AN ASSESSMENT OF SOCIAL VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE: A CASE OF WARD 28 IN MUREHWA DISTRICT, ZIMBABWE.

MAPFUMO SHINGIRAYI

B1646692

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RELEASE FORM

The undersigned certify that they have read this dissertation and have approved its submission for marking after confirming that it conforms to the department requirements.

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Supervisor    Dr. E. Mavhura    Date
DECLAREATION

I, Shingirayi Mapfumo, hereby declare that this project is my own work and has not been copied or lifted from any other source without acknowledgement.

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Mapfumo Shingirayi Date
DEDICATION

This work is dedicated to my beloved family and friends for standing by me through this academic journey.
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This project would not have been possible without the encouragement of my family. I thank them for their unwavering support. I would like to express my special thanks and gratitude to Bindura University of Science Education, for granting me the opportunity to pursue a Master’s Degree in Natural Resources Management and Environmental Sustainability program. I would like to express my sincere gratitude to my supervisor Dr E.D. Mavhura for his assistance, motivation, patience and guidance throughout the research. A special mention goes to my fellow students at Bindura University of Science Education for your co-operation and an enjoyable academic year. I would like to thank all those who participated in the research whose names may not appear here. Your effort is greatly appreciated.
ABSTRACT

This study assessed Climate Change (CC) and Variability impacts, Social Vulnerability (SV) and adaptation strategies in ward 28 in Murehwa. Questionnaires, interviews and Focus Group Discussions (FDGs) were the primary data collection methods used. The research combined both stratified random sampling method and purposive sampling and came out with 75 research participants which constituted a sample size of 10%. CC and variability in the study area were determined in terms of droughts, erratic rainfall and increased temperatures. SV to CC was determined using an indicators approach were SV factors like demography, social and economic were assessed. The results showed that smallholder farmers are highly SV to CC with a SV index of 0.565. Percentages of those engaged in coping and adaptation strategies varied as crop diversification 72%, conservation agriculture 88%, non-agricultural occupations 51%, migration to urban areas 68% and farming education and training 32%. An investigation of these strategies showed the need to implement indigenous strategies which are context specific to the study area so as to build resilience to CC. This study is important for policy makers in developing countries to assess CC vulnerability from different perspectives not only to confine to biophysical vulnerability. This therefore brings the concept of Social Vulnerability to Climate Change.
LIST OF ABBREVIATIONS

CC – Climate Change

COP – Conference of Parties

IPCC – Intergovernmental Panel on Climate Change

SPSS – Statistical Package for Social Sciences

SV- Social Vulnerability

SVI- Social Vulnerability Index
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CHAPTER 1: INTRODUCTION

1.1 Background to the Study

Global climate change is one of the most critical challenges facing the international community (Okonya et al, 2013). Climate Change (CC) thereafter refers to long-term statistical shifts of the weather, including changes in the average weather condition or in the distribution of weather conditions around the average i.e. extreme weather events (Wu et al., 2016). It includes change in climate characteristics such as temperature, humidity, rainfall and severe weather events over long period of time. The recent pace of global warming is around 0.065 degrees Celsius per decade on average (IPCC, 2013). Future projections for warming in the 21st century are notably higher, although the estimated rates vary across models, together with warming, extreme weather events such as drought, extreme rainfall and storms have also increased and changed in their timing and characteristics (Pandey and Bardsley, 2015).

Drivers of CC which increases greenhouses gases into the atmosphere are either natural or anthropogenic. Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, largely driven by economic and population growth, and are now higher than ever. This has led to atmospheric concentration of carbon dioxide, methane and nitrous oxide that are unprecedented in at least 800, 000 years (Climate Change, 2014). Evidence to show that CC is occurring is include increased surface warming that has taken place the last 21st century, thermal warming and acidification of oceans, rise in sea level causing floods, loss of mass in the arctic areas, biological and structural changes of species and their extinction.

Climate change is certain to amplify these vulnerabilities given projections of warming temperatures, potential for increased activity attributable to the El Niño Southern Oscillation and trends of increased aridity in southern Africa and other regions within Africa (Okonya et al, 2013). Zimbabwe has not been spared by the impacts of CC. Susceptibility of the country is closely linked to its geographical location where global wind patterns and pressure systems have altered climate related conditions. El Nino-induced droughts of 1982, 1992, 2002 and 2012 years and floods which have recurred each passing rain season in the low lying rural communities notably Muzarabani are evident enough. Long periods of very cold winter seasons compounded by heat waves have been experienced. Cyclones like Elline and Dineo
have been known to cause extensive damage on crops, infrastructure and general livelihood base for Zimbabweans especially the rural poor.

According to IPCC (2013) ecosystems suffer biodiversity and habitat loss and human systems like health will be negatively impacted. CC vulnerability in rural areas of Zimbabwe has been exacerbated by high population growth levels, increased poverty due to food insecurity and demographic gender imbalances. According to Brown et al. (2012) Zimbabwe’s demographic data show that more women than men are poor and live in the rural areas, sex ratio 1:2 (Zimstats, 2012), where livelihoods are intimately linked with the exploitation of the natural resources base which is vulnerable to climate change. Women and children experience the greatest impacts of climate change while at the same time; they have the least capacity or opportunity to prepare for its negative effects.

Vulnerability to CC often take various forms such as biophysical and environmental. According to Dumenu and Obeng (2015) few studies have addressed the social aspects of climate change impacts, vulnerability and adaptation strategies at the household and community level. It is important that more studies explore the social aspects of vulnerability to climate change with in-depth examination of the underlying socio-economic factors that determine how populations respond to and cope with climate change impacts at the local level. Murehwa rural area has not been spared again and this study sought to assess the magnitude of Social Vulnerability to CC as poverty levels have continuously increased.

It should be noted that CC is not a new phenomenon as there have been global efforts to address its concerns. Adaptation, in contrast, can reduce climate-related risks in human-managed systems on regional and local scales, and often with a short lead time. However, its scope is generally limited to specific systems and risk types (Legesse et al, 2012). Coping strategies that have been recommended for instance in Zimbabwe, crop and livelihood diversification were the main coping strategies used to reduce the risk of crop failure and livelihood vulnerability (Gukurume, 2013). Also, emphasizing the importance and need for local level adaptation studies, IPCC (2007) points to how most local communities develop indigenous-based adaptation practices and how identifying these practices can lead to harnessing them to improve the resilience of communities (Dumenu and Obeng, 2015). An investigation of these context-oriented adaptation strategies in Murehwa ward 28 becomes paramount so as to reduce social vulnerability.
1.2 Statement of the Problem

Poverty eradication remains a key aspect of policy makers in Zimbabwe especially in rural communities which are agrarian based. Ward 28 of Murehwa district in Zimbabwe has not been spared and continues to witness effects on determinants of their livelihoods due to low agricultural production, outbreak of diseases and rural to urban migrations. This has incapacitated the majority of people in this community especially the elderly and children and is being compounded by the impacts of CC. It is evident that most households are socially vulnerable from Climate Change as the effects of drought, erratic and unreliable rainfall and increased temperatures continually hit the area.

Efforts from the government and NGOs to improve smallholder farmer’s livelihoods in the area are acknowledged. However, the community continues to suffer from food shortages and disease outbreak. This increase in poverty warrants attention and investigations as it has eroded people’s livelihoods especially agriculture which is the form of subsistence for this community. An assessment of Social Vulnerability and Adaptation to CC in this area will go a milestone in improving livelihoods of these smallholder farmer’s.

1.3 Justification of the Study

An investigation into rural peoples’ social vulnerability to CC and adaptation will benefit the several categories/groups of people. Policy makers and stakeholders in strategic planning and management especially in developing countries will identify avenues to build local communities’ resilience to CC through effective policy implementation.

Social science researchers are set to benefit from this research through increased academic knowledge on the magnitude of social vulnerability and adaptation to CC. Since rural communities are heterogeneous in Zimbabwe the research can stimulate interest of researchers so as to undertake a similar study but in different rural settings. Contextual Adaptive strategies to mitigate CC impacts in the area will be identified. Locals from Murehwa will benefit from this research in that adaptive strategies recommended to reduce social vulnerability will go a long way in ensuring food security and disease eradications and migrations thereby improving livelihoods in the community.
1.4 Aim of the Study

Assess social vulnerability and adaptations to climate change in Ward 28 Murehwa.

1.5 Specific Objectives

✓ Identify climate change impacts on smallholder farmers’ livelihoods in Ward 28.

✓ Analyse the social vulnerability of smallholder farmers to climate change impacts.

✓ Examine the coping and adaptation strategies employed by smallholder farmers to mitigate climate change impacts.

1.6 Research Questions

✓ What climate change impacts have affected the smallholder farmers’ livelihoods?

✓ How socially vulnerable are smallholder farmers to climate change?

✓ What coping and adaptation strategies are employed to mitigate climate change?

1.7 The Scope of the Study

The study focused on assessing smallholder farmers’ social vulnerability and adaptive strategies to CC impacts. The research was confined to ward 28 in Murehwa where the majority of people especially the elderly, women and children have been socially vulnerable to CC. Ward 28 is a rural set up made up of 18 villages with high poverty levels. Climate Change is known to cause physical, economic and social vulnerability but this study only focused on the social aspects. Also, since CC is broad a phenomenon, climate variability in terms of erratic rainfall, droughts and rise in temperatures was the prime focus. The effectiveness of CC adaptation strategies in place in the study area was examined.
1.8 Limitations

Ward 28 of Murehwa District is a politically sensitive area especially during election times. Strangers who visit the area for whatever reason are usually held with suspicion. This is a challenge that was encountered by the researcher. To counter this problem the researcher used an introductory letter from the college for identification purposes and explaining reasons behind conducting this research. Also, the researcher sought permission from local leadership that is the councillor of ward 28 and village heads to access the study area.

Questionnaires were designed in English and this became a challenge to research participants especially the old who were not conversant with the language. Language barrier was resolved by administering the questionnaires in person with help of some research assistants who interpreted some of the questions in vernacular.

