

**PERCEPTIONS OF RURAL COMMUNITIES ON CLIMATE CHANGE AND ITS
ECONOMIC IMPACTS ON THE LIVELIHOOD: A CASE OF MOTUPA COMMUNITY IN
TZANEEN, LIMPOPO PROVINCE**

BY

MAKWALA NKOMI SHAUN

Submitted in fulfilment of the requirements for the degree of

MASTERS

In

SOCIOLOGY

In the

FACULTY OF HUMANITIES

Department of Sociology and Anthropology

At the

UNIVERSITY OF LIMPOPO

SUPERVISOR: Prof. S A RANKOANA

2018

DECLARATION

Ideclare that the dissertation is submitted for the degree of Master of Arts in Sociology, and has not previously been submitted by me for a degree at this or any other university; that is my work in design and in execution, and that all materials contained herein have being duly acknowledged.

.....

Makwala NS (Miss)

.....

Date

DEDICATION

I want to humbly dedicate this study to the Almighty God for giving me Grace without which nothing was to be accomplished. The study is also dedicated to my mother Agnes Modjadji Makwala and my spiritual mother Nomfundo Kalpens for their support and dedication. May the good God bless them abundantly. The study is also dedicated to my brother Botha, sisters Joyce and Modjadji, and nephews Mahlatse and Neo for being there through hard times in my studies. Thank you all.

ACKNOWLEDGEMENTS

I would like to express my humble appreciation and gratitude to God for his love and Grace He showed unto me. On the same note, the following individuals deserve a thank you for the support and encouragement rendered when it was needed most.

- My supervisor Prof. S.A Rankoana for her support and guidance. The completion of this study is because of her patience and motivation. Without you I would have not completed the study. “Thank you for your dedication and patience”. You’re a true blessing to my life.
- Dr S.J Kubayi (DLitt et Phil- Unisa) Senior Lecturer (Department of Translation Studies and Linguistics -UL) for editing my dissertation.
- Mr M.E Kgatla, from Department of Translation, Interpretation and Linguistics Studies for editing my proposal and interpreting the data collection tool.
- Ms Nomfundo Kalpens for prayers, motivation and guidance.
- Mr William Mathole for words of encouragement and motivation.
- Ms Snowy Ncobo for words of encouragement and motivation.
- The Motupa community traditional leader Mr. M.P Machaba for giving me permission to conduct the research at the village.
- I would like to thank Motupa community members for their time dedicated to participate in this study.
- I would like to thank all the pastors, Bishop Mphosi and members of Jesus Glad Tidings International Church for their support and prayers.
- I thank God for the Strength, Grace and Wisdom that He gave me during tough times with this study.

ABSTRACT

Climate is a primary component of agricultural productivity, and as such, it influences the vulnerability of the households, communities and the broader economy. A heavy dependence on climate-sensitive economic sectors, in particular agriculture, makes South Africa particularly vulnerable to climate change. The study aims to explore the perceptions of the Motupa community members on climate change and its economic impact on their livelihood patterns. Motupa community is a rural area situated on the Southern part of Tzaneen, Limpopo province South Africa.

A triangulation of focus group discussion and semi-structured data collection method were adopted. Analysis was based on 20 participants who were purposively selected at Motupa community aged between 45 to 90 years to obtain their perceptions of climate change and its economic impact on livelihood. The study found that climate change in rural communities has a major impact during the past years. Climate change has contributed to major rural environmental stresses affecting local resources such as water, subsistence agriculture, economic activities, farming, livestock, forest and soil, among other natural assets.

The rural livelihoods show high levels of vulnerability to rapid climate change due to notable low adaptive capacity. The high level of vulnerability to changing climate is exposing the study population to increased prevalence of poor production, crop and livestock failure, food insecurity, poverty, malnutrition, diseases and viruses, among other impacts. The increase in temperatures and unpredictable rainfall patterns are major causes of climate change that Motupa community members have identified. Low production affects most community economic activities, resulting in livelihood vulnerability. The study concludes that factors creating barriers to climate change adaptation are related to those contributing to poverty and holding back sustainable local development. The study indicates that community members are using their indigenous knowledge as adaption to cope with the current climate change.

Table of Contents

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ACRONYMS	x
LIST OF FIGURES	xi
LIST OF TABLE	xi
CHAPTER 1	1
INTRODUCTION	1
1.1 Introduction and Background	1
1.2 Problem Statement.....	2
1.3 Definition of Key Concepts	3
1.3.1 Climate Change.....	3
1.3.2 Livelihood.....	3
1.3.3 Perception	3
1.3.4 Vulnerability.....	3
1.3.5 Economy	3
1.3.3 Impact.....	4
1.4 Purpose of the Study	4
1.4.1 Aim.....	4
1.4.2 Objectives	4
1.5 Study Area	4
1.6 Significance of the Study	5
1.7 The Role of Theory.....	5
1.8 Chapter Outline	7
CHAPTER 2	8
LITERATURE REVIEW	8
2.1 Understanding the Concept of Climate Change	8

2.4 Climate change in South Africa	11
2.5 Climate change in Limpopo Province	14
2.6 Climate Change as Perceived by Local Communities.....	18
2.7 Vulnerability to climate change.....	19
2.8 The impact of climate change	23
2.9. Economic impact of climate change	25
2.10. The livelihood pattern of rural communities under current subsistence economy	28
2.10.1 Food production	28
2.10.2 Water resources	28
2.10.3 Health.....	30
2.10.4 Social systems.....	30
2.10.5 Political organisation.....	32
2.11. Adaptation to climate change	33
2.12. Summary.....	36
CHAPTER 3	38
RESEARCH METHODOLOGY	38
3.1 Study area.....	38
3.1.1 Location	38
3.1.2 Climate.....	39
3.1.3 Settlement and Demography.....	39
3.1.5 Livelihood.....	40
3.2 Research Methods	41
3.2.1 Study design	41
3.2.3 Data collection	43
3.2.4 Data analysis.....	46
3.2.5 Trustworthiness	47
3.2.6 Ethical consideration	48
3.2.6.1 Informed consent	49
3.2.6.2 Voluntary participation.....	49

3.2.6.3 Right to privacy.....	49
3.2.7 Conclusion	49
CHAPTER 4	51
PRESENTATION OF THE RESULTS OF THE STUDY	51
4.1 Introduction	51
4.2. Demographic information	52
4.2.1 Respondents' Gender.....	52
4.2.2 Respondents' number of years living in a community	53
4.2.3 Household size	54
4.2.4. Employment	55
4.2.5 Education qualification.....	56
4.2.7 Respondents' subsistence production practices	57
4.3 Responses to the research questions	58
4.3.1 Description of the perceptions of Motupa community members on climate change	58
4.3.1.1 Perceptions of climate change	58
4.3.1.2 Indications of climate change	60
4.3.1.2.2 Changing rainfall patterns.....	61
4.3.2 An analysis of the impact of climate change on subsistence economy	63
4.3.2.1 Land ownership.....	63
4.3.2.2 Land cultivation	66
4.3.2.3 Preparation of soil	68
4.3.2.4 Seasonal plantation.....	69
4.3.2.5 Irrigation System	69
4.3.2.6 Distribution of harvested crops	70
4.3.2.7. Challenges of subsistence crop and livestock production in the community	71
4.3.3 Livelihood pattern under current subsistence farming	74
4.3.3.1 Subsistence farming.....	74
4.3.3.1.1 Sustained /Improved production.....	77
4.3.3.2 Alternative sources of food.....	82
CHAPTER 5	84

DISCUSSION, CONCLUSION AND RECOMMENDATION	84
5.1 Introduction	84
5.2 Study Sample	84
5.3 Research Methodology	85
5.3 The results of the study	87
5.3.1 Perceptions of Motupa community members on climate change	87
5.3.2 An examination of the impact of climate change on subsistence economy	88
5.3.3 Livelihood patterns under current subsistence farming.....	89
5.4 Conclusion	90
5.5 Recommendations	91
APPENDIX A: DATA COLLECTION TOOL	100
APPENDIX B: CONSENT FORM	102
SEGOMARETŠWA SA A: THULUSI YA KGOBOKETŠO YA TSEBO	103
SEGOMARETŠWA SA B: FOROMO YA BOITLAMO	105

ACRONYMS

DEA	Department of Environmental Affairs
FAO	Food and Agriculture Organisation
FFC	Financial and Fiscal Commission
GDP	Gross Domestic Product
IDP	Integrated Development Plan
IRD	Integrated Rural Development
MDGs	Millennium Development Goals
NGOs	Non- Governmental Organisations
RCP	Representative Concentration Pathway
SAL	Sustainable Livelihood Approach
SSA	Sub-Saharan Africa
UNDP	United Nations Development Programme

LIST OF FIGURES

Figure 1: Respondents' gender.....	43
Figure 2: Respondents' number of years living in a community.....	44
Figure 3: Respondents' household size.....	49
Figure 4: Respondents' employment.....	50
Figure 5: Respondents' educational qualification.....	51

LIST OF TABLE

Table 1: Respondents' subsistence economic practices.....	45
---	----

CHAPTER 1

INTRODUCTION

1.1 Introduction and Background

The effects of climate change and extreme weather events have undermined progress in poverty alleviation and food insecurity, as well as development efforts especially in rural communities (Intergovernmental Panel on Climate Change [IPCC], 2012). Dube and Phiri (2013) attest that about seventy percent (70%) of people living in rural areas depend on subsistence crop production, which is recently characterised by low productivity and instability as a result of marginal and erratic rainfall, low soil and ambient temperatures below the minimum temperature of 10°C. Subsistence farmers in South Africa are mostly reliant on rain-fed agriculture, and natural resources which are sensitive to climate change (Sango & Godwell, 2014).

Rankoana (2016) posits that the livelihoods of rural areas are rapidly changing as a result of unpredictable rainfall and changing temperature patterns. The IPCC (2012) observes that rural communities have ceased to practise subsistence farming because of changing weather conditions which resulted in low precipitation and unfavourable environmental conditions. Skoufias, Rabassa and Olivieri (2011) attest that the impact of changing climatic conditions on subsistence economy negatively affects the livelihood patterns of rural communities. The IPCC (2013) supports that change in weather conditions impacted the livelihoods of communities depending on categories of subsistence economy practising for livelihood.

Limited reliance on subsistence farming may result in food insecurity and poverty with negative effects on the welfare of rural community members (Seager, 2008). Cultural values, belief systems and practices are compromised as community members adopt non-tested indigenous knowledge systems and new interventions to adapt, cope and mitigate the impact of changing environmental conditions (Bhusal, 2009; Rankoana, 2016). The proposed study seeks to add value towards understanding of perceptions of rural communities on climate change, and how their livelihood patterns are affected by

changing subsistence economy as a result of climate change.

1.2 Problem Statement

The African continent is vulnerable to widespread poverty, recurrent drought, inequitable land distribution, and over-dependence on rain-fed agriculture as a result of effects of climate change (IPCC, 2014). Members of rural communities are aware of changing climatic conditions and the resulting impact (IPCC, 2014). Furthermore, the IPCC (2014) outline that most communities are aware that malnutrition, poverty, water and air contamination increased risks of diseases, floods, soil erosion and depletion of biodiversity are as a result of climate and environmental variability. Climate change threatens agriculture systems by putting pressure on the quality of life (McCarl, 2010) with negative consequences on people's health, economy and cultural activities (Kruger & Shongwe, 2004). This is particularly evident in less industrialized regions in which environmental change has immediate and direct effects on the health and well-being of millions of households that depend on natural resources for their livelihood (IPCC, 2012).

Observations of changing environmental conditions are notably, unpredictable rainfall, increased incidences of drought and changing seasons (Brown, Rance & Chatiza, 2012). Unpredictable rainfall, drought and increased temperature patterns negatively impacted subsistence economy (Mohale, 2014). The impacts on environmental and economic resources have directly affected human beings (Stern, 2006) and the most obvious consequences are poverty and food insecurity. Food insecurity and poverty are responsible for ill-health conditions, migration, land invasion, decreased demography and loss of income, which ultimately alter the livelihood patterns of rural community members (Skoufias, Rabassa & Olivieri, 2011).

