

**The effects of climate change on rural livelihoods in Indaba ward, Zvishavane
By Tenson Shoko : 2015**

Dedication

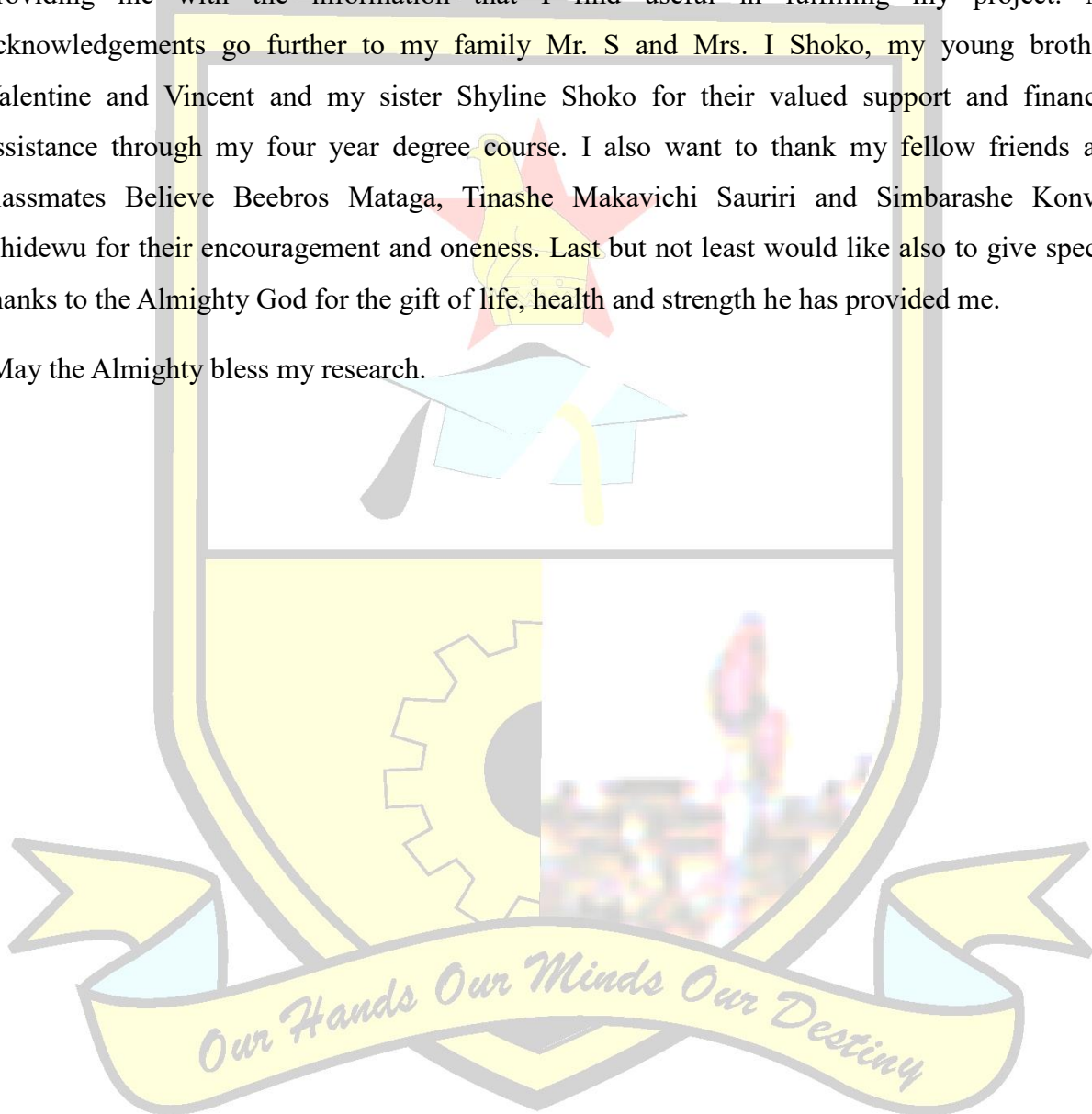
To my caring and loving parents Mr. S. and Mrs. I Shoko for making this research successful.



Acknowledgements

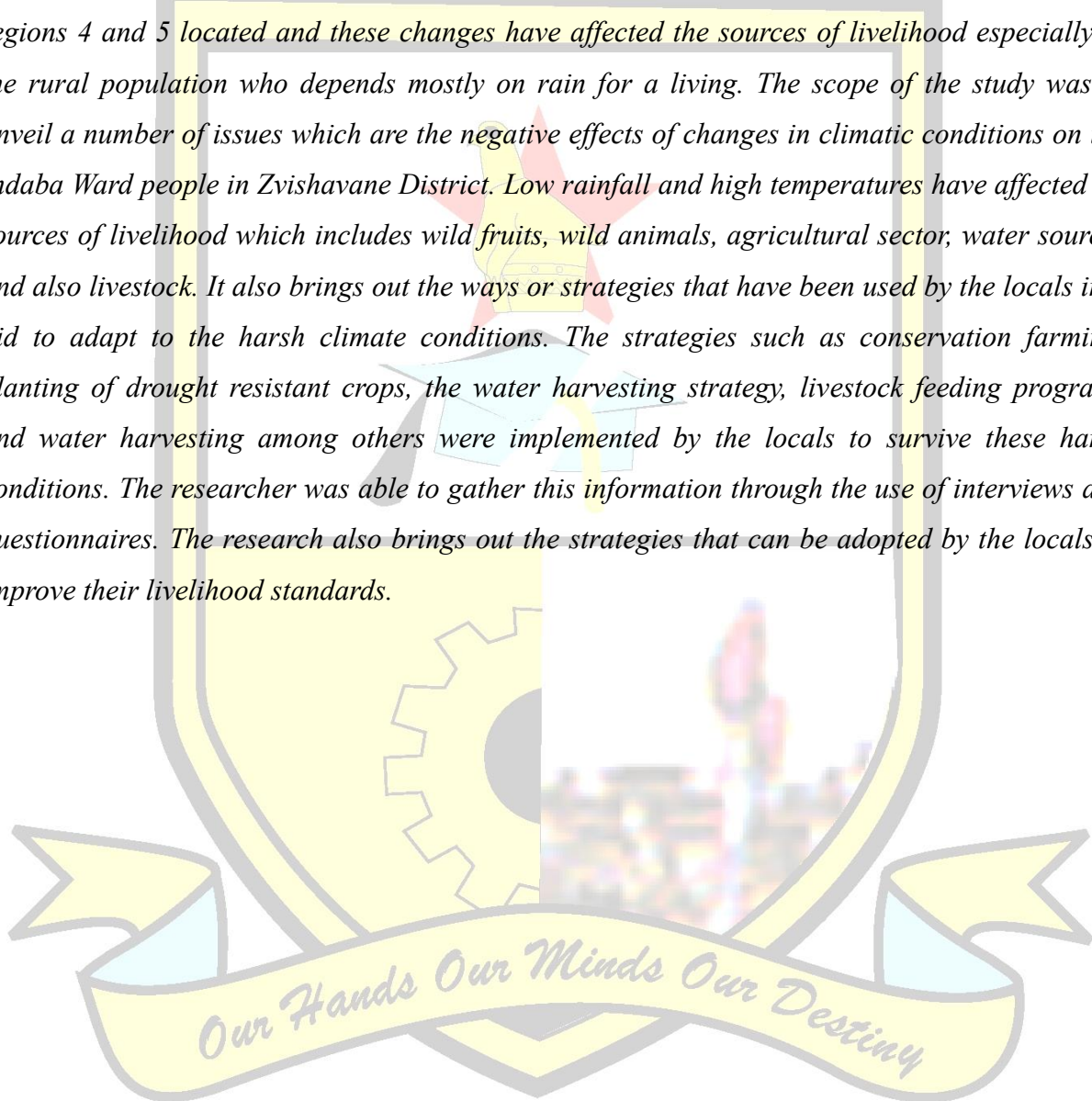
I want to give special thanks to my supervisor Dr. J. Matunhu who helped me coming up with this document through his patience and effort in guiding me through my study. I would also like to thank the following people, Ward 15 people, AREX, ZFU, NAC and Extension Officers for providing me with the information that I find useful in fulfilling my project. My acknowledgements go further to my family Mr. S and Mrs. I Shoko, my young brothers Valentine and Vincent and my sister Shyline Shoko for their valued support and financial assistance through my four year degree course. I also want to thank my fellow friends and classmates Believe Beebros Mataga, Tinashe Makavichi Sauriri and Simbarashe Konvict Chidewu for their encouragement and oneness. Last but not least would like also to give special thanks to the Almighty God for the gift of life, health and strength he has provided me.

May the Almighty bless my research.



Abstract

Extremely high temperatures and very low rainfall has been witnessed in Zimbabwe and this has been the evidence that has shown that climate change is taking place within the country. The Indaba Ward in Zvishavane District has got a population of 5067 people, 2307 men and 2660 women. These changes in climatic conditions have been witnessed specifically in agro-ecological regions 4 and 5 located and these changes have affected the sources of livelihood especially of the rural population who depends mostly on rain for a living. The scope of the study was to unveil a number of issues which are the negative effects of changes in climatic conditions on the Indaba Ward people in Zvishavane District. Low rainfall and high temperatures have affected all sources of livelihood which includes wild fruits, wild animals, agricultural sector, water sources and also livestock. It also brings out the ways or strategies that have been used by the locals in a bid to adapt to the harsh climate conditions. The strategies such as conservation farming, planting of drought resistant crops, the water harvesting strategy, livestock feeding programs and water harvesting among others were implemented by the locals to survive these harsh conditions. The researcher was able to gather this information through the use of interviews and questionnaires. The research also brings out the strategies that can be adopted by the locals to improve their livelihood standards.