There were spatial and temporal challenges faced due to the geographic location of the study area. Ward 28 is made up of 18 villages. So, data capturing against the background of limited time set for the research was not feasible to interface with all research participants. This affected the reliability and validity of the results. In order to increase reliability and validity the researcher ensured wide coverage through stratified random sampling technique. Villages became strata and participants were purposively sampled from these strata. Due to limited time the researcher used secondary and archived data of past climate records obtained from the Meteorological Department to augment primary data collected from the field.

Resistance was also faced since some households were not at liberty to divulge their demographic data and other information related to their families, for instance, incomes, diseases and education levels. Participants who were not at liberty to disclose some information were assured confidentiality.

1.9 Definition of Terms

Climate change refers to long-term statistical shifts of the weather, including changes in the average weather condition or in the distribution of weather conditions around the average i.e. extreme weather events (Wu et al., 2016). It includes change in climate characteristics such as temperature, humidity, rainfall and severe weather events over long period of time.
**Climate Change adaptation** is defined as the process of adjustment to actual or expected climate and its effect (Edward, 2017). It includes strategies that are taken to manage the unavoidable impacts of CC such as living sustainably in the face of impacts e.g. growing drought resistant and short season varieties where seasons have shifted.

**Climate Change vulnerability** is the degree to which a community/system is susceptible to and unable to cope with adverse impacts of climate hazards driven by a range of physical, social, economic and environmental factors and/or processes (Alam et al., 2016).

**Climate variability** on the other hand is used in reference to naturally occurring changes in global climate, that is, changes caused without human activity (Manyeruke 2013).

**Social vulnerability to climate change** is defined as the degree to which a system is susceptible to the effects of climate change owing to interplay of social, economic and demographic factors (Dumenu and Obeng, 2015).

**Vulnerability** refers to the degree to which a system is likely to experience harm or damage due to exposure to a hazard, stress or shock. In other word it is defined as the propensity for individuals and households to be adversely affected by climatic and other environmental shocks and stresses (Leichenko and Silva, 2014).

**1.10 Organisation of Study**

This chapter looked at the introductory aspects such as the background to the study, purpose and scope of the research, statement of the problem, Justification of the study aim and objectives amongst others. Chapter 2 reviewed literature pertinent to the research; exposed the gap in the literature which this study is filling and theoretical conceptualisation. Chapter 3 dwelt on research methodology that is research design, instruments and data analysis methods. Chapter 4 focused on result presentations and discussions. Lastly chapter 5 was on discussions, conclusions and recommendations.
1.11 Conclusion

This chapter presented the background to the study that ward 28 in Murehwa is socially vulnerable to CC impacts. High poverty level is being experienced. Due to the magnitude of social vulnerability due to CC in the area it was necessary to examine mitigating and adaptive strategies in place. The problem statement of increased poverty level prompted an investigation of social vulnerability and adaptations to CC in the study area. The scope of the study delineated the breath and width of the study. The value of this study and challenges likely to be encountered were outlined. Next chapter reviewed related literature to the topic.
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed related literature on rural people’s social vulnerability and adaptation to CC at different time and scale. It included evidence of CC impacts in Zimbabwe, overview of Social Vulnerability concept, and adaptations strategies. Also included was a conceptual framework that guided and informed this research on vulnerability to CC.

2.2 Climate Change and Variability

Climate change refers to long-term statistical shifts of the weather, including changes in the average weather condition or in the distribution of weather conditions around the average i.e. extreme weather events (Wu et al., 2016). It includes changes in climate characteristics such as temperature, humidity, rainfall and severe weather events over long period of time. According to Manyeruke et al. (2013) the climate system evolves in time under the influence of its own internal dynamics and due to changes in external factors that affect climate called forcings of which external forcings include natural phenomena such as volcanic eruptions and solar variations, as well as human-induced changes in atmospheric composition. These changes in climate can be attributed to both natural and anthropogenic activities which alter the composition of the global atmosphere due to increased emission of GHGs.

Since CC is a broad phenomenon this study will focus on climate variability with special reference to rainfall and temperature. Climate variability on the other hand is used in reference to naturally occurring changes in global climate, that is, changes caused without human activity (Manyeruke et al, 2013). Temperature increases, erratic rainfall, temporal shifting of seasons and long periods of droughts are such aspects significant in Murehwa area. According to the IPCC (2014) anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever.
2.3 Climate Change in Zimbabwe

Recent studies which use global circulation models show that from the current period up to the year 2080, Zimbabwe will face a general decrease in reliability and predictability of rainfall patterns while temperatures are expected to rise by 2 degrees Celsius (Manyeruke et al, 2013). According to the Zimbabwe Department of Meteorological Services, Zimbabwe has increasingly seen more hot days between 1950 and 1990 (UNEP/GRIDA, 2002). Month on month rainfall patterns indicate that there will be a reduction in annual rainfall during the summer (November to March) cropping season. Although rainfall appears to be normal in some parts of the country this can be attributed to recharges from violent storms but generally most parts have been experiencing a decline in the amount received and this overall decline is nearly 5% in rainfall across the country since 1901 (Manjengwa et al., 2014). Murehwa has not been spared since rainfall averages 886 mm/year has exceedingly decreased to around 700 mm/year.

Extreme weather events associated with El Niño and La Nina conditions have continuously hit the country and these are ascribed to CC. In 2000, the country was wrecked by Cyclone Eline followed by Cyclone Japhet in 2003 causing flooding in some low lying parts of the country such as Muzarabani in the Zambezi Valley. These disasters have been attributed to climate change (Manyeruke et al, 2013). According Zimbabwe Floods Situation Report No.01 of April 2017 above normal rainfall, worsened by the effects of tropical Cyclone Dineo in March 2017, have resulted in severe floods affecting 36 districts in Zimbabwe.

Droughts have now become a common feature of Zimbabwean climate system. In Zimbabwe 10-year cycles of droughts have now shifted to a short time period. Manyeruke et al (2013) propounded that by the mid-1990s the frequencies of droughts and dry spells had increased to every 4-5 years. By the late1990s, the country began witnessing alternating wet and dry years every three years. Since 2000, the country’s situation has worsened as droughts have become more successive from 2002-2003, 2004-2005 and 2007-2008. These successive periods of droughts have significantly increased vulnerability of the rural poor communities of Zimbabwe like Murehwa which are agrarian based.

Persistent heat waves where temperatures have soared to above 38 degrees Celsius in recent years and very low temperature decrease often causing ground frost and cold related illness are linked to CC. Brazier (2015) propounded that temperature extremes cause ground frost
during the cold season and heat waves during the hot season. Climate Change is expected to bring an increase in temperatures of between 1 to 3 degrees across the country. Manjengwa et al (2014) noted that about 68, 9% vulnerable groups in rural communities especially children have been exposed to very hot summers. Manyeruke et al (2013) adds that global warming has caused an increase in the average temperatures resulting in the shifting of the traditional farming seasons and agro-ecological zones.

Apart from atmospheric related indicators to CC biophysical and socio-economic aspects such as water scarcity, energy challenges, increased outbreak of diseases, food shortages and species extinction are indicators that CC is happening in Zimbabwe. Brazier (2015) noted that Zimbabwe agriculture systems are already insecure as they depend mainly on seasonal rainfall. CC will reduce food production as land will be degraded and soil quality affected through unsustainable practises especially in rural communities. Due to recurrent droughts water and forest resources will be drastically reduced. Access to safe drinking water will be aggravated as underground water tables decreases and surface sources silt. People will travel long distances to fetch water and firewood fuel in most rural areas as wood remains the most common and accessible energy resource. CC affects the fundamental requirements for health such as safe drinking water, clean air, sufficient food and secure shelter has many adverse health impacts (Young et al, 2010).

2.4 Climate Change Vulnerability

Vulnerability is defined as the propensity for individuals and households to be adversely affected by climatic and other environmental shocks and stresses (Leichenko and Silva, 2014). Vulnerability in relation to climate change is a function of the sensitivity of a system to climate change, the exposure of the system to climatic variability and change, and the adaptive capacity of the system (Pandley and Bardsley, 2015). This means that vulnerability has both an ‘exposure’ component to a hazard and a social component which depends on an individual or community’s political and socio-economic characteristics. These components determine the degree of susceptibility, and capacity to be resilient of a system.

Generally, vulnerability is seen as the outcome of a mixture of environmental, social, cultural, institutional, and economic structures, and processes related to poverty and (health) risk, not a phenomenon related to environmental risk only (Brouwer et al, 2007). This means
vulnerability is multi-faceted and take different forms. Poor people in rural communities of Less Economic Developed Countries (LED Cs) are usually more vulnerable to CC impacts. They are more vulnerable because of their high dependence on natural resources, and their limited capacity to cope with climate variability and extremes. Leichenko and Silva (2014) added that poorer individuals are expected to have a greater propensity to be harmed by climate change for a variety of reasons: they have fewer assets to help them recover from climate shocks and stresses such as droughts, hurricanes and floods.

Africa’s rural areas are expected to experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the in the production areas of food and non- food crops (IPCC, 2014). The economic impact of climate change and variability in Africa will be compounded by its agriculture-based economies, use of traditional technology and its dependence on small agricultural exports (Manyeruke et al, 2013). In addition to reliance on agriculture and natural resources, particularly in drought-prone regions, other frequently cited indicators of climate change exposure include living in low-lying coastal zones or in informal urban settlements, and poor nutrition and health status (Leichenko and Silva, 2014). Factors that increase vulnerability of rural poor were summarised as limited land ownership, lack of options for livelihood diversification, lack of market access, on-going degradation of local ecological resources such as forests, reliance on cash crops, and globalization of markets (Leichenko and Silva, 2014).