Roncoli (2002) emphasised that the economic impacts of climate change such as high incidences of marginalised populations, rural-urban migrants, illegal settlements, ethnic minorities, women and children are already experienced by rural communities. Furthermore, decreased subsistence production in many rural communities is

responsible for cessation of cultural values, belief systems and practices, which are major challenges faced by rural communities (Seager, 2008).

1.3 Definition of Key Concepts

1.3.1 Climate Change

The IPCC (2012) defines climate change as transformation in the state of climate that can be identified by changes in the mean and the variability of its properties and that persists for an extended period, typically decades or longer. For the purpose of the present study, climate change refers to unstable weather conditions in the form of changing temperature and climate rainfall patterns.

1.3.2 Livelihood

Livelihood refers to everyday life in which people have various ideas about its meaning comprising capabilities and assets, including both material and social resources and activities required for a means of living (Bigsten & Tengstam, 2011). In the present study, livelihood means the way in which people live in order to survive over time.

1.3.3 Perception

In this study perception refers to the way in which community members recognise, understand and interpret observations and experience change in climatic conditions.

1.3.4 Vulnerability

Vulnerability refers to Motupa community members' awareness of susceptibility to various shocks resulting from change in climatic conditions.

1.3.5 Economy

Economy is an area of the production, distribution, or trade, and consumption of goods and services by different agents (Bigsten & Tengstam, 2011). In the present study,

economy refers to subsistence economy of Motupa community, which entails trade exchange of maize for maize meal, selling of cows, goats and chicken, and indigenous vegetables in other community members.

1.3.3 Impact

Impact is a strong effect on a situation, process, or person or something affecting community members (Bigsten & Tengstam, 2011). In this study, impact refers to either positive or negative influence from changing climatic conditions.

1.4 Purpose of the Study

1.4.1 Aim

The study explored the perceptions of Motupa Community members of climate change and how the change impacts subsistence economy and livelihood patterns.

1.4.2 Objectives

- To describe the perception of Motupa community members of climate change.
- To examine the impact of climate change on subsistence economy.
- To define the livelihood patterns of the community under current subsistence economy.

1.5 Study Area

Data was collected in Motupa community, which falls within Greater Tzaneen Municipality in Mopani District of Limpopo Province. The district is 80% rural and covers an area of 3 242, 6 km² with a population estimate of 58261 and an average density of 25 km² (Statistics South Africa, 2011). The community lies in a semi-arid area with an annual rainfall of approximately 403mm. Daily average summer temperatures range between 18 °C, 17.7 °C and 8.1 °C, 9 °C. Summer rainfall occurs between October and April, followed by a dry winter season (Statistics South Africa, 2011). It is located

between the Longitudes: 29 °C 52'E to 31 °C 52'E and Latitudes: 23 °C 0'S to 24 °C 38'S, with 31 °C E as the central meridian. Motupa community is inhabited by Balobedu of Ga-Modjadji. The people speak *Khelobedu*, which is the main dialect in the community. Statistics South Africa (2011) indicates that most communities' primary economic activities are subsistence farming and livestock.

1.6 Significance of the Study

Scientists studying climate variation, its impact and the capacity to adapt to effects of change have diverted attention to experiences of climate change by rural communities. The main goal is to understand the perceptions of the rural communities of climate change, how the livelihood assets are impacted and the competence of the communities to respond to change. The study adds value towards knowledge about the perceptions of rural communities of climate change and its economic impact on their livelihood patterns, especially subsistence farming, social and cultural capital on which the communities depend. The results of the study inform policy on adaptation to climate change by including the voices of local communities in terms of experiences of climate change, its impact and how community members are adapted to change. Most importantly, the results provided insight into the interconnectedness of social and cultural livelihoods assets and how they affect each other in the face of climate change.

1.7 The Role of Theory

Krantz's (2001) sustainable livelihood framework is a tool for assessing the vulnerability of different socio-economic groups and their capacity to cope in the presence of shocks, and to adapt to changing trends, which is very important within the context of climate change (Krantz, 2001). The framework suggests that major livelihood assets include human, natural, financial, physical, social and cultural capitals. These assets of social and cultural capitals are crucial in understanding the impact of climate change and the vulnerability of rural communities to climate shocks as the communities derive their livelihood from these social and cultural capitals. Access to these assets determines a person's level of resilience and adaptive capacity with respect to climate change.

The sustainability livelihood framework is useful to understand perceptions of climate change and how it affects subsistence economy and the livelihood patterns of a rural community. Perceptions of climate change provide experiences about the extent to which the community is vulnerable to climate change hazards. The study examined the impacts of climate change on the community's subsistence economy (cultural asset) and its implications on the current livelihood patterns (social assets). This approach is supported by Chingarande (2013), who argues that when subsistence economy fails, a community's livelihood assets such as social networks, mutual support, values, belief and practices become vulnerable to shocks.

The Sustainable Livelihood Approach recognised that the poor themselves often know their situations and needs the best, and must therefore be involved in the design of policies and projects intended to better their lives. Given a say in design, they are usually more committed to implementation. Thus, participation by the poor improves project performance. In many respects, the Sustainable Livelihood Approach is reminiscent of the old Integrated Rural Development (IRD) approach, which was also broad and multi-sectorial (Krantz, 2001). Sustainable development theory said to be a practical framework for evidence – based intervention and has much logic resting behind it, especially in a world undergoing rapid change and where resources to support development interventions are inevitably limited (Krantz, 2001).

The crucial difference is that the Sustainable Livelihood Approach does not necessarily aim to address all aspects of the livelihoods of the poor. The theory 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. The intention is rather to employ a holistic perspective in the analysis of livelihoods, to identify those issues or subject areas where an intervention could be strategically important for effective poverty reduction, either at the local, or policy level. Some of its proponents have therefore likened it to an acupuncture approach to development (putting the needles in the right place) (Chambers & Gordon, 1992).

1.8 Chapter Outline

Chapter 1

This is the general orientation of the study; it provides an overview of the study, including the introduction, research problem, aim and objectives of the study, definition of key concepts, theoretical framework, ethical consideration and the significance of the study.

Chapter 2

The chapter presents literature review about rural community members' perceptions of climate change.

Chapter 3

This chapter discusses the study design, sampling size and composition, data collection, data analysis, trustworthiness and ethical consideration adopted to conduct the study.

Chapter 4

The chapter presents the findings of the study.

Chapter 5

The chapter contains the discussion, conclusion and recommendations for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 Understanding the Concept of Climate Change

Climate change is a global and complex issue where different scholars explain it in various ways and in terms of their experiences. According to the IPCC (2012), stated that during the past century, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere which results in climate change. Sango and Godwell (2014) expressed that climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, persistent anthropogenic changes in the composition of the atmosphere or in land use, and activities that human engage in daily being harmful to weather conditions either directly or indirectly.

In addition, Sango and Godwell (2014) argue that internal and external forces such as air pollution caused by industries and gas emissions from cars can cause climate change. Rankomise (2015) is of the view that climate change implies the long-term average of the individual weather conditions that communities experience every day. Climate change has become a complex concept to define or understand due to the rapid change in daily weather conditions in South Africa. The impact of climate change and life-threatening weather events has undermined improvement in poverty alleviation and food insecurity globally, nationally, provincially and locally (Intergovernmental Panel on Climate Change [IPCC], 2012).

Sango and Godwell (2014) observe that South African subsistence farmers are mostly reliant on rain-fed agriculture and natural resources for their livelihood pattern development. Furthermore, Rankoana (2016) project that the livelihoods of rural areas are rapidly changing because of unpredictable rainfall and changing temperature patterns. However, the IPCC (2012) adds that rural communities face extinction in

terms of practices of subsistence farming because of unreliable weather conditions which threaten their economic activities.

Skoufias, Rabassa and Olivieri (2011) are of the view that the effect of climate change condition on subsistence economic activities will negatively impact the livelihood pattern of rural communities. The IPCC (2013) reports that changes in weather conditions affect the livelihoods of rural communities depending on the kind of subsistence economy practised. Moreover, the IPCC (2012) adds that community production is recently characterised by poor productivity and instability as a result of increasing weather temperature, unpredictable rainfall and poor soil. Partial reliance on subsistence farming may result in food insecurity, poverty and poor health, with negative effects on the welfare of rural community members (Schlenker & Lobell, 2010; Seager, 2008).

Sociologist observed that in order to understand and respond to climate change there is a need to develop two kinds of imagination: to see the relationships between human actions and their impacts on earth's biophysical system (ecological imagination) and to see the relationships within society that make up this environmentally damaging social structure (sociological imagination) (Norgaard , 2018). Furthermore, the application of both sociological and ecological imagination allows the understanding of four key problems on unpredictable climate change. Firstly, will understand the question why climate change is happening, secondly, how we are being impacted, thirdly, why we have failed to successfully respond so far, and lastly, how we might be able to effectively do so (Norgaard , 2018).

These will able to make the rural communities to engage in developing the policies and coping strategies on climate change as Krantz (2001) at sustainable livelihood approach (SLA) theory that people that are facing the problem are supposed to be the one to come with the prevention strategies to achieve the positive response towards the problem.

2.2 Climate change in Africa

The 4th IPCC Assessment Report (IPCC, 2007) presented evidence that Africa is warming faster than the global average, and this is likely to continue due to rapid climatic change conditions. Bhusal (2009) observes that African countries are under pressure from climate stresses and are highly vulnerable to climate change. Sango and Godwell (2014) conclude that climate change has been identified as leading to human and environmental crisis recently in most of African countries, where agricultural production depends almost entirely on the rainy season that makes Africa particularly vulnerable to climate change (IPCC, 2013). During the 1980s and 1990s, increase in drought negatively affected African and Southern African people. The IPCC (2012) asserts that climate change is a key concern in Africa where annual temperatures have increased by 1.5 times above the observed global average of 0.65 °C over the past five decades.

These changes are ongoing because the 2013 South African Long Term Adaptation Scenarios and the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5) proposed that climate change from 1986-2005 would not have the same effect as the changes of 2018-2100 (Madzwamuse, 2014). Kahsay and Hansena (2016) support that climate change poses a significant threat on African countries' water resource, food security, health, infrastructure and economy as a whole.

Rankomise (2015) shows the observed estimation report indicating that one third of African people already live in drought-prone areas, and 220 million are exposed to drought each year. However, several factors contribute and compound the impacts of current climate variability in Africa, and have negative effects on the continent's ability to cope with climate change (Rankomise, 2015). Kahsay and Hansena (2016) further hold that these will result in poverty, illiteracy and lack of skills, limited infrastructure, low levels of primary education and health care, poor access to resources and low management capabilities. Schlenker and Lobell (2010) are of the view that overexploitation of land resources, including forests, increases in population, and

desertification and land degradation poses additional threats to climate conditions. Kahsay and Hansena (2016) further argue that due to changing in climate condition and global warming poses threat to the rural communities' livelihood which results in lack of inability to implement policies and political instability to address issues affecting livelihood.

2.4 Climate change in South Africa

Climate change is a global challenge to both sustainable livelihoods and economic development (Debay, 2010). Seager (2008) observes that climate change is one of the major challenges confronting South African people together with their government. It leads to acute conflicts. It therefore becomes imperative to achieve a proper understanding of this phenomenon. Furthermore, Debay (2010) states that the great public, political and academic attention is now devoted to the issue of climate change and global warming. Madzwamuse (2014) adds that developing countries are vulnerable to disasters, and South Africa is one of them, because it is still characterised by deep rural areas.

Low capacity resilience to cope with risks disaster may lead to famine and widespread disruption of socio-economic well-being, especially on subsistence economic activities (Madzwamuse, 2014). Madzwamuse (2014) adds that it is widely evident that ongoing changes in climatic conditions will have an adverse effect on agricultural production in both Africa and South Africa. The impact of climate change condition on agriculture is motivated by the agriculture mainstay of rural economies in South Africa and the entire African continent (Blignauta, Ueckermannb & Aronson, 2009). Ziervogel, New and Van Garderem (2014) further emphasise that South Africa faces major changes in its climate. However, the annual average temperatures have increased in the past three years and the extreme rainfall events have increased in frequency, and this may cause positive and negative results of climate change.

