# AN ANALYSIS OF THE VULNERABILITY AND CLIMATE ADAPTATION STRATEGIES OF RURAL WOMEN IN CHIVI DISTRICT, ZIMBABWE.

**by**

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**STUDY LEADER: DR. J. BELLE**

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**DECLARATION**

I, Tendai Mapingure, hereby declare that the submission I have made in respect of the Master's degree in Disaster Management at the University of the Free State is my own work and has not been submitted to any other University or towards any other qualification.

I moreover proclaim that acknowledgement has been given to all sources that have been utilised throughout the compilation of the study.

Date: ___/___/ 2020

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Tendai Mapingure

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Last but not least, the Almighty, you sent a strong support team throughout my studies, blessed me with a gift of life. Without all these I would not have made it.

## DEDICATION

This work is dedicated to my sons, Tatenda Vhumisai and Takudzwa Vhumisai.

## ABSTRACT

Household food security has become an increasingly important area of policy debate with the increasing evidence of climate change. Rural women farmers in the semi-arid areas of Africa are most vulnerable because of their overreliance on the natural resources, rural women have less access to resources and often are marginalized yet they are the ones responsible for feeding the family. The pupose of this study was to analyse what makes rural women vulnerable to climate change and the strategies they employ in order to adapt to climate change. The inter-disciplinary nature of the research (disaster management and climate change) led to the analysis of four theoretical frameworks linked to disaster manangement and climate change. These were utilised to discus the vulnerability of rural women and one theory was used to explain rural women's resilience to climate change.

The pragmatic and post-positivist philosopies were used in the study. The study adopted a mixed method approach where both qualitative and quantitative methods were used with the population of interest being the small-scale rural peasant farmers of Chivi district. Stratified random sampling was utilised to select the 107 rural women who participated in the research. The techniques used to collect data included, questionnaires and informal field observation. Some of the findings made through data collected using these techniques revealed that climate change has impacted negatively on rural women through a shortage of water and a decline in crop and livestock production over the years. This has reduced Ward 25 of Chivi to a barren, dry and marginal area characterised by harsh climatic conditions making people vulnerable to disaster risks like famine and diseases related to food shortages.

Although there are adaptation strategies that can be employed in this area, there are some factors such as lack of access to capitals and decision making powers that prohibit the rural women from adopting them. Descriptive analyses encompassed the use of means, percentage, ranges and cross tabulation. The Statistical Package for Social Sciences (SPSS) was used for data analysis. The quantitative analyses tools involved the use of binary logit regression, vulnerability scoring and a modified stakeholder analysis. The major recommendation was the livelihoods of the rural women need to be involved in the decision making processes because they are the implementers of the policies. In addition, it can also be recommended the rural livelihoods be diversified through creating projects and reduce their vulnerability.

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**A list of Acronyms**

| | |
|---|---|
| DRR | Disaster Risk Reduction |
| FAO | Food and Agriculture Organisation |
| IPCC | Intergovernmental Panel on Climate Change |
| ISDR | International Strategy for Disaster Reduction |
| MMR | Mixed method research |
| OCHA | Office for the Coordination of Humanitarian Affairs |
| PIP | political institutions and processes |
| SDG | Sustainable Development Goal |
| SLF | Sustainable Livelihood Framework |
| UNDRR | United Nations office for Disaster Risk Reduction |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USAID | United States Agency for International Development Community |

## Definition of Terms

*Adaptation:* this can be defined as the processes and adjustments to the actual or expected climate change and its effects in order to moderate the harm (UNDRR 2017).

*Climate Change:* has been explained by IPCC (1997) as the change in the state of climatic conditions over a longer period attributed to direct and indirect anthropogenic factors altering the global sphere.

*Food Security:* is perceived by the FAO (2011) as the physical and economic access to enough food that is safe and nutritious to meet the dietary necessities for a healthy and active life of all people. The physical access addresses the supply of food which is determined by the level of food being produced and the economic aspect covers the ability to purchase the produced food (UNFCCC, 2011; IDSR, 2001). Thus food security can be viewed as the availability and access to nutritious food.

*Livelihood:* is viewed as FAO (2011) as how people make a living. It encompasses all the resources and activities that people have in order to make a living. Therefore, in simple terms, livelihood can be viewed as what people have and what they do to make a living.
*Resilience:* the UNDRR (2017) defined this term as the ability of households, communities and nations to absorb and recover from shocks, whilst positively adapting and transforming their structures and means for living in the face of long-term stresses, changes and uncertainties.

*Shock*: a sudden event with an important and often negative impact on the vulnerability of a system and its parts. Shocks represent significant negative (or positive) impacts on people's means of living and on the functioning of a state (UNFCCC, 2011).

*Stress: a* long-term trend, weakening the potential of a given system and deepening the vulnerability of its actor (UNDRR, 2017).

*Vulnerability:* refers to the circumstances created by the social, economic, environmental and physical factors resulting in the inability of communities to resist or respond to a hazard. (UNDRR 2017)

# CHAPTER 1

## 1.1 Introduction

Extreme events such as droughts, hailstorms, tropical cyclones and floods are increasing in intensity and frequency. The main findings of the 2018 Intergovernmental Panel on Climate Change (IPCC) special report indicated that the world is warming swiftly as a result of the increase in temperatures. The IPCC report further stated that issues related to climate change have been of major concern for the most part of the last half of the 20$^{th}$ century posing a risk to households' food security (United Nations Framework Convention on Climate Change, (UNFCCC, 2018). Although the effects of climate change vary geographically across the agro-ecological regions, countries and continents, the vulnerable rural women in Africa have already experienced and can expect increases with the unpredictability of weather patterns and more extreme weather events (Challinor, Adger and Benton 2017). According to Challinor, *et al* (2017), in the absence of adaption strategies in the face of heat and water stresses that adversely impact on plants, livestock and people, there will be a great likelihood of reduced food production and nutrition prospects. Herrero and Thornton (2014) support this notion and add that the natural resource base on which these rural women depend will be altered; traditional socio-economic safety nets will be stressed and the potential for agricultural development jeopardised.

Rural women are particularly reported to be at a high risk of negative impacts from climate change (Mkwambisi, 2013). This is because their household responsibilities such as childcare and the collection of firewood and water makes them more climate-sensitive because they take on more agricultural work as men migrate for labour in urban areas and neighbouring countries. They also have less access to agricultural resources such as land, extension services and inputs with which to adapt to climate variability and change (Bhatasara, 2015). This is supported by the Food and Agriculture Organisation (FAO) (2011) and Wright (2014), who highlighted that gender social norms and roles inhibit women's adaptive capacity to climate change and thus expose them to food insecurity and malnutrition.

Women's vulnerability to the effects of climate change can be attributed to their over-dependence on natural resources, their responsibility for water and food procurement and their increased risk exposure during times of disasters and severe weather crises (Challinor *et al.,* 2017). In addition,

rural women lack access to resources to mitigate against changes in their natural environment, and are left with no option but to adapt to the climatic conditions. All these negatively affect household food security as the women may not have other ways to supplement their nutritional requirements. Climate change thus, erodes women's freedom and limits their livelihood choices.

## 1.2 Description of study area

### 1.2.1 Location

Chivi District is located in south central Zimbabwe, north of Mwenezi District and west of Masvingo (Figure 1.1). The district extends from 20° 14' S to 20° 24' S. It lies at an elevation of 811 metres above sea level. As stated in ZIMSTAT (2017), Chivi District covers approximately 3 534km². The study sites were selected from Ward 25 identified by the District Council. The study area is located in Masvingo Province as indicated in Figure 1.1.

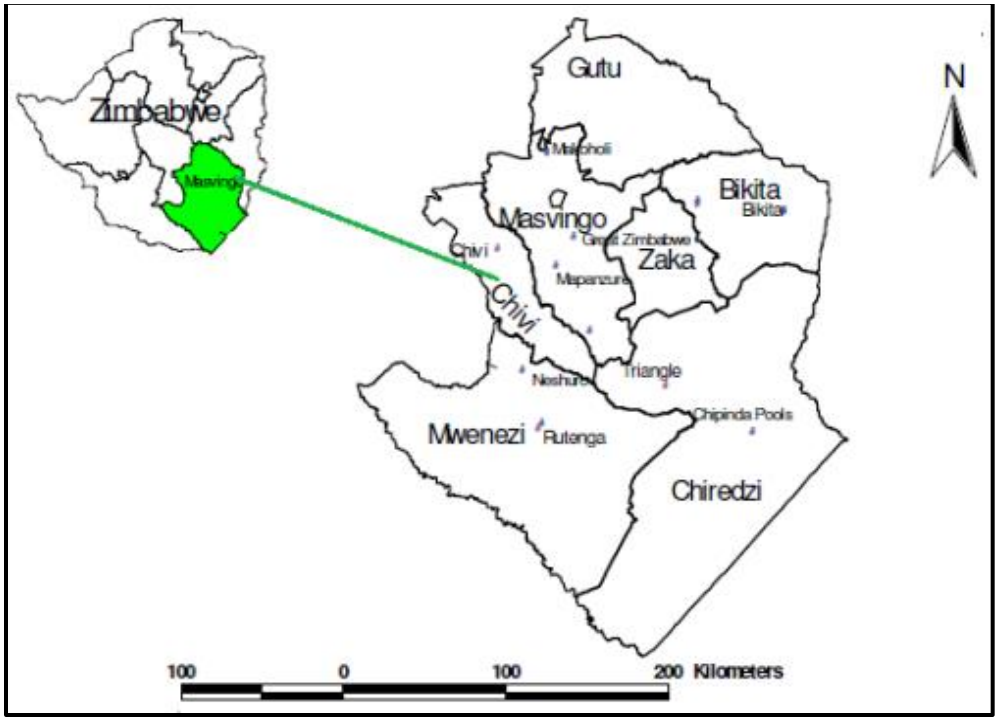


*Figure 1.1: Location of Chivi District in Masvingo Province, Zimbabwe*
[Source: Zimbabwe.opendataforafrica.coc, 2016]

### 1.2.2 Climate and agricultural activities

The area receives low and unreliable rainfall with a mean annual rainfall of approximately 530 to 545 mm and is generally characterised by poor crop productivity and food insecurity (Chikova and Kangalawe, 2013). Major soils in Chivi are mainly made from coarse-grained granite and include the chromic luvisols, ferric luvisols and eutric regosols which are described as infertile (Chikodzi, Murwendo and Farai, 2014). Baobab trees are known to be drought-resistant and thorn bushes are common vegetation in Chivi. The District is located in the drought-prone region of the country, occupied by subsistence farmers for their sustainable livelihood. The farming system in the area is mainly mixed farming consisting of maize, small grains and livestock system. Cattle and goats are reared and owned by men to provide manure for gardens and draught power. Figure 1.2 indicates the location of Ward 25 in Chivi.

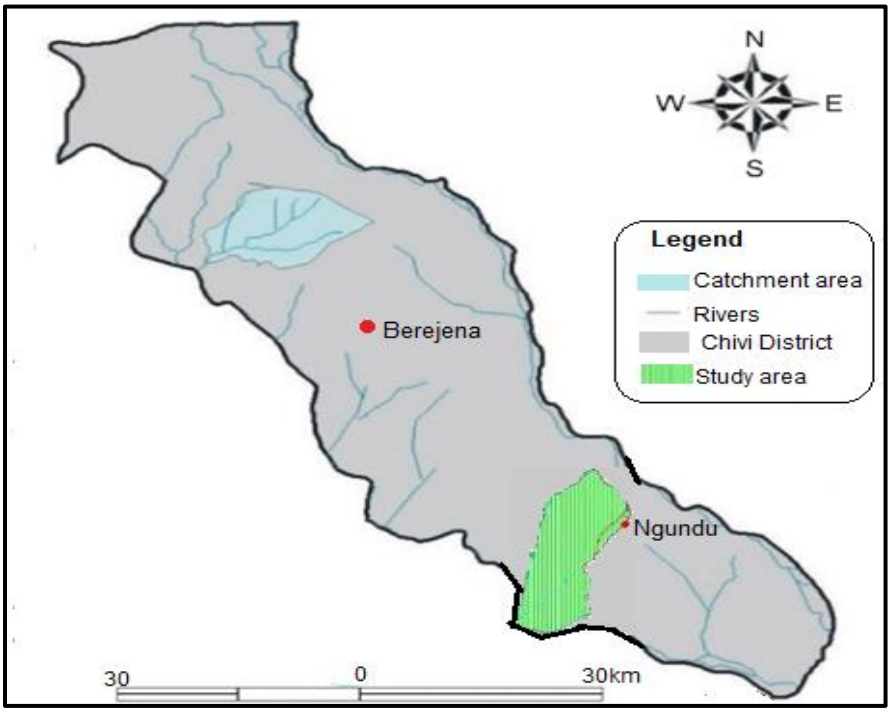


*Figure 1.2: Location of Ward 25 in Chivi District*

[Source: Adapted from Zimbabwe.opendataforafrica.coc, 2016]

### 1.2.3 Socio-demographic of ward 25

As stated in the Food Poverty Atlas (2016), Ward 25 of Chivi District has a total population of 10 893 with 1070 households who rely mainly on subsistence farming for their livelihood. The District is divided into 29 Wards with a total of 180 villages, a population density of 64.5 people per square kilometre (Inter-Censal Demographic Survey (2016) in ZimStat, 2017) and has a shopping centre. The infrastructure is not well-developed, there is a rural district clinic and no

banking services. The languages mostly spoken there are Shona, Ndebele and Tshivenda. Most of the population consists of women with approximately 55.6% (6 059) of the total population in Ward 25 and men constitute 44.4% (4 834). The ZimStat (2017) stated that Inter-Censal Demographic Survey of 2016 indicated that 58% of the households in Ward 25 are headed by females and 42% by males with an average of 6.7 people per household.

### 1.2.4 Education level and economic situation

The literacy rate of Ward 25 is 85% for males and 71% for females (Food Poverty Atlas 2016). The most common economic activities prevalent in Ward 25 are farming, vegetable gardening and selling home-brewed beer locally known as *ndari* (Mugambiwa and Tirivangasi 2017). Although the literacy rate is high, the unemployment rate in Chivi District is 73% with most of the unemployed being economically active women (Mugambiwa and Tirivangasi 2017). Figure 1.3 indicates the employment status of women in Ward 25 in Chivi.

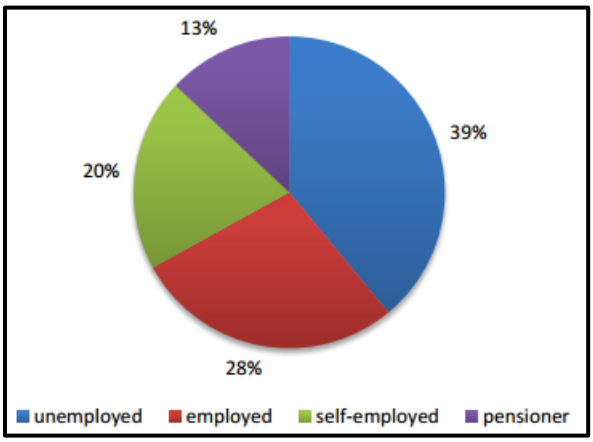


*Figure 1.3: Employment status of women in Ward 25*
[Source: Adapted from ZIMSTAT 2017)

As a result of natural disasters such as droughts and the deterioration of economic conditions in Zimbabwe, there was a large scale migration of mostly men from Chivi (Ward 25) area to urban areas and neighbouring countries such as Botswana and South Africa in search of jobs leaving mainly women and children behind (Mugambiwa and Tirivangasi 2017). This erodes the social support and makes the rural women more vulnerable to the harsh climatic conditions in the area.

## 1.3 Research Problem

The FAO (2016) stated that women agriculturalists contribute approximately 45-80 percent of food production in many developing countries. About two-thirds of the female labour force in developing countries, and more than 90 percent in many African countries, are involved in agriculture (FAO 2016). In the perspective of climate change, traditional food sources become more erratic and limited. Challinor *et al*. (2017) depicted that rural women in developing countries are particularly vulnerable because they are highly reliant on indigenous natural resources. These resources are frequently threatened by climate change for their livelihood and they have limited mobility. Furthermore, women are usually not involved in decision-making on the use of land and resources which are critical to their livelihoods (Choden, Keenan and Nitschke n.d.).

Zimbabweans depend heavily on natural ecosystem services such as hygienic water, fertile soils, timber and fuel wood and nutritious wild foods. Overexploitation, poor resource management coupled with climate change lead to the resources' depletion. (Choden, Keenan and Nitschke n.d.). As wildlife struggle to survive on dwindling resources, they are likely to encroach, increasingly on human settlements thereby threatening people, livestock and crops. Soil degradation is most likely to occur resulting in vegetation loss and erosion being exacerbated by changing rainfall patterns, droughts, floods and wildfire (Hilson, 2016).

Zimbabwe's agricultural systems are already insecure as they depend mainly on seasonal rainfall. In addition, ruinous land use practices in the form of poor soil and water management, reduced biodiversity and poor choice of crops to plant have led to degradation of the resource base on which agriculture depends (Mkwambisi, 2013). Climate change will hasten the degradation and exacerbate food insecurity, which is already prevalent in Zimbabwe.

Ward 25 in Chivi is ruled under the traditional Karanga customs and beliefs. Mugambiwa and Tirivangasi (2017) assert that land in Chivi is not marketable but hereditable, meaning that it is passed on from one male generation to the next male generation. Females do not own land in accordance with these traditional beliefs. Marriage in the area is patrilocal which implies that when a woman marries, she moves from her family to the husband's family where she will not have any title deeds to any asset. In the event that the woman is widowed and does not have an adult male child to inherit the land, she is most likely to lose the land and other assets to the deceased's brothers and will be exposed to risks (Mugambiwa and Tirivangasi, 2017). This has been

supported by a study conducted by ZimStats (2017) which indicated that three quarters of the women in Chivi were reckoned to be living below the national consumption poverty line in 1995, and the prevalence of extreme poverty, as measured by the Food Poverty Line increased in the 1990s from 17% to 37%.

Although there is a superfluity of reasons for Zimbabwe's economic misery, there is no doubt that the economy as a whole and the agro-based livelihoods in particular are at risk of climate change and reduced prospects of food and nutrition security. Chivi District lacks employment opportunities and is affected by perennial drought due to the unreliable rainfall thus exposing the inhabitants to a risk of food insecurity (Chikodzi *et al.,* 2014).Taking into cogniscence that approximately 55.6% of the population are women who rely on natural resources for livelihood, this exposes many families to food insecurity which may trigger other problems in the community and country at large.

In addition, Mugambiwa and Tirivangasi (2017) contend that climate change increases agricultural pests and diseases, implying that households are most likely going to lose their livestock that they depend very much on as assets. In a study conducted by Dhilwayo (2007), the female-headed households in Ward 25 in Chivi district face difficulties as a result of climate change because they rely on the sale of livestock for survival during drought. In a study in Ward 25 of Chivi District, Dhilwayo (2007) established that farm produce and livestock were sold to educate children but as a result of drought there is no or less surplus to sell thereby making life more difficult, especially for women because their responsibilities are closely tied to these natural resources. The area does not have any dam to supply water, the boreholes that were dug are dry and women travel approximately 25 kilometres to fetch water for household use making them vulnerable to the hash climatic conditions (Dhilwayo, 2007).

In a separate study conducted by Chineka (2016), Ward 25 in Chivi experiences extended heat waves, hot and dry weather conditions, resulting in drying up of rivers, dams and wells. These changes in pattern and timing of seasons are a confirmation of climate change. Some of the impacts of these conditions in Ward 25 includes crop damage, poor plant germination, pests, lower incomes and reduced yields resulting in food insecurity (Chineka, 2016).

Furthermore, the United Nations for Coordination of Humanitarian Affairs (UN-OCHA) (2014) and Human Rights Watch (2015) reported that the Chivi area experienced heavy rainfall and

mudslides in late January and early February 2014 which caused the partial collapse of the Tokwe-Mukosi Dam wall resulting in flooding. Tokwe-Mukosi is in the semi-arid southern Masvingo region (Chivi District) and received double (850 mm) than normal rains in 2014 (Rusvingo, 2014). This can be attributed to climate change and led to disaster-induced displacements of approximately 2500 households with about 60 000 people affected. (OCHA, 2014; Human Rights Watch, 2015).

Many of the measures that have been proffered to deal with climate change in the area are either out of step with normal farming practices or are too expensive, complicated or too labour- intense to the mostly women and children dominated agricultural systems of Ward 25, Chivi District of Zimbabwe's rural areas. This study is relevant as it sought to investigate how rural women of Ward 25 in Chivi District are affected by climate change in relation to their livelihoods. Most importantly, the study seeks to find out the best climate change adaptation strategies that are in line with the pedo-climatic conditions of rural area farmers in Chivi District of Zimbabwe as well as suitable for their socio-economic circumstances.

## 1.4 Research questions

In order to narrow down the scope of the research and gain an insight about the problem, the answers to the following questions will be sought:

**Main question:**

- To what extent are rural women in Ward 25 of Chivi District vulnerable to climate change and do they have any adaptation strategies to climate change-induced risks?

**Sub questions:**

1. *What evidence suggests that climate is changing in Chivi?*
2. *What risks are posed by the changing climate**?***
3. *What makes rural women vulnerable to climate change?*
4. *What strategies do households in the study area use to adapt to climate change induced risks?*
5. *Are there any other best climate adaptation strategies that can be implemented by these rural women?*

## 1.5 Objectives

The following objectives were proposed for this study:

**Main Objective:**

- To assess the vulnerability of rural women to climate change and establish the adaptation strategies implemented to increase the coping capacity.

**Sub-objectives:**

1. *To assess some evidence of climate change in the study area**;***
2. *To identify some risks posed by climate change in the area**;***
3. *To determine what makes rural women more vulnerable to climate change;*
4. *To analyse different strategies implemented by the households in Ward 25 of Chivi District in Zimbabwe in adapting to climate change induced risks;*
5. *To propose measures that could improve the coping and adaptive capacities of these rural women to the impacts of climate change**.***

## *1.6 Significance of Study*

Although similar researches on climate change have been conducted in Chivi District, this research is the first to be conducted in Ward 25 in line with International frameworks such as the United Nations Office for Disaster Risk Reduction (UNDRR) (2015) which places gender matters at the heart of disaster management. The results from this study are expected to enlighten policy makers in government, agricultural and other sectors that are affected by climate change on the current adaptation strategies that rural women in Ward 25 are implementing. This will enable the establishment of gaps, effectiveness, and weaknesses of the current adaptation strategies with a chance of finding out appropriate interventions that are in line with the study area's condition. Furthermore, this will assist in enhancing the livelihood assets and find ways of diversifying their livelihoods and become resilient to climate change induced disasters.

## 1.7 Methodology

### 1.7.1 Research Design

This research used the Mixed Method Research (MMR) because the research is exploratory and explanatory in nature, therefore integration of qualitative and quantitative methods provide a deeper understanding of the research problem. Exploratory approach as described by Leavy (2017) and Creswell (2015), is used when researching a topic that is new or under-researched and has some knowledge gaps. This approach enables the researcher to generate emerging insights about the topic thus prompting further investigation. On the other hand, the explanatory approach is used to explain the causes and effects of a phenomenon (causes of vulnerability in women to climate change and the impacts thereof) and seeks to establish why things are the way they are (Creswell, 2015; Leavy, 2017). These two approaches are suitable in this specific study because the topic has some gaps due to lack of adequate research especially on the vulnerability of women to climate change and may result in guiding other researchers to other research questions. Moreover, the exploratory and explanatory approaches enable the generation of details and meanings in the context of the study area through experiences on the correlations between climate change and the vulnerability of women.

According to Creswell and Miller (2012), MMR design refers to a procedure of collecting, analysing, and combining both quantitative and qualitative research methods in a single study to understand a research problem. The use of this method enables the collection of data that reflects the participant's point of view thus collecting extensive and comprehensive data (Hesse-Biber and Johnson 2015). Furthermore, as indicated by Mouton (2015), the qualitative approach is ideal because it is naturalistic and allows the researcher to experience first-hand learning through participation and involvement thus data collection will be more effective. The integration of the quantitative approach will augment the qualitative approach thereby broadening the scope of the data to be collected.

### 1.7.2 Population and sampling

#### i) Target population

Schumacher and McMillan (2014) defined target population as the group from which data will be collected. Although all the households in Ward 25 are affected by climate change, this study focused on a sample of women in the study area. The Inter-Censal Demographic Survey (2016)

cited ZimStat (2017) indicated that 58% of the households in Ward 25 are headed by females and 42% by males with an average of 6.7 people per household. Mouton (2015) explained that a sample refers to a representative subset of observations from a population.

ii) Sample size and sample determination

Ward 25 has many households as indicated by the Inter-Censal Demographic Survey (2016) in ZimStat (2017). Of the total 1070 households, 67% (713) were women and affected by climate change. It was not practical for every household to participate in the study given the limited time and resources, therefore 15% of the total (713) women headed households (107) were selected to participate in the study. This was done through the assistance of the Rural District Councillor because there were no updated official records of all women-headed households due to dynamics such as remarriages, deaths and migrations within the area of study.

iii) Stratified simple random selection

Stratified simple random sampling where sampling which is referred to as the $N^{th}$ selection technique was used. As described by Leavy (2017) stratified simple sampling involves the selection of a subject from a continuous list by choosing every $n^{th}$ subject. Stratified simple sampling was the best method in this case considering that the population to select from was big and there was a list written, with men-headed and women-headed households. The researcher selected the women-headed households from the list drawn to ensure that the population will be representative of the total population (Schumacher and McMillan, 2014). The advantages of stratified simple sampling include that the population is arranged according to a certain variable, For instance in this research, the list of the population in this study is stratified according subgroups of male and female-headed households, the researcher was assured that all the households are represented in the sample. In addition, it is also advantageous because it provides a greater accuracy in minimising biases. Furthermore, it also allows for well-organised and effective use of time and resources (Leavy, 2017). Therefore, stratified simple sampling was regarded to be more feasible because of its simplicity in execution and that it enables the use of a part of the population rather than the whole of it.

### 1.7.3 Data collection tools

Data collection refers to the process of gathering both first-hand information from informants and other secondary sources in order to achieve the objectives of the research. In collecting data, primary and secondary data sources were utilised Creswell (2015). The researcher used questionnaires and field observations as the primary data collection tools.

i) Questionnaires

Questionnaires are a set of statements or questions used to assess opinions or beliefs and biographical information of the subjects. In order to collect accurate information, the questions must be well-formulated, clear and designed to meet the objectives or answer the research questions asked (Schumacher and McMillan, 2014). Both open and closed-ended questions were asked to collect the necessary data on the impact of climate change on the rural women's livelihoods, as well as basic characteristics of household heads such as age, gender, marital status, employment status, level of income and household size (Schumacher and McMillan, 2014). Closed-ended questions are meant to collect specific data and save time whilst unstructured questions were intended on making sure that the views of the respondents are taken into account where they were given an opportunity to explain themselves. Before distributing questionnaires, permission was sought from the Rural District Council.

ii) Field observation

Mouton (2015) described a field observation as a process of noting and recording behaviours, events and artefacts in a social meeting. The researcher engaged in a non-participant observation approach where the researcher observed the activities of the subjects without being directly involved in that activity. Mouton further proposed that the researcher must have a descriptive checklist on the areas of interest where the data will be recorded. Creswell (2015) further explained that this method is very useful especially where some of the sampled population may not be able to articulate themselves in the interviews or questionnaires or who may be shy or uncomfortable to air their views in interviews. In this study, observation was done on the crops that were planted in the fields as well as the economic activities the rural women were involved in at the local shopping centre.