2.5 Social Vulnerability to Climate Change

According to Dumenu and Obeng (2015) social vulnerability is defined as the degree to which a system is susceptible to the effects of climate change owing to interplay of social, economic and demographic factors. In other words, social vulnerability to climate change is viewed as the exposure of groups or individuals to stress as a result of the impacts of climate change and related climate extremes events (Adger, 1999). Social vulnerability is partially the product of those factors that shape the susceptibility of communities to harm and those that govern their ability to respond. It also includes “place inequalities”, those characteristics of communities and the built environment, such as the level of urbanization, growth rates, and economic vitality - that contribute to the social vulnerability of particular places (Shah et al, 2013).
In this study social vulnerability of the whole community to CC was assessed. Vulnerability has both physical and social aspects. The second component related to social vulnerability is equivalent to capacity of the system and is largely determined by socioeconomic factors such as income distribution, assets, ethnicity, gender, migration, poverty and source of livelihood (Dumenu and Obeng, 2015). The aforementioned independent variables were assessed against the dependant variable which is SV to ascertain the magnitude of social vulnerability to CC of Murehwa ward 28. Change in social vulnerability from its baseline level incorporates notions of economic development, as well as adjustments to livelihoods based on adaptation to climatic conditions, and changes in institutional and political structures. If institutions fail to plan for changing climatic conditions and risks, social vulnerability increases (Adger, 1999). Dumenu and Obeng (2015) expressed social vulnerability mathematically as follows:

\[ SV = f \frac{1}{n} (DF + EF + SF) \]

Where, \( SV \) = social vulnerability, \( DF \) = demographic factors, \( EF \) = economic factors, \( SF \) = social factors, and \( n \) = number of social vulnerability factors. So, these factors stated in the formula become key indicators and their functional relationship to CC in measuring social vulnerability.

### 2.6 Adaptation to Climate Change

Countries in Sub-Saharan Africa are particularly vulnerable to adverse impacts from climate change because of their limited capacity to adapt (Byran et al, 2012). Adaptation can reduce the risks of climate change impacts, but there are limits to its effectiveness, especially with greater magnitude and rates of climate change (IPCC, 2014). Adaptation is a key factor that will shape the severity of future climate change impacts on social development, agriculture and food production. However, successful adaptations will require significant investments by farmers, governments, scientists, technologists and development organizations, all of whom face other demands on their resources (Eakin et al, 2014). Adaptation will require the involvement of multiple stakeholders, including first and foremost, farmers, but also policymakers, extension agents, NGOs, researchers, communities and the private sector (Byran et al, 2012).
Most studies have focused on biophysical and environmental aspects of climate change vulnerability, while impacts and adaptation studies have mostly targeted the national scale. Few studies have addressed the social aspects of climate change impacts, vulnerability and adaptation strategies at the local level (households, rural communities, districts). It is important that more studies explore the social aspects of vulnerability to climate change with in-depth examination of the underlying socio-economic factors that determine how populations respond to and cope with climate change impacts at the local level (Dumenu and Obeng, 2015).

Also, emphasizing the importance and need for local level adaptation studies, IPCC (2007) points to how most local communities develop indigenous-based adaptation practices and how identifying these practices can lead to harnessing them to improve the resilience of communities (Dumenu and Obeng, 2015). Niang et al (2014) however noted that, across the continent, most of the adaptation to climate variability and changes is reactive in response to short term motivation is occurring autonomously at the individual/household level and lacks support from the government stakeholders and policies. This suggests that Africa is still experiencing adaptation barriers, adaptation incapacity because strategies are not indigenous and unique to a specific area.

In Zimbabwe CC adaptation and mitigation strategies exists though they remain ineffective and a challenge. Due to CC vulnerability Brown et al (2012) said in response, a growing number of NGOs and research organisations, including UN agencies, are engaging in a variety of development projects, many of which have strong adaptation component. Autonomous adaptation which is indigenous response and planned policy options exist in Zimbabwe and at various levels. CC adaptation strategies reflect a sectorial form where water, energy, health agriculture amongst others has their own unique responses.

Zimbabwe has several things in its favour when it comes to adaptation. It has abundant natural resources and a well-educated, resilient population. The social networks that exist in Zimbabwe, particularly in rural areas are still fairly strong. Moreover, a wealth of local and traditional knowledge, which has enabled Zimbabweans to survive in a highly variably climate for centuries, can be tapped into (Brazier, 2015). Nhemachena and Hassan (2007) posit that adaptation measures are therefore critical in the short-term to medium term, while in the long run mitigation efforts are required to reduce risks and create sinks for further greenhouse gas emissions. Adaptation should involve building the resilience of human
communities and ecosystems to environmental shocks as well as implemented sustainable
development measures that focus on improved natural resource management and
strengthening of social networks (Brazier, 2015).

2.7 Social Vulnerability and Adaptation to Climate Change: A Worldview

The concept of social vulnerability to CC and adaptation was applied to Vietnam. This study
which focused on the districts of Vietnam departed from the predominant view of
vulnerability being physical and studied the social dimension which usually disrupts
livelihoods. According to Adger (1999) a set of indicators is developed to examine the
relative vulnerability of any given set of individuals or social situation. These concepts were
applied to a case study district in northern Vietnam, demonstrating that present day climate
extremes as well as social and economic changes result in an evolving state of vulnerability
with off-setting and interlocking social, economic and institutional facets. Adaptation
strategies are there but they face numerous challenges. Existing policies and practices in
agriculture, forestry and coastal resource management, as well as inequitable distribution of
productive resources, in themselves can have perverse effects of increasing vulnerability, and
hence can be "maladaptive" (Adger, 1999).

While most research on the connections between poverty and vulnerability focuses on
developing country contexts, studies have also documented greater exposure to climate
stresses of relatively poor populations in advanced countries, particularly in the United States
where extreme climate events including Hurricanes Katrina in New Orleans and Hurricane
Sandy in New York and New Jersey harmed poor population due to lack of institutional
capacity, social isolation, and dynamics of local housing markets (Leichenko and Silva,
2014).

Bangladesh’s vulnerability to climate change has been recognized in global media accounts
(Haque et al., 2013). Bangladesh is a highly flood prone country where the majority of its
rural poor people populates its floodplain areas. Brouwer et al. (2007) stated that since the
mid-1990s, the concept of social vulnerability is used to describe and analyse the exposure
and coping mechanisms of groups and individuals to environmental risks, primarily in the
context of climate change and flooding hazards in developing countries. In Bangladesh,
where a large proportion of the population is vulnerable to climate change, health impacts are
expected to take place through a variety of ways causing diseases such as diarrheal, skin diseases, malaria, mental disorders and dengue (Haque et al., 2013).

In face of CC in China Tong et al., (2015) summarised that adaptation measures and actions were also proposed, such as strengthening existing disease surveillance systems and vector monitoring, developing and improving relevant legislation, policies and guidelines; engaging the community in infectious disease research. In rural Mexico, poor households tend to be dependent for part of their income on activities that are highly sensitive to climatic conditions, like agriculture and natural resources (Lopez-Feldman et al, 2014). On the other hand, these households are also very exposed to extreme climate events. According to Yunez et al (2014) in 2013, around 60% of the surveyed households faced severe climate events i.e. droughts, extreme rainfall and landslides and 55% suffered from plagues. Monterroso (2015) noted that Mexican farmers have already started to implement autonomous adaptation strategies like modifying planting dates, increasing the number of plants per area and changing varieties, among others.

2.8 Regional Perspectives on Social Vulnerability and Adaptation to Climate Change

The development challenges that many African countries face are already considerable and compounded CC impacts. These impacts are particularly important for countries such as Kenya, where the poverty rate is 52 percent and 73 percent of the labour force depends on agricultural production for their livelihood (Bryran et al, 2012). Because agricultural production remains the main source of income for most rural communities in the region, adaptation is imperative to enhance the resilience of the agriculture sector, protect the livelihoods of the poor, and ensure food security (Bryran et al, 2012). In rural communities of Kenya Adger (1999) opined that a better understanding of farmers’ perceptions of climate change, ongoing adaptation measures, and the decision-making process is important to inform policies aimed at promoting successful adaptation of the agricultural sector.

In Ethiopia, cereal production is expected to decline by 12% due CC impacts where temperatures have increased annually at the rate of 0.2°C over the past five decades. Among the Ethiopian regional states, Oromia is already vulnerable to extremes of climatic variability; and climate change is likely to increase the frequency and magnitude of some natural disasters and extreme weather events. These extreme events could be worsened by existing social and economic challenges in the region, particularly for those areas and communities
dependent on resources that are sensitive to climate changes (Legesse et al, 2012). Adaptation, in contrast, can reduce climate-related risks in human-managed systems on regional and local scales, and often with a short lead time. Therefore, adaptation is critical in developing countries (Nhemachena and Hassan, 2007).

An assessment of social vulnerability to climate change in four ecological zones using a social vulnerability index was done in Ghana. These studies evaluated the strength of indigenous adaptation strategies to climate change. According to Dumenu and Obeng (2015) explained that focus of these studies were based on how policymakers, development planners and all stakeholders involved in developing and implementing climate change policies and plans in Ghana can better meet the needs of vulnerable populations in rural communities. In South Africa responses to these challenges which has exposed vulnerable communities is through implementation of short to long term programs related to CC, disaster risk reduction, early warning systems, and water demand management. There is also limited experience with climate adaptation, monitoring and evaluation internationally and in South Africa, despite it being prioritized by South African government in many other sectors (Ziervogel et al., 2014).

Social vulnerability and adaptation to CC has been done in Zimbabwe at different levels. Factors that determine socio-economic have been assessed such as agriculture, health, demography, energy amongst others. Brown et al. (2012) said there is growing evidence that CC will affect human health through increases in floods, fires, droughts and storms hence changes the range to diseases. Energy sector will be greatly affected especially Hydro-Electric Power as recurrent droughts will affect normal recharge of water bodies. Since women are more than men in rural areas at sex ratio of 1:16, Changutah (2010) added that women are likely to be disproportionately vulnerable to the effects of CC. This is due to over-reliance on rain fed agriculture and dependence on natural resources which are climate sensitive.

Adaptive mechanisms are there but these are not being effective due to numerous challenges. Brown et al (2012) cited that the costs of adaptation are likely to be high in Zimbabwe due to its macro-economic problems, of which agriculture will be most affected. In Mberangwa district the Makuwerere ward adopted a participatory approach where the community took a leading role in planning, promoted sustainable utilisation of woodland and raised awareness of CC to build community coping capacity. Davis (2011) observed that determining adaptive
capacity in the face of CC is “context specific”. This therefore prompted an investigation of social vulnerability and adaptation to CC in Ward 28 Murehwa.