Seager (2008) identifies major effects of climate change on the environment, including severe changes in subsistence economic activities. Climate change research in South Africa is no longer seen purely as an environmental problem, but also as a growing problem (Madzwamuse, 2010). Most rural communities in South Africa rely on subsistence economic activities to enhance their livelihood sustainability. To understand climate change as an evolving problem, many studies have showed evidence about the impacts of increasing temperatures, increased flooding, changes in rainy seasons and changes in winds on many aspects of broader economic development, such as water availability, food security, housing and infrastructure (Ziervogel, New & Van Garderem, 2014). It is observed that changing weather conditions will further impact rural community livelihood patterns because temperature is ever changing.

Hummel (2015) and the IPCC (2012) argued that it is important for human communities to determine their survival through indigenous knowledge that they have experienced during the change of seasons in their economic activities and practices such as crop production, livestock and other traditional plants. Climate change as a factor of life is particularly a threat to low income rural communities whose livelihoods heavily depend on rain-fed subsistence agriculture like the Balobedu community. Furthermore, South Africa has high levels of poverty and inequality, which hinder the development of the country's economy at provincial levels (Hummel, 2015). The unpredictable rainfall and increase in temperature results in low production which affects the livelihood of community members. Most rural communities still characterized by trade exchange in order to improve their economic activities and maintain their social capital.

Rankoana (2016) emphasises that most rural areas depend on agricultural farming, which almost entirely count on rainfall for their production. Communities acknowledge that rainfall amounts decreased over the past years, and the overall temperatures have also increased. Madzwamuse (2010) supports the statement above by emphasising that the meteorological data claimed that such changes have reduced agricultural productivity, particularly by prolonged drought, inadequate and uneven distribution of rainfall, as well as unpredictable onset and ending of rains.

Schulze (2010) explains that stressors such as crop diseases and pests, low soil fertility and inadequate extension services were reported to contribute to the decline in agricultural productivity and re-occurrence of food insecurity. Moreover, the IPCC (2012) adds that some African countries have already faced semi-arid conditions that make agricultural production challenging. Consequently, climate change has reduced the length of growing seasons as well as force large areas of marginal agricultural potential out of production (Roncoli, Ingram & Kirshen, 2002). For example, food production assessment indicates that domestic food production has already declined by 10% in several Sub-Saharan countries.

Furthermore, Schulze (2010) argues that Statistics South Africa (2009) projected that a decrease in crops in some countries will be as much as 50% by 2020, with small-scale farmers being the most affected. Therefore, the ecosystems, land use and livelihoods of local communities are among aspects influenced by climate change and variability (Schulze, 2010). Ncube, Madubula, Ngwenya, Zinyengere, Zhou, Francis, Mthunzi, Olivier and Madzivhandila (2016) argue that in South Africa, millions of people living in rural areas are amongst the poorest and the most vulnerable with have low capacity for resilience to cope with disaster risks. Most developing countries are increasingly vulnerable to disasters.

Food and Agriculture Organisation (FAO) (2007) details that the current interventions recognise different types of impact of climate change disasters on people's livelihoods, especially in rural households. To identify households and livelihoods that are vulnerable to climate change has become a key input for targeting, monitoring and evaluating adaptation policies (Rose, 2015). According to Ncube et al. (2016), climate change is a global externality that negatively affects households, communities and the broader economy. Furthermore, the potential of climate change to destabilise economies and public finances is real, and can no longer be ignored. In addition, Bewket (2012) states that climate change is associated with many of the natural disasters in South Africa and can lead to widespread of food and water insecurity. Furthermore, the dependence of climate sensitive economic sectors such as agriculture makes South Africa vulnerable to climate change.

The Financial and Fiscal Commission (FFC) (2012) posits that the effect of climate change on agricultural output will directly affect rural communities through less income and reduced employment. This will have effect on both the rural economies and food security in most rural areas. Moreover, rural households are more vulnerable because they lack knowledge about the means of adaptation to climate change. FFC (2012) further indicates that financial and physical resources are limited, and these scarce resources are targeted in the most vulnerability communities. In South Africa, a number of studies have analysed vulnerability at the household level, but have scarcely examined the dimensions of vulnerability within these households (Ncube et al., 2016).

2.5 Climate change in Limpopo Province

According to Dube and Phiri (2013), Limpopo Province is one of South Africa's richest agricultural areas, whose major produce is vegetables and fruits. The subtropical climate enjoyed by much of the province gives rise to the cultivation of vegetables, tea, coffee and fruits, especially tropical fruits. Agricultural farming makes a major contribution to the economy because it is used to produce wheat, millet, maize, and groundnuts (Maponya & Mpandeli, 2013). Livestock farming includes goats, pigs, chickens, cattle ranching and game with abundance of orchards with various subtropical fruits and nuts forming the basis of a thriving agro-industrial sector, which contributes to the growth of the economy in Limpopo Province (Maponya & Mpandeli, 2012).

Statistics South Africa (2009) estimates that 3 million farmers in South Africa practise subsistence agriculture primarily to meet their family sustainability and improve rural poverty. Furthermore, the current unpredictable climate condition in Limpopo Province could phase worse results on their economic activities. Ncube et al. (2016) supports Statistics South Africa (2009) by stating that due to low income, lower technological and capital stocks, households are predicted to have limited options to adapt to changing weather patterns like drought. Drought is a serious problem in the province considering that it is in a semi-arid area with low, unreliable rainfall.

Roncoli, Ingram and Kirshen (2013) further hold that the impact of lower rainfall has negatively affected the agricultural sector, resulting in decreases in agricultural activities, loss of livestock, shortage of drinking water, low yields and shortage of seeds for subsequent cultivation. Schulze (2010) adds that the challenges of draught which the province is facing from time to time leads to reduced grazing, and reduced water for livestock and irrigation, which negatively affect the agricultural sector. Limpopo Province was worst affected by drought in the past years where dams were only 50% full, compared with 84% in the late nineties (Schulze, 2010).

Getu (2015) states that the agricultural sector has been seen as an important source of livelihood for Limpopo Province rural areas. Due to extreme weather changes such as drought, it will be difficult for rural communities to adapt to current change. In addition, Maponya and Mpandeli (2012) attest that it is distressing because in some parts of communities, farmers have already been forced to sell their livestock as a result of drought conditions. Moreover, Kumsa and Jones (2010) show that this will turn to serious challenge for agriculture, and will result in insufficient or shortage of food (food scarcity), not only in Limpopo Province, but also in South Africa as a whole. This will be caused by the geographical locality of Limpopo Province situated at the northern part of South Africa, which is characterised by many fields that are vulnerable to climate change (Getu, 2015).

Tshiala and Olwoch (2010) argue that climate is a primary element of agricultural productivity, and as such, influences the types of vegetation that can grow in a given location. Tshiala and Olwoch (2010) cited Maponya and Mpandeli (2012) stating that the tropical regions in the developing sphere are particularly vulnerable to potential damage from environmental changes. This will be because large areas of these regions are covered by poor soils, which have already made much of the land unusable for agriculture. Small-scale farmers, who are predominant in the Province, have little capital and will not be able to pursue new strategies that will be required to adapt to the change in climate (Tshiala & Olwoch, 2010).

Limpopo is one of the developing provinces in South Africa, and is predominantly vulnerable to the impact of climate change, partly because of its exposure to extreme weather events and sensitive economies (Kahsay & Hansena, 2016). According to Mokhem and Janse van Vuuren (2015), Limpopo has a high number of rural dwellers who are dependent on natural resources. Communities in Limpopo region may have a greater ability to adapt to long-term changes in climate such as increased seasonal temperature and altered patterns of precipitation.

Limpopo Province is characterised by deep rural areas where subsistence agriculture is a major economic activity for survival. Furthermore, the community smallholder farmers rely on rainfall for cultivation in order to increase production to enable them to trade their goods (Bruckner, 2012). Limpopo Province is also the breadbasket and agricultural engine of South Africa (Sango, 2013). The data represented above illustrate that Limpopo is one of the provinces in South Africa that has a bigger role to play in the economy. Although climate changes affect the agricultural activity as is the primary activity amongst the communities and surrounding farmers, many farmers use their indigenous knowledge to adapt to climate change (Mapaure, Mhango & Mulenga, 2011). Most farmers rely on cultural indigenous knowledge on ploughing, putting manure, irrigation and preserve seeds for the next season to adapt to current climate change.

The Financial and Fiscal Commission (FFC) (2012; 2013) estimates that 33% of households in Limpopo Province are considered agricultural households. Moreover, Limpopo Province covers 16% homes of South Africa's agricultural households. Despite the above statement, the agriculture sector contributed 3% to the province's annual average Gross Domestic Product (GDP) in 2012 (FFC, 2012; 2013). It is noted that in the Limpopo Green Economy Plan, agriculture is a key sector for the province's subsistence economy because it is a source of food security, is a creator of employment, sustainability and trade exchange, and contributor of exports to other provinces (FFC, 2012; 2013).

Mokhem and Janse van Vuuren (2015) argue that the recent rapid changes in weather condition in Limpopo Province poses a threat to smallholder farmers and households' livelihood. Many families depend on subsistence agriculture and animal production for socioeconomic activities and for survival. Dube and Phiri (2013) attest that some smallholder farmers are able to create employment, due to lack of rainfall and high rate of drought, they are forced to reduce people from work and will not employ again. The rapid change of weather condition in South Africa accelerates food prices due to the high inflation rate. This puts more threat to the government as well.

Tshiala and Olwoch (2010) stated that the South African agricultural sector is traditionally a large employer in the economy. However, the contribution of agriculture to total employment has declined from 30% in 1971 to 13% of the economically active population in South Africa in 2000. Tshiala and Olwoch (2010) further cited the Department of Environmental Affairs Notice of 2010 (2010) that commercial farms provide estimated six million households with employment and their educational needs for the development of rural communities. There are also 240,000 small farmers who provide livelihood to more than one million of their family members and occasional employment to another 500,000 people (Tshiala & Olwoch, 2010).

Blignaut, Ueckermann and Aronson (2009) indicate that the ongoing changes in climatic conditions have an adverse effect on agricultural production in Limpopo Province. The impact of climate change felt predominantly by farmers through changes in the timing, frequency and intensity of rainfall events, drought and irregular rainfall is a result of these changes in climatic conditions. Subsistence agriculture is the mainstay of rural economies in Limpopo Province. The importance of agriculture cannot be overemphasised from a food security perspective (Blignaut, Ueckermann & Aronson, 2009).

The historical changes in rainfall and temperature changes in South Africa and Limpopo Province agricultural production constrain the livelihoods of people and government to cope with strategies of adapting to climate change (Kumsa & Jones, 2010). Mokhem

and Janse van Vuuren (2015) further argue that South Africa was forced to import maize as a result of drought that destroyed crops and infertile soil in most farmers' land. Furthermore, FAO (2003) shows that drought has damaged crops in different provinces, which comprised 64% of output in 2014. The local price of white maize has risen by 27% in Johannesburg this year, and that of yellow maize, used mainly as animal feed, by 13% as the Crop Estimates Committee predicts the smallest harvest since 2007 (FAO, 2003).

2.6 Climate Change as Perceived by Local Communities

Perceptions of climate change and its threats to rural communities are among the major challenges faced by scholars, analysts and scientists on research in South Africa. The perceptions of climate change by rural communities are centred on observations of variations in rapid changes in temperature and rainfall patterns (Rankoana, 2016). Gandure, Walker, and Botha (2011) attested that communities are aware of the rapid climatic change condition and its impacts on people's livelihood. However, it is reported that rural communities' experiences sever challenges of scarcity of rainfall, which affects their subsistence economic activities within the community (Gandure, Walker, & Botha, 2011).

Gandure, Walker and Botha (2011), observed changes in rainfall and temperature patterns are supported by explanations of a drastic increase in temperatures, with negative impacts on the livelihood patterns of rural communities. This type of understanding of climate change is crucial in planning adaptation and mitigation measures to address the effects of increased temperature and scarce rainfall for sustainable livelihood (Nath & Bhagirath, 2011).