Secondary data

The research used relevant secondary sources. Creswell (2015) asserts that using secondary sources to collect information is convenient and affordable. These sources enabled the researcher to trace the background of the vulnerability of women, climate change and its impacts on rural women's livelihood from a global, regional, national and local scale because the information was readily available. Information on the number of households was sourced from the Rural District Council enabling correct calculations of the number of participants.

### 1.7.4 Data analysis

The research findings are qualitative and quantitative thus presentation and analysis will be both descriptive and thematic which will be summarised in tables, figures and charts. After the collection of data, it will be captured in such a way that allows conclusions to be drawn. Flick (2014), Corbin and Strauss (2014) describe descriptive analysis techniques as useful because they enable the researcher to organise, summarise and describe observations, interviews and questionnaires, making it easy to interpret data. In this research, descriptive analyses involved the use of means, percentages, ranges and cross tabulation Quantitative analyses tools involved the use of binary logit regression, vulnerability scoring and a modified stakeholder analysis.

### 1.7.5 Data validity and reliability

In order to ensure that the data collected is valid and reliable, same questions and instruments were used to all the sampled population. Triangulation is another method which involves the use of different data sources and data collection strategies to get the same information (Schumacher and McMillan, 2014; Leavy, 2017). Triangulation design was most suitable in this research because of the mixed method design that was applied in the research. In this research, triangulation was used to validate the data where data was collected using different data collection methods such as questionnaires and field observations. Triangulation as explained by Honorene (2017) is applied to check the consistency of the research findings from the data collected using different methods. The use of different methods in data facilitates a deeper comprehension while overcoming the intrinsic biases and deficiencies that arise through the use of a single method thus reducing uncertainty and personal impacts on research findings. (Tecehurst and Veal 2000).

## 1.8 Limitations and Delimitations of the study

### 1.8.1 Limitations

i) Time

The research was carried out for academic purposes, therefore there was a limitation on time since the researcher had to divide time with other studies, professional duties and household chores.

ii) Financial services

The research was a self-sponsored project hence it was affected by financial constraints. The researcher had limited financial resources for travelling, typing and printing of the material that was used during the study.

iii) Respondents' level of education

Educational level of participants gave limitations in responding to the written questionnaires. For those respondents who were not be able to write or read the questions, an interpretation of the questionnaire was done in the local language in order for them to understand.

iv) False information

There was a possibility of the participants giving false responses, thereby affecting the results. To overcome this, the participants were reassured of confidentiality' Pseudonyms were used throughout this study.

### 1.8.2 Delimitations

Chivi District is vast, with many Wards. Therefore the study was conducted only in Ward 25 thus confined to a small area. The study focused only on women not including the men's perspectives on the issue of climate change. This did not have much impact on the results and conclusion of this research because the research sought the perceptions of women on their vulnerability to climate change and its impacts through their experiences and the strategies they implement to strengthen their coping capacity.

## 1.9 Ethical considerations

The researcher took into consideration the fundamental principles of ethical research which include justice, beneficence and respect for human dignity while conducting this study. The ethical consideration in respect to this particular research was discussed thoroughly with the participants. Flick (2014) postulates that social research can harm research participants in several ways such as: physically, psychologically and harm to a person`s career. In this study, the researcher avoided sensitive questions. The study protocol was explained in full to all study participants in Shona and Ndebele (their local languages). Before embarking on data collection. As per the University policy, it is imperative that the researcher applies for ethical clearance from the University of Free State's Ethical Committee. Therefore an application was submitted to the ethical committee and the research was approved.

Participants were not forced, coerced, or threatened to give responses. Permission to carry out the study was sought from the Rural District Council. Participants with diminished autonomy such as the elderly and mentally retarded did not participate as subjects. The researcher clearly explained the purpose of the study so that respondents avoid any suspicions. The researcher ensured that confidentiality and secrecy of information is adhered to by not writing names on the questionnaires, instead codes were be used.

Furthermore, to ensure that the work complies with the University's policy on plagiarism, the research was be submitted on Turn it in to check if all work from other researchers was duly acknowledged.

## 1.10 Chapter Summary

This chapter gave the general introduction and background to the research. It focused on the research problem, the objectives, the research questions, and the research methodology, the significance of the study as well as the limitations and delimitations statement and area of study.

## 1.11 Chapter Outline

The research report consists of six chapters. Chapter one is made up of the general introduction, the problem statement and area of study. It expounds the research design used, as well as the sampling method employed to collect data, the data collection tools used have also been outlined. The theoretical and legislative frameworks in climate change are presented in chapter two of the research. Chapter three consists of the scholarly review from a global, regional, national and local perspective on the vulnerability of women to climate change and its impacts on their livelihood. The research methodology employed in this study is outlined in chapter 4. Data analysis, presentation and discussion form chapter five of the study. The conclusion and recommendations form chapter six.

# CHAPTER 2

# THEORETICAL AND LEGISLATIVE FRAMEWORKS RELATED TO RURAL WOMEN AND CLIMATE CHANGE

## 2.1 THEORETICAL FRAMEWORKS

### 2.1.1 Introduction

According to Mpofu, Otulaja and Mushayikwa (2014), a theoretical framework is a crucial component of research which directs the methodological design and guides the study forming the starting point to interpret research. Furthermore, Grant and Osanloo (2014) define a theoretical framework as predominant philosophies in literature already authenticated and is regarded as putative theory in academic works. Thus theoretical frameworks can be viewed as imperious components of the research process serving as a keystone for empirical knowledge collection.

Four conceptual frameworks related to disaster management will be discussed as the researcher's understanding of the path this study will take. The main focus will be on the vulnerability of rural women and their adaptation strategies to climate change. An outline of the Pressure and Release (PAR) model, Resilience conceptual framework, the Disaster Management Continuum will be given. Then a discussion of the Sustainable Livelihood Framework (SLF), which will be the main framework in this research will be done in the context of the vulnerability of rural women to climate change. The Social Capital theory will be explained under the climate adaptation perspective. The SLF is the most suitable theoretical framework that is applied to enhance comprehension of the vulnerability of Chivi rural women to climate change and the adaptation strategies implemented to prepare for and mitigate the effects of climate change.

Proficient governance and operative legislative frameworks play a pivotal role in rural livelihoods' adaptation to climate change in many countries. The coordination of adaptation policies or measures implemented and the capability of citizens to implement agreed strategies is anticipated by National governments (Shemdoe, Kassenga and Mbuligwe, 2015). Therefore, coordination is one of the crucial factors in enforcing climate change adaptation. As indicated by the IPCC (2014),

adaptation and mitigation responses are buttressed by shared enabling factors which include effective institutions and legislatures, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods, behavioural and lifestyle choices. Against this background, the legislative frameworks, with emphasis on Zimbabwean legislatives that apply to vulnerability of women and climate change adaptation strategies will also be explained.

### *2.1.2 The Pressure and Release (PAR) model and its application to the vulnerability of rural women to climate change*

The model explains the progression of vulnerability in three stages, where dynamic pressures transform root causes into unsafe conditions in a way that when a hazard hits such a vulnerable community, the result is a disaster (Wisner, Blaikie, Blaikie, Cannon and Davis, 2004). Unsafe conditions refer to the particular forms where people's vulnerability is displayed in time and space in relation to a hazard (Wisner *et al.,* 2004). Wisner *et al*. (2004) further pointed out that a disaster is pronounced when a hazard occurs on vulnerable communities, hence expressed as an equation: Risk = Vulnerability + Hazard. The vulnerability of people is embedded in the socio-economic and political processes and the underlying causes which may encompass poverty, discrimination is based on age, gender or ethnic factors resulting in unsafe conditions. The conception of release occurs through the abating of vulnerability. The forces elucidated in the PAR model changes over time and are explained as follows:

Components of the PAR model:

*i)* *Root causes* can be viewed as entrenched and extensive economic, political and demographic processes within a community that results in vulnerability over time and affects the distribution and access to resources such as land and farm machinery.

*ii)* *Dynamic pressures* are factors that transform root causes into an unsafe environment that exposes the community to shocks or hazards. Examples include rapid population increase, discrimination against women and repressive policies. (Wisner *et al.,* 2004). The model argues that the intersection of the opposing forces is processes that generate vulnerability on one side and exposure on the other results in a disaster. Examples of these include limited access to

resources and lack of education and training increasing the vulnerability of people to risks (Lamond and Kinyanjui, 2012).

*iii)* *Unsafe conditions* denote particular forms in which the vulnerability of people is expressed in space and time in relation to a hazard or hazards. For instance, a settlement or unsafe buildings constructed in a floodplain with inability to afford safe places or insufficient coping capacity thereby making the people vulnerable.

The PAR model is diagrammatically presented in Figure 2.1.

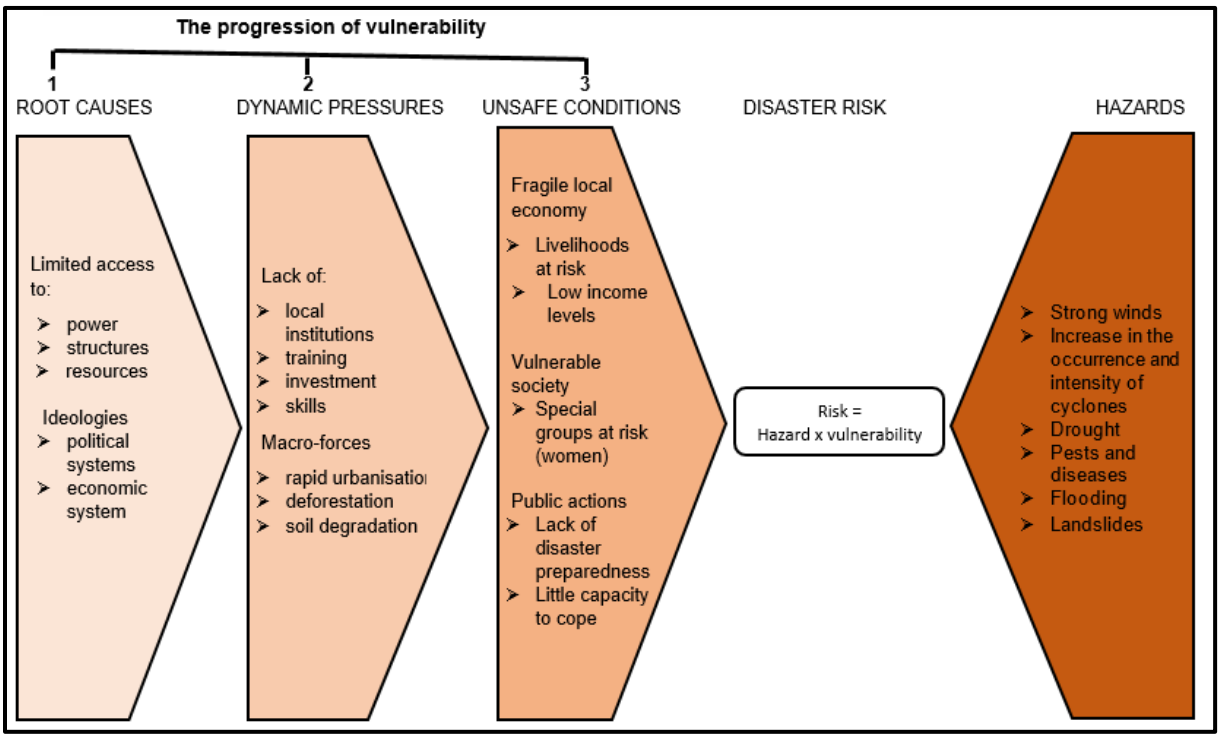


*Figure 2.1: The Pressure and Release (PAR) Model: The progression of vulnerability*

[Source: Wisner *et al.,* 2004]

2.1.2.1 Application to the vulnerability of rural women to climate change

It can be noted that the magnitude of a hazard and the degree of vulnerability of the people determines the disaster risk. In order to comprehend trends of a hazard, an analysis of its intensity, the level of preparedness to respond and cope with hazard, the speed of onset, its frequency, time of occurrence and duration need to be established (Wisner *et al*. 2004). For

instance the intensity, seasonality, and frequency of climate-induced hazards like tropical cyclones, floods and droughts, can be taken into consideration in view of the changing climate. The vulnerability of people is caused by the social processes which are: the root causes, dynamic pressures and unsafe conditions. The unsafe conditions may arise and persist due to dynamic pressures interacting on root causes (OXFARM, 2012),

The root causes, as expounded by Wisner *et al*. (2004) can be viewed in terms of limited and differential access of resources between men and women and the distribution of power in communities. This gives an implication that the people who have minimal access to resources may be regarded as less important in decision-making processes thereby making them even more susceptible to shocks. The OXFARM (2012), affirms that the root causes can also be looked at from a gender discrimination perspective where there is unequal gender representation in economic, political systems and structures at all levels of government which makes women vulnerable to the effects of climate change.

In the case of rural women, the migration of their male partners in search of jobs will imply that they will be left with all the household duties thereby making them more vulnerable to the harsh climatic conditions and their impacts thereof. Furthermore, restricted training and learning prospects for women as a result of gender stereotypes coupled with limited freedom of media to raise matters regarding the well-being of women can be categorised as dynamic pressures (OXFARM 2012).

The lack of disaster preparedness skills and coping strategies may create unsafe environments thereby increasing the vulnerability of people. For instance, in the case of a drought that may be a consequent climate change, burden is placed on rural women as they will need to travel long distances to fetch water or firewood as one of their responsibilities thus exposing them to the harsh climatic conditions (OXFARM 2012). In addition, low farm productivity in rural areas may end up pushing women to take up perilous livelihoods as confirmed in a study by Eakle, Bourne and Mbogua (2018). They assert that some women who may have migrated to urban areas end up taking high-risk jobs in unsafe environments, for instance as commercial sex workers which ends up making them vulnerable to abuse and Sexually Transmitted Infections (STIs) and HIV and AIDS. The release part of the PAR model is included as a reverse mechanism that converts the root causes of vulnerability into safe conditions (Wisner *et al*. 2004).

Although the PAR model serves as an important exploratory tool in assessing vulnerability to disasters, it is limited in that its emphasis is on the explanation of vulnerability and not on measuring vulnerability. Another weakness of the PAR model as indicated by Wisner *et al*. (2004) is the separation of the development of vulnerability from the mechanisms in which natural hazards affect people. This suggests that there is no connection between the two. Furthermore, it lacks focus on the human interaction with the environments and the impacts thereof to the occurrence of a hazard (OXFARM 2012). For example, deforestation increases floods and global warming resulting in drought and climate change.

### 2.1.3 Resilience conceptual framework and its application in this study

The resilience conceptual framework was developed and elucidated by Frankenberger, Mueller, Spangler and Alexander (2013) with the aim of providing a clearer understanding on factors and processes impacting on a community's vulnerability and resilience within a dynamic social, economic and natural environment. The notion of resilience was used by Holling in 1986 to explain ecosystem resilience and has recently been useful in other contexts, increasingly in social sciences, to describe household resilience (Levin, Schneider and Gaeth 1998). Considering the wide diversity of resilience opinions, it becomes intricate to perceive all mutual features. Nevertheless, approximately all explanations emphasise the ability for operative adaptation against shocks and stresses.

The framework incorporates the socio-economic context, shocks, stresses, community livelihood assets and community social dimension which institute the community's capacities for mutual action that effect community resilience. The resilience conceptual framework includes three types of capacities namely the absorptive, adaptive and transformative. The absorptive capacity entails the aptitude to abate exposure to shocks and stresses by preventive procedures and suitable coping approaches to circumvent perpetual, adverse impact (Levin *et al.* 1998). Adaptive capacity implies taking pre-emptive, conversant choices about alternative livelihood strategies in dynamic environments. The transformative capacity involves governance policies/regulations, infrastructure, community networks and accepted social defence mechanisms that establish the empowering environment for complete change. These capacities are interlinked and reinforcing

which occur on numerous levels (Béné, Wood, Newsham and Davis 2012; Frankenberger *et al.* (2012) quoted in USAID 2013).

According to Rival (2009), the framework (Figure 2.2) indicates that, in order to build community resilience, it is important to build community capitals through an integrated approach that augments the ability of communities to act cooperatively in disaster risk reduction activities which include mitigation of conflict, social security, management of natural resource and of public properties and services. The situations that deprived communities find themselves in such as inequality, poverty and climate change may not have been created at local level, therefore their solution, will most likely be found at a national or regional level (Rival 2009). This therefore calls for the involvement of institutions at national of regional levels to abate the effects of climate change.

Components of the Resilience Framework

i) *Context* refers to the environmental, political, social, economic, historical, demographic, religious, conflict and policy conditions impacting on and impacted by the abilities of a community to cope with shocks.

ii) *Disturbance* can be rapid onset or slow onset shocks like earthquakes or droughts. USAID (2013) contends that resilience assessment requires the acknowledgement that some disturbances are quirky, thus they can affect households while others will affect the whole populace or a geographic area. It should also be noted that when a community becomes resilient to one type of shock for instance drought, this does not guarantee resilience to other shocks like a rise in food price and conflict.

iii) The term *'pathways'* highlights the notion that vulnerability and resilience can be perceived as processes rather than stationary conditions. (Rival 2009; Barrett and Constas, 2012). Communities with the ability to mobilise their assets, social dimensions, and collective actions to manage the shocks and stresses are susceptible, thus reducing their vulnerability and becoming less sensitive, are on a resilience pathway. Whereas those with less or no capability to be involved in collective action to manage shocks and stresses are sensitive and most likely follow a vulnerability pathway.

iv) *Livelihood Outcomes* refer to the necessities and intents that households and communities anticipate to achieve. Communities that are resilient have the ability to ensure availability and access to enough nutritious food in a safe environment with their income and health secured. This therefore enables them to educate their children and be able to be involved in wider socio-economic processes that have impacts on the lives of their members. Vulnerable communities will experience food insecurity and environmental insecurity.

The resilience conceptual framework is illustrated in Figure 2.2.

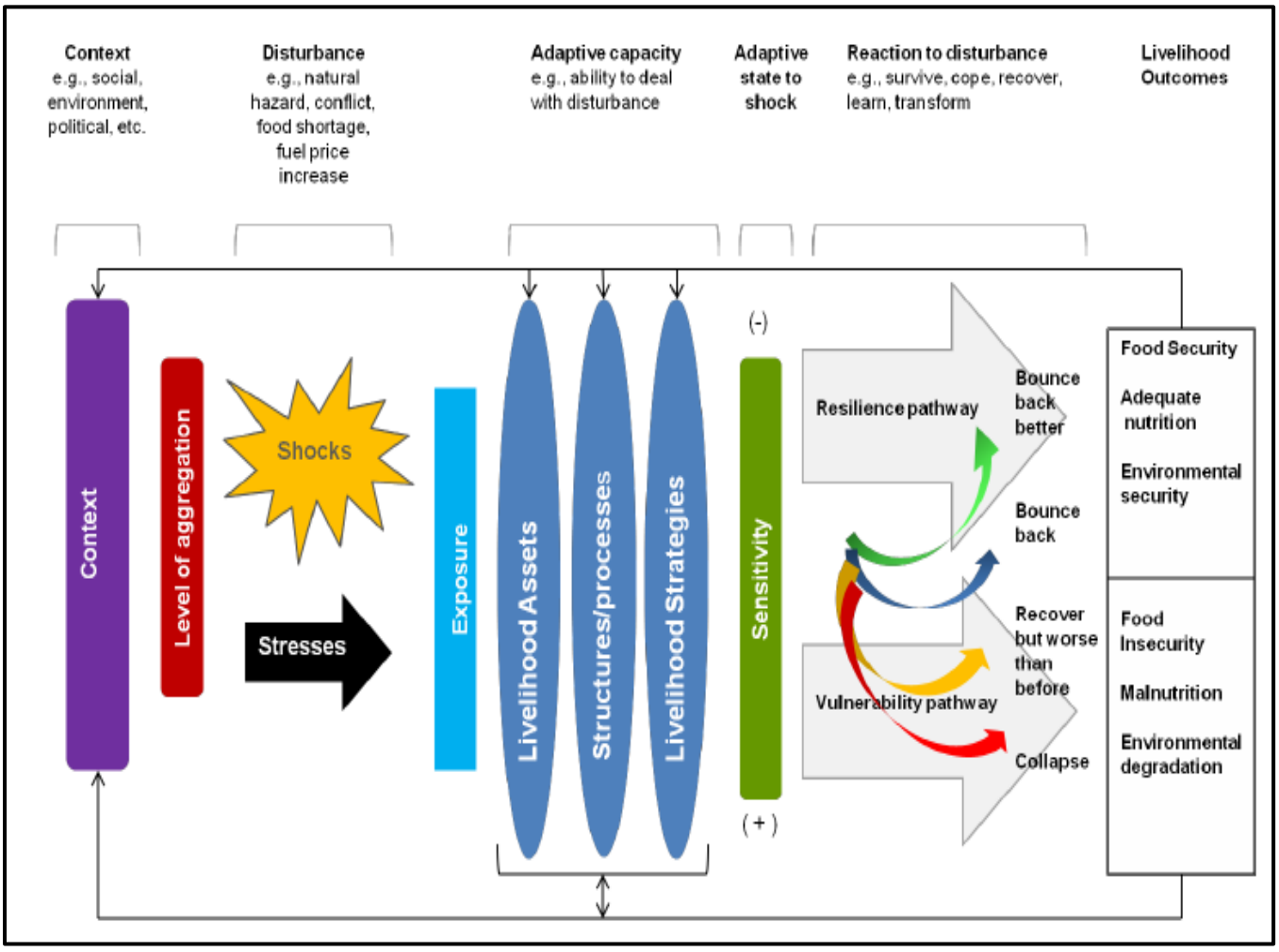


*Figure 2.2: The Resilience Conceptual Framework*

[Source: Source: Frankenberger *et al.* 2012]

2.1.3.1 Application of the vulnerability of rural women to climate change

The focal point of the framework is on the interconnectedness of human and nature. The interactions of human and nature will result in the human adapting to environmental changes and the altering of the environment as a consequence. In order to implement adaptation strategies to climate change, understanding the risks that affect communities and how they affect them, assessing the way communities cope with the risks by either adapting or transforming the shocks to boost resilience is of great importance (Barrett and Constas, 2012; Organisation for Economic Co-operation and Development (OECD), 2014). The three capacities (absorptive, adaptive and transformative) are considered to be multi-dimensional and holistic in nature and can be subdivided into five categories that are known as the economic, social, physical, ecological and institutional dimensions. These are explained by OECD (2014) as follows in no apparent order:

- The social dimension denotes descriptions like education, health, and food security which have a significant role in climatic shocks and stresses.

- The ecological dimension addresses an assortment and condition of the natural environment. The factors such as biodiversity and the rate of deforestation also determine the functioning of ecosystems on which human beings censoriously rely on for drinking water and fresh air.

- The economic dimension embraces economic endeavours together with the accessibility and supply of financial assets and other funding to accomplish various purposes. For example savings can be used for repairing goods damaged by a climatic hazard.

- The physical dimension's main focus is on infrastructure, such as communication networks, housing or health facilities and their function during and after the occurrence of extreme events, for example, roads being passable after a tropical cyclone.

- Lastly, operational governance, institutions and participation on different levels are central aspects under the institutional dimension. They determine to a great extent how the procedure of building climate resilience is achieved and also harmonising the different perceptions and objectives on climate change response and mitigation.

Climate resilience is viewed as an amalgamation of absorptive, adaptive and transformative capacities, which can be described according to the responses to climatic shocks and stresses that they facilitate (Béné *et al*., 2012). Rural women can implement strategies that make them resilient to climate-induced disasters through being prepared for, mitigating or recovering from the negative effects of climate change (Béné *et al*., 2012). For instance, climate change can result in more than usual rainfall causing flooding. In such a case, early warning systems, having savings and weather insurance, trained disaster risk reduction teams, or ditch systems in flood-prone areas can be considered as absorptive and adaptive capacity (Béné *et al*. 2012). The main purpose of the mentioned activities is to minimise damage, prepare for, recover and restore the basic structures or functions that might have been destructed or interrupted (housing or crops) by the climate hazard.

In addition, Béné *et al*. (2012); the IPCC (2014) and Choden *et al.* (n.d), further acknowledge that rural women may have the ability to alter their activities and actions so that they respond better to the prevailing and expected future climatic shocks and stresses and take advantage of opportunities. Adjusting the planting season, raising awareness on climate change-related information through education events and improving natural resource management can be cited as examples of adaptive capacities that can be implemented by rural women.

On the other hand, the resilience conceptual framework has been criticised by scholars such as Béné *et al*. (2012), highlighting that resilience depends on the blend of these capacities as various types and intensities of climatic shocks and stresses require different responses. Thus, for instance, a community with a high level of absorptive capacity but inexistent adaptive and transformative capacities cannot be regarded as climate-resilient. An example would be a farming village whose populaces have weather insurance schemes but are unable to change their planting behaviour or diversify their sources of income/s notwithstanding tenacious and increasing of water scarcity. Choden *et al.* (n.d) points out that the framework views resilience as a desired outcome, ignoring that it can be negative as well considering the adaptive capacities which requires societies to adjust their aspirations and expectation in the face of adverse climatic conditions. One example would be the rural-urban migration as a climate change adaptation strategy which may make the household resilient but also making them vulnerable to urban settlement issues such as high crime rate and high levels of pollution.

In the same vein, Davidson (2010) criticised the framework for assuming that irrespective of their diverse backgrounds and experiences, societies work together to address the adverse conditions to become resilient. It fails to reflect on the socio-political dynamics of societies which are not homogeneous. In addition, the framework overlooked the individual households' choices to negotiate their livelihood in the face of disasters. Emphasis is placed on the role of the system instead of considering the individuals in the system with the capabilities to either exercise or not exercise control on the processes that form the base on which resilience is developed (Davidson 2010).

For the above cited reasons, the resilient conceptual framework will not be the most appropriate framework to apply in this study. Although the study will be conducted in one area, there are some underlying socio-political and cultural dynamics which limits the access to equal resources between the women and men as highlighted in chapter 1. While there may be adaptation strategies employed and interventions in the Chivi area to build resilience, the already marginalised groups such as the women are most likely to remain vulnerable.