2.9 Rural vulnerability to CC in Zimbabwe

The extent and magnitude of rural people vulnerability in Zimbabwe takes various forms which include vulnerability to health, food, water, energy amongst others. According to Brazier (2015) Zimbabweans are a resilient and adaptable people, but also acutely vulnerable especially the rural population of certain demographic structure like children, women and the old. This is relevant to climate change because the elderly are more vulnerable than younger age groups due to injury resulting from weather extremes such as heat waves, drought and floods.

Climate change vulnerability in Zimbabwe will be increased through low agricultural production. Chagutah (2010) observed that diseases often deprive households of labour during critical periods, particularly women and orphans. The long-term effects will be on food production which will bring malnutrition diseases if communities are not well fed. Brazier (2015) concurred that the impact of CC on these vulnerable groups will mean more work and greater hardships for women and children as they will have to walk long distances to collect water and firewood and encounter increasing adversity in food production.

Climate-induced variability increases the vulnerability of rural livelihoods and reduces the ability of households to deal with risks, shocks and stresses since these households typically have limited assets, they are at increased risk (exposure) and their ability to cope is restricted (Shah et al 2013). The magnitude of rural community’s vulnerability to CC related diseases continues to increase due to unsound programmes and environmental policies that fail to address CC issues. According to Bai et al (2014) levels of vulnerability are partly a function of the programs and measures that are in place to reduce burdens of climate sensitive health determinants and outcomes, and partly a result of the success of traditional public-health practices, including access to safe water and improved sanitation and surveillance programs to identify and respond to infectious diseases outbreaks.
2.10 Theoretical Framework

Political economy approach is a conceptual framework that informed and guided this research. According to Fussel (2006) it denotes approaches that focus their analysis on people asking who is most vulnerable and why. In this study institutional structures and socio-economic characteristics of this community will assist in assessing the magnitude of SV to Climate Change. This is summarised in a theoretical framework in figure 2.1. It shows various factors such as environmental, socio-economic and institutional factors which usually leads to SV. Fussel (2006) summed that, this approach views vulnerability as internal social vulnerability or cross scale social vulnerability. Political economy approach will be incomplete without mention of resilient and adaptive capacity. This brings another dimension of this research where coping and adaptation strategies of this community will be assessed.

![Theoretical framework](source: Ghaus and Nadeem, 2013 pp34).
2.11 Conclusion

This chapter reviewed literature on the concept of social vulnerability and adaptation to CC. Indicators of CC, CC in Zimbabwe and the magnitude of rural people vulnerability was reviewed. An assessment of this vulnerability from different areas was done. Also included is the theoretical and conceptual framework that was used. The next chapter will look at research methodology.
CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Research methodology gives the overall framework of research which includes data collection methods and analysis techniques. Questionnaires, interviews and focus group discussions were data collection methods used. Secondary data sources used were from archival materials and literature search. Data collection methods are described: how they were used, their strengths and limitations. Both qualitative and quantitative methods were used to analyse data. A description of the study area, population and sampling techniques, research design, reliability and validity of the research instruments are also described.

3.2 Description of the Study Area

The study area was described in terms of its physical features, socio-economic activities, its demographic features aided with a location map of Murewa highlighting ward 28 which is the study area.

3.2.1 Physical characteristics of the study area

Ward 28 of Mangwende communal lands lies in agro-ecological region 2 where the average altitude is around 1300m. Rainfalls averages 850 mm and mean annual temperatures is around 18, 6 degrees Celsius (Masvaya et al, 2009). Savannah grasslands dominate the forests with few patches of woodlands. Grasslands have provided pastures for livestock and woodland have been exploited mainly for energy source. Relief is generally undulating and impermeable granite rocks have influenced the dendritic drainage pattern in the area where rivers like Nyagui and Macheke all confluence into Shavanhowe which flows in a North Easterly direction. Sandy soils are predominantly cultivated in this area which is poor in plant nutrients (Jerome, 2007). Figure 3.1 shows the location of the study area in terms of transport routes, farming, relief and drainage system.
3.2.2 Socio-economic characteristics of the study area

Murehwa lies 75km NE from Harare. The area is well linked with transport routes from Marondera and Harare- Nyampande highway. Subsistence cultivation is the main form of
economic activity. Livelihoods depend on rain fed agriculture which is dominated by women. Maize and small grains (cowpeas, millet, and beans), cattle and goats are reared for subsistence purposes.

The communal grazing area provides the most feed for cattle during the rainy season, while crop residues support cattle during the dry season (Jerome, 2007). Draught power is usually ox-drawn which usually renders farming activities laborious. Surplus from farming and some horticultural crops produced like vegetables and tomatoes are sold in markets in Harare and Marondera. Such incomes are used to pay school fees and purchase of agricultural inputs.

Ward 28 is within the jurisdiction of chief Mangwende where headmen preside over 18 different villages. People in the area still uphold their traditional ceremonies of appeasing spirits of the dead between Augusts –September period. Social ties between urban folks and those in rural is still very strong.

Effects of drought have been felt in the area. Not all people have the capacity to generate incomes hence donor aid like COMTEC and government through presidential inputs scheme have continually assisted this area. Forests are dwindling because firewood is the most common form of energy used. The area is not yet electrified except for a single Manjonjo Primary School in the ward. In terms of education there are 3 primary schools and a secondary school in the area.

3.2.3 Demographic characteristics

Murehwa has a total population of 199 607 with a population density of about 56.13 people/km² which is considered to be very dense (Zimstats, 2012). Murehwa is subdivided into 30 administrative wards of which ward 28 which is the study area with a total population of 2 852 and 98 household units. High population densities can be attributed to improved transport networks which gives easy access to Harare and Marondera. The area has an ageing population dominated the old (above 50years) whereas those who are economically active usually migrate to towns to seek for employment. According to Zimstats (2012) life expectancy is around 48 years and sex ratio of 1:2 whereby women dominate men.
3.3 Research Design

This research used a case study design because it allows an in-depth study of phenomena. According to Rose et al. (2014) a case study has the ability to investigate cases in depth and to employ multiple sources of evidence hence make them a useful tool for descriptive research studies where focus is on specific situation or context where generalisation is less important. In this study the case study research design allowed an in-depth investigation of social vulnerability to CC and adaptation mechanisms in Ward 28.

A case study is therefore more qualitative than quantitative in nature but not exclusively (Starman, 2013). This means that though it is generally regarded as qualitative in nature. There are instances where it can be used in combination with quantitative approaches. This allowed the researcher to utilise qualitative descriptions of the phenomena through use of interviews and questionnaires as well as use archival secondary data sources to for quantitative statistical analysis especially on assessing magnitude of social vulnerability.

The benefit of using a case study research design is its adaptability to different types of research questions and to different research settings (Rose et al, 2014). In this case survey method was used as case study strategy and it allowed research questions such as “what” and “which” to be answered. The only limitation faced in the use of this design is that it is labour intensive as it allowed handling of large amount of information which was time consuming to analyse. Also, where generalisation of results is needed case study is not suitable (Rose et al, 2014).

3.4 Pilot Survey

A pilot study provided the researcher an opportunity to investigate whether ward 28 is socially vulnerable to CC and examine adaptation strategies in existence. The researcher engaged the local leadership which included the councillor and village heads together with the introductory letter from the university to spell out the purpose of this research and its duration.

According to Johanson and Brooks (2009) pilot study size will depend on the particular purpose of the pilot study. Twelve households were selected from 3 villages to pre-test the
questionnaire. In this case it ensured that the questionnaire collected relevant information on CC impacts, the magnitude of social vulnerability to CC and adaptation strategies in ward 28. Data collection process conducted in 3 days. Questionnaires were personally administered by the researcher. Potential challenges were seen and mitigated like sensitive and ambiguous questions in the questionnaire document were rephrased.

The researcher ensured confidentiality through anonymity of research participants. This was important for this research since some participants were not at liberty to divulge their socio-economic status like incomes, level of education and health related issues.

3.5 Population

Murewa Ward 28 is made up of 18 villages with a total population of 2,852 and 98 households units (Zimstats, 2012). This has a sex composition of 33% males against 67% females.

3.6 Sampling

Two-stage sampling method was used in selecting research participants for the study. First probability random sampling method was used to choose elements from the total population of Murehwa since it is not feasible to deal with the crude population due to time and financial constraints. The researcher used stratified random sampling. According to Qeadan (2015) stratified sampling is a sampling method in which a sample is obtained by firstly dividing the population into subpopulations (strata) based on some characteristics and then a Simple Random Sampling (SRS) is taken from each stratum. Combining the obtained SRSs will give the final stratified sample. Minority subgroups of interest can be ensured by stratification. Eighteen villages in ward 28 formed the strata.

Second, from these traditional jurisdiction boundaries (villages) participants were chosen using purposive sampling. It ensured that household heads above 35 years only were included. The reason for that was to capture views from respondents who have experienced long term changes in climate. Combining the two sampling method has the following benefits: The sample is more representative as it allows certain segments of interest, from the target population, to be captured but its challenges are that it might introduce some complexities at the analysis stage, more time consuming and effort than other sampling
methods [http://www.mathalpha.com/SAMPLING/sampling.do](http://www.mathalpha.com/SAMPLING/sampling.do). Alvi (2016) added that the benefit of using stratified sampling for a heterogeneous population is it produces a representative sample as it captures the diversity which otherwise is likely to be undermined through simple random or systematic random sampling.

To ensure that the sample size is representative enough 10% of the targeted population was calculated. These were added together with 20 key informants who were selected in the study area for interview purposes. Groups of 3 – 5 people were used in focus group discussions and these members were from AREX, health, village heads amongst others. Household heads and women were given representation in the sampled population because these make decisions and interact more with the environment. In total the study used 75 research participants.

### 3.7 Dependant and Independent Variables

The dependent variable of this study is social vulnerability (SV) which was scaled from 0 to 1. The scale ranged as follows 0 means not SV to Climate Change, below 0.5 mean it is a weak index causing SV, above 0.5 are a strong index and 1 extremely strong index for SV. The independent variables included economic, demographic and social factors. Economic factors were made up of indicators such as Agriculture, Incomes, and Health. It is assumed that these factors had an effect on SV to Climate Change. Demographic factors included-Gender, Family sizes and Migration whilst social factors were made up of Education and Access to CC information. It was assumed that any change in these independent variables would affect SV variable.