Mapaure, Mhango and Mulenga (2011) attest that about 60% of people in developing countries living in rural areas depend on subsistence crop production, which is recently characterised by low productivity and instability as a result of marginal and erratic rainfall, low soil and ambient temperature below the minimum temperature of 10 °C. For this reason, subsistence farmers are vulnerable to the impacts of climate change,

increased temperature and drought, which are among recent prevalent stressors that rural communities have to cope with (Dube & Phiri, 2013).

It is becoming clear that the realisation of development goals would be seriously hampered by a decrease of suitable areas for maize, cotton and sorghum suitable by 2080 (IPCC, 2013). Drought and global warming is also expected to exacerbate declining agricultural outputs, further compromising economic growth and stability, employment levels, food security, demand for other goods and poverty reduction (Maponya & Mpandeli, 2013; Nath & Bhagirath, 2011). Foremost climate hazards, excessive heat, diseases, depletion of biodiversity and water scarcity threaten the livelihoods of communities that depend on subsistence crop production. Furthermore, there is a remarkable ecological variability as a result of persistent drought which results in decreased water resources and production (IPCC, 2013), threatening the livelihoods of rural communities.

2.7 Vulnerability to climate change

Dessalegn and Akalu (2015) add that the continent also has low adaptive capacity, making it particularly vulnerable and exposed because of high rates of poverty, financial and technological constraints as well as heavy reliance on rain-fed agriculture (IPCC, 2014). The IPCC (2014) further adds that rural livelihoods are subject to multiple shocks and stresses that can increase household vulnerability. Climate variability is one of the pervasive stresses that individuals and communities in rural areas have to cope with (Dessalegn & Akalu, 2015). Global warming as the influence element of climate change threatens the production of most subsistence farmers and rural livelihood.

Financial and Fiscal Commission (2012; 2013) points out that rural households are expected to be further vulnerable as they lack means of adaptation with climate change. The effect of climate change on agricultural output will directly affect rural communities to be vulnerable, through reduced income, employment, and knock-on effects for rural economies as a whole, and the food security nexus (FFC, 2012; 2013). Dessalegn and

Akalu (2015) argue that many households are becoming more vulnerable to being poor due to climatic change conditions. Widespread food and water insecurities are some of the vulnerability of climate change experienced by subsistence communities (Dessalegn & Akalu, 2015). Rural communities in South Africa are faced with vulnerability because they lack more knowledge about implementing the coping strategies' of climate change and unpredictable rainfall.

Hummel (2015) further indicates that in South Africa few studies have analysed vulnerability at the household level, where policies are supposed to be implemented to make a difference. Therefore, Olsson, Opondo, Tschakert, Agrawal, Eriksen, Perch and Zakieldeem (2014) note that within these households, the gender dimensions of vulnerability have barely been examined, and affect the implementation adaption and mitigation strategies. Most of the sociologist studies about climate change findings indicated that there is lack of proper implementation of coping strategies and political inability to dress the issue related to climate change.

Yohe and Tol (2002) outline that rural livelihoods are subject to multiple shocks and stress that can increase household vulnerability on subsistence agriculture. In addition the increase in temperature results in lack of rainfall which influences low production within the households which threatens the livelihood. Climate variability is one of the persistent stresses that individuals and rural communities have to cope with in their subsistence economy (Hummel, 2015). Climate vulnerability is not only a stress on livelihoods, but also impacts on seasonal forecasts that require evaluation of agricultural activities that might change in response to these forecasts (Yohe & Tol, 2002). Furthermore, the multiple dimensions of rural livelihoods that constrain the uptake of information have secondary effects, and determine the system's ability to handle future stress (Yohe & Tol 2002).

Getu (2015) stated that Southern African households depend on rain-fed agriculture for survival and is often considered a risky enterprise with low returns. Many people seek paid employment and off-farm income sources in order to increase their livelihood

support bases which make them vulnerable (Getu, 2015). Rose (2015) elaborates that factors such as unstable economies, variable government policies and health crises threaten households' vulnerability directly. For example, HIV/AIDS is eroding many aspects of rural livelihoods: financial assets deplete when used for health care and when those of working age are sick; agricultural labour decreases when the work force is not strong enough and social networks erode when young family members die and traditional practices are compromised (Rose, 2015).

Bruckner (2012) illustrated that South Africa is dependent on agriculture and climate sensitive economic sectors, which make it more vulnerable to the impacts of climate change because of its less resilience to negative external events and low capacity to adapt than other developing countries. Bruckner (2012) further adds that South Africa is vulnerable due to its low level of economic development and low capacity of adaption measures within the households. Higher temperatures and rainfall variability reduce crop productivity in low income and agriculture-based economies. Rose (2015) believe that subsistence farmers and small-scale farming, climate change, such as increasing temperature and declining rainfall, pose considerable risks to the livelihood patterns of rural communities.

People who are poor and marginalised usually have the least buffer to face even modest climate hazards and suffer most from successive events with little time for recovery (Olsson, Opondo, Tschakert, Agrawal, Eriksen, Perch & Zakieldeem, 2014). Most African countries, including South Africa are more affected by climate change because of their reliance on agriculture as well as their lower financial, technical, and institutional capacity to adapt to climate change (Rose, 2015; Singh & Purohit, 2014; Huq, Huger, Boon & Gain, 2004). The South African government have identified and have policies and strategies to cope with climate change but there is lack in implementation process. South Africa is expected to be the most affected by climate change, land degradation, and desertification because of current rapid climate change conditions (Hummel, 2015).

The African Partnership Forum (APF, 2007) opines that climate change can no longer be considered as an environmental problem only; it has also become a major threat to sustainable development and poverty reduction. Climate change can hinder sustainable development of nations by minimising yield production, which leads to food insecurity. Sub-Saharan Africa (SSA) is the most susceptible and vulnerable place to climate change. It is also estimated to be the most food-insecure region in the future. According to the report of the Economic Intelligence unit of 2014, food affordability in Sub Saharan Africa is undermined by low average incomes, widespread poverty and heavy reliance on costly food imports (Nath & Bhagirath, 2011). Although one to two of the Millennium Development Goals is to eradicate extreme poverty and hunger but due to increase in temperate which results in drought threatens the livelihood of rural communities.

Dessalegn and Akalu (2015) claim that highly fragmented farming systems, little use of modern farming systems and low application of productivity enhancing techniques undermine agricultural output and make the Sub Saharan Africa a net food importer. The impacts of climate change on smallholder farmers who depend only on rain-fed agriculture are among the most disadvantaged and vulnerable groups (Tetteh Opareh, Ampadu & Antwid, 2014). According to Getu (2015), agriculture and livestock keeping are amongst climate sensitive sectors. The negative impacts of climate change are more severely felt by poor people in developing countries who mainly depend on natural resources. Similar to crop productions, climate change also adversely affects livestock production.

According to the Food and Agriculture Organization (2003), over 60% of Africans depends on agricultural activities for household sustainability. Low yields of agricultural production lead to losses of economic development that hinder efforts to meet the Millennium Development Goals (MDGs) of African countries. Sub Saharan Africa predicted to loss of about 26 billion US\$ by 2060 due to climate change (United Nations Development Programme (UNDP), 2011). The IPCC (2007) estimates that climate change will reduce the yields of rain-fed agriculture by up to 50% by 2020.

2.8 The impact of climate change

Aljareo (2014) observed that most rural communities are facing the impacts of climate change which result in hindering their development on subsistence economies. The food insecurity on both rural and urban areas is threatened because the current climate changes influence the subsistence farmers to enhance their production (Aljareo, 2014). South Africa has various agricultural economies comprising of well-developed commercial farming and small-scale, largely subsistence production (Turpie & Visser, 2013/2014). Agricultural activities range from intensive crop cultivation, mixed livestock and crop farming in winter rainfall and high summer rainfall areas, to cattle ranching in the bushveld in the semi-arid regions (Turpie & Visser, 2013/2014).

The IPCC (2013) argues that the impact of changing rainfall and temperature patterns on subsistence farmers has increased food insecurity in South Africa. Due to global warming precipitation amount, type and timing are changing because of increased evaporation, especially in the South African regions, where subsistence farmers are threatened by unpredictable changing weather events (Sango & Godwell, 2014). Although other studies have shown a 2% overall increase in global land precipitation (IPCC, 2001), rainfall characteristics have shown considerable variations from region to region, with some areas experiencing decline and increase in precipitation due to increased extreme weather patterns.

According to the IPCC (2013), changes in rainfall patterns have negatively affected mixed rain-fed agricultural subsistence farmers, mostly in rural areas. The IPCC (2013) further states that agriculture has progressively become more marginal in the arid and semi-arid areas. A significant decrease in suitable rain-fed agricultural land and production potential for crops and cereals has been predicted under severe climate change by 2080 (Sango & Godwell, 2014). The IPCC (2014) further emphasises that rainfall patterns have been changing as climate changes and rain-fed agriculture are unpredictable. But due to climate change, the reliability of the rain for agricultural purposes has reduced in recent years.

Although there has been much research findings IPCC(2013) about the effects of climate change in rural areas, there has been little discussion that engages both science of climate change impact on agriculture, and specificities of smallholder and subsistence systems (IPCC, 2013). South Africa is still a developing country and has faced several challenges on the impact of climate change. Furthermore, 40% of the country's disadvantaged population resides in rural areas, and depend either directly or indirectly on land as a source of livelihood (Gyampoh, Amisah, Indinoba & Nkem, 2014). Benhin (2008) adds that agriculture plays a significant role in the country's economy, contributing about 2.9% of GDP, 10% of formal employment and 10% of the total value of exports in 2000.

South Africa is particularly vulnerable to impact of climate change due to dependency on climate-sensitive economic sectors, high levels of poverty and drought with related to impacts of HIV/AIDS (Madzwamuse, 2010). Climate change is a potential threat to the world food security agenda because of its strong and negative impact on dry-land crop cultivation or rain-fed agriculture, which forms the basis of smallholder agriculture (Sango & Godwell, 2014). Furthermore, Gyampoh, Amisah, Indinoba & Nkem (2014) assert that an estimated three million primary food producers meet their family needs through subsistence farming. Since farms tend to dominate the African agricultural landscape, the impacts of climate change are likely to have negative effects on net revenues.

Singh and Purohit (2014) argue that while farming still remains important for rural households, people are looking for diverse opportunities to increase and stabilise their incomes. Rural livelihoods are based not solely on agriculture but on a diverse array of activities and enterprises. The extent of dependence on non-farm income sources varies across countries and regions (Singh & Purohit, 2014). Observation shows that half of household income came from crops, livestock and the other half from non-farm wage employment, self-employment and remittances. The proportion of non-farm income was higher for upper income groups than for the lowest income groups. The

poorest households were therefore more reliant on agriculture; a reliance which decreased as non-farm activities increased (Rose, 2015).

According to the National Climate Change Response' White paper (2012), most South African rural communities are situated in the low level and on semi-arid regions, which makes them vulnerable to climate change. During this period, peasant agriculture, with its subsistence orientation and relatively low yields, was discouraged in favour of agro-industrial production (National Climate Change Response White paper, 2012).

African rural-dwellers value the pursuit of farming activities (FFC, 2012), thus subsistence production of food is still a major component of livelihoods in sub-Saharan Africa. The use of improved input packages is declining since effective input packages have not yet been developed, especially for the drier parts of the region (World Bank, 2010). In addition, the input packages that exist for the higher rainfall areas need to be supplemented by the expansion of intermediate and appropriate technology to improve returns to labour (World Bank, 2010). Peasant farmers have the potential to play an important role in reducing sub-Saharan Africa's food deficit. Subsistence production and smallholder production can increase food supplies and thus cushion households from food price shocks, thereby improving household food security (World Bank, 2010).

2.9. Economic impact of climate change

The rapid increase of climate change in South Africa has been observed to have a severe impact on the economy in large. Most subsistence farmers are faced with more challenges because most of their crops depend on rainfall for survival. Therefore, Sango and Godwell (2014) hold that subsistence economy can be defined as a non-monetary economy which relies on natural resources to provide for basic needs through hunting, gathering and subsistence agriculture. In addition, subsistence economy within the community provides the family and trade for exchange of money for survival.