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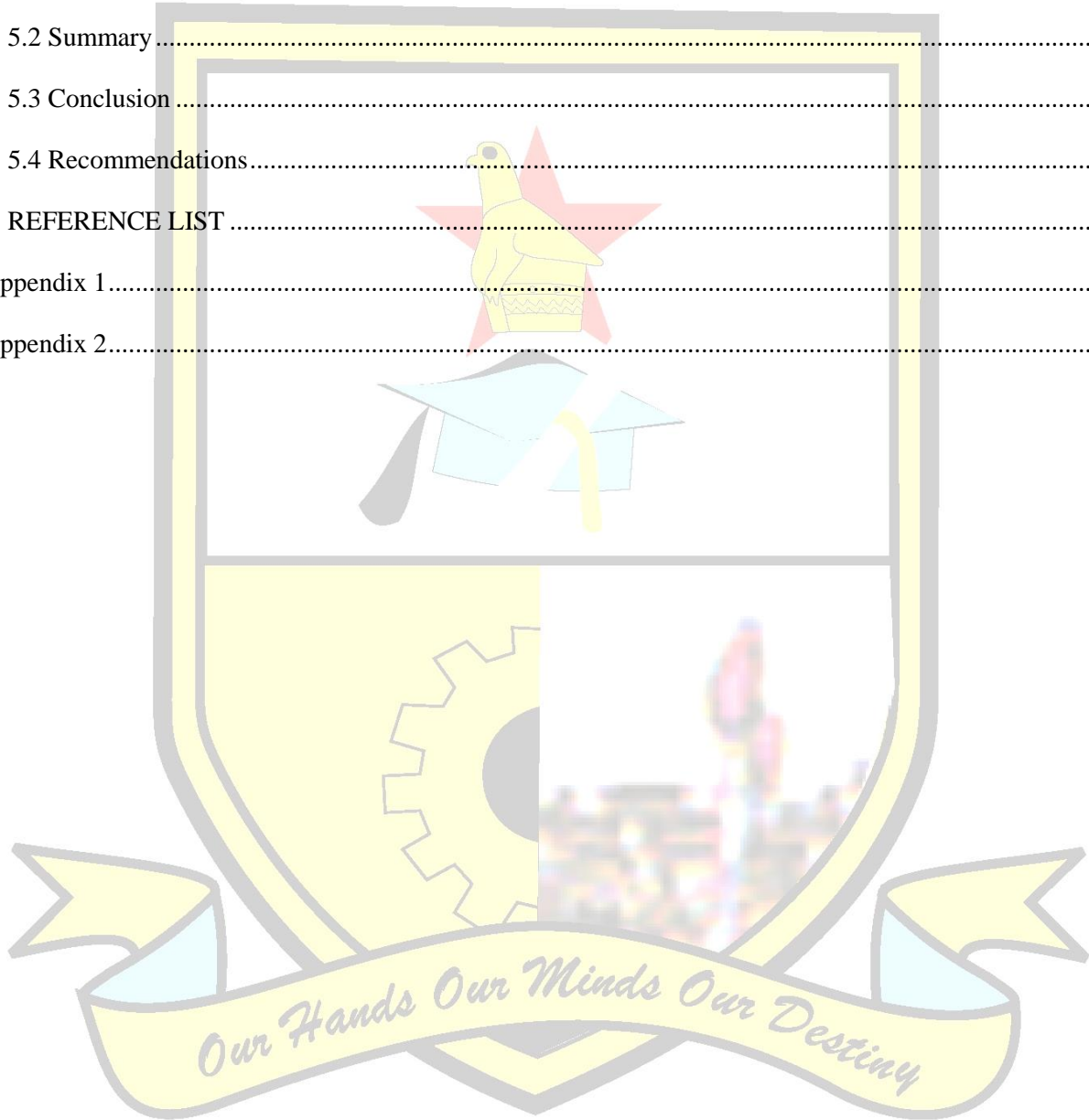
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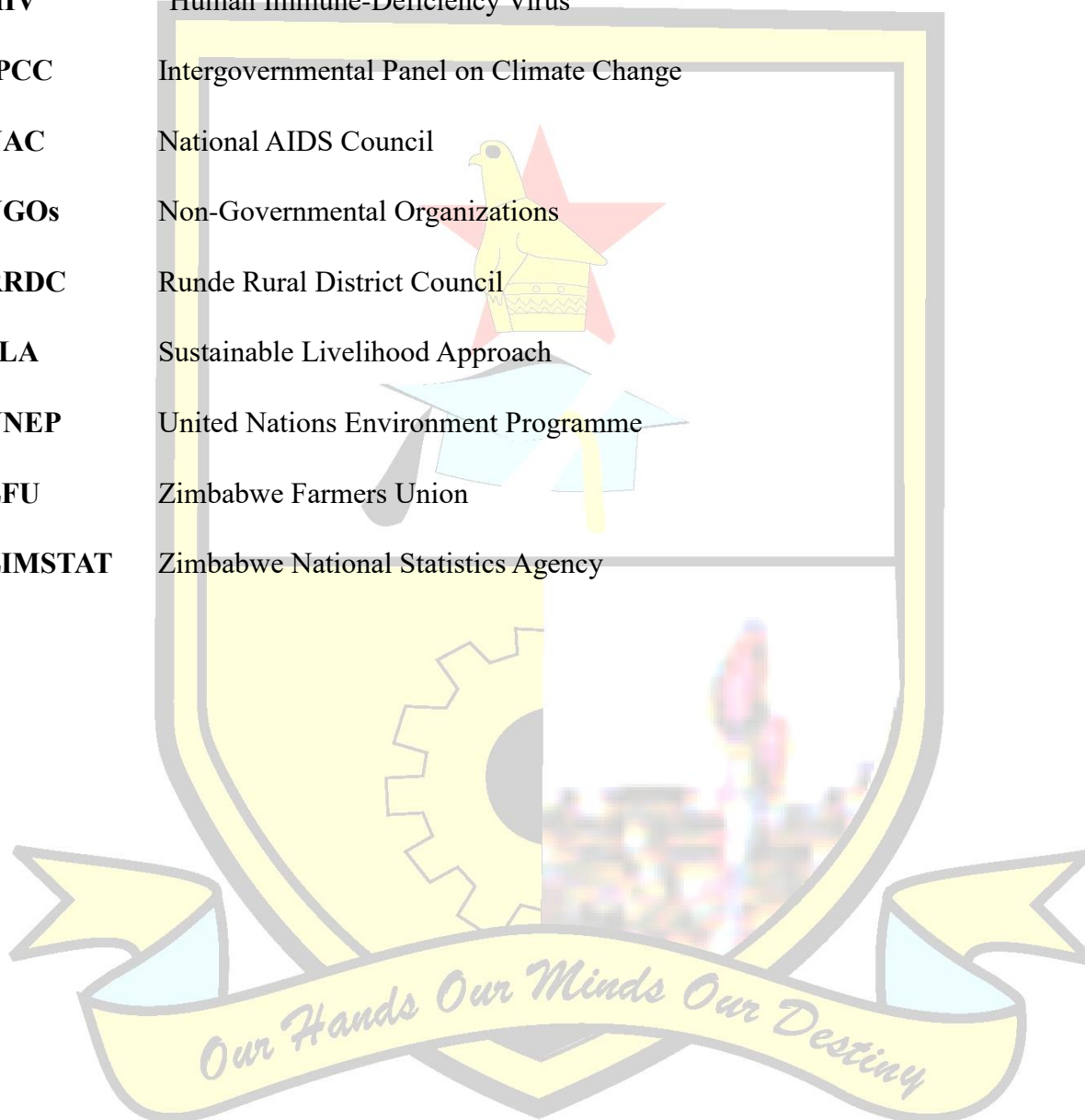


Abbreviations and Acronyms

AIDS Acquired Immune Deficient Syndrome

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AREX	Agricultural Research Extension
CCIK	Climate Change Information Kit
DFID	Development for International Development
HIV	Human Immune-Deficiency Virus
IPCC	Intergovernmental Panel on Climate Change
NAC	National AIDS Council
NGOs	Non-Governmental Organizations
RRDC	Runde Rural District Council
SLA	Sustainable Livelihood Approach
UNEP	United Nations Environment Programme
ZFU	Zimbabwe Farmers Union
ZIMSTAT	Zimbabwe National Statistics Agency



CHAPTER 1

INTRODUCTION

1.1 Introduction

Changes in climatic conditions have led to poverty in many countries that depend on climate for a living and these include African, Asian and Latin American countries. It has been also affecting development of such countries in a way because it is diverting the focus of governments to pay more attention on programs to do with the alleviation of poverty rather than development oriented ones. This chapter is an overview of what is climate change and how climate change is affecting the world as a whole, either negatively or positively and this is mainly discussed in the background of the study. The chapter discusses how the changes in climatic conditions have changed the way of living especially those in poor developing countries such as African countries which rely mostly on rain fed agriculture. The chapter also consists of statement of problem, research questions, objectives, study area, the theory linked to sustainable livelihood and assumptions of the study.

1.2 Background

Climate change has now become a global challenge as it has been evidenced all over the world. Climate change has been affecting many in developing countries than in developed countries as developing countries mostly depend on agriculture as a way of living than in developed countries which are more industrialized. According to Ungani (1996) climate change is a shift of climatic conditions in a directional incremental move, with values of climatic elements changing significantly. Climate change has become a serious problem to both sustainable livelihoods and economic development. In most African countries their livelihoods depend on land and water and therefore because of changes in climatic conditions African people suffer more. Climate impacts such as changes in temperature and rainfall patterns resulting in droughts, flooding, landslides and all exerts significant effect on rural livelihood especially agriculture which forms the safety nets for many African countries. Kandji et.al (2006) in their work expressed that Southern

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African countries experienced about fifteen droughts between 1988 and 1992 and countries like Zimbabwe after the 1982 and 1992 droughts, its Gross Domestic Product fell by 3% and 11% respectively. Kandji further discussed that the country also lost about 430.000 cattle from 4.4 million because of the 1991 to 1992 drought.

In general climate is the average condition of weather of a certain place taken over a period of time usually three decades that is thirty years and above. Climate change according to the Climate Change Information Kit (CCIK) (2002) can be defined as an alternation to measured quantities (e.g. precipitation, temperature, radiation, wind and cloudiness) within the climate system. These changes generally affect developing countries which depend mostly on rain fed agriculture. Because developing countries livelihoods depend on weather, changes in climatic conditions plays a vital role in the affecting of these livelihoods especially in African countries.

The experience of climate changes have been evidenced all over the world and in some parts of the world it has been impacting positively, for example, the Saharan desert has been lately turning into green land whilst in other countries it has been impacting negatively and that has been through the melting or shrinking of the ice in, for example, the Mount Kilimanjaro, and in some African countries there has been the experiencing of the shifting of seasons and the decrease in agricultural yields, for instance maize.

Chomitz et.al (2006) describes climate change as one of the greatest environmental, social, and economic threats facing the world today. As livelihood holds a vital place to the survival of human beings, the changes in climatic conditions especially to developing countries play an important role in the changes in their way of living. According to the Livelihoods Framework described by UK Department for International Development (DFID) there are five types of capital support livelihoods Carney (1998) and these are natural capital (land, water and air) , human capital (such as knowledge and skills), financial capital (such as income opportunities), physical and social capital and these types of capital form the concept of sustainable livelihoods. According to the theory behind sustainable livelihoods approach, a livelihood comprises the capabilities, assets including both material and social resources) and activities required for a means of living. According to Chambers and Conway (1992) a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

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Climate change in Southern Africa has the negative impacts on rural livelihoods and that is on agriculture, water sources, changes in grazing lands, depletion of wild fruits and wild animals. Because of the changes in rainfall patterns and shifting of rain seasons, the continent has experienced a number of challenges especially in agricultural sector and that in turn has got the negative impact on the continent's food security. According to Bunce et.al (2010) the African continent risks becoming a major global food crisis epicenter if the climate change issue remains undressed at local levels.

According to Somorin (2010) for Africa climate change is not only about global warming, it is also associated with change in climate variability and changes and the frequency and magnitude of extreme events such as more droughts and floods. Climate change has got negative impacts, for example, it can cause increased concentration of greenhouse gases (GHGs) in the atmosphere which in turn disrupt climate system and frequency and severity of extreme events, for example, typhoons, flooding or changes in rhythm and intensity of such phenomena as El Nino (Robledo and Forner 2005). According to Oxfam (2009) in Piya and Maharjan (2012), Nepal, with its fragile geography, predominantly natural resource based livelihoods, and low level of adaptive capacity due to higher incidence of poverty, is placed among the most vulnerable countries to climate change.

Matarira *et al* (1995) in Mutuvekwa's journal on Sustainable development in Africa established that maize crops are the most widely grown crop in Zimbabwe and they have decreased drastically under dry land conditions in some regions irrigation has also been facing decrease as higher temperatures in the country have been increasing the alkalinity of the soil. According to the Zimbabwe Meteorological Service, daily minimum temperatures have risen by approximately 2.6°C over the last century while daily maximum temperatures have risen by 2°C during the same period. Poverty Income and Consumption Survey (2011/12) it has been estimated that in 2011 about 78% of rural households were poor.

Zvishavane District has got a population of 115 372 people, an estimated 27 000 households and it has got 18 and 15 rural and urban wards respectively (ZIMSTAT. 2012). Ward 15 also known as Indaba ward is amongst the 18 wards in Zvishavane district. It is located about forty (40) kilometres South East out of the Zvishavane town along Buchwa road. The Indaba ward is separated by the Ngezi River from Mberengwa district and the river is the one which is used as

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the main source of water. Ward 15 is an area with a haphazard type of settlement and with a population of about 5067 people. The Ward 15 is also located along the Great Dyke which makes the community rich of minerals such as gold. Looking at rainfall patterns and temperature, Indaba Ward is a low lying and semi-arid area associated with low rainfall sometimes erratic and sporadic type of rainfall and its high temperatures. Indaba Ward is in ecological region 4 with an average rainfall of 300 mm and with higher temperatures, as high as 37 degrees Celsius. The area is also associated with late rainfall seasons which start as late as December. Ward 15 population mostly depends on agriculture and artisan mining as their way of living or to have an income. They grow maize, sorghum, round nuts, groundnuts, and millet as the source of food. They also do the rearing of animals such as cattle, goats, donkeys and roadrunners. The artisan mining is also practiced along the Ngezi River. All these activities make the livelihood of the Indaba Ward.