### 3.8 Data Collection Methods

Both primary and secondary sources of data were used in this research. The questionnaire was the main research instrument used to collect data. A structured questionnaire was administered on sampled households in different villages of the ward. Interviews were conducted and focus group discussions with key informants were done. Also, secondary sources of data from relevant literature were used. Literature search was vital since it provided past records on climate variability i.e. droughts, past rainfall and temperature patterns.
3.8.1 The questionnaire

A comprehensive and well-designed questionnaire was used to capture aspects of research objectives and questions. The questionnaire survey was focused on gathering information on climate change impacts and coping/adaptation strategies. Structured questions were put into three sections that is, first part focused on the demographic aspects of participants, second part focused on CC impacts and last section examined adaptation strategies in existence.

A total of 50 questionnaires were administered in the study area and research assistants helped the researcher to gather information. This was done in a two-week period. Face to face method of gathering information was used, though it proved strenuous. According Mather et al, (2007) respondents with low literacy level will have greater difficulty completing a self-completion or postal questionnaire. Face-to-face interactions ensured that almost all questionnaires were responded to and in time. Learners from different villages and households would ask family members to respond to some questions that had been translated to vernacular. This helped for easy understanding and saved time.

The benefit of using this method is that responses are gathered in a standardised way, so questionnaires become objective. It enabled information to be collected from a large sampled group. However, some open-ended questions generated large amount of data that took time to process and analyse.

3.8.2 Interviews

Key informant interviews augmented the questionnaire. According to Grazhdani (2013) personal interview technique is more preferred because it builds rapport and confidence. At least participants 20 were interviewed. Interview schedules were designed to last fifteen minutes so as not to create boredom with participants. Since these participants were drawn from different village at least 2 people were interviewed per day from the 18 villages. Interviews were conducted in 10 days for them to be complete as it involved a lot of movements between villages.

The interview schedule was a structured two page document with 3 sections. Opening section was meant to establish rapport, state purpose of the interview and motivate the interviewee. Second section dealt much on aspects of the research topic that is demographic aspects, social
vulnerability and adaptation to CC and the last section concluded by summarising what had been captured to the interviewee and an appreciation for the time and information to maintain rapport.

Interviews captured information on demographic and socio-economic factors such as primary and secondary occupation, household size, illiteracy, and access to climate change information, coping strategies in existence, dependence natural resources and diversification of sources of income. These formed the basis for assessment of the level of social vulnerability in the ward. These interviews enabled the researcher to probe further and seek clarity on issues that were not clear. Mather et al, (2007) stated that face to face interviews are very labour intensive but can be the best way of achieving high quality data.

3.8.3 Focus group discussions

Focus group discussions were held so as to gain information that could not be obtained through the questionnaire and interviews. The researcher posed questions for discussion in each group. The questions were aimed at gathering information on challenges they were facing in face of changes in rainfall pattern, increased temperatures and droughts. Focus group discussions provided data on the magnitude of vulnerability in the community and strategies that were being employed to adapt to these challenges. An interview guide was used to elicit data.

Five focused group discussion sessions were conducted and these targeted key stakeholders who were useful to the research like AREX officials, village heads, teachers, community health workers, business people and women. These were conducted when an opportune time arose. AREX officials, councillors and village heads discussed with researcher on the side-lines of input distribution programmes at Chogogodza service centre, teachers from various schools in the area gave their input during zonal athletics competitions and women doing food for work programme together with village health workers. Usually the groups comprised 5 to 10 members. To ensure that the discussions do not lose focus the researcher took a leading role and used and interview guide to elicit information.
3.8.4 Secondary data sources

Secondary sources of information that were used came from Meteorological Department, Central Statistical Office (CSO) and Ministry of Health and Child Care. Meteorological Department provided information on past climate records i.e. rainfall and temperature patterns. Ministry of Health and Child Care and CSO Department provided socio-economic and demographic data of the study area.

3.9 Reliability Testing

Reliability reflects consistency, dependability and replicability over time. Test-retest reliability is the method that was used to test the reliability of questionnaire and interview guide. It involved administering 20 questionnaires to 2 groups of non-sampled participants in a 5-day interval period and interviews were also conducted. The results were that the questionnaire had questions which needed to be rephrased and refocused so that it gathers information related to research questions asked in chapter one. Such refinement made ensured that the instrument gathered accurate data and eliminated potential errors and ambiguity. However, the interview guide proved to be effective since 8 out of 10 interviewees responded consistently to the questions and information gathered on SV to CC and adaptation was to the research.

3.10 Validity testing

According to Kimberlin and Winterstein (2008) validity if often defined as the extent to which an instrument measures what it purports to measure. Mixed approach research methods were used to increase validity in this research. It involved triangulating of quantitative and qualitative data collection methods such as questionnaires and interviews. Secondary data information was also compared with primary data source this enhance validity of results.

3.11 Method of Data Analysis and Presentation

Quantitative and qualitative methods of data analysis were used. This involved use of descriptive statistical methods and descriptive narratives. Statistical Package for Social Sciences (SPSS) version 22.0 was used for quantitative data analysis. This package enabled the researcher to determine frequencies of Climate Change impacts, SV index and factors and
non-agriculture occupations. It involved graphic analysis, use of tables, pie charts and bar graphs.

**Calculating Social Vulnerability Index (SVI) of Smallholder Farmers**

SVI was calculated to establish the magnitude of social vulnerability of smallholder farmers to CC impacts. The procedure involved standardising each indicator with an ascribed position between 0 and 1. The procedure to normalise indices was described by (Hahn et al, 2009) and it used the following formula:

\[
\text{Index Value (Standard Value)} = \frac{\text{Actual Value} - \text{Minimum Value}}{\text{Maximum Value} - \text{Minimum Value}}
\]

In order to assess Social Vulnerability to CC in Ward 28 an indicators approach was used. It involved computation of indicators / variables measuring Social Vulnerability. This approach can be applied at any scale and is useful when developing a better understanding of factors that cause SV. These indicators were grouped into demographic factors, economic factors and social factors. In total these 3 factors gave 8 indicators which are demographic factors (Df) had migration, education and gender, economic factors with agriculture, health and incomes and social factors (Sf) had household sizes and access to CC information. Expert judgement was used to select these indicators amongst a wide of those that existed in the area.

Estimating Social Vulnerability index meant standardising and weighting of these unit variables. These were scaled on the basis of results obtained from questionnaire results. The scale ranged as follows 0 means not SV to Climate Change, below 0.5 mean it is a weak index causing SV, above 0.5 are a strong index and 1 extremely strong index for SV.

Qualitative data gathered through interviews and focus group discussions on investigating and examining effectiveness of adaptation strategies in existence were presented through tables and discussed using research narrations. These research narratives are useful in this instance where they are considered as real-world measures suitable for investigating real life problems like SV to CC. These narratives again were used to describe archival information and secondary data on SV and adaptation to CC.
3.12 Conclusion

This chapter used a case study research design due to its unlimited benefits. Questionnaire survey, interviews and focus group discussion are the research instruments that were used to collect data. To ensure that the research is consistent and dependable, and minimize potential errors validity testing, reliability testing and pilot study were conducted. Sampled population of 98 participants was used and this was obtained through stratified random sampling and purposive. SPSS was used for quantitative data analysis and presentations together with indicator approach method and research narratives.
CHAPTER 4: DATA PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter presented results of the study and analysis. The chapter was divided into three sections i.e. impacts of climate change, results obtained for social vulnerability to CC and last section results for coping and adaptation strategies. These three broad sections were subdivided into smaller sections where aspects of climate change impacts, social vulnerability and coping and adaptation strategies were analysed using both quantitative and qualitative methods. Tables, bar graphs and pie charts were used to present the results. Research narrations assisted in analysis of results.

4.2 Climate Change Impacts to Smallholder Farmers’ Livelihoods

Social Vulnerability to CC can only be assessed effectively in the area if CC impacts are identified. Through questionnaire survey and interviews the researcher observed that several CC impacts affected the area. Frequencies of the sampled population affected by CC impacts were expressed as percentages and presented in the Table 4.1. Results showed that reduction in crop yields and shift in cropping season are amongst the greatest impact that have affected smallholder farmers in Ward 28. These related impacts are a direct result of erratic and unreliable rainfall brought about by changes in the climate system. Environmental resources like water and firewood were not an exception as siltation and increased deforestation impacted the area. However diseases outbreak affecting crops, livestock and smallholder farmers due to changes in rainfall and temperature patterns were noted though not so severe.

Table 4.1 Impacts of Climate Change to Smallholder Farmers’ Livelihoods

<table>
<thead>
<tr>
<th>Climate Change Impacts</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in crop yields</td>
<td>84</td>
</tr>
<tr>
<td>Shift in cropping seasons</td>
<td>60</td>
</tr>
<tr>
<td>Rural to urban migration</td>
<td>78</td>
</tr>
<tr>
<td>Outbreak of diseases</td>
<td>28</td>
</tr>
<tr>
<td>Siltation of water sources</td>
<td>34</td>
</tr>
<tr>
<td>Shortage of firewood</td>
<td>50</td>
</tr>
</tbody>
</table>

A decline in agricultural production had the greatest impact in the area of 84%. This is a direct result of erratic rainfall and recurrent droughts experienced in the area. This situation is not only unique to ward 28 as expressed by Manyeruke et al, (2013) that erratic rainfall, droughts and cyclones which induced excessive rainfall and floods, contributed to poor agricultural performance in the country. As a result of that crop production remains a challenge in the area. This is being compounded by shortage of inputs, labour, draught power and fragmentation of land. An assessment made in the ward 28 showed that the total hectarage of maize has declined by 40% as people opt to grow other crops. During focus group discussions AREX officials attributed this to unreliable rainfall and high cost of maize production. Farming remains the prime source of subsistence in the area though a significant number is now willing to divert to other non-farming ventures.

A shift in the cropping season is another CC impact experienced in ward 28. 60% of smallholder farmers revealed that the cropping seasons have shifted. Erratic and unreliable rainfall has necessitated these changes. According to the information gathered the onset of rainfall has changed from October to late November and the rain season now stretches up to April. This has also happened in Malawi. Over the last 30years the rainfall in Malawi has become less predictable, that the rainy season is arriving later in the year causing delays in the planting of the main crop (Dasgupta et al, 2014). This has prompted farmers in the area to shift from the main crop maize and explore the potential of growing other small grain and short season varieties.