During the course of human civilisation, communities in all parts of the world have developed ways of earning livelihoods, and of supplying their needs for food, water,

shelter and other goods and services that are adapted to climates in which they live (Sango & Godwell, 2014). However, during the last century, climate has increasingly become variable and changeable. Singh and Purohit (2014) assert that challenges of agriculture in the 21st century requires a systemic integration of the environmental, social, and economic pillars of development to meet the needs of present generations without sacrificing the livelihoods of future generations.

Over the next 50 years, the world has been projected to increase by 3 billion, primarily in the developing countries. These abnormalities lead to disruptive consequences on the ecosystems and human livelihoods patterns (Debay, 2010). Debay (2010) further indicates that such climatic abnormalities have become a major concern in the modern world. Today 800 million people go hungry daily, and more than a billion live on less than a dollar per day due to food insecurity because of climate change (IPCC, 2013).

A large proportion of the rural population is already living in environmental vulnerable zones. Evidence from the Intergovernmental Panel on Climate Change (2013) suggest that since 1900, much of Southern Africa has progressively experienced warmer temperatures, rising on average of 0.7°C, and an overall decline in precipitation of 5% (IPCC, 2012). Karfakis, Velazco, Moreno and Covarrubias (2011) show that if global mitigatory actions remain as weak as they currently are, many communities of the world, particularly in tropical rural Africa, are likely to experience some of the worst impacts of climate change in their subsistence economy. Africa is likely to emerge among the most vulnerable regions to climate change, with agriculture subsistence losses of up to 7% of the affected countries' gross domestic product (Schlenker & Lobell, 2010).

The notable increase in the frequency and severity of drought and other weather extremes that are proving to be among the biggest threats to the livelihoods of rural communities are climate-sensitive (Foresight, 2011). The effects of gradual climate changes and extreme weather events have undermined the progress alleviation of poverty and economic growth, while also having a negative effect on overall

development efforts (Foresight, 2011; IPCC, 2012). Economic sectors that largely depend on weather conditions either directly or indirectly, most notably agriculture and fisheries, are increasingly subject to the impacts of climate change (IPCC, 2012). Moreover, the depletion of natural resources as a result of increased environmental and demographic pressures tends to aggravate the severity of climate change impacts (IPCC, 2013).

Foresight (2011) asserts that there is an increase in concerns threats rising for current income and consumption patterns of households. The IPCC (2012) states that natural disasters also have economic consequences, and in developing countries, 90% of economic losses due to storms, floods and droughts are borne by households, businesses and governments. Kumsa and Jones (2010) agree that rural livelihoods are dependent on natural resources, and their availability will differ in a changing climate, and will result in having effect on human security and wellbeing.

The IPCC (2013) asserts that South Africa is currently undergoing dramatic economic changes as a result of globalisation and climate change conditions. Furthermore, it is projected that South Africa is importing more than exporting as expected currently. In considering changing patterns of vulnerability in Southern Africa, it is important to emphasise that the effects of economic and climate changes are unevenly distributed both between and within countries (IPCC, 2012).

According to the World Bank (2010) and Foresight (2011), it is important to monitor the influence of economic changes, particularly agricultural policies that either promote or limit agricultural growth among small-scale farmers on the resilience and future vulnerability of this sector. The IPCC (2012) describes climate change as a development problem that is rooted in sustainable development policy, which gravely hinders poor countries to develop.

2.10. The livelihood pattern of rural communities under current subsistence economy

2.10.1 Food production

The livelihood pattern of most African rural communities is based on subsistence agriculture. The agricultural practice of rural communities is based in semi-arid regions on a small-scale with vulnerable climatic conditions (IPCC, 2012). Agriculture forms the backbone of rural communities' economy and is much dependent on climate and weather patterns. Yohe and Tol (2002) posit that rural communities are the most vulnerable regions that experience change in climate that threatens their subsistence economic activities. Furthermore, subsistence agriculture plays a dominant role in supporting rural livelihoods, economic growth and sustainability of various communities. Kumsa and Jones (2010) argue that rural subsistence agricultural practices provide food, income, power, stability and resilience to rural livelihoods. Subsistence agricultural people are able to improve the economy of the community and provide foods with fewer prices for many households.

Ncube, Madubula, Ngwenya, Zinyengere, Zhou, Francis, Mthunzi, Olivier and Madzivhandila (2016) add that climate change is a global externality that negatively affects households, communities and the broader economy. In South Africa, 80% of people are still dwellers of rural areas and mostly depend on agriculture for their economic activities (IPCC, 2013).

2.10.2 Water resources

The impact of climate change on rural livelihood threatens the current type of cultivation within various communities. Water plays an important role in the growth of crops, but due to current increase in temperature, some of the crops are unable to survive within the fields (IPCC, 2013). Water is a key factor affecting agricultural production and reduction of rural poverty. Most small farmers live in rural areas with poor natural resource conditions, where water-related constraints are a root cause of low production

and increasing vulnerability to natural disasters and climate variability (Khanal, Santini & Merrey, 2014).

The importance of securing water availability for rural livelihoods is therefore increasing. Most studies report that there is tremendous potential for well-targeted water interventions to enhance livelihoods and to support rural development even in water-scarce environments (Khanal, Santini & Merrey, 2014). According to Khanal, Santini and Merrey (2014), future investments in agricultural water management should complement other interventions to support rural transformation and poverty reduction programmes. Rural livelihoods are in transition and evolving in complex ways. These transitional challenges maintain rapid economic growth and manage natural resources sustainably. According to Khanal, Santini and Merrey (2014), interventions will involve both hardware (infrastructure) and software (policy, institutional, management, virtual water).

Given the complexity of agricultural water management interventions and accompanying biophysical and social impacts, both types of intervention play equally important roles in delivering services to smallholder farmers (Khanal, Santini & Merrey, 2014). In addition, livelihood systems still offer some potential to further develop water resources for agriculture through investments in hydraulic infrastructure; but these options must be assessed based on specific social, economic and environmental conditions (Khanal, Santini & Merrey, 2014). Though these areas are not water-scarce in overall terms, rainfall variability, especially within seasons, presents the foremost challenge for rural smallholders, and must be given high priority in designing future water intervention programmes. Poor service delivery and lack of servicing existing infrastructure deprive issues of water resources in rural communities.

2.10.3 Health

The potential of climate change to destabilise economies and public finances is real and can no longer be ignored. Climate change in South Africa came with many negative impacts such as natural disasters, and can lead to widespread food and water insecurity, especially in rural communities (Department of Environmental Affairs (DEA), 2011). The current unpredictable changing weather condition affected the health of rural community members. Due to drought, it influences food insecurity, malnutrition and other diseases. South Africa's disasters and its food and water insecurity are often analysed at the comprehensive level whereas identifying vulnerable households is critical in order to formulate well-targeted adaptation and mitigation policies and strategies (Ncube, Madubula, Ngwenya, Zinyengere, Zhou, Francis, Mthunzi, Olivier & Madzivhandila, 2016).

Climate change is associated with many natural disasters in South Africa, and can lead to widespread food and water insecurity. The physical conditions in Limpopo present challenges for maize production (low rainfall, high temperatures, high evapotranspiration, poor soil, et cetera). Climate change is likely to increase pressure on food security in the area. These will affect the health care of the community because of unpredictable increase in weather conditions (Ncube, Madubula, Ngwenya, Zinyengere, Zhou, Francis, Mthunzi, Olivier & Madzivhandila, 2016).

2.10.4 Social systems

The effect of climate change on agricultural output will directly affect rural communities through reduced income and employment, and will have a knock-on effect on both the rural economies and the food-security nexus (Kumsa & Jones, 2010). Tetteh et al. (2014) further indicate that rural households are more vulnerable because they lack the means of coping strategies to climate change. As a result, factors such as human, financial and physical resources are limited and scarce in communities. Heavy dependence on climate-sensitive economic sectors of rural areas, particularly agriculture, makes communities to be vulnerable to climate change. Dasgupta, Morton,

Dodman, Karapinar, Meza, Rivera-Ferre, Toure Sarr and Vincent (2014) state that over last few years, the importance of vulnerability and adaptive capacity has been frequently cited in explaining the societal aspects of climate change. The vulnerability research and consequent adaption policy has become top priority. In addition, the provincial and local government have already implemented some of the coping strategies of climate change while others are still outstanding.

According to Dasgupta et al. (2014), few studies have tried to address the social aspects of climate change impacts, vulnerability and adaptation strategies at the local level (households, rural communities, districts). It is important that more studies explore the social aspects of vulnerability to climate change with in-depth examination of underlying socio-economic factors that determine how populations respond to and cope with the impacts of climate change at the local level. Furthermore, the Department of Environmental Affairs (2011) has assessed the local impacts, vulnerability and adaptation of climate change for the development of policy measures that address specific local needs and avoid one-size-fits-all measures that often result from national scale climate change assessment.

The IPCC (2007) argued that besides the complex combinations of socioeconomic, political and environmental factors that act and interact to influence vulnerability to climate change, the magnitude of the resultant impact and the set of adaptation strategies that are developed in response to the impacts of climate change cannot be ignored. The IPCC (2007) further points out that most local communities use them to develop indigenous-based adaptation practices to sustain their production and how to identify challenges on these practices that can lead to harnessing them to improve the resilience of communities.

The IPCC (2007) cited by Dumenu, Elizabeth and Obeng (2015) opines that there are different aspects of vulnerability namely, physical and social. The physical conception of vulnerability focuses on exposure, and is a measure of the natural hazard or

environmental stressors. This aspect may affect the environmental aspect where rural community members are practising their subsistence agriculture.

The social conceptions of vulnerability focus on the capacity of the system, and draw attention to socio-economic factors characterising vulnerability. The second component related to social vulnerability is equivalent to capacity of the system, and is largely determined by socioeconomic factors such as income distribution, assets, ethnicity, gender, poverty and source of livelihood (IPCC, 2007). In support of the above statement, most rural communities rely on subsistence agriculture for their economic activities in order to survive. Trade of subsistence product produce plays an important part among different communities as their economic activity.

Dasgupta et al. (2014) report that livelihood patterns of rural communities are vulnerable to climate change, which is determined by the physical impacts of climate change. This will result in scarcity of resources to adapt to the current changing climatic conditions. Vulnerability can be understood as a social construct which is influenced by institutional, economic and biophysical features. Rural communities are experiencing high rates of poverty due to the rapid change of climate, and are marginalised because they lack resources to produce large quantities of food. Likewise, as was found with rural women in the research, vulnerability to climate change is likely to exacerbate existing vulnerabilities and create new vulnerabilities (Dasgupta et al., 2014). Dasgupta et.al. (2014) further emphasize that drought as the results of increasing weather condition continue to threaten subsistence agriculture within communities.

2.10.5 Political organisation

Ncube et al. (2016) states that categorising households and livelihoods that are vulnerable to climate change has become a key input for targeting, formulating, monitoring and evaluating adaptation policies by South African government. In addition, Saturnino and Borras (2009) hold that agrarian transformations within and across countries have been significantly and dynamically altered during the past few decades

compared to previous eras, provoking a variety of reactions from rural poor communities worldwide. The change in political organisation also influenced recent intervention in the impact of climate change on rural livelihood development.

An overview of changes in the global economy and politics in general influence the transition of development in rural communities (Saturnino & Borras, 2009). Saturnino & Borras, (2009) adds that many pursue their means of reproduction across different sites of the social division of labour: urban and rural, agricultural and non-agricultural, wage employment and self-employment. Furthermore, the corridors of labour flows have also brought with them multidimensional socio-cultural changes, including those involving information and communication technology, resulting in previously isolated rural communities, or at least some portions of these communities (Saturnino & Borras, 2009).

