the 1991/1992 drought was identified as signaling the start of a downward trend in rainfall. Farmers also distinguished between drought years (*makore enzara*) with *mvura*

shomanana (little rainfall) and dry years (*makore enzara nzara*) with *mvura shoma* (low rainfall). They reported that in the 1990s, it used to rain very well, the rain season ended in March and crops received adequate rains, but now it is low in most years. It emerged as well that *mvura yenyemba* (rains for cowpeas), *yemunyorondenga* (rains for last crop of maize) and *yekudzurisa matere* (rains to allow the uprooting of groundnuts), that is expected between end of February and early April, is becoming erratic. To further elaborate, the discussions on rainfall adequacy produced the following account from a respondent in my study:

> *.....Yes in 1992 there was hunger; it did not rain well since that year. We have not received mvura yakadzodzera kwemakore akandowanda* [rains that are adequate for a number of years] (Life history interview, August 2014, ward 3).

Another respondent added that:

> *What I remember is that in 1992, I planted and the maize germinated but did not grow. The rain was long gone before the season ended. In 2002 rainfall was very little, I did not harvest much. I can say it is raining all seasons but most of the time the rainfall is too low* (Life history interview, August 2014, ward 3).

On a different note, for farmers in Charewa, it is not only rainfall adequacy or amounts that are of prime concern, but the quality of rain received. *Gukuravhu* (high intensity rainfall) was perceived to be increasing and was negatively regarded because of its impacts. It was cited by farmers that high intensity rainfalls *anondorovera ivhu* (cause soil to be compact) and they wash away fertilizer. Farmers prefer rain *yakadzikama* (calm), to allow crops to germinate, to allow farmers to work in the fields and to allow crops to absorb fertilizer. According to respondents, high intensity rainfall severely eroded the soils, and destroyed fields and rivers in the area in the last season (2012/2013 season). Heavy, short lived downpours also end up as runoff, therefore not contributing to moisture in the fields. In relation to this, one female responded narrated that:

> *…Mvura irikundonaya makore ano apfuura aya, nerino iri ine simba rakanyanyisa. Iri kunayisa zvine simba rakapfurikidza. Inokukura fertilizer, yane 2 years ichiita manairo acho iyaya* [Rainfall these years and the past years is too heavy. It is too intense. It washes away fertilizer. It has been raining like this for two years now] (Life history interview, August 2013, ward 3).

5.3.2 Farmers' Concerns on Temperature

The discussion above provided the detailed findings on farmers concerns and observations on rainfall. In this section, I discuss how farmers perceived changes in temperature. In general, respondents in Charewa were anxious over trends in temperature. From the survey, 57% of the respondents were dissatisfied with temperature conditions, 31% were satisfied and 12% were indifferent. At the same time, whereas rainfall emerged as the most important concern, respondents established connections between temperature and rainfall. For instance, they indicated that in 1992 *mvura haina kunaya* (it did not rain)[18] because *zuva rakarova* (the sun was too much) and *kunze kwaipisisa* (it was too hot). Further probing revealed that farmers associated the little rainfall they received with high temperatures they experienced. What is also clear from farmers' responses is that they are dissatisfied over rising temperatures, extremes in temperatures, and increasing and intense cold and hot spells.

5.3.2.1 Rising Temperatures

Respondents in the study generally concurred that temperatures have increased in both rainy and dry seasons. The increasing temperatures were regarded as responsible for problems they were experiencing such as high livestock and crop diseases. To illustrate this finding, one key informant pointed out that:

> *The production of ticks is fuelled by hot temperatures and rainfall. These promote the hatching of ticks. When it rains and the grass grows, ticks hatch and remain on grass stems, then they get to livestock when they are grazing* (In depth interview with officer, Veterinary Department, April 2014, ward 3).

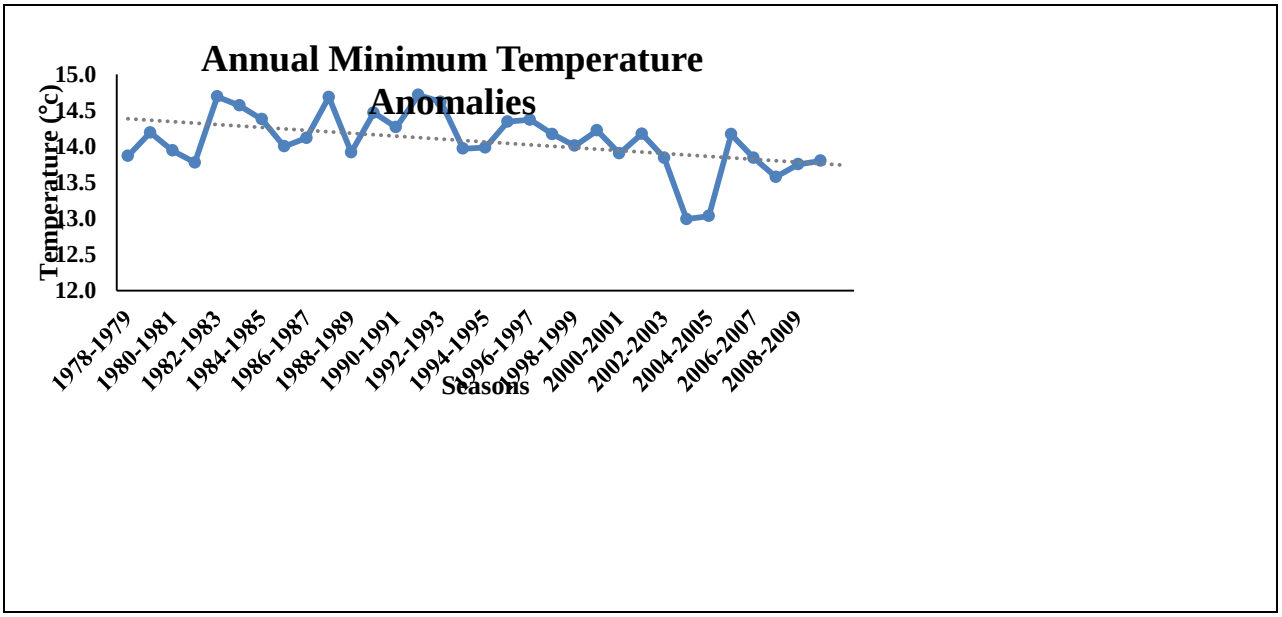
In addition, although farmers did not provide actual temperature figures, to clarify that temperatures were rising, they stressed that even if they had received *mvura zhinji* (a lot of rainfall) in some years compared to other years, water sources were drying up rapidly. They expected that in seasons they received a lot of rainfall, water sources would have water for some time, at least up until October. But that was not the case because they were experiencing rising temperatures. On a similar note, scholars have highlighted that there has been a significant

[18] Note that when farmers said it did not rain, they did not actually meant there was no rainfall at all, but the way it rained was as good as if it did not rain.

increase in daytime and overnight temperatures over the last few years in Mutoko, although actual figures are not readily available (Makonyere, 2011).

To further augment the above, other studies, for example by Mudowaya (2014) who did an analysis of temperature data for Mutoko (1978-2010), concluded that annual mean maximum temperature in Mutoko district has been increasing. This increase in annual maximum temperature might be due to an increase in frequency of incidences of hot days (Mudowaya, 2014:45). Furthermore, Freeman (1994) concluded that temperatures in the last decade have risen in winter months around Mutoko district by 1^0 Celsius and precipitation has been fluctuating. To expand on this, Figure 5.4, below shows temperature anomalies in Mutoko district.

Figure 5. 4: Mutoko District Annual Minimum Temperature Anomalies from 1978-2010



Source: Adapted from Mudowaya (2014:45).

However, although my survey data and other studies showed that temperatures are increasing, some farmers were more specific in interviews and perceived temperatures to be particularly higher in years of little rainfall. At the same time, a few respondents were of the view that even in years of normal and excessive rainfalls, the extended dry spells that they have experienced

were accompanied by high temperatures. These findings are also consistent with the opinions in the Intergovernmental Panel on Climate Change Report, IPCC report. According to the IPCC (2001), in the course of the 1992 drought, which was linked to an El Nino Southern Oscillation (ENSO) episode, Zimbabwe's temperatures reached maximums of about 47^0 Celsius, documented along the South Africa and Zimbabwe boarder.

5.3.2.2 Shorter Winter Seasons

The findings of my study reveal that farmers are experiencing shorter winter seasons. Apart from this, some respondents were of the view that the onset of winter is now difficult to tell while others asserted that winters were getting warmer than before. Farmers' descriptions pointed towards usual winter season starting in May and ending in July. However, now farmers are experiencing days with hot temperatures between May and July, similar to those found during the wet, hot season.

When asked which month winter has been starting since 2000 responses from farmers were divergent. However, what was clear was that farmers thought winter was ending early because of increasing warm temperatures. At the same time, some respondents insisted that the length of the winter season is still the same, but they indicated that *ikozvino kuri kunyanyisa kutonhora* (it is now extremely cold) compared to some years back. As one respondent narrated, she started living in Nyakanyanga village in 1989. She had gotten married and moved from Mkumbura, Mashonaland Central. She remembered that when she settled in the village *kwaitonhora hakowo* (it was somewhat cold) but now there are days *ane kutonhora kwakawedzera* (now there are days which are very cold). The following statement also speaks to the perception that winter periods are shrinking and getting warmer:

> *We used to have winter from May to August. Of course there were cold days in August, but it used to be windy most of the time, now it can actually be very hot sometimes* (In depth interview with elder, August 2014, ward 3*).*

Another respondent added that:

> *Everyone knew chando chaJune* [cold in June], *kwaitonhora zveshuwa* [it was cold for sure], *not like these days. It is warm. By the time July is over, tomatoes will be having Redspider* [a bug that affects

crops]. *It will be all over because it will be hot* (In depth interview with village head, April 2014, ward 3).

5.3.2.3 Extremes in Temperature

The majority (71.3%) of respondents in the study answered that that they were encountering extremes in temperatures and 28.7% said they were not. For some respondents, the problem was not just that they were experiencing extremes in temperature but days in which they experienced these were becoming more frequent. There were sentiments that *mwando wekupisa* (hot spells) and *mwando wechando* (cold spells*)* were becoming intense. From the survey results, 88.3% of respondents said they were experiencing intense heat and 11.7% said they were not. On the other hand, compared to the 1990s, 68.3% of the respondents thought the frequency of cold spells had increased since 2000, 19.7% said the frequency of cold spells had decreased and 12% said there was no change. These hot and cold spells were considered as random hence farmers were not able to predict their timing. In essence, just like they can no longer predict the start of the rainfall season, farmers pointed out that it was challenging to do the same with these cold and hot spells.

Furthermore, reference was made to cold and hot spells from different years. Common reference was made to the cold spell that lasted for almost a week in early April 2014. During continuous interactions and discussions with respondents, it became evident that some respondents attributed this cold spell to 'too much rain' they had received in January and February 2014. Some respondents also noted that that in February 2013 *kwakaita mapipi ezuva chibage chikapera nemakonye* (there was unbearable heat such that maize was destroyed by worms). These black worms were said to have been caused by high temperatures. Still on extreme temperatures, one respondent had this to say:

> *Pane musi chando chakarova muna June 2011. Kwakandotonhora husiku hwese. Ndakamuka ndichiwona zvirimwa zvese zvakasvipa nechando mugadhe. Paive nemagodo echando. Zvinhu zvese zvainhuwa.Pakazosvika masikati zvinhu zvanga zvawoma. Ndakatodzura beans, macucumber, pepper nemabutternut kwakutorasa, madomasi ndiwo andakandodziridza akandofundira* [There was a day when it was extremely cold in June 2011. It was cold the whole night. I woke up to discover all crops darkened because of the cold. There were cubes of ice. Everything smelled badly. By the afternoon

crops were dry. I had to remove beans, cucumbers, pepper and butternuts and throw them away. I watered tomatoes and they regenerated] (Life history interview, August, 2014, ward 3).

5.3.2.4 Undifferentiated Hot and Cold Periods

Although most respondents alluded to the above mentioned changes in temperature, a few were of the view that hot and cold months were no longer clearly and strictly distinct. Respondents constantly made references to times when their parents were alive, their childhood times or times before they got married to explain this observation. Comparably, farmers were of the perception that during the aforementioned times they used to clearly distinguish cold and hot seasons. The period between November and April was regarded as *nguva yekupisa nekunaya* (hot, wet summer), May to July was *nguva yekutonhora isina mvura* (cold, dry winter) and August to October was *nguva yekupisawo kusina mvura* (a bit hot, dry summer). However, respondents reported that since the year 2000, they have found it increasingly difficult to apply these characteristics in clear terms. As one responded pointed out:

> *Sometimes it is difficult to tell the difference between various seasons. Even June is now as hot as October* (IGC, April, 2014, ward 3).

A key informant added that:

> *During the time when we were young boys, zhizha* [rainy season], *chirimo* [dry season] *and nguva yechando* [winter season] *had specific times. It was hot from September but now even July ari kupisa zvisirizvo* [but now even July is hot in a manner it is not supposed to] (In depth interview with key informant, April, 2014, ward 3).

Another respondent added that:

> *Things have changed. Long back, by the time we got to May the sun was rarely seen and around the 20th of July, the sun would be shifting up and we knew winter was coming to an end. Now I can see even in June there are sunny, even hot days* (Life history interview, August, 2014, ward 3).

5.4 Beyond Climate: Other Concerns Raised by Farmers

In the preceding sections, I have articulated farmers' concerns related to rainfall and temperature. However, contrary to 'conventional wisdom' prevalent in many local studies on climate change and variability that treats farmers as existing in a vacuum, what is emerging in my thesis is that it is not feasible to disentangle climate variability from the wider economic, social and political

context shaping farmers' lives. The overarching argument is therefore that whereas farmers are predominantly concerned about changes in climate variability, they are simultaneously concerned about the prevailing socio-economic situation. In the end, farmers' concerns extend beyond climate. Through life histories, in depth interviews, repeated interactions and conversations with farmers in Charewa, there was indication of general discontent with the macro-economic environment obtaining in the country. For farmers, the macro-economic decline has brought challenges and uncertainties in their lives. These challenges pertain to markets, farming inputs, local economy and poverty.

Almost all farmers in the 18 life histories pointed out that the deteriorating economic conditions have left them vulnerable to poor market conditions. The road from Charewa to Mutoko growth point is hardly ever maintained and transporters of produce pass on the costs for breakdowns to the farmers. As I noted before, the roads are in worse conditions during the rainy season. In this case, transporters decline to collect produce from homes or fields such that farmers have to ferry produce to a designated location to meet transporters. Farmers also bemoaned the highly fluctuating prices and the low prices they are offered by buyers at *Mbare Musika* mainly for horticultural produce. They were of the opinion that private buyers for grain short change farmers. Farmers indicated that they do not determine the prices of their produce at *Mbare Musika*. In addition, the general conditions at the market are also very bad. To shed more light on some of these issues, I refer to the statement by one female respondent below:

> *…You do not decide, either you sell or you can dump the tomatoes. At present tomatoes are ferried at 50 cents per crate and I pay 4 dollars for my own fare. A 50kg of sugar beans is ferried at 4 dollars again and when l get to Mbare I have to pay 10 dollars market entry fee. There is no accommodation; I sleep on open spaces, on the pavement in front of BATA* [a shop that sells shoes]. *It is not for free, there are men who demand a dollar per night for me to sleep on that pavement* (Life history interview, August 2014, ward 3).

Another respondent added that:

> *…They* [buyers] *are the ones who determine the price of the produce. When we are going to the market we have prices that we expect but when we get there they tell us what they will be paying. Once they decide on a certain amount, they will not give you more. In most cases there is no*

negotiation, they just dictate the price whether we like it or not (In depth interview with farmers' chairperson, April 2014, ward 3).

A key informant also stated that:

….GMB [Grain Marketing Board] *should be refurbished. We used to sell crops there and got money to survive on but now we sell to private buyers. These buyers steal from farmers; they pay very low prices for good quality maize. They attract us with cash payment for our crops, but in the end we get nothing* (In depth interview with key informant interview, April 2014, ward 3).

For most farmers, prices of farming inputs are beyond their reach. Fertilizer emerged as a significant concern. Respondents indicated that agro-ecological conditions characterised by poor sandy soils required that they invest in fertilizer in particular. It appeared from respondents' views that there was no other way other than applying fertilizer to get a good yield of maize. Even with conservation agriculture promoted by NGOs and supported by the government as well as manure, farmers insisted that fertilizer was still required. The following account bears concern on farming inputs:

…Fertilizer and pesticides are expensive. You end up farming just for the sake of farming. Instead of trying to give me free fertilizer, the government should give fertilizer companies money so that prices are affordable. I do not want free things. I can buy my own fertilizer if it is cheap. In Malawi a 50 kg bag is sold for 5 dollars and in South Africa 6 dollars, here it is 50 dollars (Life history interview, August 2014, ward 3*).*

Another respondent also stated that:

…Chembere ino irikunetseka nefotireza.Kurima ndiri kuda asi fotireza inonditambudza. Aiwaba zvandiwomera. Zimwe zvese ndondoti baba Mercy ndirimirei, vouya vorima.Mari yechigayo ndoiwana, ndikatengesa ndoiwana asi pafotireza pakawoma [This old woman is having problems with fertilizer. I want to farm but fertilizer gives me challenges. Yes, things are hard for me. Everything else I tell Mercy's father to come and plough for me. I can have money to take grain to the grinding mill, if l sell l can get it, but when it comes to fertilizer it is hard] (Life history interview, August 2014, ward 3).

Again on fertilizer, a respondent added that:

…..Ehee it is not raining well. Rainfall is not good. But you have to get fertilizer. If you do not get it this month [August], *then when you get to October, you will not be able to buy it because it will be*

expensive. What is good is to make sure by the time this month ends you have fertilizer in the house (Life history interview, August 2014, ward 3).

Micro-scale or garden irrigation in *mabani* (vleis) and *dafanya* (wetlands) was cited as important by virtually all farmers in the study yet the majority does not have access to irrigation pipes and water pumps. Two discernable views emerged. On the one hand, some respondents thought that the issue was not that these were expensive but they had no income whatsoever to purchase even the cheapest brands. On the other hand, for others the primary reason is that even when they can sell produce and get income they cannot afford the irrigation pipes and water pumps as they are expensive.

The local economy in the ward revolves around subsistence agriculture. According to respondents there are hardly any opportunities beyond farming and selling produce at *Mbare Musika.* Farmers mentioned that they have played the roles of primary producers for generations and are not deriving many benefits, suggesting stagnation of the local economy. In an informal group conversation, farmers jokingly stated that all that most people remembered about Buja people were mangoes and tomatoes, beyond that, there was nothing. The local economy is not diversified and, as the conditions in the country continue to deteriorate, so does their situation. One aspect that key informants reiterated was the lack of processing industries in the district and the lack of investment to promote their growth. To explicate on this, I refer to the following statement by a respondent in Charewa:

...All we do is grow tomatoes and go and give other people at Mbare Musika at cheap prices. We have done this for years. It is not going to stop. The government needs to put measures to protect us. Why don't they empower us to make something out of these things? They think only foreigners are able to make these things? Farmers are also learned (In depth interview with Community Representative, April 2014, ward 3).

The presence of *vanhu vemakwari* (black granite miners) irked a number of respondents. The main reason was that they were not investing in meaningful infrastructure development and providing employment, particularly for the youth in the area. However, there were divergent views that emerged. On the one hand, respondents thought that, if these 'foreign' miners did not

extract the granite, the local people were not in a position to do so. Therefore, they thought, the miners might as well take the stones and let the government come up with measures to make sure these re-invested in local communities. On the other hand, there were people who thought the miners should not be taking the granite in the first place because these were resources that belonged to local people and *Vadzimu* (ancestral spirits). Even with these two opinions, the common perception was that *vanhu vemakwari* (black granite miners) have actually worsened their situation. One respondent highlighted that:

> *We have people taking these granite stones, is it not so? Us people are watching as these people take these stones. They are destroying our land, they are leaving open pits. Cattle and children are in danger because of these open pits. We just watch, what is that*? (In depth interview with key informant, August 2014, ward 3).

Another respondent noted that:

> *You see the road passing through Gurure going to Katsukunya, they* [black granite miners] *are there. You see them taking these stones. If you look at the roads, they are in a bad state. Even these foot bridges, they are not okay. You have no idea how these lorries carrying stones destroy these roads* (In depth interview with key informant, April 2014, ward 3).

Again, another respondent added that:

> *As a community we are not benefiting anything from them. The only benefit is maybe 4 or 5 people who might be working for the companies. But mainly it is some ordinary jobs they do. The money is not even enough for their families to survive. We cannot even talk about share ownership schemes like those in Chiadzwa. If these are there maybe it is the local authority that gets the benefits* (In depth interview with key informant, April 2014, ward 3).

The main consequence from all the above evident in the data was persistent and deepening poverty. Respondents gave the impression that they were worse off than they were in the 1990s. Signs of persistent poverty were that they cannot invest in farming implements, those who have lost cattle are not able to restock and *dzimba dzaimbowonekera dzasakara* (houses that were once admirable are now in a bad state). I interpret these findings in terms of a 'vicious cycle of poverty' as farmers cannot afford farming implements, they cannot expand production, and subsequently they suffer low productivity as well as food and financial insecurity. Consequently, poverty endures.

5.5 Interpretation of Changes in Climate Variability

Besides articulating the multifaceted concerns above, understanding farmers' interpretations of changes in climate variability served to elaborate on how they problematised it. Data was therefore obtained from respondents by investigating their perceptions on drivers of changes in climate variability. The findings in the study reveal that farmers have diverse interpretations of changes in climate variability. From the survey results, 47% of respondents pointed to religious and cultural reasons as the main driver, 48% natural shifts in climate, 2% wars being fought in other countries and 3% said they did not know. These figures show that there is no significant difference in numbers between those who noted religious and cultural reasons and natural shifts in climate as main drivers of change. However, in my presentation below, I have deliberately decided to focus my discussion on religious and cultural reasons. The reasoning behind this is that a lot of intriguing findings around these aspects emerged during qualitative interviews.

Notwithstanding my decision to focus on cultural and religious facets, the fact that 48% of the respondents pointed to natural shits in climate remains an important finding. To these respondents, these changes represent *kungochinjawo kunofanira kuitika* (it is just change that is supposed to occur). Only one male respondent commented that he did not understand why it was not raining properly when the water cycle occurs every day, therefore, he was convinced that these must be natural changes in climate. Quite a number of respondents were of the view that *masandinisi* (scientists) and those with knowledge were saying weather is supposed to change. Therefore if experts said that particularly through mass media, then the weather was changing and it is something that should happen naturally. One can therefore infer that climate variability was regarded as a natural phenomenon by farmers in Charewa.

On a different note, along the widespread perception that changes in climate variability were caused by natural shifts in climate, there was almost equal indication that they were induced by *Vadzimu* (ancestral spirits) and God. The ancestral spirits and God were therefore responsible for the 'good' and 'bad' seasons and other climatic extremes that farmers were experiencing. Contrary to the current discourse on global warming that predominantly supposes anthropogenic causes; changes in climatic variability in Charewa are perceived and understood by farmers as

reactions to provocation by these two extra-human entities. As such, farmers postulated a direct relationship between climate and the spiritual realm.

Vadzimu (ancestral spirits) were perceived to be angry over increasing cultural defilement and moral decadence. Dominant among the signs of the decadence and defilement were failure to follow traditional religious practices such as *kuwombera Vadzimu* (honoring the ancestral spirits) and traditional environmental practices. The subversion of local traditions and religious practices was regarded as evidence of increasing disorder in the religious, social and moral lives of people of Charewa. In general, people in the area were regarded as no longer interested in conducting traditional religious ceremonies which angered Nehoreka. One key reason provided by key informants on why they thought people were no longer interested in rain ceremonies was the fragmentation of traditional religious beliefs owing to intruding modern values and Apostolic religious discourses. Basically, these promoted *kurasa tsika dzechivanhu* (abandoning traditional values).

Generational rupture in terms of who bears the responsibility for the perceived increasing cultural defilement and moral decadence was evident in Charewa. However, this finding should not be read in terms of elders versus the young as there were also respondents (among both the young and old) whose perceptions were different. On the one hand, the perceptions of disruption of and deviation from valorised traditional religious practices, social mores and cultural values by young people were common amongst elders. It was generally perceived that there is a disconnection between the young generation and various traditional practices. The young generation was particularly blamed for *kurasa tsika* (abandoning tradition), *kuita zvisina hunhu* (engaging in immoral acts) and *kuita zvechirungu* (following modern ways). For example, one elder noted that:

> *Vapwere vari muno vari kundoita zvechirungu. Zvino ino inzvimbo yaNehoreka, ndiye anonaisa mvura* [Young people is this area are following modern ways, but then this land belongs to Nehoreka, he is the one who makes it rain] (In depth interview with elder, August 2014).

The ostentatiousness of modern habits was also pointed out in relation to traditional marriage practices. In conversations, elders lamented that appropriate marriage rites were being ignored as

vana vari kungotizisana (children are eloping). In the end, marriage as it is construed and valued in the traditional sense is being downgraded. Consequently, *Vadzimu* (ancestral spirits) were angered and they retaliated in various ways including inducing drought as punishment.

On the other hand, young respondents in the study thought that those responsible for leading the traditional rain seeking ceremonies and other practices were no longer consistent. They cited that elders no longer visited Mutimuchena in Mt Darwin and Dzivaguru were they are instructed on what to do regarding various facets of their lives. It was noted that over the years the elders had stopped visiting these areas and increasingly disregarded the centrality of the spirits in their lives. Some respondents however noted that the elders resumed visiting these areas in 2012, and that is why they had received a lot of rainfall in the 2012/2013 and 2013/2014 seasons. Nonetheless, it was also highlighted that when the rains become too much within the season, the elders have to hold ceremonies to appeal to the ancestral spirits to reduce the rains; but this was not done and that is why rainfall ended up causing *kundondovera* (leaching).

At the same time, someone respondents blamed the current chief and her messengers for not being firm regarding people who were doing things that angered the ancestral spirits or Nehoreka. Furthermore, it was pointed out that there were people who were practicing *makunakuna* (breaking taboos) by engaging in incest. Other unacceptable practices that angered *Vadzimu* (ancestral spirits) included using black tins and pots to draw water from *zvisipiti zvinoera* (sacred springs). To support these findings, I refer to the following statement by one respondent:

> *...People are farming in sacred areas. They take manure from places that are sacred. Even at Mupata wa Nyajira, people do not respect the place anymore. People are putting their pipes there when these places should not be tampered with. Even using metal tins to draw water it is not allowed, one has to use mukombe or deme* [calabash] (In depth interview with key informant, August, 2014, ward 3).

In this case, the spiritual and the natural worlds were often presented as not dichotomous. The spirits were regarded as the guardians of the sacred springs and trees, among other natural resources and areas found in the study site. In return, these springs and trees provided abundant water and fruits respectively. Therefore, the use of tins or pots to ferry water from sacred springs

and the destruction of scared trees attracts wrath from the spirits and they cease to protect people. They let the environment respond to the provocation by bringing droughts and cyclones.

There were also interpretations that pointed to climate variability as the ultimate response of God to inappropriate human behavior. Besides angering the ancestors, interviewees cited that what was happening was *ndezva Mwari* (it is God's doing). God was angry because of increased evil doing. Some people thought *zvivi zvawandisa* (sins have increased) and some respondents suggested that there was a lot of Satanism therefore God is angry. However, it did not necessarily mean that people who were engaging in evil doings were from Charewa all the time, but from other areas as well.

What was clear from respondents' descriptions was that *kusanaya kwemvura mutongo waMwari* (that it was not raining properly was God's punishment) regardless of who had sinned. It was common among those who attributed droughts and hunger to God's anger to quote Bible verses. In particular, they referred to the story found in Genesis 41:15 '……seven great years of abundance are coming throughout the land of Egypt, but seven years of famine will follow them'. Related to this, respondents believed that changes in climate variability were signs of a coming apocalypse. They therefore perceived increase in droughts and hunger in the study site as signs foretold in the Bible that the world was coming to an end.

Finally, although I have established in chapter 3 that most studies do not pay attention to how farmers define and interpret climate variability in Zimbabwe, consistent views have been noted by some scholars. For example, others discovered that perceived climate changes were linked more to natural and human forces (in Makoni), and unknown forces as well as a breakdown in cultural norms and beliefs and rise of Christianity (in Wedza) (Mtambanengwe et.al, 2012). In other African contexts, scholars have found that scanty rains can be taken as the sign that God and the spirits of the ancestors are displeased with local people because of their conduct; in contrast, abundant rains can indicate divine or cosmological favor (Orlove et.al, 2010). Similarly, Speranza et.al (2010) observed that agro-pastoralists thought drought was God's plan.

5.6 Conclusion

This chapter began by discussing the local context within which Archer's theory was operationalised to understand the structures, processes and conditions underpinning farmers' adaptive strategies. I then proceeded to present findings on the changes in rainfall and temperature as perceived by farmers in Charewa. In Archerian terms, this is the process of problem identification. I therefore exposed the problems farmers are grappling with by articulating the multidimensional concerns farmers have on rainfall and temperature. These concerns are articulated in view of past and present observations and experiences. In this regard, taking increasing unpredictability and unreliability of rainfall as the ultimate concerns, what is problematic for farmers are: high intensity rainfall, inadequate rainfall, poor rainfall quality, late onset of rainfall season, early rainfall season cessation and poor rainfall distribution. At the same time, farmers are dissatisfied by rising temperatures, extremes in temperatures, and increasing and intense cold and hot spells. Furthermore, the concerns farmers have extend beyond climatic aspects.

Apart from the above, the chapter shows that farmers have different interpretations from 'scientific' explanations of causes of climate change. Farmers largely attributed changes to natural shifts in climate, but significance was attached to 'extra human' intentions and reactions as well. In the final analysis, the findings presented in this chapter allows for one to conclude that climate variability is increasingly changing in the study site. In Archerian terms, farmers in Charewa are therefore experiencing a moment of morphogenesis or contextual discontinuity.

CHAPTER 6: FARMERS' LIVELIHOODS CHALLENGES IN THE CONTEXT OF CLIMATE VARIABILITY IN CHAREWA, MUTOKO

6.1 Introduction

Growing up in rural Zimbabwe I had learnt something about gardening. In fact, I thought I had 'good' experience growing tomatoes, onions and leafy vegetables. So, when I joined VaMazambi[19]and his family in their garden on this day I was confident I was getting into something I knew about. The family was picking, grading and packing tomatoes into wooden boxes for sale at the market. VaMazambi and his eldest son were leaving in the evening the following day to go to *Mbare Musika*. We picked tomatoes first putting them into buckets and then placed them under a mango tree just next to the neat rows of tomato plants. After that the real work of grading began, and it was cumbersome. First we picked the green ones, then the middle ones (those about to ripen), followed by the ripe ones and last the 'soft ones' (those that looked like they would break easily) and put them into separate heaps. The rotten ones had their own heap on the other side. The grading was followed by packing the tomatoes into wooden boxes. The next day VaMazambi would use oxen driven scotch cart to ferry the tomatoes from the garden to a roadside near their home. In the afternoon a lorry would come and the tomatoes would be ferried to *Mbare Musika* in Harare.

I just want to go back to the moment we were grading tomatoes in the garden. That moment was illuminating in so far as my research agenda was concerned. As the day progressed, the different heaps of tomatoes grew. My attention however was on the two heaps of rotten and soft tomatoes. Everything was going well until I noticed that Mai Mazambi was getting uneasy with these two particular heaps. I think she was disappointed. Though I did not ask her, my thoughts were confirmed when she said she had not expected *masoft akawanda* (too many soft tomatoes). They (the family) had also underestimated how rotten the tomatoes were. From that moment, the excitement I had registered earlier when I joined them was waning.

[19] This is a pseudo name.

I then asked VaMazambi how many boxes they were expecting to take to the market the next day. He said he had expected 300 boxes. In his words, *kana akabereka chaizvo and achiibva zvakanaka tinoenda ne400 boxes paweek* (if the yield is good and if the tomatoes ripen properly we can take 400 boxes per week to the market). They would pick the tomatoes four times, getting a consistent number of boxes. The fifth time they would pick just a few and then they would be finished. If they watered the tomato plants again, sometimes they started flowering again and they would harvest again, though the yields would be low.

However, on this day, VaMazambi said he would be lucky if he took 250 boxes to the market. There were too many rotten and soft tomatoes. If he decided to take the soft tomatoes to the market, he would at most get 50 cents per box. He indicated that it was likely that the tomatoes had been infected with Redspider (a bug that attacks tomatoes and other crops) but at the same time there was something unusual he did not understand. He had sprayed the tomatoes with pesticide several times and thought the tomatoes were okay. To his disappointment tomatoes were rotting on one side and turning yellowish. Even his bean crop had problems. Normally one bean plant should have 18 pods and he should fill a tea cup with beans from one plant. He was noticing that *bhinzi dziri kuwoma mazhizha* (leaves are drying) when the beans had not even flowered. He was watering the beans, but he found that the leaves were drying first, then the whole plant.

The above story exposes how this chapter came to life. At first, this appeared to be an isolated experience with low yields and crop diseases by one farmer. However, as I progressed with my fieldwork, interacting and conversing with farmers, making observations and conducting life histories, I started to discover that this was not just a fragmented experience describing some perceived livelihood challenge. Later on, as I analysed my data, merging what I had obtained from a small survey, key informants, observations and informal group conversations with life histories, I began to realise that these stories I collected from different farmers were connected to one another. In my interpretation of these stories and other data, what emerged was a theme on livelihood conundrums under increasingly changing climate variability. That being the case, in order to chart the terrain for a detailed discussion of livelihoods struggles in the study site, I first outline the livelihoods system in the following paragraphs.

6.2 Livelihoods Systems and Dynamics in Charewa

Livelihood refers to what people do to earn a living. A livelihood refers to the means of gaining a living, including livelihood capabilities, tangible assets, such as stores and resources, and intangible assets, such as claims and access (Chambers and Conway 1992: 9-12). Thus, the term livelihood is all encompassing. Scholars also contend that livelihood includes resources for building a satisfactory living, risks management in resource use, and institutional and policy opportunities or constraints. In addition, the notion of livelihood captures both material and non-material wellbeing. As noted by Wallman (1984:22):

> Livelihood is never just a matter of finding or making shelter, transacting money, getting food to put on the family table or to exchange on the market place. It is equally a matter of ownership and circulation of information, the management of skills and relationships and the affirmation of personal significance and group identity. The tasks of meeting obligations, of security, identity and status, and organizing time are as crucial to livelihood as bread and shelter.

Therein, the livelihoods system of people of Charewa comprises an agricultural calendar and predominantly agricultural activities as discussed in the following paragraphs. Non-agricultural activities are thus marginal in the survival of subsistence farmers in this semi-arid rural area.

6.2.1 Agricultural Calendar

Livelihood activities in the study site are organised according to a local agricultural calendar shown in Table 6.1 below. However, it is important to note that there are shifts occurring in the calendar primarily because of changes in the onset of rainfall season and cessation of rainfall. The main agricultural season occurs between November and March[20] in the ward. Land preparation, which includes clearing the land of crop residues from last season and ploughing, ordinarily commences in September. However, ploughing can be done earlier than that, which is termed *hwinda purawu* (winter ploughing) by farmers in the study. Planting starts mid-October, but farmers can do what they call *kupandira* (dry planting) in early October. Farmers also sometimes plant crops in March such as *chibage chemunyorondega* (late maize crop), cowpeas and beans depending on their assessment of soil moisture. Between November and February farmers engage in many rounds of weeding crops and applying fertilizer. The green agricultural

[20] Note the differences between rainfall season October-March and main agricultural season between November and March as perceived by farmers. Agricultural season implies the time when most agricultural activities are done.

show competition is held in March and it involves assessment of fields by AGRITEX officers to select the best farmers.

Table 6. 1: Agricultural Calendar

Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Land preparation												
Planting												
Weeding												
Green Agricultural Show												
Harvesting												
Gardening												
Kugarira magarden (waiting on gardens)												
Dry Agricultural Show												
Kufudza mombe (herding cattle)												
Kusairira mombe (setting cattle free)												
Traditional ceremonies (e.g *mabira*)												
Malaria Peak												

Source: Fieldwork, April 2014.

Harvesting in most cases starts by *kudzura matere* (uprooting groundnuts) in early April, followed by maize and then other crops such as roundnuts, beans and cowpeas. The dry

agricultural show competition will then be held in August in preparation for the annual agricultural show held during the last week of August in the capital, Harare. The end of harvesting marks the end of the wet season and the beginning of the dry season. As such, gardening begins around May up until October, depending on availability of water. Cattle and other livestock are let free (*kusaiirira mombe*) every year on 1 June, therefore everyone should have put their crops in storages by then. During *kusairira mombe* (letting the cattle free) everyone should look after their gardens since livestock will be allowed to graze freely. However, whilst livestock are let out to graze freely, people who do not get their livestock for overnight keeping (*kuvhaira mombe*) are fined.