However rural to urban migration which has left the community depopulated has occurred. Sampled households revealed that at least they have their family members who have migrated. Migration trends were assessed at 78%. Solely attributing migration to CC was refuted by Dasgupta et al, (2014) who viewed it as complex. Many households mentioned lack of job opportunities and low agricultural productions due to droughts as the main reasons triggering such movements. This has created labour shortages in rural areas. Those remaining in rural areas have benefitted through remittances coming from towns. However during interviews one village head stated that, these young people often return home having contracted diseases like HIV/AIDS as they engage in prostitution when they fail to secure jobs and others had relatives who have been arrested due to theft. This increases hardships in the area as the old will have an extra burden to look after them.
Shortage of firewood is amongst CC impacts cited and was assessed at 50%. Although deforestation activities are rampant in the area, deforestation for firewood is common. Fig 3.1 showed that the area is covered by grasslands and sparse-bushy trees. These have failed to regenerate due to erratic rainfall, prolonged droughts and veld fires. Over-reliance on firewood as an energy source in ward 28 is a result of limited alternative energy sources as energy demands are shown in fig 4.1.

**Fig 4.1: Energy Consumption for Smallholder Farmers**

Firewood was the dominant energy source used because it is locally available followed by gas. Gas is increasingly gaining prominence because it is now locally available for selling in the area and it is also affordable. Electricity and other energy sources use like solar were equal. The ward is still to fully benefit from rural electrification programme. Only Manjonjo Primary School was electrified in the ward. Political interference was cited by the ward councillor as the main reason why the area has not benefitted from rural electrification programme. Use of solar powered gadgets like lights, radios and television sets was there since there is no maintenance costs involved once these are purchased.

Siltation of water sources has also impacted the area. This impact was assessed and aggregated 34%. Ward 28 has faced water availability challenges as underground extraction for domestic use is becoming difficult. The only 3 rivers in the area showed that Shavanhowe
decrease in water level whereas Nyagambe and Nyagui River silts during the dry season and only recharge on the onset of the rains. Siltation of the rivers due to low rainfall is aggravated by brick moulding activities along the river bed and nutritional gardens undertaken on wetlands as evident from the location map of the study area. An expert from DDF Murehwa revealed that water tables decline in the dry season and has affected many water sources in the ward, for instance Mabika secondary school has 4 boreholes which run dry.

Outbreak of diseases was evident and had the least score of 28%. Its minimal impact to the ward is because there was no evidence to show that crop and livestock production is being affected by CC induced diseases. However human health was affected from CC related diseases. Studies have found that long-term climate warming tends to favour the geographic expansion of several infectious diseases and that extreme weather events may help create the opportunities for more clustered disease outbreaks (Wu et al, 2016). Interviewing a community health worker revealed that malaria and dysentery are on the increase in the area. High temperatures were cited as increasing the geographical range of mosquito vector for malaria and shortage of safe drinking water causing dysentery. Disease outbreaks had impacts on farming labour force and eroded people’s incomes as they seek treatment.

4.3 Social Vulnerability of Smallholder Farmers to Climate Change Impacts

Social Vulnerability index (SVI) was calculated. To ensure comparability of various indicators of SV these were standardised so that each indicator is ascribed a relative position between 0 and 1. The results of Social Vulnerability factors and indicators are presented in Figure 4.2.

Table 4.2 Results for Social vulnerability Index and Mean of SVI

<table>
<thead>
<tr>
<th>Major factors</th>
<th>indicators</th>
<th>Social Vulnerability Index (SVI)</th>
<th>Mean of SVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic factors</td>
<td>Migration</td>
<td>0.81</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Household size</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Economic factors</td>
<td>Agriculture</td>
<td>0.8</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>Social factors</td>
<td>Education</td>
<td>0.47</td>
<td>0.405</td>
</tr>
<tr>
<td></td>
<td>Access to infom</td>
<td>0.34</td>
<td></td>
</tr>
</tbody>
</table>

The results showed that of the 3 major factors of SV to CC demographic factors scored the highest mean value of 0.73, followed by economic factors at 0.56 and lastly social factors at 0.405. These values were obtained through summation of values of indicators for each factor then find the mean.

Results showed that the magnitude of Social Vulnerability Index in Ward 28 is 0.565. Using the scale of 0 to 1: 0 not SV, below 0.5 less SV, above 0.5 highly SV 0, 5 and 1 severely SV, it means smallholder farmers in ward 28 are highly Social Vulnerable to CC impacts.

Results for factors causing SV in the area are presented in figure 4.2 below. The results showed that demographic factors were the greatest contributor of SV to CC in ward 28 with 43%. This was followed by economic factors with 33% made up of agriculture, health and incomes indicators. Lastly social factors with 24% had education and access to CC information as indicators. Its effect on causing SV in the ward was minimal.

![Figure 4.2: Social Vulnerability Factors on Smallholder Farmers (Field Survey, 2017)](image)

It should be noted from table 4.1 that although demographic factors have the highest SVI score it is not the one with the highest SVI of indicators. Agriculture has the highest at 0.84 SVI, followed by migration 0.81, gender 0.76, household size 0.62, health 0.51, education
0, 47 access to information 0, 34 and lastly incomes with 0, 33. With that order it means Agriculture is the most affected indicator of SV and income is the least SV indicator.

Economic factors of SV had Agriculture practises that are seriously affected by CC. In the study area this is primarily due to erratic rainfall, impacts of droughts, shortage of inputs and fragmentation of land. Bryan et al (2012) concurred that countries in Sub-Saharan Africa are particularly vulnerable to climate change, given over-dependence on agricultural production and limited adaptive capacity. The IPCC stated with high levels of confidence that the overall effect of climate change on yields of major cereal crops in the African region is very likely to be negative, with strong regional variation (Niang et al. 2014). Agricultural livelihoods are affected by drought (Dasgupta et al, 2014). Murewa Ward 28 being agrarian based has witnessed a decline in crop production rendering it vulnerable to food shortages.

Smallholder farmers in the area were SV to diseases. Health indicators of SV aggregated a SVI of 0, 51 which means ward 28 is SV to CC related diseases. Poverty levels have been exacerbated in the area due to prevalent of malaria, dysentery and HIV/AIDS. Health risks seen as potentially impacted by climate change include: food insecurity and malnutrition; natural disasters; communicable diseases, specifically HIV/AIDS; non-communicable disease; high injury burden and occupational health (Ziervogel et al, 2014). A community health worker stated that malaria outbreak in the area prompted USAID to donate treated mosquito nets to every households. HIV/AIDS prevalent is being fuelled by low agricultural production hence there is increased prostitution at Juru growth point and Msami service centre. Dysentery is being caused by shortage of safe drinking water especially during drought periods and dry season when a lot of boreholes dry.

Social Vulnerability in the ward is a result of household size. Household size SV indicator scored SVI of 0, 62. According to the questionnaire survey conducted large families are those with 10 members and above and small families 5 members and below. Results showed that very large families which are a common feature in ward 28 are SV to CC impacts compared to smaller families. Large family sizes are a result of strong cultural practises of inheritance and polygamous families of the Marange Apostolic sect in the areas. Size of households is closely linked to income levels in this community. From the assessment made income SV indicator had 0.33 and it showed that smaller households had high income levels compared to
large households. Incomes were not determined in monetary terms but accumulation of wealth and assets. Those with smaller families had adequate wealth in term of food; livestock and other non-farming sources of income to cushion them from SV to CC, yet poor large families had limited asset portfolios to reduce CC impacts.

According to gender as an indicator of SV a questionnaire survey revealed that the majority of women were SV than men. This indicator had the third highest SVI score of 0.76 which means that the magnitude of SV according to gender is significant in the area. Women are always in contact with the environment as they till the land, fetch firewood and water. The impacts of climate change will mean more work and greater hardship for women and children as they will have to walk further to collect water and firewood and encounter increasing adversity in food production (Brazier, 2015). Women who were doing food for work programmes testified that the reason why they were engaged in such activities was to augment very little they were getting from agriculture as they were constantly missing the unreliable rainfall pattern and droughts effects. Although the sampled population had more women than men results show high confidence of gender analysis that women are socially vulnerable.

Migration is another SV indicator which is very noticeable because of its second highest SVI score of 0.81. There has been a massive exodus of economically active people. The ages of these migrants are between 18 – 40 years. The majority migrated to Harare and Marondera. The majority of migration in response to environmental change worldwide occurs within country borders and much migration is from rural to urban areas (Serdeczny et al, 2016). An analysis of the questionnaire showed search for employment and food insecurity as reasons for such movements. Shortage of labour force hampered agricultural production. Women and children are left alone to fend for themselves. The benefit of such movements is through remittances of agricultural inputs, school fees and food for their rural folks if they are fortunate to get employment. Generally, the displacement of people is projected to increase under continued climate change (IPCC 2014).

Education and access to CC information were amongst the SV indicators that scored very low i.e. 0.47 and 0.34 respectively. Low education levels characterised the area where the questionnaire survey showed that 18/50 participants confessed that they failed to complete Ordinary level due to various reasons giving a 36% school drop-out rate. Literacy levels were 82% yet the community had not accessed much information on CC issues. Schools acted as
the only focal point were CC issues are taught. Presence of EMA to raise educational awareness campaigns on CC related issues was not seen. One respondent acknowledged that she knew EMA officials as police officials arresting perpetrators of the environment. Limited access to education and access to CC information aggravated their challenges in face of Climate Change.

4.4 Coping and Adaptation Strategies to Mitigate Climate Change Impacts.

Several adaptation strategies to CC exist in the area. The dominant strategies engaged in ward 28 by smallholder farmers are related to agriculture. Sampled households reported that they have used many adaptation strategies which include crop diversification, Conservation Agriculture (CA), education, engagement in non-agriculture occupation and migrations to urban areas. Legesse et al, (2012) stated that a single strategy is inadequate in adapting to the impact of climate variability and change as combination of several strategies is likely to be more effective than a single strategy. An analysis of the data collected produced results of those that had adopted these strategies. Frequencies of those who embraced these strategies were summarised in table 4.3 below.