1.3 Statement of the problem

The research was an investigation on how rural livelihoods are being affected by climate change in Ward 15, located about fifty kilometres South East of Zvishavane District. The changes in climatic conditions, increased droughts and the increasing of livestock mortality drove the researcher to look at the relationship between rural livelihoods and climate conditions in the area of study.

1.4 Objectives

The objectives of the research are to:

- 1) To examine how climate change has affected the area of study.
- 2) To assess the severity of climate change on the way of living of the Ward 15.
- 3) To assess strategies that has been practiced by the community to adapt to the changes of climatic conditions.
- 4) To show problems that the community is facing in trying to adapt to the changes in climatic conditions.
- 5) To outline other adaptation measures that can be used by the community to climate changes.

1.5 Research questions

The research seeks to answer the following questions:

- a) What evidence shows that climate change has been taking place in the area of study?
- b) What are the effects of climate changes on their way of living?
- c) What measures have been taken by the community to adapt to these climate conditions?
- d) What problems have been faced by the community in trying to adapt to the changes in climatic conditions?

1.6 Assumptions of the Study

- 1) Community has noticed changes in climatic conditions.
- 2) Targeted community has experienced the negative impacts of climate change on their livelihoods.
- 3) The community has done something to try and adapt to these harsh conditions of climatic changes.
- 4) The community will provide the researcher with information concerning climate change.

1.7 Delimitations of the Study

The researcher narrowed his area of study to Ward 15 in Zvishavane rural. In an attempt to cut transport cost, the researcher was able to conduct his study in Ward 15 which is rather accessible in terms of distance. There are about 18 rural wards and 10 urban wards. The researcher chose to focus on rural areas because their way of living depends mostly on rainfall and these include agriculture, rearing of animals, depending on wild fruits and worms and their water sources.

1.8 Limitations of the Study

1.8.1 Time Frame: The lack of enough time impeded either way on the progress of the research. However the researcher was able to sacrifice his vacation period to cover the whole of Ward 15 and do the research so as to produce accurate data. The researcher was therefore able to budget his time to try and reduce the impact of this limitation to his research.

1.8.2 Financial Problems: Lack of sufficient funds to cover transport costs also hampered the scope of the study. To gather all the information the researcher needed, there was need for the researcher to travel from one place to another within Ward 15 so as to conduct interviews and also the distribution of questionnaires but his financial status limited him from doing so. However, the researcher was able to seek financial assistance from family and friends so as to be able to travel and have his research done so that a reliable and valid finding was to be realized.

1.9 Significance of the Study

1 To the researcher

The research will benefit the student in that it will sharpen his research skills that he will be able to use when in industry

2 To the Community

The community will benefit from the results of the research as it will come with some new ideas to cope with the changes in climatic conditions of the area of study.

3 To the Institution

The document will also be used as literature review and complement the existing studies

4 To the Department of AREX Department

The research will help the department take action to improve rural livelihoods and that is helping the community adapt from the changes in climatic conditions

1.10 Theoretical Framework

The researcher in his study used the Sustainable Livelihood Analysis as an approach to development. According to Morse et.al (2009) Sustainable Livelihood Analysis (SLA) has since the 1990s become the dominant approach to the implementation of development interventions by a number of major international agencies. Morse further discussed that SLA is defined in terms of the ability of a social unit to enhance its assets and capabilities in the face of shocks and stresses over time. Sustainable Livelihood Analysis first seeks to identify the important assets in livelihood, their trends over time and space as well as the nature and impacts of shocks and stresses (environmental, economic and social) upon these assets.

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The approach puts people at the centre of development. For example, because of climate change people suffer from shocks and stresses such as droughts, floods, famines, crop pests, diseases and many others to mention just but a few. Sustainable Livelihood Approach was therefore able to help the researcher to come up with more reliable and valid data. According to Carney (1998) the strength of the livelihood approach is that it mainstreams environment into its framework.

1.11 Chapter Breakdown

The following is the format that was used by the researcher in presenting his data:

Chapter 1

This chapter discussed the background of the study, the statement of the problem, the research objectives, research questions, the limitations and delimitations of the study, the assumptions of the study, theoretical framework and the significant of the study.

Chapter 2

Chapter 2 discussed the causes of climate change at global level, effects of climate change on the sources of livelihoods, a brief background on climate change in Zimbabwe and also the related literature from other scholars

Chapter 3

This chapter shows the methods that were used by the researcher to gather the data form his research. The researcher used questionnaires and interviews to gather the data for his research. Chapter 3 also discusses the researcher ethics which were followed by the researcher and these include voluntariness, seek permission and the respect of privacy and confidentiality. The chapter also shows data collection procedures which were employed by the student.

Chapter 4

Chapter 4 discussed the data which was gathered from the field by the researcher. This chapter focused on presenting, analyzing and discussing the data gathered. The data was discussed using narrative method in conjunction with survey photos and tables. The chapter also discussed the

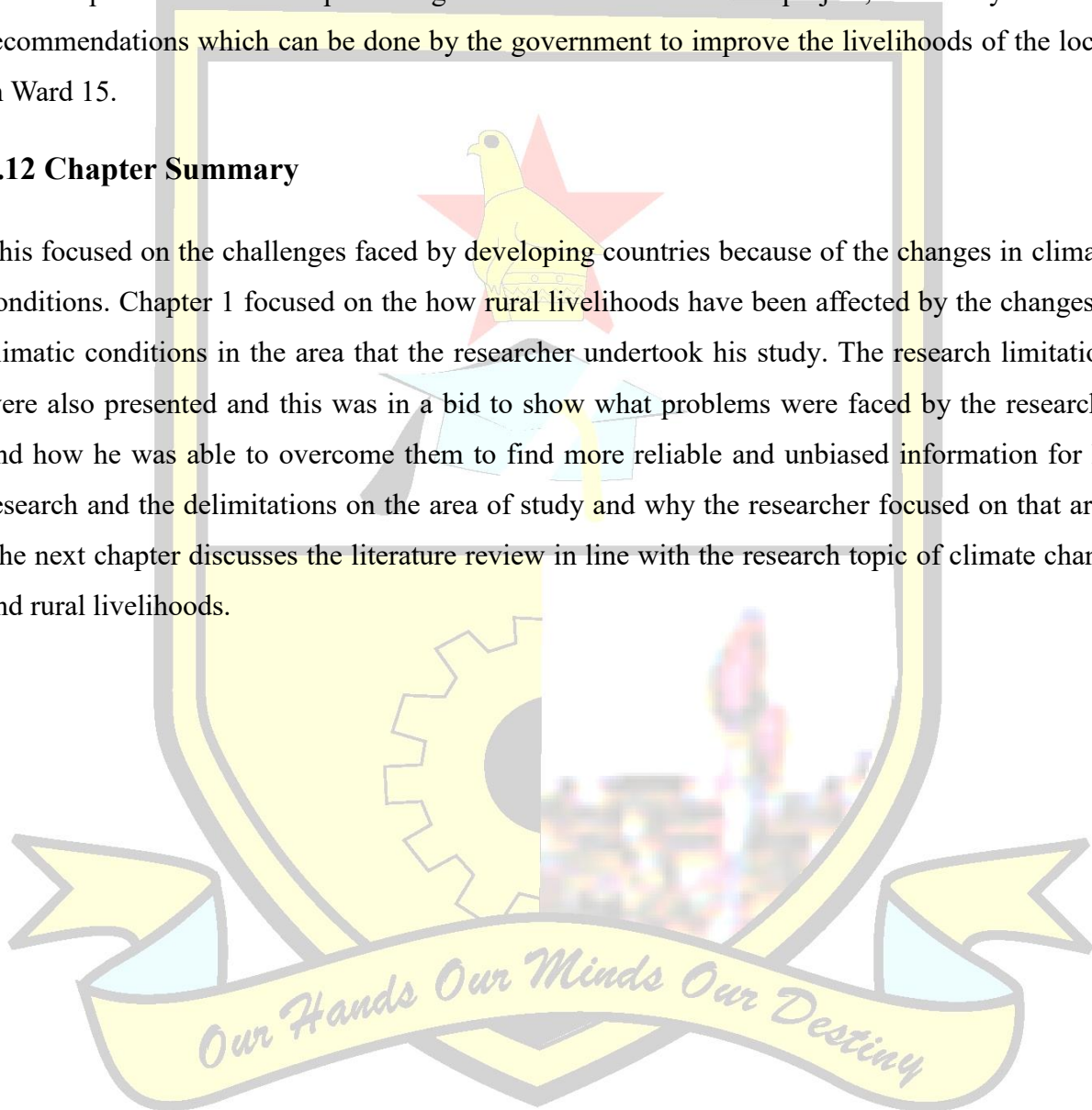
challenges faced by the locals due to climate variability, strategies which were being applied by the locals to adapt to changes in climatic conditions.

Chapter 5

The chapter focused on presenting the conclusion of the project, summary and the recommendations which can be done by the government to improve the livelihoods of the locals in Ward 15.

1.12 Chapter Summary

This focused on the challenges faced by developing countries because of the changes in climatic conditions. Chapter 1 focused on the how rural livelihoods have been affected by the changes in climatic conditions in the area that the researcher undertook his study. The research limitations were also presented and this was in a bid to show what problems were faced by the researcher and how he was able to overcome them to find more reliable and unbiased information for his research and the delimitations on the area of study and why the researcher focused on that area. The next chapter discusses the literature review in line with the research topic of climate change and rural livelihoods.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The chapter aims to show the causes of climate change, the effects of climate change on rural livelihoods. This chapter also discusses works of different scholars on the problems that were brought about by the changes in climatic conditions. The chapter also focused on the works done by other scholars and how these works are related to the conditions being faced by the researcher's area of study. This chapter also focuses on disclosing the gaps that were left out by other scholars and link them to his cope of the study.

2.2 What Is Climate Change

Climate is referred to as the average conditions of weather for a given area over a relatively long period of time usually three decades. Therefore climate change according to Somorin (2010), for Africa it is not only about changes in climatic conditions, it is also associated with change in the frequency and magnitude of extreme events such as an increment in droughts and floods.

2.3 Climate Situation in Zimbabwe

African countries have been experiencing extreme changes in climatic conditions. In some parts of the continent there has been rising in temperatures, rainfall patterns having a sharp decline, the increase in pests and diseases and death of animals because of the changes in weather. The African countries, although they have been not responsible for changes in climatic conditions, the countries more than the major culprits, for example, the greenhouse gases have been emitted by the western and more developed countries (Mawere et al, 2013). Zimbabwe in Africa has been amongst the countries which have been carrying the burden of changes in climate conditions.

Zimbabwe is a semi-arid country located in Southern Africa with five different regions on its own located about 1000m to 1500m above sea level. According to Ungani (1996) the country is located between latitudes 15.5 and 22.5°S and longitude 25 and 23°E. Zimbabwe has also been

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experiencing climate changes as it has been witnessed by scholars and this has been evidenced in all the five agro-ecological regions in the country. The agro-ecological regions 4 and 5 in Zimbabwe have been experiencing low rainfall and high temperatures and this has been affecting negatively on rural livelihoods as crop yields, animal lifespan, wild fruits and many more which are shockingly decreasing. The seasons in Zimbabwe are divided into three main categories which includes, summer, winter and autumn with different weather readings. The rain season has been known to start from late October to April with the months between December and February being peak precipitation months. The country has been also divided into two categories and that is the Highveld being the northern side of the country, regions one to three and the Lowveld being the southern part of the country regions four and five. The Highveld receiving about 1500mm of precipitation whilst the Lowveld being the driest receiving an annual rainfall of 450mm.

2.4 Climate change situation in Zimbabwe

Climate change is now a well-accepted reality and that it has been impacting negatively on the rural livelihoods and that it possess threat on development especially in developing countries. The climate change subject has received attention from scholars as it has been playing a vital role on the livelihoods. Many schools of thought have researched on the same issue of climate change and its effect on the way of living both at national and local level.