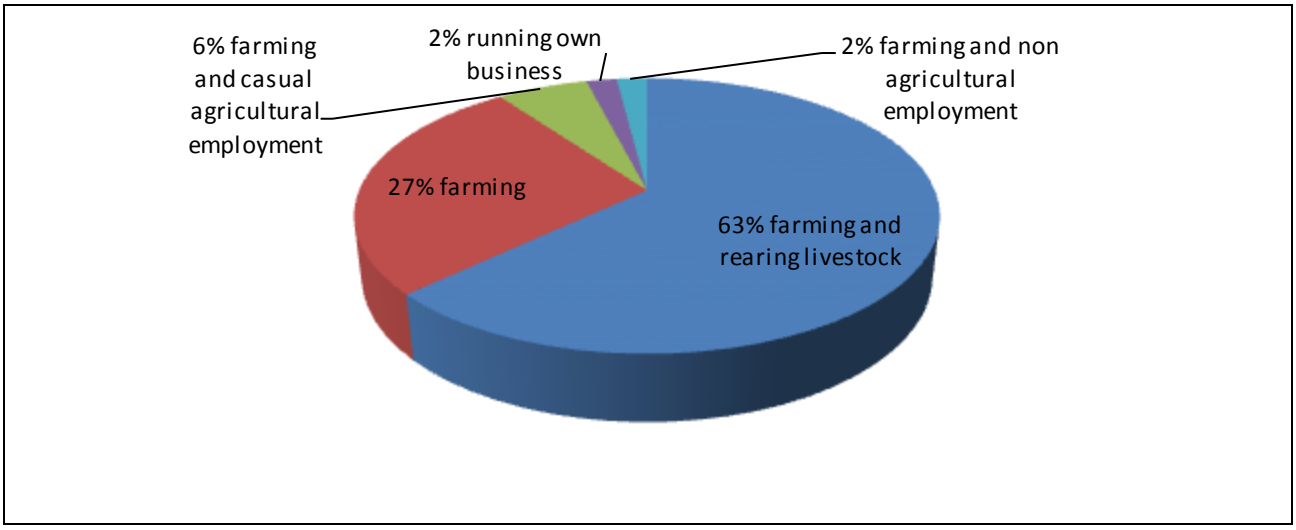
At the same time, whereas villagers negotiated and agreed on the date to start *kusairira mombe* (letting cattle free), villagers have not yet agreed on when to start *kufudza mombe* (herding cattle). Generally this starts in November and is based on an assessment of crops planted. Key informants however mentioned that disputes are quite common when some people plant crops and livestock destroy their crops. On a different note, traditional ceremonies such as *kurova makuva* (ceremonies for dead people), *mabira ekuteta mvura* (ceremonies to seek rain) and *mabira* e*kutsvaira maDzimbawe* (ceremonies for sweeping Dzimbawe) are held during the dry season. Concurrently, those villagers who will not be engaging in serious gardening take time to visit relatives outside the ward or district during the dry season.

6.2.2 Agricultural Livelihoods Strategies

Respondents in the study are predominantly smallholder farmers who depend on rain-fed crop farming and livestock rearing. From the data, no respondent depends on an activity that does not involve farming. A significant number (63%) of respondents in the study site depend on crop farming and rearing of livestock as highlighted in Figure 6.1 below. No respondent depended solely on rearing (and sale) of livestock. More male headed households than female headed households depend on farming and rearing of livestock as their main livelihood activity. Whereas there are no significant differences in this regard, huge differences were noticeable in terms of education. Most respondents who mainly rely on farming and rearing of livestock had some form of primary education. In terms of wealth, although other studies (for example, Chiripanhura

2010; ZimVac, 2011) established that most poor communal households depend on casual agricultural employment, this is not very apparent in my study. Most people across all wealth groups do farming and rearing of livestock. It is only that the poor and the very poor households do not produce enough food hence they engage in casual labour as the major strategy to supplement food deficits.

Figure 6. 1: Livelihoods Strategies



Source: Field Survey, July 2014.

Charewa can be classified as a peasant farming region with low rainfall and is vulnerable to drought. The farmers practice a semi intensive mixed farming system based on crop production in summer, supported by livestock as well as horticulture in the dry season. Households in the ward have small permanent arable fields, typically 2-3 hectares. Maize and groundnuts, shown in Picture 6.1 below, are the main field crops grown in these fields. Maize is the staple grain for most households in the study site. Other field crops grown include bambara nuts (*nyimo*), beans and cowpeas (*nyemba*). Maize is mainly cultivated for consumption whilst groundnuts, beans and bambara nuts are for sale. The sale of these crops is mainly done at *Mbare Musika* in Harare, whilst dry season sales of maize are done locally through cash sales and barter transactions. The diversification of food and non-food crops is very limited. Tobacco farming was adopted by only 2 farmers in 2011. As stated by respondents, rapoko, sorghum and millet once popular are not widely grown. Farmers selectively grow them to a smaller extent mainly for social, religious and

cultural purposes. Rice, usually grown in vleis and wetlands, is no longer popular with farmers as well.

Picture 6. 1: Main Field Crops

Source: Fieldwork, April 2014.

Mono-cropping is quite prevalent, with a few households practicing mixed cropping and a negligible number undertaking crop rotation. This finding contradicts the view that in most communal areas of Zimbabwe mixed cropping or intercropping represents one of the most important practices within traditional farming systems. For those practicing mixed cropping, as shown in Picture 6.2 below, they usually mix maize crops with legumes (cowpeas and pumpkins) and sunflower. Field crops in Charewa are largely grown on dry land and rely heavily on rainfall. However, some irrigated maize crop is also cultivated in gardens on a limited scale around October. Tuber crops such as sweet potatoes are mainly cultivated in wet areas.

In addition, fertilizer and animal manure are the most common inputs used by better off and middle households. Poor and very poor households may not apply any fertilizer or they do so when they engage in casual work in exchange for fertilizer. However, households across all wealth groups use *murakwani* (manure from plant residues). Fertilizer is purchased locally or at Mutoko centre. Mechanisation is limited and the family is the main source of labour. As noted by Campbell et.al (1997), peasant production relies largely on family labour, with relatively simple

technical inputs and little or no capital input. Labour shortage was therefore cited as a big challenge by respondents in Charewa. This was understandable given the small household size revealed in the survey data and also the concentration of young children and the elderly within these households. Better off households tend to then hire labour for labour intensive farm activities such as weeding, harvesting and grading tomatoes. *Nhimbe* or *hoka* (mutual labour) is not common in the ward.

Picture 6. 2: Mixed Cropping (Maize, Pumpkin and Cowpeas)

Source: Fieldwork, April, 2014.

Apart from the above, farmers predominantly grow medium season varieties of maize. Long season maize varieties are grown by a few households. Maize seeds are usually purchased every season by better off households but households across all wealth groups may use retained maize seeds. At the same time, it is common practice for farmers, both better off and very poor, to derive seeds for groundnuts, roundnuts and cowpeas from the previous season's harvest. Key informants reported that traditional seeds such as *ambuya vangafe* (maize), *gachegache* (rapoko), *mukotami* (sorghum) and *mukadzi usaende* (groundnuts) were no longer widely grown. Crop diseases caused by pests and aphids were also cited as prevalent in the ward. These pests and diseases affected maize and groundnuts as well as horticultural crops mainly tomatoes and beans. Quella birds were mentioned as menaces to sorghum, millet and rice. Agricultural extension is

provided by a locally based extension officer from the Department of Agricultural Research and Extension (in the Ministry of Agriculture). There is also a Farmers' Chairperson responsible for disseminating farming related information in the ward.

Together with farming of field crops and rearing of livestock, horticulture is an integral component of the farming system in this remote communal area. All the farmers in ward 3 who participated in the study use water from streams, rivers, weir dams and wells to irk a living from horticulture. However, the extent of participation in horticulture widely varied amongst households. Some households cultivate small portions of land and grow leafy vegetables, tomatoes and beans while other households cultivate large pieces of land and grow a variety of crops including fine beans, green pepper, cucumbers and butternuts. Horticultural crops are typically grown on areas located in vleis or near wetlands and near rivers/streams. These crops are predominantly grown for sale at *Mbare Musika* in Harare.

Water to irrigate crops is far and wide, and drawn manually using tins. Some farmers use gravity powered irrigation pipes to siphon water and some use engine powered pipes. Water from streams and rivers is accessed by farmers through an open access tenure system and at the same time households maintain private wells in their own gardens. Exclusive weir dams are constructed at strategic points along the rivers and streams. In addition, available studies indicate that, generally, the temperatures in the Mutoko district are warm (temperatures range between a maximum average of 21 °C for the coldest month and a maximum average of 29°C for the hottest month) and this makes it suitable for the production of vegetables throughout the year (Climatedata.eu, 2011). However, as outlined in the agricultural calendar, farmers grow horticultural crops mainly between May and October when they are free from agricultural work. At the same time, there were indications that some farmers have started to integrate horticulture within the main agricultural season.

Related to the above, during the time of the study I established through observations and interviews that tomatoes, shown in Picture 6.3 below, were the major horticultural crop grown by almost every household while other crops like butternuts, carrots, onion, leafy vegetables, cucumber, fine beans and green pepper were grown to a lesser extent. According to some key

informants, Charewa is well known as the 'tomato hub', producing most of the tomatoes consumed in the country's capital, Harare. On a different note, difficulties in accessing markets and poor prices were cited as problems affecting the sale of produce by respondents. In addition, because horticulture is mainly done during the dry season, the market is usually flooded between July and October when supplies will be also coming from other parts of the country such as Domboshava in Goromonzi district.

Picture 6. 3: Main Horticultural Crop

Source: Fieldwork, July 2014.

Simultaneously, livestock are important assets for farmers in Charewa. There is however no farmer who specialises in livestock production since this is done as part of an intricate mixed farming system where the various enterprises complement each other. Households in the study site keep livestock such as cattle, goats and poultry with small livestock dominating across all wealth groups. Pigs and sheep are rarely kept by households. Cattle are highly valued and sale of cattle is not common given the small herd sizes. For example, very poor households, who are the majority, do not own any cattle, whilst the maximum number owned by a better off household is 6 cattle. Goats and poultry are all commonly sold in the ward and are generally slaughtered during family and community ceremonies whilst cattle are used primarily for draught power and payment of *lobola* (bride wealth). In addition, cattle provide milk and manure; are a symbol of wealth in some African societies; and are an integral part of the farming system (Shumba et.al, 2012). Livestock are reared in the open access communal grazing areas. The rugged and

mountainous terrain in the ward is also considered palatable for smaller livestock such as goats and sheep. However, grazing disputes were cited as erupting occasionally. Bush encroachment was cited by extension officers to be high due to shortage of pastures. Farmers harvest crop residue to use as supplementary feed for livestock during the dry season.

Both oxen and milking cows are generally replaced from within the herd although cattle purchases occur following a good farming season. However, some respondents mentioned that good quality cattle breeds have significantly declined. The Veterinary officers cited that there are poor cattle breeds in the ward due to uncontrolled breeding. The level of in-breeding is very high and is now manifesting in the size of cattle which is declining (Makonyere, 2011). Higher fertility was recorded among goats than cows and survival chances of calves were cited to be low. Indigenous chickens and guinea fowls were regarded to be faring well in the ward. According to the Veterinary offers I interviewed, the ward is a Clear Zone, meaning there are no notifiable diseases such as anthrax, black leg and foot and mouth. The Department of Veterinary Services (in the Ministry of Agriculture) provides sporadic vaccinations and dipping either for free or through animal levies. Other services provided to farmers include deworming, dehorning and bull castration.

The full range of livelihoods strategies in Ward 3 is complex and varied. This includes not only field cropping, horticulture and livestock rearing but also fruit production and sales, and harvesting of natural resources. Mangoes (*mangifera indica*) are particularly a significant part of the local economy. Almost every household owns a mango tree and mangoes are commonly harvested and sold at *Mbare Musika* just before the start of the rainy season. Farmers in the ward usually enjoy good prices at the market because their mangoes mature earlier than most in the country. Bananas and *masawu* (ziziphus mauritiana) are also common fruits in the study site. *Masawu* (ziziphus mauritiana) trees thrive well in dry and hot areas therefore they have gained popularity with farmers in the ward. Sugar cane, widely grown in gardens, is harvested for subsistence and sold locally between May and August. Leaves from the moringa (moringa olifera) tree are used as vegetables and herbs for treatment of various ailments. Wild trees provide fruits which are harvested for subsistence and for sale. Common among these fruits are *mazhanje* (uapaca kirkiana), hacha (parinari curatellifolia) and *mawuyu* (baobab fruit).

Mushrooms, *zviriri* (wild beans) and tubers called *manyanya* are harvested for subsistence from surrounding forests.

In addition, casual agricultural work, locally known as *maricho* is part of the livelihoods of people of Charewa. It is mostly poor and very poor households that combine farming and casual agricultural work. Most of the agricultural work is seasonal and is done locally and extra-locally. In this regard, when poor people seek casual labour extra-locally, they are therefore developing multi-local livelihoods. Respondents in the study site are not rooted to space hence they travel long distances to take up casual labour to supplement their food and income. Resettlement and small-scale commercial farming areas in regions II and III of Mutoko district as well as Macheke outside the district are the usual destinations for agricultural workers. Planting, weeding and harvesting (such as picking tobacco and cotton) are the common activities people engage in when they seek agricultural employment in these distant farming areas. Social networks are important in connecting people to agricultural employment and for providing shelter when these respondents are 'far from home'. However, work can also be obtained locally. Locally, households engage in casual work involving field crops during the rainy season whilst work such as picking and grading tomatoes (see Picture 6.4 below) is common in the dry season.

Finally, people who engage in casual work are paid in cash or in kind. Those who pay in kind predominantly use grain. At the same time, cash payments are highly unstable. Most farmers derive their income from selling horticultural crops at *Mbare Musika*. At the market, farmers noted that there are good market days but bad market days are also frequent. In the end, casual agricultural work is a problematic source of earnings or income, as the wages are unstable and low.

Picture 6. 4: Grading Tomatoes

Source: Fieldwork, July 2014.

6.2.3 Non Agricultural Livelihoods Strategies

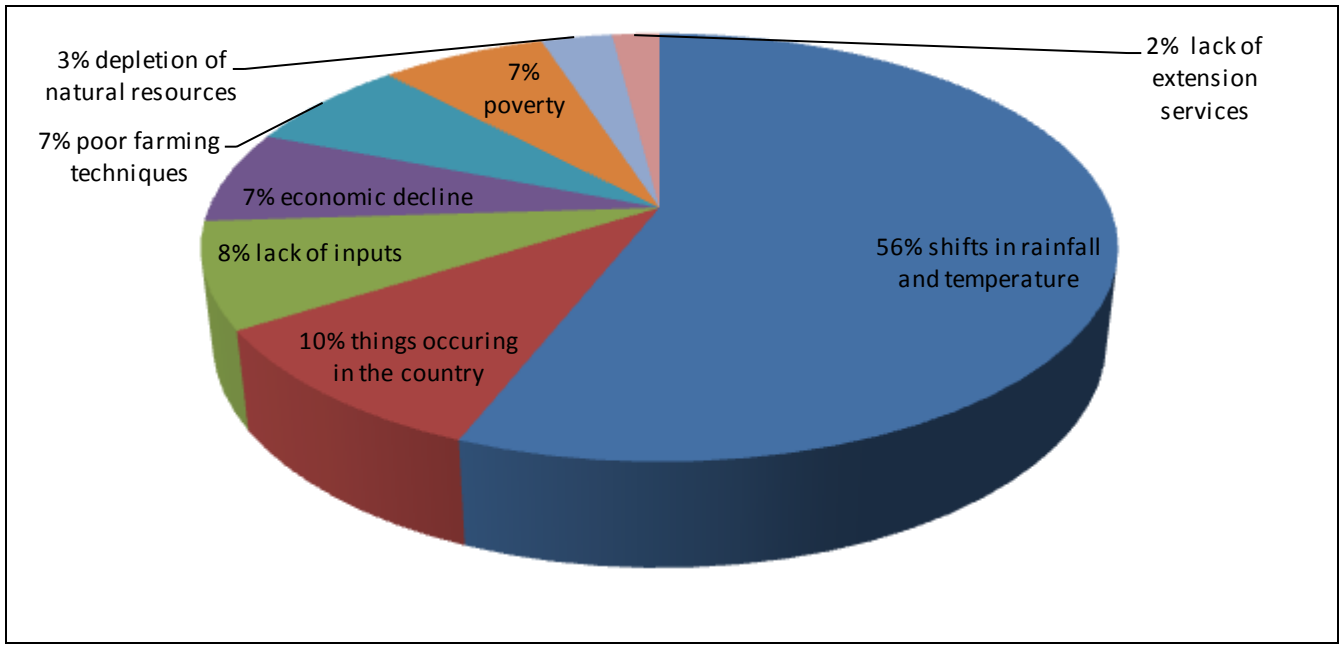
A very insignificant number of respondents in the study depend on casual non-agricultural employment and running own businesses. Non-agricultural work or off farm employment is scarce in the ward and beyond. Black granite mines, which respondents said should provide employment, were accused of bringing 'alien workers'. In rare cases where people are employed in these mines, they will be casual workers. Apart from that, another strategy was gold panning done in Makaha. During the dry season, one can migrate to Makaha to do gold panning and only come back in time for farming.

On another note, business opportunities are scarce. Only one male headed household in the study is running a business and owns a store at Kagande business centre. The store sells food stuffs and other items such as fertilizer. The respondent also indicated during the time of fieldwork that the household had diversified into chicken rearing and selling furniture. The household had employed 2 men to make wardrobes and beds at the time of fieldwork in July 2014. However, the fortunes derived from the business are highly inconsistent. Business may be good immediately after harvesting time in the ward, as farmers make crop sales hence they will have disposable incomes. This is usually followed by depressed sales for extended periods of time.

6.3 Livelihoods Conundrums under Climate Variability in Charewa

Bearing in mind that farmers in Charewa have entered a period of nascent morphogenesis since the early 1990s, my argument in this chapter is therefore that structural uncertainties (produced by increasingly changing climate variability) are imposing complex livelihoods conundrums. Although I highlighted in the previous chapter that for farmers in Charewa, their ultimate concern was rainfall, most (88%) of them agreed that their livelihood was highly dependent on climate parameters (both rainfall and temperature) whilst 12% disagreed. In addition, over half of the respondents (56%) stated that shifts in rainfall and temperature were the main driver of their livelihood changes as illustrated in Figure 6.2 below. However, there were significant gender differences among those who mentioned climate parameters as the main driver of livelihood problems. Therefore, 63.6% were males whilst 36.4% were females.

Figure 6. 2: Main Drivers of Livelihoods Changes



Source: Field Survey, July 2014.

At the same time, even if the survey data seems to portray that respondents blamed rainfall and temperature equally, trawling through field transcripts and farmers' narratives reveals that increasing rainfall variability appears principally responsible for a wide array of emergent livelihoods challenges with which farmers are grappling with. That being the case, in the

following sections I deliberate on the livelihood challenges observed and experienced by farmers in the study site. However, it is not my intent to provide an exhaustive discussion of all the challenges mentioned by respondents in this chapter, but to rather identify the main ones discussed repeatedly in life histories, key informant interviews and group conversations. The major challenges that were identified by respondents are therefore categorised as: the disruption of the agricultural calendar, harvest failures and livestock losses, landscape degradation, depletion of water resources and problems with ecological aspects. Extended dry spells, extreme occurrences (mainly drought), rising temperatures and high rainfall intensity were perceived to have mostly induced these livelihoods problems. However, these interact with other processes to exacerbate livelihoods complications in the study site. These problems mutually reinforce each other and they are also cumulative, therefore, complex patterns have materialised.

6.3.1 Disruption of the Agricultural Calendar

Over and above everything else, farmers in Charewa had pessimistic views on the nexus between climate variability and their livelihoods. Increasingly changing climate variability has ushered in what Archer (1995) calls 'logical inconsistency' in the livelihood system of farmers in Charewa. In this case, one of the striking challenges farmers in Charewa have to grapple with is the disruption of their agricultural calendar. As shown in the discussion above, strategies that households engage in are not illogical but rather revolve around a well-structured agricultural calendar. This calendar in a way establishes 'livelihood order' or ensures 'livelihood continuity'.

At the same time, agricultural activities are tuned to the typical rainfall patterns and temperature conditions in agro-ecological region IV. Therefore, late onsets of rainfall season and early rainfall season cessation as well as increasing unreliability of rainfall are regarded as disrupting the established logical order of the agricultural calendar. Although respondents did not use the word 'chaos', their statements on how rainfall is not giving them dates they used to know when they were growing up or before they got married implied there were serious disturbances and equally worrying livelihoods challenges. For most respondents, what makes the late onset of the rainy season problematic is that it has become difficult to predict with precision better timing of sowing. It is also problematic for most respondents in the study that they were coming to

December in many seasons without planting crops. By and large, the increasing disruption of the agricultural calendar by variations in the onset of the rainy season militates against the proper planning of agricultural activities, resulting in crop failures. In other studies, Jennings and Magrath (2009) echo similar views. As the rainfall seasons start late, farmers are increasingly challenged by the uncertainty of the effective planting period (Jennings and Magrath, 2009).

Spurious rains were regarded as deceiving farmers into planting and thereafter extended dry spells ensue such that farmers were made to believe that they were experiencing *chirimo muzhizha* (experiencing dry season during the rainy season). When farmers experienced prolonged dry conditions, it becomes difficult to do activities such as weeding and applying fertilizer. This is better captured in the following statement from a life history:

> *….If I start at the 1992 drought, by the time we got to February, it was like chirimo* [dry season]. *Cattle were already out. I just said to myself, why should I keep them in the pen? I do not have anywhere to graze them….that was an unusual year. For sure, January, February tinenge tichisakura* [we will be weeding] *but that year we had to just sit. Again, I do not remember so well but it was around 2002, if not 2004, I just remember Plan* [NGO] *was here. I had to abandon weeding because it was too hot, you would do some weeding and crops would wilt. I could not even put the little fertilizer I had, kutototi kwandonayaka* [only when it rained] (Life history interview, August, 2014, ward 3).

The above quote reveals the problems encountered in drought years yet my study also points to disruption of field operations due to excessive water logging. When asked if excessive water was a current crop production challenge, 91.7 % of the respondents said it was not in the survey and 8.3% said it was a challenge. I later followed up the issue when I discussed the consequences of extended wet spells with respondents, in particular during the 2013/2014 season as quite a number of respondents had described it as a season characterised by *nzara yemvura* (rain induced hunger). It emerged that indeed excessive water was not a challenge but localised water logging mostly in gardens was increasingly becoming a challenge in a number of seasons. During the time I visited the ward in April 2014, I noticed that a number of gardens were water logged and farmers reported that they were not able to plough or plant. In August 2014 again I noticed during transect walks and observations that a few farmers were still failing to plough some areas

in their gardens due to continued water logging. For those who had attempted to plant beans, the seeds had not germinated. What was emerging from my interaction with respondents was that water was only good as long as did not interfere with field operations, as this also culminated in delays in planting of horticultural crops and subsequently farmers missed income opportunities.

Early cessation of rainfall was said to be inimical to the growing of late crops around February and March. To reiterate what I highlighted in Chapter 5, *mvura yenyemba* (rains for growing cowpeas) and *mvura yemunyorondega* (rains for late maize crop) are increasingly getting erratic. *Mvura yekudzurisa matere* (rain for uprooting groundnuts) is important because it makes uprooting of groundnuts easier. In the end, farmers are not able to plant late crops and they have to go through laborious processes to harvest groundnuts when rainfall ceases early. In most cases, when the land is too dry they resorted to digging, but they reported that groundnuts were damaged in the process.

In addition, farmers are experiencing frequent seasons with unexpected heavy downpours during harvesting time which are disrupting the harvesting of maize in particular. Maize that has already dried in the field should not be harvested after downpours because *chinenge chine hunyoro* (it will be moist) and *chinowora* (it will rot). If harvested when moist, farmers have to go through mundane tasks of drying it before they can put it in *mudura* (granary). It was also generally stated that maize is difficult to store when it is moist.

Furthermore, through continuous discussions with respondents, the seriousness of the challenges posed by unreliable rain events around harvesting time was elaborated in relation to the timing of activities that mark the start of the dry season such as *kusairira mombe* (letting cattle free) and *kutanga magarden* (starting gardening). When farmers are forced to postpone harvesting crops, it means they have to postpone the other subsequent activities. Many farmers indicated that this was costly socially and economically and puts them in difficult situations. Winter tomatoes, particularly those that mature around the 3rd week of June, are significant to the survival of farmers in the ward. These winter tomatoes are preferred because they fetch a better price at *Mbare Musika* and no respondent registered enthusiasm to miss the opportunity to grow them.

Besides having to postpone starting gardening, it was equally challenging to negotiate with fellow villagers to postpone *kusairira mombe* (letting cattle free) just because some crops would still be in fields. Therefore, changes in climate variability not only disrupt the economic wellbeing of farmers but they undermine established social practices and, in the end, social relations. According to Jennings and Magrath (2009), changes in the seasons can be described broadly as creating existential shocks to individuals and to societies through threatening belief systems, cultural practices and, as a result, social relationships. To augment on how the changes in rainfall patterns are undermining social practices in Charewa, I draw attention to the following quotation from a key informant in the study:

> *……That is a challenge. People in this area are hard headed. Who will go around telling people that that they cannot let out their cattle roam around on 1 June? It is like people do not care who has maize in the fields especially if they do not have any. They just tell you we agreed on 1 June livestock should be set free. Anyone with crops in the fields, it is their own problem* (In depth interview with village head, April 2014, ward 3).

In relation to this, a sizeable number of respondents alluded to distractions induced by little and low rainfall to horticultural activities. Normally farmers engage in intensive gardening from May and switch to field crop activities just before the rain season starts. They constantly referred to increasing number of years in which *vari kundokasira kundosiya maghadhe nekuti mvura ishoma uye iri kundokasika kupwa* (they were abandoning gardens early because water is limited and it is drying up early). Apart from the income lost when there is no more water to irrigate gardens, farmers alluded to subsistence challenges especially in October. It was stated that a number of households would have exhausted their maize grain around October and then depended much on leafy vegetables and beans for food. Therefore, abandoning gardens early had serious implications for food availability.

6.3.2 Harvest Failures and Livestock Losses

Ogalleh et.al (2012) found that climate change and variability increase farmers' vulnerability as they lose their natural assets (crops and livestock) upon which their livelihoods depend. Therefore, farmers' repeated experiences with harvest failures and livestock losses were of concern in my study. The overall challenge from repeated harvest failures has been continually

declining yields and subsequently increasing household food deficits and loss of income. Perceptions on harvest failures largely revolved around maize and to a lesser extent, groundnuts; on the other hand, perceptions on livestock losses centered mainly on cattle. The major finding therefore is that maize crop failures and cattle losses are significant livelihoods challenges in Charewa.

6.3.2.1 Farmers' Experiences with Harvest Failures

Persistent harvest failures were linked by respondents to poor rainfall distribution, extreme rainfall events and rising temperature. In light of other studies, these findings are not surprising. Other scholars have established that after the rains set in, distributions over the rainy season greatly influence the growth and development of crops (Kasei et. al, 2010:90). The overarching effects of harvest failures highlighted by respondents in Charewa are food insecurity and loss of income from reduced or no crop surplus. According to farmers in Charewa, the occurrence of intermittent mid-season dry spells was not in harmony with their crop water requirements and growth. There were several dynamics that ensued when dry spells occurred and occurred frequently for that matter. Mention was made for example of *Hakirikinya* (long season maize crop) and medium season maize crops widely grown by farmers in the ward.

In the past season, *Hakirikinya* shown in Picture 6.5 below was planted by some farmers when they experienced a lot of rainfall in December 2013. But to their disappointment the crop was later caught up in a dry spell. In this case, farmers were of the perception that dry spells coupled with high temperatures induced severe moisture stress. Some maize crops wilted whilst some crops that were at the tasseling stage failed to develop cobs. However, farmers acknowledged that little rainfall was experienced in March after the dry spell and some maize crops recovered. Still, most severely affected long season crops such as *Hakirikinya* did not recover. Therefore, what is emerging from the findings is that crops suffer and eventually yields decline when dry periods occur during critical developmental stages such as *kuvhurura* (tasseling).

Picture 6. 5: Failed Hakirikinya (Long Season Maize)

Source: Fieldwork, April 2014.

In addition, farmers blamed the poor quality maize on the dry spell. There were sentiments that moderate amounts of rainfall were needed to ensure that maize crops developed good quality cobs. This was particularly evident in group conversations where one respondent said:

> *Chibage pachatakatanga kuvhurura mvura bvayaenda miguri haina kuzokura futi* [When maize started to develop cobs and rainfall stopped, cobs did not grow further] (Informal Group Conversation, IGC, Nyakanyanga village, July 2014, ward 3).

Another respondent augmented that:

> *When rains ceased around February, most of the farmers had crops that had not matured. People had planted late. Chibage chakazosara chovavarira kukora neshero* [Maize struggled to mature, it had to depend on dew] (IGC, Nyakanyanga village, July 2014, ward 3).

Contrary to some tendencies in literature that predominantly associate crop failures with dry spells only, harvest failures were prompted by wet spells as well in Charewa. Farmers were of the opinion wet spells were not particularly welcome when *matere ane maveve* (groundnuts have just developed nuts). Continuous rainfall affects the maturity of nuts. Picture 6.6 below shows the typical poor quality of groundnuts perceived to have been harvested by most farmers in the study site in the 2013/2014 season. For farmers, what were regarded as conducive to ensure a good yield of groundnuts were sunny conditions at a time when groundnuts were developing nuts.

Picture 6. 6: Failed Groundnut Crop

Source: Fieldwork, April 2014.

Furthermore, quantitative crop assessments usually associate failures of crops such as maize with drought conditions. On the contrary, farmers in Charewa cited prolonged wet spells as the reason why they had experienced *nzara yemvura* (rainfall induced hunger) that they said occurred in the 2013/2014 season. Medium season maize varieties were affected by water logging and *kundondovera* (leaching) in the stated season hence some farmers got low yields. Farmers were of the view that when leaching occurred, the fertilizer and manure they had applied got diluted hence maize was adversely affected. In my transect walks and observations I encountered failed medium season maize crops such as that presented in Picture 6.7 below (mostly in gardens). Following these findings, it is therefore apt to convey the fact that high rainfall is not always associated with high yield (Ziervogel and Calder, 2003). This is because excessively wet periods cause yield declines due to water logging and *kundondovera* (leaching).

Picture 6. 7: Failed Medium Season Maize

Source: Fieldwork, April 2014.

Again, constant reference was made to the 2013/2014 season to illustrate the effects of extended wet conditions on crops. I make reference to the following account:

> ..*This season rainfall started well. It was late but it rained well. It then became too much so that crops like groundnuts did not mature. Most developed nuts but dzakandoputika* [did not fully mature]. *A few farmers have good yield of groundnuts because they had planted early and their crops experienced some sunny conditions. That sunny weather is the one that enables groundnuts to start developing nut tubers on the roots. When the dry sunny conditions set in the nut tubers then develop into actual nuts. But when the rain persists the ground will be cold and when that happens it will not be possible for the crops to develop a good root system. The root system will be inferior and simply supports the upper part of the groundnuts but they bear no nut* (In depth interview with farmers' chairperson, April 2014, ward 3).

Another respondent observed that:

> *Groundnuts did not do well. As you can see, mawewe ega ega* [these nuts are not fully developed].*This year the season started late. Then rainfall was quite heavy for some time in January and February. In areas that are prone to water logging I did not harvest anything, that includes my garden where I had planted in November. It was too much such that the crops did not do well. In the fields I had planted in December, the maize was affected and struggled to reach maturity. In some sections of the fields maize did not recover when the rains stopped* (Life history interview, August 2014, ward 3).

Still, another farmer had the following to say:

> *…Yes that is February. Aaaaaa, it rained so much then stopped for good. Some of the maize was in this field. Some survived too much rain, but then when rains stopped for good the maize I had planted at pachuru* [ant hill] *then dried. That time I had planted some maize in the garden, it did not do well. When the rainfall became a bit too much, ha, mugadhe macho makadhirika manje* [the land in the garden cracked]. *When the rains subsided, the maize was past the time of developing cobs, there was no hope for maize developing cobs. It had been badly affected by water yet I had also applied fertilizer. I had no more fertilizer to re-apply since the fertilizer I had applied had been washed by rainfall. So, some of the maize survived by God's grace, some totally failed* (Life history interview, August 2014, ward 3).

Simultaneously, droughts and dry conditions were linked to recurrent harvest failures and declining crop yields in the study site. A significant number of the respondents (96.7%) concurred that declining crop yields was a current crop production challenge whilst 3.3% declined. On the same note, 86.4% stated that they were experiencing decreases in crop productivity since 2000, 9.6% said crop productivity had increased and 4% said there was no change. Notwithstanding the drought years, the 1990s were evaluated as better in contrast to the 2000s in terms of yields**.** To elucidate on this, Table 6.2 below shows the major perceptions on droughts in the ward and the livelihood complications that ensued.

Table 6. 2: Perceptions on Droughts and Livelihoods Challenges

Year (s)	Description of Drought	Experienced Livelihood Challenges
1992	Extreme, the worst in lifetime, perceived as resembling a 'curse', worse than 1982 drought	• Total crop failure, • Widespread deaths of livestock • Major livestock sales • Significant water scarcity • The first time water almost dried up at Mutombo waBepeta (sacred spring) • Dorongoma dam almost dried up
1993-1995	Very serious	• Total crop failure • Serious deaths of livestock • Very serious water scarcity
2002	Serious, complicated because farmers were recovering from cyclone Eline	• Crop failure but some people harvested • Serious shortage of irrigation water • Minor livestock deaths
2004	Mild, complicated by cyclone Japhet	• Crop failure but some people had good harvests • Minor livestock losses • Destruction of houses and classrooms at Kagande schools
2008	Serious but manageable	• Crop failure but some people harvested
2007-2011	*Makore emvura shoma* (dry years), not serious, manageable	• Shortage of irrigation water • Minor crop failures • Experienced *nzara-nzara* (hunger like conditions)

Source: Fieldwork, April and July 2014.

In relation to the 1992 drought, regarded as the worst in the respondents' lifetime, the preponderant perception was that there was total crop failure. When asked about *goho* (harvest) of the staple crop (maize) in 1992, most respondents said they did not harvest anything. At the same time, data shows that on average most of the respondents obtained six bags of maize. Here are some views that support the livelihoods challenges produced by the 1992 drought in Charewa:

> *…You mean 92? There was a disaster in this area. Rain came in November and people planted and put fertilizers. In December there was rainfall. When we got to the stage that the maize was beginning to tussle, the rainfall stopped and the crops dried. There was nothing that was harvested, groundnuts as well. The only people who managed to harvest something are the ones who had done planting in the gardens in October the previous year* (In depth interview with key informant, April 2014, ward 3).

Another respondent noted that:

> *I can say in 1992 I experienced drought and hunger, I experienced in a big way. Then I still had a small family but I remember I only managed to harvest 2 50kg bags of maize. It was hard, there was nothing to eat. Cattle would just roam around looking for pastures but they came back in the evening looking the same. That year it was not possible to do gardens during the dry season. Gardens were not viable. It got to the point that water was scarce we would share the same water source with cattle. Most of the water dried up. Boreholes dried up, even wells* (Life history interview, August 2014, ward 3).

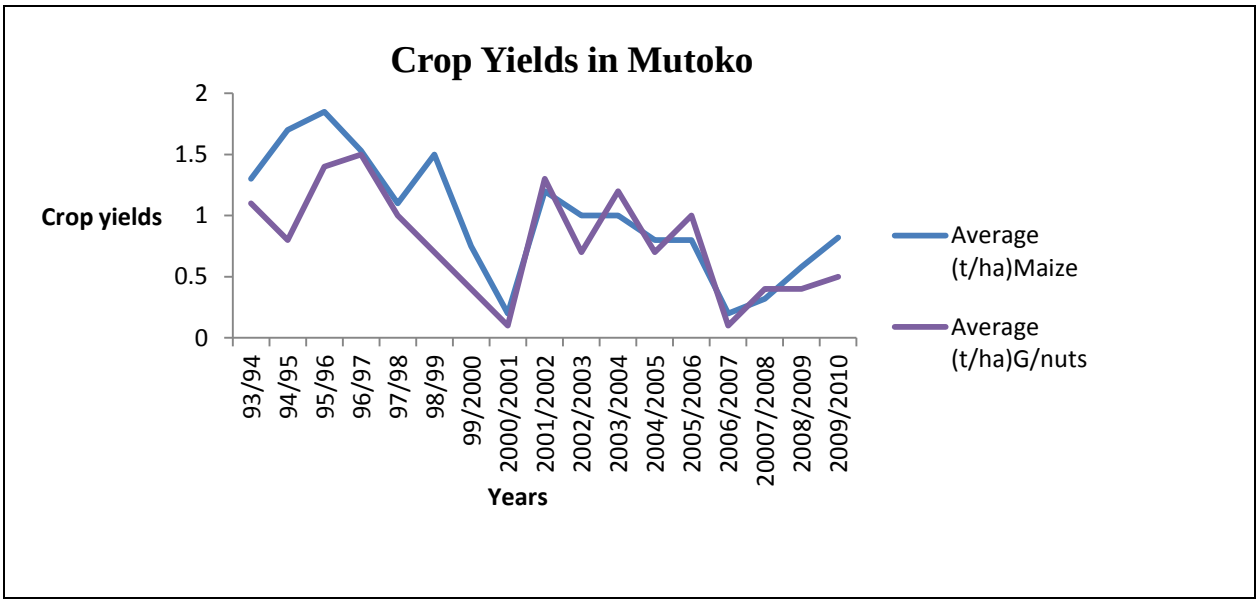
The results of the drought in 1992 were critical grain shortages and loss of incomes because there was no surplus for sale. Consequently, most households in the ward became dependent on food aid. This dependence was also evident during my fieldwork when respondents thought I was going to facilitate the distribution of food aid or the starting of food projects in the ward. I therefore interpret dependence on aid as a condition reflecting the 'contradictory effects of drought' as coined by Benson and Clay (1998:23).

Furthermore, it was common for most respondents in life histories to mention that they did not harvest anything pertaining to all the other drought years experienced after the droughts between 1992 and 1995. Although this was rather an exaggerated response, the consistent theme was that, overwhelmingly, farmers obtained seriously depressed yields during these drought years. Over

and above this, farmers suggested that maize yields are declining and they cited droughts, dry spells and early rainfall cessation as primarily responsible for the decline. The reliance of farmers on rainfall as the sole source of moisture for field crops is thus mirrored in highly variable crop production levels. At this point I also draw attention to the declining maize and groundnuts yields in Mutoko district between 1994 and 2010 as illustrated in Figure 6.3 below.

As stated in the previous chapter, official records noted that average annual rainfall in Mutoko over recent years is about the same yet crop yields are seriously declining. This may mean that there are other factors driving the decline in crop yields in the district. Nevertheless, famers in Charewa insisted that the rains are increasingly coming late and are accompanied by mid-season dry spells to the point of withering crops, and they perceived crop yields to be seriously declining.