### 2.1.4 The disaster management cycle

Khan, Vasilescu and Khan (2008) and Warfield (2008) contend that the disaster management cycle is a continuous process with two distinct phases namely the pre-disaster risk reduction phase and the post-disaster reduction phase. The disaster management cycle incorporates the society, government and the non-governmental organisation and different sectors to implement programmes, measures and polices. These are aimed at preparing for, minimising, in some cases, avoiding and effectively responding to and recovering from the aftermath of a disaster (Warfield 2008). Determining the timeline of disaster management interventions is difficult, for instance establishing when disaster response and relief ends and when the rehabilitation starts and ends. In this research, the disaster risk reduction activities to adapt to climate change will be incorporated in both the pre-disaster and post-disaster activities. An overview of the activities is outlined below.

*i) Pre-disaster activities*

Preparedness

Preparedness refers to the measures and activities undertaken before the occurrence of a disaster in order to ensure response that is effective and includes timeous early warning and temporary evacuations of people and properties from a hazard pathway (UNISDR 2009 in Belle 2016). Preparedness enables government institutions, communities and individuals to swiftly and effectively respond to disasters. Measures in this phase include proper and clear evacuation procedures, provision of early warning systems, well-established and known emergency communications and public education and awareness coupled with training programmes which incorporates drills, exercises and tests (Warfield, 2008). Most, if not all disasters can be prepared for even if their time period may not be estimated. The use of appropriate technologies can significantly reduce the impacts of a disaster through early warning systems, awareness levitation and operative response machinery thereby strengthening the response.

Mitigation

This refers to actions that are meant to reduce the effects of disasters or hazards. According to Carter (2008) cited in Belle (2016), some mitigation measures include the zoning and land use regulations, agricultural programmes that aimed at the reduction of impacts of hazards on crops and the control on the use of hazardous substances. Good and effective mitigation measures can lead to the reduction of the impacts of hazards that are inevitable.

Prevention

This involves activities that are employed to avoid or encumber a disaster from occurring and minimising the progression of a hazard into a disaster. The activities encompass avoiding settlements in disaster prone areas such as mass movements or unnecessary fires in areas that are prone to veld fires and flood control measures such as dam or levee construction. This phase is characterised by measures taken to increase the coping capacity of communities. As stated by Food and Agriculture Organization (FAO), programmes should be developed frequently and should be on an ongoing basis (FAO, 2015). Activities that aim at reducing human and property loss are undertaken in this phase at household, community, national or International levels to prevent the occurrence of a disaster or to minimise the impacts of unavoidable disasters. The United Nations (UN) (2013), stated that women play a pivotal role in designing mitigation

strategies because they are directly and more affected by climate change and therefore know the proper strategies to mitigate impacts.

*ii) Post-disaster activities*

Response

These are activities that aim at saving lives, assuage distress, and give basic care during or immediately after the occurrence of a disaster (UN, 2013). Such activities include the search and rescue, evacuations, provision of basic needs such as food, medical help and shelter as well as initial assessments of damages (FAO, 2015). In this phase, the community members are the first responders, thus their capacitation and training become vital to equip them, thus enabling effective response.

Recovery

This refers to the process of restoration of communities back to the pre-disaster or better pre-disaster situation. Restoring essential services, provision of temporary shelter, repairing damaged houses and provision of psycho-social support to the affected people all form some of the recovery activities (UNISDR, 2015). In this phase, humanitarian aid which aims at saving lives is provided.

The disaster management cycle is indicated in Figure 2.3..

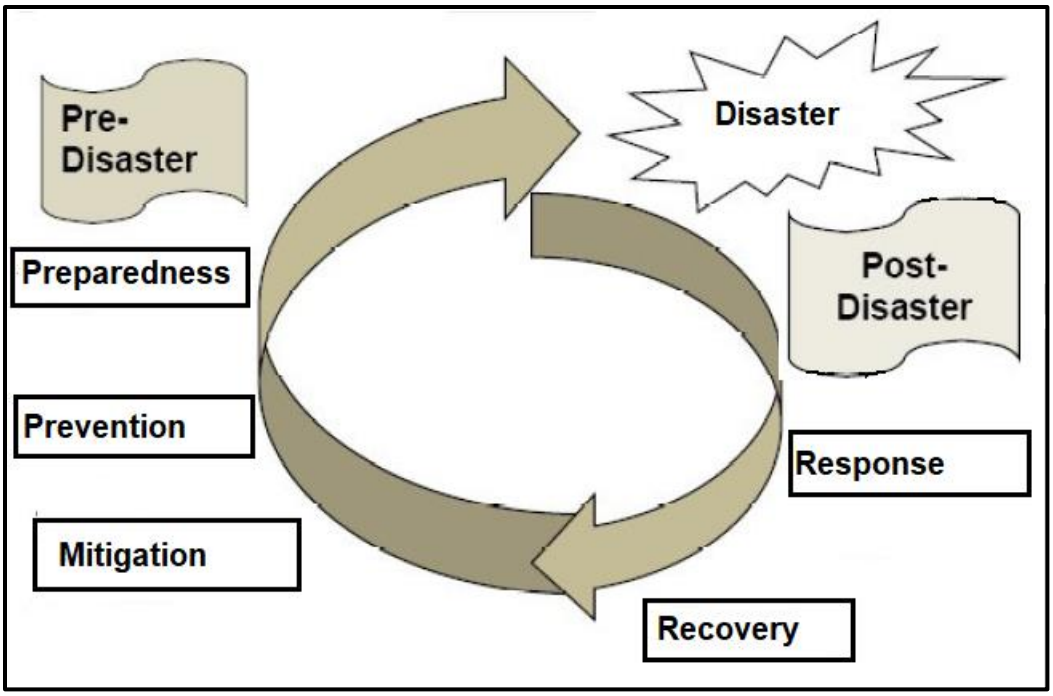


*Figure 2.3: The Disaster Management Cycle*
[Source: Adapted from UNDP 2011]

2.1.4.1 Application of the Disaster Management Cycle

The occurrence of disasters can be rapid or slow, so preparing for them before they occur will minimise the damages and loss of life. Climate change induced disasters such as occurrences of tropical cyclones can be prepared for through issuing early warnings and tracking the paths of the cyclone, issuing timeous updates for people to be prepared in terms of staying in-doors and stocking up enough food and water. In addition to that, the actions that are taken to minimise the effects of disasters include moving people and livestock in the case of flooding as a mitigation strategy (Belle 2016).

Dam construction which can be both a mitigation, prevention and preparedness measure can be an effective way to deal with climate change induced disasters (UNISDR, 2015; Belle, 2016). Belle (2016) professes that the activities that aims at returning life to normalcy after a disaster can be categorised under the post-disaster phase of the disaster management cycle. A smooth transition from response to recovery phase enables the provision of sustainable restoration of psychosocial support and infrastructure. Activities such as the dissemination of information and education, data collection for risk assessments and documentation of the event for future awareness is of great importance as response, preparedness and mitigation strategies. (UNISDR,

2015). It can therefore be noted that the climate adaptation strategies that can be implemented before or after a disaster are intertwined in the disaster management cycle.

However, the Disaster Management cycle cannot be applicable to this study because it outlines the phases of disaster management. It emphasises on the activities that can be employed to prepare for, respond to, prevent and minimize the effects of disasters. Although risk analysis forms part of the activities, the cycle does not encapsulate that the context of human to climate change is different depending on the availability and access to resources and gender differences. However, the activities that can be implemented to adapt to climate change can fall under the pre and the post disaster in the cycle.

### 2.1.5 The Sustainable Livelihood Framework (SLF)

The SLF can be viewed as an investigative tool dealing with the dynamic dimensions of poverty and well-being. The framework places underprivileged people at the centre, being surrounded by livelihood assets which covers the social, financial, natural, human and physical aspects (Ellis, 2000). The vulnerability context contains shocks such as conflict, exclusion or exploitation based on gender, natural disasters and political instability as well as trends and changes such as population or demographic changes, climate change, technology transfer, and trade. All these influence the access to these assets (Ellis, 2000). The UK DFD (2006) summarised that the SLF designates how the human being's assets can be vulnerable to hazards as illustrated in Figure 2.3 The vulnerability affects and is affected by prevailing transformations and processes and the livelihood strategies adopted can negatively or positively affect the livelihood outcomes.

Different understandings of the SLF have been discussed, with Hamilton-Peach and Townsley (2004) emphasizing that the framework consists of two components which are; comprehending the complexities of poverty and the principles guiding the actions to deal with and overcome poverty. On the other hand, Khanya-AICDD (African Institute for Community-Driven Development) (2006) opine that the SLF constitutes of crucial elements namely, the sustainable livelihoods principles and six governance issues namely levels of government, private sector, laws, policies, culture and institutions at micro, meso and macro level. Despite the diverse opinions and understanding of the SLF, prominence is given to its significance in identifying the challenges of the poor and the intervention strategies that can be employed through access to

different capitals in improving their livelihood (UK Department for International Development (UK DFID) 2006).

Transforming structures and institutions which can also be referred to as political institutions and processes (PIPs) covers the complex social, economic and political contexts within which people pursue their coping strategies. They also have influence on access to assets and the ability of communities to fulfil their intended goals. (Norton and Foster, 2001; Carney, 2011).The PIPs are at all stages from family to the international arena and in all spheres from public to private which is capable of aggravating or easing the effect of external shocks on susceptible people. They determine the accessibility to the various types of capitals, livelihood strategies and decision making, the terms of exchange between the types of capital, economic and other sources of income from livelihood strategies (Morse and McNamara, 2013). Following certain livelihood strategies may result in outcomes such as more sustainable use of natural resources, improved well-being, better income, and reduced vulnerability (Singh and Gilman, 1999; Arce, 2003; Toner and Franks, 2006).

The local, national, regional policies and their implementation conditions on climate change may create circumstances for diverse and appropriate livelihood strategies that can either enhance or inhibit community or household resilience (Few, 2004). Ecological integrity, ensuring that livelihood activities do not irrevocably vitiate natural assets in a particular bionetwork can also foster adaptation to climate change. Few (2004) further postulates that social equity, which encourages preferment of livelihood opportunities for a community should not foreclose alternatives for future groups, presently or in the future.

Figure 2.4 represents a schematic illustration of the SLF.

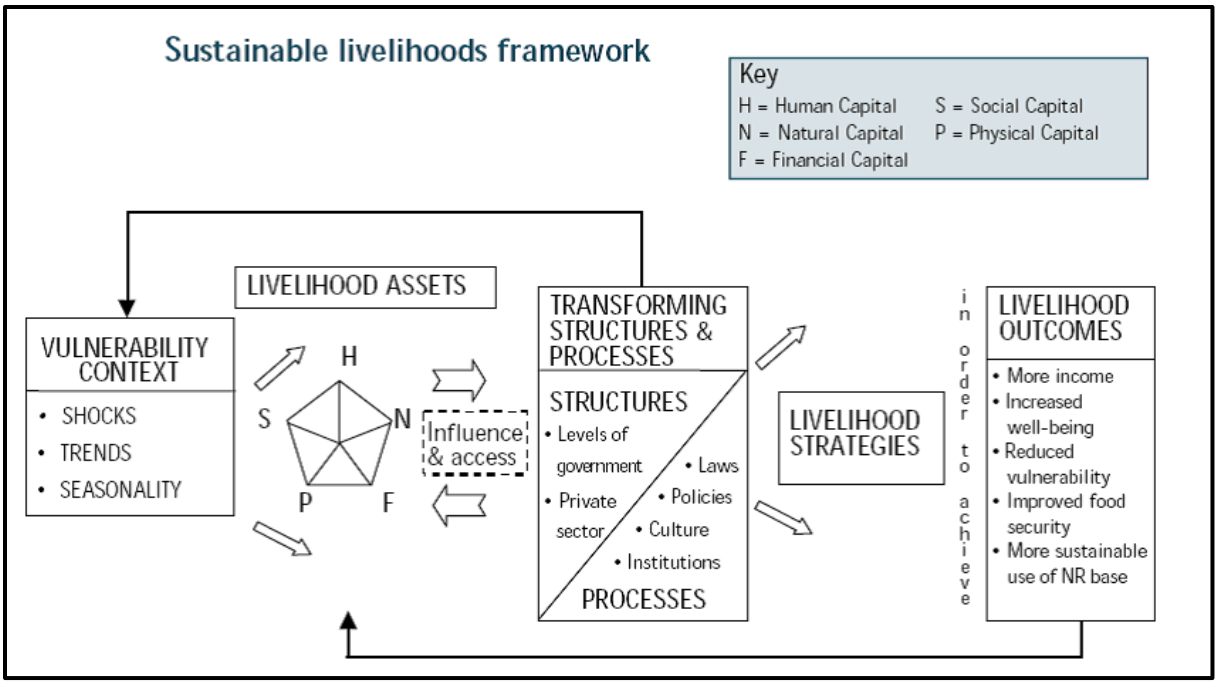


*Figure 2.4: The Sustainable Livelihood Framework*

[Source: UK DFID 2006]

In order for communities to achieve social welfare, a combination of assets utilisation and activities is required (Morse and McNamara, 2013). Five assets are important for developing a community system that reflects populism and conservatism which represents the SLF as indicated on the pentagon in Figure 2.4. It is within the vulnerability context, that the impoverished people have access to these different assets to reduce poverty and food insecurity sustaining enough income to live (Norton and Foster, 2001; Morse and McNamara, 2013). These assets are explained in Table 2.1.

*Table 2.1: Livelihood assets*

| Assets | Examples |
|---|---|
| **Natural** | Natural resources such as soil, water, wild animals and environmental resources |
| **Social** | Trustful relationships, access to social institutions and support networks based on the same interests. |
| **Human** | Man power, good health, education, knowledge and skills and work status to pursue various livelihood options |
| **Physical** | Basic infrastructure like roads, communication networks water supply and sanitation, schools, and energy that can be utilised in coping strategies. |

| | |
|---|---|
| **Financial** | Available income from employment, savings credit remittances or pension funds for people to livelihood outcomes. |

[Source: Adapted from Norton and Foster, 2001; Morse and McNamara, 2013]

People's access to the stated assets is a step to establish a livelihood (UK DFID 2006; Khanya-aicdd 2006; Morse and McNamara, 2013). The SLF explicitly indicates that various capitals are requisite to cognise the significance of micro and macro links of livelihood. Furthermore, this understanding can be considered in developing sustainable livelihood outcomes for the underprivileged at an individual stage or family stage (Morse and McNamara 2013). On the other hand, the balance of these capitals may change from family to family over time. For instance the occurrence of epidemiological disasters such as the novel corona virus negatively impacted volatile assets like the human (health) and financial capitals differently in different sectors of the economy (loss of income as a result of closure of work places as a measure to combat the spread of the virus) (Stiegler, and Bouchard, 2020)

The assets are shaped by the vulnerability context and the transforming structures and processes. The access to one asset is most likely to result in the escalation of another asset and vice versa. An example can be that, access to good health, knowledge and skills (human capital) may result in more farm produce and surplus can be sold thus the financial capital grows. Consequently, the people's physical capital is enhanced through buying or upgrading their houses, with access to healthy food, clean water and sanitation and a healthy lifestyle. (Morse and McNamara 2013). SLF does not consider poverty as a lack of income but the assets that the poor people need to sustain a living. Impoverished people reduce vulnerability through having more access to more assets. Thus, as indicated by Twigg (2001) cited in Belle (2016), the model incorporates strategies employed to reduce poverty, participation and empowerment processes and sustainable development into a framework for analysing policy and programming.

#### 2.1.5.1 The core principles of the SLF

As explicated by Sneddon (2000) cited in Ncube (2017), the SLF is anchored on eight principles which are:

- *People centred*: An analysis of how the people's survival techniques are conducted with the view that those survival techniques are not static. The policies and institutional arrangements are analysed with consideration of their impact on people.

- *Holistic:* Various livelihood strategies are combined taking cognisance of the different factors that may promote or inhibit the survival opportunities.

- *Unit of analysis:* Acknowledges the numerous societal groups which include religious, gender or age which may play a role in achieving the livelihood outcomes.

- *Dynamic:* Change is inescapable, therefore all the inputs that come into being disparities need to be considered.

- *Building on strength:* The focal point is people's resilience as opposed to their vulnerability.

- *Macro-micro links*: The international perspectives' influences are encompassed and applied at the functioning of local levels.

- *Sustainability:* Enhancing resilience aims at the prevention of vulnerability with consideration of the effects of the decisions in the long run.

- *Extensive stakeholder participation:* Long term development entails consultations of all stakeholders.

2.1.5.2 The SLF: Application to vulnerability of rural women to climate change

Vulnerability context of rural women

Vulnerability to climate change is generally tacit as a characteristic shaped by exposure to a specific climate change-related hazard, the level of sensitivity and adaptive capacity of the exposed system (Keys, Thomsen and Smith 2016; Howard 2017 and Manyani and Bob 2017). Gender relations underpin the responsibilities and status of men and women in a certain socio-economic, cultural and religious context (OXFARM 2012). This implies that women and men experience different levels and types of vulnerability to disasters, inclusive of those triggered by

climate change. (Manyani and Bobb, 2017; Howard, 2017,). A set of deep-rooted socio-economic elements such as denial of human rights, denial of access to power structures, access to quality education, employment opportunities, land tenure, availability of and access to resources, access to infrastructure, basic services and information, together have the ability to create and maintain extreme levels of vulnerability of rural women (Howard 2017; Manyani and Bob, 2017).

Livelihood assets of rural women

According to Carney (2011,) and Howard (2017), the extent to which rural women have access to the livelihood assets will determine their coping and adaptive capacity through increasing livelihood alternatives in the face of climate change hazards. Women are regarded as more vulnerable due to the restricted access to the assets they have. This inhibits them in sufficiently anticipating, withstanding and recovering from a climate induced hazard such as a pandemic, drought or floods which may result in the increase in migration tendencies of men which also lead to change in the social structure (Chodan *et al.*, n.d). Musyoki and Khayesi (2012) noted that most women do not have access to land, livestock and financial capital which are critical in disaster vulnerabilities reduction attributed to the cultural beliefs. Choden *et al.* (n.d) articulated that in some African cultural beliefs, properties are owned by men regardless of who the breadwinner is. Few, Mike, Matthies and Kovats (2004), further added that, women's social networking and flexibility is reduced by the traditional gender roles of household caretaking. For example, rural women have limited time to form social networks as they are culturally tied to household duties like walking long distances to fetch water and firewood and provide food for the family.

Transforming structures and processes

The capacity of communities' to acclimatise to or recover from shocks and stresses is profoundly reliant on transforming structures and processes as well as the stability of income and economic efficiency (Carney, 2011; IPCC, 2014). Many policies and measures have been established to support the resilience of individuals and societies. The different roles and responsibilities of men and women, regardless of age and access to resources, influence how each will be affected by hazards, and how they will cope with and recuperate from a disaster (IPCC, 2014). UN women (2015) clarified that gender discrimination suggests that, despite the implausible resilience and capacity for survival that women may exhibit in the face of disaster, they also experience gender-specific vulnerabilities. For this reason, the recent legislatures such as the National policy for Civil

Protection put emphasis on understanding how gender relations shape people's lives and translating this understanding into appropriate practices which is critical to Disaster Risk Reduction (DRR) (UN Women, 2015).

Livelihood outcomes

Howard (2017) indicated that gender empowerment enhanced women's access to resources and participation which are significant livelihood outcomes. This has been supported by Keys *et al*. (2016) and Manyani and Bob (2017) who further expounded that in achieving sustainable livelihood outcomes and promoting resilience, empowerment and participation of vulnerable people are of paramount importance. Odero (2006) suggested that information should be added to the SLF as the sixth capital, as access to it plays a pivotal role in diversifying the livelihood strategies to achieve the positive outcomes. It can be incorporated in the physical capitals under communication networks, making the framework practical and logical in this dynamic world. Communities are active dynamic entities with incredible capabilities to address the effects of climate change through aptitudes to make adjustments grounded on experiences. (OXFARM 2012; Musyoki and Khayesi 2012)

This research is anchored on the Sustainable Livelihood Framework because it posits the factors that either augment or restrain livelihood opportunities and how they are linked to each other with special reference to rural women as a more vulnerable group (Manyani and Bob 2017). The SLF's strength lies in the explanation that livelihood contains the assets, capacities and activities essential for a means of living. It further emphasises that sustainability is determined by the capabilities and assets to cope presently and in future to recuperate from stress and shocks without damaging the natural resource base (Keys, *et al*., 2016; Howard, 2017; Manyani and Bob, 2017). The SLF's other strength lies in its applicability in all geographical areas and social groups and it acknowledges that there are many influences on people and seeks to analyse the people's livelihoods and how these changed over time. People are at the centre of the framework, taking conscience of their views. (Keys *et al*., 2016; Howard, 2017). As clarified by Carney (2011), the effects of various policy and institutional arrangements on people and households were explored and sought to support people to achieve their livelihood goals. The framework acknowledges that the rural women can change their vulnerable condition through improvements on the various available capitals to become resilient, therefore making it the most relevant framework in this study.

### *2.1.6 Climate change resilience: Social Capital theory*

The social capital theory's definition is usually related to its function which places emphasis on the idea that social ties, reciprocity, trust and shared rules enhance the attaining of common goals. (Dubos, 2017). The theory explains the importance of relationships as the backbone of accumulating human capital and development. This view according to Tanner, Mensah, Lawson, Gordon, Godfrey-Wood, and Cannon, (2014) is based on the premise that the establishment of purposeful relationships and their application to acquire both tangible and intangible welfares has short and long term benefits. Tanner *et al*. (2014) further elucidated that the benefits can be psychological, economical or emotional. Climate adaptation strategies lies within individuals, societies and organisations which can be either initiated from top-bottom (international to local levels) or bottom–top (individual to national level) (Adger, Huq, Brown, Conway and Hulme, 2003). Social relations become crucial in sharing ideas and assisting each other in the implementation of the adaptation strategies.

The inclusion of this theory in this study is to integrate it with and reinforce the sustainable livelihood framework which emphasises the importance of building community resilience through having access to capitals. In addition, its incorporation is also through the consideration that climate change is not entirely an environmental problem that requires scientific, managerial and technical solutions but an enigma of politics, justice, marginalised groups and differences in its impact geographically (Tanner *et al.,* 2014). Social capital theory can be perceived in two ways: firstly, it can be seen as a concept based on the proposition that social connections have the capability of facilitating economic and non-economic benefits to individuals (Narayan and Cassidy, 2001). Secondly, it can be understood to exist in the relations and not in individuals (Narayan and Cassidy, 2001).

The social capital theory has three types of networks as illustrated in Figure 2.5 namely; bonding network, which is a connection amongst the community members; linking networks which are associations with members outside the community which enable them to have access to resources that may be needed for the continuity and bring change to the community; and lastly the bridging network which involves expanded associations that enable functioning of the community.

With the above understanding of social capital theory, Adger *et al.* (2003) noted that historically, resource reliant communities collectively managed their weather dependant resources like water resources, fish and livestock on which their livelihood depends. Strengthening of the social capitals between civil society and the states promotes the adaptive capability of that particular community to cope with climate change. Furthermore, rural women are usually marginalised in terms of involvement in decision making on climate change issues at local and national levels, thus social relations form pillars of support in maintaining psychological equilibrium in the event of a climate induced disaster (Cinner, Adger, Allison, Barnes, Brown, Cohen, Gelcich, Hicks, Hughes, Lau, Marshall and Morrison, 2018). Social capital theory has five dimensions crucial for this study as explained by Onyx and Bullen (2000) and Paxton (2002) which are:

- *Networks* – associations varying in size.
- *Reciprocity*/engagement – exchanging of goods or services for mutual benefit.
- *Trust* – willingness to take risks or initiatives.
- *Social norms* – undocumented shared values that guides behaviour and interactions.
- *Personal and collective efficacy* – voluntary and active engagement of citizens within a community.

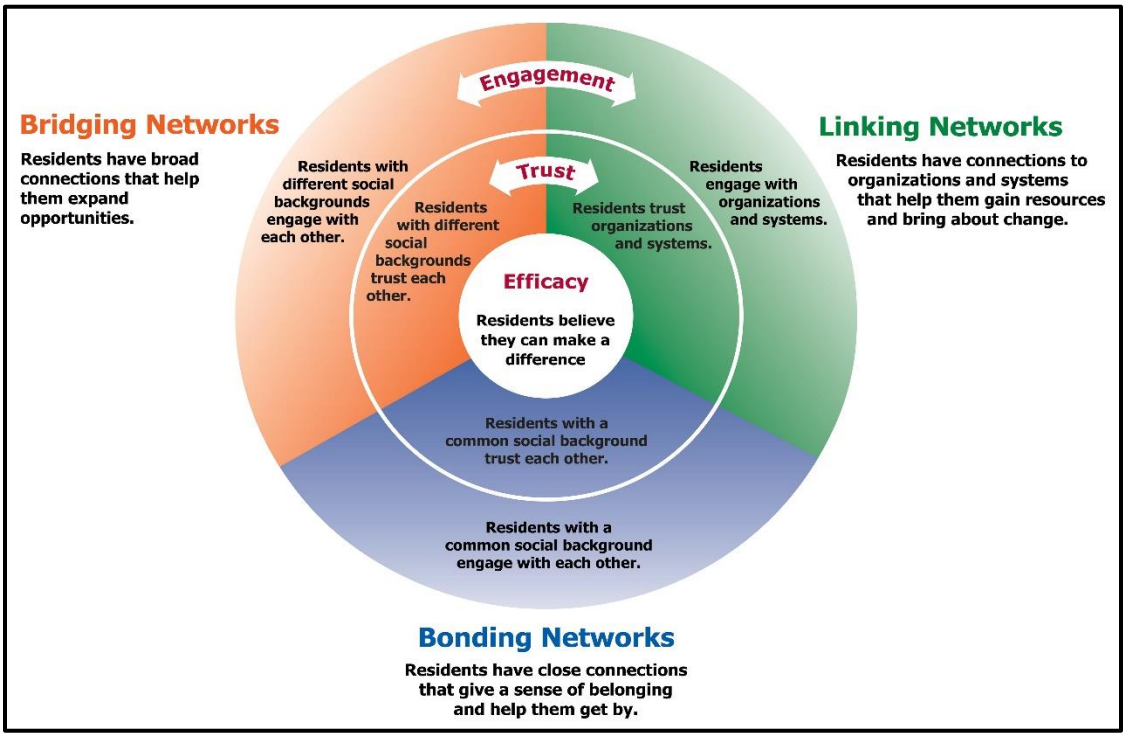


*Figure 2.5: Components of the social capital theory*

[Source: Adapted from Adger 2003]

Resilient individuals or communities are regarded as flexible and prepared for uncertainty and information sharing skills between individuals become vital components of social capital in order to come up with climate adaptation strategies that enhance resilience (OECD, 2001). Weil *et al*. (2006) and Bhandari (2014) stated that literature in disaster management designates that close social networks play a pivotal role in assisting victims to cope with, prepare for and recover from disasters. The critical role of social capital is seen in disasters such as the 2019 floods caused by the tropical cyclone *Idai* where social networks expedited the dissemination of information, financial and physical assistance (Devi, 2019).