Mutekwa (2009) discussed the effects of climate change on agriculture and pointed out some of adaptation measures, and these included awareness campaigns to sensitize the problems so as to promote adaptation measures, the need for field days and trips as a participatory approach and the need for Agricultural Extension Officers to explain and train farmers. He went on to discuss the impact of prolonged wet weather and prolonged hot and dry weather during rainy season and that these conditions has been affecting maize yields of the area of study. In his research, he discovered that smallholder farmers are still ignorant about climate change and that climate change awareness campaigns are needed to sensitize them. However, Mutekwa's document failed to bring out what other crops can suit the climatic conditions being experienced for example the introducing of drought resistant crops such as finger millet, rapoko, sorghum and among other crops. The introduction of such crops will also help in improving the livelihoods of

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the given community rather than them focusing much on agriculture alone as way of making a living

Dube and Phiri (2013) cited the impacts of climate change on livelihoods in South Western Zimbabwe and they pointed out that climate change has altered the physical geography of the area leading to a disappearance of flora and fauna and other natural habitat that constituted the livelihoods of the local people. They further on goes to mention its effects on cropping, wild fruits and honey and water sources.

Dongodza (2010) focuses on climate change and how it affects women and the adaptation measures. She focused on women as the ones who have been affected by changes in climatic conditions as they are the ones dominating the agricultural sector. Dongodza further discussed that women are the most vulnerable to climate change as women's access to decision making is very minimal. However she was only focusing on women as if they are the only ones who only depend on rain fed agriculture for a living. Hence the research is going to focus on both men and women who are household heads and how they have been affected by changes in climatic conditions.

According to Brown et.al (2012) in their working paper of Climate change impacts, vulnerability and adaptation in Zimbabwe pointed out that climate records demonstrate that the country is already beginning to experience the effects of climate change, notably rainfall variability and extreme events. These conditions, combined with warming trends, are expected to render land increasingly marginal for agriculture, which poses a major threat to the economy and the livelihoods of the poor due to Zimbabwe's heavy dependence on rain-fed agriculture and climate sensitive resources. The research however was done at national level so the data produced was not specified to which areas were being affected more with changes in climate.

The scholars above focused on climate change and natural capital. They did not put into consideration the social, human, economic and also physical capital as also being affected by the changes in climatic conditions. When studying rural livelihoods, the researcher must also focus not only on agriculture but other means of living that are being affected by climate change such as human capital (for example good health, education).

2.5 Causes of Climate Change

A number of factors have contributed to changes in climatic conditions and these include both human and natural factors. Factors such as overgrazing, deforestation, emission of greenhouse gases, volcanic eruption, changes in earth's orbit and many others have contributed to the changes in climatic conditions as discussed below:

2.5.1 Over Grazing

This is caused by too many animals grazing on a small given area or failure to control animal grazing activity properly. According to Extension Forage Agronomy (2000) overgrazing reduces plant leaf which in turn leads to the reduction of the absorbing of sunlight and resulting in poor plant growth. Overgrazing as a result causes soil erosion which means there carbon sinks are destroyed.

2.5.2 Deforestation

Deforestation involves the cutting down of trees for energy use, clearing places for farming activities, for construction purposes, veld fires and many other reasons to mention but only a few. Forest works in many ways which if they are destroyed can cause climate changes. Forests works to keep the soil intact, they reduce over evaporation, provide transpiration which has a certain percentage on precipitation, as carbon sinks and they also absorb greenhouse gases such as carbon dioxide. According to UNEP (2008), African continent has been recorded to be losing an estimated 9.9 million hectares every year and this has been due to the cutting down of trees. Trees therefore play a vital role in making earth a place to live and by destroying the deforestation, human kind will be just setting fire on them. The cutting down of trees causes the increase in percentage of greenhouse gases in the atmosphere which have a negative impact on the ozone layer as the carbon sinks would have been destroyed by human activities. The destruction of ozone layer increases the escaping of ultra violet radiation which in turn leads to the over evapotranspiration.

2.5.3 Greenhouse gases emission

Greenhouse gases include carbon dioxide (CO₂), methane and nitrous oxide also plays a role in climate changes. Carbon dioxide is primarily produced from human activities for instance

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through the burning of fossil fuels which comprises oil, coal and other natural gases. It is then absorbed by trees which by the cutting down of trees increase the percentage of this greenhouse gas into the atmosphere. The concentration of the greenhouse gases in the atmosphere leads to global warming. According to the United States Environmental Protection Agency (USEPA) greenhouse gases from human activities has been a leading driver of observed climate change since the mid 20th century. Because greenhouse gases after being released stay long in the atmosphere, they warm the climate leading to changes in climatic conditions.

2.5.4 Burning of fossil fuels

The use of fossils such as coal, oil and natural gases have also contributed to the changes in climatic changes. These fuels emit lots of gases which are harmful to the environment and these include greenhouse gases and carbon dioxide which destroys the ozone layer. The gases produced by the fossil fuels stay in the atmosphere for a long period of time. According to WWF (2013), coal has been contributing more to the damaging of the atmosphere as it releases an estimated 70% more carbon dioxide than other gases.

2.5.5 Earth's Orbit

Changes in earth's orbit also have also contributed to the changes in climate conditions. Koppen and Wegener (1924), in Gornitz (2009) discussed that the evidenced Permo- Carboniferous ice age discovered in different parts Gondwanaland has been as a result of continental drifts.

2.6 Effects of Climate Change

Climate change has got both negative and positive effects on the way of living of human being. It impacts on all aspects of living which comprises of agriculture (both farming and non-farming activities), ecosystem, forests, human health, energy, water resources, transportation, tourism, coastal zones and many others to mention only a few. Although climate change can impact positively, it affects more in an opposite way which is going to be discussed below.

2.6.1 Agriculture

Agriculture simply refers to the growing of crops and rearing of animals for commercial or subsistence purposes. Agriculture plays a role as source of livelihood to the rural people.

2.6.1.1 Crop Yields

Changes in precipitation, wind, radiation and temperature affect crop yields in either way. Agriculture depends on climate conditions and this is mainly evidenced in countries that depend on rain fed agriculture, the extreme the changes in temperature and precipitation, the lesser the crop yields. In countries which depend more on grain yields if the temperatures are too high the crops grow faster and they will have less time to produce. For example the farmers lost about US\$8 billion after the Mississippi River flooded just before they had harvested. Because of erratic rainfall in Zimbabwe, the percentage of smallholder farmers planting maize has increased. The country has been experiencing shifting of rain season late rainfall and early stopping.

2.6.1.2 Livestock

As agriculture generally means the growing of crops and rearing of animals, the changes in climatic conditions also has been affecting livestock production. The change in climatic conditions leads to heat waves, drought, flooding and emerging of new diseases and parasites and all these have got an impact on livestock. Drought for instance threatens grazing lands and according to ZimVac (2013) report drought reduces the amount of quality forage available to grazing livestock. The ZimVac report (2013) further expressed that of the households that reported losing cattle in the period between 2012 and 2013, 56% reported diseases as the main cause and in places such as the Matebeleland South deaths was due to drought. The effects of diseases on livestock also include reduction in fertility and in milk production. This shows that changes in climatic conditions are affecting livestock production.

2.6.2 Wild foods

In African countries wild foods also play a role in making their way of living, these can include honey, mopane worms, birds and wild animals. Changes in climate conditions have led to the disappearing of these wild foods. Birds and wild animals have been migrating to favorable climate conditions. In Zimbabwe for example according to Dube and Phiri (2013) mopane worms were in the Matebeleland region were regarded as a source of food and people have been making money with them but because of increases in temperatures and the decrease in precipitation the mopane worms have disappeared. Another effect of climate change which has

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been witnessed, in Lithuan birds are dying because of the unseasonably mild winters(Climate Action Network).

2.6.3 Desertification

Climate change has been linked with the increase of desertification within the African continent. In Binns (1990)'s article "Is desertification a myth", 50 households were interviewed on each of located in Kitui District, Kenya and Same District, Tanzania regarding sources of livelihood and local resource revealed the effects of climate change on each of the two.

2.6.4 Health

Climate change has also been detrimental effects to human health. The extreme weather events have got a negative impact on health for example water borne diseases and diseases associated with extremely high temperatures have been increasing astronomically and this has been caused by the changes in precipitation and temperatures. Hartman et.al (2002) in Boko. et.al (2007) using sixteen climate change scenarios showed that changes in temperature and rainfall in Zimbabwe may play a role in the distribution of malaria by 2100. Because of experienced changes in climate conditions, there has been a change in the distribution of vector borne diseases such as malaria and epidemics of meningococcal meningitis, rift valley fever and cholera in Africa. For example, according to Patz et al (2005), the Rift Valley fever epidemic has also correlated to climate variability.

2.6.5 Water Sources

The changes in climatic conditions have led to the increase in evaporation as the temperatures have been rising. This has led to the further going down of the water table as there has been no equilibrium between the water being lost through evaporation and precipitation levels experienced as a result of climate. Some areas have been drying up as a result of low rainfall experienced. According to IPCC Fourth Assessment Report (2007), the loss of cloud forests since 1976 resulted in 25% annual reduction of water sources derived from fog, affecting annual drinking water of one million people living in Kilimanjaro.

2.6.6 Sea Level Rise

There has been the rise of average sea level during the 20th century as compared to the 19th century (New York Metropolitan Resources 2004-2005) based on the tide gauge data. Till et.al (2010) pointed out that the rising in sea level affects coastal areas. Africa has got about 320 cities close to coasts with an estimated population of about 10 000 people and the rise in sea level will affect people living in the low lying coastal areas (IPCC. 4th assessment report 2007). According to Ricardo et al (2007), the global sea level has risen with about 6.7 inches in the last century.

2.6.7 Glacier Shrinking

According to Thompson et al (2009) glacier shrinking has also been as a result of climate change. Over the last thirty five years of research, it was discovered that ice- core records of climatic and environmental variation from the Polar Regions and from low- latitude high level elevation ice fields from sixteen countries. For example, Mount Kilimanjaro lost 85% of its glacial coverage as from 1912 to 2006 and also the observations proved that glacier shrinkage have also been experienced in the Andes, Himalayas during the 20th and 21st century Thompson et al (2009).The multiyear ice decrease by 20% percent in Arctic sea during the past 30 years of the century and the thinning of the ice by two(2) metres in Central Arctic between the 1960s and the 1990s has also been as a result of climate change (Rothrock and Zhang 2005).

2.7 Chapter Summary

The chapter discussed the causes of climate change and these include volcanic eruption, earth's orbit, overgrazing, deforestation and greenhouse gas emission. The chapter also went on the figure out the effects of climate change in the whole world and these include sea level rise, glacial shrinking, effect on agriculture and livestock, on wild fruits and animals, health and water sources. It also gives the brief background on climate change situation in Zimbabwe and looks at the related literature and this is how some of the scholars have viewed the topic under study and their own views on climate change in their own areas of study.

CHAPTER 3

RESEARCH METHODS

3.1 Introduction

The chapter focuses on the types of research methods which were employed by the researcher in gathering the information that he used for his research. These were used to try and find accurate, reliable and non-biased data for the research. This chapter also provides the types of data collection techniques employed by the researcher and these include sampling techniques, interviews, questionnaires and secondary data. The chapter also discusses the target population and also the sample size of the project, how it was selected and the technique used to select the representatives of the whole community. Ethical considerations will also be discussed in this chapter.

3.2 Research Approach

The study employed a qualitative method of research and this has influenced the researcher to undertake interviews (using an interview guide), to use secondary data, and use of questionnaires in the research. Buras and Grove (2003) described qualitative approach as a systematic subjective approach that can be used to describe the life experiences, situations and give them meaning. Qualitative research is characterized by its aims which relate to understanding some aspects of social life and its methods which generate words rather than numbers as data analysis (Patton et.al 2002). Qualitative research method can be better used to understand the experiences of the people in general and it also seeks to answer questions such as What, How and Why. The researcher employed the qualitative research method so as to describe and understand the impact of climate change on rural livelihoods.