Figure 6. 3: Maize and Groundnuts Yields in Mutoko



Data Source: Makonyere (2011).

Furthermore, farmers' own seed varieties remain a key component of agriculture systems in semi-arid areas (Leclerc et.al, 2014) yet their survival in Charewa is being threatened by climate variability. The erosion of traditional seed varieties was cited as problematic by farmers in in the study. This was viewed as a consequence of the increasing number of drought and dry years.

Regardless of other factors[21], the common perception was that traditional crop varieties namely *ambuya vangafe* (maize), *mukotami* (sorghum), *mukadzi usaende* (groundnuts) and *gachegache* (rapoko) had significantly declined in the ward. Studies that have analysed the impacts of rainfall variability on farmers' traditional seed losses over time have obtained consistent results (see Leclerc et.al, 2014). It has been observed that climate events such as extreme droughts have played an important role in crop diversity changes. In addition, Chagutah (2010) argues that the lack of diversity and the minor role played by drought-tolerant staples such as sorghum, millet and cassava increase the vulnerability of food systems to the effects of climate change and variability.

In the final analysis, I underscore that there is 'contextual incongruity' (Archer, 2012) ensuing in Charewa. As a result of the erosion of traditional seed varieties which are drought tolerant, disease tolerant and are therefore palatable for the semi-arid region, farmers are increasingly growing unsuitable varieties. To expand on these findings, I refer to the following account from a respondent:

> *....One of the reasons is the erosion of the seeds that took place in this area. In the past farmers used to have some granaries where they would store seeds because they knew they were good. But, because of the droughts people ended up using the seeds as food. Dzimwe dzakarovera mumunda* [Some seeds got lost in the fields] *because crops wilted* (In depth interview with elder, July 2014, ward 3).

Related to the above are the contradictions created by too much water in some seasons. According to farmers in the study, crops such as sweet-potatoes and pumpkins do not require lots of water. They reported that because of recurrent seasons in which they are receiving sporadic downpours and localised water logging, sweet potatoes and pumpkins *anenge akazara mazimvura* (they will be full of water). What this means is that the crops are of poor quality and do not taste good. Connected to this, in northern Malawi, villagers blame drought for killing

[21] Other factors cited by respondents included the challenges in finding markets for traditional varieties hence farmers were losing interest in traditional varieties and also the perception that they are less productive hence they are being abandoned for high breed seeds. Some respondents mentioned problems associated with processing of traditional crops to have contributed to their decline.

plantain trees and drying up pasture with the result that the traditional diet of 'mbalagha' (beef and boiled plantains) is now much less common (Jennings and Magrath, 2009).

Concurrently, during my interactions with respondents, it emerged that growing high rainfall intensity within many rainy seasons has had adverse implications for crop productivity. Essentially, intense bursts of rainfall damage younger and standing crops (those with ripening grain) and promote soil erosion. In Charewa, constant reference was made to the adverse effects of rainfall in the 1998/1999 season, to the time of cyclone Eline and episodes of intense rainfall in other seasons. Poor quality rainfall, such as high intensity rainfall, was thought to induce crop failure by respondents in my study. In interviews, heavy downpours during planting time were negatively viewed because *anorovera* (they cause soil to be compact) and seeds fail to germinate. According to farmers in the study, when these downpours came sometime in February 2013, beans and cowpeas were at flowering stage, therefore some crops had flowers wiped out. More so, heavy downpours eroded fertilizer and they came when farmers had applied Ammonium Nitrate (top dressing fertilizer) in the maize fields. In the end, farmers were of the perception that they did not obtain the quantity and quality of yields they expected from these crops. To explicate this further, I refer to the following narrative:

> *....Over these three years however I discovered that my production of field crops was not good. The rainfall is too strong causing the little fertilizer that I would have applied to be washed. When the fertilizer is gone you cannot expect to harvest anything* (Life history interview, August 2014, ward 3).

Another respondent added that:

> *...if I look back at the way it rained the season 2012 to 2013 and even this year, it left many farmers without food, not only me. Even other years, I do not remember well, but I was here. There was plenty of rainfall but in the fields there was nothing. In rural areas people survive on sadza, so I would need maize. But, I am not getting enough maize, you see. It is just rainfall that does not mean anything. It is actually destructive* (Life history interview, August 2014, ward 3).

Furthermore, a female respondent reiterated that:

> *...Aaaa I do not remember well the year, maybe 2011, maybe 2012 but it was around January. Yakanaya mvura zvekuti unobvuma* [It rained to the extent that one was satisfied]. *I applied fertilizer one day, then rain poured and washed away the fertilizer. I applied fertilizer again the following day and it was again washed away. The fertilizer got finished and the maize crop needed fertilizer. It was just rain and no fertilizer. In the end, it was not possible to have a good yield. I only managed to*

harvest two 50kgs from this entire field. Ndakachema kuti chibage chese kundondovera shuwa [I cried because all the maize got leached for sure]. *Asi kwakuita raki munda pane pamwe pakapfutsama, ndopandakaboya. Ndingadai ndakashaya zvachose* [But I got lucky there are elevated areas in the field, that is where I managed to harvest something. I could have gotten nothing] (Life history interview, August 2014, ward 3).

On a different note, whereas these are not direct, some benefits were highlighted by some respondents. They alluded to increases in selling prices of horticultural produce at the market during years of crop failures. There were views that a few farmers who were able to utilise weir wier dams to grow horticultural crops realised huge profits at *Mbare Musika* in 2002. In addition, during the dry season that year, farmers with gardens located around Dorongoma dam and Mutombo waBepeta rented out garden spaces to those whose water sources had been exhausted in return for farming inputs, mainly fertilizer. However, juxtaposed with the intricate challenges discussed in this chapter, the benefits noted by farmers in Charewa are insignificant. To use the notion of winners and losers espoused by O'Brien and Leichenko (2000), most farmers in Charewa are currently losers as they are largely disadvantaged by increasingly changing climate variability and are experiencing negative livelihoods consequences.

On the contrary, others envisage large benefits for farmers in Africa in the context of climatic changes. International Fund for Agricultural Development (IFAD, 2008) for example contends that multipurpose crops that can grow on marginal lands and whose components can be used for biofuels, animal feed and human consumption, could become a new source of income for small farmers. Eriksen et.al (2008) also found that some commercial farmers in southern Mozambique were able to pump irrigate their crops during the 2001-2003 drought, and profited from higher prices in regional and urban markets. Even so, Mbilinyi et.al (2013) underline that the positive impacts do not last as the climate continues to change. In addition, the positive impacts are only in few areas and adverse effects are projected to dominate the world, especially in the tropics and subtropics (Mubaya, 2010). Nonetheless, in the following extract from an interview, I draw attention to some of the benefits perceived by farmers in Charewa:

When the rainfall is less farmers make money because many people will not be able to grow crops like tomatoes and beans and therefore the market will not flood. When rainfall is less only a few

people with the right equipment will be able to draw water from places where it will be available and grow crops. But, when there is a lot of rainfall everyone will be able to do farming which will cause the market to flood and when that happens the farmer will not be able to get profit (In depth interview with Community Representative, April 2014, ward 3).

Another key informant added that:

....The level of rain was such that those who had dip wells for water for irrigation in their own gardens did well because horticulture crops were on demand on the market. So, most of those who had water sources and equipment in 2002 managed to buy livestock like goats and cattle or even build houses. Some of the amazing houses in this area were built in 2002. It was a year that was good for the farmer. The market was really paying. A crate of tomatoes which weighs 8 kg was sold for a price close to $15[Zimbabwean dollars]. *Butternuts weighing 50kg were sold for $45 to $60, cucumbers were fetching $75 in that year. A bucket of beans was sold at prices around $35 in 2002. So it was a season that was rewarding for those farmers who remained with water in their gardens* (In depth interview with farmers' chairperson, April 2014, ward 3).

6.3.2.2 Farmers' Experiences with Livestock Losses

Apart from harvest failures, farmers have also experienced livestock losses especially in times of droughts. The death of livestock was not the end of the story, as this was translated into loss of draught power and decreases in acreage ploughed by households; hence the frequent perception by respondents that *kazhiniji kacho chibage chinokwanaba* (most of the time maize is not sufficient). The loss of cattle was closely linked to loss of manure and hence poor crop yields. To elaborate on their responses in qualitative interviews, respondents made comparisons of livestock owned before and after the drought in 1992.

Key informants reiterated that livestock ownership, especially cattle, had declined as compared to the period before the drought in 1992. Currently, from the survey data, a better off household in ward 3 owns between 4 and 6 cattle but respondents stated that herds were bigger before the 1992 drought. Just as the 1992 drought was perceived as the beginning of a downward trend in rainfall, it was also regarded as the beginning of the decline in herds of cattle. There were sentiments that most farmers never fully recovered from livestock losses experienced in 1992. Quite a number of respondents highlighted that they have failed to reinstate cattle numbers to pre

1992 drought levels over the years. Likewise, the 1992 drought was perceived to have eroded 'good quality' cattle breeds. As one respondent narrated:

> *Kare kwaive nemadhonza aityisa. Asi zhinji dzadzo dzakapera nenzara ya92.Mikono yakanaka hakusisina* [Back then there were impressive oxen. But most of them perished during the drought in 1992. There are no more fine bulls] (Elder in IGC, April 2014, ward 3).

In addition, just when farmers thought they could start building their herds after drought years in the early 1990s, they were confronted by the droughts in the early 2000s and again in 2008. Farmers found themselves loosing livestock over and over. Similar observations have been made in the country. One scholar has noted that the 2002–2004 droughts killed many households' livestock, especially in arid areas of Chivi and Mutoko districts (Chiripanhura, 2010). At the same time, it was not only loss of livestock due to death that complicated farmers' livelihood in Charewa. Farmers were also 'forced' to sell cattle, in most instances, under unfair terms to obtain food during drought years. As a result, herds declined drastically.

Finally, whereas farmers in the study preponderantly believed that harvest failures and livestock losses were induced by shifts in rainfall and temperature, they also thought these interacted with poverty, lack of inputs, economic decline and 'things' that were happening in the country. A negligible number of farmers remembered Economic Structural Adjustment Programme (ESAP) in the 1990s as 'things' that happened in the country that caused suffering. To them, increases in prices of inputs began with ESAP. For others, the drought in 2008 was viewed as more like the one in 2002 in terms of low rainfall amounts received but the livelihood impacts differed. Some farmers said they suffered more in 2008 because of the economic hardships that the country was experiencing emanating from sanctions imposed on the country and the unstable political situation prevailing then. Key informants stated that some people did not have inputs to use in the fields so the acreage for maize was low. Respondents also cited that most of them managed to plant only small pieces of land without fertilizer in 2008.

In addition, although respondents were of the perception that livestock losses in the 2002 and 2008 droughts combined did not amount to the losses between 1992 and 1995, they believed that if the economic situation was not bad, they could have averted livestock losses by vaccinating

cattle in 2008. Although livestock deaths due to tick bone diseases were not regarded as high, there were sentiments among farmers that erratic dipping was also responsible for the increase in tick bone diseases. This was augmented by officers in the Ministry of Agriculture working in the the study area. Dipping was considered to be erratic due to shortages of chemicals emanating from the economic challenges in the country. These findings confirm the notion of 'double exposure' embraced by O'Brien and Leichenko (2000) which refers to the fact that regions, sectors, ecosystems and social groups will be confronted by both the impacts of climate change and other factors that are not climate-related.

6.3.3 Livestock and Crop Management Challenges

Climate variability is aggravating predicaments in crop and livestock management for smallholder farmers in Charewa. Following droughts, increased temperatures and other extreme occurrences, farmers are experiencing increasing livestock and crop diseases. From the survey data, 89.8% of the respondents indicated that they have been facing increased incidences of crop diseases after 2000, 1.7% said incidences of crop diseases had decreased, 5.1% said there was no change and 3.4% had no responses. As well, 84.7% stated that they have been facing increased livestock diseases since 2000, 1.7% said livestock diseases had decreased, 10.2% said there was no change and 3.4% had no responses.

In addition, a significant number of respondents alluded to increased crop pests and diseases as a current crop production challenge. Respondents in fact cited an overall decline in animal health and mentioned poor animal health as a current livestock rearing constraint they are encountering. Increased incidences in mortality of livestock was cited by most (74.6%) of the respondents, 3.4% said livestock mortality had decreased, 18.6% said there was no change and 3.4% had no responses. In other semi-arid regions of Zimbabwe, scholars have found that farmers indicated that they had experienced reduced crop production and high morbidity and mortality rates in livestock related to diseases due to climate change (Moyo et.al, 2012).

The respondents reported that the prevalence of crop pests and livestock diseases had increased in comparison to the 1990s as a result of increasing temperatures. *Nhata* (aphids) and *makonye masvipa* (black worms) that affect tomatoes, groundnuts and maize were cited to have increased

because the temperatures are too hot. Farmers cited an increase in *zvirwere zvekuwora* (rotting diseases) in tomatoes as caused by rising temperatures. Farmers also said that they were increasingly noticing that tomatoes *airikuibva nezuva* (ripening induced by high temperatures) instead of ripening naturally and this makes them to rot rapidly. Farmers also perceived that they were noticing some infections in bean crops they had never seen before. The overarching implication of these instances is that farmers are losing income since most of the tomatoes and beans are grown for sale. In Picture 6.8 below, I draw attention to an infected bean crop as observed in a farmer's garden.

Picture 6. 8: Infected Bean Crop

Source: Fieldwork, July 2014.

Simultaneously, respondents stated that that there was a high prevalence of tick borne diseases and worm infections among livestock due to rising temperatures as well. Tick bone diseases including heart water, gall sickness, red water and sweating sickness were cited by key informants in the study. Key informants from the Veterinary Department and the Department of Livestock Production and Development additionally indicated that an unfamiliar condition called lumpy skin which mainly affects cows was on the increase due to rising temperatures. In this regard, changes in climate expose communal farmers to new and unfamiliar conditions.

Furthermore, for the 2013/2014 agricultural season, the common cause for *makonye* (worms) and skin infections in livestock was perceived to be *mvura zhinji* (a lot of rainfall) that was received during the extended wet spell between January and February. According to respondents in the study, the wet spell gave rise to parasites that caused livestock diseases. More so, high temperatures were thought by respondents to be responsible for cattle getting tired easily and being 'aggressive' during ploughing. *Kuwondoroka* (malnutrition) was noted as prevalent during drought and dry years due to poor pastures and water scarcity.

Related to the above, farmers were concerned about the problems created by the delay in onset of the rainfall season. Since livestock depend so much on rangeland pastures, the delay in onset of rainfall in Charewa is contributing to delayed and slow pasture regeneration. Unless farmers provide feed supplements (such as maize crop residues), the major implication highlighted by respondents was that *mombe dzikanonoka kukora zvinonetsa pakurima* (if cattle take time to get strong, it is difficult to plough). Having highlighted the foregoing, the following quotation sheds more light on the difficulties surrounding livestock and crop management in the study site:

> *Unpredictable rainfall is making livestock more vulnerable.The type of veldt (grass) is the main issue. It is increasingly of poor quality* (In depth interview with officer, Department of Livestock Production and Development, March 2014, Mutoko growth point).

Another respondent explained that:

> *When there is a lot of rainfall, diseases that attack horticultural crops increase. This becomes costly to farmers who normally do not have the money. Alternatively they use a lot of money to control the diseases yet when farmers take their produce to the market they realise less profit* (In depth interview with farmers' chairperson, April 2014, ward 3).

On a similar note, another respondent said that:

> *....It was not a major issue in this ward, however for the past four years I have seen an increase in worms. They invaded the area and they destroyed crops. In 2012, chibage changu chakajiwa chese kusara zvitsinde* [In 2012 my maize crop was destroyed; only stems remained] (Life history interview, August 2014, ward 3).

Still on the same issue, a key informant added that:

> *I have problems with my cattle and goats. Now there are too many diseases. Makwekwe awanda* [ticks are too many]. *Livestock are dying from diseases caused by worms. There are too many strange*

diseases caused by worms. These result from too high temperatures. Sometimes too much rainfall is to blame (In depth interview with spiritual leader, April 2014, ward 3).

Generally, respondents opined that when there is drought and temperatures are high there are plenty of complications that arise regarding livestock. This is not an isolated finding. This sentiment can be supported by the IPCC reports, citing an increase in occurrence of certain livestock and crops diseases due to increasing temperatures and decreasing water availability caused by climate change (IPCC, 2007). In a related manner, warmer temperatures may accelerate development rates of some insect species, resulting in a shorter time span between generations (IPCC, 1995).

To add to this, farmers associated years of drought and dryness with poor quality pastures and shortage of pastures as well as water scarcity for livestock. The general view was that because rainfall is increasingly becoming erratic, pastures are not enough for livestock. What was discernable from the interviews and conversations I had with farmers was that pastures were better in the 2012/2013 and 2013/2014 seasons than previous years. However a constant reminder of the effects of drought on pastures and livestock was the 1992 drought. A number of respondents remembered that there was nothing for livestock to feed on as there were no crop residues (most crops had wilted) and rain was too insufficient to stimulate pasture production. According to farmers, livestock that survived the drought in 1992 in Charewa were said to have fed on *gokoro* (dry clay soil found in former wet areas). Horrific stories of weak and thirsty cattle collapsing in and near Dorongoma dam were also presented by some respondents.

At the same time, although rainfall and temperature were blamed for the complications in crop and livestock management in Charewa, respondents also said that increase in livestock pests and diseases was as a result of lack of vaccinations and inconsistent dipping. Increasing crop diseases were also attributed to the inability to contain pests and insects due to expensive pesticides and insecticides.

6.3.4 Water Scarcity and Depleted Water Sources

Climate variability is closely linked to shortages of irrigation water and general depletion of water sources in the study site. From the survey, 61.7% agreed that they were facing the challenge of depleted water resources whilst 38.3% were not. In a similar vein, 73.3% of respondents stated that they were experiencing depleted vleis (*mabani/matoro*) and wetlands (*madafanya*) as a current challenge and 26.7% were not. Concurrently, 89.8% of the respondents stated that they had experienced increased depletion of water resources after 2000, 3.4% said depletion of water resources had decreased, 1.7% said there was no change and 5.1% had no responses. A combination of increasing number of years of droughts and dry conditions, and rising temperatures, was pointed out as the explanation as to why wells and rivers/streams had insufficient water. There was also constant mention of *mvura yakunetsa kubata* (it is difficult to reach the water table) in informal group conversations. This was discussed in the context of constructing wells in the study site. According to farmers, they used to dig 6 meters to get water when constructing wells but now they have to dig further because ground water levels have deteriorated. Related to this finding, studies done in Mutoko have found that the water table has dropped further down, reducing the moisture levels in the surrounding arable fields and eventually reducing crop yields (Makonyere, 2011).

At this juncture, I draw attention to some of the nuances surrounding the depletion of *mabani* (vleis) and *madafanya* (wetlands) obtained from key informants, in particular the elderly, spiritual leaders and those who participate in *mabira emvura* (rain seeking ceremonies). This is something I could not capture in the survey because I had not included it (it never crossed my mind!) and even if I had thought about it (which was really impossible anyway) this could not be quantified. There was a perception that *kuwoma kwebani zvachose* (vlei getting dry completely) was one of the worst things that can happen to a people. Apparently, vleis are not supposed to get dry because they symbolise life for human beings and other creatures. To the respondents, *nzvimbo ine bani ine hupenyu* (a place with a vlei has got life). Vleis symbolise life because people get water, grow crops, graze cattle and harvest grass there. In addition, there was a spiritual dimension that was pointed out that connected the dead and *kutonhodza kunoita bani* (the peace that vleis provide). There was a perception that dying young makes children sort of 'angry'. If young children are buried on dry land, they would not find peace and their 'cries'

would haunt the living. Therefore, burying them in vleis muffled their souls. The overarching view was therefore that vleis should persist forever for the continuity of life and peaceful human existence. To this end, to these particular respondents, the depletion of vleis in Charewa is shaking the very core of existence of people in the area.

As a result of erratic rainfall, negative production changes have ensued in Charewa. It was common among those who alluded to wetlands and vleis disappearing to cite that their parents used to grow plenty of rice in these places. Most of the farmers in the study cited that they no longer cultivate rice because there is simply not enough moisture in vleis to cultivate it. A few farmers who attempt to cultivate rice after they have assessed rainfall and water levels in December are constantly facing the challenge of rice not fully maturing because of mid-season droughts or early rainfall season cessation. To support this finding, Bushesha et.al (2009) noted that while some crops, such as cocoa, are peaking in the current climatic conditions in Tanzania, other traditional crops such as millet have been abandoned partly because they perform poorly with the current climate variability regime.

To augment the above, some respondents stated that there used to be plenty of *ndoronya* (insects that thrive in wetlands and vleis) but not anymore. Respondents stated that they were noticing that wells were drying rapidly and perennial rivers and streams, in particular Marowo, were now seasonal. Springs (including those considered sacred) were drying and an example was cited of the spring at Nyagate that has dried up. At the same time, to show that water sources have indeed depreciated, respondents were of the view that trees that normally thrive in wet areas were dying. To explicate on this, one key informant noted that:

> *Rainfall determines ground water. Now that there are significant changes in rainfall, the dry period is longer. It is now dry from March to December. So there is no way we can get groundwater. Because of erratic rains, water is used before it reaches the aquifer; it is not soaking into the ground* (In depth interview with officer from the District Development Fund, Water Division, March 2014, Mutoko growth point).

In a related manner, one elder stated that:

You mean mapani ane mvura [you mean vleis with water?]. *They are now few, some dried up. Because of the erratic rains and dryness of the land they can now be found here and there* (In depth interview with elder, July 2014, ward 3).

Furthermore, another respondent noted that:

When there are adequate rains, our river Marowo can start flowing around December and stop around August or September. That's when the water gets finished. But still there are few places where you can find water. If there is little rain the river starts flowing end of January and by June it will be dry. When there is drought that means no water to irrigate my garden. It is difficult; I have to get by netumuhomba twutatu twemuriwo uchindodiridza netumvura nhando [I have to get by with 3 portions of vegetables, watering them with water that does not mean anything] (Life history interview, August 2014, ward 3).

At the same time, the farmers' chairperson added that:

You see there are 12 boreholes here. Most of them were put by the government after the drought in 1992. They all had water for some time. Now only a few are working.I do not know, these things are difficult but you see I think it is because of these droughts we had here that these other boreholes are not working. The rainfall we have had for years is not much so they do not have water, even under ground, it also gets finished (In depth interview with farmers' chairperson, April 2014, ward 3).

A critical look at farmers' views regarding water sources and horticulture points to a far from certain future. Here I need to tell a story about how a long established livelihood strategy is being severely threatened by increasingly changing climate variability. I had long conversations with farmers, walked through many fields and gardens, and observed streams and wells. I discovered that sources of irrigation water are highly valued for horticultural livelihood activities. Invariably, these sources depend on rainfall for their water hence farmers were of the perception that increasing erratic rainfall has contributed to *mvura iri kungopera tisati tadii* (water being exhausted when we have not done much). The 'much' that was being referred to was the growing of horticultural crops. To make matters worse, respondents were of the opinion that wells, streams and rivers are drying rapidly because of rising temperatures. It was regarded as now too hot; winter months as also having days with high temperatures that are contributing to wells (see Picture 6.9 below) drying earlier than they used to.

Picture 6. 9: Depleted Well

Source: Fieldwork, July 2014.

What is compounding the problem for farmers is that even in seasons with above normal rainfall, water sources are drying rapidly due to rising temperatures. Wells that used to have water until a few weeks before the onset of a new rainfall season were drying in July or August. For these farmers, the most direct effect on their livelihoods is the decline in horticultural production and inevitably loss of potential household income. There is also emerging uncertainty regarding continued horticultural production since some farmers are being forced to abandon gardening every year when water sources are completely exhausted. Consequently, since horticulture is mainly done for income generation, for some farmers, abandoning horticulture means they are not be able to earn income to pay schools and thereby risk abandoning their children's education.

At the same time, irrigation water scarcity is resulting in what one can call a 'situational logic of competition' (Archer 2012) between different groups of farmers. There were sentiments that competition and tensions over remaining water resources intensified when most water sources were exhausted. The sources that remain with water and are physically accessible to most households are limited. For example, when all other irrigation sources along Marowo River dry up, water that may last up until September in some seasons remains at Mutombo waBepeta. This water source is easily accessible with irrigation pipes. In addition, the consequences of declining

water sources were further elucidated by stories of people *vanovhariana mvura* (enclosing water) and even getting to the point of *kundotemerana mapipe* (destroying each other's irrigation pipes). These are signs of a deteriorating moral economy (Watts, 1983) in the context of climate variability. In other contexts, Narajan (2003) found that family solidarity reduced and tensions over water and fodder escalated because of drought in India.

Further discussions with respondents on depleted water sources led to the realisation that the ensuing challenges are quite multifarious. I have noted already in the chapter that when irrigation water is exhausted, farmers are forced to abandon gardens, leading to financial insecurity (due to loss of income) and food insecurity (due to lack of food for subsistence). Beyond these challenges, when farmers abandon gardens, fruit trees mainly bananas and sugar cane are left unattended. Subsequently they are destroyed by livestock yet fruit trees are fundamental in the livelihoods of people in ward 3. Bananas are consumed mainly in the dry season and also sold locally. During transect walks and observations, I noticed that a number of farmers had banana trees in their gardens and I got curious, especially when respondents had given me the impression earlier on that 'there is nothing much to survive on in the gardens besides growing vegetables'. What later emerged when I talked to these farmers was that *mabanana aitofundira* (banana trees were regenerating) because when they abandoned gardens because of water scarcity the trees were repeatedly destroyed.

Nevertheless, although farmers for the most part attributed complications surrounding water scarcity to erratic rainfall and rising temperatures, they considered other challenges. It emerged that some respondents acknowledged that water sources *azara jecha* (they are clogged with sand) therefore they cannot retain water for long. In addition, some farmers pointed out that the rapid drying of water sources especially in seasons with higher or normal rainfall amounts was partly because there was increased demand on water. As other scholars have noted, reduction in the perceived availability of water from a well or spring can result from increased demand as well as reduced flows (Mertz et. al, 2009). Furthermore, mechanisms to conserve water especially those enforced by religious and cultural norms were perceived to have weakened in Charewa. Constant reference was made of people destroying *mahapa* (indigenous plants that are perceived to conserve water) thereby contributing to water sources rapidly declining.

Whereas data reveals that the overwhelming majority of respondents stated that (even in seasons with above normal rainfall) they were facing crop production or productivity challenges and increased incidences of livestock diseases, some respondents pointed out that things were 'better' in 'wet' years than during drought or dry years. For example, some farmers indicated that in years they had suffered excessive leaching and maize crops failures, they took advantage of moist conditions in these fields to grow early maturity sweet potatoes, tomatoes and beans. This was not possible in drought years when field crops failed because of moisture stress.

More so, when asked if poor pasture was a current challenge, most (67.3%) said no and 32.7% said yes. When asked if pastures had increased, decreased, or there was no change (contrasting with the 1990s) most (76.1%) farmers said pastures had decreased. The explanation for respondents saying overall pastures had declined but currently they are not facing pasture problems was that rainfall in the 2013/2014 was perceived to have stimulated pasture growth. During interviews there were nuances revealing that even if farmers had seasons when they suffered challenges such as *nzara yemvura* (rainfall induced hunger) and livestock diseases they perceived to have been induced by *mvura yakawandisa* (excessive amounts of rainfall), overall it was said that pastures were abundant and of good quality. The perception that livestock enjoyed prolonged green pastures even if rainfall was excessive for crops scored highly among respondents. To elucidate on this, I draw attention the following response by a key informant in ward 3:

> *....In seasons with excessive rainfall, there is increase in external parasites, in seasons with low rainfall, tick production is low. This season ticks are high. But, excessive rainfall is good for pastures. This season there are good pastures to maintain animal nutrition for longer. This reduces time for animals to be malnutrient. I think this year brown pastures will delay coming during the dry season* (In depth interview with officer, Veterinary Department, April 2014, ward 3).

6.3.5 Land Degradation

Increased land degradation is further weakening farmers' livelihoods. Increasing incidences of high intensity rainfall were primarily blamed for destruction of fields, gully formation and destruction of contour ridges. Intense soil degradation emerged as a prominent issue from the data collected. Although respondents cited other problems encountered in the ward such as loss

of trees from deforestation, droughts were viewed as predominantly contributing to increased soil aridity and loss of soil fertility. Also, some households pointed to *ivhu harisisna chimuko* (poor soil productivity) due to high intensity rains (*gukuravhu*) washing away soil nutrients.

High intensity rainfall was also blamed for soils becoming *jechajecha* (too sandy) and ultimately becoming prone to *kundondovera* (leaching). At the same time, besides negatively affecting crop productivity in the study site, soil degradation is increasing the need to ameliorate fertility levels through fertilizer or manure yet farmers are resource constrained. The complexity of the problems that have developed in Charewa is evidenced in the following quotation:

> *….There is a lot of soil erosion taking place and gullies are forming in the fields. The rivers are also experiencing destruction due to water action. The soil that is washed away from the rivers and the fields is being deposited in the dam downstream when we expect the dam to be the source of livelihoods for people during times when there is inadequate rainfall. That is where we do our fishing and sell the fish as well as draw water for irrigation on areas that are nearby for our children to survive* (In depth interview with Community Representative, April 2014, ward 3).

Furthermore, some farmers have had their fields and gardens eroded a number of times by heavy rainfall. When this occurs farmers have to contend with the time, economic and environmental costs of reconstructing their gardens and most importantly their livelihoods. As observed by one respondent:

> *…People had their gardens swept away by the heavy rains that fell in 2013/2014 season. People just woke up one day to find that they no longer had gardens. This has happened before, but you see, they always construct them again. It is just that people have no other ways* (In depth interview with officer, Department of Agricultural Research and Extension, April 2014, ward 3).

To support the above points, during transect walks and observations, respondents also showed me eroded fields, gullies and sand clogged water ways and streams that they perceived to have been caused by *gukuravhu* (high intensity rainfall). This is evident in Picture 6.10 below.

Picture 6. 10: Effects of High Intensity Rainfall

Rain Induced Gully	Stream clogged by washed soil
	

Source: Fieldwork July and April 2014.

At the same time, although the dominant perception was that *gukuravhu* (high intensity rainfall) has contributed to the intensification in soil erosion, this is not occurring in isolation from other factors. I stated before that 7% of the respondents in the survey attributed their livelihood challenges to poor farming techniques. Therefore, it was noted that there was increase in erosion because farmers were not constructing contour ridges anymore. To use the words of one key informant '*varimi havachateerera madhumeni, havachachera madhudhuru* (farmers are no longer following the advice of extension officers, they are not constructing contour ridges). Water runs through fields when there are no contours and erodes the nutritious top soil. In addition, other respondents thought that the soils are worn out already such that they were unable to withstand downpours or high intensity rainfall. Again, others blamed people who practiced stream bank cultivation and deforestation for making the soil prone to erosion in the event of high intensity rainfall.

6.3.6 Disruption of Ecological Aspects

Ecological aspects are fundamental parts of livelihoods of people in Charewa. Therefore, in addition to the above livelihood challenges, rainfall and temperature were also connected to the decline in diverse species (grass, plants, birds and insects), changes in tree flowering and fruiting

times and the appearance of invasive species. The changes in tree flowering and fruiting time is presenting challenges for peasant farmers who depend on them not only for fruits for subsistence and sale, but to make farming decisions. As noted by other scholars in Zimbabwe (see Moyo et.al, 2012), farmers have always based their perceptions on rainfall upon observation of natural phenomena such as the behavior of animals and trees in their localities. Roncoli (2006) also refers to diverse plants that African farmers use for predicting local climate. The quantity of leaves and fruits produced by certain local trees are among the most common indicators mentioned by African farmers (Thomas et. al, 2007).

In my study, farmers pointed out they observed tree flowering and generation of new leaves to determine the onset of rainfall season. In the previous chapter, I mentioned that farmers were concerned about *mvura yepfumvudza* (rainfall that marks the generation of new tree leaves) increasingly becoming erratic. When trees such as *mupfuti* (brachystegia boehmii), *munhondo* (julbernadia globiflora) and *musasa* (brachystegia spiciformis) start developing new leaves (*pfumvudza*), farmers interpreted this to mean that the rainfall season was about to start. More so, farmers also observe the flowering and fruiting time of trees such as *muzhanje* (uapaca kirkiana), *muhacha* (parinari curatellifolia), *mushenje* (diospros mesplifomis) and *mumbumi (*strychnos cocculoides). *Mbumi* (strychnos cocculoides) tree is illustrated in Picture 6.11 below. According to respondents, *hacha* (parinari curatellifolia), *shenje* (diospros mesplifomis) and *mbumi (*strychnos cocculoides) fruits normall*y* ripen during the dry season whilst *mazhanje* (uapaca kirkiana) during the rainy season. These were also consistently described as abundant at the time *pataikura muno* (when we were growing up here) by respondents. When fruits such as *hacha* (parinari curatellifolia) are abundant, the elders interpreted that as an indicator of low rainfall that season, and therefore people have to brace themselves for hunger.

Picture 6. 11: Mbumi Tree

Source: Fieldwork, July 2014.

As I noted earlier, there were sentiments that things have changed. From the survey data, 91.7% of respondents agreed that they had noticed shifts in tree flowering and fruiting time[22] after 2000 whilst 8.3% did not agree. From interviews and conversations with key informants and elders, trees were producing less and low quality fruits than they used to observe when they were growing up in the area. Most *mbumi* trees (Picture 6.11 above) were mentioned several times as having disappeared. In addition, a decline in grass, insect, plant and bird species was reported by respondents. Farmers mentioned that the production of grass such as *tsinde* (digitaria ternate) and *jekacheka* (scleria foliosa) found in vleis and wetland was decreasing. Plants called *mahapa* (plants that conserve water) and *tsanga* (reeds shown in Picture 6.12 below) once found in abundance and wide varieties in streams/rivers and water ponds were said to be disappearing. These findings are consistent with what other scholars have discovered in some parts of the country, namely, that changes in climate have altered the physical geography of areas leading to the disappearance of flora and fauna and other natural habitat that once contributed to the livelihoods of the local people (Dube and Phiri, 2013).

[22] Observations of flowering, fruiting and leaf fall are termed phenological observations (see Mudowaya, 2014).

Picture 6. 12: Tsanga (Reeds)

Source: Fieldwork, April 2014.

The observation of insects, animals and birds to determine rainfall onset, rainfall amounts and occurrences of extreme rainfall events is part of local indicators employed by farmers in Charewa. As noted by one spiritual leader:

> *When a local bird called Kadzonya builds its nest with the entrance facing southwards, then the season will have a lot of rain. We also look at mahwakwanya* [mist] *in Dorongoma, when there is a lot, then there will be a lot of rain in the season and farmers grow crops that require lots of water* (In depth interview with spiritual leader, April 2014, ward 3).

Another key informant added that:

> *Mvura inobva nekuchamhembe inonzi mvura yaNyamhanga nekuti inenge ine hasha, dutu nemabhanan'ana. Tinobva tandoudza vapwere kuti vavharire mombe kana zvadaro* [Rainfall that comes from the south is termed Nyamhanga because it will be intense, windy and accompanied by thunderstorms. We then tell children to drive cattle into the kraals when that happens] (In depth interview with village head, April 2014, ward 3).

In the same manner that farmers have observed phenological changes attributed to climate variability, they observed changes in insect species. A number of farmers made repeated reference to the disappearance of local insects called *tsunyatsunya* or *mbututu* whilst some thought these insects *dzakadzama* (they were extinct) because *mvura yashoma uye kunze kwakupisisa* (because rainfall is now low and it is now very hot). 'Wisdom' birds called

madendera whose sounds are interpreted to signal the near onset of rainfall season were reported to have disappeared. Birds called *haya* whose cries were interpreted as markers of impending heavy rainfall on a particular day were perceived to have become rare during the rainfall seasons. More so, birds called *shuramurove* (migratory birds perceived as signifiers of rainfall) were perceived as becoming uncommon during the rainy season because rainfall was erratic. In addition, respondents cited that they had noticed the presence of invasive insect species, in particular, rare *makonye* (worms*)* and *hwiza* (locusts) after 2000.

Nonetheless, although shifts in rainfall and temperature scored highly as the drivers of the above changes, these were connected to other processes. To start with, deforestation was blamed for the 'disappearance' of the *mumbumi* tree (strychnos cocculoides). Among the 3% who cited the depletion of natural resources as the main driver of livelihood problems, some were of the view that in general the environment has deteriorated, and forests which used to be habitat for *madendera* and *haya* (local birds) have disappeared. Basically, habitat destruction mainly due to expansion of farming activities was thought to have contributed to wild animals and birds migrating to other areas. None however admitted that these may have been hunted down in the process of agricultural expansion instead of migrating.

On a positive note, although respondents in Charewa did not cite positive changes, Mudowaya (2014) argued that whilst the modification or shift in phenological processes in Mutoko district are not yet well pronounced, with the current transition in climate there are evidences of shifts. For instance *muzhanje* (uapaka kirkiana), which was biennial in the district, is now flowering at two intervals in March-April and August-September; henceforth there are possibilities of having two harvests in a year especially in August or December.

6.4 Conclusion

In summation, given that climate variability is increasingly changing, I found it especially important to deliberate on what was happening to farmers' livelihoods in Charewa. However, I was conscious that a survey alone was not going to give me the full answers to the multitude of questions I had. To this end, in my repeated interactions, conversations and observations in the

field I sought flagrantly to qualitatively capture farmers' lived experiences and challenges. As a result, findings from both the survey and qualitative interviews demonstrate that climate variability is the most critical driver and is exacerbating negative livelihood trends and, outcomes in the study site. All the same, given the complexity of the discussed livelihoods transitions, it was particularly useful to place climate variability in the broader context as one factor among other drivers and processes currently being experienced by farmers. Therefore, climate variability is escalating livelihoods pressures when farmers are already exposed to significant stress posed by poverty, economic decline and natural resources depletion among other factors. I also found that these emergent livelihoods challenges and outcomes are too complex to draw neat conclusions about the implications of climate variability. Even so, many of the aspects I articulated such as declining crop productivity, increasing incidences of crop diseases, intensification of land degradation and rapid depletion of water resources, suffice as entry points for me to understand farmers' adaptive strategies in the next chapter.