Fafchamps and Minten (2001) resonate that the effectiveness of the social capital was witnessed in countries such as Malawi, Benin and Madagascar among their agricultural traders. The various traders' networks reduced the transaction expenses because of increased search and necessitating the circulation of information and building more trust. This indicates that when employed effectively, the networks can stimulate information seeking behaviour which will facilitate development and resource mobilisation in case of disasters thereby building resilient communities (Bhandari 2014).

## 2.2 LEGISLATIVE FRAMEWORKS

The control of livelihood assets and adaptation to climate change matters has been recognised at global and national levels with the management of climate conditions being traced back to 1979. This was when the First World Climate Conference, organised by the World Meteorological Organisation and the adoption of the Convention on Long-Range Transboundary Air Pollution (CLRTAP) was held. Nothing concrete was concluded until 1988 when the signing of the IPCC showed commitment to climate related issues (Ayers *et al.* 2014; Keys *et al.* 2016; Howard 2017; and Manyani and Bob 2017). There are annual conferences and head of states summits held where nations share their experiences and map out a way forward on a green sustainable future. Based on this, governance of climate change is regarded as a crucial universal issue where countries establish their climate change policies based on the agendas of the global agreements (Belle 2019). This section will discuss the legislative frameworks that apply to the vulnerability of women and climate adaptation strategies with specific reference to Zimbabwe.

The level of a community's preparedness before a disaster occurs largely contributes to that community's ability to mitigate the impacts, effectively respond to a disaster and quickly bounce back thus building resilience. In advocacy, the Hyogo Framework 2005–2015 was recognised in 2005 with the main aim of reducing disaster risks (UNISDR 2019b). Subsequently, the Sendai Framework was established replacing the Hyogo Framework. The Sendai Framework echoes the same sentiments of disaster risk reduction emphasising on the collective accountability of all stakeholders (Belle 2019 and UNISDR 2019b).

International organisations acknowledge the prominence of gender sensitivity in disaster risk reduction plans to be sustainable. The Hyogo Declaration, in setting out the Hyogo Framework for Action (HFA 2005–2015), indicates that gender perception ought to be incorporated in all Disaster Risk Reduction (DRR) plans, policies and decision-making practices. This is reinforced by Sustainable Development Goal (SDG) number 5 which seeks to achieve gender equality and empower all women and girls (UN Women, 2015). It aims to end all forms of discrimination and violence against women, recognising that women play pivotal roles in their communities, and therefore, it is essential to evade gender inequality, especially in all activities designed for DRR (UN Women, 2015). Furthermore, the Millennium Development Goal number 3 advocated for gender equality as one of the critical tools in development and DRR activities in all the phases of the disaster management cycle.

### 2.2.1 Constitution of Zimbabwe

The Constitution of Zimbabwe of 2013, section 17 stresses the importance of strengthening gender balance and redressing previous gender imbalances. All levels of government are mandated to implement measures that ensure women's access to resources, as well as land, the right to equal opportunities politically, economically, culturally and in social spheres. Section 289 on the principles guiding the policy on agricultural land, subsection C indicates that the apportionment of agricultural land must be impartial, having regard for gender balance and varied community interests.

Although the constitution of Zimbabwe advocates for gender balance and fairness in distribution of resources, the situation on the ground does not uphold the constitution because women are still having limited access to resources such as land. As indicated by Musyoki and Khayesi (2012), land is one of the most crucial capitals in vulnerability reduction. Without access to land, women

will be susceptible to food insecurity and their livelihood will be threatened, with special reference to the rural women who may neither have any formal nor informal employment.

### 2.2.2 The National Policy for Civil Protection Act 5 of 1989

The legal Framework in Disaster Management, The Civil Protection Act 5 of 1989 is the prime Act and regulatory Framework guiding and regulating disaster management in Zimbabwe. As indicated by the Zimbabwe Civil Protection Act 5 of 1989, central government initiates measures to reduce hazard through appropriate sector ministries. The responsibility for implementing and monitoring its effectiveness is taken by the local administration.

The Department of Civil Protection in Zimbabwe falls under the Ministry of Local Government, Public Works and National Housing and was delegated to head disaster risk reduction and response. The Department co-ordinates all the pertinent disaster management stakeholders making use of existing Government departments, private sector and NGOs with activities that constitute features of disaster risk mitigation, prevention and community development. In terms of climate change issues in Zimbabwe, the National Policy for Civil Protection ensures that public awareness programmes and campaigns employed for both the dry and wet seasons such as on flooding and lightning hazards should be carried out near and throughout the wet season. Campaigns on fire hazards are done in winter. These campaigns are done through the multi-sectoral approach with Department of Civil Protection taking the lead in co-ordinating the programmes (Zimbabwe Civil Protection Act 5 of 1989). In the campaigns, efforts are made to include women in rural areas as advocated for by the Constitution of Zimbabwe.

The National Policy for Civil Protection states that every citizen of the country ought to succour in every way possible to forfend the effects of disasters. This can be achieved through developing and strengthening capacity in weather, climate research, as well as modelling education and training. Reduction of vulnerability to climate variability and climate related disasters is another priority of the policy that can be realised by reinforcement of adaptive capacity and hastening mitigation measures (Climate policy 2016).

### 2.2.3 Zimbabwe Climate Policy (2016)

The National Climate Policy provides a structure for addressing climate related challenges faced by Zimbabwe currently and in future thereby forming the foundation of establishing Action Plans for national determinations on climate adaptation and mitigation. It also provides a platform to implement Zimbabwe's nationally determined contributions to reduce the global temperature. In addition, the Policy enables the creation of a channel towards a climate resilient and low carbon development economy.

The National Climate Change Response Strategy was established to identify risks, impacts, challenges and opportunities in the perspective of adapting and mitigating in a variety of key sectors (Jaka and Shava, 2018). It further ensures that the climate policy is solely possessed by all Zimbabweans with gender sensitivity as a priority. In the case of climate change induced disasters, the Zimbabwe Climate Policy gives guide on the assessment of the extent of the threat to human and the environment and put critical actions to manage the potential effect. For instance, in the flooding Chivi area where most people rely on rain-fed agriculture, education and training on irrigation schemes are conducted as a climate change adaptation strategy (Jaka and Shava, 2018).

The Climate Change Policy put strategies of ensuring that climate change is integrated at all spheres of government and synchronised in the activities in all economic sectors. This improves the livelihood of the affected people with the involvement of rural women who are hit hard by climate change. The affected communities were included in the discussions of strategies that can be implemented to create a resilient community.

### 2.2.5 Comprehensive Agricultural Policy Framework 2012-2032

The Comprehensive Agricultural Policy Framework was formed in 1994 under the name "Zimbabwe Agricultural Policy Framework: 1995 to 2020". The policy aimed at ensuring food security and maintenance of agricultural resource. This policy is implemented in conjunction with other Acts such as the Water Act and the Climate policy to ensure that climate change impacts are mitigated and the populace's resilience is strengthened.

With the realisation that climate change can be as a result of anthropogenic causes and has a great impact on the agriculture sector which is a major source of livelihood to rural communities in Zimbabwe, the Framework's prime responsibility is to work with the agriculture sector. This is to minimise the human contributions to climate change. At local level, education and training is given on better adaptation strategies such as the change in the cropping season, introduction and implementation of the irrigation schemes and mobilisation of resources to assist the farming communities in rural areas (Comprehensive Agricultural Policy Framework 2012-2032).

### 2.2.6 The Water Act (1998) of Zimbabwe

Increased efficient and sustainable use of water was promoted in Zimbabwe through the involvement of stakeholders in the management of water at stakeholder level. The Water Act increased the sense of water ownership among the users. Under this Act, the management of water was decentralised to promote sustainable use of water and protect the environment. Catchment Councils (CCs) and Sub-Catchment Councils (SCCs) were established as the main institutions to manage water in Zimbabwe on a daily basis. The Zimbabwe National Water Authority (ZINWA) was established with the prime responsibility of controlling the commercial functions of the Department of Water Development. This enforces the management of the environment which has a major impact on the livelihood of people. Stakeholder involvement ensured successful sustainable use of water with people taking responsibility for their actions. The Water Act of 1998 was complimented by the land reform programme that aimed at redistributing land and encouraging more utilisation of water by farmers.

In addition, the Water Act (1998) tasked the users and polluters to pay values where the water users pay a fee that would go to the Water Fund. The designated minister would use the money from the fund to provide water in areas that had serious water shortages. This, according to Manzungu (2002) was done with the acknowledgement that water is a vital resource in livelihood endeavours and its efficient management will assist in the mitigation of the impacts of climate change. In drought ridden rural areas, like Chivi, boreholes are drilled as a climate adaptation strategy and awareness promoted in schools to save water through the Zimbabwe National Water Authority (ZINWA) to manage the water resource.

### 2.2.7 The Environment Management Act 13 of 2002 (chapter 20:27)

The Environment Management Act (chapter 20 section 27) points out that everyone has a right to live in a clean environment that is protected to benefit people presently and the future generations. This can be ensured by using legislature such as the Environmental Management Act (EMA) to prevent pollution and ecological degradation whilst promoting sustainable use of resources for social and economic development. The EMA was established to regulate and monitor the use of resources and establish, as well as implement the environmental impact assessments with the aim of protecting the environment.

The environment plays a pivotal role in the livelihoods of rural people. Poor management of resources or lack of access to resources can be detrimental to rural women. For example, high levels of pollution can result in diseases and environmental degradation that leads to poor soil quality and food insecurity (Manyani and Bob, 2017). The EMA regulates the use of resources and monitors that resources are not over-utilised. This is done by raising awareness through campaigns such as the Green economy Initiatives in rural areas. These campaigns discourage deforestation while encouraging afforestation and advocating for land use change to adapt to the changes in the climate in rural areas. In addition, the use of non-conventional energy sources is advocated for to reduce carbon emissions which are contributors to climate change.

## 2.3 CHAPTER SUMMARY

This chapter examined the disaster management cycle and its components with more emphasis on preparedness and mitigation in order to display the significance of pre-planning before a disaster ensues and the ability to prevent or minimise the impacts of unavoidable disasters. Four frequently used disaster management theoretical frameworks were also explained in this chapter. They gave an understanding of the vulnerability of women, the impact of climate change on rural livelihoods and some preparedness measures, as well as mitigation strategies that can be implemented to climate-induced disaster for communities to adapt to climate change and increase resilience. Although all of the theoretical frameworks may be applicable, the most appropriate one to this particular research was selected. These climate change resilience strategies can, however,

not be implemented without supporting governance and accountability. Therefore the legislature relevant to climate change specifically in Zimbabwe was discussed.

The following chapter will explore scholarly literature to establish the evidence of climate change in Zimbabwe and vulnerability of rural women. It will also discuss the impacts climate change on rural livelihoods particularly women and analyse the strategies that are implemented to mitigate the impacts of climate change.

# CHAPTER 3
# LITERATURE REVIEW

## 3.1 Introduction

Conducting a research on and linking it to existing knowledge forms a firm foundation for academic research in all disciplines. Tranfield *et al.* (2003) quoted in Snyder (2019) perceive literature review as a methodical way of gathering and synthesizing previous research. This facilitates theory development and the integration of findings form the base for advancing knowledge while addressing research questions (Snyder 2019). Furthermore, literature review unearths areas with disparities and areas where research is needed which is a critical component of theoretical frameworks and conceptual models (Dlamini and Johnston, 2016). Thus literature review gives an in-depth comprehension of the research topic and propels further research.

This chapter presents an analysis of literature relevant to the study. It explores what makes rural women vulnerable and seeks to understand if climate is changing globally, then narrows down to the area of study and how this change affects the rural women's livelihoods. An analysis of previous and similar studies on the topic is done tapering down the analysis to Africa, Southern Africa and then Zimbabwe. It identifies the methodologies used, the findings and then the recommendations made and finally, makes an evaluation of the gaps and the salient features of these studies.

## 3.2 Climate Change

### 3.2.1 Climate Change background

The popularly used definition for climate change was coined by the Intergovernmental Panel on Climate Change (IPCC) in 1997. Here climate change was defined as "a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer)". It views climate change to be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. The United Nations Framework Convention on Climate Change

(UNFCCC)'s working definition of climate change is as follows:

*"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"* (UNFCC, 1992:52).

The UNFCC therefore distinguishes between climate change that results from human activities and climate variability caused by natural causes. The national Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce (2007) simplistically defines climate change as a long-lasting change in the measurements of the weather elements (including its averages). It is important to note the emphasis of all these definitions is on "collective elements of weather" and that climate change takes place "over a long period of time" which makes it different from daily, monthly and yearly changes in weather patterns. Table 3.1 gives an overview of the significant events in global governance of climate variability and change concerns.

Climate change is determined by a number of variables as explained by Reynolds (2015) cited in Belle (2016). The first variable is temperature, where the minimum and maximum temperature is observed to determine the daily, monthly and annual average over a long period of time which is presumed to be 30 years or more. Next is precipitation, with more emphasis on rainfall and snowfall. Then wind, in terms of speed and direction, atmospheric pressure and humidity must also be observed. Lastly, sunshine also plays an important role in climate change.

*Table 3.1: Global governance of climate change timelines (adapted from IPCC 2014)*

| YEAR | EVENT |
|---|---|
| 1979 | First World Climate Conference, organized by the World Meteorological Organization and the adoption of the Convention on Long-Range Transboundary Air Pollution (CLRTAP). |
| 1985 | Vienna Convention for the Protection of the Ozone Layer. |
| 1987 | Montreal Protocol on Substances Depleting the Ozone Layer. |
| 1988 | IPCC established and climate change was regarded as a general issue of humanity. |
| 1990 | First IPCC report acknowledging climate change as a critical issue. |
| 1992 | UNFCCC signed by 154 nations at Rio Conference. |
| 1993 | Cities for Climate Protection Program launched. |

| | |
|---|---|
| 1995 | Second IPCC report analyzing the seriousness of climate change. |
| 1997 | Agreement of Kyoto Protocol with focus on regulations on reducing greenhouse gas emissions. |
| 2001 | Third IPCC report on the Joint Implementation and Emissions Trading set in the Kyoto Protocol and United States announced its withdrawal from Kyoto Protocol. |
| 2002 | Association of Southeast Asian Nations (ASEAN) Agreement on Transboundary Haze Pollution. |
| 2005 | Kyoto Treaty signed by all major industrialized nations except US and the Large Cities Climate Leadership Group founded. |
| 2007 | Fourth IPCC report and Western Climate Initiative founded under Bali Action Plan. |
| 2008 | Adaptation fund operationalized and Poznan Technology mechanism and Nationally Appropriate Mitigation Actions (NAMAs) advocated for. |
| 2009 | Copenhagen Accord at 15$^{th}$ session of Conference of Parties COP and 3$^{rd}$ World Climate Conference had binding emission targets. |
| 2010 | Cancún Agreements adopted and encouraged the reduction of greenhouse gas emissions by 25-40% by 2020 in developed countries and launched the Green Climate Fund. |
| 2011 | Conference of Parties (COP17) held in Durban focusing on adoption of global legal agreement on climate change by 2015. |
| 2012 | Kyoto Protocol no longer legally binding but continuation endorsed by Copenhagen Accord. |
| 2013 | Warsaw International Mechanism for Loss and Damage, Warsaw Framework for REDD+ Climate Technology Centre and Network discussed. |
| 2014 | Lima Call to Climate Action sets the stage for the 2015 agreement, by urging countries to declare their Intended Nationally Determined Contributions by 2015 and Green Climate Fund. |
| 2015 | Paris Climate Change Agreement seeking the implementation of the bottom–up approach in both developed and developing nations in climate change. |
| 2017 | The incorporation of Gender Action Plans, Local Communities and Indigenous Peoples Platform in Climate change mitigation and adaptation processes |
| 2018 | UN 24$^{th}$ Climate Change Conference held in Katowice, Poland |
| 2019 | UN COP25 25$^{th}$ climate change conference held in Madrid, Spain. |

### 3.2.2 Evidence of global climate change: Incidence of climate induced disasters

In 2019, approximately 396 natural disasters were recorded in EM-DAT (2020) killing 11,755 people, affecting 95 million and costing nearly 130 billion USD. The data indicated that the number of disaster events in 2019 was over the average of the previous 10 years. At a regional level, the most susceptible continent was Asia with 40% of all disaster events, resulting in 45% of the total deaths with 74% of the population affected by disasters worldwide (EM-DAT, 2020). Figure 3.1 indicates the number of disasters that occurred in 2019 globally. From this Figure 3.1, it can be noted that floods were the most climate-related disasters that occurred in 2019. A total of 49% of all the disasters leading to 43% deaths and affecting 33% of the population were recorded. Twenty-three percent of the disasters were storms which killed 21% and affecting 35% of the world population. Although extreme temperatures had a less percentage in occurrence, they contributed to 25% of the deaths. Droughts is another disaster that affected 35% of the total population globally in 2019.

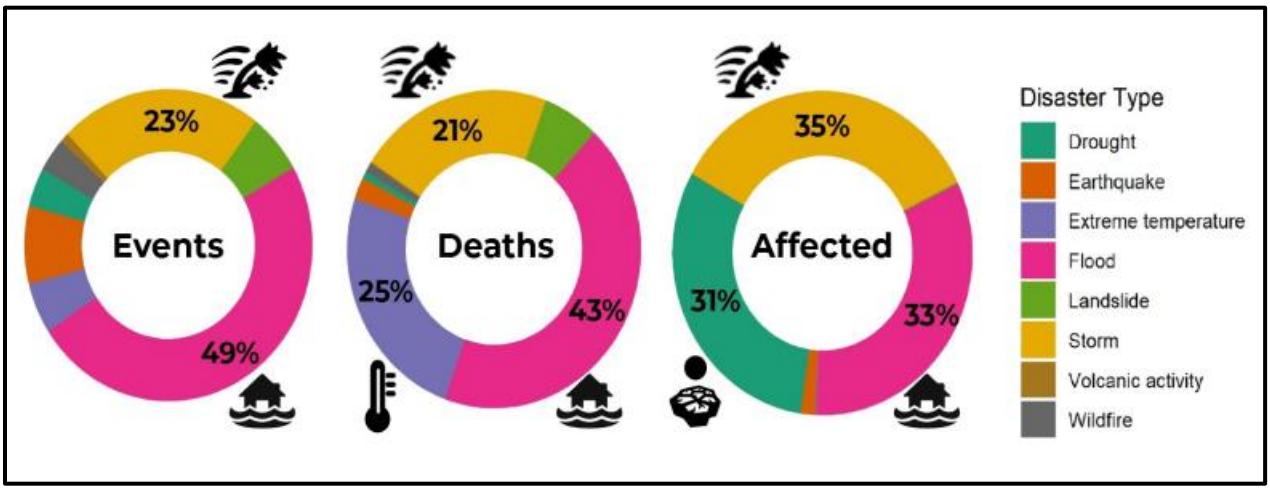


*Figure 3.1: Global disaster events in 2019 and their impacts*

[Source: EM-DAT, 2020]

According to Fountain, Cradock-Henry, Buelow and Rennie (2020), climate change scientists recognised that carbon dioxide emissions are increasing at an alarming rate with a measurement of 315 parts per million in 1958 and an increase of 32% by the end of May 2020. Fountain *et al.* (2020) further explained that on the basis of an analysis of 136 coastal areas around the world in 2013, an increase in sea level by 20% had been recorded leading to approximately $1.2 trillion United States dollars flood damages. In a different study conducted by the Union of Concerned

Scientists as explained in Fountain *et al.* (2020), Florida residents in the United States of America experienced severe hurricanes as a result of climate change. The hurricanes draw their energy from high sea temperatures. The increase in the sea temperatures lead to the intensification of the occurrence of these weather systems (Fountain *et al.,* 2020). Furthermore, Perkins-Kirkpatrick and Gibson (2017) elucidated that the change in global temperatures resulted in the disappearance of the Arctic sea's ice and glacier.

Climate-induced disasters contribute to huge economic losses due to the destruction of infrastructure causing a reduction in production (USAID, 2019). The top five countries that were most affected by climate-induced disasters as recorded by EM-DAT (2020) are listed in Table 3.2.

*Table 3.2: Top 5 countries economically affected by disasters in 2019*

| **Country** | **Disaster** | **Loss in US$** |
|---|---|---|
| Japan | Tropical cyclone Hagabis | 17 billion |
| China | Tropical cyclone Lekima | 10 billion |
| India | Floods | 10 billion |
| USA | Floods | 10 billion |
| Japan | Typhoon Faxai | 9 billion |

[Source: USAID 2020]

Linked to climate change, environmental conditions conducive for the transmission of infectious diseases has increased with diseases such as dengue, Vibrio cholerae and other pathogenic Vibrio species (WHO, 2018). The 2019 Lancet Countdown report indicated that malaria and dengue fever are endemic in numerous parts of the world contributing significantly to the problem of diseases where young children are mostly vulnerable (WHO, 2018). The transmission of mosquito-borne infectious diseases as indicated by WHO (2018) is affected by aspects like temperature, humidity and precipitation, implying that any increase in these conditions can result in the increase of the spread of malaria. The suitability of malaria had an upward trend in Africa's highlands areas of Africa with an average of 29.9% illnesses between the years 2012 and 2017. Figure 3.1 indicates the global changes in vectorial capacity for dengue virus vectors (aegypti and albopictus) between 1950 and 2017. It is evident from Figure 3.1 that there is an increase in the dengue virus vectors which may be exacerbated by the suitable environmental conditions created by global climate change as indicated by WHO (2018).

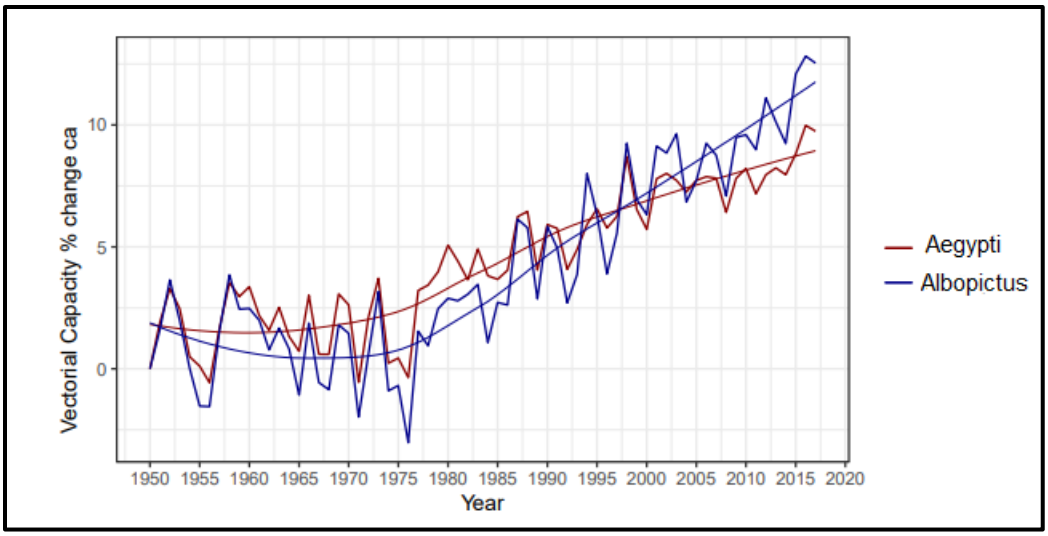


*Figure 3.2: Vectorial capacity for dengue virus vector changes (1950 - 2020)*

[Source: USAID, 2020]

Veld fires are another type of climate induced disasters that increased their effects both on people and on the economy in 2019. USAID (2020) stated that economically, veld fires accounted for approximately 30billion USD with 25 billion lost in United States of America only. Veld fires can be caused by humans but increased by factors such as high temperatures, lack of rainfall, drought, strong winds and high temperatures. In September 2019 to February 2020, EM-DAT recoded 32 deaths in Australia due to veld fires, 50 deaths in South Sudan and 30 deaths in China with huge impacts on the environment. Figure 3.3 illustrates that the occurrence of veld fires increased in 2014 and the effect on people also increased. Although the incidence of veld fires declined in 2015, there was an upward trend in the economic impacts.

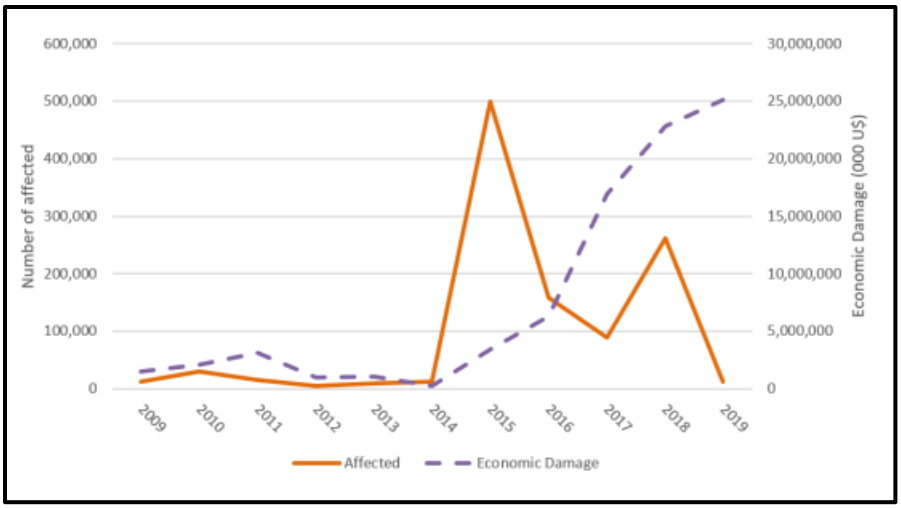


*Figure 3.3: Impacts of veld fires on people and economy*

[Source: EM-DAT 2020]

The Sustainable Development Goal's number 2's efforts to end hunger by 2030 is facing challenges due to climate change. Zhao, Liu, Piao, Wang, Lobell, Huang, Huang, Yao, Bassu, Ciais, and Durand (2017) noted that worldwide, crop yield prospective for maize, wheat, rice and soybean has lessened as a result of temperature increases. In the literature's meta-analysis by Zhao *et al.* (2017), the findings were that global harvests of the main crops declined by 6%, 3.2%, 7.4%, and 3.1% for each 1°C increase in global mean temperatures. This therefore implies that there will be increased hunger and starvation which may lead to malnutrition, conflicts and large-scale migration across that world.