3.3 Target Population

Target population were the local household heads in Indaba Ward who have been living in the area for about ten years or more whom have witnessed the changes in climatic conditions. In general, target population refers to the number of people within the sample area, the number of

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people that the researcher intend to gather data or information from. According to ZIMSTAT census report (2012) the ward has got an estimated population of 5067 people. Moreover, the departments to do with agriculture and sustainable rural livelihoods were also targeted.

3.4 Sample size

Sample size refers the number of people that the researcher chose to gather data from representing the whole community. Because of limitations such as time and financial problems, the researcher chose to do the research with just a limited number of people as his sample size to meet time frame and financial status. The researcher opted to do his research with a limited number of thirty (30) participants.

3.5 Sampling

Sampling is the act, process or technique of selecting representative part of the population for the purpose of determining parameters or characteristics of the whole population. The purpose of sampling was to draw conclusions about the experiences of the whole community from climate change from samples (a number of selected respondents). The purposive sampling helped the researcher to reach the targeted respondents quickly. Using a sample in research saves money and time, so with little time and money the researcher had, he was able to use sampling to avoid unnecessary costs and wasting of time. Therefore to avoid getting biased data, the researcher was able to use purposive sampling in selecting thirty participants for his research and to realize more reliable, accurate and unbiased data in his research. He was able to pick households using purposive or judgmental sampling which he used in blending with interviewing the respondents.

3.6 Data Collection Instruments

To gather data the researcher used interviews, questionnaires and secondary or already existing information for his research to be successful.

3.6.1 Interviews

According the Oxford Dictionary an interview is a conversation or questioning for the purpose of eliciting information for publication. Interviews are in different types and these range from semi-(structured using a topic guide) structured to less structured interviews. Interviews were useful in

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carrying out this research because they were able to help the researcher to discover what individuals have experienced from climate changes and how it has affected their livelihoods. The researcher was able to undertake interviews to a selected number of household heads within his own area of study using the research interview guide. The researcher was able to interview ten respondents whom include household heads, councilor, village heads and extension officers and the District Administrator on issues pertaining climate change and its effects on the community under study.

Advantages

- i. They were flexible and did not limit the interviewee to express his or her line of thinking. The respondents were able to produce to the researcher more information than he was expecting.
- ii. The respondents also answered the asked questions with as much information as he or she was willing to provide with. The researcher was able to gain much information from interviewees.
- iii. Because they were face to face interview, the interviewer was able to ask for further clarification from the information which was being provided to him by the respondents.

Disadvantages

- i. Interviews were time consuming, that is the interviewer lost much of his time doing interviews
- ii. The respondents were not straight to the point. The interviewer was forced to be patient in listening to all the information that he was being produced by the interviewees although some of the information was irrelevant.
- iii. Some people were not willing to provide the researcher with the information. This was due to unidentified reasons.

3.6.2 Questionnaire

The researcher distributed questionnaires with a number of questions to the selected population or respondents. The households were selected from the sample size and twenty questionnaires were administered to twenty selected households across the Ward 15. The main aim of the

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household questionnaires was to understand the impact of climate change on those households and that was, for example, the decreasing of their agricultural yields as a result of climate change and also what they have done to reduce its impacts. The questionnaires distributed included both closed-ended questions and open-ended questions in which both literates and semi-literates were able to respond to.

Advantages

- i. Because the questionnaires were a combination of closed and open ended questionnaires both literate and semi-literate were able to participate
- ii. Questionnaires were not time consuming. The researcher did not take time in distributing questionnaires and also collecting them from the respondents.
- iii. The use of questionnaires increased the rate of response as the identity of the respondents was anonymous. The researcher was able to receive more than half of his questionnaires and this was because the names of the respondents remained anonymous.

Disadvantages

- i. Some respondents failed to have time to fill in the questionnaires. Out of 20 questionnaires that were distributed by the researcher only 13 were received back.
- ii. Not all the respondents were able to give back the questionnaires to the researcher due to unidentified reasons.
- iii. Questionnaires were financially demanding in printing and typing them. The researcher failed to print enough questionnaires as his pocket could not allow him to do so. The researcher with the assistance of his family was able to print 20 questionnaires instead of 30 for his research. The researcher thus used interviews for the remaining 10 respondents.

3.6.3 Secondary Data/ Already Existing Data

The researcher in gathering data also used secondary sources in his study and this included journals, newspapers, textbooks, annual reports and also students' work. The secondary data were used in support to the primary data which the researcher had gathered. This was to help the researcher to find out what was already on the table about his research although it was not able to fill all the gaps he was looking for. Secondary data refers to the use of online information, books,

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newspaper in a research. The researcher used the secondary data in order to get the weather conditions of the Zvishavane Rural through the Meteorological department. The disadvantage of using secondary data is that sometimes you find outdated data on the internet which will affect the credibility of the research.

3.7 Research Ethics

Before conducting the research, the researcher put ethical consideration into play. With this, the study observed privacy and confidentiality of all the respondents. The researcher also asked for permission from local leaders such as councilors and ward coordinator to carry out data. The researcher did not use any force or coercion towards the respondents, responding was based on voluntary basis.

3.7.1 Voluntariness

The researcher did not force information out of the respondent for him to achieve his research. The participants were able give the information at their own will after the researcher introduced them to his own studies.

3.7.2 Seek Permission

Before going into the field, the researcher was able to take the rightful procedures of going through the village heads and to the councilor to seek permission to carry out the research study in their area. This helped the researcher to find more accurate and reliable data as he received help from the community leaders and this has uncovered more important information.

3.7.3 Privacy and Confidentiality

The researcher respected the respondent's identity. This is because some participants will not want to be exposed and would want to remain anonymous. Guaranteeing the respondent's identity has helped in gathering more accurate and appropriate information to the study. The researcher managed to protect the respondent's identity.

3.8 Data Collection Procedures

Before the researcher went into the field to collect data he sought permission from the local authorities who include the councilor, the District Administrator and the village heads so as to avoid unnecessary disturbances during the research. The researcher used a letter provisioned by the school department which asked for permission to carry out the survey on behalf of the student. The letter has therefore guaranteed respondents that the information will be put to good use. The researcher was able to give a brief background about his scope of study so as to try and give an insight to the authority on what he wanted to research about. The researcher was also able to guarantee the respondents that their identity would not be revealed and that he would not force information out of them and that he was going to respect their decision.

3.9 Data Analysis and Presentation

The researcher collected data from the selected households, the Zvishavane Meteorological Department, Zimbabwe Farmers Union, the village heads and the Runde Rural District Council. The researcher approached the sampled households, village heads and other respondents with questionnaires and also to schedule interviews with them. The data collection was done through the use of questionnaires, interviews and secondary data. After the data was collected, then the researcher took his time in analyzing the data omitting the ones which was irrelevant and making use of the one important to the study. The study used diagrams, pictures and tables in presenting the data so as to make the research more reliable authentic. After analyzing the data it was now time for data presentation, the researcher used pictures and tables in helping the narrative method the research study used in explaining data carried out.

3.10 Chapter summary

The chapter discussed how the researcher collected data and this was through the use of questionnaires, interviews and secondary data. The chapter goes on to explain the procedures which were taken by the researcher before collecting data and also during the process. The chapter also presented ethics that were observed during the research such as respect for respondents' identity, no use of force or coercion and bribery since this would distort the information by making it not accurate. The chapter ends discussing the data analysis and presentation methods used.

CHAPTER 4

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

The chapter focused on the analysis and the presentation of data which the researcher used to make up the research study. The data was presented in both narrative way and through the use of tables and pictures gathered from the survey. The information was gathered from thirty respondents including the selected households and from AREX, ZFU, RRDC, Extension officers and many other through the use of research tools which were mentioned in the previous chapter. The findings which were discussed were linked to the objectives and research questions pointed out in Chapter 1 and the main aim was to evaluate whether they have been achieved or not and also relating them to the literature review. The data was presented using tables and pictures. The scope of the study was to evaluate the effects of climate change on rural livelihood on Ward 15 in Zvishavane District.

4.2 Response rate to Interviews and Questionnaires

The researcher conducted seven out of ten interviews that the research had previously scheduled and these were done with institutions and individuals such as the ZFU, AREX, RRDC, councilor, community leaders and the local people. Twenty questionnaires were distributed to twenty local people who include the village heads, councilor and the household heads in the Ward 15 area

Response rate to Questionnaires

The researcher was able to distribute one (1) questionnaire to the ward councilor of the Ward 15 and it was received back. Of the sixteen questionnaires which were distributed to the household heads, only nine (9) of them were received back and this was maybe because some respondents chose not to respond to the questionnaires and some had no time to fill in the questionnaires. From three questionnaires which were administered to the village heads only two were received back to the researcher. In summation of the twenty questionnaires distributed, only thirteen were received back and this was due to numerous unidentified reasons. The table on the next page shows how the questionnaires were administered and their response rates by respondents.

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Table 4.1 Response Rate to Questionnaires

Respondents	Questionnaires distributed	Questionnaires received	Questionnaires not answered
Councilors	1	1	0
Head of households	16	9	7
Village Heads	3	2	1
Total	20	13	7

Source: Field Survey (2015)

Response rate for interviews

Of the 10 interviews which the researcher had scheduled, only seven (7) of them were conducted. The interviews were targeting the institutions to with rural living, the local people, the village heads, agricultural extension officers and the councilor. The table below shows how many interviews were scheduled and how many were successful.

Table: 4.2 Response rate to Interviews

Respondents	Scheduled interviews	Interviews Done	Interviews not Done
Local People/ Household heads	6	4	2
Institutions	3	2	1
Councilor	1	1	0
Total	10	7	3

Source: Field Survey (2015)

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As shown by the table above, the researcher scheduled ten interviews so as to get reliable data from the survey. The student was able to conduct seven (7) interviews out of the ten (10) which had been scheduled and this was the overall response rate to the interviews scheduled to the local people and the targeted institutions and stakeholders. Out of six (6) anticipated interviews with the local people, only four (4) of them were successful. The interview which was targeted to the councilor was done with no fail.

4.3 Effects of climate change on Indaba Ward sources of Livelihoods

The changes in climatic conditions have played a significant role on the way of living of the people living within Ward 15 area in Zvishavane rural. Climate change has affected all pillars of sources of livelihoods of the local people and these consists of farming activities such as (cattle rearing and growing of crops), water sources, wild foods, wild fruits and health. One of the respondents during an interview responded that there has been an evidenced change of climate conditions, the temperatures have been increasing and at the same time low rainfalls has been experienced in the area and this has affected all farming activities and their way of living.

4.3.1 Climate change and its effects on Farming activities

People of the Indaba Ward rely on rain fed agriculture as a way of making a living and the changes in climate conditions has affected their routinely way of living negatively. Crops such as ground nuts, round nuts, maize, millet and sorghum are amongst the crops that the rural population relies on as their sources of livelihoods. Specifically maize as it is the backbone staple food of the community it has been grown every year. Unlike other small grain crops such as millet and rapoko, maize needs adequate rainfall and average temperatures for it produce excellent yields. The decrease in precipitation and the experiencing of high temperatures for the past decade has affected the yields expected by the local people adversely. According to one of the villagers answering after asked by the researcher, "In what ways has climate change affected rural livelihoods", the villager responded that the maize yields have been decreasing for the past ten years and this has been due to poor precipitation and also the short rain seasons. The respondent further expressed that during the 2014-2015 rain seasons, rainfall fell down as late as 23 December 2014 and vacated as early as 2 February 2015 making it impossible for crops such as maize and groundnuts to survive and produce good yields. This has given no chance for the

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crops to grow and produce satisfying yields. The respondent clearly shows out that decrease in rainfall patterns has been playing a significant role in the low outputs from the fields.