Most rural communities are facing drought as the common effect of climate change. Therefore, they rely on government intervention strategies on climate change to cope with current stress (Saturnino & Borras, 2009). The political organisation involves authorities in making, implementing, changing, contesting and evading policies regarding allocation of resources amongst rural communities. The dynamics of social change in developing rural areas have some features distinct from those that are already developed to cope with current increasing temperature (Ncube et al., 2016).

2.11. Adaptation to climate change

The National Climate Change Response White Paper (2012) provides a framework for climate change adaptation and mitigation at the national level, and identifies comprehensive set of policies that provide support environment on climate change. The strategy provides broad support to the policies and principles laid out in the Government White Paper on Integrated Pollution and Waste Water Management as well as other national policies, including those relating to energy, agriculture and water. Madzwamuse (2010) posits that global climate change is a threat to sustainable

development, especially in developing countries. Furthermore, it could undermine global poverty alleviation efforts and have severe implications for food security, clean water, energy supply, environmental health and human settlements.

The IPCC (2013) asserts that the South African Country Studies Programme identified the health sector, maize production, plant and animal biodiversity, water resources, and rangelands as areas of highest vulnerability to climate change. These areas need to be targeted for adaptation measures. With regard to vital industries, the mining and energy sectors are particularly vulnerable to climate change mitigation measures. Furthermore, the South African economy is vulnerable to possible response measures implemented by developed countries.

The National Climate Change White Paper (2012) indicates that there are adaptation strategies that have been proposed in the National Climate Change Response Strategy to address vulnerabilities in agriculture, health, biodiversity and water sectors. However, the success of these strategies depends on an enabling policy environment. Lack of appropriate policies and legislative framework may present barriers to the implementation of adaptation strategies (FAO, 2003). Mudombi, Nhamo and Muchie (2014) believe that to enable workable and effective adaptation measures, ministries and governments, relevant institutions and Non-Governmental Organisations (NGOs), should consider integrating climate change in planning and budgeting in all levels of decision-making. Non-Governmental Organisations work together with the local government under rural development with implementing coping strategies on climate change by using both advised and indigenous knowledge.

Mutekwa (2009) posits that adapting to climate change will involve adjustments and changes at every level of society, from community to national and international. At the national level, governments need to implement strategies that enhance the resilience of national economies to the impact of climate change. Local communities, on the other hand, must build their resilience, including adopting appropriate technologies while making the most of traditional knowledge, and diversifying their livelihoods to cope with

current and future climate stress (Mutekwa, 2009). Madziwa, Mabeza and Mawere (2013) stated that

Madziwa, Mabeza and Mawere (2013) illustrate that South Africa's policy and legislation for sustainable development, environmental management and governance of natural resources has undergone profound changes in the past decade. Furthermore, these policy development processes are ongoing and are critical for supporting climate change adaptation at various levels. Mudombi et al. (2014) and Madziwa et al. (2013) state that South Africa's constitution (Act 108 of 1996) creates the overall framework for environmental governance in South Africa. Mudombi, Nhamo and Muchie (2014) are of the view that it establishes the right to an environment that is not harmful to health and well-being, and balances the right to have the environment protected with rights to valid social and economic development. The constitution provides the fundamental basis of the 'architecture of entitlements' upon which the country can promote options for adaptation (Madziwa et al., 2013).

Hummel (2015) argues that after environmental education and awareness creation, the concerned stakeholders will do their best to bring change through adaptation and mitigation options. Climate change adaptation and mitigations are essential mechanisms of saving the life of vulnerable communities, particularly in the African continent (Hummel, 2015). Hummel (2015) further emphasize that the way of addressing the impacts of climate change is by integrating adaptation measures into sustainable development strategies in order to reduce pressure on natural resources, improve environmental risk management and the social well-being of the poor especially in rural areas.

Nath and Bhagirath (2011) state that climate change adaptation and mitigation workshops, seminars and panel discussions are effective tools of solving the extreme temperature and rainfall variability that leads to agricultural yield reduction, water scarcity, drought and flooding, prevalence of various pathogenic diseases and expansions of deforestation in different regions. Inviting key stakeholders (High

governmental officials), public and private officials, university academia's and researchers as well as individuals from all sectors, industry, road, agriculture, municipality, mining, fishery, forestry, pastoralists, hotel and tourism and other sectors on climate change adaptation and mitigation workshops will change the people's attitudes towards climate change solutions (Nath & Bhagirath, 2011).

The IPCC (2013) argues that promoting community participation in all adaptation and mitigation plan is a key factor to implement on the ground. In general, in order to minimise the impacts of climate change in the African continent, all governmental and non-governmental organisations, private sectors and individuals should be involved in afforestation, reforestation and forest conservation (IPCC, 2013). Similar to forest sectors, all organisations, private and individual, should have concern for water and soil conservation. The wise use of water is another task of the African people. Thus, the community at large should use water in effective ways, practise the culture of water harvesting and storage techniques, livelihood diversifications and enhance the use of climate resilient green economy (IPCC, 2012).

2.12. Summary

In summary, the IPCC (2013) indicated that the impacts of climate change on patterns of settlement, subsistence economy, livelihoods and incomes in rural areas will be complex and depend on many intervening factors that are hard to project. These restraints of impact on subsistence economy may originate with extreme events such as floods, drought and storms, which result in rapid change climatic condition. Therefore, such extreme events will directly affect rural infrastructure and may cause loss of many lives. The agricultural and other ecosystems (rangelands, fisheries, wildlife areas) on which rural people depend may face extinction due to change in climatic condition.

The rapid changing weather condition affects many subsistence economies because they depend on seasonal production in order to trade with other market economies. The

vulnerability of these subsistence economies disadvantages rural communities, especially those that are dependent on subsistence farming. The literature has showed that many rural communities are dependent on subsistence agriculture in order to sustain their livelihood patterns. Much subsistence agricultural farmers rely on indigenous knowledge to adapt to the change in climatic condition to sustain their production to produce better. The current rapid weather change threatens the subsistence economy of rural livelihood of the poor. The current pattern of rainfall affects the production and pattern of harvest, which results in food insecurity in the country.

Given strong dependence in rural areas on natural resources, the impacts of climate change on agriculture, forestry and fishing, and thus on rural livelihoods and incomes, are likely to be serious. Secondary (manufacturing) industries in these areas, and the livelihoods and incomes that are based on them will, in turn, be substantially affected. The infrastructure (e.g., roads, buildings, dams, and irrigation systems) will be affected by extreme events associated with climate change. The literature asserts that climate change is a complex issue to tackle and needs partnership to align the strategies in order to cope with its impact.

These climate impacts may contribute to migration away from rural areas, though rural migration already exists in many different forms for many non-climate-related reasons. Some rural areas will also experience secondary impacts of climate policies, the ways in which governments and private sectors try to reduce net greenhouse gas emissions such as encouraging the cultivation of biofuels or discouraging deforestation. Most subsistence farmers are familiar with adaptation measures to cope with the current unpredictable weather condition.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study area

3.1.1 Location

The study is based on fieldwork conducted between July 2017 and December 2017 among the Balobedu tribe of Motupa community under Greater Tzaneen Municipality in Mopani District of Limpopo Province, South Africa. Motupa community is located in Greater Tzaneen Municipality, which has a total area of 5.46 km² with a population of about 6954 (1274.05 per km²). Greater Tzaneen Municipality is located south of Modjadjiskloof and south of Trichardtsdal (47km). The municipal boundaries form an irregular, inverted T-Shape, which results in certain developmental implications for the Municipality, and more specifically, the distance to markets creates difficulties in respect of service provision, and constraints to implementing development vision / strategy.

The municipality comprises 425 rural villages, concentrated mainly in the south-east, and north-west, of the study area. Almost 80% of households reside in these rural villages, and are characterised by extensive and intensive farming activities (commercial timber, cash crops, tropical and citrus fruit production). Motupa community is a mountainous, inaccessible terrain in the west and south, and un-even topography (gentle slopes) to the north and east. The area is an exceptional natural beauty, with considerable untapped tourism potential. In addition, a large area of land is in private ownership, ranging from smallholdings to extensive farms, used mainly for commercial farming activities. Equally, a large area of land is in the ownership of the state, and under the custodianship of six traditional authorities.

Motupa is situated between 29° C 52'E to 31° C 52'E longitude and 23° C 0'S to 24° C 38'S latitude, with 31° C E as the central meridian (Statistics South Africa, 2011). Motupa area lies in a semi-arid climate type with an annual average rainfall of

approximately 403 mm. It has a daily average temperature of between 18 ° C, 17.7 ° C and 8.1 ° C, 9 ° C (Statistics South Africa, 2011).

3.1.2 Climate

Summer rainfalls occur between October and April, followed by a dry winter season. Motupa community is inhabited by Balobedu ba Ga-Modjadji, 89% of which mostly speak Khelobedu dialect of Sepedi language. The area is characterised by lowland and mountains, while environmental challenges are inadequate sanitation systems, erratic rainfall, drought and lack of water supply and the community is negatively affected by the current experienced drought (Rankoana, 2016; Rankomise, 2015). The temperature at the area rises unpredictably daily and affects the pattern of rainfall seasons.

3.1.3 Settlement and Demography

The households are distributed in the area between Kubjana and Mopje along Relela village main road. The community falls within the summer rainfall region of Limpopo Province. Motupa community households comprises 1644 (301.20 per km²) with a total gender of 3713 females and 3241 males. This illustrates that females outnumber males as they comprise 53.39% of the population. It is noted that the Community Survey 2016 concluded that the population stands at 6950. The slow growth may be attributed to various factors such as migration, birth and death rates (Greater Tzaneen Municipality Integrated Development Plan [IDP], 207/2018). The Statistic South Africa Census 2011 demonstrated that most males of Motupa community households are heads of families rather than women. Fewer households are headed by orphans (10-15 years) and older people (90-112 years).

Most community members practise subsistence agriculture where they cultivate at their home-gardens, fields and farms. Community members consist of farming and livestock breeders. Those who are practising subsistence farming have inherited the land through family legacy, and the livestock was inherited the same. Common crops and livestock were identified, such as mafela (maize), dimaake (nuts), ditloo marapo (njugo

bean), lerotse (pumpkin) and nawa (bean), mostly at the fields and home-garden. Furthermore, those who cultivate home-gardens also cultivate vegetables such as spinach, cabbage and tomatoes with the aim of selling to other community members to be economically active. Farmers breed livestock such as dikgomo (cows), dipudi (goats) and dikgogo (chickens) at the community.

3.1.5 Livelihood

The employment status of Motupa community in Greater Tzaneen Municipality, according to the Statistics South Africa Census 2011, does not show an impressive situation. It shows that 54% of people in the households are unemployed, discouraged work-seekers and not economically active (Greater Tzaneen Municipality Integrated Development Plan [IDP], 207/2018). In addition, the total population of 41% in the community does not have any source of income; they only use child support grant and old age grant for survival.

While the rest of the individuals do have sources of income, 45% of them earn an income below the minimum living levels of R 9,600 per annum, or lower than R 1,600.00, as defined by Statistics South Africa. Furthermore, Statistic South Africa observed that most community members are working at local farms and use production as a means of being economically active (Greater Tzaneen Municipality Integrated Development Plan [IDP] , 207/2018). While most community members are unemployed, they are at least self-employed. The educational level remains a challenge because Statistics South Africa Census shows that 24518 are in Grade 9/Std 7/Form 2/ABET 4. Therefore, higher education remains a challenge not only locally, but nationally as well.

Furthermore, 47% people are secondary school dropouts due to lack of motivation and family support, which results in poor livelihood. Furthermore, low level of education in the community has a negative impact on economic development as this factor poses difficulty in skills transfer (Greater Tzaneen Municipality Integrated Development Plan [IDP], 207/2018). The community practises subsistence farming, which influences

religious beliefs, practices and health care. Most community members attend different churches, but still believe in traditional healers to secure their home-gardens and fields to produce their production without problems.

The land use ranges from residential use, subsistence farming and livestock holdings. Although the economy and sources of income have been diversified and expanded, many families still rely on the subsistence economy and natural resources for survival. Most community members still value cultural traditions such as ploughing using a hoe, and livestock raising (Rankoana, 2016; Rankomise, 2015). The rain-fed crops are both planted in the home-gardens and fields, but due to the erratic rainfall patterns and climate change conditions, most community members are producing less than expected for sustainability. Furthermore, the IDP (2013) claim that cattle, goats and sheep are raised by fewer households because rearing a livestock is expensive as a result of climatic conditions. In addition, crop production is the primary economic activity in the community.