### 3.2.3 Projections of Climate Change

At the current rate, the Earth's global average temperature is projected to rise from 3 to 7°c by 2100, and it will get even warmer after that (IPCC 2013). As the climate continues to warm, more changes are expected to occur, and many effects will become more pronounced over time. For example, heat waves are expected to become more common, severe, and longer lasting. Some storms are likely to become stronger and more frequent, increasing the chances of flooding and damage in coastal communities ((Ringler and Rosegrant, 2020). Mkwambisi *et al.* (2013) proclaim that climate change will affect different regions, ecosystems, and sectors of the economy in many ways. This depends not only on the sensitivity of those systems to climate change, but also on their ability to adapt to risks and changing conditions. According to Jordaan (2011), for time immemorial, people and bionetworks similarly have displayed noteworthy capability to react to

risks and acclimate to different climates and ecological changes. Now, climate change impacts have already been detected, and the degree of warming has increased in recent decades (Ringler and Rosegrant, 2020). Consequently, human-caused climate changes become a challenge - that might need new approaches and ways of thinking to guarantee a productive community and a healthy natural environment.

The Environmental Protection Agency (2015) indicated that the “Crisis belt” which encompasses the sub-tropical region as indicated in Figure 3.4 is more vulnerable to climate change as a result of temperatures that are already high, water and soil systems are degraded and variable. In addition to that, the governments have less money to reinforce climate adaptation measures and lack of resource management issues.

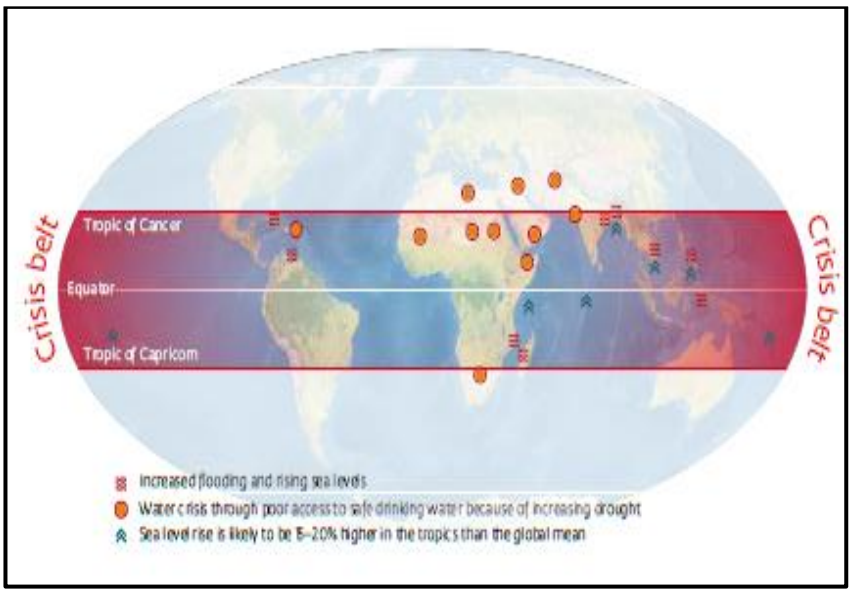


*Figure 3.4: The area vulnerable to climate change*

[Source: Adapted from Canali 2013]

As indicated by Lesolle (2012); Shanahan, Shubert, Scherer, Corcoran, Banda (2013); IPCC (2014) and Davis and Hirji (2014), it is projected that due to climate change, the world’s annual rainfall will be reduced which will lead to less ground water recharge with the exception of the east Africa where rainfall is expected to increase. Furthermore, rainfall seasons will shift and climate hazards will increase, threatened by erosion in severity and frequency damaging infrastructure, natural systems and settlements. Desertification into Namibia, Botswana and

Zimbabwe will be accelerated with soil fertility being endangered as a result of erosion and increased temperatures (Shanahan *et al.,* 2013) In addition, vulnerability of coastal communities is increased by raising seas and an increase in ocean acidity which damages fisheries and degrade coral reefs (Davis and Hirji 2014). The map below, Figure 3.5 is a summary of the projected impacts of climate change.

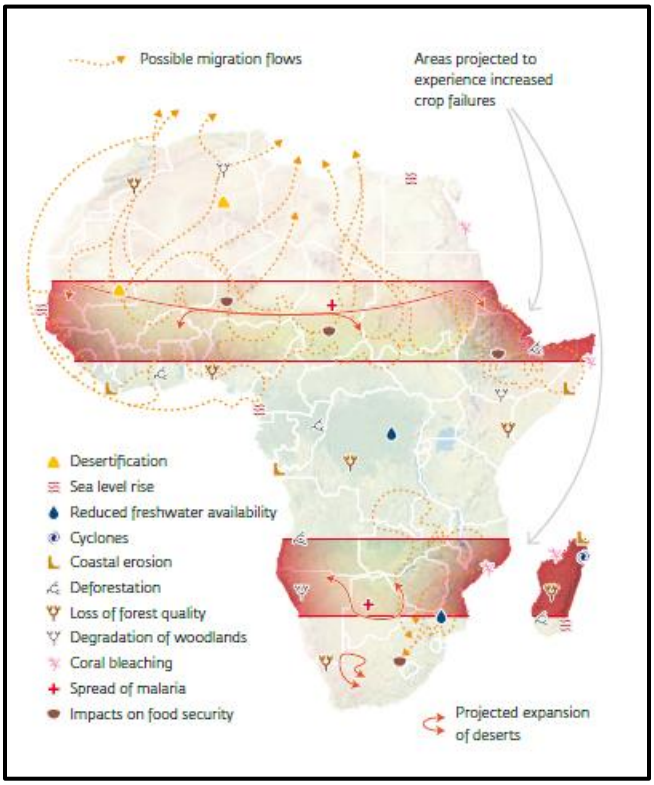


*Figure 3.5: Projected impacts of climate change in Africa*

[Source: Adapted from Canali 2013]

As indicated above, ecosystems will be destroyed with grazing land for livestock reduced, this will result in malnutrition and diseases (Shanahan *et al.* 2013; IPCC 2014b). The quantity and quality of water for household and commercial use will be reduced which may lead to the extinction of some species and reduction in wetlands and wildlife. A surge in migration and human displacement will occur (Shanahan *et al.* 2013; IPCC 2014b).

### 3.2.3 Causes of Climate Change

The World Food Programme (WFP) (2015a) indicated that human and natural causes to climate change exist and work mostly through the phenomenon known as the greenhouse effect. Zhao *et al.* (2017) indicated that water vapour and carbon dioxide are the two major contributors to the greenhouse effect. Other greenhouse gases such as methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs) and other greenhouse gases are present only in trace amounts. However, they also have a noteworthy effect on the warming effect due to their heat-trapping capabilities and their lasting presence in the atmosphere. In the absence of greenhouse effect, earth's average temperature would be -18°C, rather than the present 15°C (Zhao *et al.,* 2017).

According to Ringler and Rosegrant (2020) and WFP (2015a), concentrations of greenhouse gases especially $CO_2$ have risen over the past two hundred and fifty years, mostly as a result of the combustion of fossil fuels for energy production. From the beginning of the Industrial Revolution in the eighteenth century, the concentration of $CO_2$ in the atmosphere has risen from about 270 parts per million (ppm) to about 370 ppm (Ringler and Rosegrant, 2020). Concentrations of methane have also risen due to cattle production, the cultivation of crops, and release from landfills (WFP 2015a).

Nearly one-third of human-induced nitrous oxide emissions are linked to industrial processes and automobile emissions (FAO 2015). Ringler and Rosegrant (2020) hold the view that the combustion of fossil fuels is not the only anthropogenic source of carbon dioxide. When ecosystems are altered and vegetation is either burned or removed, the carbon stored in them is released to the atmosphere as carbon dioxide (FAO 2015). The principal causes of deforestation are agriculture, urban growth, harvesting timber for fuel and construction. Currently, up to a quarter of the carbon dioxide emissions to the atmosphere can be attributed to land-use change (FAO 2015). Over the past century, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere contributing to climate change (Ripple *et al.* 2020). The majority of greenhouse gases come from burning fossil fuels to produce energy, although deforestation, industrial processes, and some agricultural practices also emit gases into the atmosphere (FAO 2015; Zhao *et al*., 2017; Ringler and Rosegrant, 2020).

### 3.2.4 Who is Causing Climate Change?

The IPCC (2018) explained that greenhouse gases are mostly released by the most developed and industrialised countries. Table 3.3 shows the top 10 countries emitting the most greenhouse gas for the period of 1991 - 2015 as indicated by the Zhao e*t al*. (2017). China currently produces around 22.7% of global greenhouse gas emissions, while the United States is responsible for 15.6% (IPCC 2018). Zhao *et al.*, (2017) elucidate that although China is currently the largest emitter as shown in Table 3.3, this is a recent trend and will continue to change in the imaginable future. Zhao *et al. (2017)* predicted that the carbon dioxide emissions could increase by 26.5% - 36% in 2030 in comparison with 2005.

*Table 3.3: The top 10 global emitters of greenhouse gasses (1991 -2015)*

| **Country** | **% Contribution to global greenhouse gas emissions** |
|---|---|
| China | 22.7 |
| United States of America | 15.6 |
| India | 5.7 |
| Russia | 5.4 |
| Japan | 2.9 |
| Brazil | 2.6 |
| Germany | 2.1 |
| Saudi Arabia | 1.9 |
| Canada | 1.7 |
| Indonesia | 1.6 |

[Source: Adapted from Zhao *et al.,* 2017)]

### 3.2.5 Climate Change in Africa

Africa is the most susceptible continent because of its reliance on rain-fed agriculture and pastoralism for basic food supplies (Brazier, 2015; Foti, Musemwa, Chivheya and Mwanza, 2020). Mudimu (2009) and Belle (2016) assert that, Africa's climate is forecasted to be more variable, and life-threatening weather events (like drought, heat waves and flooding) are projected to have increased risk to human health and life. Slight temperature changes, precipitation and water accessibility lead to detrimental effects on agricultural output consequently on food security (Brazier, 2015).

Food insecurity and extensive interruption of socio-economic welfare are possible consequences. Brazier (2015) projects that that Africa may lose close to 50% of its revenue from agricultural production due to climate change. In many parts of the region, warmer temperatures and changes in amount and seasonality of precipitation will likely destabilise agricultural production that still depend largely on rainfall for irrigation till date (Brazier 2015). Foti *et al.* (2020) note that, population increase coupled with reduced precipitation and water supply results in severe water scarcity and stress.

Furthermore, food and water shortages and increasing desertification are one plausible scenario that follows from shorter growing seasons and lower yields, and the overall loss of large areas suitable for agriculture or pastures (Brazier 2015; Foti *et al.,* 2020)). It is unlikely that areas that will possibly receive more precipitation can provide sufficient compensation. In addition, about one third of water-related disasters of the world such as flooding, landslides and drought occur in Africa (UNISDR 2004) and one third of people in Africa already live in drought-prone areas and are vulnerable to the impacts of droughts; moreover floods and droughts can occur in the same area within months.

In an article by Mooitinho De Ameida and Guha-Sapir (2019), one of the listed indicators of climate change in Africa was the occurrence of tropical cyclones with Mozambique experiencing the most devastating effects. Mozambique recorded 46 cyclones in 30 years (Mooitinho De Ameida and Guha-Sapir 2019). In March 2019, Mozambique was ripped by tropical cyclone *Idai* that resulted in coastal flooding, destroying homes and sources of livelihoods in the poor rural areas. They further explained that the hospital servicing approximately 12 million people was damaged by cyclone *Idai,* leaving 10% of Mozambique non-operational and threatening the people's health. To worsen the situation, approximately 6000 cases of cholera cases were reported as a result of the flood waters aggravated by the cyclone that polluted the sources of water (Mooitinho De Ameida and Guha-Sapir 2019).

Brazier (2015) elucidated that climate change is likely to intensify already existing detrimental conditions, natural or human induced. These includes the likes of land degradation and desertification, fires and deforestation, loss of wetlands and water stress, declining biodiversity, increasing dust storms, and spread of climate sensitive diseases. Stocker *et al*. (2013) added that poverty and human migration, together with rapid urbanisation cripple the environment even further and will continue to do so. Population growth and rapidly changing land use patterns are going to worsen this delicate situation. The above information shows that Africa is already a region

under hefty pressure from climate stresses and its current low adaptation capacity makes it highly vulnerable to the impacts of climate change (Brazier 2015). Stakeholders in the region, therefore, need the appropriate and most up-to-date tools to better understand and predict climate change, assess its impact on African ecosystems and population and evaluate and undertake the correct adaptation strategies (Brazier 2015).

### 3.2.6 Climate change in Zimbabwe

Global climate change patterns raise major quandaries for developing nations such as Zimbabwe (Unganai 2006). Around 20% of Zimbabwe's land area, including the Zambezi and Limpopo river valleys, lies below 900m (Brazier 2015). The climate is strongly influenced by the Inter Tropical Convergence Zone (ITCZ), which develops as a result of the meeting of warm moist air masses from the north and cool air masses from the south, producing the main rainfall season (Brazier 2015).

Rainfall in Zimbabwe exhibits a seasonal pattern, with one wet season running from mid-November through to mid- March, with most rain occurring in December, January and February (Dube and Nhamo 2019; Brazier 2015). The dates of the onset and end of the rainy season are quite variable, at times starting as early as October and stretching well into April (Mkwambisi 2017; FAO 2015). Records show that the heaviest 10% of rain-days account for almost 45% of the entire annual precipitation (Dube and Nhamo 2019). Mean annual rainfall shows a north–south, and west–east gradient, in response to the country's topography and the higher moisture content of those air-streams that approach Zimbabwe from the northwest and northeast (FAO 2015; Brazier 2015). Total seasonal rainfall exhibits high inter-annual variability. According to FAO (2015), the coefficient of variability increases from 26% in the north to above 36% in the south.

The Zimbabwe Department of Meteorological Services (2000) indicated that climate change, in the sense of altered long-term changes in the average state of the atmosphere, is already occurring in Zimbabwe. There is evidence from records since 1900 that average annual surface temperature has increased by 0.4°C (Brazier 2015; Foti *et al.,* 2020). There are now increased hot days and fewer cold days than in the past. The temperature increase has been most pronounced during the dry season with five warmest years on record having occurred since 1987 (Zimbabwe Department of Meteorological Services 2000).

Droughts resulted in the lack of agricultural purposes, loss of livestock and growth of algal blooms (Belle, Moyo and Ogundeji 2017). Below is the risk profile of the top 10 natural disasters in Zimbabwe between 1982 and 2019 (EM-DAT, 2020). Table 3.4 is a presentation of the top 10 disasters that occurred in Zimbabwe between the years 1982 and 2015 (EM-DAT, 2020). Chineka (2016) indicated that the most common disasters in Zimbabwe are droughts elicited by climate variations and climate change posing a danger to the rainfall agro-based economy (Mkwambisi *et al.,* 2013). Furthermore, induced ecological changes result in degradation of pastures and intensified desertification. Droughts that occurred in the year 2001 were the most devastating than the period 1982 – 2015, affecting 6 million people (EM-DAT, 2020).

Floods are another common hazard in Zimbabwe which are caused by extreme precipitation and tropical cyclones such as tropical cyclone *Eline* in the year 2000, tropical cyclone *Japhet* in 2003 and tropical cyclone *Idai* in 2019. (Mkwambisi *et al.* 2017). Cyclone *Eline* led to flooding, leaving 120 people dead and affecting over 250 000 people with about US$7.5million economic loss (Shumba 2005 cited in FAO, 2015). As explained by Mkwambisi *et al*. (2017) floods disrupt the flow of essential services and economic activities, pushing communities in dire poverty. Biological vectors result in biological disasters. FAO (2015) highlighted that inadequate provision of clean water in Zimbabwe resulted in the outbreak of cholera in 2008/2009 where approximately 100 000 cases and 4000 deaths were recorded.

*Table 3.4: Top 10 disasters in Zimbabwe (1982 – 2016)*

| **Disaster** | **Year** | **Number of people affected** |
|---|---|---|
| Drought | 2001 | 6 000 000 |
| Drought | 1991 | 5 000 000 |
| Drought | 2007 | 2 100 000 |
| Drought | 2010 | 1 680 000 |
| Drought | 1982 | 700 000 |
| Epidemic | 1996 | 500 000 |
| Flood | 2000 | 266 000 |
| Epidemic | 2008 | 98 349 |
| Drought | 1998 | 55 000 |
| Flood | 2001 | 30 000 |

[Source: Adapted from EM-DAT, 2020)

The Zimbabwe Meteorological Services (2000) specified that the average rainfall during rainy season decreased by about 5% since 1900. The indication is that the increase in temperatures results in changing of rainfall pattern (Zimbabwe Department of Meteorological Services 2000).. The Zimbabwe Meteorological Services (2000) further noted more dry days during the rainy season and an increase in the frequency of droughts and floods since 1990, usually occurring end-to-end, with a flood year immediately following a drought year (Zimbabwe Department of Meteorological Services 2000; Foti *et al*., 2020). Climate change in Zimbabwe make it challenging for people who solely rely on rainfall and water resources, like those involved in agriculture, tourism and industry to plan their activities (Mugambiwa and Tirivangasi, 2017; Foti *et al.,* 2020).

### 3.2.7 Causes of Climate change in Zimbabwe

The largest contributor to climate change, as indicated by the IPCC (2016) is power generation which is accountable for more than half of the total greenhouse gas emissions in the country. This is followed by agriculture and industrial activities contributing 20.8% and 16.6% respectively (IPCC 2016; Foti et al, 2020)

*Table 3.5: Contribution to greenhouse gas emission per sector*

| **Sector** | **% Contribution to greenhouse gas emissions** |
|---|---|
| Power generation | 60.7 |
| Agriculture | 20.8 |
| Industry | 16.6 |
| Waste | 1.9 |

[Source: IPCC 2016]

### 3.2.8 Impacts of Climate Change in Zimbabwe

De Groeve *et al*. (2014) in Belle (2016) detailed that yearly, lives and livelihoods of millions of vulnerable people are risked by natural and man-made hazards and disasters. Weather-related hazards are increasing in scope, incidence and severity with hazard exposure also increasing. (IPCC 2012). The weather hazards that Zimbabwe experiences include tropical cyclones causing intense rainfall (more than 100 mm in 24 hours) and thunderstorms sometimes leading to

hailstorms, floods and flash flooding (International Crops Research Institute of the Semi-Arid Tropics (ICRISAT) 2013). A recent example is of cyclone *Idai* in 2019 which had devastating effects of rural livelihoods in the Chimanimani area of Zimbabwe (Chanza, Siyongwana, Williams-Bruinders, Gundu-Jakarasi, Mudavanhu, Sithole, and Manyani, 2020). Droughts are prevalent in Zimbabwe, as enlightened by Braziel (2015) lasting from one to three years and occurring every five to seven years. This natural cycle can be attributed to El Niño-Southern Oscillation, which originates in the Pacific Ocean (Braziel 2015; Chanza *et al.* 2020). The temperature changes in the Pacific Ocean in certain years causes rainfall variabilities across the southern hemisphere. Braziel (2015) further explained that El Niño can last up to nine months and the correlation between El Niño events and droughts in Zimbabwe is very high.

i) Rainfall patterns

Wide-ranging decline in normal mean seasonal rainfall over the last century has been witnessed in Zimbabwe (Braziel 2015; Chanza et al. 2020). This decline is attributed to climate change. An average of four to five dry spells can be expected during an average rainy season (IPCC 2016) Extremes in temperatures results in ground frost during the cold season and heat waves during the hot season (IPCC 2014b; Davis and Hirji 2014). Climate change is expected to bring an increase in average temperatures across the country of between 1°C and 3°C. According to ICRISAT (2013), rainfall spatial and temporal variability in Zimbabwe is expected to increase with climate-related hazard events, such as droughts becoming more recurrent.

ii) Natural Resources Degradation

Zimbabwe has copious natural resources, such as minerals, agricultural land, water, natural vegetation and wildlife. Zimbabwe's urban and rural population depends greatly on ecosystem services that provide clean, regular water supply, fertile soils and trees for fuel, building construction and fencing (ICRISAT 2013; Braziel 2015). In addition, many rural Zimbabweans draw on important food sources in the form of wild fruits during times when agricultural produce is out of season. In a research conducted by Bhatasara (2015), these vital resources and services have been degraded over the years through various human activities. This implies that climate change will accelerate the degradation and its impacts will be felt more strongly (Bhatasara 2015). Zimbabwe's soils, for example, have been increasingly eroded through annual ploughing, burning for land clearing, deforestation and poor grazing management.

Lack of run-off water control on slopes and uncontrolled open-cast mining in some areas has added to the degradation. Bhatasara (2015) discovered that deforestation has become a major problem in recent years as forests have been cleared in preparation for agriculture, for fencing and for use as firewood, mainly for tobacco curing and brick making. This has been supported by Mkwambisi *et al.* (2013) who indicated that between 1990 and 2015, Zimbabwe lost 36% of its forest cover at a rate of 9% per decade. Destruction of natural habitats, pressure from human settlements and poaching have decimated wildlife populations, particularly those endangered (Bhatasara 2015).

iii) Shifting of Natural Regions

The Zimbabwe Meteorological Department (2016) indicated that Zimbabwe is divided into natural regions as illustrated on the map in Figure 3.6 based on soil types, vegetation and climate. These are however slowly shifting over time, thus making it hard to manage livelihoods.

***Natural region I****:* High rainfall (over 1,000 mm per year), low temperatures and steep slopes. It is suitable for high-value arable farming, diary, horticulture and forestry.

***Natural region II****:* Medium rainfall (750–1000 mm per year). Temperatures are not extreme and soils are generally good. It is suitable for intensive farming, including horticulture and dairy.

***Natural region III****:* Low rainfall (500–750 mm per year) with mid-season dry spells and high temperatures, this is a semi-intensive farming region suitable for field crops such as maize, soya, tobacco and cotton, as well as livestock.

***Natural region IV****:* Low rainfall (450–650 mm per year) with severe dry spells during the rainy season and frequent seasonal droughts. The region is suitable for livestock and drought-tolerant field crops such as sorghum, millet, cowpeas and groundnuts.

***Natural region V****:* Very low rainfall (less than 650 mm per year) and highly erratic. Suitable for livestock, wildlife management, beekeeping and non-timber forest products.

Communities living in natural regions IV and V (which make up about 64% of the land area in Zimbabwe) are at the mercy of climatic extremes, with few livelihood options (Braziel 2015). They

tend to be the most vulnerable to poverty. These regions are already feeling the impacts of climate change and will be the hardest hit in the future.

Many scientists, as stated by Mugandani *et al.* (2012) propose that the natural region map be redrawn because of climate change (as indicated in Figures 3.6a and 3.6b), with regions IV and V taking up more area and I, III and IV less as indicated in Figure 3.6. This was following the findings from the study they conducted and reclassified the climate regions to conform to climate variability and change from the 1960s.

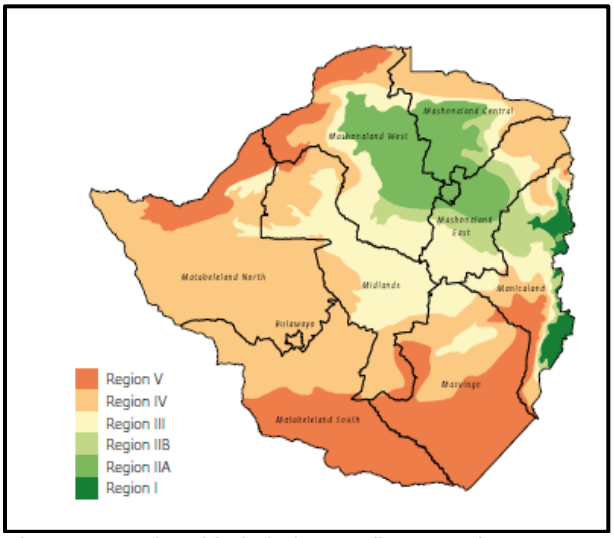


*Figure 3.6a: The old Zimbabwe's climate regions*

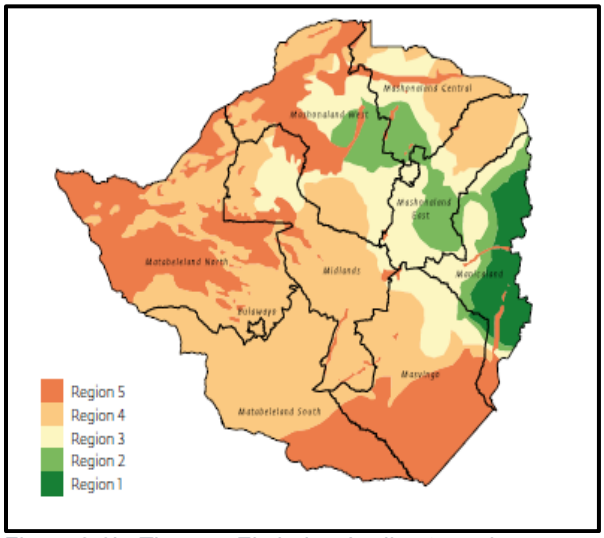


*Figure 3.6b: The new Zimbabwe's climate regions*

[Source: Adapted from Mugandani *et al*. 2012]

Although the number of the agro-ecological regions remained the same, their sizes changed, pointing out the evidence of climate change in Zimbabwe. From the study, Mugandani *et al.* (2012) found out that the natural regions I and III shrank by approximately 4.9 and 13.9%, due to the fact that these regions are the main food producing regions in Zimbabwe. This possibly results in food production being reduced and consequently food insecurity (ICRISAT 2013).

iv) Direct Impacts on People

Climate change will intensify suffering and poverty among the people of Zimbabwe. Women, children and the disabled, especially those living in rural areas, will be the most affected (ICRISAT 2013). The resilience of Zimbabweans is put to the test to develop effective coping strategies. The national census of 2013 put Zimbabwe's total population at 13,061,239, of which 41% were under the age of 15 (ZimStat 2016). The ZimStat (2016) further stated that the total fertility rate

is 3.8 children per woman, which is one of the lowest in sub-Saharan Africa. The population is predicted to double in about 70 years based on these figures. Life expectancy is 58 years with average household size being 4.2 people and 67% of the population live in rural areas (ZimStat 2016).

### 3.3 Rural women vulnerability to climate change in Zimbabwe

Cultural customs encumbers women with the obligation to provide food, fuel and water, a responsibility that will be made increasingly challenging by climate change. In Shona culture, as indicated by Mugambiwa and Tirivangasi (2017), family is viewed as a social institution where patriarchal practices are instilled in the young people to accept the sexually differentiated roles. In addition, the Shona custom of a man paying bride price makes a woman to lose her freedom and rights and is treated as acquired property, she does not have any right to own any property (Mugambiwa and Tirivangasi, 2017). This lack of access to capitals make the rural women more vulnerable to climate change as they will not have the resource base on which to rely on to perform the household responsibilities pushing them further into poverty. According to recent figures, 72% of Zimbabweans live below the national poverty line (less than US$ 1.25 per day). Poverty is higher in rural areas, with around 76% of rural people affected (USAID 2018).