Fig 4.1 shows wilting maize crop as a result of very low rainfalls



Source: Survey Photo (2015)

Fig 4.1 above presents evidence on how erratic rainfalls and experiences of higher temperatures have been affecting the maize yields and plant growth in the area under study. Evidence exhibited clearly shows yellowish lifeless maize crops and a majority of them with no maize cobs on them. The picture showed evidence that the Indaba area has been receiving very low rainfall and for a short period of time leaving crops with no option but to just give a very little they could. The yellowish sign on the maize leafs shows that there have also been very high temperature which has played a role in high evapotranspiration, leaving both the crops and the land lifeless and very dry with lot of cracks on it respectively. For maize crops to produce satisfying yields there is need for average rainfall and moderate temperatures that allow the plant to grow and have adequate time to produce yields with no disturbances. The maize yields have decreased sharply with over an estimated percentage of 90% for the past ten years as according to the opinions of the community. One of the locals responded that they used to have bumper harvests of more than thirty full scotch-cart loads of maize cobs and comparing to the yields the Ward 15 have been experiencing poor yields for the past 10 years and they have not been able to

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get at least two scotch cart loads of maize yields during harvesting periods. One of the respondents further explained that *“kurima makore ano kwakafanana kucherera mbeu pasi nokuti hapana chinobuda”*. The respondent was simply referring to that farming nowadays is no longer ideal under this scourge of climate change since input is far way past the output to be obtained by every farmer. The respondent further discussed that granaries are now of no use like in the past since they now prefer to stock their small produces within living quarters. This clearly shows that the communities can now only survive under irrigation.

In an interview with the ZFU member of Zvishavane District, the respondent alluded that poor rainfall have been experienced in the whole district but the South East of the district have been experiencing more poor rainfall than other surrounding sides areas of the district. The research also found out that although people have been supplied with inputs from the government and other development stakeholders such as fertilizer, maize seeds, nothing has been improving since poor precipitation has been a major stumbling block to have adequate outputs within the area. The Ward 15 has been one of the areas that have been affected negatively by the poor precipitation, and extremely higher temperatures. The research findings revealed that most of the people in the recent past have been abandoning their main fields and growing only on their small stand fields because they have been afraid of wasting their time for nothing as quoted from one of the locals saying *“kufira mahara uku”*. The ZFU officer also explained that maize yields have been decreasing abruptly with an estimated 95% as compared to the previous years where the local people used to enjoy bumper harvests each and every year for the past decades. He further discussed that not only maize yields have been affected by the changes in climatic conditions but also leguminous plants such as ground nuts and round nuts yields have also witnessed a notable decrease and this has also been playing a role in giving a negative livelihood platform to the Indaba Ward population. Plants such as rapoko, sorghum and finger millet have been performing fairly well as they are some of the drought resistant crops.

Fig 4.2 Photo below showing the effects of poor rainfall on maize yields

A photo below clearly shows the effects of poor or inadequate rainfall on the yields of maize crops.



Source: Survey Photo (2015)

Fig 4.2 above shows sparsely populated maize plants as which failed as a result of inadequate rainfall. The evidence exhibited above also shows that the farmer is most likely to encounter a premature harvest. The picture plays an important role as evidence on how the changes in climatic conditions have been affecting rain fed agriculture in the Ward 15. The researcher focused much on maize yields as Ward 15 population mainly depends on maize as their source of living and it also constitute to be their staple food.

4.3.2 Effects on grazing lands

Changes in grazing lands have been one of the effects of climate change in Indaba Ward in Zvishavane Rural. The decreasing of grazing lands has also played a significant role on threatening the sources of livelihoods of the local people as their livestock depends mostly on these deteriorating grazing lands. The locals own livestock such as cattle, donkeys, goats and sheep and these animals are very important on the way of living of these people as they provide food, as source of power (draught power from cattle and donkeys) and they can be sold for the

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money for school fees and to buy basic needs. The experiencing of continuous droughts in the area of study has led to the deterioration of grazing lands therefore affecting the livestock of this given Ward 15. Livestock deaths loss has been recorded in the area under study and this has caused great loss for the locals as their means of living and wealthy are dying. One of the local people expressed that during the 2007- 2008 drought he lost more than five cattle out of his 11 cattle he previously owned and also his cows were giving birth to premature calves which he explained as “*kusvodza*”. All this has been due to the experienced very little precipitation in Indaba Ward. He explained that the grazing pastures have been decreasing not only because of low rainfalls witnessed but also because of very high temperatures within the area.

Most of the locals expressed that they lost their cattle because of grazing pastures deterioration and they further expressed out that the cattle left were unhealthy and worth very low at the market as the cattle buyers have been using the strategy of weighing the kilograms of cattle and buy them with the price of US\$2 to US\$2.50 per kilogram. The locals because of the droughts they have witnessed, they were left with no option but to sell their cattle at very cheap prices just to raise money to buy basic needs such as mealie-meal, sugar and also send their children to school. It was also pointed out that because of the deteriorating grazing the health of the livestock has been decreasing also and this has led to shortened lifespan of the livestock. The cattle and donkeys as are used for draught power, because of changes in climatic conditions they are no longer strong enough to be used to cultivate land. So death of animals and their lack of power to work has led the suffering the way of living by the local population.

4.3.3 Effects on wild fruits

Wild fruits have also been regarded as part of sources of livelihoods for the Indaba Ward people. Wild fruits such as *matamba*, *makwakwa*, *nhengeni*, *matohwe*, *mapfura*, *shumha* and *nyii* have also been deteriorating compared with previous years. During food crisis wild fruits play a role on food security as they help people survive. Changes in climatic conditions for the past years have caused the loss of forests and the decreasing of wild fruits. In most African countries wild fruits are regarded to as source of food since they help during food crisis and some people also get income through the selling of these fruits but climate changes has affected all this. During an interview with one of the local people, he expressed that “ we used to eat wild fruits when we go

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in the forests herding cattle but children of nowadays no longer enjoy these fruits as they have been affected by poor rainfall which have been affecting trees to produce fruits”.

4.3.4 Madora(Caterpillars)

The Ward 15 population for the past years has been depending on mopane worms as the source food and income. Generally the rural Zimbabweans have been generating income through the selling of these worms and this means they have been the part of their sources of livelihoods. Not only through making it source of food but selling them has been helping the community people to sustain a living. Some locals even expressed that they used to send their children for school using the money from selling madora but they are no longer being harvested in abundance as they used to be done. The mopane worms have been disturbed by the increasing temperatures and declining rainfall. The decreasing of forests especially the mopane trees through deforestation has also contributed to madora deterioration.

4.3.5 Effects on water sources

The experiencing of the drying up of Ngezi River which flows passing the Indaba Ward have been also affecting the lives of ordinary Indaba people. The respondents agreed that the water sources have been decreasing and some even drying up. One of the locals quoted saying that “*taimbochera mufuku tichibata mvura padhuze*, but now we have to dig deep to reach the water table”. Animals used to have water points which they used to drink from, but they have dried up and also people’s fetching points have also dried up and this has been because of high temperatures which have been increasing evaporation and also some torrential rainfall which has been compacting soil leading to more run off than infiltration into the ground. The locals have been travelling as much as 5 kilometres to fetch water.

4.3.6 Health

Africa is known for water borne diseases such as malaria, typhoid and cholera. The increase in temperatures for past years has led to the increase on water borne diseases in the area of study. The Indaba Ward has been witnessing the malaria epidemic although they are no records on how many people died of malaria but the locals have expressed that mosquitoes especially during the hot seasons they have increased comparing to the past decade.

4.3.7 Pests and Diseases

The experiencing of high temperatures and very low rainfall has also brought about the problems of pests and diseases to both livestock and crops in the Indaba Ward. The locals have been facing problems of pests such as bollworms, stalk borers, armyworms, bacteria, ringworms, tsetse flies, cutworms yellow leaf and leaf hopper and diseases which include black leg and anthrax and this has been because of the changes in climatic conditions. One of the respondents emphasized that there has been an increase of crop pests within the community and for example the armyworms have invaded fields in the area and has left the crops lifeless. The respondent further mentioned that these pests were already there but they have rapidly increased in just a short period of time.

4. 4 Strategies practised by the community to adapt to climate change

In trying to cope up with changes in climatic conditions, the Indaba Ward people have come up with some strategies to adapt. The methods which have been used include the strategies of conservative farming “*dhigaudye*”, tilling, buying livestock food, mixed cropping, planting of drought resistant crops (millet, sorghum) and the applying of organic manure. These are some of the mitigating strategies that have been applied by the Ward 15 people in a bid to try and counter the witnessed high temperatures and low rainfall. Applied strategies according to the locals they have been helping them produce better yields from their fields and improve the health of their livestock, thus improving their livelihood status.

The *dhigaudye* strategy (as preferred by locals) has been one of the methods which the locals have applied in trying to adapt to harsh climatic conditions being faced in the area. This strategy was introduced by the extension officers (*vadhumeni*) who have been patrolling in the Indaba Ward helping the people in achieving better yields from their fields. *Dhigaudye* is a strategy in which the smallholder farmers use manual labor to cultivate land. This has been done in trying to reduce the loss of moisture in the ground, reduce soil erosion and also protecting the health of cattle. The research also founded out that a number of cases have been recorded of cattle loss during the land cultivating period as cattle will not be able to cope up with the hard work simply due to deteriorating grazing lands. The strategy has been positive in improving the yields but one of the respondents interviewed expressed that they cannot dig the whole field as the process needs intensive hard labor and cannot be practiced on a large piece of land.

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In trying to adapt to problems caused by climate change, the people have also been selling some of their cattle to buy cattle feeds for the remaining ones. This strategy has proved to be helpful as the wealthy loss percentage have been decreasing. During the 2007-2008 droughts the Ward 15 people lost many cattle due to low rainfall and higher temperatures been causing the loss of grazing lands. The people have been buying cattle feeds for their livestock and also salt stones which increase strength to the livestock therefore protecting their source of livelihood. Another strategy that has been used according to one of the locals has been of travelling with livestock specifically cattle from one place to another looking for better pastures so as to help their cattle find some good pastures and water. This however has affected young boys education as school dropouts have increased because they have been the ones herding cattle even during school times.

The shifting from less drought resistant crops to more drought resistant crops has been one strategies adopted by the community in trying to reduce the impact of climate change on livelihoods. More drought resistant crops are crops that have better chances of surviving harsh climatic conditions with better chances of producing yields which are satisfying. These drought resistant crops such as millet, sorghum, rapoko and leguminous crops have helped the community with better source of food. The community has applied this strategy in a bid to overcome the problems of climate change and this has been helping improving the sources of livelihoods. Maize is important as it is the backbone staple food of Zimbabwe and the locals have been planting short season varieties (hybrid maize crop for example pannar) which take short time to grow and produce yields. Also pest tolerant varieties have been grown by the local people as a strategy to counter the problem of emerging and increasing crop pests in the area of study.

Water harvesting technique has also been used by the locals in trying and reducing water deficit in the community. The community has been able to collect raining water through the use of open wells, dishes and tanks. These water harvesting strategies have been helping local people having water during dry spells as they have been able to use the water from the reserved tanks and wells.

The growing of legume plants such as ground nuts, beans and round nuts during the end of rain seasons have also been one of the strategies used by the locals to improve their source of living even after some crops such as maize fail. According to one household head, he expressed that

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legume plants grow fast and also are full nutrients. These legume plants can survive even through drought seasons so they have been helping provide the locals with food even during drought.

The applying of organic manure has also been used as a mitigation strategy by the locals and to adapt to changes in climatic conditions in the area of study. The use of cow dung and manure from decomposed leafs and trees has been helping as the blankets to the soil to trap moisture so that the sun would not hit directly to the soil and increase evaporation. Matured cow dung has been used to increase soil fertility to feed the crops as some of the locals have been failing to buy fertilizers for their crops.

Tilling can be described as the cultivating the land and loosen the soil before growing season as one of the respondent during a focus group discussion named “*kuvundukura*”. This helps the infiltration of water and water holding capacity during the rainy season and it also reduces soil compaction and erosion.

Mixed cropping has been also another strategy applied by the Indaba Ward community to maintain their livelihood patterns. One of the respondents in the area of study showed that the locals were mixing crops such as sorghum, groundnuts and maize in one field and this has been helping them in producing better yields. Below is a picture showing that the local people have been practicing mixed cropping to reduce the impact of climate change on crops.

Fig 4.3 The photo below shows groundnuts and millet in the same piece of land.