CHAPTER 7: FARMERS' ADAPTIVE STRATEGIES IN THE CONTEXT OF CLIMATE VARIABILITY IN CHAREWA, MUTOKO

> *When the wells are dry I just sit. Yes, just sit in the shade at home, away from the sun. I will not die; no one has ever died of hunger in this area. I just sit and hope the rains come and l start farming in my fields. Sometimes I wait at the banana trees because there is nothing else to do. But last year I just left them like that, they were destroyed by cattle. You see, it is difficult to keep sitting here when there is no more water to grow anything* (Life history interview, August 2014, ward 3).

7.1 Introduction

The above quote is from an interview with a male respondent in Charewa. Besides the bewilderment it portrays, there is nothing unique about the quote. Painting as it does a bleak picture of farmers' responses, abandoning gardens turned out to be a common strategy adopted to deal with increasing rainfall variability and subsequent deterioration of water sources. But, rather than being entangled in perennial cycles of livelihood impoverishment at the mercy of adverse climatic events, my data proves that peasant farmers in Charewa have developed versatile coping and adaptive strategies. Nevertheless, as I argued in chapter 5, farmers' concerns extend beyond climate and it is not only climate which is driving negative livelihood trends and outcomes in this semi-arid rural area. In this regard, I found it difficult to disentangle responding to climate variability and responding to other circumstances in my analysis of the study findings. That being the case, my first argument therefore is that whereas farmers are responding to climate variability, they are also concurrently navigating difficult socio-economic conditions. As noted by Ziervogel and Calder (2003), climate variability acutely affects rural livelihoods and agricultural productivity, yet it is just one of many stresses with which vulnerable rural households have to cope. Indeed, humans do not only tread a changing biophysical reality when adapting to climate change, but also a changing social, political and economic one and often in novel and surprising ways (Nielsen and Vigh, 2012).

Simultaneously, as I have highlighted several times, my thesis timeline begins at 1992. However, I do not suppose that the period before that is not important. As my findings reveal, farmers in the study site have responded to problematic climatic, political and socio-economic events several times before 1992. My second argument is therefore that farmers' adaptive strategies in this thesis should be read primarily in terms of intensification, expansion, reframing, reviving and reorganisation. Following that, in the ensuing discussion I spend my time explicating on the myriad coping and adaptive strategies adopted by farmers in Charewa to deal with both climatic and non-climatic circumstances.

7.2 Adapting Lives and Livelihoods in Charewa

Adaptation to climate variability is not an option to be considered as a last resort but a critical imperative for farmers in the semi-arid communal area of Charewa. To be able to determine whether responses were coping or adaptive strategies, I sought data on how often the strategy was used by farmers in the study. In my data analysis, I interpreted strategies that were used all the time or regularly as adaptive strategies whilst coping strategies were used very few times, occasionally and seldom. In essence, based on a temporal scale, adaptive strategies are long term whilst coping strategies are short term in nature. Coping strategies were usually taken seasonally whilst adaptive were taken for multiple years in the study. That being the case, my data illuminates that farmers in Charewa are adapting more than they are coping.

When asked in the survey on whether they were doing something in view of what they had observed in rainfall and temperature, most (88.3%) of the respondents said yes whilst 11.7% said no. My data also divulges that farmers are not responding to every livelihood challenge they are encountering. Table 7.1 below provides an overview of some of the strategies adopted by farmers and their nature.

Table 7. 1: Overview of Strategies Adopted by Farmers

Strategy	%Yes n=60	%No n=60	Nature of Strategy
Abandoning gardens	88.3	11.7	Adaptive
Drought Resistant Crops	66.3	33.7	Adaptive
Early maturity crops	76.7	23.3	Adaptive
Food for work programs	65	35	Coping
Micro Irrigation	61.7	38.3	Adaptive
Intensify gardening	61	39	Adaptive
Fodder harvesting	54	46	Adaptive
New crop varieties	58.3	41.7	Adaptive
NGO food hand outs	68	32	Coping
Restoring vegetation	53	47	Coping
Selling Assets	78	22	Coping
Soil fertility improvement	57	43	Adaptive
Conservation Agriculture	66.2	33.8	Coping
Zunde raMambo (chief's granary)	59.3	40.7	Coping

Source: Field Survey, July 2014, ward 3.

The above table indicates some of the strategies adopted by farmers in Charewa. Many of the strategies revolve around household rather than community collective action. At the same time, my data shows that each household in the study site is pursuing multiple strategies across time, each serving multiple purposes. Given this scenario, I construe adaptation as complex in this thesis. Following this complexity, it is problematic to make generalisations from the survey data. Therefore, I largely draw on qualitative interviews to present my findings under various themes.

7.2.1 Re-organising Crop Production

In order to deal with increasingly unpredictable and unreliable rainfall patterns as well as changing temperature conditions, farmers in Charewa have made changes to crops grown, how they are grown and where they are grown. Fundamentally, farmers have shifted planting dates

because of the late onset of the rainfall season. Though farmers acknowledged challenges in obtaining extra seeds once they had planted, replanting was cited as a strategy in the event of crops failing to germinate. Replanting also has various facets that were pointed out by respondents. When farmers, for example, plant maize and dry spells follow when the seeds have already been exposed to moisture, they rot; hence farmers have to plough again whole fields and replant. In other instances, respondents cited that seeds do not germinate because the moisture will be insufficient and sometimes *mbeswa dzinoroverwa nemvura* (seeds are affected by high intensity rainfall), and again farmers replant. In the final instance, sometimes seeds unevenly germinate and farmers do what they termed *kujarurura* (plant seeds on missing spaces). Besides these strategies, farmers have adopted early maturity or short season crop varieties. One common maize variety cited by farmers was 4Series, commonly known in vernacular as *Tsoko* (monkey). To further expatiate, a key informant from the Ministry of Agriculture noted that:

> *Early maturing crops, for example, those that mature within 90-100 days are the ones we are encouraging farmers to adopt. However, in terms of yield, early maturity crops do not produce much, but for food security they are good. Farmers are guaranteed getting something in these seasons that are short* (In depth interview with District Agricultural Extension Officer, March 2014, Mutoko growth point).

In addition, drought resistant maize, millet and sorghum have historically been grown in Charewa. With seasons with inadequate rainfall and poor quality rainfall increasing, these crops remain integral in the livelihood of farmers in this semi-arid area. However, traditional varieties of these crops are now limited such that farmers are obtaining hybrid drought resistant crops. For sorghum, the common type adopted by these peasant farmers is called *masiya*. More so, millet and sorghum were not only considered as drought resistant but were also perceived to have good nutritional value. In addition, according to respondents, the strategy of *kujara mumera yakasiyana* (staggering of crops) helps them to ensure that if one crop fails, they are able to harvest from another crop. Staggering of crops involves different and multiple rounds of seeding. This means farmers have early, middle and late crops. It came forth from respondents that maize is the main crop staggered by farmers.

Furthermore, farmers are re-emphasising the importance of multiple fields and gardens in the context of unreliable rainfall. Most farmers I interviewed had more than one garden. When some farmers farm on these multiple fields and gardens, they are growing a wide range of crops or crop varieties. It also emerged that farmers are increasingly finding it important to plant their crops based on careful assessment of crop moisture requirements. For example, drought resistant sorghum called *masiya* was said to thrive in *mushapa* (red clay soils). This finding is consistent with what Pandey et.al (2007) found, that farmers growing rain-fed crops in drought prone environments might seek to diversify the location of their farm plots to take advantage of high spatial variability of rainfall. Similarly, Eakin (2000) found that optimising livelihood outcomes by utilising spatial and temporal diversity in the landscape is one way in which people can spread the risks associated with climate variability and unpredictability.

Related to the above, three stories presented in Box 7.1 below shed more light on the evolution of *minda yekugomo* (mountain fields) embraced by some farmers in Charewa.

Box 7. 1: Farmers' Experiences Regarding *Minda yekuGomo* (Mountain Fields)

VaShaki's[23] Story

I started kurima munda wekuseri kwegomo [farming in the field behind the hill] *in 2010. Since then my food shortage is not severe. I was left out by an NGO that was giving out food aid so I learnt not to depend on food aid but to work on my own. Around that time it was raining but it was not okay. I realised that with little rains and ivhu rangu rasakara* [worn out soils] *I was not harvesting much. The soil in the field behind the mountain is good and there is also mumvuri wegomo* [shade from the mountain] *so there is little time for direct sunlight. There is moisture for long even mvura iri shoma* [when the rains are low]. *Since 2011, rainfall is coming, but it is ending early leaving crops before maturity, but I always get something from that field. Even if there is too much rainfall like this year, the field is not affected by water logging or kundondovera* [leaching]. *If you put fertilizer once that is okay. You know if you plant your maize there, you will get something* (Life history interview, August 2014, ward 3).

[23] Not real name.

VaKatira's[24] Story

In 2000 that is when I realised that things were not well. I did not have any cattle so I would ask people to plough for me. It was difficult to do that every season. I thought about how I could increase my yield and I thought that could help me very well to be able to buy cattle. That is when l started farming in the field kuseri kwegomo [behind the mountain]. *I decided to do that because I did not know how it was going to rain. But, I think it was raining better near the mountains. I also went there because of the soil, rakati simbei* [it is a bit strong]. *Down here ivhu harisisna feeding plus rinodya fertilizer* [the soil down here is poor and requires a lot of fertilizer]. *The soil down here is no longer good for maize asi matere anoita* [but groundnuts do well] (Life history interview, August 2014, ward 3).

VaChidoka's[25]Story

Unlike other people who go hungry in this area and do nothing, I went to farm in the mountain, there on top. I think it is now 70 years without anyone farming in Tsvipidza mountain. I started farming there in 2005, then quit in 2011…yaa it has been 3 years now since I left. It is because of the baboons that I left. They are a menace there. I saw other people coming back, then I knew l could not manage anymore. But, maize in that field did very well. Even when it did not rain well, I could get something there than here. Mainge mune mutota [there was moisture]. *I did not have many problems during those years, sadza ndairiwana* [I could get sadza] (Life history interview, August 2014, ward 3**).**

Source: Field work, August 2014.

Apart from the above, as rainfall gets more erratic and temperatures continue to rise, farmers in Charewa have realised that they need to deal with rapid water depletion. I have noted in chapter 6 that water sources are getting exhausted earlier than expected and also faster. At the same time, some farmers are experiencing localised water logging in some rain seasons. In the first case, abandoning gardens altogether and reducing land under cultivation emerged as popular strategies. For some farmers, these have become perennial strategies. To elucidate on these strategies I refer to the following quotation:

> *……That is where the real story is, I just sit, I sit. There will be no water, what else can I do? I will not even set my foot in the garden. I just sit, there is nothing really helpful to do. Ndobata rushaya*

[24] Not real name.

[25] Not real name.

kungodai [I hold my cheek like this]; *siting the whole day and thinking. When I sleep and wake up in the morning I then struggle, thinking what do I do with this problem when I really do not have vegetables to cook* (Life history interview, August 2014, ward 3).

In addition, respondents cited that in some seasons, the time that water to irrigate horticultural crops gets very scarce (that is around October) also coincides with household food deficits. However farmers in Charewa, like any other people, have to make sacrifices and trade-offs. Therefore, when some farmers reduce land under cultivation, they are forced to forego income opportunities and grow small portions of leafy vegetables and beans to supplement household food deficits. In the case of fields or gardens getting water logged from extended wet spells, waiting until water subsided was constantly referred to as a strategy. Some farmers, though a negligible number, said they drained the water. Some respondents also mentioned that they waited for the water to subside a little bit and cover the land with dry soil. However, this was considered only possible on very small portions of land.

Related to the above strategies are responses to deal with crop pests and diseases. There is evidence of integration of modern and traditional crop management strategies to deal with crop pests and diseases in Charewa. Whereas most farmers gave the general impression that the primary motive in the use of traditional methods was to respond to increasing pests and diseases in the context of climate variability, in the process farmers were also addressing resource constraints associated with purchasing insecticides and pesticides. One of the strategies cited was using *dota* (ashes) to deter aphids in cowpeas and groundnuts. All the same, there is increasing use of modern pesticides and insecticides to deal with increasing crop pests and diseases by farmers in Charewa.

7.2.2 Making up for Household Food and Income Deficits

Following up on what I presented in chapter 6, food deficits in the study site result from harvest failures and declining productivity. Income opportunities provided by both field and horticultural crops are mainly lost in drought years. At the same time, increasing dry spells and periodic wet spells cause harvest failures. As a result, my data reveals that farmers in Charewa adopt a combination of strategies to deal with these challenges. Accordingly, during the drought of 1992,

some farmers sold livestock in order to purchase grain and they dug and cooked *manyanya* (wild tubers) and *zviriri* (wild beans). As well, households participated in food for work programmes in which they constructed roads in exchange for grain.

At the same time, farmers went for *maricho* (casual labour) in *minda mirefu* (resettlement areas) where they worked in exchange for grain. They also got paid in cash which they used to buy maize grain. In this respect, farmers in Charewa resemble very closely other rural populations across rural Sahel (see de Bruijn and van Dijk, 2005a; Mortimore and Adams, 2001). In addition, NGOs provided food aid in Charewa. Furthermore, some farmers borrowed grain from relatives in the locality and beyond, whilst some households received mealie-meal from relatives in cities. More so, other households entered into barter transactions exchanging livestock for grain. The quotation below elaborates in detail what transpired during the 1992 drought:

> *….During that period (1992) people got to a stage where they could survive on root tubers that were found in the bushes, which we call manyanya. People also ate zviriri. These zviriri sort of belong to the bean family and are found in the bush. Some would even consume raw paw-paws. They would peel off the outside skin, cook them and give to the kids to eat. Some who had livestock like cattle sold all of them as well as goats. People were selling so that they could get money to buy something. Most of those who had money would go as far as Macheke to buy maize and to Harare as well. Again, people got to a stage where life was so tough that they could even sell their clothes so that they could buy food for the family. That year we would like to thank the role that was played by NGOs. When we got to November and December, everyone was so relieved. They came and gave each family three 50kg bags of maize. All the people felt relieved that time. We also got to a stage where if you visited your neighbour you would not find maize. No one had food. So, people would spend the whole night walking to Mutoko Centre to look for mealie-meal. Some would spend 3 to 4 days there but in the meantime, the family did not have anything to eat. That is when the people would look for root tubers so that families could survive waiting for the parents to come from wherever they would have gone to look for food* (In depth interview with key informant, April 2014, ward 3).

As evident in the above quotation, wild fruits assume a significant role in supplementing food deficits during droughts. Farmers found it paradoxical that during drought years fruits such as *masawu* (ziziphus mauritiana), *mazhanje (*uapaca kirkiana*), mawuyu* (baobab), *shenje* (diospros mesplifomis) and *hacha (*parinari curatellifolia) were abundant. Some respondents believed that

Vadzimu (ancestral spirits) provided abundant fruits so that people survived the droughts. Aside from consuming wild fruits, farmers dry vegetables (see Picture 7.1) such as cowpeas leaves, *nyevhe* (wild vegetable) and pumpkin leaves. When preserved in large quantities, dried vegetables are sold at *Mbare Musika* and farmers make up for income lost when they abandon gardens or reduce land under cultivation. *Masawu* (ziziphus mauritiana) fruits are also dried and preserved for later consumption and sale. Income generated from *Masawu* (ziziphus mauritiana) sales is partly used to purchase grain. In addition, besides responding to food and income deficits in diverse ways discussed above, farmers indicated that withholding dry season grain sales until the rainfall season started was a common strategy they have adopted in recent years.

Picture 7. 1: Dried Vegetables

Source: Fieldwork, July 2014.

In the above discussion, I provided an overview of the strategies adopted by farmers to deal with food and income deficits when they experience harvest failures, and I also made specific reference to the drought in 1992. At this juncture, I direct my attention to some of the specific stories drawn from life history interviews conducted in Charewa. Besides portraying the common strategies adopted, the stories presented in Box 7.2 below shed more light on the movement of strategies across time, suggesting the formation of adaptive trajectories by some respondents. Simultaneously these stories indicate how farmers are responding to both climate

variability and problematic socio-economic conditions. As Nielsen and Vigh (2012) found in their study, exposures such as globalisation, population increases, and various policy and economic incentives and barriers intermingle with cultural and individual concerns and environmental change when particular strategies are either chosen or rejected.

The two stories below highlight some of the multiple strategies farmers are pursuing across time. Whilst these strategies are common among farmers in Charewa, I want to draw attention to the fact that in both cases presented below, adaptive strategies are involving multiple geographies or localities. In the case of Jane, some of the strategies border illegality.

Box 7. 2: Coping with Food Deficits in Charewa

Chamu's Story

Chamu[26]was born in 1972 to Ebia and Stella Zenda[27]. His great grandparents came from Chivhu to settle in Charewa. He was born in a family of 9 and one sister is dead. After completing Ordinary level in 1990, at which he obtained 2 subjects, he went to Harare in 1991 to look for work. He lived with his nephew whilst trying to secure employment but did not do so. As he recalled, the situation was getting bad and he thought it was because of ESAP. After failing to secure employment, he came back to Charewa in 1993, stayed home and then moved to Bulawayo and stayed there until 1996. Still he had no secure permanent employment but just engaged in several piece jobs. Whilst in Bulawayo he got married to a woman from Masvingo in 1996. He moved back to Charewa that year, built a house for his wife and went to Harare, where he stayed, which frequent home visits until 2002. According to Chamu:

In 1992, there was drought and extreme hunger but I did not directly experience them as I had moved to Harare but I still visited home. That year DANIDA [Danish NGO] *came and people went to work for DANIDA and were given food. That was food for work programme. My father went as well to work for DANIDA and they constructed the road from Nyamuzuwe to Benson Mine. In 2002 there was another drought but I was not here as well. I was working in Harare. That is the year people survived on bulgur and wheat that they bought from Harare. I bought mealie-meal for my family in Harare. I went as far as Magunje and Chinhoyi to buy maize. I realised transport costs were too high so I would get transport*

[26] Not real name.

[27] Not real names.

from friends to bring the maize home. I had friends working for some bus companies and these would go to Mudzi and Nyamapanda. That was also the year Plan [NGO] *came to the ward to give food aid. When it came, l thought it was just a story, but they actually gave us maize, cooking oil, beans and bulgar. Plan helped me for a number of years. When Plan stopped, then came another NGO, CRS* [Christian Relief Services], *and then another one. CRS brought red sorghum, then another Methodist NGO came in 2012 but that one was too selective. It targeted widows and those who were HIV positive* (Life history interview, August 2014, ward 3).

Jane's Story

Jane[28] Daka was born in 1969 in Tirihumwe village. She attended school up to grade 6, dropped out and got married in 1983 to Eddie Muzodziwa[29], a Methodist and moved to Nyakanyanga village. She has 4 children and she has been living with her now ailing husband in the village since they got married. This is what she said on coping with food challenges:

I worry about where to get mealie-meal when I do not have maize. You see, donors target a few people; they leave you out and select others. I end up digging manyanya [wild tubers] *and eating wild fruits. Usually when there is low rainfall there is too much shenje* [wild fruit]. *They actually do well even when it is dry that season. I eat and sleep on these. I can also get masawu* [fruits], *dry them and eat later. I used to sell them but now there is no market. The prices are not good. Then at some point, I made kachasu* [locally brewed beer] *but brewing kachasu is prohibited. But, you see, when the situation is bad you just do it because you need money.*

……Aaa not really, we also do other things. Even maricho [casual labour] *if there are people who need work, but sometimes there is nothing to do here when there is drought. Everyone will be hungry. That is when I sometimes go to resettlements, kunana Chitangazuva uko* [there in Chitangazuva]. *I do whatever work, sometimes kumweta huswa* [harvesting thatching grass] *in exchange for maize. My husband also used to do some work for people, thatching houses or constructing gardens for people.That was around 1990s. Yaa again, 2005…2007… there about, Plan* [NGO] *was here then, giving us food* (Life history interview, August 2014, ward 3).

Source: Fieldwork, August 2014.

[28] Not real name.

[29] Not real name.

7.2.3 Intensifying and Expanding Micro Irrigation and Horticulture

Micro irrigation has gained momentum in Charewa. Farmers syphon water using pipes and use water engines to pump water as shown in Pictures 7.2 and 7.3 below. Water pumps are powered by diesel. With the process of syphoning water using pipes, farmers use gravity to draw water from flowing rivers and streams. Therefore, during the period when rivers will be flowing, farmers syphon water and as the dry season continues water becomes localised such that farmers use engines to pump water. As noted by one respondent:

> *……So when there is water flowing in the streams we use pipes. But when water is now low, when it is now found on one place we assist the flow using the engine so that we still get water to irrigate our crops* (Life history interview, August, 2014, ward 3).

With syphoning, a pipe is strategically placed in water, then hot water is run through the pipe from the other end of the pipe. Farmers explained that this enabled cold water in the stream/river to force itself up the pipe. Others do what they termed *kukweva* (drawing water using their mouth). In this case, a pipe is placed at a strategic place along the flowing river, and then one uses their mouth to draw air from the other end of the pipe. Water then forces its way into the pipe. In both these circumstances, when the initial process of getting water into the pipe is done, pipes are laid in such a manner that the movement of water follows gravity.

Picture 7. 2: Commonly Used Type of Water Engine

Source: Fieldwork, April, 2014.

Picture 7. 3: Syphoning Irrigation Water

Source: Fieldwork, July 2014.

As a result of pipes and engines, farmers indicated that they are now in a position to deal with mid-season droughts as they can even water their field crops, though on a very small scale. The use of pipes and engines has also led to the expansion of horticulture crops into crop fields as shown in Picture 7.4 below. To expand on this, one respondent had the following to say:

> *I now have pipes to draw water from wells and streams afar. So l can grow tomatoes anywhere as long as my pipes are long enough and there is water. I want to make sure if crops in the fields do not do well, I have something to eat* (Life history interview, August 2014, ward 3).

Picture 7. 4: Expanding Horticulture into Crop Field

Source: Fieldwork, April 2014.

The adoption and expansion of micro irrigation as an adaptive strategy in Charewa has evolved across time. Many respondents narrated their experiences with irrigation pipes and water pumps, and these were diverse. All the same, respondents' stories bring together the struggles that farmers have gone through. Some sold livestock to buy pipes whilst some still rent pipes. Those that sold livestock then suffered problems of draught power. Renting irrigation pipes is a common practice in the study site and is based on barter transactions. To capture these diverse experiences in the thesis, I refer to the following quotations:

> *...I bought my first pipe in 1996. I decided that it would make life easier. It was going to make farming better than kujega nematini* [drawing water using tins]. *Then the stream near the fields had water but it was just painful to carry water tins. It was painful. Mvura yakazotanga kupera hayo* [then water started to deteriorate]. *It eventually got worse and now we have kukwidza naChishande* [we have to go up Chishande River] to get water. *We had to buy extension pipes* (Life history interview, August 2014, ward 3).

Another respondent added that:

> *....We had our first pipes in 2004. I had gotten married in 2002. I come from Kawazva, so in 2002 that is the year I moved to this village. There was drought that year. We tried to do gardening that year but we managed to grow vegetables on just a small portion in the garden. Even in the small dam we used to draw water from, there was no water. That is when we started using drip irrigation. It is just like a drip you find in hospitals and it does not require a lot of water. We were trying our luck and thought maybe we would get something to eat. Drip irrigation works were there is little water but then we could not use it on a big portion of land. We wanted big portions because we wanted to grow crops for sale as well. But, the drip did not allow cultivating big spaces. It was also too laborious to fetch water using tins to fill up the containers connected to the drips. It was just slow because water dripped on the crops bit by bit. So we decided to buy pipes in 2004, then we bought an engine to pump water in 2008* (Life history interview, August 2014, ward 3).

Again, another respondent highlighted that:

> *....Aaaa, no. My neighbours are the ones I used to borrow pipes from. Even during ploughing they would plough for me. But they used to say you have to work for us first. I said it is okay. But, at the same time, I motivated myself to continue using tins to do my gardening and also saving some money. I then decided to buy 100 meters at a time until I had the number of pipes I wanted. Ndakazoitawo shungu kuita angu nekuti unenge uchimboniymwa kana kuitwa munhu wekusevenzeswa* [I was

motivated to have my own pipes because sometimes people refused to give me their pipes and I felt being used working for others] (Life history interview, August 2014, ward 3).

7.2.4 Increasing Crop and Livestock Diversification

My data reveals that farmers in Charewa are increasing on-farm diversification. This finding contradicts scholars that purport that there are often few on-farm diversification strategies in the Sahel and diversification out of agriculture has become the norm among African rural populations (Bryceson, 2000). Overall, expanded crop and livestock diversification in Charewa has been adopted to reduce risk associated with rainfall variability particularly the effects of harvest failures and livestock losses. One rationale for diversification by peasant farmers in my study is to create a portfolio of livelihoods strategies with different risk attributes, so that challenges posed by climate variability can be managed and recovery is easier. However, whilst for farmers in Charewa, diversification curbed food insecurity and sustained and expanded household income, they were also responding to increasing fluctuation and deterioration in crop prices in the country. Some farmers acknowledged that whereas maize prices were guaranteed by the government through the Grain Marketing Board, horticultural and other field crops were not.

In this regard, farmers are expanding diversification of crops. Multiple cropping was thus cited as a way to curb total harvest failures. Besides growing maize and groundnuts, cowpeas and bambara nuts are perceived as crops that do not require a lot of water hence they are gaining popularity amongst these smallholder farmers. These crops were also perceived to do well in less fertile soils. In some fields, cowpeas are mixed with maize or sunflower crops. Additionally, there is a notable trend in Charewa towards integrating horticultural crops into the main agricultural season, especially tomatoes. Though tomatoes are primarily grown in gardens during the dry season and irrigated, some farmers are now growing rain fed tomatoes in fields.

Another trend is that new crop varieties such as fine beans, okra, green pepper and peas have been added to horticultural crops. As noted by the District Agricultural Extension Officer, these were predominantly grown in small scale commercial farming areas but have now been adopted by communal farmers. In addition, the use of traditional crop varieties had deteriorated in Charewa, but farmers now realise the need for more integration of traditional and hybrid crop

seed varieties under increasingly changing climate variability. As well, farmers are adopting multi-cobbing maize to increase yields. Furthermore, though negligible, some farmers cited that they have expanded crop farming and rearing of smaller livestock, mainly poultry and goats. Farmers were of the perception that smaller livestock are easy to manage during times of droughts.

One striking aspect I also noticed was that farmers were diversifying indigenous and hybrid chickens. Hybrid chickens were primarily reared for selling in the locality. At the same time, though on a limited scale, there are NGOs promoting the rearing of indigenous chickens, in particular Community Technology Development Organization (COMMUTECH). Indigenous chickens are perceived to fare well during drought and dry conditions. Nonetheless, whereas diversification was perceived to have been adopted to ensure food and income security in the event of harvest challenges and livestock losses in the context of climate variability, responding to market fluctuations was equally important. For example, in relation to hybrid chickens, farmers gave the impression that they were responding to the macro-economic conditions as these chickens had a relatively stable local market and economic returns were realised within 6-8 weeks.

7.2.5 Moving Beyond Conventional Farming: Conservation Agriculture

Contrary to current and popular discourses that portray Conservation Agriculture (CA) as a new practice, farmers in Charewa have long established soil and moisture conservation practices. Farmers were of the view that they used to practice what they termed *chibhakera* (digging). Although for some farmers this served to conserve soil and minimised soil erosion, for poor households the reason was different. For households without draught power, instead of doing conventional ploughing, they used hoes to dig in their fields and plant their crops. Nonetheless, during the study, there seemed to be agreement among respondents that the notion of *chibhakera* (digging), though still being practiced, had lost momentum primarily because it is too demanding in terms of labour. Besides that, farmers also highlighted that they practiced and still practice *kupandira* (dry planting), accompanied by mulching that they believed conserved soil moisture in the event of erratic rainfall.

In the context of climate change and variability, Conservation Agriculture, locally known as *dhiga uje* (dig and eat), has been adopted by farmers with the aid of NGOs. The government was believed to have recently embraced the concept and therefore provides extension support to farmers through agricultural extension officers in the Ministry of Agriculture. Discussions with key informants in the study unveil that the underlying principles of CA being presented to farmers are moisture conservation, soil fertility improvement and improvement of crop productivity. In this case, CA is being construed as an integrated, sustainable and resources-saving cropping system.

The concept of CA was described in various ways by respondents in the study. According to the District Agricultural Extension Officer (DAEO):

> *Conservation agriculture involves using various techniques such as open furrows as the main strategy. Farmers open furrows and put mulch so that when it rains, rain is captured* (In depth interview with DAEO, March 2014, Mutoko growth point).

Another respondent noted that:

> *CA involves kuchera makomba* [digging holes] *using hoes. The field must not be ploughed. You plant your seed and put mulch on top. The mulch inchenegetedza mutota* [conserves moisture]. *When there is direct sunlight it does not affect the plant directly. Even people without assets can adopt CA. One can still plant early and at the same time with people who have draught power even if you do not have* (In depth interview with Agricultural Extension Officer, April 2014, ward 3).

In addition a farmer stated that:

> *There is a new method of growing crops that we were taught by CADS* [NGO][30]*.This is called CA and it involves digging some holes. This has helped me a lot. Even where there is sandy soil all you do is dig holes and put in a mixture of murakwani* [manure from plant residues], *soil from anthills and small quantities of compound D* [fertilizer]. *What happens is that my crops grow well and I am not going to get to a point where the soil is no longer usable any time soon* (Life history interview, August 2014, ward 3).

Again, a key informant from an NGO added that:

[30] Cluster Agricultural Development Services (CADS) is an NGO working with disadvantaged rural smallholder farmers on sustainable agriculture and livestock production.

…We teach farmers appropriate technologies under CA. We have direct seeder which involves planting seed and putting fertilizer at the same time. We have developed Conservation Agriculture Basins. These involve digging holes and putting manure, then planting seeds when rainfall has been captured (In depth interview, key informant from Community Technology Development Organization (COMMUTECH), April 2014, Mutoko growth point).

Whereas farmers adopted CA as a moisture and soil fertility conserving cropping system in the context of increasing rainfall variability and rising temperatures, there were indications that quite a number of farmers were also responding to the challenges in acquiring farming inputs, particularly fertilizer and draught power. On one hand, CA is reducing the use of inorganic fertilizers, which are expensive for some farmers. On the other hand, CA does not use conventional ploughing; hence farmers without draught power are finding the practice very advantageous. To elaborate on this, I draw attention to the following statement by a respondent in ward 3:

...With CA I use less fertilizer than when I do with normal farming. I use 80 bags of fertilizer per hectare whilst if I do normal planting I use 300 bags per hectare (Life history interview, August 2014, ward 3).

A key informant added that:

In 2008 that is when many people used CA. That is when it became effective because people had no fertilizer and even draught power. People realised they could use less fertilizer per acre and decided to abandon ox-drawn ploughs for the CA method (in depth interview with farmers' chairperson, April 2014, ward 3).

Simultaneously, some respondents believed that farmers who are winning the Agricultural Show competitions and those with good yields owe that to CA. As noted by a key informant:

There are green shows held in our communities. When we go to the individual hosting the green show, they tell us they used CA. With these people, we received the same rainfall on such and such dates. We all saw the rains ceasing, but their crops did not dry. They actually had a good harvest. The best farmer in this ward, Lameck Chigaba who won the prize at the green show did CA. All farmers who did CA have a good yield this season (In depth interview with village head, April 2014, ward 3).

In addition, I pointed out before that that most of these strategies adopted by farmers serve multiple purposes. In the case of CA, farmers believed that digging holes instead of ploughing keeps the soil intact and, in the event of *gukuravhu* (high intensity rainfall), this reduces runoff, soil erosion and ultimately land degradation. The following extract from an interview with a farmer sheds light on this issue:

> *.....Because you do not use ox drawn plough, ivhu haripindurwe* [soil is not inverted] *like what happens with the plough. With a hoe you do not rip the soil. When it rains the soil that is washed away is not much. If you use the same field that had crops the previous season when you do CA, it means there is no need to clear mashanga* [crop residues]. *These add manure to the soil* (in depth interview with winning farmer, 2014 Agricultural Show, August 2014, ward 3).

Nonetheless, there is more surrounding the adoption of CA by farmers in Charewa. There is a clear contradiction between what farmers in this study highlighted and literature on CA in Zimbabwe and beyond. For instance, the advocates of CA, mainly NGOs, see it as a coherent adaptive strategy to develop sustainable livelihoods. It is also believed to increase resilience to droughts and water use efficiency. My survey data shows that the majority of respondents agreed that they had adopted CA as a response strategy. Data also shows that farmers adopted CA at different points in their lives. However, when I asked whether the strategy was still being practiced, some farmers indicated that they had abandoned CA. More so, data on how often they had practiced CA also pointed towards some farmers saying very few times. Various reasons where cited by farmers to support their decisions to either continue or abandon CA and I will articulate these later on when I discuss constraints and enablements in the adaptation process. Over and above this, whereas CA is being promoted as an adaptive strategy to promote sustainable livelihoods under climate change, some farmers in the study portrayed it largely as a coping strategy.

7.2.6 Soil Management in the Context of Climate Variability

There are soil management strategies outside the discourse of CA that have been adopted by farmers in Charewa. I am saying these are outside CA because farmers are not employing them in an integrated manner as espoused in CA. Mulching is primarily being intensified to conserve soil and moisture in gardens. In the context of Charewa, this involves using plant residues and

harvested grass to cover beds containing horticultural crops such as beans, onions and leafy vegetables. In this way, plant residues and degradable grass are incorporated into the soils as organic matter during ploughing. Subsequently, farmers perceived this to be increasing the water holding capacity of the predominantly sandy soils and improving soil structure and conditions. In addition to mulching, farmers are increasingly watering (using tins) and irrigating (using pipes) gardens in the evening. According to farmers, the idea was to conserve moisture by watering at times when there was no direct sunlight to immediately draw out moisture.

To improve soil resilience to climate variability, farmers are using *murakwani* (manure from plant residues) shown in Picture 7.5 below. *Murakwani* is obtained from surrounding hills, forests and mountains. It was common during my fieldwork to see farmers looking for and gathering *murakwani* in the study site. According to these farmers, this traditional manure is widely obtained during the dry season and either stored for application in the fields just before the onset of the rainy season or applied immediately in gardens.

Picture 7. 5: Murakwani (Manure from Plant Residues)

Source: Fieldwork, July 2014.

For many households, the use of both cattle manure and fertilizer is a distant luxury. Faced with resource constraints, they usually skip applying compound D fertilizer when they applied manure in their fields. However, high intensity rainfall is eroding soils and leaving them infertile.

Concurrently, excessive rainfall is causing localised water logging and *kundondovera* (leaching). Some farmers have therefore resorted to applying both manure and fertilizer to curb these problems. To elaborate on this, one respondent highlighted that:

> *Mvura yegore rino yakakonzeresa kuti vamwe vaite nzara* [This year's rainfall caused other people to go hungry]. *Myself I was lucky because I put manure; I mean cattle manure and fertilizer on top. Ivhu racho harichapindirane nekuwanda kwemvura, ragarisa* [The soil is not in tandem with too much rainfall, it is worn out] (Life history interview, August 2014, ward 3).

In relation to *gukuravhu* (high intensity rainfall*)* again, farmers are constructing what they termed *mawater chani* (water channels). These water channels direct excessive run off away from the fields. Water channels are also being constructed in gardens particularly where farmers have experienced localised water logging.

7.2.7 Adapting Water Management Practices in the Face of Adversity

Farmers have adopted and are expanding varied water management strategies in the study site. Among them, rain water harvesting emerged as the most prominent adaptive strategy. Small pools or reservoirs called weir dams that are used to harvest rain water were cited by respondents. These were constructed at strategic sites across streams and rivers flowing through the study site. Weir dams are made of bricks and cement, and are primarily used to store water that is then pumped by water engines to irrigate horticultural crops in the dry season. In addition, there are private weir dams constructed in gardens by households. Furthermore, there were perceptions that farmers are embarking on expanding their weir dams and are now using them to irrigate their fields during mid-season droughts. To shed more light on water harvesting, one respondent had this to say:

> *…In 2008 that is when I decided to construct a weir dam. I actually sold cattle to buy the material for constructing the dam, pipes and a water pump. I knew every year, 3 to 4 months after the rains that the river would have stopped flowing so I needed to have a source of water for irrigation. But it was not just my decision to construct the weir dam. I approached the leaders in the community with my proposal. They agreed and told me that when I constructed my weir dam, I should allow water to continue flowing downstream for others to use* (Life history interview, August 2014, ward 3).

Another responded highlighted the following about enclosing water*:*

…Others were also doing it; they also enclosed water to put their pipes. I also said, my pipes cannot draw water unless l also did the same. So I enclose for a bit, then later on I let the water flow for others to use. It is the same thing others do, you see this stream, people move along it enclosing water then syphon it with their pipes (Life history interview, August 2014, ward 3).

In addition, another farmer noted this about weir dams:

…Yes I have another garden with tomatoes. It is located that side where you saw our Sabhuku [village head] *in the garden….Yes there is a weir dam I constructed. I then bought a pump. So I just put my pump in the dam, switch it on and I start irrigating* (Life history interview, August 2014, ward 3).

During the dry season, farmers dig *mifuku* (temporary sandy dams) in river beds to water their gardens as a coping strategy. This is more pronounced in drought years that farmers considered to be characterised by extreme water shortages for watering gardens and for livestock. Simultaneously, another strategy that is being used to deal with deteriorating irrigation water sources was creating sand bags reservoirs to store water for irrigation in the dry season. It was noted that this is usually done using sand bags by those at the upper catchment of the rivers and streams. Furthermore, though not widely used, catchment water conservation using traditional methods was hinted by some respondents. A local plant called *mahapa* is used to cover wells and weirs to prevent water being lost due to direct sunlight particularly in the context of increasing temperatures. More so, farmers practice *kudiridza magadhe manheru* (watering gardens in the evening) and mulching not only to conserve moisture but water as well.