Table 4.3 Coping and Adaptation Strategies

<table>
<thead>
<tr>
<th>Adaptation strategies</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement in non- agriculture occupation</td>
<td>51</td>
</tr>
<tr>
<td>Education on farming and training</td>
<td>32</td>
</tr>
<tr>
<td>Conservation Agriculture (CA)</td>
<td>88</td>
</tr>
<tr>
<td>Diversification of crops</td>
<td>72</td>
</tr>
<tr>
<td>Migration to urban areas</td>
<td>68</td>
</tr>
</tbody>
</table>


Smallholder farmers have devised various strategies to mitigate CC impacts in the area. The majority of these have embraced CA which has gone a long way in ensuring food security in the area. Crop diversification was evident whereby traditional maize farming was being complimented by small grains. This was necessitated by erratic and unreliable rainfall which is now suitable for short season grains and varieties. Rural to urban migration was triggered by shortage of jobs which has seen the economically active groups moving to towns. Education and training of smallholder farmers was not significant in the area. This was
viewed as time wasting by some farmers and AREX officers are incapacitated to deliver their duties.

4.4.1 Conservation Agriculture (CA)

Conservation Agriculture is one of the adaptation strategies employed by smallholder farmers in the ward 28 so as to increase crop production. According to a paper by FAO (2016) CA is farming that aims to achieve acceptable profits, high and sustained production levels while concurrently conserving the environment. The aspect of conserving the environment is important in this study because erratic rainfall and recurrent droughts are failing soil moisture to see plant growth through-out the growing season. An increase in temperature affects evaporation rates from the fields hence induces moisture stress to crops so mulching done in CA prevents that. The value of CA lies in its capacity to enable resource poor vulnerable households to plant their food crops early. CA takes advantage of natural ecological processes to conserve moisture, enhance soil fertility, improve soil structure and reduce soil erosion (Nyamungara and Matizha, 2010). Plate 4.1 below showed field A under CA with mulch managed to withstand moisture stress from long periods of dry spell compared to field B under convention farming which quickly succumbed to moist-induced stress.

Field- A                                                                 Field- B

Plate 4.1: Conservation and Convention Farming

Increase in crop production was realised because CA is intensive in nature. The only bias of CA in ward 28 is that it was only limited to maize crop production by most farmers. Those who had failed to embrace CA from the sampled population were 12%. An insight from AREX officials during FGDs of smallholder farmers showed that the practise is laborious
prone to weeds and often competes with livestock for crop residues used as mulch. The impact of this system has been overwhelming as most families are able to produce enough grain to sustain them to the next farming season in face of low and erratic rainfall.

4.4.2 Education on Farming and Training

Education on farming and training is a coping strategy used to alleviate SV of these smallholder farmers. Community education was spearheaded by different stakeholders in ward 28 and took different forms. 32% of the households professed having received some kind of education. EMA’s presence was acknowledged at a secondary school where it has raised environmental awareness through competitions amongst learners than in the community. EMA has never conducted any meeting in the ward. Arex officials in the ward have done a notable job educating local farmers on smart climate strategies so as to increase agricultural production. Effort from Arex officials is being complimented by other stakeholders like COMTEC and Zimbabwe Farmers Union (ZFU) through provision of agricultural training, skills development and researches. During FGDs a community health worker stated that they are mandated by the ministry to educate the community on nutrition, sanitation and hygiene. They also notify disease outbreaks to relevant authorities. Education and training has capacitated the farmers with knowledge about CC and production of new crop varieties. An analysis of the results shows that education has not had much impact to the community as the majority 68% had not accessed it. Reasons for limited access stemmed from ignorance and resistance to some government initiatives and programmes which are perceived as time wasting as the majority poor are worried about food production only.

4.4.3 Engagement in Non- Agriculture Occupation

Results revealed a 51% of the sampled population who are now engaged in non agricultural activities so as to sustain their livelihoods. This was being necessitated by the need to cushion themselves from losses incurred from agriculture. According to Legesse et al, (2012) livelihood diversification is not only a choice, but it is mandatory in order to survive in the face of an eminent climate variability and change. This therefore necessitated the community to engage in brick moulding, fishing, handcraft making and stone quarrying. Frequencies for these non-agriculture activities are presented in figure 4.3.
Results showed that smallholder farmers engaged in various non-agriculture occupations so as to mitigate CC impacts in the area. Brick moulding activities has been embraced by the majority. Information gathered revealed that the community is engaged in these activities because resources and raw materials used are locally available. Urban areas act as market for these farm bricks. This business is viewed as lucrative by most school leavers as they are able to generate $30 -$50/ 1000 bricks whilst a team of 5 members can produce 10 000 bricks at a given time. Handcraft making was dominated by the Marange Apostolic sect people who engaged in basketry, crocheting, pottery amongst others. Stone quarrying was not very popular and men dominated this occupation. The activity was viewed as laborious as it involved crushing granite rocks into quarry stones. Incomes generated were meagre as a wheelbarrow was being sold between $8 and $10. Ward 28 is endowed with 3 rivers. Fishing supplemented their diet and in times of good harvest they sold surplus. Results analysis showed 49% who had failed to diversify into other occupation for various reasons. Shortage of labour to engage in other activities which is not farming was cited.
### 4.4.4 Diversification of Crops

A lot of crop diversification has occurred in ward 28 as an adaption strategy to CC. Questionnaire survey results showed 72% shift of farmers from the production of traditional crops like maize to small grain crops and small leaved crops. Maize hacterage has dwindled because of CA giving more land to farmers to grow other crops. Plate 4.2 below shows some of the crops being grown from different villages such as sweet potatoes, sorghum, groundnuts and cowpeas. Other farmers are giving a hand in tobacco production so as to generate income to buy grain hence ensures food security. Nutritional gardens for horticultural crops are on the increase. Vegetable crops like tomatoes, onions, carrots, cabbages and fruits (mangoes, lemons and avocado pears) are being produce for selling at the market. Those farmers who are still doing conventional maize production are advised by Arex officials to grow high yielding maize varieties like PHB-90, G19 and ultra early maturing varieties like K-2.

![Plate 4.2: Examples of Crop Diversification](Image)
4.4.5 Migration to Urban Areas

Rural to urban migration is a short term strategy used to cope with the hardships induced by CC in ward 28. Results revealed that 68% members from different households had migrated to towns to seek for employment. Push factor reasons included lack of employment which topped with 66% followed by food shortages due to crop production decline at 54%, low living standards 14%. During interviews one household stated that the money send home is used by my wife to pay fees and purchase of seeds and fertilizers for agricultural cropping seasons. About 58% of the sampled population revealed that their young ones who had migrated had failed to secure formal jobs and end up doing odd jobs like vending, household chores in leafy suburbs of Harare.

4.5 Conclusion

The chapter presented the results obtained in the field. This was presented on tables, graphs and plates. Results on CC impacts, Social Vulnerability and coping and adaptation strategies were analysed. Ward 28 has not been spared by CC impacts. This has made the smallholder farmers livelihoods highly vulnerable. Various coping and adaptation strategies have been employed. Quantitative statistics of frequencies and mean were used together with qualitative research narratives to analyse the data.
CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study was conducted to assess social vulnerability and adaptation to climate change in ward 28, Murewa. The study established that this area has high poverty levels being experienced as a result of increased social vulnerability to climate change. This therefore brings the need for adaptation strategies that alleviates poverty and makes this community resilient to the impacts of climate change.

5.2 Discussion

Climate change impacts have not spared the livelihoods of this community. Low agricultural production, shortage of firewood, siltation of water sources, increased migrations to urban areas which resulted in labour shortages, and human health impacts are amongst challenges faced. Other studies conducted elsewhere concurred with these challenges faced in rural areas of developing countries. According to Manyeruke et al (2013) 75% of the world’s poor live in rural areas where agriculture is their main source of income and it is in these areas that the effects of climate change have been drastic because of lack of proper infrastructure such as irrigation systems. The health effects of such impacts tend to reveal as shifts in the geographic and seasonal patterns of human infectious diseases, and as changes in their outbreak frequency and severity (Wu et al, 2016). Malaria outbreak is amongst diseases that have affected the area. These impacts though they vary in magnitude but in totality they have all induced SV.

The magnitude of Social Vulnerability on smallholder farmers in the study area was assessed to be highly vulnerable according to the index used. In the study the socio-economic and demographic indicators used to assess are in a way linked to Agriculture. Social vulnerability was solely attributed to the impacts of CC. However other scholars refute this notion as SV concept involves an analysis of complex factors. According to Adger (1999) the causes of social vulnerability are the characteristics of the climatic threat, the political economy structure making decisions and institutional and societal benefits for adaptation strategies.
Coping and adaptation strategies employed to help smallholder farmers reduce SV to Climate Change include adoption of Conservation Agriculture, crop diversification, engagements in non-agricultural income activities and increased environmental awareness and education on farming. Similar strategies were reported from various studies conducted in different parts of Africa like Ghana where non-farm activities increasingly played an important role in household livelihoods because they offer opportunities for diversification when agriculture becomes more risky (Dumenu and Obeng, 2015). In this survey not all sections of the community have managed to adapt. According to Okonya et al (2013) adaptive capacity of smallholder farmers to changes in climatic events is usually low due to dependence on natural resources, constraints in human and physical capital, and poor infrastructure. The government has not done much to fund the growing of small grain crops and this has left the country’s small grain seed banks virtually empty (Manyeruke et al, 2013). Adaptation will require the involvement of multiple stakeholders, including farmers, policymakers, extension agents, NGOs, researchers, communities and the private sector (Bryan et al, 2012). The aforementioned stakeholders are there in the study area but are not involved effectively especially the private sector.

5.3 Conclusions

From the study the researcher concluded that:

Increased poverty levels being experienced in Murehwa ward 28 is a result of social vulnerability emanating from climate change impacts. High poverty levels have impacted on smallholder farmers’ livelihoods through decline in crop production, diseases outbreak, labour shortages and decrease in household income.