Source: Survey Photo (2015)

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In trying to make a living, the local people have been diverting their sources of livelihood to off farm activities and these include, buying and selling, gold panning (along the Ngezi River), migrating to foreign countries for example in neighboring countries such as Botswana, South Africa, and Mozambique to find a way to make a living. Families with household heads out of the country have been relying on remittances from the people in Diaspora for their source of livelihood. Gold panning has been one of the main off farm activities practiced by the Ward 15 locals as means of generating income and this has been mainly practiced along the Ngezi River among other various places. The study also found out that artisan mining has been helping them in getting money for basic needs and that they have been able to send their children to school as a result of the activity. A significant number of community members especially the youths have been practicing artisanal mining during off seasons.

4.5 Problems that are faced in trying to adapt to climatic changes

The locals have tried to come up with measures to overcome the effects of climate change on their way of living and these include tiling, mixed cropping, water harvesting and many other strategies mentioned above. In trying to adapt to changes in climatic conditions, there have been factors undermining the capacity to adapt and these include human health, ignorance, some measures are labor intensive, unemployment, women being left defacto household heads.

Diseases such as HIV/AIDS have posed negative impacts in a bid to adapt to the climatic changes within Ward 15 of Zvishavane rural. HIV/AIDS pandemic has left the families with no enough labor to do labor demanding work such as the conservation farming method “*dhigaudye*” which is more labor intensive in nature. The virus has been most dominant mainly on working class and this is between the ages of 18-35 years, leaving families with no enough labor to cultivate land the conservative way. The pandemic have killed a number of household heads in the community leaving children and women as defacto household heads. Women as according to the feminist theories they cannot perform labor intensive work so this has also reduced the capacity of community to adapt to harsh climatic conditions witnessed in the area of study. Because of the virus, the families have been taking more time on taking care of the patients at home rather than doing productive work to improve their source of livelihood.

Unemployment rates in the community have also been reducing the standards of living of the locals of Indaba Ward. Zimbabwe is one of the countries with a number of educated people but

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with extremely high unemployment rate at the same time. Because of these high unemployment rates, the standards of living have also decreased in the area of study as many who are educated are just seated. Unemployment rates have increased the inability to make a living as the locals have not been able to buy basic needs and also agricultural inputs such as fertilizers, hybrid maize seeds and cattle for draught power. This has been undermining the capacity to adapt to climatic changes and therefore affecting the source of livelihood of the locals.

The demanding of intense labor by some other strategies to improve their livelihood has also been another factor reducing the capacity to adapt to changes in climatic conditions in the Ward 15 of Zvishavane rural. The adaptation strategy of conservative farming have been practiced in the area but only by a few number of people and this has been because of its demanding on labor. Because it is labor demanding, only a few people have been practicing it and those few people have been doing it on a small piece of land which cannot feed the whole family to the next harvesting season. This has undermined the way of adapting to climate change and the adaptive measure has failed to help the community as a whole to improve their way of living in the community of study.

The families with members out country have also recently been complaining that they are no longer seeing the benefits of being in Diaspora. One of the respondents was quote saying “*vakaenda Joni ndovakaendakare*” meaning they are no longer receiving remittances from Diaspora as they used to do and she goes on to say their family members from outside the country are now only bringing with them phones and radios and these do not even help improving the way of living for the families left behind.

Water harvesting techniques such as the use of wells and tanks has been as helpful for the community under study as the families have been able to use the waters during dry spells. However the water harvesting techniques have recently been bringing more harm than good to the locals. The issue of unprotected wells has been causing the death of livestock, increasing of waterborne diseases such as the malaria, cholera and typhoid in the area of study. Deaths of livestock have been causing a great loss to the livestock owners at the same time affecting their way of living. The community has been digging and leaving their wells unprotected and this has been leading to livestock loss through falling into those wells posing a great loss for the community. Diseases such as malaria have been affecting the health of the community.

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The locals are also not receiving enough information on ways to adapt to changes in climatic changes from the extension officers and that is also another reason why the community has been to adapt effectively to the climate changes problems they have witnessed. The extension officers because they do not have enough equipment to predict changes in climate of the seasons yet to come, this has been also affecting adaptation strategies practiced by the locals as they have been unable to provide locals with knowledge on when and in what way will climate change in a given area at what specific time. The limited awareness from the researchers has been playing a role in the capacity to adapt to changes in climatic conditions.

4.6 Other adaptation measures to climate change

Apart from adaptation measures that are already into practise by the community, there are other measures which have been put in place by extension officers, migration to better lands, diversification into nonfarm livelihood, cultivating on wet lands, irrigation schemes, crop diversification, the distribution of livestock in various places, early planting, planting of nontraditional crops, reduction of areas to be cultivated, growing pest tolerant varieties and many other strategies to mention but only a number of them. To adapt to climatic changes being faced in the area of study, the locals can take into practise the adaptation measures more seriously which they have been practising at easy. The sectors includes agriculture, water, health, forests and bio diversity, livestock production, rangelands and human settlements

The rural Zimbabweans have witnessed the existence of climate change and their effects on their way of living and they have been engaging into various strategies to try and cope up with negative impacts of these changes. The Indaba Ward people in trying to mitigate to the impacts of climate change on their sources of livelihood they must engage into growing pest tolerant varieties and drought resistant crops. This involves the growing of plants which are tolerant to pests and these are the ones which can survive and produce enough yields to feed families. Drought resistant crops such as sweet potatoes, sorghum, rapoko and millet must substitute less drought resistant crops like maize. The extension workers have been helping people engage into the crops which can play a role in improving the locals' livelihood. Drought resistant crops can produce yields even after receiving little rainfall as much as 200mm and the other advantage is that they quickly mature.

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Another strategy that can be adopted by the local population is distributing their livestock in various places. This is another way to reduce the impact of the changes in climatic conditions on livestock. Animals such as cattle are less resistant to the poor pastures and water sources. So distributing them to different places, when a drought comes not all of them will be affected and die. Even after diseases break out, not all livestock will be affected. Locals should also engage more into rearing of livestock such as goats, donkeys and if cattle they must rear heifer type of cattle which can survive even through droughts.

Another strategy that can be employed by the locals which have been put in place by Bethan, MACO, MASO is to invest into nutritious gardens and these can also play a significant part in improving the way of living for the endangered community of Indaba Ward. Some Non-Governmental Organization (NGO) in trying to eradicate poverty in the district they have engaged into creation of nutritious gardens to help the locals generate income. Through accepting NGO funded gardens, the livelihoods of the locals can also improve.

Irrigation is also another way to improve living standards of the locals of Indaba Ward. Irrigation in general involves the supplying of water to a previously dry area to make productive to produce yields. Because there is little rainfall in the area of study, irrigation can be an ideal to change an unproductive land to be productive. The area can be supplied water from a near dam in the area so that they can do their irrigation and improve their way of living and reduce the impact of low precipitations and high temperatures being witnessed by the locals of the Indaba Ward in rural Zvishavane. The ward under study can be helped by the Irrigation department which is in Zvishavane District on supply of material needed to start the irrigation schemes. The irrigation helps in that there will be no dry seasons affecting the area as water is always supplied and that the locals can produce fresh food such as cucumbers, water melons and also maize cobs that can be sold at the markets for income. This can be said to another way of generating income for the community to improve its way of living.

Migration can also be another way to improve the way of living for the local community. Migration involves the moving from one place to another and this can be either permanently or temporarily. This can also be another way in which the locals can survive the harsh climatic conditions they are facing in the area. The Ward is in haphazard way of settlement and the houses are very close to each other, migration can help freeing up the space as almost every household

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have got a minimum of about 6 cattle. This have given rise to competition over land and resources and calculating resources over people the ratio shows that there are too many people in the area. Because there are too many cattle in the area, this has led to deforestation and the deterioration of grazing lands leading to soil erosion. So migration can help freeing up space in the area so that the population will share resources sustainably. This can also be another way to improve livelihood standards of the Ward 15 area.

Mixed cropping has to be taken into consideration so as to cope up with climate changes being experienced in the area of study. Mixed cropping can be described as the type of cropping which involves the mixing of crops in a piece of land. This can also help the improving of yields in that plants such as legumes absorb gases such as nitrogen into the soil and this can be used by other plants such as maize. Mixed cropping is just the mixing of crops in a given piece of land and these plants may include millet, maize, rapoko, groundnuts and pumpkins in one area and this help to improve soil fertility and therefore increase yields for the given household. Mixed cropping has been practiced by the locals but not all of them. So the community must take into practise this method of planting crops so that yields can be boosted and can help improving the living standards of the area of study.

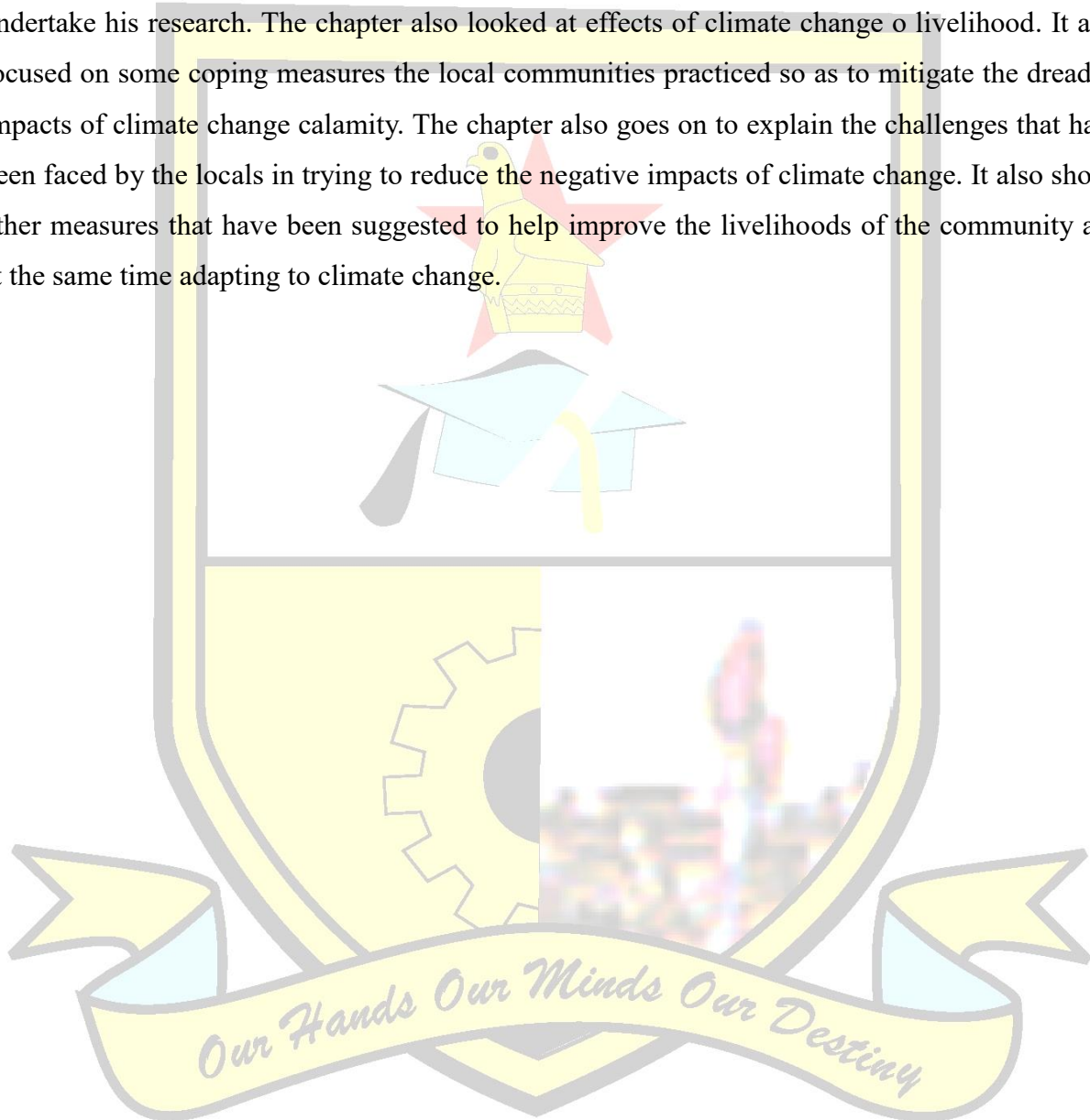
The locals should not continuously disturb forests and the cutting down of trees with no replacements. Also must emphasize on controlling the breaking of veld fires in the community. The cutting down of trees and uncontrolled fires cause the increase in the percentage of carbons in the air as trees works as carbon sinks will have been destroyed. Because gases such as carbon dioxide can stay in the atmosphere for a very long time, they will destroy the ozone layer and leading to the increase in ultra violet radiation (UVR) into the earth which can cause disasters such as the heat waves and increased evapotranspiration which can cause the occurrence of floods. So taking care of the forests can also be a measure to adapt to changes in climatic conditions in the area.