7.2.8 Livestock Management Practices in Difficult Circumstances

Adaptive strategies for dealing with livestock management challenges posed by climate variability are evident in the study site. These deal with water, pastures, pests and diseases. Some respondents in the study recalled that *vakaisira mombe mvura mumadish* (they put drinking water for cattle in dishes) during the drought of 1992. Most sources that livestock could drink from were dry except Dorongoma dam. Still, water levels went down such that livestock got stuck in the mud. Famers resorted to fetching water from boreholes and filled dishes for the livestock to cope with this drought.

Apart from the above, fodder harvesting as shown in Picture 7.6 below, is a long established practice in this smallholder farming community. From the discussions and interactions with farmers, residues from maize, beans and groundnuts are commonly harvested and stored to feed livestock at times when pastures are low, usually in the late dry season. What the findings also suggest is that fodder harvesting is not a straight forward strategy. In drought seasons, crop residues are found in short supply and farmers have devised strategies to deal with that. For example, respondents converged on the perception that during the 1992 drought most crops had wilted by February such that there was no fodder to harvest. In addition, farmers noted that they were advised by extension workers not to feed livestock crop residues from fields with *fetireza yakange isina kunaiwa* (fields in which farmers had applied fertilizer but with no rain that followed) as these were going to poison livestock. In instances like this, farmers who harvest fodder practice strict 'rationing'. More specifically, livestock such as cattle are given fodder at times considered as critical, for example they are fed when farmers want to perform tasks such as farming.

At the same time, the increasing role of livestock feed supplements in the context of increasing climate variability has been recognised by government agencies such as the Department of Livestock Production and Development, yet only a negligible number of farmers have adopted this strategy. These farmers usually provide supplements to malnourished livestock in seasons with severe pasture shortages. Meanwhile, farmers are primarily purchasing treatments from the Veterinary Department to treat increasing worm infections and diseases attributed to high temperatures. In addition, since ticks are controlled by consistent dipping and farmers do not have control over dipping schedules, they cannot subvert the high production of ticks. Therefore, they are only able to deal with tick bone diseases by purchasing treatment from veterinary service providers as well. No traditional strategies to deal with livestock diseases were cited by farmers in the study.

Picture 7. 6: Harvested Livestock Fodder (Maize Residue)

Source: Fieldwork, July 2014.

At times, to cope with pests and diseases, farmers take chances and monitor livestock without treatment with the hope they get better. For some farmers this has worked at times whilst for some, they have lost livestock. The Department of Livestock Production and Development is also promoting the development of pasture legumes that thrive in semi-arid and arid regions. There is currently a demonstration site that has been developed for pasture legumes in Charewa. In addition, the department has embarked on growing a plant called Lakina. According to key informants from the department, Lakina is a multi-purpose plant used for soil conservation and, because it is high in protein, it is being used to feed cows and pigs. However, whilst it was noted by the key informants in the Veterinary Department that they are working with the Department of Livestock Production and Development towards cattle breeding using artificial insemination to improve adaptability characteristics and also replenish cattle herds, this strategy was not mentioned by farmers in Charewa.

7.2.9 Dealing with Climate Variability through Formal and Informal Networks

My field data illustrates that farmers are also coping and adapting to climate variability through participating in formal and informal networks. Three main social networks were alluded to by

farmers in Charewa and key informants at the sub-national level. In this section I therefore discuss the revival of *Zunde raMambo* (chief's granary), consolidated gardens and irrigation networks. The information, trust and norms of reciprocity that evolve from such networks have been characterised as social capital (see Bourdieu, 1977; Putman, 1995) and social capital theories have been applied in climate change adaptation (see Pelling and High, 2005b).

7.2.9.1 Zunde raMambo (Chief's Granary)

From what I gathered from elders during informal conversations and key informant interviews, *Zunde raMambo* (chief's granary) is a strategy used to deal with food insecurity that people in the area have always employed at the community level. It is an indigenous food security strategy. From conversations with respondents it emerged that, in polygamous households, they also keep *Zunde raBaba* (father's granary). In this case, wives work on the husband's land and crops are stored in the father's granary to be used as 'buffer granary' during times of food crisis. When the wives' produce is exhausted, they depend on food from the father's granary. When it comes to the same concept, but at the community level, households in Charewa contribute maize, sorghum, rapoko and millet to *Zunde raMambo*. The grain for this granary is collected by the chief's messengers. The grain is then given to deserving households, at the chief's discretion, in cases of droughts and other emergent crises. As well, grain from the chief's granary is used during communal ceremonies.

Elaborated discussions with respondents in the study divulged that *Zunde raMambo* had collapsed a long time ago. Nevertheless, there were divergences on exactly when and how it died. Some elders thought it collapsed during the war in the 1970s. They were of the perception that production was disrupted by the war such that no one could afford to spare grain for the chief's granary. Others thought that when villagers were forced into 'keeps' (protected villages) during the war, the total collapse of the chief's granary was inevitable. Yet, other respondents regarded the overall changes that accompanied *kuuya kwevachena* (coming of the white people) during the colonial period to have disrupted *Zunde raMambo*. Over and above this, although respondents had contradictory explanations for its collapse, the general view was that people in

the area suffered much in the droughts that followed independence in 1980 as well as droughts in the early 1990s because of the breakdown of the chief's granary.

Respondents noted that the chief's granary was only revived in 2007. The same concept that was used in *Zunde raMambo* before it collapsed was maintained when it was revived. According to respondents, it was revived in view of the hardships posed by perceived increasing droughts and declining crop productivity since 2000. At the same time, respondents were of the view that the continuity of *Zunde raMambo* as a coping strategy to address food insecurity particularly in drought years is under threat. The main reason cited was the dependence of farmers on external agencies for farming inputs to enable them to grow crops specifically for the chief's granary.

7.2.9.2 Consolidated Gardens

Consolidated gardens were formed in 2005 as noted by most respondents. There are two consolidated gardens in the ward, at Tareva and Kawazva. Whereas farmers said they were responding to the challenges associated with depleting water sources, it was evident that they embraced this strategy as a response to general financial insecurity. Respondents also noted that farmers' associations and cooperatives once existed and were vibrant in the 1980s and early 1990s. These included farming cooperatives and burial societies. This finding resonates with what other scholars have observed, namely, that African farmers traditionally have organised themselves into various groups and this practice has evolved into modern times, with financial institutions taking advantage of this form of cooperation to disburse credit to farmers through group liability (Speranza, 2010). However, farmers in Charewa admitted that these had long disappeared. Constant reference was made to the difficulties in households pooling resources together as an association or cooperative. There were perceptions that farmers in the ward generally *vakunyanya kuita mazvake mazvake* (there are increasing individualistic tendencies).

According to farmers, the concept of consolidated gardens was initiated by an NGO working on livelihoods and food security and, this was supported by traditional leaders and government agencies. My data therefore suggests that climate variability created conditions for the need to revive the cooperative ethic amongst farmers in the face of new forms of adversity. Farmers

agreed to come together, obtained land through traditional leaders and received garden fences, irrigation pipes, seed packs and fertilizer from the NGO. This was the birth of the two gardens in 2005 that to this day provide nutritious food and also income to farmers. According to farmers, as members of the consolidated gardens, they do not have to worry so much about water scarcity because they have irrigation pipes to draw water from distant sources. The benefits involve risk sharing to deal with constant market challenges as farmers sell their produce as a group. In terms of land scarcity to expand horticulture, farmers have been allocated individual plots in the garden. In addition, some farmers had their gardens fenced but not consolidated in Mazhambe and Nyakanyanga villages hence they are able to do farming without disruptions from livestock.

7.2.9.3 Irrigation Networks

The necessity to establish some mechanisms to manage increasingly depleting irrigation water sources has increased in Charewa in the context of climate variability. Farmers have thus come up with informal irrigation groups and monitoring frameworks. Through these groups, farmers constructed what they termed weir dams that they use to harvest rain water. There were perceptions that the formation of irrigation groups was necessitated by hardships encountered during drought years. As one respondent noted:

> ..*I am also saying that during these drought years there is something very important which farmers started to do. Farmers started to do water harvesting in groups. They formed groups of 4 or 5 and bought cement to construct weir dams. Then they used their pipes to draw water for irrigation* (In depth interview with Community Representative, April 2014, ward 3).

Furthermore, as mentioned in chapter 6, competition over water sources is intensifying in the area particularly because of the rapid drying of irrigation sources. After this realisation, farmers agreed to design irrigation roasters whereby farmers take turns to water their gardens. Both farmers that belong to irrigation groups and non-members are part of this informal water regulation mechanism. Basically farmers are each allocated days for watering their gardens. This is particularly done between July and October.

7.2.10 Using Trees to Deal with Climate Variability

Respondents in the study alluded to Jatropha (locally known as *mujirimono* and known scientifically as Jatropha Carcus.L), *musawu* (ziziphus mauritiana), *moringa* (moringa olifera) and *magonje* (cactus) in the discussion of coping and adaptive strategies. These were considered as drought resistant and therefore suitable to grow in the area, particularly with the prevailing climate regime. Key informants mentioned that Jatropha for example, is well adapted to arid and semi-arid climates and can grow on a large range of soils, including marginal soils, provided the soils are well drained. Benefits derived from drought tolerant trees cited by respondents in Charewa included prevention of soil erosion during *gukuravhu* (high intensity rainfall) and harvesting of fruits to supplement household food requirements. There were also sentiments that drought resistant trees, in particular Jatropha, were being used for reclamation of land degraded by high intensity rainfall.

However, further discussions and interactions exposed that these trees were chosen for other purposes as well. It was widely believed that planting trees, so much advocated by the Environment Management Agency, addressed the depletion of forests. Respondents also highlighted that they planted *moringa* (moringa olifera) on their yards and used the tree for medicinal purposes. Cactus (Picture 7.7) and Jatropha (Picture 7.8) – see below – are used for live fencing on gardens, whilst *musawu* (ziziphus mauritiana) was favored for its fruits consumed in the dry season. Although the issue was not pursued at length during interviews, there were indications from key informants in the Ministry of Agriculture that expanding *masawu* trees provided opportunities for expanded crop and non-crop livelihood diversification. Subsequently this would improve farmers' ability to deal with food insecurity in the context of increasing droughts. Related to this finding, in Chiredzi, the Coping with Drought and Climate Change Project (2013) revealed how a fruit orchard (mango) land use system integrated with cassava and vegetables is helping vulnerable farmers adapt to climate change.

Picture 7. 7: Cactus (Magonje)

Source: Fieldwork, July 2014.

Picture 7. 8: Jatropha (Mujirimono)

Source: Fieldwork, July 2014.

Related to the above, the case of Jatropha in this thesis suggests that although farmers gave the general impression that they adopted Jatropha to respond to the intertwinement of climate variability and deteriorating ecological circumstances, these may have been overshadowed by economic imperatives. The quotation below from a respondent sheds light on this aspect:

> *...I heard about mujirimono* [Jatropha] *a long time time ago. In fact we had a few trees in my father's garden. But I did not see much value from mujirimono. You know, it was just another tree. I only*

realised the benefits of mujirimono when they [the government] *started talking about Jatropha diesel. Word got around that farmers growing Jatropha would sell the Jatropha seeds that would be used to make diesel. It was a good opportunity to make money. Then, I was not getting anything from selling maize. But you know, zvedhiziri zvakashaya basa izvo tikazoguma takugadzira sipo nemafuta nezvimwe zvaisambotengwa* [the diesel endeavour did not achieve anything and we ended up making soap and other stuff that no one bought]. *I was just trying; I thought I could get money. If you remember 2004, the situation was bad* (Life history interview, August 2014, ward 3).

The above quote clarifies some of the motives behind the adoption of Jatropha. This finding should not be suprising given that the initiation of agro-fuels by the government of Zimbabwe was meant to reduce foreign fuel dependency. This imperative was particularly critical as a quick fix in Zimbabwe during the country's economic crisis of 2004 to 2010 (Zibo, 2012). For the Ministry of Energy, climate change was not the main objective because the extraction of liquid fuel from coal, a fossil fuel, was adopted as a third approach after Jatropha and sugarcane growing. Beyond the above quote, unlike other strategies being expanded, intensified or revived, farmers are largely maintaining Jatropha trees they have so far planted on individual plots. According to respondents, the reason was that that they had failed to reap the 'promised' economic benefits from Jatropha. Nonetheless, although farmers were of the perception that they have failed to obtain economic returns, Jatropha remains important in the realm of adaptation to climate variability in Charewa.

7.2.11 Back to Basics: Increasing the Role of Indigenous Knowledge Strategies in the Face of Adversity

The role of indigenous knowledge has increased in the context of climate variability in Charewa. The idea that people in rural agrarian economies have often survived harsh and changing climatic conditions by developing ingenious indigenous adaptation measures has been widely mentioned in literature. A number of scholars (see Boillat and Berkes, 2013; Nyong et.al, 2007; Orlove et.al, 2010; Speranza et.al, 2010) have also recognised the role of indigenous knowledge in adaptation to climate change and variability. Indigenous knowledge consists of the body of knowledge, beliefs, traditions, practices and institutions developed and sustained by indigenous, peasant and local communities in interaction with their biophysical environment. Nyong et. al

(2007) show that the people of the African Sahel have used indigenous knowledge in natural resources conservation measures serving the multiple purposes of reducing the emission of greenhouse gases from anthropogenic sources, carbon sequestration and carbon substitution.

7.2.11.1 Rain Seeking Practices

When people in Charewa encounter both difficulties and good times, they cry to and praise their ancestors and God. They have historically held *mabira ekuteta mvura* (ceremonies to seek rain) in Dzimbawe and visited other sacred places for the same purpose. However, from conversations with respondents, this practice became inconsistent over the years. Respondents believed that after the insistent dry spells in the years that followed the drought in 2008, people had to resume visiting Mutimuchena in Mt Darwin and conducting ceremonies in Dzimbawe. The heavy rains received in 2012/2013 and 2013/2014 seasons, which were described by some elders as markers of good seasons, were attributed to these ceremonies. In the final analysis, the foregoing should be read in terms of revival of traditional rain seeking practices in the context of increasingly changing climate variability. Interestingly, as noted in chapter 5, respondents interpreted changes in climate variability as reactions of *Vadzimu* (ancestral spirits) to provocation and here farmers also perceive them as providers of rainfall. Nevertheless, whilst there is a revival of traditional rain seeking practices, there was an equally common perception that people are increasingly seeking God's intervention through prayers for rains within churches.

7.2.11.2 Reading Rainfall Patterns

Although climate variability is threatening the very sources used to predict climatic events, the role of indigenous indicators used to read rainfall patterns remains significant in Charewa. There were indications that, as rainfall patterns grow increasingly unpredictable and unreliable, it was important to draw on local practices on interpreting rainfall events. Elders and spiritual leaders in particular were the ones perceived to be in positions to read and predict rainfall seasons. Birds, animals, trees and other natural features were cited as local indicators upon which patterns of rainfall were interpreted. For example, the abundance of wild fruits that mature just before the rain season is interpreted to mean the impending season would have low rainfall. I also draw attention to the extract below from an interview with a respondent in the study site:

> *What happens here is that we have a mountain called Maizi, if it goes on fire that is a sign that we will have good rains. That is according to our traditional beliefs of the spirit mediums. There is another mountain over there called Mutungagore, if it goes on fire again, that is a sign of good rains. There is also another one in Chindenga. The fire is natural, it occurs on its own. When that happens people should prepare to plant early* (Elder in Informal Group Conversation, April 2014, ward 3).

Concurrently, prophets within churches were believed to read and interpret rainfall patterns. It was highlighted that they are shown signs in dreams. To elucidate on this I refer to some of the views below by a spiritual leader in Charewa:

> *We are sometimes told to go to a certain mountain and pray. There we are given signs of what will happen. We take seeds for our crops and we pray so that we receive good rains. We also pray so that in the event that there are people with divisi* [magic], *it will not affect our crops. All that is God's wisdom* (In depth interview with spiritual leader, April 2014, ward 3).

Consequently, from these predictions made by elders and spiritualists, farmers come up with appropriate strategies. For example, if it is predicted that rainfall will be low or little for a particular season, households harvest and dry *masawu* (ziziphus mauritiana) fruits, dry vegetables, and buy and store grain in anticipation for poor harvests. Nonetheless, there were anxieties raised by some respondents on the reliability of these predictions, whether they are done in the realm of traditional practices or praying to God. On the one hand, some respondents were of the view that these predictions were too diverse to provide reliable predictions on rainfall. On the other hand, others simply doubted the traditional rain seeking practices. In a life history, a respondent had this to say:

> ….*Other people say chivanhu hachichatevedze* [tradition is no longer being followed] *but you see, when it is about to rain that is when they do their chivanhu* [traditional ceremonies]. *They beat drums and do their dances just before the rain season, when it is about to rain, then coincidentally it rains. Yet, it was going to rain anyway* (Life history interview, August 2014, ward 3).

Even supposing the above, quite a number of respondents believed in the efficacy of traditional rainfall predictions and the role of God. As one respondent stated:

…This season those elders responsible for interpreting rainfall had told us that there would be abundant rainfall and for sure we received it. We got good rains this season (Life history interview, August 2014, ward 3).

Another respondent added that:

….Yes we thank God for good rains. There are also prophets called Rain Prophets. There are many in this area. They advise us on the type of rainfall we are going to experience. And if they give us dates when the rain is supposed to start, it actually starts around those dates. If there is going to be less rain, they advise us and if it is going to be good they also tell us. When the rain is going to have too many storms we would have already been told by prophecies (Life history interview, August 2014, ward 3).

In a related manner, a spiritual leader added that:

… Some of us who go to church and possess the spirit of prophecy can actually tell that there is adequate or inadequate rainfall in the coming season. We can precisely tell that and advise people to plant early and which type of crops to plant. If the rain is not adequate we advise people to grow short season varieties (In depth interview with spiritual leader, April 2014, ward 3).

7.2.12 Responding by Doing Nothing

My survey data indicates that 11.7% of the respondents said they were not doing anything. There are several dynamics implicated in this response. Firstly, two of the respondents who said they were doing nothing had indeed indicated that they were experiencing changes in climate variability but these were not imposing any livelihoods challenges. During further discussions, one of these two respondents stated that he was getting enough food and the only problem he was experiencing was taking it to the market because of old age. As an adaptive strategy, he has resorted to giving his produce (mainly beans and tomatoes) to his daughter-in-law to sell for him at *Mbare Musika*.

The second respondent indicated that low rainfall, late onset of rainfall season, early rainfall season cessation and droughts were not affecting his farming or his livestock. To support that climate variability was not posing problems, he mentioned that he actually gave up part of his garden land to his nephew. He was producing enough despite climatic uncertainties and did not require larges pieces of land. His only problem was getting his pension money since he retired

from work in 2003. Therefore, when his pension money was stopped in 2007 his children assisted him. He started receiving his pension money again in 2009 but still it does not come on time. In these instances, he also survives on remittances from his children.

Secondly, the other respondents who said they were not doing anything had observed changes in climate variability and were experiencing negative livelihood outcomes. A follow up question that I asked respondents who said they were not doing anything was 'why'. A critical analysis of the responses I got from some of these respondents suggests that their reflexivity is fractured as espoused by Archer (2007). Whilst some respondents did not provide much detail, I picked up from others some spiritual-religious connotations for not doing anything. It appeared as if they were disillusioned and had no control over what was happening in their lives. I remember one respondent who stated that:

> *Why should I fight against zvinhu zvakanyorwa mumagwaro matsevene* [something written in the holy Bible]. *If it is already decided no one will change that. These are the last days prophesized in the Bible. This moment was already decided. No matter how hard our lives become, this is God's will. Why should we care about making our lives on this earth better, we should care that when we die, we find peace* (Respondent during survey, July 2014, ward 3).

The above quote bears evidence on how some farmers have resigned to fate and perceived themselves to be entangled in circumstances beyond their control. But still, my follow up question to those who had said they were not doing anything pertained to their hopes for the future. Most of them hoped that things got better and hoped to get money. Some said they wanted brighter futures for their children, wanted to see their children completing school and getting good jobs. Paradoxically, they hoped for a better life even if they were not doing something tangible to deal with their situations. They did not think climate variability would be reduced or would stop altogether but still, somehow, they wanted brighter futures for their children.

7.3 Conclusion

In this chapter I have shown that farmers in Charewa have devised versatile coping and adaptive strategies to deal with increasingly changing climate variability. Given that climate variability is

only one factor driving livelihoods changes in this smallholder farming area, the chapter has shown that farmers are not only responding to climate variability. In essence, farmers are adapting to climate variability and simultaneously navigating difficult socio-economic landscapes. Therefore, whilst some of the strategies I have noted can be considered pertinent towards addressing the negative impacts of climate variability on livelihoods, some are strategies developed to address non climatic aspects. Fundamentally, farmers in the study have adopted multiple strategies in response to a range of factors and these strategies serve multiple purposes. For instance, while crop and livestock diversification has been expanded to curb food insecurity and maintain and expand incomes in the face of harvest failures and livestock losses, it is also a response to the fluctuating prices of field and horticultural crops in the country. At the same time, while some of the strategies are novel, a number of them are neither recent nor new. In this regard, coping and adaptive strategies in Charewa should be principally read in terms of intensification, extensification, re-organisation and revival.

CHAPTER 8: TOWARDS UNDERSTANDING THE STRUCTURES, PROCESSES AND CONDITIONS UNDERPINNING THE PROCESS OF ADAPTATION IN CHAREWA, MUTOKO

8.1 Introduction

This is the final empirical chapter of the thesis. Besides revealing how adaptation is a complex process fraught with various constraints, at the end of this chapter I link all the empirical chapters using one case study (of a particular farmer) drawn from my field work in Charewa. In the preceding chapter I have identified the diverse strategies employed by farmers in Charewa in the context of increasingly changing climate variability. Without a critical analysis, these strategies appear to suggest that adaptation is a straight forward process. One may easily be tempted to believe that adaptation is a smooth process as this is a common strand found in literature on climate change adaptation in Zimbabwe. Most work on adaptation fails to take into account how adaptive strategies are produced, situated and sustained within specific structures, practices, dynamic relations of power, historical conditions and cultures, as scholars such as Wolf (2011) have observed. In light of this, when I asked respondents in my study on the strategies they had adopted, I also probed on whether the strategies were still being practiced or had been abandoned and why. I also delved deeper to understand the major opportunities or enablements farmers had encountered in their strategies. My desire to understand how adaptation was evolving made me to search for nuances on the main constraints farmers had faced and were currently facing.

That being the case, my main thrust in this chapter is to empirically analyse adaptation as a complex process underscored by various structures, processes and conditions. I do this using the sociological theory of Margaret Archer. The concept of complexity as used in this thesis broadly speaks to 'an aspect that cannot be described by a few rules but a network of interrelated components' (Levin 1999:231). In this regard, to expose the complexity of adaptation, I draw primarily on qualitative interviews and conversations as well as field observations. My premise here is that complexity is better captured qualitatively. This approach is consistent with some scientific ways of dealing with complexity, such as adaptive management and fuzzy logic as

embraced by Peloquin and Berkes (2009). Therefore, qualitative methods elicited compelling evidence to allow me to argue with conviction in this chapter that adaptation as a complex process is underpinned by various structures, processes and conditions which are both constraining and enabling. Nevertheless, it is important to highlight that farmers in Charewa do not simply accede to the various enablements or constraints presented to them and allow these to determine their lives.

8.2 Socio-structural Constraints and Enablements

My findings illuminate that structures are to a great extent complicating the process of adaptation in Charewa. This finding is corroborated in other researches. Osbahr et.al (2008) noted that underlying structural issues, such as weak markets for agricultural commodities, poor infrastructure and limited access to micro-finance exacerbate the difficulties for smallholder farmers in adapting to climate change. In this section, I therefore present findings on household facets, land scarcity, natural resources tenure arrangements, crop characteristics and agro-ecology, market structures, institutional actors and socio-economic events, and availability of extension services, as socio-structural constraints and enablements underpinning the process of adaptation. Importantly, I expose how farmers are able to circumvent various constraints they encounter and at the same time actuate several enablements in their endeavour to adapt.

8.2.1 Household Factors

Household labour shortage was perceived as constraining in the adaptation process by 63% of the respondents in the study; 37% thought it was not a constraint. Household labour shortage was cited across all wealth categories in both the survey and life history interviews conducted in Charewa. In this case, household labour was linked to household structure more than to wealth. Household structure in this thesis is understood as a combination of how many people were living in the household (household size) and how many members of the household were productive (that is, composition of the household). Overall, my survey data reveals that household sizes are small, with an average household size of 1.7. At the same time, from the survey, 58% of the respondents noted age as a constraint and 42% thought it was not. Similarly, 57 % perceived household size as a constraint whilst 43% thought it was not a constraint.

Further discussions with respondents drew attention to the fact that whilst in some households the presence of young children was limiting, in others the presence of elderly members was perceived as posing challenges. At the same time, almost all the households headed by respondents above 76 years cited labour shortages as constraining adaptive strategies. In all these cases, young children and the elderly were not able to provide labour required in fodder harvesting, Conservation Agriculture (CA), intensified and expanded horticulture and farming multiple fields. Soil conservation strategies such as the use of *murakwani* (manure from plant residues) were cited as requiring a lot of labour to collect it from hills/mountains and then applying in fields and gardens. CA was regarded as laborious and involving many processes. Digging holes on dry land, and then mulching whole fields, required significant labour that most households stated they could not easily provide. Farmers were also of the perception that the labour demands under CA forced them to neglect other strategies. For example, it was difficult to balance the labour requirements of hoeing and mulching fields and at the same time work in gardens that required serious mulching towards the end of the dry season. This finding contradicts views by Doets et.al (2000) who argued that CA is labour saving. To shed more light on labour constraints, I refer to the following extract from life histories:

> *....I do not have pipes my daughter. Ndinoita zvekundojega nematini* [I draw water using tins]. *It is just me and my husband who can work, only the two of us. We have grandchildren but they are in primary school. We have another one in Form One who sometimes helps, but it is just here and there. We leave her home because she has to read her books* (Life history interview, August 2014, ward 3).

Simultaneously, lack of household wealth in the study was viewed by most (62%) respondents as constraining the opportunities for crop and livestock diversification and the ability of farmers to construct and expand weir dams and purchase pipes so as to irrigate crops.More so, respondents thought that lack of income complicated their situations when they wanted to address food deficits by purchasing grain in times of drought and obtain vaccines to manage increasing livestock and, pestcides to control crop diseases. Although some farmers indicated that they engaged in casual work in resettlements and small-scale commercial farming areas, they recalled that the general situation was difficult such that they did not obtain sufficient income to meet household food requirements in times of droughts. The perception that household wealth

constrained farmers reverberates with other scholars who argued that, for individuals, their capacity to adapt to climate change is a function of their access to resources (Adger, 2003). Still other scholars suggest that resources alone are of questionable importance (Patt and Gwata, 2002).

Furthermore, poor and worse off households in the study were mainly of the perception that lack of income constrained their ability to hire labour so much required in labour intensive strategies such as CA, expanded horticulture and undertaking soil management strategies as well as harvesting fodder for livestock. Here my argument is that when it comes to hiring labour, farmers are not influenced in the same manner by social structures (or lack of income in this case). At the same time, lack of income is constraining farmers' access to technology, in the form of pipes and engines to pump water. This confirms that responding to a varying climate is often constrained, not only by varying rainfall but also by other more pressing factors including, in the case of small scale farmers, the ability to gain access to resources that would assist them in their agricultural activities (Vogel and O'Brien, 2006). This is negatively affecting the intensification of micro irrigation and expansion of horticulture into fields as well as drawing water from distant sources in Charewa. To shed more light on this finding, I refer to the response below:

> *…We cannot buy enough seeds for the garden or spray our tomatoes when there is Respider* [aphid that affect tomatoes].*Not only that, planting again is not easy when you do not have money. Where do you get seeds to plant a whole field when you had struggled to buy seeds in the first place? We have 2 cattle only; we cannot sell those just to buy seeds; how we will be able to plough?* (Life history interview, August 2014, ward 3).

Nevertheless, farmers in Charewa are not passive victims of structural constraints in the adaptation processes. Whilst some farmers cited hiring labour as one way of dealing with labour constraints, some have abandoned CA, some were reducing how often they use CA in the farming seasons and have some reduced the size of farm land under CA since the initial year of adoption. Similarly, with other strategies such as fodder harvesting and soil conservation, farmers were of the view that they just have to manage with available family labour. At the same time, some households cited that for expanded horticulture and farming and, maintaining

multiple fields, they hired labour at critical times such as weeding and harvesting. The common labour hiring system that was cited by respondents is called *madoka-doka* (literary morning to evening). With *madoka-doka* the hired worker works for an entire day for a flat fee regardless of the size of the land. During the time of the field work the fee for *madoka-doka* was US$ 4.

Other farmers dealt with constraints in household wealth through borrowing inputs and others responded by using *mbeu yemudura* (seeds from harvested grain) to do replanting. Those with irrigation pipes rented them out in exchange for farming inputs such as fertilizer and seeds. In the process of increasing diversification, most farmers noted that they processed different crop combinations of poultry feed to deal with the costs associated with purchasing feed. In this case, farmers do not passively accede to these objective conditions but actively construct life strategies in the process of adaptation.

On a different note, most (60%) of the respondents in the study regarded farming experience to have simplified the process of adaptation whilst the remainder perceived otherwise. According to farmers who cited this as an enablement, the re-organisation of crop production, transition to CA and diversification of indigenous and hybrid varieties were permitted by experiences and knowledge deriving from years doing farming in this semi-arid, smallholder farming region. The experience of living in and farming in this locality for a number of years coupled with acquired knowledge from trainings meant that they knew well the types of soils suitable for new crop varieties, early maturity crops and drought resistant crops. Therefore, they were not only able to assess soil moisture content but to allocate the new crops to fields according to moisture requirements.

8.2.2 Land Scarcity

This was mentioned as a constraint by over half of respondents (54%) in relation to their attempts to expand horticulture and maintain multiple fields. For horticultural crops in gardens, it was widely considered as ideal to expand near water sources yet garden spaces around these were already taken. Overall, there is no virgin arable land for farming that is readily available within the ward. All the same, it is apparent that farmers are aware of the structural constraints

entailed in land scarcity but they choose to display their agency in confronting these. They have clear strategies to deal with land scarcity. As a result, farmers stated that they resorted to renting gardens. However, whilst renting gardens was a common practice, few respondents indicated renting crop fields to deal with land scarcity. It was cited that different terms were negotiated between farmers when renting gardens such as cash payments, paying using produce grown in the garden and payments using farm inputs notably fertilizer and seeds. To support this, I refer to the following statement from a respondent:

> *….What you have to do is just negotiate with the owner of the garden and agree on certain terms. From what I have been doing so far, I give the owner of the garden 2 bags of fertilizer, one D* [Compound D] *and one AN* [Ammonium Nitrate] *to rent the garden for 3 months. But sometimes there are disagreements; garden owners may start demanding more that is why I have to involve traditional leaders in the community* (Life history interview, August 2014, ward 3).

Another respondent stated that:

> *...Farmers are used to this. They rent gardens to each other but not on a permanent basis. People agree on a specific period like a season or two seasons or whatever period they want. These agreements can be renewed each season depending on whether both partners are satisfied* (In depth interview with farmers' chairperson, April 2014, ward 3).

Again, another respondent added that:

> *....I just find somewhere to rent… Aaah wherever you get someone who is willing to rent land to you. Then when we agree on the terms I cultivate on the agreed portion. In most cases I have paid using produce but sometimes he demands a bag of fertilizer. I usually rent that side near Kakanda, I think ndakarenda 2 foro* [I think I rented 2 fallows] (Life history interview, August 2014, ward 3).

8.2.3 Natural Resources Tenure Arrangements

Access to land and water sources are fundamental in the adaptation process in Charewa. As noted by other scholars, much adaptation hinges upon the ability of farmers to use land and water in new, different or flexible fashions (Crane, 2013). In Charewa, tenure arrangements regarding water were cited by 56% of respondents as enabling the process of adaptation and 44% thought differently. Additionally a significant number (78%) of the respondents also cited land tenure as enabling their adaptation.

Following that, water from streams and rivers is utilised by farmers through open access whilst wells in gardens are regarded as household private property. Access to water in sacred springs is mediated through traditional leaders. My findings divulge that the existence of an open access system on streams and rivers permitted farmers to construct weir dams and enclose water at strategic points along the course of the river. The benefits of open access to water were evident when some farmers, for example, highlighted that they encroached into Samatanda and Macheka villages when they extended their pipes up Chishande River. In addition, due to the existence of open access, farmers freely constructed *mifuku* (temporary sand dams) in river beds and drew water for their livestock from communal boreholes during droughts.

Pertaining to land tenure in the process of adaptation, respondents widely perceived it to be enabling. Households have access to their own pieces of land that are passed from generation to generation in Charewa. These pieces of land are obtained from *Sabhuku* (village head). All in all, farmers held that land belongs to the government and, at the same time, it belonged to *Vadzimu* (ancestral spirits). It was very common to hear respondents in ward 3 saying *nzvimbo ino ndeya Nehoreka* (this land belongs to Nehoreka). Having said this, my data exposes that land tenure arrangements were flexible and allowed for people to adopt multiple fields, for example, expanding to *minda yekugomo* (mountain fields) through negotiating with the traditional leaders. In addition, when farmers developed consolidated gardens, they obtained land through the traditional leaders. Furthermore, through open access, farmers harvested wild fruits from forests to supplement household food deficits in times of droughts and harvest failures.

Nevertheless, as I noted in chapter 5, access to land is not as equal for everyone as was portrayed by most respondents in the study when I discussed adaptive strategies with them. Here the contradictions are clear. When I discussed access to land in general, respondents noted that there was unequal access to land that worked against women in ward 3. However, when I discussed access to land in the context of adaptation, respondents gave an overall impression that the system of access to land was open access and beneficial to everyone. Yet, access to land remains highly gendered in the study site and this extends to gendered access to water as well. Although a negligible number, some women in the study noted that they owned small pieces of land, but this made it difficult to diversify crops, farm multiple fields and expand horticulture. Access to water

in family wells is controlled by male members of the family. To clearly explicate on how the systems of access to land are constraining some women in the process of adaptation, I refer to the story in Box 8.1 below.

Box 8. 1: Vaina's Story

Vaina[31] was born in 1951 in Pasirayi village. She never attended school and according to her: *Our father said he will never educate female children, they would become prostitutes. But my three brothers went to school. My other 2 sisters went to school as well but when it came to me and my younger sister, my father said he could not send us to school because there was no profit in doing so*. Vaina got married in 1964 and moved to her husband's patrilineal home in Suswe (Mudzi district). However her husband died in 1987 and her father asked her to come back home and she did so with her 4 youngest children. As she said, *I had to come home because my husband had no brother who could take me for levirate marriage*. When she came back home she stayed with her parents until they died in 1991 and her eldest brother took over the parents' compound. Vaina was allocated a small piece of land to build her own house, cultivating crops and a small portion for growing vegetables in the family garden by her eldest brother. Vaina felt that she was unfairly treated. As she highlighted:

I do not want to depend on anyone. I can work on my own, but how do I do it? When our father died, I was given a small piece of land on the upper side of our father's land. This is rocky and I cannot grow much, just little maize and groundnuts. How do you grow something on land like this? I cannot ask for land from Sabhuku [village head], *he will say get it from your brothers; they have land, don't they? As you can see, this place is where I grow tomatoes, do you see where the water well is? I have to carry water tins all the way from there. How much can I grow doing that every day? I have no say in these things. Am just shirikadzi yakadzoka mumusha* [am just a widow back home].

……I have no cattle of my own; they all belong to my brothers. Life is not good when you are a woman here.So, when it is ploughing time, they plough their fields first, it is difficult to plant early like others. You have to wait for them [brothers] *to come and plough for me. When I think about it, I am the one who brought these cattle in this family. When I got married, my husband gave them a lot of cattle. But who do you tell that to? I just sit in my home. I do not beg from anyone. It is embarrassing to beg.*

Source: Fieldwork, August 2014.

[31] Not real name.

8.2.4 Factors Related to Crop Characteristics and Agro-ecology

When farmers in Charewa resorted to particular strategies, they were expecting that they would improve their lives and livelihoods. However, as some farmers have realised, early maturity crops are easily affected by pests, diseases and grain borers. Farmers highlighted that 4series, known locally as *Tsoko* (monkey), *inondopfukutwa iri pamuguri muminda* (it is affected by grain borers whilst still in the fields*).* After harvesting, 4series also requires multiple applications of grain protectant. This is costly to farmers; yet increasing the level of grain protectant was viewed as the main strategy to deal with grain borers. Without that, the next option was abandoning growing that maize variety altogether. In addition, short season varieties that are suitable in the context of increasingly early cessation of rainfall seasons were generally regarded to produce low yields and having low nutritional value as compared to other varieties.

With Jatropha, its ability to thrive in arid regions enabled its adoption, among other factors. Farmers were of the perception that it was beneficial in preventing soil being eroded during *gukuravhu* (high intensity rainfall). However farmers noted that, besides being easily affected by pests, Jatropha permanently destroyed soil. It was cited that *muminda mamborimwa jatropha hapana chinondobudamo* (in fields were Jatropha was once grown, nothing else survives). Jatropha was regarded as exhausting all soil nutrients and this made it difficult to grow other crops. Yet farmers cannot afford to lose agricultural land. If anything, in view of expanding horticulture into fields, farmers need all the land to be cultivatable. Therefore, a number of farmers have halted the expansion of Jatropha in response to these inherent constraints as well as other issues related to markets. Other farmers have abandoned Jatropha altogether.

In addition, agro-ecological conditions emerged as constraints in the process of adaptation in this smallholder farming community. Pertaining to growing short season and drought resistant varieties of sorghum called *masiya*, farmers cited Quella birds as a major constraint. Quella birds were described as sorghum eating birds that move in groups and are very common in Charewa and Mutoko district as well. This kind of sorghum particularly favours ecological conditions in arid and semi-arid regions, but as one respondent noted:

> *….That sorghum variety has a problem with birds because they like it a lot. They like that sorghum; that is why you see that people are finding it difficult to grow it in this area. If you grow sorghum as*

an individual, you will not harvest anything. These birds will give you problems (In depth interview with village head, April 2014, ward 3).