Yadav and Rattan (2018) believe that rural women's workload and long working hours inhibit education. In Zimbabwe, the ritual is that women engage in household duties which sometimes hinder them from acquiring education (Makaudze 2017; Mkwambisi *et al.* 2017). In the case of abject poverty in some households where there are girl children, arranged marriages are seen as a source of wealth regardless of the level of education of the girl child. This can be done in exchange for financial capital or assets, such as livestock (Kambarami 2006; Makaudze 2017; Mugambiwa and Tirivangasi 2017). Makuzva (2016), Dziva and Mazambani (2017) depicted that in Masvingo the prevalence of child marriages (marriages of girls below the age of 18 years) was 39% in 2015. The rural women are involved in chores such as fetching water and firewood, planting and harvesting. Mugambiwa and Tirivangasi (2017) profess that the increase in extreme weather conditions such as droughts, heatwaves and floods exacerbate the women's workload resulting in them walking long distances with heavy loads.

Environmental degradation and depletion of natural resources which are the main sources of livelihoods for rural women further expose women to be vulnerable (Makaudze 2017). This,

according to Adger *et al.* (2003) and Mkwambisi *et al.* (2017) reduces the economic opportunities of the rural women because some of them rely on nature for their livelihood. For instance, some of the women in Zimbabwe gather wild fruits and sell or gather firewood and sell in order to support their families. FAO (2015) echoed the same sentiments highlighting that approximately 70% of rural women rely on traditional energy sources for cooking and lighting such as crop residues, firewood and cow dung. It is the women's responsibility to collect these resources that is making them to be exposed to the harsh weather conditions and sexual harassment. In some cases where the woman is pregnant, they are at risk of pregnancy complications (Mugambiwa and Tirivangasi 2017; Makuzva 2016; Dziva and Mazambani, 2017). ICRISAT (2015) emphasised that in the event of less crop production, due to climate change induced hazards, such as droughts or floods, women are made susceptible in trying to fulfil their feminine duties. They tend to put family needs first and they eat less and last which may deprive them of the essential nutrients and adversely affect their health.

Large scale migration to urban areas and other countries by the economically active male counterparts as a climate adaptation strategy disrupts the social structure. It increases the range of the family income thereby making women vulnerable because they become less financially secure thus impacting on food security (Braziel 2015). Food insecurity may increase the women's nutrient deficiencies and intensify their vulnerability to diseases (Khurana and Sen 2017). In Zimbabwe, the women's place is at home, women have limited suppleness because they are culturally supposed to take care of the children and the elderly members of the family whilst men are regarded as breadwinners (Mkwambisi *et al.* 2015; Mugambiwa and Tirivangasi 2017). Lastly, FAO (2015) depicted that in the case of climate-induced disasters, women are susceptible to gender-based or sexual harassment during and after the disasters.

### 3.4 Adaptation and resilience strategies

Delfet *et al*. (2017) portrayed that the variable climate and turbulent history of Zimbabwe have bred a population that is familiar with adverse living conditions. Delfet *et al*. (2017) further acknowledge that Zimbabweans have developed both positive and negative strategies for coping with long-term hardship and acute shocks due to a wide range of factors. These factors include the colonial relocation of the majority into marginal reserves that became overpopulated and degraded; the effects of economic sanctions imposed on Rhodesia during the 1960s; the impacts of economic structural adjustment programmes; the HIV and AIDS pandemic in the 1990s; and

recent economic and political instability (Braziel 2015; Mkwambisi and Tirivangasi 2017). The country boasts the most highly educated population in Africa, with an overall literacy rate of 96% (94% for women) (ZimStats 2016). In addition, there is a vast wealth of local traditional knowledge that has enabled Zimbabwean communities to adapt to a fluctuating climate for centuries (Braziel 2015).

As asserted by Braziel (2015) and Zhao *et al.* (2020), if greenhouse gas emissions are stopped, many of the negative impacts of climate change will continue to have an effect for decades. The IPCC (2016) foresees that if greenhouse gas emissions continue to rise, there will be disastrous results for human societies and natural systems. It is known that climate change is going to affect Zimbabwe's future, but we do not know exactly what the effects will be (IPCC 2016; Braziel 2015).

It is therefore crucial that individuals and communities strengthen their ability to withstand potential adversity and to adapt the ways we live and the resources which we use. From the definition of adaptation given earlier by the IPCC (2007) under the definition of terms, it is clear that human beings have the potential to significantly reduce some of the effects of climate change through effective adaptation measures. Adaptation can involve changes to behaviour, such as encouraging farmers to plant drought-resistant crops, and changes to infrastructure, such as digging boreholes or flood-proofing roads and bridges (IPCC 2007).

i) Building resilience systems

Resilience is the ability to withstand and recover from hazards or shocks and is an important part of adaptation (IPCC, 2014). Resilience is increased when a system can learn from past disasters in order to reduce future risks (IPCC, 2014). For resilient communities of people and the ecological resources on which they depend, successful adaptation to climate change becomes very crucial. In order to apply resilience principles, there is need to think about communities in terms of systems. IPCC (2014) and (Brazier 2015) assert that, resilience acknowledges that every part of a system – whether a village, forest or farm – is connected. This means that whatever happens to one part of a system can affect many of the other parts. For example, drought reduces water, causing crops to die; soil to be damaged and people become food insecure, as well as posing health problems and income reductions.

ii) Encouraging diversity

One of the most important principles of resilience, according to Brazier (2015), is encouraging diversity in all forms. For example, obtaining water from a variety of sources, growing many different crops and having many sources of income (Brazier, *et al.* 2015). The more diverse elements are present in a system, the stronger the system. If one element of the system is damaged, for instance, through drought, fire or disease, then another element is able to take the damaged element's place. For example, if we grow only maize, drought may destroy the entire crop, but if we also grow millet, sorghum and legumes, it is likely that some of the crops will survive the drought, giving at least some food and income.

iii) Adaptation and sustainable development

Many adaptation measures are not specifically related to climate change, but are essentially sustainable ways to improve the management of resources and communities. (FAO, 2015). Thus, most adaptation measures are the foundations of sustainable development and will go towards achieving many of the Sustainable Development Goals and many objectives of the government's blueprint for sustainable economic development (Zimbabwe Agenda for Sustainable Socio-economic Transformation (ZimAsset) 2015).

Foti *et al.* (2020) indicate that, because these measures will benefit communities, whether or not climate change happens, they are called "win-win", "no regrets" or "low regrets" solutions. For example, increasing the diversity of crops to include drought-resistant varieties will not only reduce the risk of an entire harvest being destroyed by drought, pests or intense rainfall, but will also help to improve the soil, reduce pest infestations and diseases and improve family nutrition overall (Foti *et al.,* 2020).

iv) Adaptation and mitigation

Ideally, adaptation measures should also lower greenhouse gas emissions, reducing or mitigating the effects of future climate change (FAO, 2018). An example is planting trees and protecting existing forests which will protect the soil and improve the ability of rainfall to recharge underground water stores. Additionally, the trees will help to take $CO_2$ out of the atmosphere, thus reducing global warming (Mugambiwa and Tirivangasi, 2017).

## 3.5 Chapter summary

This chapter discussed the concept of climate change, its causes and the impact from a global perspective down to Zimbabwe where the study area is. It further explores the literature to determine why rural women are vulnerable to climate change and the possible adaptation and mitigation strategies to climate change. There are two main ways to adapt to future climate change impacts: reducing the vulnerability of communities, including people and the ecological components on which they depend, by building resilience and increasing their adaptive capacity (ability to adapt); and by reducing the risks of climate hazard impacts (disaster risk reduction).
The next chapter presents and discusses the findings of the research from the data collected on the vulnerability of rural women in Chivi to climate change and the strategies that are being implemented to adapt to climate change.

# CHAPTER 4
# METHODOLOGY

## 4.1 Introduction

This chapter provides a general description of the methods used in conducting the research. The research design, population, sample size, sample unit description, formulation and administration of research questionnaires, pre-testing of the instrument and data analysis are also covered in this chapter. These were explained in line with the objectives stipulated in chapter 1. The statistical procedures employed in data analyses are also outlined.

## *4.2 Research Design*

This research made use of the mixed method research (MMR) which is a strategy of enquiry that uses both the qualitative and quantitative approaches, extracting the strengths of both. Creswell and Miller (2012), explain MMR design as a procedure for collecting, analysing, and merging quantitative and qualitative research methods in order to derive meaning from facts. The quantitative approach is grounded in the post positivism paradigm while the qualitative is rooted in phenomenological philosophy (Leavy, 2017 and Creswell, 2015). The post positivism paradigm as explained by Creswell (2015) argues that causes determine effects therefore problems studied mirror the necessity to ascertain and assess the underlying causes that influence the outcomes.

In addition, this study is a real world issue which is one of the characteristics of the post positivism school of thought. (Mouton, 2011). In this study, the reasons why women are regarded as more vulnerable to climate change will be explored to determine their vulnerability. In the post positivism paradigm, knowledge is generated by observing individual behaviours (Leavy, 2017). With the phenomenological strategy, the researcher understands a phenomenon from the participants' point of view (Creswell, 2015). The topic under study requires both exploration and explanatory angles, thus the employment assists in gaining insight from combining the qualitative and quantitative approaches.

Mixed method research has been employed in this study because it enables the participants' point of view to be reflected (Shumacher and McMillan, 2014). This research seeks to understand the

vulnerability of women to climate change, thus Chivi rural women will explain the contextual facts according to their experiences that makes them vulnerable. Comprehensive data will therefore be collected.

## *4.3 Population and sampling*

i) Target population

Schumacher and McMillan (2014) defined target population as the group from which data will be collected. Although all the households in Ward 25 are affected by climate change, this study focused on a sample of women-headed households. The Inter-Censal Demographic Survey (2016) in ZimStats (2017) indicated that 58% of the households in Ward 25 are headed by female and 42% by men with an average of 6.7 people per household. Mouton (2015) explained that a sample refers to a representative subset of observations from a population. The researcher engaged with the Councillor of Ward 25 as one of the key informants who provided data on other issues relevant to the study.

ii) Sample size and sample determination

Ward 25 has many women-headed households, as indicated by the Inter-Censal Demographic Survey (2016) cited in ZimStas (2017).Of the total 1070 households, 67% (713) are headed by women and they are affected by climate change. It was not practical for every household to participate in the study given the limited time and resources, therefore 15% (107) of the total (713) women-headed households were selected to participate in the study. This was done through the assistance of the Councillor as there were no updated official records of all women-headed households due to various dynamics such as remarriages, deaths and migrations within the area of study.

4.3.1 Stratified simple random selection

Stratified simple random sampling is where sampling which is referred to as the $N^{th}$ selection technique will be used. As described by Leavy (2017), stratified simple sampling involves the selection of a subject from a continuous list by choosing every $n^{th}$ subject. Stratified simple sampling was the best method in this case considering that the population to select from was big

and there was a list with men-headed and women-headed households. The researcher selected the women-headed households from the list to ensure that the sample was representative of the total population (Schumacher and McMillan, 2014). The advantages of stratified simple sampling include that if the population is arranged according to a certain variable, for instance in this research, the list of the population in this study was stratified according subgroups of male and female-headed households, the researcher was assured that all the households were represented in the sample. In addition, it is also advantageous because it provides a greater accuracy of minimising biases. Furthermore, it also allows for well-organised and effective use of time and resources (Leavy, 2017). Therefore, stratified simple sampling was more feasible because of its simplicity in execution and enables the use of a part of the population rather than the whole population.

In addition, purposive sampling was also used to select individuals to be interviewed as key informants, the Councillor and two agricultural extension officers because they had information pertaining the management and administration of the whole area. The Councillor as the key informant provided current information such as the women-headed households in Ward 25 and the environmental gave records on the evidence of climate change and the impacts on crop production. Schumacher and McMillan (2014) assert that when purposively sampling, the researcher determines that which needs to be known and finds people who are able and willing to provide information based on their knowledge or experience. In this case the agricultural extension officers had records on the changes in climate and human practices over time in Ward 25.

## *4.4 Data collection tools*

Three data collection tools were employed in this study: questionnaires, field observations and literature review.

i) Questionnaires

These were the primary data tools which contained both open-ended and closed-ended questions in order to collect extensive information. A total of 107 questionnaires (see appendix) were administered to women in Ward 25 in Chivi and they were completed, the results analysed in the following chapter.

ii) Field observations

Non-participant observations were also done at a shopping centre and on the cultivated fields. The researcher observed the livelihood activities of the subjects as they were completing the questionnaires.

ii) Literature review

A detailed literature review was done from previous similar studies on the topic. The study looked at the literature from a global perspective, regional and national level. Where there was no information at the local level, provincial and national information was applied. The use of different data collection instruments became vital for triangulation for data validity and reliability.

## 4.5 Pilot study

A combination of three graduates, one Masters student and two Honours students were conscripted to test the questionnaire before the pilot study. This enabled the researcher to identify problems using the question technique. One problem was identified on language usage where the use of the phrase ‘intervention strategies’ seemed to be unpopular and difficult to understand for qualified respondents and was edited to use simple language like ‘activities to combat climate change’.

## 4.6 Data Analysis

4.6.1 Data analysis techniques

Data analysis follows data collection in order to make sense of the study and reach particular findings (Ahmad *et al.* 2015). The collected data was converted into information through the use of SPSS. Assistance was requested from a Lupane University, Agricultural Engineering Department, Zimbabwe and Great Zimbabwe University, Department of Agricultural Sciences to work with Mathematical Statistics. Both descriptive and quantitative analyses were employed in this study, based on the objectives stated in Chapter 1. Descriptive analysis involved the use of

means, percentages, ranges and cross tabulations. The quantitative analysis tools involved the use of binary logit regression, vulnerability scoring and a modified stakeholder analysis.

### 4.6.2 Modelling of Factors Affecting the Use of Adaptation Strategies

Generally the term adoption refers to various processes and stages as one gets to know about an innovation and finally uses the innovation (Khraim, Shoubaki, and Khraim, 2011). In this study, adoption was defined to mean using any form of climate change mitigation strategies. This definition implied a binary dependent variable since any respondent would either be an adopter (user of climate change adaptation strategies) or non-adopter (non-user of climate change adaptation strategies). According to a guide by Meurer and Tolles, (2017), the specification of the logit model allowed for the examination of the climate change adaptation strategies' adoption determinants within the context of the sampled decision-making units. In this study, the likelihood of observing the dependant variable ( $P_i$ ) was tested as a function of independent variables which included the age of the respondent, awareness of climate change adaptation strategies' options, gender of the respondent and experience in using the climate change adaptation strategies platforms. Therefore, as stated by Meurer and Tolles, (2017),

$$P_i = \Pr\left(Y_i = 1\right) = \frac{\exp\left(Z\right)}{1+\exp\left(Z\right)} \quad (1)$$

Meurer and Tolles, (2017),) also show that, a natural log transformation of (1) will result in (2) and can then further be modified to (3) as:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum_i^n \beta_i \mathrm{X}_i + \mu_i \quad (2)$$

$$Z_i = \beta_0 + \sum_i^n \beta_i \mathrm{X}_i, + \mu_i \quad (3)$$

Where:

- $P_i$ is the probability that the $i^{th}$ respondent is an adopter of climate change mitigation strategies (Y*i* = 1).

- $\beta_0$ is the intercept; $\beta_i$'s are the slope parameters; and $X_i$'s are the independent variables.

As implied by Meurer and Tolles, (2017), in this logit model, the dependant variable, $Z_i$ in (3) is to be interpreted as the natural logarithm of the probability that the choice to adopt climate change mitigation strategies would be made. The coefficients in the model will give the signs of the partial effects of each of the independent variables on the probability of a woman respondent using climate change adaptation strategies (IPCC, 2013). The expected effects of selected determinants on the climate change adaptation strategies adoption decision are presented in Table 4.1.

*Table 4.1: Description of climate change mitigation strategies adoption variables*

| Variable | Description | Units | Expected Effect |
|---|---|---|---|
| **Dependent variable** | | | |
| Choice | The choice made by the respondent (=1 if adopter) | dummy | |
| **Independent variables** | | | |
| Age of head | Age of the respondent in years | Year | -ve |
| Married | Marital status of respondent (=1 if married) | dummy | +ve |
| Distance | Distance to the nearest markets | km | -ve |
| Labour | Labour availability index for the household | number | +ve |
| Membership | Number of social groups by respondent | number | +ve |
| Training | Formal agricultural training (=1 if yes) | dummy | +ve |
| Extension | Frequency of access to extension services | dummy | +ve |
| Land Tenure | Fixed Land Tenure (=1 if yes) | number | +ve |
| Farm size | Farm size for the household in acres | Years | +ve |
| Information | Number of times exposed to awareness per week | Number | +ve |

### 4.6.3 Modified Stakeholder Mapping Analysis

One of the major importance of stakeholder analysis is to summarise the data to be more manageable without losing any of the important information, therefore making it easier to test theories. The main reason for using a modified stakeholder analysis framework was to explore

the perceived performances of the climate change adaptation strategies based on the structure and characteristics of the option being used by the respondent. These attributes, also called latent variables, aim to measure things that are usually hard to measure directly, such as attitudes and feelings of stakeholders involved (Creswell, 2012;). The exploration started with many questions, and then by using stakeholder trimming analysis, was reduced to a smaller and manageable number. The reduced results were also then used for other analysis such as logit regression analysis.

Data obtained on the stakeholders involved in the climate change adaptation platforms as well as their relationships were analysed using the interpretative approach suggested by Creswell (2012) and more specifically through stakeholder thematic mapping. This allowed the study to separate specific links which are associated with the stakeholders' decisions in the study area. Missing and potentially beneficial networking linkages were also observed and reported as thematic areas in an effort to open up avenues for enhancing efficiency in women' management of climate change related vulnerabilities.

### 4.6.4 Empirical strategy for ranking the vulnerability management strategies

This study explored and scored the various vulnerability management strategies. This was important to get insights into how the specific knowledge, attitudes and practices were positioned and how they could be re-designed to suit the women respondents' resource endowments and localities. The women respondents were asked to prioritise the vulnerability management strategies which were presented to them. A Likert scale of 1-5 was then used and if a response of 1 was recorded, it meant that the respondent viewed the strategy as "least preferred" while a response of 5 meant the respondent viewed the strategy as "most preferred'. A conversion of the responses/choices was then turned into a percentage using the formula suggested by Meurer and Tolles, (2017);

$$S_i = \frac{Xi}{\sum_{i=1}^{n} Xi} \quad (4)$$

Where:

$S_i$ = % score of the $i^{th}$ vulnerability management strategy;

$X_i$ = score of the $i^{th}$ vulnerability management strategy;

$\sum X_i$ = total sum of the score of all the vulnerability management strategies; and

$i$ = 1, 2, 3, ... , n are the vulnerability management strategies.

### *4.7 Presentation of results*

The presentation of findings was done in figures, tables, charts and graphs.

## 4.8 Chapter Summary

The Chapter highlighted the research plan that was adopted for the study. The study sites where the various climate change adaptation and vulnerability tendencies were analysed was identified as Chivi District, and more specifically Ward 25. A presentation of the data collection strategies and analytical approaches used in the study was also done. The next chapter is a presentation and analysis of the findings.

# CHAPTER 5:

# RESULTS PRESENTATION AND DISCUSSION

## 5.1 Introduction

In this chapter, the data that was collected was analysed and results presented in tables and graphs. The emergent responses are highlighted in preparation of the following chapter. The next sub section 5.1.1 indicates the summary of Variables of the respondents.

### 5.1.1 Socio-demographics of the respondents

Table 5.1 shows a summary statistics of the characteristics of those households that have adopted at least one climate change adaptation in terms of gender, female-headed households are generally better adopters than male-headed households (World Bank, 2016). Adopters of climate change adaptation strategies were significantly younger than non-adopters. This could be attributable to the fact that older individuals have already established their own ways of doing things over many years and are not willing to adopt new technologies for fear of risk. It could also be because these community members do not trust new ways of doing things or do not believe that climate change is a reality.

Agricultural training significantly improves the adoption of climate change adaptation strategies with household heads who have undergone agricultural training more likely to adopt climate change adaptation strategies at a less than 0.005 level of significance. Credit in this case could be given to the current curriculum in agricultural training colleges and universities that focus on issues related to sustainable agricultural practices. Marital status does not seem to have a significant effect on adoption although married heads are more likely to adopt. Although income and availability of markets are some of the most acclaimed prime movers of technology adoption, this study shows that they are not significant contributors to the adoption of climate change adaptation strategies in Chivi District Ward 25. The reason for this could be that most climate change adaptation strategies require that communities move from their previous lucrative livelihoods systems to those that are less lucrative. This would mean that availability of markets

would make communities reluctant to adopt technologies that are good for the environment but leave them with less income.

*Table 5.1: General characteristics of households in the study*

| **Household Characteristics** | | | |
|---|---|---|---|
| | Adopters | Non-adopters | Significance - P level |
| Age | 41 | 53 | 0.013 |
| Marital Status (Married) | 68.3 | 66.1 | 0.047 |
| Education (Years) | 11.6 | 10.1 | 0.098 |
| Agriculture training | 2.1% | 1.6% | 0.000 |
| **Household Characteristics** | | | |
| Size | 7.3 | 6.1 | 0.011 |
| Income | 2640.23 | 2864 | 0.094 |
| Distance to market | 2017 | 2019 | 0.245 |
| Total land Size | 3.7 | 3.2 | 0.022 |
| Grow Maize | 92.3 | 74,1 | 0.000 |
| Grow legumes | 54.9 | 45.7 | 0.000 |
| Grow Cotton | 7.9 | 6.8 | 0.000 |
| Grow Tobacco | 0 | 0 | - |
| Grow sunflower | 1.7 | 2.2 | 0.016 |
| Cattle | 61.3 | 53.9 | 0.004 |
| Donkey | 56.7 | 46.1 | 0.007 |
| Chicken | 65.9 | 62.8 | 0.093 |
| Sheep | 76.7 | 78.1 | 0.168 |

[Source: Survey data]

The final issue that is worth noting from these results is the fact that crop production is associated with higher levels of adoption of climate change adaptation strategies than livestock production. This might be because most agricultural activities that involve crops involve tilling the land and also because most climate change adaptation strategies considered in this study are applied in crop production. It can be suggested that this study could have been more useful if it also concentrated on crop-livestock interactions.

### 5.1.2 Climate change knowledge

One of the questions asked was to determine the respondents' knowledge on climate change. From the responses, it was clear that the majority of the people in Chivi Ward 25 were aware of the concept 'climate change'. Ninety-six percent acknowledged that they have general knowledge on the concept. Table 5.2 indicates that only 3.7% were not aware of what climate change is.

*Table 5.2: Knowledge on Climate change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Yes | 103 | 96.3 | 96.3 |
| No | 4 | 3.7 | 100.0 |
| Total | 107 | 100.0 | |

### 5.1.3 Information dissemination

A follow-up question about communication on the dissemination of information about climate change indicated that social media plays a huge role on climate change information sharing. Out of the 107 respondents, 54 (50.2%) indicated that the media is their source of information. The traditional communication methods such as newspapers are not playing a major role anymore as only 3 respondents (2.8%) indicated that they have access to newspapers. This is possible due to the economic situation in the area that makes them not to afford newspapers but prioritise food. Table 5.3 shows the summary of the findings.

*Table 5.3: Where you heard about climate change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Media | 54 | 50.5 | 50.5 |
| Internet | 27 | 25.2 | 75.7 |
| School/ Universities | 16 | 15.0 | 90.7 |
| Government information | 2 | 1.9 | 92.5 |

| | | | |
|---|---|---|---|
| Newspaper | 3 | 2.8 | 95.3 |
| Other | 5 | 4.7 | 100.0 |
| Total | 107 | 100.0 | |

### 5.1.4 Evidence of climate change.

The respondents were asked if they noticed that weather patterns are changing in the study area and 95.3% indicated that the weather patterns are indeed changing through noticing the weather patterns in the area. The weather changes over a long period of time can be an indicator of climate change, this response confirms the findings by ICRISAT (2013) and Foti (2020) hat climate is indeed changing. This shows that there is indeed noticeable changes that might have an impact on them. Table 5.4 illustrates the responses of the respondents.

*Table 5.4: Noticing weather pattern changing*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree Strongly | 64 | 59.8 | 59.8 |
| Agree | 38 | 35.5 | 95.3 |
| Neither | 5 | 4.7 | 100.0 |
| Total | 107 | 100.0 | |

### 5.1.5 Human causes climate change

Ninety-three percent of the respondents acknowledged that there are anthropogenic causes of climate change. This is an indication that they might be aware of the human activities that contribute to climate change. This can assist in reducing climate change because alternative activities may be used to substitute the ones that contribute to climate change. Table 5.5 illustrates that 6.7% were not aware of human activities' contribution to climate change.

*Table 5.5: Humans contribute mainly to climate change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree Strongly | 43 | 40.2 | 40.2 |
| Agree | 57 | 53.3 | 93.5 |
| Neither | 7 | 6.5 | 100.0 |
| Total | 107 | 100.0 | |

### 5.1.6 Impacts of climate change on daily activities

On the impact of climate change on their daily lives, 40.2% the respondents indicated that their workload increased as a result of the migration of the male counterparts. This is in line with the studies conducted by Mugambiwa and Tirivangasi (2017) which eluded that climate change exposes women to high risk of hash climate and the increased household chores can overwhelm them, making them anxious. Droughts, starvation and heat stress were among the responses that were cited more as effects of climate change. The responses indicated that the respondents fully understood how climate change affects them. Table 5.6 illustrates the responses.

*Table 5.6: Day-to-day impacts of climate change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Air pollution | 1 | .9 | .9 |
| Animal deaths | 1 | .9 | 1.9 |
| Biodiversity loss | 3 | 2.8 | 4.7 |
| Deforestation | 1 | .9 | 5.6 |
| Drought | 9 | 8.4 | 14.0 |
| Food insecurity | 1 | .9 | 15.0 |
| Food price rise | 2 | 1.9 | 16.8 |
| Food shortages | 1 | .9 | 17.8 |
| Heat stress | 8 | 7.5 | 25.2 |
| Heavy rains | 1 | .9 | 26.2 |

| | | | |
|---|---|---|---|
| High pollution | 1 | .9 | 27.1 |
| High production costs | 1 | .9 | 28.0 |
| Less wood fuel | 7 | 6.5 | 34.6 |
| Low income | 5 | 4.7 | 39.3 |
| Low production | 1 | .9 | 40.2 |
| Malnutrition | 1 | .9 | 41.1 |
| More workload due to male counterpart migration | 43 | 40.2 | 81.3 |
| Poor livelihood | 2 | 1.9 | 83.2 |
| Poverty | 3 | 2.8 | 86.0 |
| Soil infertility | 1 | .9 | 86.9 |
| Starvation | 8 | 7.5 | 94.4 |
| Unemployment | 3 | 2.8 | 97.2 |
| Water pollution | 2 | 1.9 | 99.1 |
| Water shortages | 1 | .9 | 100.0 |
| Total | 107 | 100.0 | |

5.1.7 Action to combat climate change

The rural women in Ward 25 indicated that they were not passive victims of climate change, but that they have some actions that they were taking to minimise the effects of climate change in the community. This has been indicated earlier by Ncube (2017) in a separate study on vulnerability of women. Table 5.7 illustrates that 57% of the respondents were taking some actions against climate change.