The improving of water harvesting techniques can also play a role in the adaptation to the changes in climate variations in the Ward 15. Water harvesting techniques as mentioned earlier above include the use of tanks, wells and also dishes that will be collecting raining water the house roofs. The water must be used wisely as water is one of the major problems being faced by

the local population. The water can be used to irrigate gardens, or channel it into the fields if not for future use. This can also help reduce the water deficient in the area under study.

4.7 Chapter Summary

This chapter focused on the response rate from the field where the researcher has gone to undertake his research. The chapter also looked at effects of climate change on livelihood. It also focused on some coping measures the local communities practiced so as to mitigate the dreadful impacts of climate change calamity. The chapter also goes on to explain the challenges that have been faced by the locals in trying to reduce the negative impacts of climate change. It also shows other measures that have been suggested to help improve the livelihoods of the community and at the same time adapting to climate change.



CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter aims to give a summary of the previous chapters, give conclusions and recommendations to the scope of the study. The chapter aims to answer all research questions and objectives presented in the chapter 2 and also find causes and effects of climate change and give solutions to the problems faced by the community under study.

5.2 Summary

Low rainfall and very high temperatures are the two main problems that have been witnessed in the area of study as a result of climate change. It has also shown that there is a strong link between the way of living of the locals and climate. As sources of livelihood include the availability of water, on agricultural, outputs, availability of forests, rangelands, and many others mentioned in the previous chapters, changes in climatic conditions have posed a great threat to the way of living of the locals as most of their source of livelihood depends on precipitation. The decreasing of rainfall and the shifting of seasons in Indaba Ward means has affected the sources of livelihoods.

Using the case study of Indaba Ward in Zvishavane district, the researcher was able to conduct seven interviews and administer twenty questionnaires to the thirty selected respondents in the community to find out the problems they are facing because of changes in climate conditions and the strategies they have engaged, to try and mitigate the effects of climate change on their way of living. The locals were able provide the researcher with the information on what changes they have noticed and these has been mainly the decreasing of precipitation and the increase in temperatures in the area. About 90% of the locals have shown that they have noticed changes in climate and these are mainly those who have living in the area for more than 30 years, and those who have living the place for less than ten years have seen no changes in climatic conditions and these includes the house hold heads of younger age of the ages between 22-35 years. Low rainfall and very high temperatures have caused great loss of cattle and decrease of crop yields as mentioned by the locals. For example the 2007-2008 droughts were because of the low rainfall

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experienced in the area. The researcher was also able to gather information through the use of secondary data (student work, newspapers, journals, books and articles). This helped the researcher know what was already on the ground related to his scope of study and was able to add it in his literature review in chapter 2. To help explain his scope of study, he used the theory of sustainable rural livelihood which guided him through his research.

The researcher used tables and survey photos. Pictures were helping showing the real effects of climate change on agriculture as for example the one with armyworms destroying maize crops. The respondents argued that the changes in climatic conditions brought with it deadly pests which have destroyed their crops therefore affecting crop yields.

The community has engaged into practices such as conservative farming (dhigaudye), tilling, mixed cropping, use of organic manure, cattle feeding and water harvesting as mitigation strategies to the low precipitation and high temperatures and to try and improve their way of living as it has been disturbed by climate problems. In implementing these strategies, the community has been facing problems and these include unemployment, the issue of defacto household heads and some mitigating measures that require intensive labor.

The researcher goes on to give some of the strategies that can be taken into account by the locals so as to adapt to changes in climatic conditions. The strategies are as follows, the starting of nutritious gardens, irrigation schemes, migration to reduce pressure on resources, wise use of water.

5.3 Conclusion

In conclusion, the problems caused by changes in climatic condition have been unveiled and these mainly include the low precipitation and high temperatures experienced in the Indaba Ward in Zvishavane district. The researcher was able to come up with strategies that the community could use as adaptation measures to the haunting climate change problems.

5.4 Recommendations

It is the role of the government, the ministry of agriculture, AREX, NGOs, extension officers to make sure the community has the best of way of living. The following are some of the recommendations that can be implemented to ensure that rural communities survive under the scourge of climate change.

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- ✚ The Meteorological Departments must make sure that the community receives early warnings on rainfall to be expected in every season. This can be done through the use of flyers, through the radio and television and this can help the community to know what to plant and what not to in the next season.
- ✚ Irrigation schemes must be erected to avoid non-performance of rain fed agriculture. The Department of Irrigation should be very instrumental. Widespread erection of irrigations can enhance the wards' and national food security status. Dry regions should be given first priority since cultivation of crops has risen to be a more difficult task when depending with rains to farm.
- ✚ Farmer education must be done. Teaching communal farmers the best ways possible of sustainable farming especially on how and what to farm under this climate change calamity. To add strength, local extension service workers should be granted with transport that can enable them penetrate remote parts of the society.
- ✚ The government must also give support to local communities such as issuing income generating projects to the community so as to diversify rural livelihood pillars. This can have a good and sustainable impact that can enable communities not to solely rely on rain fed agriculture. Also, this will enhance community's disaster prevention mitigation as well response.
- ✚ The government and other development oriented stakeholders should also help farmers acquire high yielding and short season variety crops. It will add value if these crops are pests, diseases and drought resistant. This can help farmers produce good outputs after a farming season and it will certainly add to instances of enhanced food security.
- ✚ Government must also introduce schools for farmers and teach them on how to adapt through harsh climate conditions. Climate change subjects must be introduced at all levels of education especially starting at secondary level. This can enhance awareness thereby creating generations that are climate mindful. This can enhance climate change initiatives to better thereby guaranteeing food security.

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Appendix 1

Questionnaires for Indaba Ward household heads

My name is Shoko Tenson, I am an undergraduate of the University of Midlands doing Development Studies. In partial fulfilment of the requirements of the Bachelor of Arts Honours Degree, I am doing a research on the effects of climate change on rural livelihoods in Indaba ward, Zvishavane. May you please kindly assist me with information?

Please tick where applicable

1) Are there any signs of climate change in your area?

Yes

No

2) If there are any changes, for how long have you been witnessing them?

Below 10 years

Above 10 years

3) Has there been any change in rainfall patterns and shifting of rainfall seasons?

Yes

No

4) What do you understand by the term climate change?

.....

5) In what ways has climate change affected your sources of livelihoods?

.....

6) Are your livestock being affected and if so, how?

.....

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7) What have you been doing to cope up with climate change?

.....

8) Did your harvest increase or decrease in the past 10 years?

.....

9) Are you adjusting to climate change?

.....

10) Any problems you have been facing in trying to cope up with climate change?

.....

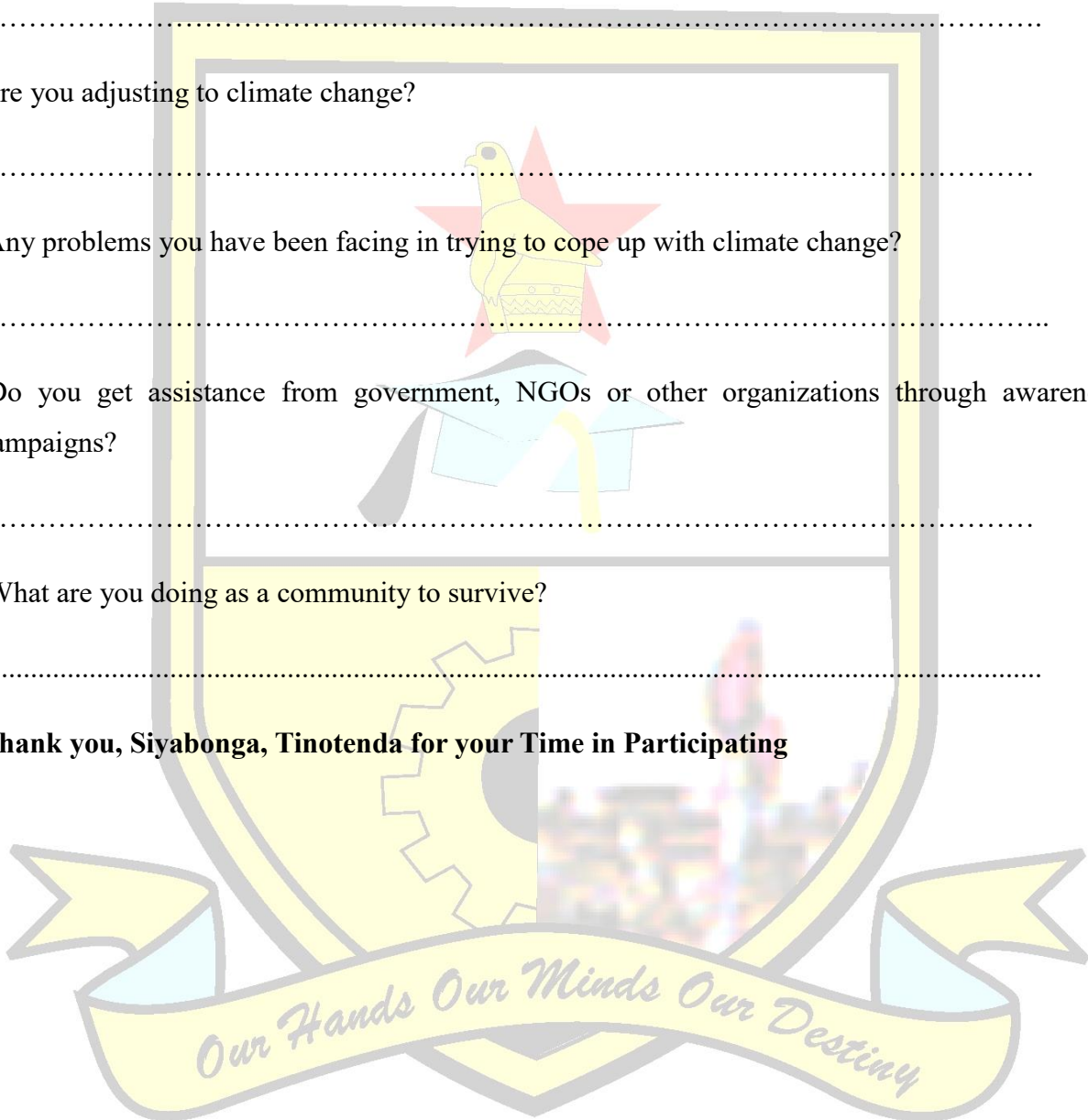
11) Do you get assistance from government, NGOs or other organizations through awareness campaigns?

.....

12) What are you doing as a community to survive?

.....

Thank you, Siyabonga, Tinotenda for your Time in Participating



Appendix 2

Interview guide

Good morning/afternoon, how are you. I am Tenson Shoko, a student from Midlands State University doing Development studies. In partial fulfilment of the requirements of the Bachelor of Arts Honours Degree, I am doing a research on the effects of climate change on rural livelihoods in Ward 15, Zvishavane. May you kindly assist me with information?

1. What do you understand by the term climate change?
2. How has climate change affected your way of living?
3. What have you been doing to cope up the changes in climate?
4. What challenges have been facing in trying to adapt to climate change?
5. What help do you need from the government that can help coping with the changes?

Thank you, Siyabonga, Tinotenda for your Time in Participating