3.2 Research Methods

3.2.1 Study design

A qualitative study was conducted to explore the perceptions of rural communities on climate change, and its economic impact on the livelihood pattern that threatens their subsistence economic production. Data was collected through in- depth face - to face interviews and focus group discussions with the participants. Semi-structured interviews and focus group discussions were used to collect data. The interview questions was developed, revised and adopted through several meetings with experiences of climate change by the participants. This was done to make the participant to understand the questions on climate change and give in-depth information. The questions started with biographical information of the participants, followed by their perceptions of climatic condition, their awareness of the impact of climate change on subsistence economy, and the implications of change in subsistence economy on livelihood patterns.

3.2.2 Sampling size and composition

Semi-structured interviews and focus group discussions were conducted with a sample of 20 participants purposely selected in Motupa community over a period of four weeks. This prolonged period of data collection allowed the researcher to interact with the participants. Both data collection tools were used to obtain a diversity of responses about perceptions of rural communities on climate change and its economic impact on their livelihood. This group of community members was selected on the basis of their knowledge of environmental change, members who practise and depend on subsistence production of livestock and crops.

This selection criterion is corroborated by FAO (2008) that community members above 50 years have knowledge of environmental conditions favouring and negatively impacting on subsistence production. The perceptions of climate change in rural communities of Limpopo Province have not been fully explored; few studies have been conducted. Furthermore, the researcher used both data tools on the sample to obtain in-depth knowledge on the current impact of changing weather conditions. The sample was stratified in terms of age, gender, period they have been staying in the community, socio-economic group and subsistence economic activities.

The sample comprised heads of households (8 males and 12 females) whose age ranged from 45 to 90 years. Both focus group discussion and in-depth face - to - face interviews were used on the above aged group. The recent economy of the community is varied and, as result, most participants depend fully on subsistence farming for their livelihoods. Subsistence farming recently increases the food stuffs bought from retail stores. Despite observable scarcity of rain and its impact on the livelihoods of community members, 12 participants are engaged in subsistence crop production in their home-gardens surrounding the compound and in the ploughing fields, five (5) grow crops only in their home-gardens, while three (3) participants work in small local farms.

The fields are arranged in different parallel patterns within a walking distance from the households. The average land holding is three lines of mango tree per household. Absence of a fence around the field boundaries prevents members of the community to cultivate their home gardens earlier than their counterparts who work in the fields. This is caused by community members' livestock that feed on small plants around the community. The fields are ploughed instantaneously, and cow dung is used as manure for concurrent protection of the crops from damage by stray wild animals, livestock and insects. Maize, nuts, pumpkins and beans are the most common subsistence crops recently planted, that are able to cope in the current changing weather condition.

3.2.3 Data collection

Semi-structured interviews and focus group discussions were used to collect data. All the participants spoke *Khelobedu*. As a result, the interviews were conducted in *Khelobedu*, a *Sepedi* dialect, and translated into English. The interviews were conducted in the households of the participants where they were mostly relaxed, and could respond freely to the questions. Interviews were used to obtain in-depth knowledge of the participants' perceptions of climate change and its impact on the livelihoods. Interviews were conducted face to face with the participants. Both interviews and focus groups were conducted by the researcher. The responses were captured for each question. The explanations for the responses provided were captured in a note book and audiotaped. Data were transcribed to facilitate qualitative analysis. Focus group discussions were conducted with four (4) groups of five (5) participants each. The whole process took four weeks; each group was engaged for three hours during the four-week period. The participants were all from Motupa village by origin and aged between 45 and 90 years.

Focus group

Focus group is a way of collecting qualitative data, which essentially involves engaging a small number of people in a discussion that focuses around a particular topic of conventional issues. Neuman (2000) asserts that a group discussion is usually based on a series of questions in the focus group schedule, and the researcher generally acts

as a mediator for the group, posing the questions, keeping the discussion flowing, and with group members participating fully. One reason for the contemporary popularity of focus groups in social science research is the flexibility of the research. In this study the research made use of a focus group discussion and one-on-one interviews to gather perceptions of climate change and its impact on the community livelihood. As stated above, the following is a focus group discussion session. The parents, grandparents and single parents aged between 45 to 90 years participated in the study.

First session

This session was used to make appointments with the participants, agree on the place to meet, time, how long the discussion would take, and used the opportunity to unpack the topic of the study and its purpose. The participants were informed about their consent in the study, and that the study is voluntarily; they were free to withdraw if they were not interested, and that the study was for academic purposes only. Therefore, they would remain unknown. This was done with the aim of establishing trust and of building relationship between the respondent and the researcher.

Second session

Four (4) of five (5) participants in each focus group discussion and in-depth face – to face interviews were held by the researcher. All discussions were conducted in Zone 02, Motupa village. A total number of 20 participants were chosen. This session was characterised by an in-depth discussion of major themes which emerged as the discussion unfolded. The participants deeply discussed their experiences over years of subsistence farming and looked at the current rapid climate change. They were able to unpack their perceptions about climate change, the economic impact of climate change on their subsistence activities, how it affects their livelihood pattern and adaptation strategies that they have adopted to cope with the change.

Third session

The researcher conducted the third session with 20 participants who cultivate their home-gardens and fields, and those who cultivate their home-gardens only. This was done with the purpose of gaining the views of the respondents about their perceptions of climate change and its impact on their livelihood on subsistence economic activities. Throughout the process of data capturing, probing was used to gain a deeper understanding of critical issues. This involved tracking clarification and reflective summary.

The researcher repeated some of the questions to the participants to bring about deeper meanings, ideas and opinions of the participants with exactness. Babbie and Mouton (2001) observe that probes are one of the useful ways of getting answers in more depth without bias. During data collection, there were prominent themes which were much like economic impact of climate change, lack of rainfall, trade exchange, food insecurity and land distribution.

Fourth session

All four (4) focus groups discussion of 20 participants were conducted. The purpose was to obtain more views and ideas about groups in order to find knowledge about climate change and its impact on the livelihood. The researcher repeated the question and allowed the participants to express their views on the study topic and how they experienced the impact of climate change in their subsistence economy, including measurement strategies that they are using in order to adapt to this change. This was done to ensure consistency on the information gathered about climate change.

Tape recording discussion

A tape recorder was used during interviews and focus group discussions. The researcher sought permission to use the audiotape and note taking during the interviews and focus group discussions from the participants. Both interviews and focus group discussion proceedings were audiotaped for further and critical analysis.

During the last session, the researcher used the opportunity to thank the participants for their efforts and their contribution towards the success of the study. For the sake of inclusion of as many respondents, the researcher carried out informal engagements to get the views of other people outside the selected sample. The purpose was to find the overview perceptions of climate change and its economic impact on their livelihoods.

3.2.4 Data analysis

Data from the audiotape was transcribed to facilitate qualitative analysis. A thematic analysis of data was done by finding common issues that recur in the responses. Braun and Clarke (2006) argues that this type of analysis is highly inductive, that is, the themes emerge from the data and are not imposed upon it by the researcher. In this analysis, data collection and analysis are done simultaneously. Field notes were categorised into themes and sub-themes. The sub-themes emerged from the data about the perceptions of rural communities on climate change and its economic impact on livelihood. The type of subsistence economic activities that they are practising, the impact of climate change on subsistence economy, the implication and adaptation measures that were specified, such as indigenous knowledge of rainfall prediction, change of crop, mixed cropping and use of fertilisers.

The researcher followed the six stages of thematic analysis (Braun & Clarke, 2006). At first, the researcher immersed herself in the data by reading and re-reading textual data (transcripts of interviews) and listening to audio-recordings. The researcher translated the discussion into writing while re-reading transcripts and listening to the recordings. This gave her an opportunity to get familiar with the data. The researcher read the data actively, analytically and critically to understand the meaning of participants' responses on the research topic. This helped the researcher to have an idea about their perception of climate change and its impact on their livelihood.

Secondly, the researcher started to build notes and ideas from the transcripts. This is called the coding phase, where the researcher allocates codes to the data. The researcher put relevant codes in relation to the understanding of data extracts collated

for each code. The third stage involves combining all the codes which are similar into themes. The analysis will start to take shape because the researcher shifts from coding to identifying themes. According to Braun and Clarke (2006), a theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set. The researcher constructed the themes rather than discover them. This involved reviewing of coded data to identify areas of similarities and intersections between codes.

The fourth stage takes place at two levels. First, the researcher ensured that the coded data is in a logical pattern. This means that the researcher checks the themes against the collected extracts of data, and explores whether they work in relation to the data. If not, the researcher has to remove some codes or relocate them under another theme, or alternatively, redraw the boundaries of the theme, that is, meaningfully captures the relevant data.

Once the researcher has a common and logical set of themes that are in relation to the coded extracts, she proceeded with the second process of reviewing the themes and sub-themes in relation to the entire data set. The researcher re-read the data to determine whether the themes are meaningfully captured on the entire data set. If not, further refining and reviewing is done to adequately capture the data. In stage five, the researcher defined and named the themes, with each theme assigned its name. The research clearly states the distinctive specification about each theme. Finally, the report production clearly presented the study findings.

3.2.5 Trustworthiness

Credibility and transferability of the collected data was obtained through reviews of data with the participants. According to Strydom, Fouche and Delport (2005), the aim of credibility is to assess intentionality of respondents, to correct obvious errors and to provide additional information. It also creates an opportunity to summarise the first step of data analysis and to assess the overall adequacy of the data in addition to individual

data points. In this study, the researcher was confident that the primary data collected is a fair reflection of the problem being studied. Furthermore, by conducting personal interviews, the researcher was confident of the perception of climate change and its economic impact on the rural community livelihood, which is the subject of the study.

Strydom, Fouche and Delport (2005) assert that transferability is alternative to generalisation. This refers to the extent to which the findings can be applied in other contexts with other respondents. It is the obligation of the researcher to ensure that findings can be generalised from a sample to its target population. From the interviews and focus group discussions, it was established that there was uniformity and consistency on participants' responses. This gave the researcher confidence in the community's responses on perceptions of climate change and its economic impact on rural livelihood (Strydom, Fouche and Delport, 2005).

In addition, the researcher organised the community consulting meeting to have all the participants together to review the collected data. The objective of the gathering was to identify and clarify inconsistencies, contradictions and data gaps in order to validate the results. The review was done with the participants to provide corrections, inconsistencies, contradictions and data gaps. This enabled the research to have coherent data in order to yield positive results.

3.2.6 Ethical consideration

Ethical approval was obtained from the University of Limpopo to give the researcher permission to conduct the study. The researcher also sought permission from the local authorities to be allowed to conduct the interviews and focus groups in Motupa community. Throughout the study, the researcher was guided by the code of ethics of conducting scientific research.

3.2.6.1 Informed consent

The participants were informed about the nature and objective of the study prior to the data collection process. They were asked to sign a consent form as an indication of their voluntary participation in the study. The participants were neither forced to sign a consent form nor to participate in the study. In cases where the prospective participants were not willing to sign the consent form, community members meeting the sample criteria were recruited to sign the consent form in order to participate in the study.

3.2.6.2 Voluntary participation

Participation in the study was voluntary. The participants had the right to decide not to participate, or to stop taking part at any time without providing a reason for doing so, without any repercussions.

3.2.6.3 Right to privacy

The participants' identities were protected and not revealed in the research findings; instead codes were used. The researcher informed the participants that when signing the consent form, they should not provide their names, and that the study was for academic purpose only.

3.2.7 Conclusion

The chapter examined the study area, methodology and data analysis that informed the study. A qualitative exploratory design was employed to explore perceptions of rural communities of climate change and its economic impact on the livelihood of Motupa villagers. Focus group discussions and semi-structured interviews were employed to collect data. This was done to obtain in-depth information about perceptions of climate change on rural communities. In this context, the data collection tools allowed the participants to share ideas freely, to be consistent and be able to share important

knowledge about climate change and its economic impact on their subsistence farming and livelihood in general. The data from triangulation data tools were analysed through the creation of themes using thematic analysis.