Furthermore, most fruits used to supplement household food requirements and incomes in years of crop failures are seasonal. For example, most mangoes in Charewa ripen between November and December whilst *masawu* (ziziphus mauritiana) ripen between June and August. On another note, those farmers who viewed agro-ecological conditions as providing opportunities for adaptation cited type of soils, for example, *mushapa* (red clay soil) suitable for drought resistant sorghum. In a related manner, the topography of the area provides some advantages. Fields on higher elevations, for example *minda yekugomo* (mountain fields), were perceived to provide farmers with security in the event of water logging in low-lying fields.

Nonetheless, farmers do not let seasonality of fruit trees and Quella birds halt their endeavours to adapt to climate variability and expand their strategies. *Masawu* (ziziphus mauritiana) fruits are harvested and dried for later consumption and sale. More so, the main strategy to deal with Quella birds cited by farmers was waiting in the fields even though that was problematic in view of labour shortages. The other way was to trap these birds using various traditional methods. Still, this is cumbersome and so far the strategy has not worked for farmers.

8.2.5 Market Structures

Commodity buyers and markets were viewed as constraints by 63% of the respondents and 37 % thought otherwise. Farmers indicated that when they adopted small grains, in particular drought resistant sorghum and millet that were being promoted by both NGOs and the government, they were under the impression that there were ready market structures for these grains. However, to their disappointment, small grains are difficult to sell. In a related manner, prices of horticultural produce were unstable and were generally perceived to be low.

In addition, geographical capital (discussed in chapter 5) is very poor in Charewa thereby constraining farmers in my study. In terms of physical capital, farmers in Charewa are not only geographically isolated from markets for horticultural produce, but they highly depend on one

main market located in Harare. Political capital, that is, market infrastructure constructed by the local authorities at Mutoko growth point was perceived as way to small. The situation is compounded by the fact that the population at the growth point was limited and unable to absorb field crops, livestock and horticultural crops from Charewa. Furthermore, some respondents were of the perception that residents at Mutoko practiced agriculture such that they did not readily buy produce from communal farmers in Charewa.

Furthermore, conditions at *Mbare Musika* were chagrins to almost every farmer in the study. Respondents cited that there was no security at the market, farmers do not have anywhere to safely keep their produce and proper accommodation is unavailable. To shed more light on this, I refer to the following response form a key informant:

> ..... *There is also a problem with the market place itself. With all the money that people pay we expect the standard of the market to be high but you find that it is an open place where farmers are exposed to poor conditions like rain. There is also the problem of thieves who habitually steal from farmers. You also do not have the support from the council police who seem to connive with the thieves. These farmers do not have anywhere to sleep. You just sleep in an open space where it is possible to just find yourself without your shoes or bag tomorrow* (In depth interview with key informant, April 2014, ward 3).

Another farmer added that:

> *…That is the only market I take my produce to. Some people go to Chikwanha and Highfields but it is quite a challenge to get there. You may not get transporters. When we get to Mbare the challenges I face include not able to get accommodation. You can get there sometimes and your produce is stolen. And also the price of tomatoes, you can actually see that your tomatoes are very good quality but you do not get the corresponding price for them. What happens then is also that the security is not good, even if you do not want to sell, the buyers wait until you reduce the price. Because there is no adequate security, the buyers also victimise you* (Life history interview, August 2014, ward 3).

Nonetheless, whilst the above quotes paint a grim picture of how market structures are affecting horticultural expansion as an adaptive strategy, my findings reveal that farmers are not trapped in these structured circumstances and the future of this strategy is not predetermined. There are various novel ways farmers utilise to deal with poor market prices. Some of the farmers indicated

during life history interviews that they sometimes withheld their produce until prices were better. In this case they applied crop protectant and stored their produce. Further discussions with respondents however showed that this was easiest to do with crops like groundnuts, beans, bambara nuts and cowpeas. It was impossible to do this with tomatoes, pepper and fine beans. More so, with root crops like carrots and onions as well as cucumbers and butternuts, farmers were able to withhold produce for a limited number of days. It was not possible to withhold produce for days whilst still at the market, as the market entry fee is paid on a daily basis and therefore farmers incurred costs. Respondents cited that when they decided to take produce such as beans back home to store and wait for better prices, they incurred additional transport costs. Under normal circumstances, farmers are not charged for transport costs back home. Furthermore some farmers, though negligible, indicated that when prices were so low that it made no sense to incur costs for accommodation, food and market entry for a number of days, they 'dumped' tomatoes in particular by selling them at very ridiculous prices. Lastly, farmers indicated that with leafy vegetables, when prices were poor they harvested them and dried them, only to sell them later at *Mbare Musika*. Dried vegetables were deemed to fetch reasonable prices, and on a number of times, compared to fresh ones.

Furthermore, I have alluded to the fact that when farmers are adapting to climate variability, they are also navigating socio-economic terrains. This is similar to what Nielsen and Vigh (2012) termed 'social navigation'. Therefore, with Jatropha, my findings revealed that farmers were bent on expanding income opportunities even though they noted its benefits in responding to climate variability. Nonetheless, respondents in informal group discussions and key informant interviews expressed discontent with the Jatropha market. When farmers started to expand Jatropha beyond live fences, it was perceived that selling Jatropha would bring great benefits to these smallholder farmers in Charewa. Related to this, other scholars have noted that the government of Zimbabwe believed that rural dwellers would earn extra income through selling Jatropha seeds; therefore, rural farmers' hopes and motivation to join the programme were hinged upon this promise (Mubonderi, 2012). Contrary to this promise, farmers in Charewa regarded prices for Jatropha as relatively low compared to other income generating activities such as horticulture. During the time of fieldwork, farmers said Jatropha seeds were being sold at approximately 10 cents a kilogram whilst, with the same amount of tomatoes, farmers could get

70 cents. Resultantly, some farmers have abandoned growing Jatropha for this reason. Similarly, a number of farmers do not maintain the Jatropha trees anymore as they have stopped harvesting the seeds for sale. At the same time, the village Jatropha project initiated in 2007 in the ward hit rock bottom because farmers realised the economic benefits are marginal if not non-existent.

8.2.6 Institutional Actors and Socio-economic Events

Socio-economic contexts and institutional actors have been demonstrated to be important in shaping adaptation processes (see Wolf, 2011). A number of studies have noted that the socio-institutional context within which the farmer acts is a barrier to adaptation (see for example, Moser and Ekstrom, 2010). On the contrary, in my study, the socio-economic events and institutional actors largely enabled the adoption of strategies such as CA, *Zunde raMambo* (chief's granary), consolidated gardens, drought resistant crops and drought resistant trees among other strategies. The presence of NGO projects was cited as an enablement by 61.8% of respondents in the study whilst 38.2% disagreed. I therefore argue that, in this respect, the process of adaptation was driven by external actors' agendas. However, these findings should not be read in linear or deterministic fashion. For example, when farmers where presented with CA and consolidated gardens, the adoption of the discourses and practices that were being presented by various external actors was not automatic. Farmers invoked their agency to activate these enablements by showing interest in the strategies, and accepting and participating in these strategies.

To be very specific, findings in this thesis demonstrate that farmers saw CA as mainly propagated by development actors. The role of development actors in the field of adaptation has been acknowledged elsewhere (Ireland, 2012). In the context of Charewa, CADS and COMMUTECH were cited as the key players in promoting the adoption of CA. These farmers-oriented NGOs were targeting smallholder rural farmers with various technologies and concepts under the banners of sustainable livelihoods development, enhancing food security and addressing climate change. These actors entered rural communities as wielders of knowledge on adaptation practices and adaptation resources. According to respondents, the government also

supported CA through the provision of extension services. To support the view that the presence of external actors propelled the adoption of CA, a state agricultural officer had this to say:

> *Let me see.. Eeeh…CA was introduced by CADS. Farmers were given fertilizer and a lot of them adopted CA. But then CADS stopped giving fertilizer in 2011 and now many farmers have abandoned CA. You see, farmers did CA only to get fertilizer. AGRITEX has been doing demos and advising farmers on CA but not many people listen. We have nothing to give them to do CA; they just ignore us* (In depth interview with officer, Department of Agriculture, Research and Extension, April 2014, ward 3).

A NGO respondent added that:

> *…We are a community technology development organisation. The objective is to increase access, availability and utilisation of food in the communities. We support development of appropriate agricultural technologies, farmer innovations and sustainable resources utilisation. The major thrust of the programme is to address food insecurity caused by recurrent droughts and climatic change, targeting beneficiaries affected by HIV and AIDS pandemic. We choose wards in Mutoko because the area is a dry area. It is only in 2012/2013 season and 2013/2014 that the area received a lot of rainfall. The baseline we did revealed acute food insecurity and malnutrition as well as post-harvest problems. The environment is continuously changing yet farmers continue to use traditional ways of farming which give them low yields* (In depth interview, key informant from COMMUTECH, April 2014, Mutoko growth point).

With regards to Jatropha, key informants reported that Jatropha was initially introduced in the early 1990s by an NGO called BUN (Biomas Union Network) working on rural development in Mashonaland East Province, including Mutoko district. At first farmers were encouraged to use Jatropha to curb the problems of deforestation. Thus they were urged to use Jatropha as live fences for gardens and homes. Along the way, NGO interests shifted to processing Jatropha seeds to promote financial self-sufficiency amongst smallholder farmers. As some key informants recalled, NGOs trained local farmers and encouraged them to form cooperatives for small scale production. Farmers in Charewa did not establish Jatropha cooperatives but some farmers admitted to attending trainings and seminars on various activities such as making soap using Jatropha oil. Still, only a few farmers were interested in Jatropha at that time. As one key informant noted:

> *At first most farmers did not see benefits beyond fencing gardens. They were suspicious as well. There were rumors that Jatropha was poisonous to cattle and goats. You know how people are; people interpreted everything the wrong way* (In depth interview with a Community Representative, April 2014, ward 3).

However, the emergent conditions that led to the widespread adoption of Jatropha in the study site arrived with the economic meltdown that began in the late 1990s. At this juncture, a number of respondents recalled that the situation in the country was bad. The country was undergoing rapid economic change that was characterised by hyper-inflation, shortage of fuel and increasing levels of socio-economic suffering. As some farmers recalled during life histories, it was a desperate situation as they faced shortages of inputs and they watched as markets for their crops collapsed. Similarly, other scholars have remarked that the height of desperation created by the economic crisis was the moment government officials visited a female traditional healer in Chinhoyi, who purported to possess the power to extract diesel from rocks (Mubonderi, 2012).

As such, it was amidst this crisis and desperation that the expansion of Jatropha to meet the country's fuel needs was introduced. To the farmers in the study, Jatropha presented income generating opportunities that they could not ignore. They were told that they would sell the seeds for biodiesel processing and at the same time realise income from Jatropha by-products such as oil used to make soap. As noted by other scholars, the programme was sold to the nation as *jatropha mutsvairo wenhamo* (jatropha the broom of poverty) (Tsiko, 2010). It was therefore these exogenous processes that enabled the expanded adoption of Jatropha by farmers in Charewa.

Nonetheless, farmers did not meekly submit to these enabling factors so as to allow them to determine their lives. They responded to these structured circumstances by developing vested interests (Archer, 1995) in the Jatropha biodiesel project. They contextualised or localised the perceived benefits of Jatropha, such that these resonated with the widespread excitement that engulfed the country when the government initiated the National Jatropha Programme in 2005. In addition, according to key informants in the study, when Mutoko was selected for Jatropha Outgrower Schemes spearheaded by the National Oil Company of Zimbabwe (NOCZIM),

farmers were thrilled. Farmers thus activated this structural enablement by showing willingness to participate in the projects and accepting the jatropha growing practices that were being propagated by NOCZIM. In this case, the events taking place in the country simply oriented farmers or provided strategic guidance (Archer 1995) but did not determine the adoption of Jatropha.

In the case of the resuscitation of *Zunde raMambo* (chief's granary), a critical look at what respondents said regarding community networks suggests that this was an exogenous process. The presence of NGOs, specifically Plan Mutoko, working on livelihoods and food security in Mutoko district facilitated the revival of Zunde raMambo. Key informants noted that Plan Mutoko had a number of projects in the district and Ward 3 was selected as one of the project areas. The NGO gave farmers inputs so that they would grow crops and contribute to the chief's granary. In the final analysis, the strategic role played by the external agency enabled the revival of *Zunde raMmabo.* Nevertheless, amidst this apparent consensus on the role of external agencies, an isolated view emerged on how *Zunde raMambo* was revived. I want to consider this a discordant perception, presented by one male respondent during life histories as worth mentioning. I quote:

> *….You see, people portray Zunde raMambo as something it is not. The NGOs gave use seeds and fertilizer on condition that after we harvested we took some of the grain to Zunde. Everyone who got seed packs and fertilizer was told to contribute a certain amount. That is true, but some of us saw things behind the back. Ndinofunga kuti it was convenient that madhara akangotanga kuti Zunde Zunde ipapo* [I think it was convenient that the old men started to say Zunde Zunde at that particular time]. *Things were happening in the country. I cannot say much, but it was politics. That is my own thinking. Elections were coming and not everyone was happy. Kwanga kuri kungoda kuwona kuti musangano uchiri kudiwa here neZunde* [It was a way of assessing whether the political party was still favoured] (Life history interview, August 2014, ward 3).

Furthermore, the roles of external actors working on livelihoods and food security were not only limited to *Zunde raMambo,* as their presence in the ward led to the formation of consolidated gardens. Respondents noted that the adoption of *moringa* (moringa olifera) as a drought tolerant tree was enabled by an NGO which introduced it to the ward in 1996. Nevertheless, given that

farmers were no longer engaging in formal cooperatives, they could easily have rejected the idea of consolidated gardens; instead, they reacted to this structural enablement by agreeing to organise themselves into groups. All the same, the role of external actors remains very crucial in understanding the process of adaptation in Charewa and their withdrawal has also threatened the continuity of some strategies. In particular, respondents noted that currently *Zunde raMambo* is not being practiced because the NGOs withdrew their support with farming inputs in 2010. After the withdrawal of inputs, farmers only autonomously contributed to *Zunde raMambo* in 2011 and then stopped that same year.

Food aid and food for work programmes as coping strategies have largely been driven by NGOs and government agencies. It emerged from the study that during the 1992 and 2002 droughts, the Civil Protection Unit committee chaired by the District Administrator's office and designed to respond to a wide array of local disasters, provided food relief to drought hit wards in Mutoko. It was noted that the committee does not respond to droughts only but it has done so during Anthrax, Cholera and Typhoid outbreaks experienced in the district. Again, some respondents cited that the government Department of Social Welfare assisted households and targeted children with food aid in the 1992-1995 droughts. NGOs, in particular DANIDA (Danish NGO), were mentioned as having provided a food for work programme in 1992 as well. Finally, in the droughts of 2002 and 2008, Plan Mutoko was said to have played a very a significant role in providing food aid in Charewa.

8.2.7 Availability of Extension Services, Information and Support

The provision of crop and livestock extension services by locally based government workers has also enabled farmers to manage crops and livestock in the context of climate variability. This finding agrees with what other scholars in Africa have observed. There in, a key ingredient in the ability of farmers to cope with or adapt to climate variability and change is their access to relevant knowledge and information that will allow them to modify their production systems (Challinor et.al, 2007). Others have alluded to access to seasonal forecasts and other climatic information in enabling or constraining adaptation (see Patt and Gwata, 2002; Vogel and O'Brien, 2006; Ziervogel and Calder, 2003). In Charewa, the Department of Livestock

Production and Development was said to conduct animal fairs to promote interactions and exchange of knowledge on rearing and managing livestock under increasingly uncertain climatic conditions. To support this finding, I refer to the following response from a key informant in the Ministry of Agriculture:

> *We provide farmers with expertise on fodder supplements and encourage them to use crop residues particularly from maize. We also provide farmers with extension activities such as deworming. As I have told you, there are worm infections that farmers are experiencing, these are new to them. We encourage them to report these diseases early and we on our part also conduct animal inspections* (In depth interview with officer, Veterinary Department, April 2014, ward 3).

Crop extension is also contributing to the endurance of strategies on crop management and re-organising crop production in Charewa. Farmers admitted to having received advice on the adoption of small grains, drought resistant crops, early maturity crops, adoption of Jatropha and CA. Extension was also noted in designing water drainages in the event of localised water logging and adoption of soil conservation techniques. Field days and demonstration sites are used to disseminate new knowledge and skills to farmers in this semi-arid rural community. To support these findings, I refer to the following response:

> *They* [AGRITEX officials] *are giving us knowledge on farming issues and giving us advice on adopting a new cropping calendar, be it field crops or horticulture. They are giving us a calendar explaining what crops are supposed to be grown in which season. So with AGRITEX, we do not have a problem yet* (Life history interview, August 2014, ward 3).

However, there were some contradictions evident from both farmers' perceptions and those of some key informants. On one hand, some farmers felt that they were not being given reliable advice as they are now experiencing side effects from some of the strategies they had adopted and these were perceived to be costly to counteract. Further discussions and interactions with farmers revealed that some farmers expressed pessimism and frustration about the role of extension workers. More so, during informal group discussions with villagers, there were sentiments that the serious damages that Jatropha posed on agricultural land were omitted when Jatropha was introduced externally. In general, farmers noted that the intentions of NGOs seemed to have been clear. But, as the Jatropha discourse was intertwined with the national

biofuel drive, it seemed that no one cared about the serious impacts of Jatropha. Farmers were also frustrated with the cattle dipping services and vaccinations that were growing more erratic. In addition, livestock treatment was considered as very expensive by farmers. On the other hand, extension officers cited farmers' attitudes as constraining the process of adaptation. One key informant had the following to say:

> *Farmers do not listen to us AGRITEX officials. We conduct field days, demonstrations and seed fairs on small grains that are drought resistant but farmers do not turn up. There seem to be a new generation of farmers who want quick cash, they do things their own way; they do not follow advice* (In depth interview with District Agricultural Extension Officer, March 2014, Mutoko growth point).

All the same, although there are evident contradictions between farmers and extension service providers, what is clear is that, overall, agricultural extension has weakened in Charewa. More so, notwithstanding their concerns, farmers still believe in the legitimacy of extension workers in providing information regarding various adaptive strategies.

At the same time, the role of by-laws on environmental management espoused by the Environmental Management Agency was cited by farmers in the study site. Fundamentally, these by-laws were regarded as complicating the process of adaptation. Many farmers do not have fences around their fields yet they are have embraced CA which require them to plant early. CA is undertaken at a time when livestock movement is not controlled and these destroy planted fields. Therefore, to be able to undertake CA successfully, farmers need to fence their fields yet lack of household wealth constrains them from buying fences. A number of farmers reported that they have resorted to cutting down trees to fence their fields and gardens; yet doing so attracts a penalty from environmental regulators.

In addition, most farmers' gardens are located near streams and rivers yet stream bank cultivation is also discouraged. Farmers indicated that they have not experienced any demolitions of gardens by government officials, but they receive unexpected visits from officials who will be checking on how they are utilising land near streams and rivers. What emerged from farmers was that, whereas locating gardens near stream/river banks was condoned, intensified use of fertilizer and chemicals was prohibited in these gardens. According to farmers, officials argue that

fertilizer and chemicals are washed into rivers and streams during *gukuravhu* (high intensity rainfall*)* and subsequently water is contaminated. Therefore, farmers are in a quagmire as they noted that the only way to increase yield was to intensify use of fertilizer and chemicals to control increasing crop pests.

8.3 Socio-cultural and Interactional Constraints and Enablements

In this section, my argument is that the micro-level relationships and interactions that farmers are part of in Charewa, and the values and discourses they uphold, are more enabling than constraining in the adaptation process. Other scholars have found that the ability to create and expand social networks was part of the ability to live with change and uncertainty (Nyamwanza, 2012). Empirical evidence, too, suggests that the ability of societies to adapt is determined, in part, by the ability to act collectively (Adger, 2003). In a similar vein, literature shows that the presence of bridging social capital (links between distinct groups), bonding social capital (relationships between individuals who share a social identity) or linking social capital (networks of trust across authority gradients) may, albeit not necessarily, lead to an increase in resilience in societies and are associated with survival and recovery from natural disasters (see Adger, 2003; Pelling, 1998; Pelling and High, 2005b). Nonetheless, as I discuss below, in Charewa it seems that macro-scale interactions and relationships are mostly complicating the process of adaptation. All the same, I empirically demonstrate in this thesis that farmers are able to negotiate constraining relationships and interactions in order to adapt to increasingly changing climate variability.

8.3.1 Local Interactions and Values

Whereas I have noted above that some strategies by farmers were enabled by exogenous processes and actors, the formation of networks on irrigation was an endogenous process in Charewa. The ability of farmers to self-organise, together with the existence of trust and a cooperative ethic among farmers, largely enabled them to confront problems of depletion of irrigation water sources through forming irrigation groups. Farmer to farmer extension assistance was also cited as very important in driving the process of adaptation in this smallholder farming community. It was regarded as a source of farmers' knowledge, for example, on how to handle

new crop varieties and livestock diseases. The main benefits noted by farmers when they organised farmers' gatherings were exchange of information, updates on new crops and learning from each other's experiences. To elucidate on this, I direct attention to the following comment:

> *....That is where we educate each other and also arrange our shows. That is where we select the best farmers depending on different categories like best maize farming. For instance, with respect to maize production some still use ox-drawn ploughs and others have adopted CA. People get educated from those who would have done well by explaining how they did it* (Life history interview, August 2014, ward 3).

In addition, relations with family and friends were cited by most (72%) of the respondents as enabling strategies, such as borrowing food in times of drought. Market access by elderly households was mainly facilitated by relatives. Farmer to farmer relationships, family relations and neighbourly bonds were regarded as very important in so far as farming inputs were concerned. Based on some mutual understandings, respondents noted that they are able to borrow fertilizer, seeds and food. They are also able to rent gardens and pipes, and receive draught power. To expand on this, I refer to the following from a respondent in Charewa:

> *....I get along with my neighbours. I give them stuff they want and they do the same for me. But, as you know, there are some people who can give you and those who do not. Same with me, there are people I give stuff but some I have to think twice* (Life history interview, August 2014, ward 3).

The existence of these relationships was reiterated by the notion of *kadonor* (a container that accommodates 5 kilograms of fertilizer or grain) that these farmers mentioned. When I heard about *kadonor*, I asked farmers what they meant. It was revealed that this name was coined when a certain NGO came to the ward to distribute food and gave each selected household 5 kilograms of red sorghum. This *kadonor* is very popular among farmers and represented how social relationships are organised. It was common practice for farmers to give each other *kadonor kefertilizer or kechibage* (5kgs of fertilizer or maize) in times of need. According to these farmers, giving someone *kadonor* was a common gesture in fulfilling ones' obligations to neighbours or fellow farmers. Similarly, in other contexts, extensive familial and social networks that reach beyond the community also help farmers to deal with the risk of harvest loss in adverse climatic conditions (Boillat and Berkes, 2013).

On the contrary, although respondents in the study indicated that they assisted each other with farming inputs and food, one striking feature that emerged from most interviews was that there were no networks or associations for sharing labour beyond the family in Charewa. Even though I probed this issue several times, respondents simply highlighted that households are doing *mazvake mazvake* (working on their own) as individual families or as kin members. In other words, individualistic tendencies seem to have replaced the moral economy of *nhimbe* or *mukwerera* (mutual labour sharing) in ward 3, thereby negatively affecting labour intensive adaptive strategies such as CA.

Notwithstanding not sharing labour, neighbourly bonds were perceived to enable farmers in micro-irrigation. During transect walks I observed that irrigation pipes cut across different farmers' fields and gardens suggesting that doing that was based on some kind of social understanding that allowed farmers to lay these pipes across fields. More so, trust, which has been defined by Glaser et.al (2000) as a belief that other people are trustworthy (and thus it entails a particular social orientation to other people), is important in the adaptive lives of farmers in Charewa. When I asked farmers how they managed moving pipes and water engines for safe keeping in their homes, some respondents indicated that they did not believe that anyone would steal them so there was no need to move these every day. Generally respondents thought that farmers did not steal from each other, suggesting the existence of trust. However, cases of pipes being vandalised and wells filled with sand were cited, suggesting that even if farmers trusted each other there were challenges regarding the existence of social capital.

Simultaneously, my findings reveal that unequal household relationships are being exploited in ways that are driving the process of adaptation. This was evident during informal group discussions and life histories where some farmers did not appreciate that those with irrigation pipes were syphoning and pumping more water from streams/rivers compared to those without pipes and engines. Those that I have termed non-irrigators (those who use tins to water crops) in my study thought that it was unfair that some people were using pipes to draw a lot of water from sources that are supposed to benefit everyone. Here I refer to the following extract from a life history to shed more light on this aspect:

....No I do not have pipes. I do not have those pipes. Ndiri chimunhu munhu [I am just a nobody]. *I do not have any pipes. Can I buy those things, am I a man? I do not even have cattle. I just have to use tins, which is what I do. But, there are people who have made it and bought pipes. There are plenty of them, all over there. They take most of this water. It is better when they are* [only] *syphoning because kana yaengine unozowona mvura pasisina* [because if it is the engine you just find the water finished] (Life history interview, August 2014, ward 3).

Whereas my findings portray that preponderantly, socio-interactional processes are enabling adaptation there is evidence that lack of social capital is complicating CA. With CA, farmers plant early and practice dry planting. Yet most fields are not fenced and therefore livestock destroyed their crops. It was noted that people have not yet agreed as a community on the dates to start *kufudza mombe* (herding cattle). However, although this lack of a social contract was a problem affecting most farmers who have adopted CA, it was also affecting those doing conventional farming. To shed more light on this, I refer to the following statement:

....At the same time, during that time in our areas the village heads were very responsible because by October they would ensure people started herding their cattle so that they would not stray into the fields where crops would have been planted. But, now they just watch people doing what they want (In depth interview with Community Representative, April 2014, ward 3).

As a result, farmers are being forced to wait on and near their fields when they have other farm tasks to do. In addition, the strategy of maintaining multiple fields is also being defeated. I have noted labour constraints earlier in the discussion such that farmers are not able to wait on multiple fields under CA. At the same time, farmers face wealth constraints to purchase fences for their fields and gardens. In general, expanding CA to fields afar is proving difficult, resulting in it being a localised strategy. During transect walks I observed that, overwhelmingly, CA was done in fields near homes and around gardens. Further discussions with respondents revealed that this enabled farmers to tend to both fields and gardens to deal with livestock challenges. By doing this, farmers are influenced but not determined by the barriers they are facing in practising CA.

At the same time, my findings reveal that, to some extent, social networks are also hindrances regarding water management strategies. Whilst many studies venerate the positive role of social capital in adaptation, other scholars have argued that strong bonding ties can contribute to the vulnerability of a population rather than reduce it; and that social networks do not always contribute to positive outcomes (Wolf, 2011). As well, Di Falco and Bulte (2011) found negative effects of kinship linkages on investing in adaptation. Similarly, in Charewa, informal irrigation groups formed around weir dams are surrounded by complications. One aspect that stood out was that, though these groups had come up with irrigation rosters and that these served to control times for irrigation, they did not regulate the amount of water drawn by each member. It emerged that farmers were using the time they were given to draw as much water as they can, overusing water and at times wasting water when they left their pipes to run overnight. Competition for water is thus not limited to the whole community but is evident within these micro irrigation groups. Consequently, the initial purpose of saving water through weir dams in view of increasing deterioration of water sources is being threatened.

Finally, discourses on land ownership are constraining women in the adaptation process. I have highlighted before that access to land in Charewa is gendered. The system of unequal access to land between men and women is sustained by various discourses. For example, the idea that men are regarded as the heads of households justifies why they should own land. Other ideas that key informants regarded as long established traditions were that *vakadzi havandopihwe nhaka* (women should not inherit property) and hence family land is passed on to male children upon the death of parents. Therefore, in the event of widowed daughters coming back home, as in the case of Vaina presented earlier on, their access to land is mediated through male members of the family. More so, there are beliefs that women should not own land *nekuti vanoroorwa* (they will get married and leave). Consequently, strategies such as expanding horticulture and farming multiple fields are complicated for women in the study.

8.3.2 Macro-scale Interactions

Whilst micro-scale interactional processes and relationships seem to be driving adaptation in this smallholder farming area, relationships are complicated if not fractured at the macro-level.

Overwhelmingly, respondents regarded their trading relationships with commodity buyers as unequal and constraining their adaptive strategies. When farmers intensify and expand horticulture, they want to address both financial and food insecurity, yet they were of the perception that they are being ripped off by *makoronyera* (swindlers) at *Mbare Musika.* They not only perceived that they were being ripped off but they were also being exploited for the benefit of a few people. They provided good quality produce but did not get value for it as *makoronyera* (swindlers) connive amongst each other and have an upper hand in setting the prices of the produce. In fact, there was a wide perception that in most cases prices are not negotiable. If farmers reject set prices, they are victimised and they lost their produce. Respondents believed that these *makoronyera* sent their men to steal from farmers who reject prices offered. Overall, swindlers were perceived to be a well-organised group and were difficult to maneouvre around. To elaborate on these issues I refer to the following account:

> *…How we relate with buyers at Mbare is complicated. When we get to Mbare we display our produce according to grades from the first to the third. However, when the notorious buyers we call makoronyera come, they mix up everything. Sometimes some of the produce can be stolen. The security of the produce at the market is a real problem, so you see sometimes those that keep the produce for us are the ones who steal from us. I give these people my produce for safe keeping in the market and pay them, good money but in the morning they can tell you stories that they have lost the produce to thieves. You see, they actually work together, makoronyera* [swindlers], *thieves and these people we pay to keep our produce. After I pay these people, in the morning I have to pay the market entry fee, it is 10 dollars but sometimes there are con men who purport to be Council workers who collect market entry fees from us* (Life history interview, August 2014, ward 3).

Another respondent added that:

> *…Our relationship with those that we sell the produce to is a disaster. The issue is that the farmer has no security when he gets to the market. Suppose I go there with a bag of cucumber, the swindlers will simply tell you that we are buying your bag at $17. After buying it from you they can just move 5 metres away and sell that bag for 3 times more the amount he paid you. They do not allow you to get a good price but for themselves* (In depth interview with Community representative, April 2014, ward 3).

Related to the above, another respondent added that:

> *The relationship with the buyers is not good. The buyer dictates and pays little yet as the farmer I am the one who spent my time working. There are bogus buyers and those we call makoronyera*

[swindlers] *who buy the produce at very low prices and re-sell at high prices making huge profits* (Life history interview, August 2014, ward 3).

Nonetheless, farmers in Charewa refuse to be victims of the above circumstances. As such, to deal with these constraints farmers highlighted that at times one has to 'hire' some of these *makoronyera* so that they sell the produce on their behalf and also keep their produce safe. It was believed that *makoronyera* controlled most of the transactions and activities that go on in the market so sometimes, for one to get a better deal, one has to hire them or even befriend them. In the following quote I draw attention to one way farmers deal with these encounters at the market:

..*You have to pay the middle man. You can give him 5 boxes of tomatoes, it depends on how you can negotiate, but whatever happens you have to make sure you pay him, otherwise you get into trouble. Sometimes you can get someone who does not demand a lot of money, but that does not happen a lot* (Life history interview, August 2014, ward 3).

This quote, together with many others found in my data reveals that farmers are acutely aware of the real restrictions and challenges that they face in the market place and are positively putting strategies in place to negotiate these.

8.4 Internal Conversations

Inner dialogues farmers engaged in during the process of adaptation are fundamental in this thesis. Through inner dialogue or internal conversation, people reflect upon their situation in light of current concerns and projects (Archer, 2003). Individuals conduct a conversation between their subjective self, which asks a question, and their objective self, which provides the answer (MacMerrin, 2007). It is a method for arriving at self-knowledge and decisions through the process of 'discernment, deliberation and dedication' (Archer, 2003:138). Internal conversations govern peoples' (agents') responses to their objective circumstances; in this case, climate variability. In light of this, I asked respondents in the survey that, 'some people are aware that they are having conversations with themselves, silently in their heads, we might just call it "thinking things over". Is this the case with you?' In response, a significant number of respondents (70%) said yes, 8.3% said no and 21.7% did not have a response to the question.

Following this, I invoke Archer's theory of reflexivity to argue that most farmers are reflexive, as evident in the internal conversations which they conducted in their daily reflections on the world about them, a world being altered by increasingly changing climate variability. Still within the Archerian discourse, farmers are also reflexive as shown in their reflections on the nature of their personal projects (adaptive strategies) within this changing world. At the same time, although Archer (2007) argues that internal conversations result in distinct modes of reflexivity, my findings cannot be read neatly from these modes of reflexivity. What I simply want to do in this thesis is to expose internal conversations within the process of adaptation. In Box 8.2 below, I illustrate some of these obtained in life history interviews.

Box 8. 2: Internal Conversations

Karize's[32] Story

Sometimes I received aid, sometimes I did not. It was not always certain. I had to find other ways than just wait for aid. I did maricho [casual labour] *doing all sorts of things. I would use the money to send someone to get mealie-meal in Harare…Ummm, that was 2001/2002 I think, then I struggled to feed my family. As the man in the family I debated several times how I was going to get food for my wife and children. My wife also constantly reminded me that I had to do something; she made me feel maricho* [casual labour] *was not enough. I had to make peace with that, she was right. Then we had children in primary and secondary school and I could not fail them. I was not going to have peace if that happened. I knew I had to do something but, I was not sure how. It was not easy, like I woke up after a sleepless night and decided to try new things, not at all. Life is not easy here. But, just that reality at the back of my mind, the children going to school and all made me want to change things.*

My mind was set on making a good life, even if the situation was bad. You know, I did not need to do something out of this world. I told myself that just getting more pipes and trying things that could fetch me good prices at Mbare [market] *was okay. I knew there were no guarantees, prices at Mbare are not stable, but I had to ask myself, was sitting and worrying about prices at Mbare Musika going to feed my family or make me a good harvest? At present I cannot say things have really changed but am positive am moving in the right direction, maybe I need to change a few things, but am still debating like what exactly?*

[32] Not real name.

Snodia's[33] Story

...I can tell you a lot of things, what was happening in our lives and all, but you see, sometimes one does not remember exactly every detail of things that were going on in her mind. Aaaa, let me see, I can say kutya chaiko [real fear]. *Just being unsettled about what life has become and asking yourself why things have become so difficult. All these things happening around you. Things have really changed, kutambura kwanyanya* [there is a lot suffering]. *I am not really sure if that matters to you, but I think deep down I did not just worry that we were losing lots of fertilizer and stuff, harvesting just a little, but I was scared, maybe that little was not going to come anymore? It is not that I did not believe in working hard, but I said to myself, what if that was not enough? That was a frightening question. Droughts are just coming, sometimes not even drought, like this year* [2013/2014] *season, it rained a lot but still I did not manage to harvest, zvakandondovera* [crops were affected by leaching].

It is difficult to see where we are going with this kind of life. Yes I was afraid but I convinced myself I had to do more, grow more vegetables, try new vegetables, zvimagreen pepper [green peppers], *and see how things would go. Even CA, others were doing it isu tichongotyira kure* [some of us were hesitating], *then I realised things could get worse iwe uchingotyira kure* [whilst still hesitating].*Not only that, dai ndakatenga mapipes kuma1999 kwaitenga vamwe, I do not think taizonyayanya kutambura* [if I had bought pipes around 1999 when others were buying, I do not think we could have suffered a lot]. *So yaa you ask yourself many questions and in most cases, you realise that you thought things were bad, when they were actually worse than that, that what makes you afraid.*

Source: Life histories, August 2014.

Apparently, a number of respondents indicated that they had conversations about their future living in this semi-arid region. In this case, climate variability is not only felt in the present by farmers but is also projected into the future. Therefore, when some farmers came up with coping and adaptive strategies, they sought to act in the immediate as well as move towards positions in the yet to come. They sought to transform their situations, and not just to accommodate change, but to retain meaningful future lives for themselves and their children. Adaptive strategies are thus mediated by aspirations for an improved future. For some farmers, hope for a better future was fundamental in them increasing crop and livestock diversification, expanding horticulture

[33] Not real name.

and intensifying micro-irrigation. Unlike food for work programmes and borrowing from friends and relatives, these strategies were capable of taking them into the future. There is evidence of determination by respondents to overcome negative livelihood outcomes and not letting challenges posed by climate variability define their future. In this respect, I argue that adaptation to climatic variability in Charewa should never really be understood as a matter of adapting to the present only but rather adapting to a multiplicity of proximate, mediate and future perforations.

Furthermore, internal conversations about the past are evident in my data. Although the findings are inadequate to conclude that the process of adaptation in Charewa is being driven by past experiences, some respondents divulged nostalgia on how good things were during the times they were growing up. Some of these farmers conversed about the past and had memories of what they perceived as 'good old days'. If I may go back to chapter 5, quite a number of respondents gave the impression that they missed the times when they enjoyed Christmas holidays with green mealies from the gardens because then the rainfall season started early (that is, in October). In a related manner, when I asked respondents to compare a number of aspects during the 1990s and after 2000, they had positive views of the former and pessimistic interpretations of the later. Thus, conversations and memories of better lives in the 1990s and increasing difficulties after 2000 were crucial in the adaptation process. Although farmers highlighted that they had no control over the late onset of the rainfall season and they could not 'get back the lost seasons', these memories played a part in making them re-organise their crop production practices.