*Table 5.7: Action to combat climate change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Yes | 61 | 57.0 | 57.0 |
| No | 46 | 43.0 | 100.0 |
| Total | 107 | 100.0 | |

### 5.1.8 Actions to combat climate change

Climate change interventions seemed to be employed in Ward 25 of Chivi. The community was contributing to the reduction of climate change through actions. They also indicated what they would like to see happening in their area. Several responses were obtained. Gully reclamation was noted as the most common action that these rural women did. The results assume that there were increased occurrences of erosion which led to the gully formation. However, although the respondents indicated that they were aware of climate change, 41% were not taking any action this as indicated by OXFARM (2012) can make the rural women to be more vulnerable because it will exacerbate the climate change impacts. All the responses given by research participants are summarised in Table 5.8.

*Table 5.8: Actions to combat climate change.*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Afforestation | 12 | 11.2 | 11.2 |
| Awareness campaigns | 1 | .9 | 12.1 |
| Borehole drilling | 3 | 2.8 | 15.0 |
| Conservation agriculture | 4 | 3.7 | 18.7 |
| Conserving nature | 1 | .9 | 19.6 |
| Crop rotation | 1 | .9 | 20.6 |
| Enclose livestock | 3 | 2.8 | 23.4 |
| Greenhouse erection | 1 | .9 | 24.3 |
| Gully reclamation | 16 | 15.0 | 39.3 |
| Irrigation development | 3 | 2.8 | 42.1 |
| Manuring fields | 1 | .9 | 43.0 |
| Mixed cropping | 1 | .9 | 43.9 |
| New technology | 1 | .9 | 44.9 |
| No action | 44 | 41.1 | 86.0 |
| Planting grass | 1 | .9 | 86.9 |
| Protecting forests | 1 | .9 | 87.9 |
| Smart agriculture | 1 | .9 | 88.8 |

| | | | |
|---|---|---|---|
| Soil and water conservation | 6 | 5.6 | 94.4 |
| Use of pesticides | 1 | .9 | 95.3 |
| Veld fire control | 2 | 1.9 | 97.2 |
| Watering livestock | 3 | 2.8 | 100.0 |
| Total | 107 | 100.0 | |

## 5.9 Proposed interventions

Table 5.9 shows that the major strategies suggested by communities were irrigation development (20.5%), mechanisation (10.3%), farm inputs (14%) and building dams (13.1%). These findings reflect the aridity of the study area for they all seem to point at the increase in the supply of water as the most desired climate change adaptation intervention. These interventions are however costly and long term. They also reflect community reliance on external solutions from government and donors. Household brewed and managed mechanisms such as cropping systems and diversification were given little weight. This over-dependency syndrome is a worrisome finding in terms of sustainability issues and community self-reliance and will likely leave communities still vulnerable to climate change.

*Table 5.9: Proposed climate intervention strategies*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Advisory services | 1 | .9 | .9 |
| Build dams | 14 | 13.1 | 14.0 |
| Conservation agriculture | 2 | 1.9 | 15.9 |
| Create Jobs | 2 | 1.9 | 17.8 |
| Donate conservation agriculture implements | 1 | .9 | 18.7 |
| Donate water tanks | 3 | 2.8 | 21.5 |
| Drilling boreholes | 1 | .9 | 22.4 |
| Drought relief | 1 | .9 | 23.4 |
| Farming inputs subsidies | 15 | 14.0 | 37.4 |
| Food aid | 2 | 1.9 | 39.3 |

| | | | |
|---|---|---|---|
| Give Agribusiness loans | 4 | 3.7 | 43.0 |
| Grain loan scheme | 1 | .9 | 43.9 |
| Increase farming inputs subsidies | 1 | .9 | 44.9 |
| Irrigation development | 22 | 20.5 | 65.4 |
| Land reform programme | 5 | 4.7 | 70.1 |
| Mechanisation | 11 | 10.3 | 80.4 |
| Nature conservation | 1 | .9 | 81.3 |
| No idea | 1 | .9 | 82.2 |
| Not available | 2 | 1.9 | 84.1 |
| Not sure | 1 | .9 | 85.0 |
| Pass on projects | 1 | .9 | 86.0 |
| Provide extension services | 2 | 1.9 | 87.9 |
| Sink boreholes | 3 | 2.8 | 90.7 |
| Smart agricultural equipment | 1 | .9 | 91.6 |
| Subsidies on solar equipment | 2 | 1.9 | 93.5 |
| Trainings | 6 | 5.6 | 99.1 |
| Water harvesting | 1 | .9 | 100.0 |
| Total | 107 | 100.0 | |

## 5.10 Willingness to sacrifice for the Environment

With regard to the community's attitude towards climate change hazards, research participants were asked to what extent they think that human beings should sacrifice for their environment. Table 5.10 shows the responses. 76% indicated that they were willing to make sacrifices for the environment which is a positive response with regards to climate change mitigation. This implied that given alternatives to minimise human impacts on the environment, this community was willing to adopt new strategies in order to save the environment.

*Table 5.10: Willingness to sacrifice for the environment*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree Strongly | 37 | 34.6 | 34.6 |
| Agree | 45 | 42.1 | 76.6 |

| | | | |
|---|---|---|---|
| Neither | 17 | 15.9 | 92.5 |
| Disagree | 8 | 7.5 | 100.0 |
| Total | 107 | 100.0 | |

## 5.11 Views about the need to conserve nature

As part of trying to unravel community attitude towards the environment and climate change, respondents were asked if nature was strong enough to cope with climate change on its own. Their responses are summarised in Table 5.11. More than half of the respondents thought that nature is able to survive the vagaries caused by humans and other activities so there is no need to change human behaviour to save the environment. Some based their attitude on the religious belief that God will never allow human activity to destroy the earth. This can be a dangerous attitude since it interferes with efforts being made to change human behaviour to save the environment.

*Table 5.11: Views about the need to conserve nature*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree strongly | 20 | 18.7 | 18.7 |
| Agree | 41 | 38.3 | 57.0 |
| Neither | 5 | 4.7 | 61.7 |
| Disagree | 17 | 15.9 | 77.6 |
| Disagree Strongly | 24 | 22.4 | 100.0 |
| Total | 107 | 100.0 | |

## 5.12 Causes of climate change

Table 5.12 shows what community members think about being the main contributors to climate change. It is good to note that communities realise that deforestation and overpopulation, which results in human pressure on the environment, are major contributors to climate change. They also mentioned veld fires as the major contributor to climate change and this is consistent with the generally accepted theories. The responses revealed that communities get this kind of knowledge from radio, forestry commission and agricultural extension agents. It is however rather

concerning that communities downplay their own agricultural activities as contributors to climate change.

*Table 5.12: Contributors to Climate Change*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Air pollution | 2 | 1.9 | 1.9 |
| Anthropogenic pressure | 19 | 17.8 | 19.6 |
| Artisanal mining | 1 | .9 | 20.6 |
| Clearing of land | 3 | 2.8 | 23.4 |
| Deforestation | 38 | 35.5 | 58.9 |
| Greenhouse gases | 8 | 7.5 | 66.4 |
| High temperature | 11 | 10.3 | 76.6 |
| Industries | 4 | 3.7 | 80.4 |
| Not sure | 2 | 1.9 | 82.2 |
| Overgrazing | 1 | .9 | 83.2 |
| Poor agricultural practices | 1 | .9 | 84.1 |
| Soil erosion | 4 | 3.7 | 87.9 |
| Urbanisation | 1 | .9 | 88.8 |
| Veld fires | 12 | 11.2 | 100.0 |
| Total | 107 | 100.0 | |

## 5.13 Climate change adaptation strategies

### i) Disaster response

When asked which climate change adaptation strategies the communities would recommend, the results given are summarised in the Table that follows. Close to 74% agree that the establishment of efficient and effective disaster response mechanisms is a potentially good climate change adaptation strategy. This showed that communities need these to be established both at national and community levels. A number of disasters that have occurred in the district mainly related to droughts and floods in some years have seen communities establish their own mechanisms of developing disaster response mechanisms. However at national level, these mechanisms are often very few or even non-existent in times of disasters especially in Chivi District.

*Table 5.13: View about the need for a disaster response system*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree Strongly | 16 | 15.0 | 15.0 |
| Agree | 63 | 58.9 | 73.8 |
| Neither | 18 | 16.8 | 90.7 |
| Disagree | 5 | 4.7 | 95.3 |
| Disagree Strongly | 5 | 4.7 | 100.0 |
| Total | 107 | 100.0 | |

ii) Insurance schemes

Insurance schemes are often an effective way of coping with risk and disasters especially those caused by weather and climatic variations. However, these are difficult to organise especially at community level. National insurance systems are either too weak or too expensive and beyond the reach of most community members. Accordingly, community members in the study area share the same sentiments as shown in Table 5.15 with a considerable number of respondents strongly disagreeing to the idea of insurance schemes as compared to other strategies.

*Table 5.14: Views about the need for insurance schemes*

| | Number of respondents (N=107) | Percent | Cumulative Percent |
|---|---|---|---|
| Agree Strongly | 15 | 14.0 | 14.0 |
| Agree | 37 | 34.6 | 48.6 |
| Neither | 18 | 16.8 | 65.4 |
| Disagree | 24 | 22.4 | 87.9 |
| Strongly Disagree | 13 | 12.1 | 100.0 |
| Total | 107 | 100.0 | |

iii) Sustainable agricultural practices

The promotion of sustainable agricultural practices is one of the methods that was mentioned as a climate change adaptation strategy. The activities that some non-governmental organisations were promoting in the area such as tied ridging were well received by the community members as indicated in Figure 5.1.

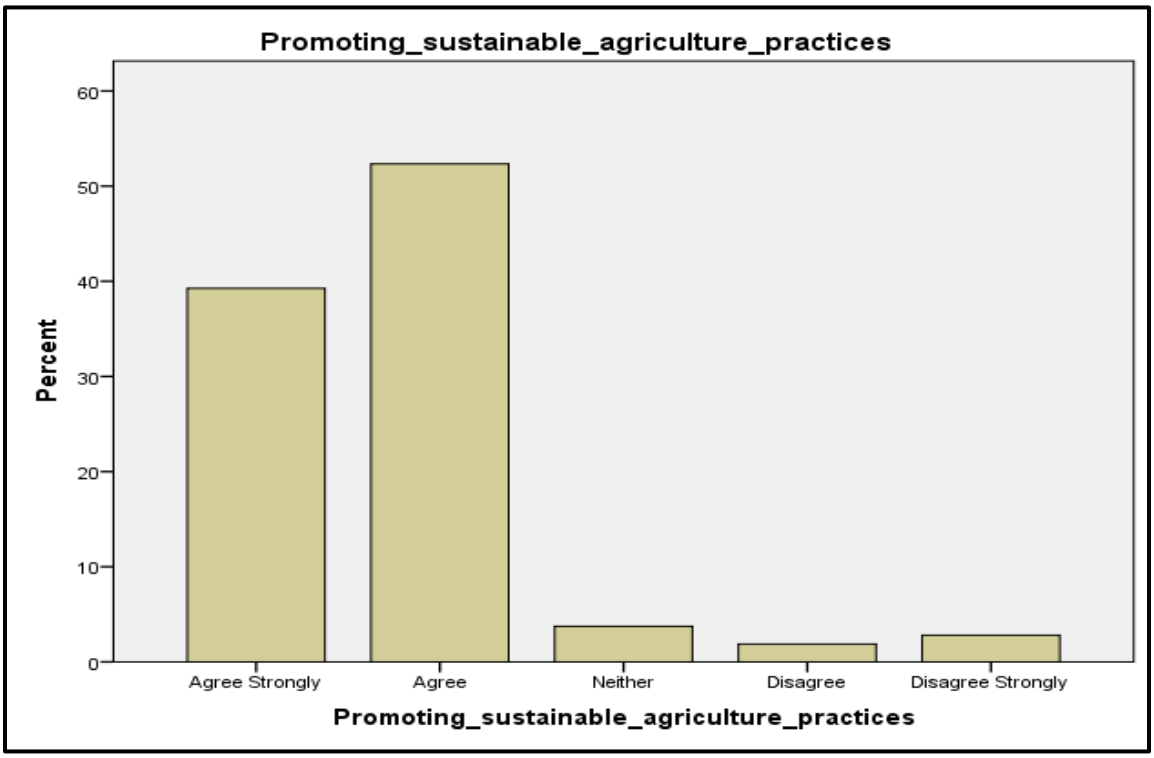


*Figure 5.1: Views on the need for promoting sustainable agricultural practices*

iv) Improved irrigation schemes

Although irrigation is one of the most expensive ways of adapting to climate change, it can be very effective if well managed. The disadvantages for most irrigation systems is that if not well managed, they will eventually collapse due to a number of factors such as wear and tear of the irrigation equipment, disputes in water sharing and drying up of water bodies used for irrigation. Figure 5.2 shows the responses that were given by the community members regarding irrigation.

Approximately 80% of the respondents either agreed or strongly agreed that irrigation improvement provides a good opportunity to deal with climate induced risk. This is mostly because from the farmer's point of view, once the government has established the irrigation scheme,

irrigation becomes easier and can yield high returns from the improved crop yields. From the social and economic point of view however, irrigation can be very expensive especially if we factor in the costs of constructing water bodies, the displacement of people in the establishment of the schemes and the initial costs of establishing the scheme and making it work.

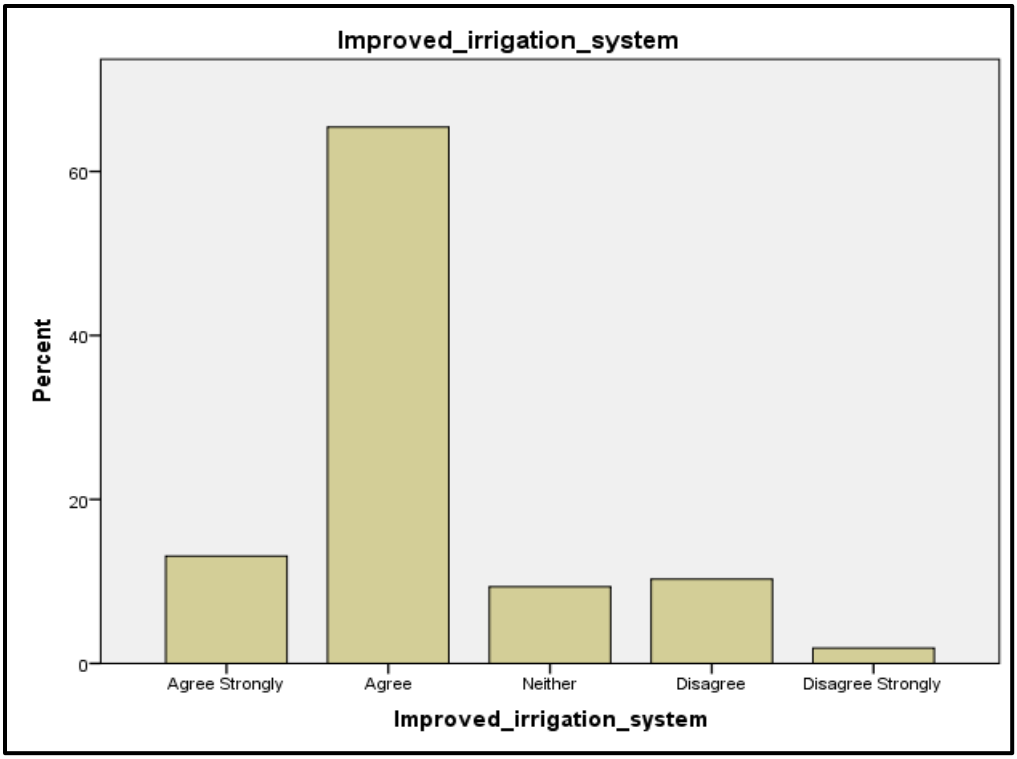


*Figure 5.2: Views about the need for irrigation*

v) Vulnerability assessment

Vulnerability assessment is normally carried out by the government and some non-governmental organisations. The capacity to carry out these assessments is usually limited and assessments are usually carried out in a reactionary manner after a climatic disaster has already taken place. Such assessments are usually hurriedly done and ineffective. Communities feel that improved vulnerability assessments can be a good way of preparing for climate risks as indicated by their responses summarised in Figure 5.3.

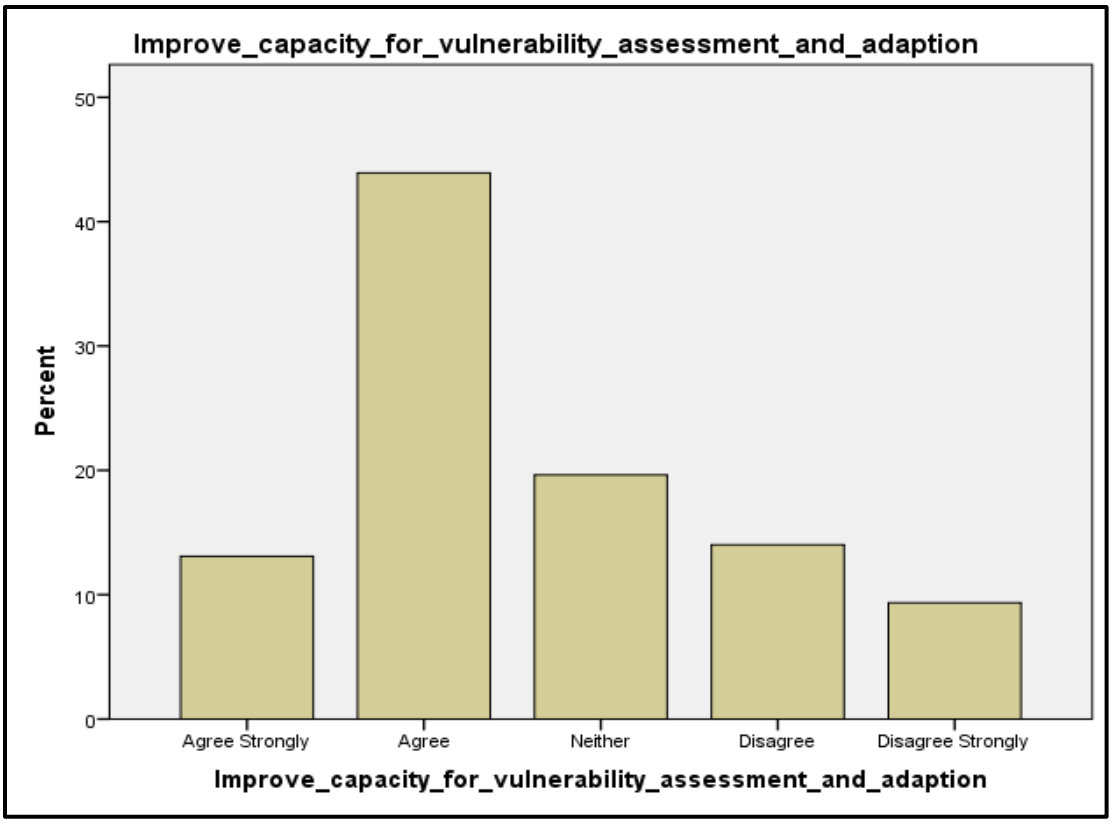


*Figure 5.3: Views about the need for improving capacity*

vi) Skipping meals

As shown in Figure 5.4, one way of dealing with the hunger brought about by climate change is to skip meals. This is a difficult and unhealthy way of adapting to climate change but it is one that is very popular in the study area of Chivi. More than 50% of the households think that it is an effective way of dealing with climate change induced hunger. The side effects of skipping meals can be negative especially to child nutrition.

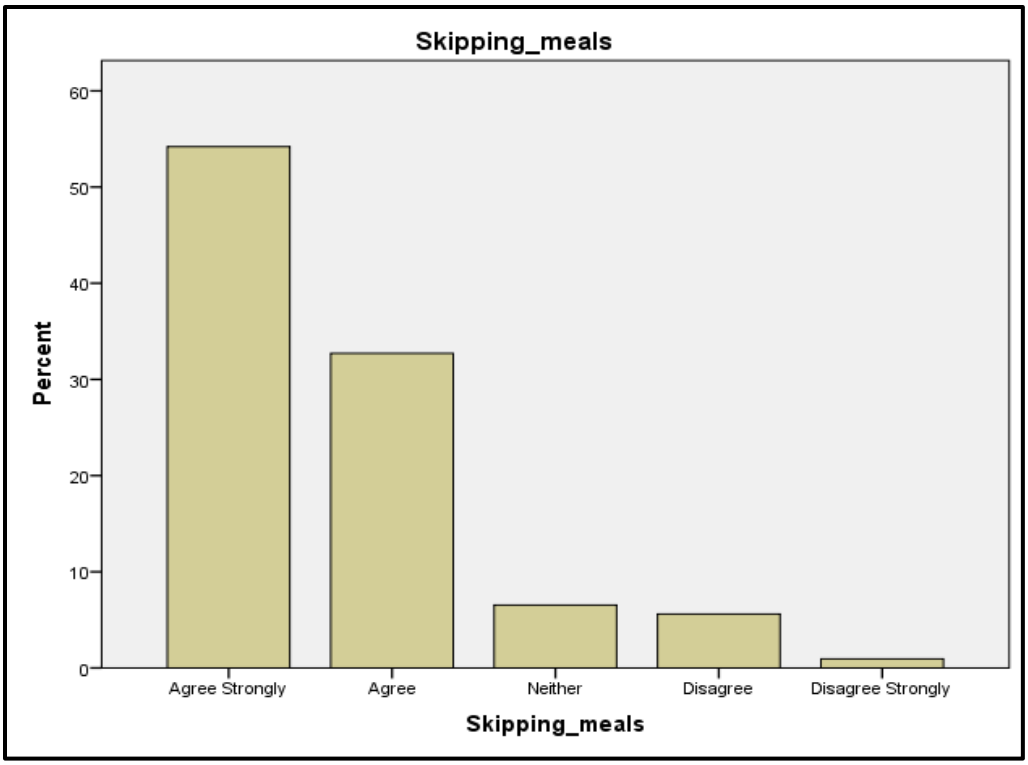


*Figure 5.4: Views about skipping meals*

vii) Selling farm assets

The selling of farm assets is one of the most desperate and retrogressive ways of dealing with climate induced disasters. It leaves households worse off especially if the assets being disposed of are production implements. However, as illustrated in Figure 5.5, communities in Chivi District rank the sale of assets as one of the most commonly used ways of dealing with climate famine. The sale of assets during famine has left most households in the study area without productive capacity and has led to a poverty cycle. Households get poorer and their future ability to cope with risks is highly compromised making them more vulnerable The SLF emphasised the importance of availability and access to livelihood assets as one way of achieving favourable outcomes, the disposal of these capitals may contribute to vulnerability of rural women. .

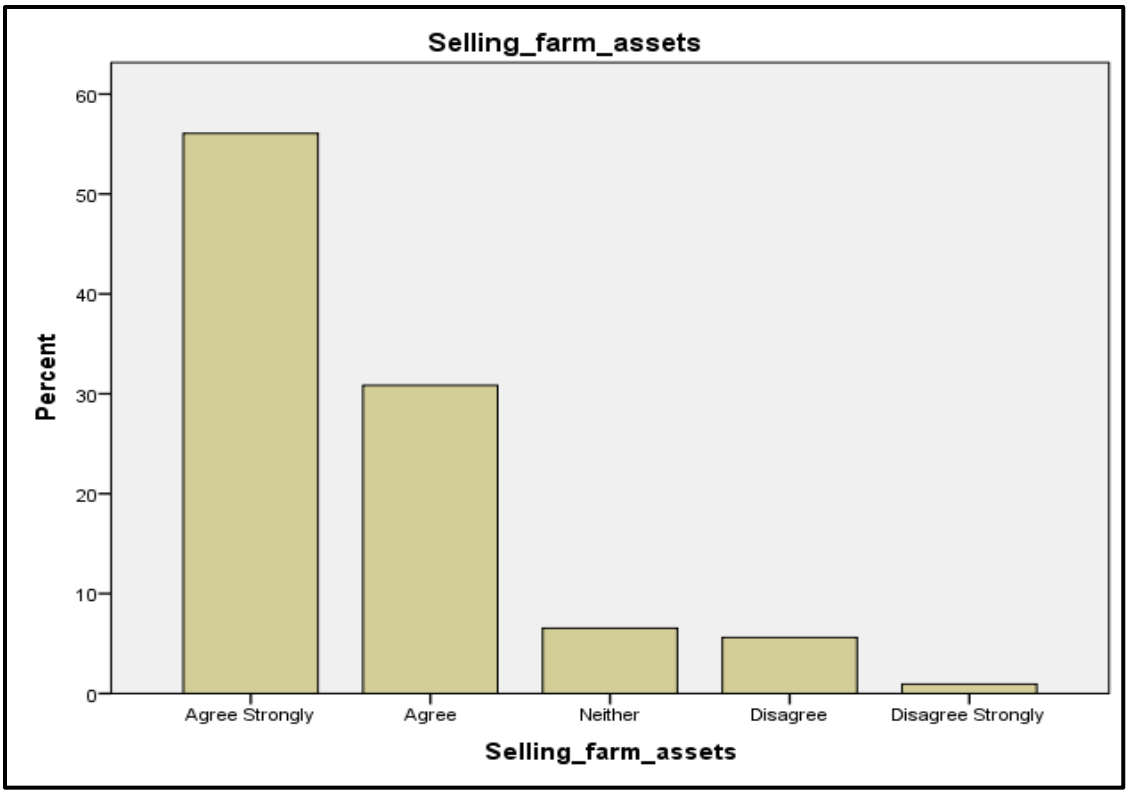


*Figure 5.5: Views about the need for selling farm assets*

## viii) Social clubs

Social clubs and a number of cooperative related associations help communities to share or pool risks this advocates the views of the SLF which places people at the centre and values the human capital as a way of building resilience. Shocks that come as a result of climatic disasters are shared by a bigger entities and they do not affect individuals severely. About 60% of respondents as indicated in Figure 5.6 agree that social clubs are valuable in reducing the impact of climate induced risk. Social clubs as a form of social capital provides immediate relief in the event of a disaster whilst waiting for assistance from the government of non-governmental organisations. However, the effectiveness of these clubs is dependent on the availability of resources and the social cohesion that exists among community members.