Climate Change impacts that affected the area included reduction in crop yields, outbreak of diseases, shortage of labour force due to migrations, siltation of water sources and shortage of resources such as firewood and water. These impacts are a result of increased temperature conditions, recurrent droughts and erratic rainfall being experienced in the area.

The area is highly social vulnerable to CC impacts. The magnitude of SV was very high since livelihood aspects such as farming, health, incomes, gender imbalances and education
were being affected. These livelihood aspects determine a sustainable lifestyle and the social well being of a community.

Adaptation and coping strategies are being employed by smallholder farmers. These are aimed at reducing SV to Climate Change impacts. The most common strategies include Conservation Agriculture, crop diversification, and engagement in non-agriculture occupation, environmental and farming education and migrations opportunities to sustain rural folks. However these strategies have not been effective since they face numerous challenges.

5.4 Recommendations

✓ Education and awareness campaigns are important and should be accessed and increased to as to reduce SV to CC. This should involve active participation of different stakeholders with interest in CC issues. Education can be increased through researches, skills training and development, workshops and rediscovering the value of IKS. This will go a long way in changing environmental perceptions and attitudes, raising awareness and adoption of suitable strategies that ensures resilient to CC impacts.

✓ Increased participation of the community in CC related programmes will reduce social vulnerability. This will include empowering the community to make decisions on issues affecting them. Such participation should be gender sensitive since women are usually the most vulnerable group affected by CC. Women should be empowered to lead public and private institutions for various programmes to be effective.

✓ Development of rural areas will reduce Social Vulnerability to climate change. This can be done through infrastructural development and provision of services such as water, energy and transport. There is need to evaluate the growth point policy of Zimbabwe and support SMEs initiatives and formalise non-agriculture ventures in rural areas. This will enhance rural community livelihoods since over-reliance on rain fed agriculture is at risk to Climate Change.
For effective SV assessment all systems should co-ordinate since this is a complex phenomenon. This involves triangulating primary and secondary data sources. For instance primary data collected from the field should be augmented with secondary data from National census survey.

Adaptation strategies should be multi-sectorial. This involves developing unique strategies in different sectors such as Agriculture, Health, and Energy among others. This will increase the potential to cope and adapt to CC hence achieve sustainable livelihoods.

5.5 Suggestions for Further Research

Literature is populated with a lot of researches on the bio-physical impacts of CC yet vulnerability takes different dimensions. This study which looked at the concept of social vulnerability should stimulate the interest of would be researchers to conduct different researches but in different settings.

The study focused on SV to CC and adaptation strategies which is a short term measure to reduce CC vulnerability. There is also another aspect of Climate Change mitigation which is long term which needs to be explored giving specific attention to rural communities.

Results obtained from this study revealed the need to assess CC social vulnerability at a micro-scale. This should draw the attention of policymakers to develop and implement policies that are indigenous and unique to different settings for adaptation strategies to be effective.

Gender and climate change social vulnerability and adaptation in agrarian settings can be an area of interest that can stimulate research. This will involve investigation on the magnitude of SV to CC on gender basis and adaptation strategies.
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Edward, R, Carr, 1, and Mary C. Thompson, R (2014) Gender and Climate Change Adaptation in Agrarian Settings: Current Thinking, New Directions, and Research Frontiers

FAO website on conservation agriculture http://www.fao.org/ag/ca/


APPENDIX A

A QUESTIONNAIRE

RESEARCH TOPIC: An Assessment of Social Vulnerability and Adaptation to Climate Change: A Case of Ward 28 in Murehwa District, Zimbabwe.

Introduction and explanation of the survey to the respondent

Good day, I am Shingirayi Mapfumo. I am conducting a study on An Assessment of Social Vulnerability and Adaptation to Climate Change: A Case of Ward 28 in Murehwa District, Zimbabwe, for the partial fulfilment of Master of Science Degree in Natural Resources Management and Environmental Sustainability at Bindura University of Science Education. The study is based on social vulnerability and adaptation to Climate change. The questionnaire is designed to gather information about climate change impacts in the area, magnitude of social vulnerability and adaptation strategies in place. Hence your opinion and perception will help me in this regard. The answers are strictly confidential and for academic purposes. The information collected will be anonymously kept. Names are irrelevant in this regard. There are no wrong or correct answers. I request that you answer the questions honestly and as truthfully as you can.

1. General information
   1.1 Sex( please tick)

   Male
   Female

   1.2 Age(please tick)

   Below 30 years
   30-----39
   40------49
   50-------59
   60-------69
   Above 70 years
1.3 Marital status

<table>
<thead>
<tr>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
</tr>
<tr>
<td>Single</td>
</tr>
<tr>
<td>Divorced</td>
</tr>
<tr>
<td>Widowed</td>
</tr>
</tbody>
</table>

1.4 Education level (please tick)

<table>
<thead>
<tr>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below O level</td>
</tr>
<tr>
<td>O-level</td>
</tr>
<tr>
<td>A-level</td>
</tr>
<tr>
<td>Degree level</td>
</tr>
<tr>
<td>Above degree</td>
</tr>
</tbody>
</table>

1.5 Monthly incomes (US $)

<table>
<thead>
<tr>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 100</td>
</tr>
<tr>
<td>100----200</td>
</tr>
<tr>
<td>200----400</td>
</tr>
<tr>
<td>Above 400</td>
</tr>
</tbody>
</table>

1.6 Household size (please tick)

<table>
<thead>
<tr>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 3 members</td>
</tr>
<tr>
<td>4 to 6 members</td>
</tr>
<tr>
<td>7 to 10</td>
</tr>
<tr>
<td>Above 10 members</td>
</tr>
</tbody>
</table>

1.7 Source of income/ subsistence

<table>
<thead>
<tr>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
</tr>
<tr>
<td>Non-agriculture</td>
</tr>
</tbody>
</table>

1.8 Non – agriculture activities specify: ..............................................................
1.9 Water source (please tick)

- Tap water
- Borehole
- Borehole
- Well
- none

1.10 Energy source

- Firewood
- Electricity
- Gas
- other

SECTION B: Climate Change Impacts

2.1. Are there changes in rainfall?
- Yes  [ ]  No  [ ]

2.2. How is rainfall changing?
- Decreasing  [ ]  Increasing  [ ]

2.3. Is temperature changing?
- Yes  [ ]  No  [ ]

2.4. How is it changing (temperature)?
- Decreasing  [ ]  Increasing  [ ]

2.5. Have you witnessed drought in your area?
- Yes  [ ]  No  [ ]

2.6. How many droughts have you experienced so far?
- Less than 2  [ ]  between 2-4  [ ]  more than 5  [ ]

2.7. Has these changes in rainfall and temperature affected your lives?
- Yes  [ ]  No  [ ]

2.8. Which areas have been affected by climate change?
2.9. Have you witnessed crop failure/decline in climate change?

Yes [ ]  No [ ]

2.10. Are there any deaths of livestock due to climate change?

Yes [ ]  No [ ]

2.11. How many animals have died so far?

Less than 5 [ ]  between 5-10 [ ]  More than 10 [ ]

2.12. Are the following affected by climate change?

Rivers [ ]  Forest [ ]  Wildlife [ ]

2.13. Any other problems from climate change?

........................................................................................................................................

Social Vulnerability to climate change

3.1. Indicate areas of your lives suffering or being affected.

Agriculture [ ]  Health [ ]  Education [ ]  Housing [ ]
3.2. Are you experiencing poverty?

Yes ☐ No ☐

3.3. Any food shortages in your family?

Yes ☐ No ☐

3.4. Is your income adequate?

Yes ☐ No ☐

3.5. How you witnessed migrations as a result of hardships?

Yes ☐ No ☐

3.6. Any deaths/sickness from your family due to hardships?

Yes ☐ No ☐

3.7. Are you able to send all your kids to school?

Yes ☐ No ☐

3.8. Men and women who suffer the most?

Men ☐ Women ☐

3.9. Do you have a clean source of water?

Yes ☐ No ☐

3.10. Estimate distance from your household

- At home ☐
- 1-5 km ☐
- More than 5 km ☐

2 Coping and Adaptation Strategies

4.1. Have you received any help?

Yes ☐ No ☐

4.2. Who gave you assistance?

Government ☐ Non government organisation ☐ other ☐
4.3. Tick areas you have received help

- Agriculture
- Health
- Education

4.4. Is this kind of help effective?

- Yes
- No

4.5. How often do you receive assistance?

- Few times
- Many times
- Not at all

4.6. Tick if you have engaged in these strategies

- Crop diversification
- Non agricultural jobs
- Education and Training
- Crop diversification
- Migrated
APPENDIX B

INTERVIEW GUIDE SCHEDULE

My name is Shingirayi Mapfumo a student at Bindura University of Science Education. I am doing my research on Social Vulnerability and Adaptation to Climate Change: A case of Murewa ward 28. All information gathered will be used on this research project only and will not be shared with the public. Your name will not be published to ensure confidentiality.

INTERVIEW GUIDE

1. How has rainfall and temperatures changed in your area?

2. What are impacts of drought that you faced in your community/household?

3. Describe how CC has affected agriculture production in your area?

4. Do you consider your area to be vulnerable to CC impacts

5. Which aspects of your lives do you consider vulnerable?

6. What is the magnitude of this vulnerability?

7. Have you ever received any kind of assistance to mitigate hardships?

8. Who has rendered you assistance?

9. What kind of strategies have you employed to reduce these CC challenges?

10. Are the strategies effective?

11. Can you associate these changes in climate to hardships you are facing?

12. Are there other challenges that you face not related to changes in climate?

13. How can these challenges be addressed?

14. Any comments related to CC impacts and adaptation in your area?
APPENDIX C

FOCUS GROUP DISCUSSION GUIDE SCHEDULE

1. How has climate (rainfall and temperature) changed the past decade?
2. Describe climate change impacts that you have experienced in your community?
3. What are the impacts of drought in your area?
4. How have you managed to cope with the effects of drought?
5. Are you strategies being to alleviate CC effective?
6. How vulnerable is your area to CC impacts?
7. Which areas of livelihoods would you consider vulnerable?
8. Describe coping and adaptation strategies employed to reduce vulnerability?
9. Are these strategies effective?
10. Why are they not being effective?