At the same time, enthusiasm for change was also highlighted. Having gone through successive droughts, mid-season dry spells and short seasons that were accompanied by harvest failures, what some farmers wanted was change in their lives. This was not only limited to changes made in horticulture, addressing water scarcity and other strategies but also change associated with socio-economic conditions. For instance, the widespread adoption of Jatropha was in part pushed by events in the country but additionally by farmers' enthusiasm to gain income and regain productive livelihoods overall. The following response sheds more light on the foregoing:

....It just makes me happy to know that what I am doing is going to change my life. Not many people thought about it, I do not know for sure with other people, as for me, when we were taught CA, I saw my life changing. A number of people in this ward did not think it was a good method; they just wanted the fertilizer that was being distributed freely. People have different ways of seeing things, as I said I am not sure but, that is what I saw. For me it was different, I wanted my life to really change. I had been wrestling with my thoughts thinking of how to make things better, to change the situation. I had been asking myself, how long was I going to let these problems affect our lives?I mean mvura kusanaya zvakanaka, kubirwa nemakoronyera kuMbare nekuwana tumatsga tushoma shoma twechibage [not raining well, swindlers at Mbare stealing from us and harvesting a few sacks of maize]. *So when CA came, that was the moment l told myself, if I missed this, my life was not going to change* (Life history interview, August 2014, ward 3).

Furthermore, quite a number of farmers in the life histories indicated that they were afraid of the consequences of not adapting. Bewilderment and a sense of insecurity were often profound in life histories, along with sadness and fears for the future if things remained unchanged. These farmers had conversed about the losses they had encountered (income, crop and livestock losses) and the anxieties these had created. Others seemed to have been upset and haunted by the events of the drought in 1992 and indicated that they were not prepared to relive those kinds of experiences. In this case, when they conversed about that drought, they were overwhelmed by fear and therefore they had to come up with life projects (Archer, 2003). Others were scared that if they did not do something to address the livelihoods challenges posed by climate variability, the situation would degenerate into something beyond their control. Therefore, if they did not construct weir dams, form irrigation groups and adopt various water management practices, it was then impossible to maintain and expand dry season horticulture. More so, some farmers conversed repeatedly about what life would be like if they had to abandon horticulture for good. It was thus evident that it was scary for them to imagine having to abandon a long established livelihood strategy such as horticulture.

Concurrently, my life history data shows that conversations about obligations and duty to one's family are present in the process of adaptation. This finding points towards communicative reflexivity in Archer's typology of dominant modes of reflexivity. Some of the aspects found in

the data that shed light on this included respondents saying 'I thought about my sick husband', 'I have orphans that I am taking care of' and 'I could see there was nothing to eat for my wife and children'. Some respondents decided to travel for casual labour in resettlement and small-scale commercial farming areas, buy mealie-meal from supermarkets and work in food for work programmes because they wanted to fulfil their family obligations. On the contrary, whilst respondents gave the impression that they struggled with so many inner questions and would do anything to fulfil family obligations in the face of adversity, they were not prepared to do the same to fulfil communal obligations. All the same, the following case from the data highlights the significance of conversations on duty to families and I quote:

> *…Yes I went for food for work, everyone was going there. Only 1 or 2 people maybe did not go for food for work. My first time was 1992 and again 1995. Most of the people went as well. So you see none pointed fingers at anyone. We were all in the programme, the whole ward. But, now it is different, when you are given aid, some people envy you and some people laugh at you. Zvakangowoma kungoita munhu anonzi anotambura, munhu anopihwa chikafu* [It is just hard to be a person who suffers, to be a person who depends on food aid]. *It is just that people forget it is not my problem I am like this, they embarrass you. But you ask yourself, what is embarrassing begging from other villagers or receiving food from NGOS? Yes, getting aid is also embarrassing, but I wanted my family to survive, so if it was cooking oil and beans from NGOs that were going to make us survive, I said to myself let them be. Sometimes you have to make up your mind about how to live your own life, ask yourself what matters, your family or what people say?(*Life history interview, August 2014, ward 3).

The above quote and others not presented here reveal some of the internal struggles vis-à-vis family duties that some people in the study went through in the process of adapting to increasingly changing climate variability in Charewa. At this point, I need to draw attention to the fact that although the conversations I presented in this section were done in the context of adapting to climate variability, they were concurrently done in the context of the wider socio-economic landscape. It is therefore not analytically possible to clearly demarcate conversations on climate oriented adaptive strategies and those on responses to non-climatic facets.

8.5 Climate Variability and Adaptation Process in Charewa: An Overview

I indicated in chapter 5 that the findings of my thesis started by seemingly helpless women on a rainy day in April 2014. I also indicated that my thesis findings which began with events on that particular day would be completed with farmers employing versatile strategies. Indeed, I have presented these strategies in chapter 7, and the constraints and enablements encountered in the process of adaptation in the current chapter. Evidently, my four empirical chapters are organised under various themes and they seem to tell different stories. Nevertheless, my chapters are interconnected and should be read as such. Therefore, in this section, I link my four empirical chapters drawing on one case study extrapolated from life history interviews. This serves to clarify the fact that in order to understand the process of adaptation in Charewa, one needs to begin by revealing the changes that farmers have observed, how they interpret these changes and then expose the livelihood challenges with which farmers are grappling. Next, one needs to recognise that farmers are reflexive and innovative hence they devise multiple coping and adaptive strategies. Finally, one should not be under the illusion that the process of adaption is simple hence the need to capture various structures, processes and conditions which are both constraining and enabling.

The following case involves a female-headed household drawn from my fieldwork in Charewa. Though this particular household may not be statistically representative of my sample, the perceptions and practices of the head of this household speak to and illuminate, in a very vivid manner, the many themes about climate variability and adaptation which I raise in this and preceding chapters.

8.5.1 The Case of VaTandi[34]

VaTandi is a 62 year old female head of a household in Pasirayi village. She lives with her four orphaned grand-children. She grew up in Kagande village in Charewa and got married in 1980 to a man from the same area. VaTandi had six children, with the first boy born in 1981. Unfortunately, from the six children only one is surviving. VaTandi also separated from her husband in 1994. From what she said, her husband just left for some farm in Macheke in 1994

[34] Not real name.

when their last child was a few months old and has since gotten married to another woman. She said some people in the area think she is a widow when in actual fact her husband just left and that was the end of their marriage.

Regarding how she irks a living in this semi-arid, peasant farming community, VaTandi engages in crop farming and horticulture. She grows maize and groundnuts in the fields whilst sweet-potatoes, tomatoes, beans and leafy vegetables are grown in the garden. The garden is located in the vlei, a few yards from her homestead. She also has several banana trees in her garden. When the bananas are ripe, she gives them to her eldest grand-child to sell at the local schools. In many respects, the household is fragile and very poor. VaTandi said she does not produce enough maize to last until the next harvest. The household does not have a stable source of income because there is usually no surplus grain to sell. Household income is largely derived from occasional sales of horticultural crops and *maricho* (casual labour). Income is supplemented with the sale of bananas. Her grandchild also sells sweets at the local school. During the time of fieldwork in August 2014, the sweets were sold at one South African Rand each. Furthermore, the household owns a few chickens and one goat. Therefore, for farming, VaTandi requests her former husband's uncles to plough her fields. She assists these uncles with planting and weeding so that in turn they help her to cultivate her fields. In addition, she does not have irrigation pipes so, as she aptly said, she has to carry tins on her head to water her crops.

From my conversations and interactions with her, VaTandi has made several observations regarding rainfall patterns. She said sometimes when rainfall comes, it does not last. The rains just stop and she only sees rainfall in December when crops are already dying. She emphasised that rainfall is now erratic but groundwater was better. She also remembered the droughts in 1982 and 1992. She said in 1992, *nzara yakarova munhuwe* (there was extreme hunger). She said she suffered a lot and her livestock as well. The nearby dam (Dorongoma) did not dry but the water levels went down drastically.

Her perception of the 2013/2014 season was not far from what other farmers in the study mentioned. Essentially the rainfall season started late and by mid-February when crops were

tasseling, *zuva rakarova* (there was a dry spell). I refer to the following extract from my interview with her in August 2014 to shed more light on this:

> *This season, there was a lot of rain than other years but, it created problems for many people. It started late, around November. Even me, I started farming in November. But those who planted during the last week of November and December did not harvest much. There is actually hunger in this area this year.*

In addition, the way VaTandi understood and interpreted the climatic changes occurring in Charewa is not very different from other farmers. She alluded to evil spirits and the sin that was committed by Adam and Eve as stated in the Bible, as the causes of the problems she was facing. To be specific, she said:

> *...Ah hatichanyatsoziva kuti zviri kukonzerwa nei. Kuti zvava zvii? Zvave ndondofunga mweya wetsvina izvi. Wobva wati handiti Adam na Eve vakakonzera. Handiti ndivo vakakonzera kuti tiite izvozvi zvinhu zvisina nebasa rese? Hazvisati zvapera. Tototi kana zvapera kuona kuguma kwenyika, ndokuti zvapera. Ehe. Asi iye zvino izvi tichiri kuona kuti Adam na Eve vachiri kufamba. Chivi chichirimo mudzimba dzevamwe vanhu. Ehe hutsinye kudini.Vamwe vanoita zvezvikwambo. Zviripo, ndozvana Adam na Eve izvozvo* [Ah we do not really know what is causing this. Is it sin? But, I think this is because of evil spirits. Then, Adam and Eve also caused this. Is it not that they caused us to do meaningless things? That sin is not over. Only when the world ends should we say the sin is over…Yes… Even now we see that Adam and Eve are still walking around. There is still evil in other people's homes. Doing bad things and all. Others keep goblins, they are there. Those are related to Adam and Eve].

Furthermore, like other farmers in Charewa, VaTandi is astutely aware of the changes around her and how these have affected her livelihoods. She said she used to grow *mhunga* (millet) and *rukweza* (rapoko) but a lot has happened in recent years. It is now difficult to grow these so she is concentrating on maize because she can easily get different seed varieties from the shops. She said she used to fill her granaries with millet but things are not the same anymore. During the times she harvested a lot of millet the household did not have problems with food deficits. She also indicated that she used to grow a good variety of groundnuts called *mutasa* which required a lot of water. These groundnuts thrived in sandy soils but now *ivhu rajecha-jecha* (soil is too sandy) and it does not rain like it used to, therefore, it is difficult to grow them now. Similarly,

VaTandi stated that in the 1980s, the big well in her garden never used to dry. A lot of people actually used to get water from her garden and do their laundry there. But, now it is drying because there are no more good rains and she also thought it was because of irrigation pipes that some people use to draw water away from her garden. As if climatic challenges were not enough, she also has problems acquiring fertilizer to do her farming.

Notwithstanding the above perverse observations and challenges, like most farmers in Charewa, VaTandi is trying to cope with and adapt to climate variability. She alluded to varied strategies she has been employing to deal with rainfall challenges. The first thing she said pertained to how she has continued farming despite the various changes in rainfall patterns. This is evident in the following statement:

> *….Tinondorima; hapana zvatinga zviite, tinondorima. Ukatangidzira imomo muna November imomo mvura yauya, dzimwe nguva unokohwa, ukatozorima muna December nana January, ah hapachisina* [We just farm; there is nothing else one can do, we just farm. If you do so in November when some rains come, you can actually harvest something. But, if you farm in December and January, ah there will not be anything].

Simultaneously, she abandons gardening when the two wells in her garden are dry. However, unlike other farmers who abandon their gardens for good, she waits on her banana trees. These survive without being irrigated. To elaborate on this, I draw attention to the following statement:

> *If the water is finished, we just sit. What will remain will simply be waiting on the garden so that cattle do not destroy it. What else can I do? We just wait on the garden, like me, I will not abandon the garden, I will not. There are bananas there. But, others actually abandon their gardens for good and sit at home. But, I will not, I just wait on the bananas.*

More so, similar to other households in Charewa, VaTandi has received food aid from NGOs in times of drought. She also recalled that, in 1992, she fed her family *zviriri* (wild beans) because it was difficult to obtain maize. From her description, *zviriri* are poisonous and involve a mundane process of preparing them. One has to boil them for the whole day and night and then, the following morning, one peels the skin off and boils them again till they are safe to feed the family.

At the same time, VaTandi was insistent on staggering crops so that one does not lose everything when the rain season ends early. She believed that *unojara umwe mumera uye umwe mumwera pava paye* (you plant one crop the first time, then another time). One has to plant the first crop with the first rains, then another crop with another round of rainfall so that one can harvest something; otherwise, if one plants the whole field at once, all the crops may die when a dry spell comes. In addition, she plants maize crop she termed *chibage chemasesa mhepo* (dry season maize) around September and October in her garden, at least when she is lucky to have water until that time. This enables her to harvest some maize, and dry it to use as mealie-meal when the rain season would just be starting, which is now late for that matter.

More so, her views point to the importance of having multiple fields when one does not know how the rainfall season would behave. As she mentioned:

> *Zvinoda kuti rimei kugadhe worima kuno kuitira kuti hauzozive kunoita zuva nekunoita mvura. Dzimwe nguva kugadhe ndiko kunoita mvura segore rakapera. Taka kohwera kugadhe, kuno kumunda handina chandaka kohwa* [It requires one to farm in these fields and also in the garden. Sometimes you do not know where there will be water and where the sun will hit. Sometimes there will be water in the garden like last year. So I managed to harvest from the garden but I did not get anything from the fields].

Even though VaTandi appeared to be on top of the situation when we had the conversations on how she has responded to the various challenges she had encountered, it was evident that she was unsettled about a few issues. This actually proves that adaptation is a complicated process. She said that she has problems in replanting when crops fail due to prolonged dry spells. To use he own words, she indicated that:

> *…Ah hatiwanzo jarurura nokuti zvimwe zvinenge zvato dai. Unoti ukarima muna November kana December, zvakuenda kuda kuno tarubuka ka.Ucha jarurura papi, mbeu unenege unayoba?* […Ah we do not usually do replanting because some of the crops would be grown. If you plant in November or December you cannot later on do replanting because some of the crops will be on tasseling stage. Where do you replant, would you still have seeds?].

The above quote illustrates the dilemmas that she faces regarding replanting when some of the crops are already grown. She also hinted at the problem of lack of money to purchase additional seeds for replanting. However, VaTandi does not get trapped in this structured circumstance, and hence she borrows *kadonor kemasidzi* (5 kilograms of seeds) from neighbours and relatives so as to replant.

Apart from this, she highlighted labour constraints as affecting her response strategies. She said she does not have anyone else to help her work on her land except her eldest grandchild. For her, it was real painful to work on her own. Like what key informants and other respondents alluded to in the study, VaTandi mentioned that there was no one who helped someone to work in their fields unless if it was hired labour. Nonetheless, like others in her situation, she does not allow labour constraints to limit her endeavour to cope or adapt. Therefore, she had to be content working on her land on her own or with her eldest grandchild when she decided to do replanting and farm multiple fields.

One striking aspect that VaTandi mentioned that other respondents in the study did not articulate as a constraint was the seasonality of local agricultural *maricho* (casual labour). During the time of the fieldwork, she indicated that she was not engaging in any casual work because agricultural work in the fields was not available. Similarly, due to the rapid deterioration of water sources, gardens under cultivation were few such that it was difficult to get work. At the same time, in seasons with very poor harvests due to drought and poor harvests due to *kundondovera* (leaching) from too much water, it was difficult to find work in return for either money or grain. Nevertheless, VaTandi is able to handle these constraints in some way. Like what some of the few respondents in the study do, when *maricho* (casual labour) is scarce locally, she occasionally goes to small-scale commercial farming areas to work. There she is paid in cash or kind (grain).

Whereas adaptation is fraught with constraints as articulated above, there are also enablements. These enablements can be structures, interactions, relationships and internal dialogues that people engage in. For VaTandi, internal conversations on fulfilling obligations to her orphaned grandchildren were pertinent in the strategies she pursued. To fully submit this aspect, I refer to the following quotation:

… Yes all these children, there is none with a mother or father. I had 5 of these children here, 3 boys and two girls. This one in grade seven was left by her parents when she was in grade 3. That girl, my daughter I showed you on the picture with her husband, that is the mother for this one in grade seven. So you can see for yourself, I have to worry and think how to get all of them educated. I also had another boy called Givy I was taking care of. I paid his school fees up to form one. I could not just sit and continue eating my heart out. I also asked myself, is it fair for these children to drop out of school, they are orphans? So I educated him from selling bananas and doing maricho [casual labour]. *At the back of my mind, deep in my heart, I told myself to just work for that little money so that my son's child would go to school. I also had his* [Givy's] *little brother who was taken this year to go and live in Harare. I was working for him. I have always asked myself, if I do not work, what do I do with these children? Will they be able to cope sitting at home whilst others go to school?*

Fundamentally, as evident in the above quote, the internal dialogues she had regarding her grandchildren were indispensable in the adaptive trajectories she has followed.

8.6 Conclusion

In this last empirical chapter I have shown that adaptation is a complex process underpinned by various structures, processes and conditions. These are both constraining and enabling the process of adaptation in the study site. Even though that is the key finding in this chapter, from an Archerian perspective, farmers are not perpetually entrapped in varied objective structures, conditions and processes. As such, they are reflexive and thus they are able to circumvent the multifaceted constraints imposed by various structures and interactions. At the same time, enabling structures and interactions do not simply determine farmers' responses but simply orient them. In this regard, by accepting various ideas brought by external actors and participating in NGOs projects, farmers activated enablements presented to them.

CHAPTER 9: CONCLUSION

9.1 Introduction

I left Charewa in early August 2014 as I had completed my fieldwork. When I left I hoped one day I would return and I still want to go back to Charewa, if not for more research, then just to see how these subsistence farmers who gave me the knowledge that produced this thesis are doing. Since I left I have reflected so many times on how my thesis was going to make a difference to the lives and livelihoods of farmers in this semi-arid rural area. I have tried to address that question through a critical and detailed presentation and analysis of the life stories, concerns and even fears of these farmers in the four empirical chapters of this thesis. For a number of farmers, participating in my research interviews was their first and perhaps only opportunity to articulate their personal concerns and strategies, and to rehearse what they want their futures to be like. Still, that question remained up until I developed this last chapter.

Following that, in this chapter I reflect upon the entire thesis, revisiting the numerous questions that spurned the development of the thesis. To this end, I start by summarising the entire thesis and reiterating the key findings and conclusions. I then proceed to explicate on how Margaret Archer's theory allowed me to understand how farmers are adapting to increasingly changing climate variability. From there, I direct my attention to how my thesis is contributing to knowledge and here I discuss the theoretical, empirical and policy contributions. Before I submit the thesis' concluding remarks, I identify areas for future research based on my study findings.

9.2 Summary of Thesis, Key Findings and Major Conclusions

The thesis was designed to understand and analyse how farmers problematise climate variability and how they are responding to it in a rural community in contemporary Zimbabwe. In order to fulfil this objective, several questions were asked in the research process:

1. What changes are occurring in climate variability in Charewa?
2. What do farmers perceive as the drivers of these changes?
3. What livelihoods challenges are farmers facing in the context of climate variability?
4. What are farmers doing to deal with changes in climate?

5. What are the constraining and enabling factors in adaptation processes?

The first chapter essentially establishes the research problem my thesis sought to address. Several gaps found in literature on climate change adaptation were expounded and in the process the significance of my study was established. From there, the questions, objectives, theoretical framework and methodology driving the thesis are discussed in the chapter. The second chapter explicates the theoretical framework that drove the analysis of adaptation in the study. Fundamentally, the chapter shows how the sociological theory of Margaret Archer provides an intriguing and novel way of understanding how farmers problematise climate variability and how they have formulated responses to it.

In chapter 3, I direct the reader to the national context within which my study is located. In this chapter, I establish the trends and patterns in climate change and variability in the country, and the subsequent impacts on agricultural livelihoods. In the process, I pay attention to how these have been framed in current studies thereby exposing the problems evident in these studies. In juxtaposing macro-level, model based studies to local level, farmer focused studies, I reveal their convergences and divergences. I make it clear that there is agreement that climate change is happening, but differences exist on explaining the change. In the end the chapter concludes that current studies in Zimbabwe are problematic because they concentrate more on the macro scales and are based on quantitative models thereby disregarding local scales and marginalising farmers' interpretations and discourses.

Chapter 4 shows that current studies on adaptation in Zimbabwe provide numerous insights in understanding adaptation. However, the chapter also exposes some problems found in these studies. Firstly, nearly all macro-level studies have a strong disposition toward positivist epistemology. Secondly, there is conceptualisation of adaptation from a narrower position which concentrates on sectoral vulnerability. Thirdly, theorising adaptation using sociological theories is still not widely appreciated. Fourthly, merely identifying and categorising adaptive strategies is a fundamental self-limiting trajectory as it neglects to analyse the structures, processes and conditions underpinning adaptation. The chapter concludes that various frameworks used in analysing adaptation are valuable but the marginalisation of sociological theories is not fruitful for the development of the field of climate change adaptation in the country.

The first two questions (listed above) asked in the thesis were empirically answered in chapter 5. It was found that, although both rainfall and temperature matter to farmers' lives and livelihoods in this semi-arid rural area, rainfall emerged as the ultimate concern. The study established that rainfall was now characterised by increasing unpredictability and unreliability. In addition, farmers are confronted by shifting trends in temperature. At the same time, these peasant farmers are not experiencing climatic shifts in a discrete way *per se*. In that respect, farmers are concerned about non-climatic aspects, specifically socio-economic perturbations. The thesis also found that farmers mainly construed changes in climate variability to be caused by natural shifts in climate, but they equally sought explanations for the changes within the religious and cultural domains. Over and above this, the conclusion was that farmers in Charewa are encountering increasingly changing climate variability, a phenomenon I construe in Archerian terms as a moment of nascent morphogenesis or structural/contextual discontinuity.

In chapter 6 the study sought to provide insights into the multifaceted livelihoods conundrums farmers are confronting, which is the third question above. These were appreciated within the context of climate variability. The chapter revealed that changes in rainfall and temperature were the principal drivers of negative livelihoods changes in Charewa. It was established that climate variability has disrupted the agricultural calendar, evoked repeated harvest failures and livestock losses, complicated crop and livestock management, interrupted ecological facets, induced land degradation and stimulated deterioration of water sources. The conclusion in the chapter was that whereas climate variability is principally driving livelihood changes in this peasant farming area, it is interacting with other factors such as poverty, economic decline, poor farming techniques and natural resources depletion to produce complex livelihoods challenges.

The last questions (four and five) of the thesis listed above were addressed in chapters 7 and 8 respectively. In chapter 7, the thesis presented findings on the diverse strategies used by farmers to deal with climate variability. The thesis starts by making it clear that farmers are not merely submitting to the shifts occurring in climate. On that point, farmers are aware of the changes occurring around them and what these are doing to their livelihoods and, as such, they have come up with versatile coping and adaptive strategies. At the same time, my study found that farmers are not responding to climatic changes only but they are simultaneously navigating problematic

socio-economic landscapes. The main strategies that are presented in the chapter include re-organising crop production, increasing crop and livestock diversification, conservation agriculture and increasing the role of indigenous knowledge strategies. In the final analysis, the chapter concluded that, although some strategies adopted by farmers in Charewa were novel, most of them were not and hence adaptive strategies should in the main be comprehended in terms of re-organisation, revival, extensification and intensification.

In the last empirical chapter, my thesis argues that adaptation in Charewa is fundamentally a complex process underscored by various structures, processes and conditions. The chapter shows that farmers face varied constraints and encounter diverse opportunities in the process of adaptation. Using Margaret Archer's theoretical framework, the chapter analyses these as socio-structural, socio-interactional and internal dispositions. Ultimately the chapter concludes that, although the process of adaptation is fraught with constraints, farmers use various tactics to evade these. Concurrently, enablements or opportunities presented to farmers do not determine the direction of their strategies but simply provide what Archer (1995) calls strategic guidance. In this respect, farmers actuate these enabling structures and interactions.

9.3 Understanding Adaptation from an Archerian Perspective

It was the intention of my study to show how Archer's theory can be used to provide an understanding of adaptation by rural subsistence farmers. Therefore, at this juncture I can say with conviction that in using her theory I am now better able to explicate how farmers are responding to changing climatic conditions and difficult socio-economic circumstances, as well as what underpins their strategies. This is because Archer's theory allows researchers to analyse data in such a way that they are able to advance an argument about the structures, processes and conditions under which a phenomenon (adaptation) was possible at a particular time in history and at a specific spatial location.

In that regard, the thesis was informed by Archer's theory, particularly pertinent in light of the constraints and enablement farmers faced, and the ways they engaged with these in the process of adapting. In so doing, and to reiterate, the understanding was that adaptation is a complex

process underpinned by various structures, processes and conditions that are both constraining and enabling. In the end, I wanted to reveal the following: why is it that in the difficult circumstances so seriously constraining in real ways, farmers are still able to overcome constraints which would otherwise simply determine their actions? Margaret Archer's nuanced approach to agency and structure helped me begin to make sense of the ways that farmers exhibit more complex ways of engaging with the changes in climate variability and their livelihood implications.

9.3.1 Climate Variability as Morphogenesis

Following the Archerian perspective, one needs to understand how people problematise their circumstances prior to understanding how they are responding. Therefore, my analysis of findings in the thesis reveals that farmers in Charewa have entered a moment of nascent morphogenesis or contextual discontinuity as espoused by Archer. This is a moment or period of increasingly changing climatic variability. It is apparent that farmers are not oblivious to this change especially considering that their livelihoods are dependent so much on climatic conditions, primarily rainfall. As such, for farmers, climate variability is real and problematic in very specific ways. Therefore, they care most about structural uncertainties in the form of increasing unpredictability and unreliability of rainfall. In Archerian terms, this is their ultimate concern, that is, what they personally care about most. Still, if the analysis ends here, what farmers regard as really problematic remains elusive. Therefore, what ultimately emerges as the defining features of the problem are the following: late onset of rainfall season, early cessation of rainfall season, poor rainfall distribution, extreme rainfall events, poor quality rainfall and declining rainfall amount.

At the same time, my analysis of data shows that, whereas the period of contextual discontinuity is defined by shifting climatic conditions, this is not isolated from other structural problems deriving from the wider macro-economic context. Farmers therefore defined the problem of climate variability in relation to other problems they are also facing. I can therefore argue that the problem of climate variability is intertwined with non-climatic problems. Simultaneously, farmers do not merely define the problems they are facing but they have explanations for their

emergence. In this regard, my data analysis divulges that whilst natural shifts in climate are regarded as significant drivers of changes, farmers equally seek explanations within the religious and cultural realms. As such, intensified changes in rainfall and temperature are regarded as reactions of *Vadzimu* (ancestral spirits) and God to provocation. It therefore follows that these two extra-human entities have ushered in the moment of morphogenesis in Charewa.

9.3.2 Livelihoods under Morphogenesis

Apart from the above, the livelihoods challenges resulting from climate variability can be easily comprehended within Archer's framework. I mentioned in chapter 2 that one of the strengths of Archer's theory was that it is adjustable enough to include and indeed incorporate complementary notions and insights from other scholars. In that respect, besides analysing the livelihoods challenges in Charewa within Archerian theory, I also bring in other scholars as seen in my literature review. Following that, one aspect that is clear is that climate variability has created logical inconsistences (Archer, 2012) by disrupting the agricultural calendar. Farmers are now finding it difficult to plant their crops on times they used to know. Agricultural activities such as weeding and application of fertilizer are interrupted by increasing mid-season droughts whilst harvesting activities are complicated by sporadic down pours. Eventually, the start of dry season activities is delayed and this has implications not only on growing horticultural crops but it ruptures social relationships surrounding the management of livestock.

In addition, there are clear contextual incongruences (Archer, 2012) in the livelihoods of farmers in Charewa emerging from the disappearance of traditional seed varieties. Farmers in this smallholder farming community have grown traditional varieties for generations and have retained the seeds as well. However, successive years of droughts have clearly led to the erosion of 'farmers' varieties' of groundnuts, rapoko, millet and sorghum. Resultantly, farmers have been left to rely on hybrid varieties, particularly of maize, that are ill-suited to the climatic conditions of agro-ecological region IV.

Invariably, climate variability is producing what can be referred to as a situational logic of competition (Archer, 2012) over water sources in Charewa. In a related manner, there is a

proliferation of competing identities and claims (Berry, 1984) over limited water sources. Increasing water scarcity and deterioration of water sources, for example, are intensifying competition for water among different farmers in the study area. The intensified competition becomes translucent when regarded in the context of irrigators and non-irrigators in Charewa. Those with irrigation pipes are able to draw more water from the remaining limited sources and some farmers enclose water along the river/stream channels. As a result, this is impacting on the social fabric. For example, respondents in my study noted that some of the irrigation pipes are vandalised and weir dams are filled with sand. Analytically, whilst these are merely the unintended effects of the situational logic of competition in the Archerian sense, it is also apt to regard these as signs of a decaying moral economy that Watts (1983) speaks about.

Furthermore, I have argued earlier that, whilst structural uncertainties such as rainfall unpredictability and unreliability and rising temperatures are the principal drivers of perverse livelihood changes in Charewa, they are interacting with other elements. In essence, to borrow the concept used by O'Brien et.al (2004), farmers' livelihoods are exposed to multiple stressors. Factors such as poverty, economic decline, natural resources depletion and poor farming techniques are therefore important variables in the analysis of livelihood problems ensuing in this smallholder farming community. There in, the linkage between climatic and non-climatic is best comprehended using the conceptual framework of double exposure developed by O'Brien and Leichenko (2000). In this case, whilst Archer is very good at articulating the linkages between structure and agency, the concept of double exposure considers the interplay among various structural elements, which are climatic and non-climatic aspects in my study. As such, the concept of double exposure as applied in this thesis explicitly shows that climate variability couples with poverty, economic decline, natural resources depletion and poor farming techniques in compound and complex ways.

Finally, I agree with the point raised by Archer (2012) on the heterogeneous impacts of contextual discontinuity. Similarly, using the concept of double exposure, it is apt to argue that structural uncertainties are creating both losers and winners in Charewa, though the former group dominates. This argument is informed by the view of Leichenko and O'Brien (2008) that not all individuals, communities, regions and nations will be equally affected by climate change. In this

case, some people are able to take advantage of opportunities that arise in the midst of climate adversity. In Charewa, those with irrigation pipes and gardens located near Dorongoma dam were winners because they were able to grow crops that fetched good prices at *Mbare Musika*, for example, during the drought of 2002. Nonetheless, it is clear that climate variability has created more losers than winners. Even so, the deployment of the term 'losers' in my thesis is simply for analytical purposes to show how farmers are predominantly losing out in the face of climate variability. As such I am not labelling farmers in Charewa as 'losers' in a negative or offensive way in the manner that some scholars have labelled peasant farmers as victims.

9.3.3 Adaptation as a Reflexive Process

Now, when it comes to how farmers are adapting to climate variability, the most common interpretation of the findings in this thesis would be to identify and perhaps describe the impacts of structural constraints and enablements on adaptation and end there. In many instances, scholars simply outline aspects such as wealth, technology, access to climate information, adaptation policies and access to markets as enhancing or constraining adaptive capacity. Using quantitative models (for example, logit models), scholars have argued that factors such as education of the household head, farm household size, access to credit, farming experience and exposure to information on climate change and variability all positively and significantly influence farmers' decisions to adapt. Such a notion implies that farmers are trapped in structurally deterministic modes of reaction and perhaps contingent on 'outsiders' to liberate them by providing them adaptation 'aid'. In this way, reflexivity and agency are usually suffocated under the weight of social structures. However, the findings in this thesis resisted the simple understanding of structural aspects as deterministic, which tends to deprive farmers of agency. Clearly, farmers are not drones to be determined by social conditions. Therefore, in a world in which there are no enduring guides to a life worth living, where uncertainty suffuses experience, farmers have become reflexive. In fact, I think these farmers *must* as Archer (2012) would have said it.

It is clear in chapters 2 and 4 of the thesis that literature on adaptation in rural Africa in general and in Zimbabwe in particular provides numerous examples of studies of structural conditions.

Given the real and demanding challenges faced by farmers in such contexts, this is understandable. The problem, however, is that this profoundly linear and determinist approach implicitly assumes that by creating enabling conditions, farmers' actions will automatically change and adaptive strategies will endure or even be expanded. Nevertheless, I argue in this thesis that even in constraining circumstances, farmers find ways of 'overcoming the odds' to meet their objectives. In this instance, I challenge the power of structures such as market structures, household labour, household wealth and land scarcity as well as interactions such as trading relationships to determine farmers' actions in Charewa. Archer's theory provided the means to show how farmers as persons are able to find ways to evade, endorse, repudiate or contravene enablements and constraints (Archer, 2003).

Archer's theory provided a theoretical perspective which provides a way to examine the social reality of farmers' adaptive strategies by creating ontological, methodological and theoretical space to analytically separate structure from agency. To develop my argument, I specifically reiterate the three aspects by Archer that I have also elaborated on in chapter 2. First of all, there are structural and cultural properties which *objectively* shape the situations which agents confront involuntarily, and which possess generative powers of constraint and enablement in relation to agents. Secondly, and in this context, there are agents' own configurations of concerns, as *subjectively* defined in relation to the three orders of natural reality – nature, practice and society. Thirdly, courses of action are produced through the reflexive deliberations of agents who subjectively determine their practical projects in relation to their objective circumstances (Archer 2003:135). In the end, just like Archer, I reject the notion of structural determinism in understanding adaptation.

The above suppositions therefore provided a useful way of reading the findings of the study. In particular, Archer's theory pointed to an examination of the ways that adaptive strategies were produced through the reflexive deliberations of farmers who subjectively determined their practical projects in relation to their objective circumstances. Furthermore, for anything to exert the power of a constraint or enablement, it has to stand in a relationship such that it obstructs or aids the achievement of some specific agential enterprise or 'project' (Archer 2003:6). Therefore, in the case of my thesis, the structures of adaptation such as market structures were real

constraints for farmers in Charewa, just as land scarcity and household labour shortages genuinely located farmers in challenging circumstances (point 1 above). However, farmers' experiences of the constraining factors, shown in Table 9.1 below, are mediated by their own constellations of concerns (point 2 above), and what farmers actually do occurs as a result of individual reflexive processes in which their concerns are considered in relation to the objective reality of structural enablers (such as livestock and crop extension, land and water tenure arrangements and farming experience) and constraints (point 3 above).

Table 9. 1: Using Archer to Make Sense of Farmers' Perceptions on Constraints and Enablements

Archerian Category	**Emerging Enablements**	**Emerging Constraints**
Structure	Farming experience Extension services and support Land and water tenure NGO Projects	Household Size Household labor shortages Lack of household wealth Agro-ecology and crop characteristics Land scarcity Market structures
Culture	Relations with family and friends Values on community obligations Trust among community members Culture of cooperation Farmer to farmer interactions Neighborly bonds	Trading relationships Lack of social agreement on controlling livestock Discourses on gender and land
Reflexivity	Fear of consequences of not adapting Concerns about the future Enthusiasm for structural change Sense of duty to family	

Source: Fieldwork, March-August 2014.

Following the above, and in using Archer's language, one would ask 'what is the project' farmers are engaged in? Next, one asks: what are the enablements or opportunities presented to farmers? Then, noting the constraints which realistically limit farmers' adaptive strategies, one would proceed to ask: how are the causal powers activated by farmers who are not passive recipients of the circumstances in which they find themselves in? In Charewa, it is evident that adaptive strategies are constrained but there are also enablers in the adaptation process. Noticeable however is the fact that farmers are able to reflexively evade constraints and activate enablements.

Farmers in Charewa refuse to live at the capricious mercy of structural constraints they face in the process of adapting. This resonates with what Archer said that 'when a project is constrained during its execution, agents can act strategically to discover ways round or to define a second best outcome' (Archer, 2003:6). As such, and reflexively, farmers in my study used various tactics to confront varied constraints. For example, land scarcity was challenged by farmers through renting gardens thereby evading the constraints imposed by the objective reality within which they found themselves. Archer (2003:7) also notes that 'the influences of constraints and enablements will only be tendential because of human reflexive abilities to withstand them and circumstantially to subvert them'. For example, if there are no possibilities of hiring labour due to wealth constraints, farmers ignore the constraint and manage with available family labour. There in, a structural constraint is actuated.

Farmers also exhibit their agential power by circumventing constraining relationships and interactions. In this respect, I echo Archer's view that relationships too have to be negotiated to an unprecedented degree as uncertainty and unpredictability heightens (Archer, 2012). As I presented in chapter 8, trading relationships at *Mbare Musika* placed farmers from Charewa in difficult circumstances. Even so, they used various tactics to get around these. For instance, farmers hired *makoronyera* (swindlers) so that they can be able to sell their crops and ensure safety of their crops. In addition, farmers negotiated relationships at the local level. In view of the absence of an agreement on controlling livestock, farmers who practice Conservation Agriculture (CA) and *kupandira* (dry planting) have resorted to waiting on their gardens and fields.

On another note, ignoring or evading the constraints on adaptive strategies carries objective opportunity costs as espoused by Archer. The opportunity costs arise because the decisions that farmers make and all other social actors are fallible. These costs also exist because these decisions are made within a context not of their own choosing but within a context farmers find themselves. For example, when farmers go to the market, they find that *makoronyera* (swindlers) are the ones who determine the prices of their produce. Evidently, when farmers negotiate trading relations at the market by hiring *makoronyera* (swindlers) they have to fork out money. Similarly, for farmers in Charewa, taking produce home in view of poor prices at *Mbare Musika* means they have to endure transport costs. In a related manner, when some farmers decide to wait on their fields because they plant early under CA, they have to sacrifice other farm activities which require labour. To add, when farmers withhold their produce to store and sell when prices improve at *Mbare Musika*, they have to go through the mundane processes of drying and storing, which demand labour.

Simultaneously, although farmers perceived a number of aspects such as land scarcity, household wealth and labour in a negative light, their concerns for the future, obligation to family and fear of consequences of not adapting were all powerful enablers in the study. In this regard, emotional investment is of importance to Archer (Mutch, 2007). Focus here is not on means but the end. For instance, the desire for better lives for their children was regarded as the prime concern by farmers who engaged in and reflected upon their adaptive strategies in view of future aspirations. The reflection took place in the form of internal conversations and that is why some farmers in the study came to expand or maintain strategies such as micro-irrigation and CA over time.