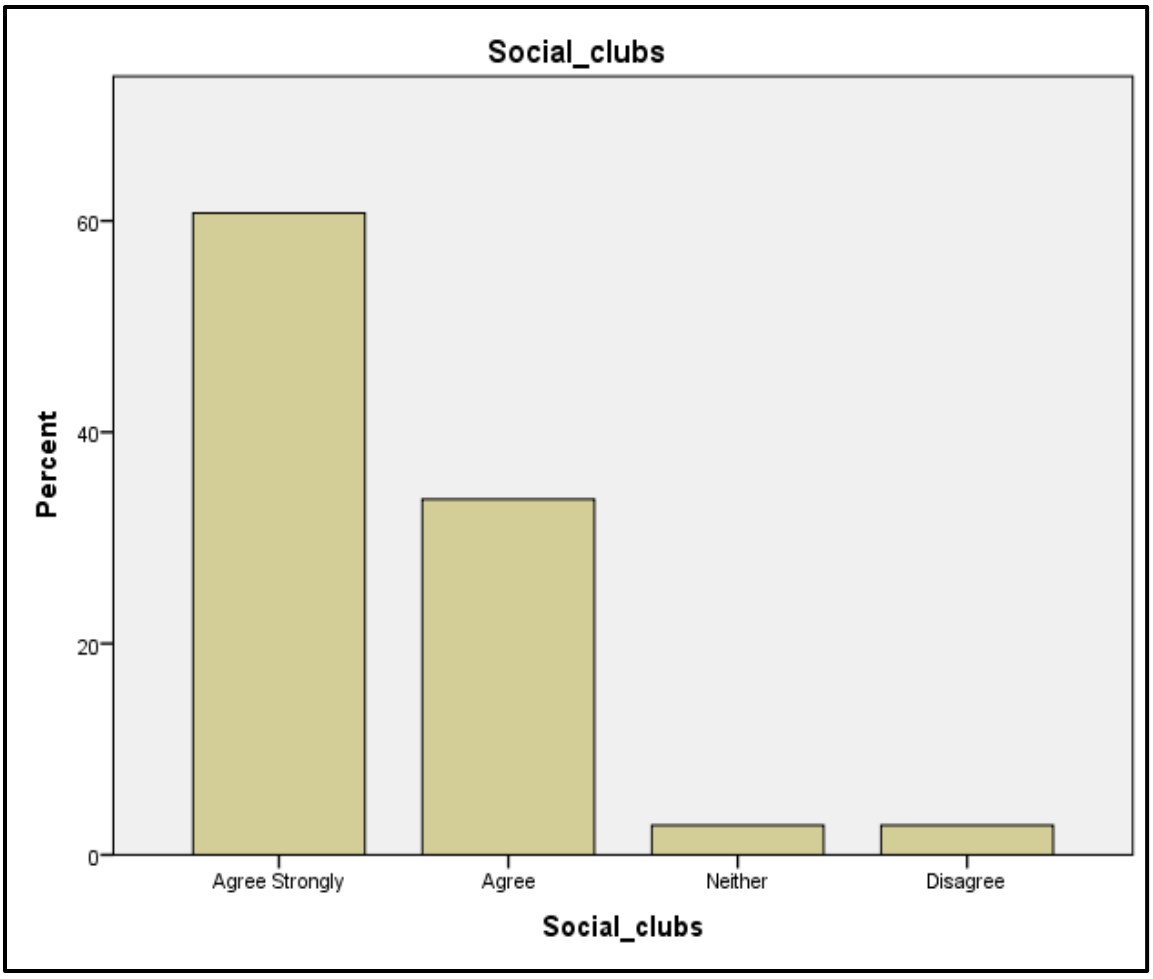


*Figure 5.6: Views about the need for social clubs*

ix) Use genetically modified foods organisms

Genetically modified organisms are a quick fix to issues of food and nutrition security. Chivi District is in the arid areas of Zimbabwe where poverty and hunger are common. Anything that provides a quick solution to the plight of these communities is a welcome development and hence the idea of genetically modified organisms was highly ranked by most of the interviewed community members as illustrated in their responses in Figure 5.7. The use of drought resistant crops will be more ideal in the area as responses in the previous questions suggested that the area is arid.

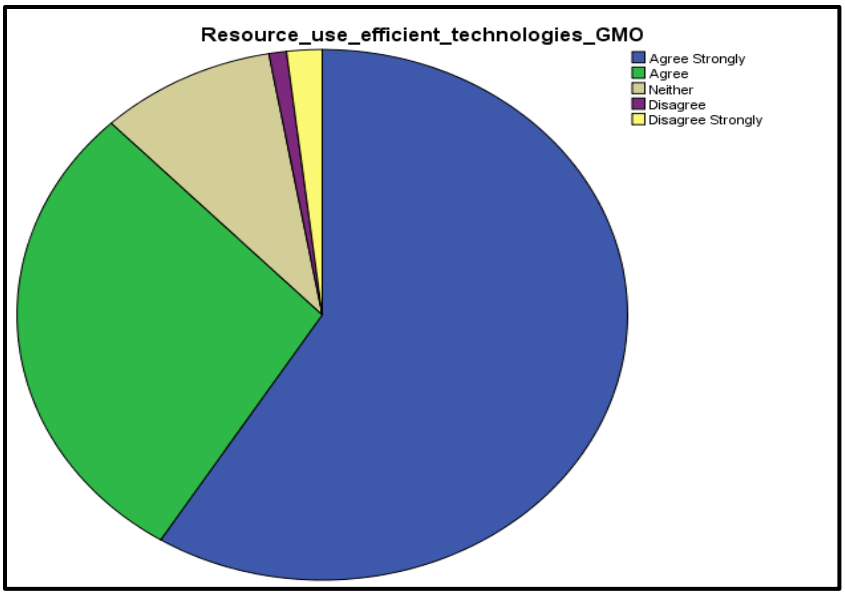


*Figure 5.7: The need for genetically modified organisms*

## 5.2 The Adoption of Climate Change Adaptation Strategies

Results of the logit model that was run to find out the factors affecting the adoption of climate change adaptation strategies are shown in Table 5.8. As indicated in this Table 5.8, age has a significant negative impact on the uptake of climate change adaptation strategies. Older farmers seem to be reluctant to adopt new climate innovations than younger farmers. Responses revealed that this is mainly because these farmers do not trust new ways of doing things. Younger farmers, on the other hand, are relatively more educated and they understand and welcome change. They are also keen to experiment and can therefore easily adopt new climate change innovations. A one year increase in age decreases the chances of adoption of climate change technologies by 7.3%.

Married respondents were more likely to adopt climate change technologies than those that are not married. This is probably because married women have more resources or capitals than those that are not married (including widows). They are therefore less risk averse and are fearless of trying new strategies. The other reason could be that men are generally risk takers, so women who are married are more likely going to be influenced by their male partners to adopt technologies.

*Table 5.15: Results of the Logit Model – Dependent Variable: Adopt climate change adaptation strategy*

| **Variable** | **Logit** | | **Marginal Effects** | |
|---|---|---|---|---|
| | Coefficient | S.E | Coefficient | S.E |
| Age of Head (years) | -1.66* | 0.015 | -0.073* | 0.091 |
| Married | 0.98* | 0.127 | 0.110* | 0.081 |
| Income | 1.04* | 0.03 | 0.041* | 0.012 |
| Distance from market | -1.11 | 0.035 | -0.031 | 0.083 |
| Labour availability | 2.34** | 0.124 | 0.055** | 0.167 |
| Membership | 1.23** | 0.087 | 0.084** | 0.064 |
| Formal Agricultural Training | 1.56*** | 0.113 | 0.133*** | 0.018 |
| Access to extension | 1.63** | 0.105 | 0.099** | 0.059 |
| Land Tenure (Fixed) | 1.34* | 0.072 | 0.088* | 0.031 |
| Farm size (acres) | 2.17* | 0.067 | 0.014* | 0.024 |
| Information | 0.98* | 0.052 | 0.063* | 0.033 |
| Intercept | 3.44 | 0.271 | 0.021 | 0.065 |
| *Significant at 10% level, **Significant at 5% level, ***Significant at 1% level | | | | |

Income has its expected positive impact on the adoption of climate change strategies while distance to markets also has the expected negative but insignificant sign. The higher the income the more the capability of households to take up innovations and also the less risk averse an individual becomes. Richer individuals and households are more likely to take up new innovations because they are less risk averse. The insignificance of markets in the adoption of climate change innovations is however in contradiction with the generally known phenomenon. Markets formally push technologies through the farming system. The lack of a significant impact of markets in encouraging the adoption of climate change adaptation strategies in this case could be due to the fact that farmers in the study area do not market their produce because they hardly produce any marketable surpluses.

Climate change adaptation and coping strategies are generally labour intensive. The highly significant impact of labour availability on the adoption of climate change technologies in Chivi District is therefore not surprising. A one unit increase in the availability of labour results in a 16.7% chance of adopting climate technologies. This could also be due to the fact that labour in the study area is a scarce resource since most able bodied women and men have migrated either

to urban areas or to neighbouring countries or they are concentrating on illegal gold mining as an adaption strategy.

The local government of Chivi District and some NGOs have facilitated the formation of groupings in the form of clubs, cooperatives and other associations. Some of these groupings are even an initiative of communities themselves without the assistance of either the government or any NGOs. The clubs range from savings clubs to agricultural cooperatives and funeral societies. Membership of these clubs, especially those related to agriculture and nature conservation, were found to positively affect the adoption of climate change technologies. One of the reasons is that it is easier to communicate climate change information through clubs than it is through individual households. Positive peer pressure is also another reason as farmers learn from each other and imitate or even compete with each other to reinforce positive behaviour. This study found that club membership increases the chances of a farmer adopting climate change adaptation strategies by 6.4% significant at the 5% level of significance.

The Knowledge, Attitude and Practice (KAP) framework postulates that knowledge changes attitude, which in turn changes practice or behaviour (Akpeh *and* Ezeoke, 2017). Results from this study support this notion for the rural women farmers in the study area. Both training in agriculture and access to agricultural extension advice had a highly significant impact on the adoption of climate change adaptation strategies. Training in agriculture had an 11.3% increase in the chances of adopting climate change adaptation strategies while access to extension advice had a 9.9% impact. These impacts are significant at the 1% and the 5% levels of significance respectively. This finding is not surprising because issues related to climate change and nature conservation form a significant part of agricultural training and agricultural extension advice. The number of times that communities are exposed to this information (information in Table 4.5) is also significantly positively related to the adoption of climate change technologies. NGOs also had a role to play in this for they work with government extension officers in the study area to promote smart agriculture and also nature conservation. These NGOs include the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and CARE international.

The study also revealed that fixed land tenure arrangements promote the adoption of climate change adaptation strategies in Chivi District Ward 25. Farmers with a fixed land tenure arrangement have an 8.8% higher likelihood of adopting climate change adaptation strategies than those without a fixed land tenure arrangement. Adoption of climate change adaptation

strategies may need some substantial and permanent investments on the land. Farmers with a temporary tenure arrangement are not likely to be willing to make such commitments to the land that does not belong to them. The size of the land is also another driving factor to the adoption of climate technologies with farmers that own larger pieces of land being more likely to adopt climate change adaptation technologies than those who own smaller pieces of land. This could be attributable to the fact that farmers who have larger pieces of land have more capital than those with smaller pieces of land or because the former have the flexibility of trying things on their land unlike the latter.

## 5.3 Other climate change adaptation strategies that can be implemented

The respondents were also asked about the potential solutions to their existing climate change induced vulnerability. The key focal targets were extracted so as to understand how the women respondents felt about what could be done better to manage climate change induced vulnerabilities in their communities. Table 5.9 shows a summary of the elements in the social and economic realm which need to be realigned to the realities of the climate change shocks.

The results indicate that the traditional climate adaptation strategies can and need to be modified to enhance their responsiveness to climate change. There are indications from the study that these options are more 'preferred' but due to numerous limitations, the women in the study area still do not use them. This might be due to the motivation to recuperate investments as opposed to the dependency on support from government subsidies, communities and NGOs. FAO (2011) also reviewed time series evidence on efficiency differences in revolving climate change vulnerability management in more integrated schemes in a number of countries. Their methodological overview included an indirect measure of stakeholder participation and resources usage patterns by estimating the frequency of use with particular revolving scheme options.

A comprehensive respondent thematic scrutiny was done to understand more about how respondents perceive the various untapped vulnerability reduction choices in terms of their potential to enhance and sustain livelihoods. A summary of the specific respondents' thematic reactions is presented. Generally, the respondents reported that the existing adaptation strategies are limited and hence the low flexibility in the choices across sub-systems of these merged options. This then motivated the study to further explore the specific elements that need

modification and thus currently limiting the uptake of the climate change induced vulnerability alternatives for climate change management. The expectations by the respondents in redesigning the various vulnerability management modes for effectively managing climate change induced shocks were scored and are shown in Table 5.9.

*Table 5.16: Summary of alternative adaptation strategies*

| Alternative adaptation strategies | Percent |
|---|---|
| Curtailing crop diseases | 3.8 |
| Soil fertility enhancement | 1.9 |
| Landslide management | 2.9 |
| Efficient crop production | 4.8 |
| Floods recessions | 4.4 |
| Drought mitigation | 4.2 |
| Afforestation | 2.8 |
| Awareness campaigns | .9 |
| Borehole drilling | 4.8 |
| Conservation agriculture | 6.7 |
| Conserving nature | .9 |
| Enclose livestock | 2.8 |
| Gully reclamation | 7.0 |
| Irrigation development | 15.4 |
| Mixed cropping | 9.9 |
| New technology | .9 |
| No action | 18.1 |
| Smart agriculture | 5.9 |
| Veld fire control | 1.9 |
| **Total** | **100.0** |

[Source**:** Survey data]

To further understand, the women respondents were asked around what specifically need to be done so as to formulate more accommodative adaptation strategies based on findings in Table 5.9. This section presents the findings.

i) The potential to reduce management costs.

The participating respondents expressed that the expected benefits of lowered management costs as a result of using efficient integrated vulnerability reduction schemes which acknowledged the space of on farm and off farm options. They also noted that for the benefits to be sustained, there is need to strengthen communication and other soft skills such as negotiating and bargaining through training support among women.

One female farmer stated that:

> *"It [the crop based integrated management scheme option] reduces the time of scouting for input and output markets since in most cases the farmers are located closer to their points of marketing. This reduces the transaction costs of doing business and reduces climate change induced risks of for example late planting. Additionally, most of the inputs for conventional crops such as maize are highly subsidized by the government and NGOs thus pushing other more competitive crops such as sorghum and millets out of production matrices".*

The findings are also confirmed in empirical work on multiple challenges with maize and sorghum support programmes in South Africa by Poonyth, van Zyl, and Meyer, (2000). They argued that if climate change vulnerability management schemes are to continue as if they are isolated interventions, the rural communities, especially women will always be vulnerable.

ii) Limitations for rural women on the management platforms to extract real value

Any innovation platform's role is to provide long-term solutions to the challenges faced by especially marginalised people from core decision-making systems, in this particular study, the rural women (Van Rooyen and Homman, 2007). If not well infused and integrated, they (rural women) always lag behind the innovation advancement revolutions and extract limited value from these platforms. From the findings, the most significant challenge with the women farmers in Chivi Ward 25 is lack of capital to purchase high technology and modern equipment to use for the management of the crop-livestock integrated scheme programmes, hence resulting in poor productivity and limited benefits. This result in rural women farmers adhering to their traditional practices which do not blend and commercialise crops and livestock. In addition, there are limited

platforms for the rural women to be involved in decision-making processes both at local and national levels.

## 5.4 Chapter Summary

The findings of the research were presented and discussed so as to draw conclusions and recommendations on the research. Dimensions as guided by the research questions on climate change coping strategies adoption determinants and the various dimensions of vulnerability management by the respondents were looked at. The next chapter presents the summary of the study's conclusions and recommendations based on the research findings.

A good chapter that could be better presented if the candidate paid attention to the Tables and figures. Discussion also hardly makes reference to literature and theoretical frameworks discussed above.

# CHAPTER 6
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Introduction

This study used a mixed method research design that included a questionnaire survey to unravel the vulnerability of rural women and the adaptation strategies to climate change in Chivi District, Ward 25 to climate change. Descriptive statistics were used to present the results of the study and data analysis took the form of a logit regression analysis. This was done in order to determine the factors affecting the take up of climate change adaptation strategies. Additionally, communities' vulnerability to climate change was described using stakeholder mapping techniques.

## 6.2 Summary

Results from the study point out to the fact that research subjects are knowledgeable about climate change, its causes and its effects. Their adaptive and coping capacity however, is impeded by a number of factors. They mentioned veld fires as the major contributor to climate change and this is consistent with the generally accepted theories. This implies that climate change knowledge systems are working in raising awareness on issues of climate change. The low rates of policy adoption could be due to the fact that communities do not have alternative ways of livelihoods other than to over-rely on natural resources and the lack of capital to diversify their livelihoods.

The respondents also know that cutting down trees and burning forests are responsible for climate change, yet the District and the study area in particular is famous for deforestation. The reason for this is that communities do not have alternative sources of fuel and with the increasing population growth, the communities have to clear land for crop production despite the fact that the area is not suitable for crop production. It can therefore be recommended that provision of alternative fuel sources and the promotion of adaptable farming systems such as small livestock production could be the best climate smart strategies for these communities. Resettlement of farmers to other areas that are suitable for crop production without harming the environment could be another solution.

## 6.3 Conclusions

In this study, a number of factors were found to affect the willingness and ability of communities in Ward 25 of Chivi District to adopt climate change adaptation strategies. Older farmers were found to have low rates of adoption mostly because they adhere to their old ways of life. Intensifying and targeting climate change knowledge dissemination systems to this group of people can be a useful strategy. This should be done by packaging and disseminating the knowledge in a way that they understand and accept. So instead of using print and other electronic media that are usually accessible to the younger generation, it might be best to use more traditional ways of communication such as “word of mouth” through farmer groups and other forms of clubs and gatherings.

Knowledge continued to dominate as a factor affecting the adoption of climate change adaptation strategies by communities in Chivi District. Formal agricultural training and access to agricultural extension advice plays a significant role in the adoption of climate change adaptation strategies. The recommendation that comes along with this finding is that schools and colleges should keep on the role they are playing in imparting knowledge to young people. In the same light, agricultural extension systems should be strengthened and supported to maintain and even increase their contribution to the adoption of climate change technologies. The private sector and NGOs should also support the existing knowledge systems.

Since shortage of labour has been found to be a limiting factor in the adoption of climate change technologies due to migration in the study area, substituting labour using machinery can be a plausible recommendation especially if cheap, affordable machinery can be found. In addition, the migration of the able bodied women and men to urban areas and neighbouring countries to seek lucrative opportunities, can be reduced by creation of livelihood opportunities in the local areas to trap the labour that would otherwise be lost through migration. Making agriculture lucrative through the creation of markets or provision of inputs can be also a viable solution.

The formation of community groups, clubs or cooperatives was found to have a positive impact on adoption of the climate change adaptation strategies by women. The local government of Chivi District and some NGOs can therefore facilitate the formation of groupings in the form of clubs, cooperatives and other associations and offer trainings on climate change to the clubs and not to individuals. Both training in agriculture and access to agricultural extension advice can have a highly significant impact on the adoption of climate change adaptation strategies. The study also

revealed that fixed land tenure arrangements promote the adoption of climate change adaptation strategies in Chivi District Ward 25*.*

Management of vulnerability shocks was also explored in the study. There is evidence showing that the rural women acknowledge that the current practices need to be realigned to the emerging climate change impacts in the communities. The strategies to reduce vulnerability need to be anchored on some critical aspects. These include the ability to be taken up by all due to lower costs of implementation and the appetite for the strategy to enable stakeholders to extract acceptable levels of value from its adoption.

## 6.4 Recommendations

It therefore becomes more strategic for programmers to include women in the decision making processes when choices about which vulnerability reduction strategies are to be implemented. This will help the strategies to become more relevant to the communities and enhance their implementation. In the process, they can be able to make more inroads by providing the services to potential communities who are currently underserved and more vulnerable to climate change shocks more than ever.

The study can go beyond the cross-sectional data which it used and also use secondary data to understand historical decisions surrounding climate change mitigation strategies and their effectiveness over time while targeting the various categories of stakeholders more directly. The study can also be expanded to include more Wards in the District to get more insight into the issues surrounding climate change induced vulnerability across the locations.

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## APPENDIX A: QUESTIONNAIRE


**Master's Dissertation Questionnaire:** ***An analysis of the vulnerability and climate change adaptation strategies of rural women in Chivi District, Zimbabwe.***

My name is Tendai Mapingure and I am currently studying for a Master's degree in Disaster Management at the University of Free State. I am conducting research on the above topic. The questionnaire consists of few questions and will take no longer than 15 minutes to complete. All responses will be kept anonymous and no one will be identifiable in the research. You are free to withdraw from completing this questionnaire at any point or to leave out any question you feel uncomfortable to answer. The information you provide will be used strictly for academic purpose. The outcome of the research will be shared with you and the Chivi Community as my academic contribution to address adaptation to climate change issues in the area. Please answer the questions as objectively as possible.

Please tick the box provided to show your consent to be part of the research ☐

**SECTION A: Demographic information**

**1. What is your gender?**

☐Male ☐Female

**2. How old are you?**

☐18-29 years ☐30-39 years ☐40-49 years ☐50-59 years ☐60 + years

**3. What is your marital status?**

☐Single ☐Married ☐Divorced ☐Widowed

**4. What is your employment status?**

☐Employed ☐Unemployed ☐Self Employment

**5. What do you do for a living?**

**……**

**6. What is your level of education?**

☐University graduate ☐High school graduate ☐Primary education ☐No formal education

**7. Which geographic location best suits where you leave?**

☐Urban area ☐Semi-Urban ☐Rural area

**8. How long have you stayed in Chivi District?**

☐less than 5years ☐5 to 10years ☐10 to 15years ☐Above 15 year

**<u>SECTION B</u>: This section will evaluate your level of awareness regarding Climate Change**

**1. Do you know what climate change is?**

☐Yes ☐No

**2. If yes to question 1, explain in your own words what you understand by climate change.**

……

……

**3. Has climate change ever affected you?**

☐Yes ☐No ☐Don't know

**4. Where have you heard about climate change?**

☐Media ☐Internet ☐Schools/Universities ☐Government information

☐Newspaper ☐Other (please supply information) …….

**5. Tick the most suitable**

| | Climate Change | Agree Strongly | Agree | Neither | Disagree | Disagree Strongly |
|---|---|---|---|---|---|---|
| **6** | It poses a threat for people around the world | | | | | |
| **7** | It poses a threat to you and your family | | | | | |
| **8** | Humans are the main contributors to climate change | | | | | |
| **9** | Media is raising awareness about climate change | | | | | |
| **10** | Do you think climate change has a role in the quality and quantity of crops harvested | | | | | |
| **11** | There is evidence of soil erosion in Chivi village | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **12** | Climate change has an effect on temperature and rainfall pattern | | | | | |

**13. Have you ever taken any action that will help combat climate change?**

☐Yes ☐ No

**14. If yes, what did you do/ are you doing?**

……

……..

……

**15. Do you think climate change can be combated?**

☐Yes ☐ No

**16. If yes to question 15, what do you think can be done to solve the issue climate change?**

……

……

……

**<u>SECTION C</u>: General views about farming and the environment**

**1. What is the size of your farming land?**

☐<1 Hectares ☐1-2 Hectares ☐3-4 Hectares ☐5> Hectares

**2. What is the current state of the land ownership?**

☐Own ☐Leased from third party ☐Owned by government ☐Family farm ☐Communal farm ☐Other (specify)……

**3. Which crops do you farm?**

☐Maize ☐Leguminous crops ☐Sorghum ☐Wheat ☐Other (Specify)……

**4. What assets are in your possession?**

☐ Tractors ☐Irrigation system ☐Borehole ☐Other (Specify)……...

**5. Where do you get water for domestic use?**

☐ Ground water well ☐Tap ☐Borehole ☐Other (Specify)……...

**6. Do you get support from government?**

☐Yes ☐No

**If yes, explain how**

.....

……

**7. Do you get support from NGO's and NPO's?**

☐Yes ☐No

**If yes, how?**.....

**8. What do you think government should do to help you?**

……

……..

**9. Tick the most suitable**

| | | Agree Strongly | Agree | Neither | Disagree | Disagree Strongly |
|---|---|---|---|---|---|---|
| **10** | Humans are severely abusing the planet | | | | | |
| **11** | I am willing to sacrifice for the sake of the environment | | | | | |
| **12** | Nature is strong enough to cope with climate change | | | | | |
| **13** | If my job contributes to environmental problems, I would rather be unemployed | | | | | |
| **14** | Do you feel the pattern of weather is changing? | | | | | |
| **15** | Plants and animals have equal rights with humans | | | | | |

**<u>SECTION D:</u> Vulnerability and impact of climate change**

**1. Do you agree or disagree with the following impacts of climate change on agriculture?**

| | Impacts | Agree | Disagree |
|---|---|---|---|
| **2** | Crop diseases | | |
| **3** | Soil fertility | | |
| **4** | Soil erosion | | |
| **5** | Landslide | | |
| **6** | Crop production | | |
| **7** | Increased temperature | | |
| **8** | Floods | | |
| **9** | Drought | | |

**10. What do you think is the major contributor of climate change here?**

……

……

**11. What other impacts do you think climate change has on agriculture?**

……

……

**12. What other impacts do you think climate change has on your day to day life?**

……

……..

**<u>SECTION E</u>: Climate Change adaptation strategies**

**1. Which climate change adaption strategies are in place in your community?**

| | **Strategies** | **Agree Strongly** | **Agree** | **Neither** | **Disagree** | **Disagree Strongly** |
|---|---|---|---|---|---|---|
| **2** | Soil erosion prevention measures | | | | | |
| 3 | Infrastructure (drainage system) | | | | | |
| **4** | Insurance schemes | | | | | |
| **5** | Disaster response | | | | | |
| **6** | Promoting sustainable agriculture practices | | | | | |
| **7** | Improved irrigation systems | | | | | |
| **8** | Improve capacity for vulnerability assessment and adaptation | | | | | |
| **9** | Skipping meals | | | | | |
| **10** | Selling farm assets | | | | | |
| **11** | Social clubs | | | | | |
| **12** | Resource-use efficient technologies (GMO) | | | | | |
| **13** | Growing multiple crops and a variety of livestock | | | | | |

**14. What other mitigation strategies do you think can be implemented to mitigate the impacts if climate change?**

**……**

**……**

**Thank you for participating in this survey.**

# APENDIX B: ETHICAL CLEARANCE

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS UV

**GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)**

07-Dec-2020

Dear Ms Tendai Mapingure

**Application Approved**

Research Project Title:
**An analysis of the vulnerability and climate adaptation strategies of rural women in Chivi District, Zimbabwe.**

Ethical Clearance number:
**UFS-HSD2020/1710/0512**

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

**Dr Adri Du Plessis**
**Chairperson: General/Human Research Ethics Committee**

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