Concurrently, farmers actuated several socio-structural and socio-interactional enablements. Here, like Archer, I argue that these enablements did not determine farmers' strategies but merely provided strategic guidance or orientation. I draw attention to the Jatropha programme and NGO projects on CA, *Zunde raMambo* and consolidated gardens presented in chapter 8 as enablers. As such, with the initiation of the national biofuel drive and the NOCZIM Jatropha Outgrower Schemes in Mutoko, 'a situational logic of opportunity' (Archer, 2012) emerged for farmers. They responded to these enablements by developing interest in the Jatropha discourse,

accepting the growing practices propagated by NOCZIM and also localising the supposed economic benefits of Jatropha. Similarly, farmers could have easily resisted NGO projects such as consolidated gardens but they agreed to participate and organise into groups. In addition, some farmers did not simply give in to CA as it was being promoted by NGOs, as they realised an opportunity to obtain free fertilizer and seeds.

Furthermore, I agree with Archer that uncertainty and unpredictability militate against instrumentalism and rationality. For some people what is rational is not to get involved with *makoronyera* (swindlers) at *Mbare Musika*, yet farmers in my study actually hire and befriend them. This way, farmers get their produce to be kept safely and sometimes sold at 'reasonable' prices. It may also not be rational to take produce back home and incur transport cost, yet this allows farmers to store crops such as beans, groundnuts and dried vegetables for sale when prices at the market improve. In a related manner, there were comments from respondents that I presented in chapter 8 that also go beyond instrumentalism. Fundamentally, these suggest life projects. For instance, adaptive strategies such as expanding crop and livestock diversification, expanding micro-irrigation, using drought resistant trees, soil management and CA were undertaken in view of 'concern for the future', 'determination to succeed' and 'desire for better lives' by some farmers. Similarly, some farmers viewed CA in a negative light because it demanded a lot of labour, yet when they made dialogues on concern for the future, they regarded it as better than food aid or borrowing from relatives or friends. Therefore, their concern for the future became a powerful enabler. This illustrated Archer's contention that 'the activation of casual powers is contingent upon agents who conceive of and pursue projects upon which they would impinge' (Archer 2003:7).

Still arguing within an Archerian framework, the costs of engaging in a life project (adaptive strategy) are differential among farmers, though to a limited extent. For example, in view of labour constraints demanded in labour intensive strategies such as CA, soil management, maintaining multiple fields and intensifying horticulture, the cost of hiring labour is higher among poor and worse off households. In the same vein, the cost of dealing with short season varieties such as 4Series that are prone to grain borers is more constraining to the same households because they cannot afford repeated crop protectant. In addition, when these farmers

do *kujarurura* (replanting) they have to purchase more seeds. Apparently, such costs are objective and failure to allow for them actually derails strategic action (Archer, 1995) as seen in some farmers resorting to abandoning the foregoing strategies.

On a slightly different note, Archer (2007) offered a typology of reflexivity shaped by the interplay between social situation and personal project. Archer notes that reflexivity is underpinned by cognitive affordances possessed by embodied agents. However, only one of her four modes, fractured reflexivity, presented clear lens through which to understand the fact that some farmers indicated that they were not responding to climate variability. In this case, instead of engaging in purposeful actions to address livelihoods challenges they were experiencing, these farmers were disoriented or were more like 'walking wounded' as Archer (2012) described fractured reflexives. Therefore, it is apt to argue that they remained trapped in these circumstances. However, in all honesty, I do not blame or find fault in the farmers who argued that they were not doing anything. They are also not victims. I therefore present them as people or agents (in Archerian terms) who have simply chosen a different coping trajectory from most farmers in the study. This is quite enlightening considering that most studies on adaptation in rural Zimbabwe seemingly portray adaptation as automatic or axiomatic from their case studies.

Nevertheless, my findings contradict Archer's notion that fractured reflexives' life chances are determined by involuntary social positioning. Instead of blaming gender, for example, some of the farmers simply felt that their circumstances were beyond their control and were determined by some higher powers. To be specific, one respondent thought that he did not have the ability to change his situation but God did, because what was happening was God's doing in the first place (because he was angry).

At the same time, there is something disquieting about how Archer frames fractured reflexivity as 'incapacity to engage in internal conversation completely'. Basically Archer implies fractured reflexives do not think or ponder over their circumstances and they lack decision making capacity. As such they cannot do much about their situations. On the contrary, my findings divulge that farmers who are not undertaking any strategy ponder over their situations or even consult their feelings. For example, I indicated that one farmer thought his condition was induced

by some powers he could not control and he deliberated on what he initially thought he could do to deal with various challenges but, in the end, decided nothing he could do would change his circumstances. Another farmer contemplated about what was happening to him, talked to himself about his lack of control over things that he had not caused in the first place, and thought about possible futures. Therefore, Archer's framing of fractured reflexivity is overly simplistic. Nonetheless, I agree with her that resigning to fate in order to cope may not be the way to shape lives and livelihoods in nascent morphogenesis. Some of the farmers indicated that they had dreams and aspirations of better lives in the future for themselves and their children, and thus it makes sense that they did something to realise their concerns.

In the final analysis, farmers in Charewa are ever ready to realise the 'thing that really matters', which is livelihoods adaptation in the face of changes in climatic conditions. They carefully weighed and sifted coping and adaptive strategies against the background of enablements such as NGO projects, land and water tenure arrangements, and family and neighbourly bonds. They cobbled together, mostly alone and sometimes with their families, a coherent understanding of the emergent constraints in the process of adaptation and methodically assembled strategies to circumvent these. Farmers not only showed inventive capacity to elude the constraints imposed by structures, interactions and relationships, but they made sacrifices and trade-offs. For example, in view of land scarcity, they rented garden spaces and in these they chose to grow crops for subsistence and thereby fore go crops for sale. It is thus not a *modus vivendi*, to use Archer's language, but a *modus operandi* that helps farmers to adapt to complexity, contingency and uncertainty (Blatterer, 2013). It is the kind of adaptation that veils itself as creativity, self-assertion and agency.

9.4 Contributions of Thesis to Knowledge

This section provides a discussion on the contributions of my thesis at theoretical, empirical and policy levels.

9.4.1 Sociological Analysis of Adaptation to Climate Variability

At the theoretical level, the thesis expands the understanding of adaptation by bringing in a sociological perspective that allows an analysis of how people problematise their circumstances and formulate responses to it. The theoretical contribution is also encompassed in the fact that the sociological theory of Margaret Archer is new to climate change research. In chapters 1, 2 and 4 I indicated repeatedly how sociology is largely missing in climate change debates and noted how middle-level theories have dominated the analysis and framing of adaptation. Structure-agency theories and other sociological concepts are marginally found in climate change research. Yet, I make the sociological argument that adaptation to climate variability is bound with structures, processes and conditions that cannot be grasped by climate models. Therefore, Archer's theory forms a novel contribution to adaptation inquiry because it allowed me to show how farmers understand the problem of climate variability and the emergent enabling and constraining mechanisms for adaptation taking into account their reflexivity.

9.4.2 Empirical Contributions

My research is an empirical, qualitative and micro-level study of adaptation that is based on farmers' interpretations and life stories. It reflects the realities of how climate variability is experienced and responded to on the ground. Whilst some of the strategies presented in the thesis are not novel, my research contributes new empirical data on structures, processes and conditions underlying adaptation practice. In addition, unlike other studies, I have empirically shown how farmers are adapting to climatic changes and at the same time navigating socio-economic conditions. Also, whilst studies in Zimbabwe widely portray adaptation as automatic or universal, I have empirically established that is not always the case. As such, whereas most farmers have devised coping and adaptive strategies, some farmers displayed fractured reflexivity therefore they have resigned to fate.

Over and above this, the thesis provides new empirical data on climate variability, livelihood changes and adaptive strategies in a marginal, remote and relatively under-researched area of Zimbabwe. It reveals, empirically, new comprehensive insights on climatic changes as well as

farmers' livelihood strategies and, in the process, highlights their adaptive strategies. In doing so, it reveals that farmers are reflexive and able to circumvent various constraints.

9.4.3 Contributions to Adaptation Policy

My research has provided knowledge and insights that might prove useful for practitioners in the field of climate change adaptation in Zimbabwe and beyond. The thesis findings can inform their actions and responses to the circumstances which confront rural farmers, enabling them to make better decisions to build farmers' resilience and promote sustainable adaptation. I therefore hope to have developed illuminative ways of understanding climatic variability and adaptation in a semi-arid context in order to help significant practitioners to operate in more considered and better-informed ways.

There in, at the policy level, the thesis provides empirical evidence and supports novel approaches to adaptation policy and practice in contemporary environments based on the recognition of the centrality of farmers' perceptions, experiences and practices. In chapter 3 of the thesis I have highlighted the various implications of approaches used in current studies on climate change and variability. Just to reiterate on some of them, assessments can entrench local communities into unequal power relations and macro-assessments can misdirect adaptation policies when they do not consider local people's concerns. Therefore, my thesis encourages a shift from response frameworks/strategies based on assessments that are blind to local people's concerns to more encompassing or locally inclusive adaptation response frameworks.

Furthermore, whilst the dominant orientation of climate change policy in Zimbabwe is adaptation that is straightforward, my thesis exposes that adaptation is a complex process. Therefore the thesis also directs policy makers to the reality that farmers in Charewa are responding not only to climate variability but also to difficult socio-economic landscapes. The current emphasis on improving adaptive capacity in relation to current and expected future climate variability must therefore be seen in the context of farmers continuously coping with and adapting to other factors that influence their livelihoods.

In addition, my discussion of response frameworks in chapter 4 reveals that there is weak climate change governance in Zimbabwe such that people at the grassroots level are excluded. However, my empirical research has shown that farmers are knowledgeable about climate issues and therefore they are able to contest the dominant framings of climate change and its impacts. Therefore, there is need for the recognition of local people's interpretations and discourses in the formulation of adaption policies and programmes. Finally, I, of course, have no warrant to generalise from my small case study. However, I also argue that qualitatively enquiring into farmers' understandings of climate variability provides a rich way of interrogating farmers' lives, and it reveals a much more complex picture of adaptation than imagined in current studies and national response frameworks.

9.5 Areas for Future Research

Using the knowledge and insights gained from my research, as well as from other researches and literature on climate change and adaptation, I suggest what I think could be areas for future research in this section. I argue that future research needs to extend sociological understandings of adaptation to climate variability. Firstly, my thesis has shown how farmers are responding to climate variability and navigating socio-economic conditions as well as circumventing structures and processes that constrain them in the adaptation process. At the same time, the thesis showed how they activated various enablements. However, my thesis did not reveal the dominant modes of reflexivity present in the evolving processes of adaptation. I believe doing so requires further and repeated stories to be told by farmers. In this regard, Archer's sociological theory would still provide a rich and valuable framework to deepen the understanding of adaptation as a complex process.

Secondly, another area that provides a fertile ground for further research is the nexus between indigenous knowledge and adaptation. Although farmers in my research talked about 'going back to tradition' to deal with challenges posed by increasing climate variability, they did not elaborate on the extent to which indigenous knowledge is able to deal with that kind of change. Farmers' perceptions articulated in chapter 5 clearly exposed that farmers have not encountered this speedy change in climate variability before. The local indicators such as trees and birds that

farmers use to predict rainfall are under threat not merely from climate variability but other processes including natural resources depletion. Therefore, it is crucial to explore further some of the contestations surrounding indigenous knowledge in highly dynamic contemporary contexts. Another related area is how to reconcile indigenous knowledge and 'scientific' knowledge in adaptation discourse and practice.

Thirdly, there is need for in depth research to understand the outcomes of adaptive strategies. My research findings suggest that some strategies adopted by farmers have negative consequences; for example, intensifying horticulture has adverse environmental consequences. Similarly, by expanding micro-irrigation, those with irrigation pipes (irrigators) are drawing more water from streams/rivers at the expense of those without (non-irrigators). In this case, as others have noted, adaptation processes can potentially exacerbate inequalities in well-being by creating winners and losers (Kates, 2000). This implies that not every response to climate change leads to a positive outcome and, therefore, the potential for negative outcomes over space and time must be recognised.

9.6 Concluding Remarks

By way of conclusion, I highlight that I have tried to shed light on how people in a rural, semi-arid region of Zimbabwe are responding to increasingly changing climate variability. In my attempt to uncover this, I have focused on the principal agents, which are the communal farmers who are living on the frontier of changing rainfall patterns and temperature trends. The most significant realisation I have made was that the complex process of adaptation is underlined by various structures, processes and conditions. Preponderantly, these proved to be constraining farmers in their endeavour to adapt their livelihoods to both changing climatic conditions and corresponding socio-economic circumstances. Even so, farmers do not concede or surrender to these objective constraints because they have properties and powers to monitor their own life and to mediate structural and cultural properties of society. Hopefully, I have been able to show in the thesis how, in a sense, these peasant farmers are able to rise above the changing conditions of their lives and livelihoods, not only by devising coping and adaptive strategies but also reflexively confronting the constraints they encounter in the process of adapting.

In doing so, I have displayed the utility of using a sociological theory for understanding adaptation to climate variability, and likewise of using the case study of a marginal rural community in Mutoko district of Zimbabwe. I did this with the consideration that many existing accounts on adaptation are substantially unsociological. Archer's theory therefore revealed facets of adaptation that have received far too little attention in Zimbabwe and indeed elsewhere. At the same time, whilst not valorising the agency of rural farmers, undoubtedly the ways they construed changes in climate variability, the novel strategies they have adopted and their ability to evade constraints all suggest that there is need to pay more attention to the ways local communities themselves understand change and respond to it.

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APPENDIX 1: GENERAL LIFE HISTORY INTERVIEW GUIDE

Early Life

1. General life-story of respondent, provoked by the question – Could you please tell me about yourself? Relatives and totem.

2. Respondent's experiences of living in the locality.

3. Looking back over the early part of your life do any difficult events or periods stand out?

4. Looking back over the early part of your life are there any positive events or periods that stand out? (Use this question to probe opportunities, aspirations)

5. How did your life compare with other villagers in your village?

Adolescence / Before Marriage

1. Describe how things changed as you became a teenager/ before marriage?

2. Looking back over your teenage years describe any difficult events or periods that stand out?

3. Looking back over your teenage years describe any positive events or periods that stand out?

Adult Life

1. How did you meet your husband/ wife; relationships before marriage; decision to get married; setting up home/ if never married relationship events etc.

2. Respondent's source(s) of livelihoods, concerns and challenges.

3. What has happened to respondent's livelihoods over the years (including how life was in 1990s and after 2000 and now)?

4. Extreme livelihoods events (peak and lows). Any other changes in respondent's life to be noted.

5. Looking at rainfall and temperature, describe how it was in 1990s.

6. Looking back over the 1990s, describe any difficult climate events or periods that stand out.

7. Looking back around 2000 describe any difficult climate events or periods that stand out.

8. Looking at present, describe any difficult climate events or periods that stand out?

9. Probe strategies – get detailed stories to explain strategy movements: What have you done in the circumstances?

10. Looking back at your strategies, why have they changed/not changed?

11. What allowed you to do those strategies? Get as full a story as possible opportunities/enablements.

12. What constrained your strategies? Get as full a story as possible about coping strategies and constraints faced.

Relationships with Other People

1. Links with 'friends' – how have these affected you? Who helped or hindered your strategies?

2. Relationships with other households – how have these affected you?

3. Social networks how have these affected you?

4. Family/Kinship networks – how have these affected you?

Events outside the Home

1. Relationship with government/ local government/ EMA, local and outside markets and buyers.

2. Policy interventions/ programmes.

3. Any other outside events.

Older Age

1. Age when stopped being able to work; changes in circumstance; health.

2. Widowhood: Age when spouse died; implications; feelings; change in status.

3. Looking over your older age are there any difficult events or periods that stand out?

4. Looking your older age are there any positive events or periods that stand out?

Internal Conversations

1. How were you feeling about these strategies you adopted?

2. What conversations did you have with yourself regarding the strategies you adopted?

3. What sort of questions did you ask yourself? What answers did you give yourself?

4. How did you relate these questions to the actions you took?

APPENDIX 2: HOUSEHOLD QUESTIONNAIRE

Questionnaire Identification

1. Village

2. Questionnaire Number

3. Interviewer

4. Date

5. Time

6. Distance from Mutoko B/Centre (km)

7. Distance from main road (km)

1. Demographic Characteristics

1.1 Village.....

1.2 Name ……

1.3 Sex 1= Female 2= Male

1.4 Age (in years).....

1.5 Ethnicity 1=Budya 2= Zezuru 3= Manyika 4= Sena 5= other…..specify

1.6 Marital Status:

1= Married monogamous 2= Married Polygamous 3=Never Married 4= Widowed 5=Divorced/Separated

1.7 Type of household:

1=defacto male headed 2=dejure female headed (absentee/sick husband) 3= female headed 4=child headed male 5=child headed female

1.8 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

1.9 Number of people in household 1= less than 5 2= More than 5 3=5

1.10 Religion 1=Christian 2= Traditional 3= Muslim 4=Other, specify…

1.11 Is respondent Head of Household 1=yes 2= No

1.12 Homestead Characteristics

1.12.1 Homestead walls 1=thatch 2=mud 3=wood 4= bricks 5= cement 5=other (specify)…….

1.12.2 Homestead floors 1=mud 2=cement 3=bricks 4=Other (specify)…….

1.12.3 Homestead roof 1=thatch 2=wood 3=iron sheets 4=asbestos 5= Other (specify)…….

1.13 Some of us are aware that we are having a conversation with ourselves, silently in our heads. We might just call this 'thinking things over'. Is this the case for you? 1= Yes 2= No

1.14 What best describes you from the following?

2. Farmers Perceptions On Climate Variability

2.1. From the following what is the most important concern in your life - the one you care about deeply?

1=Rainfall 2=Temperature 3= Both rainfall and temperature are equally important 4= None of these 5=Other (specify)

2. What 3 main challenges (*zvakawoma*) are you facing right now? (starting with most severe)

a.……b……c……..

3. What best describes your feelings regarding rends in rainfall since 1992?

1= Satisfied 2=Dissatisfied 3= Indifferent 4= Other (specify)……

4. What best describe your feelings regarding temperature conditions since 1992?

1= Satisfied 2=Dissatisfied 3= Indifferent 4= Other (specify)……

5. What is your level of concern on rainfall ? 1=High 2=moderate 3=low 4=indifferent 5=Other, specify…….

6. What is your level of concern on temperature ? 1=High 2=moderate 3=low 4=indifferent 5=Other……. specify…….

7. Are you experiencing the following problems?

7.1 Increased number of seasons without enough rainfall 1= Yes 2= No

7.2 Rainfall ends early (early cessation) 1= Yes 2= No

7.3 Rising temperature 1=Yes 2=No

7.4 Extremes in temperatures 1=Yes 2=No

7.5 Extremes in rainfall 1=Yes 2=No

7.8 Long dry spells during the rainy season 1=Yes 2=No

7.9 Rains do not come at the time they used to 1=Yes 2=No

7.10 Rainfall starts late 1=Yes 2=No

7.11 Prolonged/extended winter season 1=Yes 2=No

7.12 Winter does not come at the time it used to 1=Yes 2= No

7.13 Short winter seasons 1=Yes 2=No

7.14 Heat is more intense 1=Yes 2=No

7.15 Heat spells increased in length 1=Yes 2=No

7.16 Heat spells recuded in length 1=Yes 2=No

7.17 Cold spells increased in length 1=Yes 2=No

7.18 Cold spells reduced in length 1=Yes 2=No

7.19 Cold spells more intense 1=Yes 2=No

7.20 Too much rain 1=Yes 2=No

7.21 Erratic rainfall (Too little rainfall) 1=Yes 2= No

7.22 Rainfall distribution within seasons poor 1=Yes 2=No

7.23 Intense rainfall events 1=Yes 2=No

7.24 Other (specify)…….

8. What was the state of the following in the 1990s?

Biological Aspects

8.1 Tree flowering and fruiting time ……..

8.2 Diseases in Agriculture crops ……..

8.3 Invasive plant species ……..

8.4 Livestock Reproduction patterns …….

8.5 Grass production in pasture. ……...

8.6 Livesock pests and diseases……

8.7 Other (specify)……

Ecosystem Aspects

8.8 Incidents of drought ……

8.9 Soil moisture ……

8.10 Flooding frequency……

8.11 Water source availability ……..

8.12 Ground water table ……

8.13 Plant species ……..

8.14 Heat spells……

8.15 Other (specify)…….

9. Have you observed any of the following after 2000?

Biological Aspects

9.1 Changes in flowering and fruiting time 1= Yes 2= No

9.2 New diseases in Agriculture crops 1= Yes 2= No

9.3 Invasive plant species seen (Forest/Agriculture land) 1= Yes 2= No

9.4 Changes in livestock reproduction patterns 1= Yes 2= No

9.5 Decrease in grass production in pasture 1= Yes 2= No

9.6 Other (specify)…….

Ecosystem Aspects

9.7 Increasing Incidents of drought 1= Yes 2= No

9.8 Soil moisture depletion 1= Yes 2= No

9.9 Flood frequency increased 1= Yes 2= No

9.10 Water source availability decreased 1= Yes 2= No

9.11 Ground water table decreased 1= Yes 2= No

9.12 Extinct species 1= Yes 2= No

9.13 Declining species 1= Yes 2=No

9.14 Frequencies of heat spells increasing 1= Yes 2= No

9.15 Other (specify)……

10. What best describes your evaluation of the above aspects?

1=severe 2=moderate 3=not severe 4=Other

11. What best describes rainfall patterns/ trends in the following years?

11.1 In the early 1990s……..

11.2 In the late 1990s…….

11.3 In the early 2000s…….

11.4 After 2007……

12. What best describes temperature in the following years?

12.1 In the early 1990s…….

12. 2In the late
1990s……

12.3 In the early 2000s…….

12.4 After 2007……

13. Compared to the 1990s, what is your perception of the following since 2000?

13.1 Precipitation Annual 1= Increase 2= Decrease 3= No Change

13.2 Precipitation during Rainy seasons 1= Increase 2= Decrease 3= No Change

13. 3 Precipitation during Dry seasons 1= Increase 2= Decrease 3= No Change

13.4 Length of dry spells, rainy season 1= Increase 2= Decrease 3= No Change

13.5 Intensity of rainfall events 1= Increase 2= Decrease 3= No Change

13.6 Drought occurrences 1= Increase 2= Decrease 3= No Change

13.7 Dry season temperature 1= Increase 2= Decrease 3= No Change

13.8 Rainy season temperature 1= Increase 2= Decrease 3= No Change

13.9 Length of winter season 1= Increase 2= Decrease 3= No Change

13.10 Length of hot season 1= Increase 2= Decrease 3= No Change

13.11 Cold spells 1= Increase 2= Decrease 3= No Change

13.12 Hot spells 1= Increase 2= Decrease 3= No Change

13.13Days of extreme temperature 1= Increase 2= Decrease 3= No Change

14 What are is the main driver of these changes?

1=Natural shifts in climate 2=Cultural and religious reasons

3 = Do not know 4=Other(specify) ……

3 Implications On Livelihood Strategies

3.1 What are your main Livelihood Strategies?

1=Farming (and sale of) rain fed crops and rearing (and sale) of livestock

2=Farming (and sale) of rain fed crops

3=Rearing (sale) of livestock

4=Farming and agricultural work

5=Farming and non-agricultural work

6= Running own business

7= Sale of forest products e.g. wild fruits, firewood etc

9=Regular employment

10=Gold panning

11=Casual employment (agricultural related)

12=Casual employment (non-agricultural related)

13=Remittances.

12= Other, specify……..

2 Are your livelihoods mainly dependent on climate parameters (rainfall and temperature)? 1= Yes 2=No

3 Which of the following describes your household food production?

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

3 Are you facing the following challenges regarding your main livelihood strategies right now?

3.1 Increased prices of inputs	1= Yes 2= No
3.2 Increased transport costs	1= Yes 2= No
3.3 Crop failure	1=Yes 2=No
3.4 Loss of livestock	1= Yes 2=No
3.5 Shortage of transport	1= Yes 2= No
3.6 Labor shortages	1= Yes 2= No
3.7 Increased Land aridity	1= Yes 2= No
3.8 Declining crop productivity/yields	1= Yes 2= No
3.9 High morbidity and mortality of livestock	1= Yes 2= No
3.10 Poor pastures for livestock	1= Yes 2=No
3. 11General disturbances in farming	1=Yes 2= No
3.12 Reduced vegetation	1= Yes 2= No
3.13 Water scarcity	1= Yes 2= No
3.14 Poor soil fertility	1= Yes 2= No
3.15 Increased incidences of crop diseases	1= Yes 2= No
3.16 Reduced livestock reproduction	1= Yes 2= No
3.17 Poor livestock health	1= Yes 2= No
3.18 Degraded vegetation	1= Yes 2= No
3.19 Depleted Wetlands	1= Yes 2= No
3.20 Excessive water resources	1= Yes 2= No
3.21 Depleted water resources	1= Yes 2= No
3.22 Increased incidences of livestock diseases	1= Yes 2= No
3.23 Increased productivity	1= Yes 2= No

3.24 Leaching 1= Yes 2=No

3.25 Other (specify) ……..

4 What were your livelihood challenges in the 1990s? (list 3, starting with most severe)

……..

5 What best describes your livelihoods in the following years?

5.1 In the early 1990s……..

5.2 In the late
1990s……

5.3 In the early
2000s……..…….

5.4. After 2007
……

6. What major livestock rearing problems do you face nowadays (list three)? (starting with most severe)?……..

7. What major crop production problems do you face nowadays (list three)? (starting with most severe)?…….

8. What are the major livestock rearing problems faced in the 1990s (starting with most severe)?

……...

9. What major crop production problems faced in the 1990s (starting with most severe)?

……..

10. How best can you compare crop production in the 1990s and 2000s?

……..

11. How best can you compare livestock rearing in the 1990s and 2000s?

……..

12. Seasonal crop output in the following years

Crop (in kgs, tonnes, boxes, bales)	1990-1994	1995-2000	2000-2004	2005-2010	2011/2012 Season	Last Season	Current season
Maize							
Groundnuts							
Sorghum							
Millet							
Tomatoes							
Beans							
Vegetables							
Rapoko							
Roundnuts							
Cotton							
Tobacco							
Other							

13 Household Livestock Ownership

Livestock type	No	Yes (state number)
Cattle		
Goats		
Pigs		
Sheep		
Poultry		
Other		

14 Livestock Ownership in the following years

Livestock (in numbers)	1990-1994	1995-2000	2000-2004	2005-2010	2011-2013
Cattle					
Goats					
Pigs					
Sheep					
Poultry					
Other					

15 Comparing 1990s and 2000s, what is your perception on the following?

15.1 Cultivation i. Productivity 1= Increase 2= Decrease 3= No Change

ii. Incidence of crop diseases 1= Increase 2= Decrease 3= No Change

iii.. Crop failures 1= Increase 2= Decrease 3= No Change

15.2 Livestock i. Animal health 1= Increase 2= Decrease 3= No Change

ii. Livestock reproduction 1= Increase 2= Decrease 3= No Change

iii. Pasture 1= Increase 2= Decrease 3= No Change

iv. Morbidity/mortality of livestock 1= Increase 2= Decrease 3= No Change

iv. Overall animal health 1= Increase 2= Decrease 3= No Change

v. Incidences of pests and diseases 1= Increase 2= Decrease 3= No Change

vi. Overall livestock losses 1= Increase 2= Decrease 3= No Change

15.3 Land i. Land use 1= Increase 2= Decrease 3= No Change

ii. Abandoned fields/gardens 1= Increase 2= Decrease 3= No Change

15.4 Soils i. Fertility 1= Increase 2= Decrease 3= No Change

ii. Aridity 1= Increase 2= Decrease 3= No Change

iii. Waterlogging 1=Increase 2=Decrease 3= No Change

15.5 Vegetation i. Degradation 1= Increase 2= Decrease 3= No Change

ii. Stability 1= Increase 2= Decrease 3= No Change

15.6 Water resources i. Abundance 1= Increase 2= Decrease 3= No Change

ii. Scarcity 1= Increase 2= Decrease 3= No Change

iii. Depletion 1= Increase 2= Decrease 3= No Change

iv. Excess 1= Increase 2= Decrease 3= No Change

15.7 Wetlands i. Depletion 1= Increase 2= Decrease 3= Change

ii. Stability 1= Increase 2= Decrease 3= No Change

15.8 Other (specify)……..

16 What is the main driver of these crop production and livestock rearing changes?

1= Shifts in rainfall and temperature 2= Poverty

3=Economic decline 4= Depletion of natural resources

5=Other (specify)……..

17 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				
Extremes in temperatures				
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				
Other……..				

4. Adaptive Strategies

4.1 Are you doing anything differently to deal with changes in rainfall and temperature? 1= yes 2=No, go to section 6.

2. Which of the following have you adopted?

Strategies	Adopted 1=Yes 2=No	Year first adopted?	Is it still practiced?	How often done[35]	Reasons for Abandoning/ Continuing Strategy
Conservation farming					
Digging sand dams (Mufuku)					
New crop Varieties					

[35] How often**:** 1=Very few times (seldom) 2=Occasionally 3=Regularly 4=All the time.

Negotiating rain					
Pasture encroachment					
Harvest livestock fodder					
Livestock feed supplements					
Destocking livestock					
Informal Irrigation					
Drought resistant crops					
Barter trade					
Mixing crops and livestock					
Mixing farm and non farm activities					
Rearing smaller livestock					
Intensifying field crop production					

Intensifying gardening					
Restoring vegetation/Jatropha					
Expanding fields					
Abandoning fields					
farming rocky hillside					
Food for work programs					
New Markets					
NGOs food handouts					
Zunde ra mambo					
Temporary migration					
Planting early maturing crops					
Borrowing from friends/relatives (food or money)					

Selling assets					
Re-planting					
Begging					
Garden Cooperatives					
Pray to God					
Pray to Ancestors (Vadzimu)					
Soil fertility improvement practices					
mixed cropping					
Water harvesting					
Seed management practices					
Other, specify					

3 What are the main factors affecting the adoption these strategies?

Factor	Factors as; 1=Constraint 2=Opportunity	Responses
Household Size		
Household wealth		
Farm size		
Farming experience		
Ability to read the rains		
Age		
Commodity buyers and markets		
Indigenous Knowledge		
Farmers Groups		
Agricultural Extension		
Agro-ecology		

Social Identity (ethnicity)		
Geographic Location		
Land Tenure		
Water Tenure		
Environmental Regulations		
Adaptation policies		
Climate change impacts information		
Relations with family and neighbors in ward		
Relations in other wards		
Economic structure		
NGOs projects		
Household labor		

Technology		
Level of education		
Cognitive Awareness of impacts		
Local Churches		
Fear of the consequences		
Feel obligation to family		
Feel social obligation to community		
Credit Associations		
Labor associations		
Concern about the future		
Valuing of benefits of strategies		
Other specify		

4 Why haven’t you done anything?

……
……

5 What is your view about the future?

1=Optimistic 2= Pessimistic 3= Indifferent

6 What are your hopes, dreams and desires?

……
……

APPENDIX 3: OBSERVATION GUIDE

Aspect	Observations (aided by informal conversations)
Fields and land use patterns	
Grazing lands and pastures	
Forests and vegetation	
Gardens	
Rivers, streams and wells	
Swamps and Vleis	
Livestock and crops	
Interactions	
Other	

APPENDIX 4: KEY INFORMANT GUIDE: COMMUNITY LEVEL

Data Sought	Main Source of Information	Technique
Historical Overview of district and ward Ethnic Composition and Gender relations Authority and Leadership Structures Natural resources and assets Water resources and Pasture land Social organization and Access to social resources Economy and Wealth Social services and infrastructure Health and wellbeing Farming calendar and seasonal activities Culture and traditions Villages identification/ Ward map Identifying households (in locality on or before 1992)	Elders Village Heads Spiritual Leaders Community Representatives Farmer's representatives People involved in rain ceremonies Farmers who won Agricultural Show	Key informant Interviews Informal group conversations
Concerns and observations on changes in climate variability since 1992 Start with, what are peoples' concerns in this locality? What are their concerns regarding rainfall and temperature? Compare 1990s, after 2000 and now 1. Rainfall> concerns on annual amounts, seasonal distribution, timing (onset), type and quality of rain received, length of rain and dry seasons precipitation, annual precipitation, intensity of rainfall events, winter season rainfall amount, seasonality changes, rain adequacy, season cessation, reliability (mid-season droughts)	Elders Village Heads Spiritual Leaders Community Representatives Farmer's representatives People involved in rain ceremonies Farmers who won Agricultural Show	Key informant Interviews Informal group conversations

2. Temperature> probe concerns on seasonal/annual levels; compare hot and cold season temperatures), extremes in temperatures; prevalence of cold spells/heat spells. Probe on current cold spell/ onset of winter season 3. Probe on Extreme climatic events/years of extreme climatic conditions and other relevant events /Natural hazards in locality (droughts, floods, cyclones) and their characteristics 4. Probe also concerns on these aspects: Biological Components Ecosystem Parameters 5. Establish Drivers of the changes. Probe on main drivers/causes of changes.		
Livelihoods activities/structure in area (probe on what they mainly do, sources of livelihoods) Characterisation of current agricultural livelihoods strategies (probe land use patterns (cultivation, livestock production, irrigation), remittances, formal employment, casual labor (agriculture/non agriculture), own businessProbe on Farming Calendar Probe on current livelihood concerns. Probe: prices of inputs, transport costs Shortage of transport, Labor shortages, Land aridity, crop productivity/yields, morbidity and mortality of livestock, pastures for livestock, vegetation Water scarcity, soil fertility, increased incidences of crop diseases, livestock reproduction livestock health, Wetlands, water resources livestock diseases, Leaching. Probe on main challenges in crop and livestock production in 1990s, in 2000s and now Probe on changes in main livelihood activities since 1992. How things were in 1990s and after 2000. What happened 2013/2013 season?	Elders Village Heads Spiritual Leaders Community Representatives Farmer's representatives People involved in rain ceremonies Farmers who won Agricultural Show	Key informant Interviews Informal group conversations

What happened current season? Probe on drivers of change and ask about climate drivers last. Establish role of climate in their livelihoods Establish other drivers of livelihood changes (non-climatic)		
Adaptive strategies (and their temporal and spatial scales) What are you doing/have done about changing climate variability? What they generally and specifically do now. Probe on what they did in the 1990s and 2000s. Probe spatial dimensions(where did you do it/where are you doing it) Probe on general reasons for change in the strategies, if there are any changes Probe on non -response (no strategy)	Elders Village Heads Spiritual Leaders Community Representatives Farmer's representatives People involved in rain ceremonies Farmers who won Agricultural Show	Key informant Interviews Informal group conversations
Factors constraining and Enabling the adoption of these strategies	Elders Village Heads Spiritual Leaders Community Representatives Farmer's representatives People involved in rain ceremonies Farmers who won Agricultural Show	Key informant Interviews

APPENDIX 5: KEY INFORMANT GUIDE: SUB-NATIONAL LEVEL

Department of Agricultural Research and Extension Services

1. Current agricultural land use patterns.

2. General trends in agricultural productivity.

3. Establish agricultural productivity trends in the 1990s , 2000s and 2012/2013 agricultural season and current season.

4. Significant changes in agricultural strategies and land use patterns in the district/ward and the main drivers of change in agricultural productivity.

5. Consequences of productivity changes.

6. Agricultural productivity enhancement/security and land reclamation strategies.

7. Local reports, books etc., of relevance for this subject.

Department of Livestock Production and Development/Veterinary Department

1. Overview on livestock health in the area.

2. Livestock production trends.

3. Livestock l health challenges, past and present.

4. Strategies to promote animal health.

District Development Fund-Water Division

1. Main ground water resource use patterns.

2. Current state of ground water resources.

3. Significant changes in water resources use patterns and water resources in selected years a. State in 1990s b. 2000s.

4. What significant changes have occurred?

5. A list of major drivers of water resources changes (probe economic, political, climatic).

6. Consequences of these changes (probe on livelihoods)

7. Water resources reclamation policies and strategies deployed.

District Administrator

1. District Historical Overview and Ward and village maps and boundaries.

2. Ecological Context.

3. Natural resources and economy.

4. Social Services and Infrastructure.

5. Key Developmental trajectories.

6. Local Government responses to droughts and other disasters.

7. Local reports, books of relevance for this subject.

Ministry of Health and Child Care (Charewa Rural Health Centre)

1. Overview on health in the area.

2. Health challenges, past and present.

3. Causes of health challenge.

4. Strategies to promote health in locality.

NGOs (Local and International), Plan and COMMUTECH

1. Questions on livelihoods status and food security in area,, poverty and vulnerability, wealth and wellbeing.

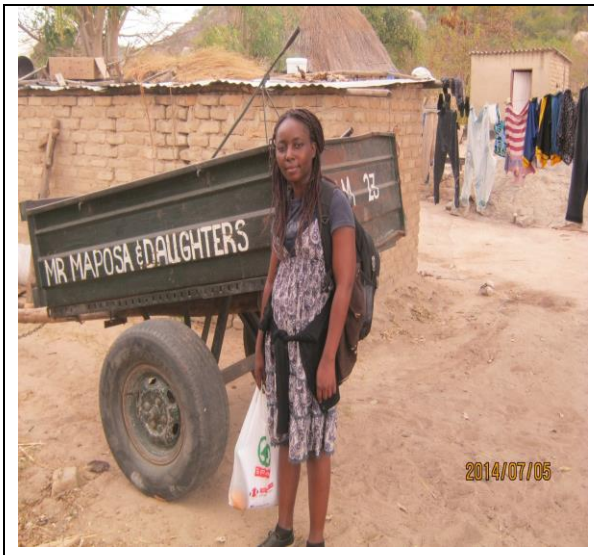
2. Livelihoods enhancing projects/programs and, projects/assistance to facilitate adaptation/build livelihood resilience in locality are imperative.

APPENDIX 6: THE PHD JOURNEY IN PICTURES

Living in the field: This was on the first day during the time I went to commence my fieldwork in April 2014. Then, I was staying in a house that accommodates Plan Mutoko fieldworkers at Kagande Primary School. I had to take my own cooking utensils, food and blankets.

Interviewing a key informant, April 2014, Charewa

At my new home in Gotora village, Charewa. This is where I stayed for the entire duration of the fieldwork after I moved from the accommodation at the primary school.



Exhausted after a day in the field.

Another day in the field, Nyakanyanga and Pasirayi villages, Charewa.

Again, another day in the field.