CHAPTER 4

PRESENTATION OF THE RESULTS OF THE STUDY

4.1 Introduction

This chapter discusses and analyses the findings of the study. The study's demographic data is presented in the form of tables, graphs and pie charts. This is done with the aim of giving meaning and simplicity to these data. In further simplifying the data, some of the information is presented in percentages. The research was exploratory in nature; this was done because the researcher wanted to find in-depth information on perceptions of climate change and its economic impact on the rural livelihood because little research has been done on the subject.

The research was qualitative in nature, hence qualitative methods of data collection in the form of focus group discussions and semi-structured interviews were used. The exercise of data collection lasted for four weeks. The discussions were audiotaped for in-depth analysis of data. The researcher listened to the audiotape to further pick recurring themes of the discussions. The findings are as follows:

4.2. Demographic information

4.2.1 Respondents' Gender

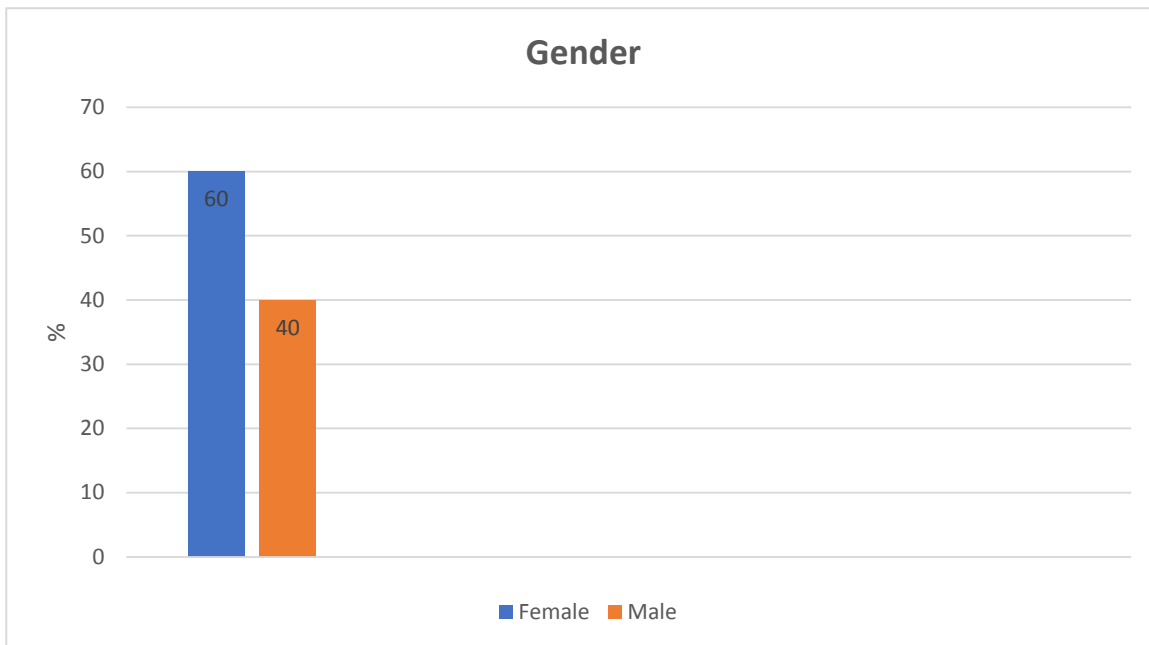


Figure 1: Respondents' Gender

The results of the study indicate that 60% of the sample were females compared to 40% of male respondents. This illustrates that there are more women than men practising subsistence farming. This also demonstrates that most families are headed by single parents who are practising subsistence agriculture for survival. 90% of women indicated that they are tilling their home-gardens and fields, while the majority of men own fields.

4.2.2 Respondents' number of years living in a community

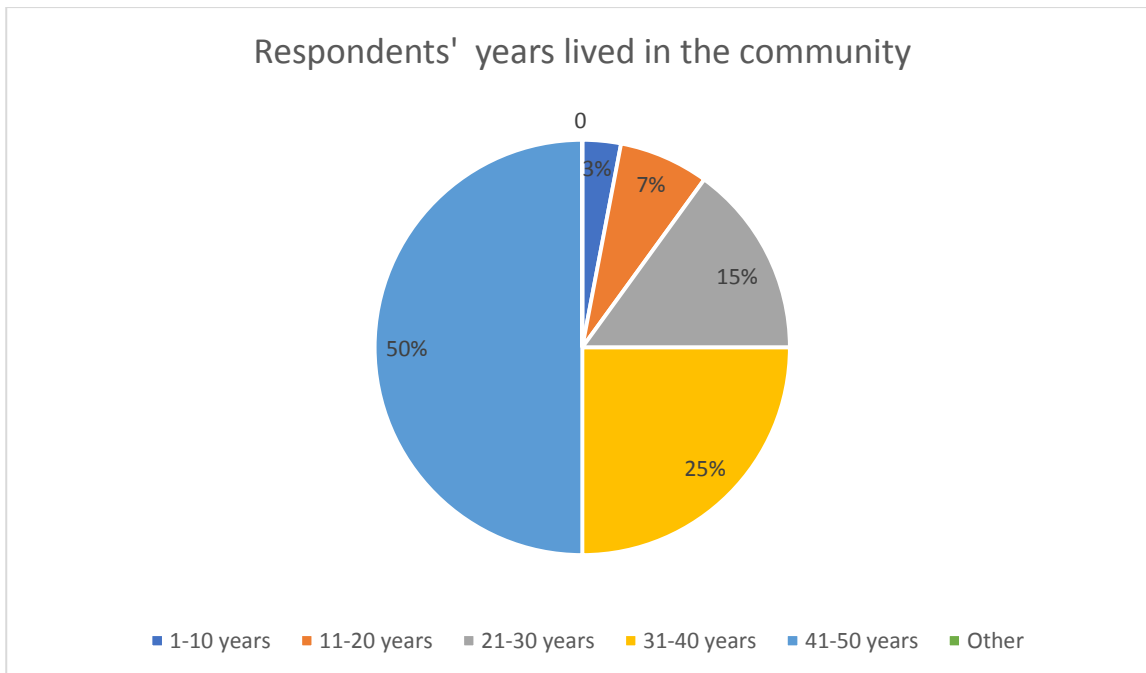


Figure 2: Respondents' number of years living in the community

The results indicated that 50% of respondents lived in the community for more than 41 to 50 years, 25% lived 31-40 years, 15% lived there for 21 – 30 years, 7% lived 11-20 years and 3% lived 1-10 years. This illustrates that majority of the respondents have been living in Motupa community for long and that they have been practising subsistence agriculture for many years. Furthermore, most respondents stated that the impact of climate change has severed challenges on their livelihood pattern. This illustrates that most respondents are born and raised at Motupa village, which means they are familiar with the changing weather condition in the community.

4.2.3 Household size

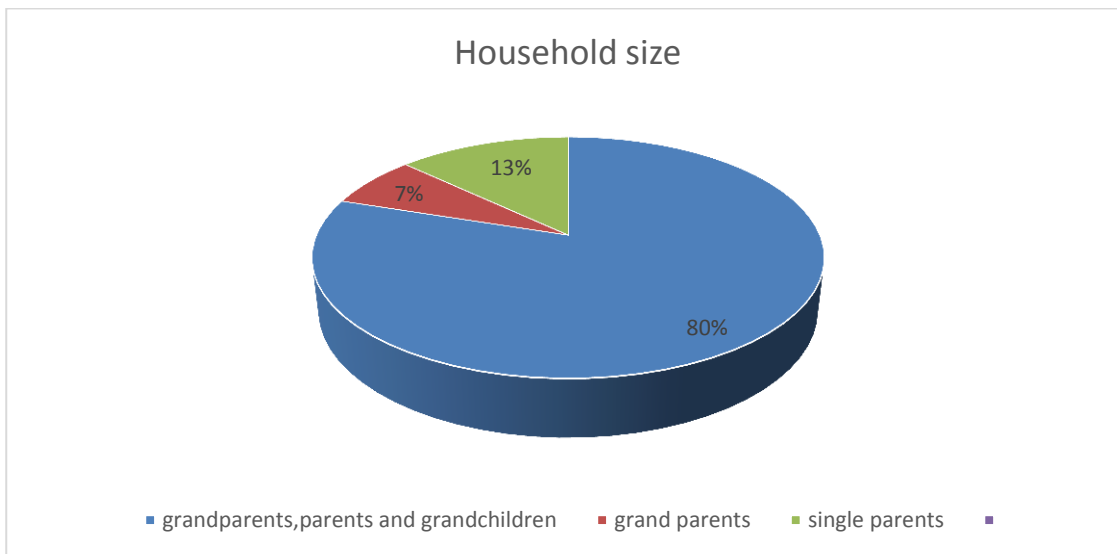


Figure 3: Respondents' household size

The results of the study indicate that 80% of the respondents' households are run by grandparents, parents, children and grandchildren. 7% are run by grandparents and 13% by single parents. The results of the study indicate that most households depend on the knowledge of grandparents for subsistence farming.

4.2.4. Employment

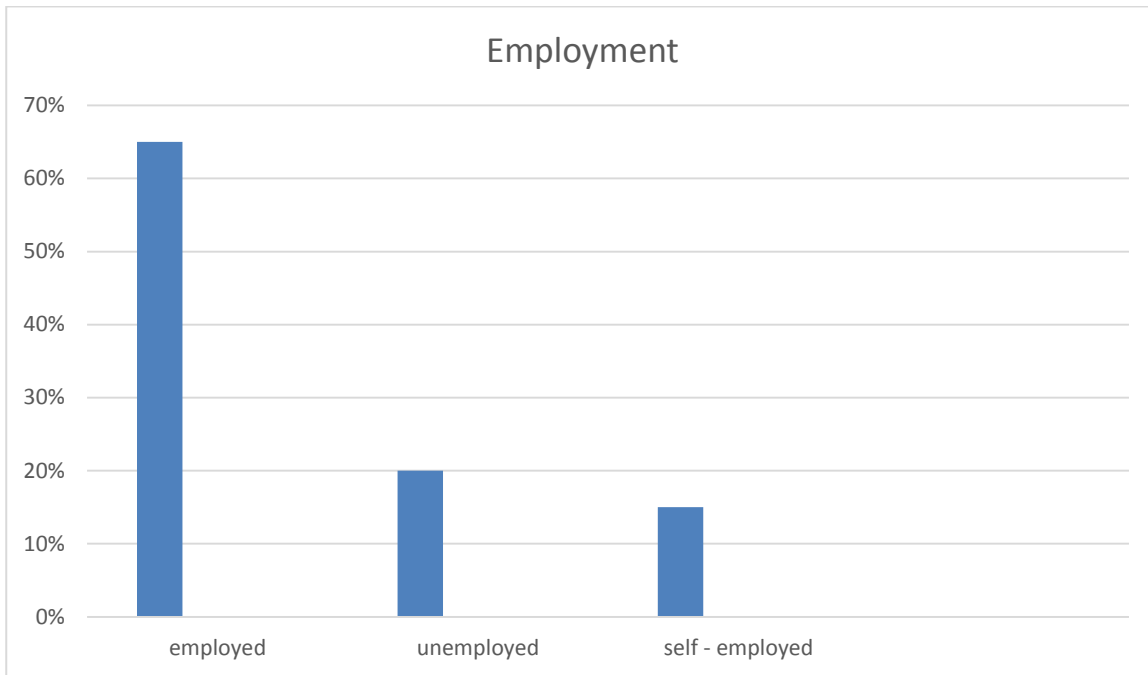


Figure 4: Respondents' employment

The results of the study illustrate that 65% of the respondents are employed, 20% are unemployed and 15% are self-employed. The study suggests that most respondents are both employed and practising agriculture while fewer are self-employed and unemployed. Therefore, majority of the respondents depend on subsistence farming for survival.

4.2.5 Education qualification

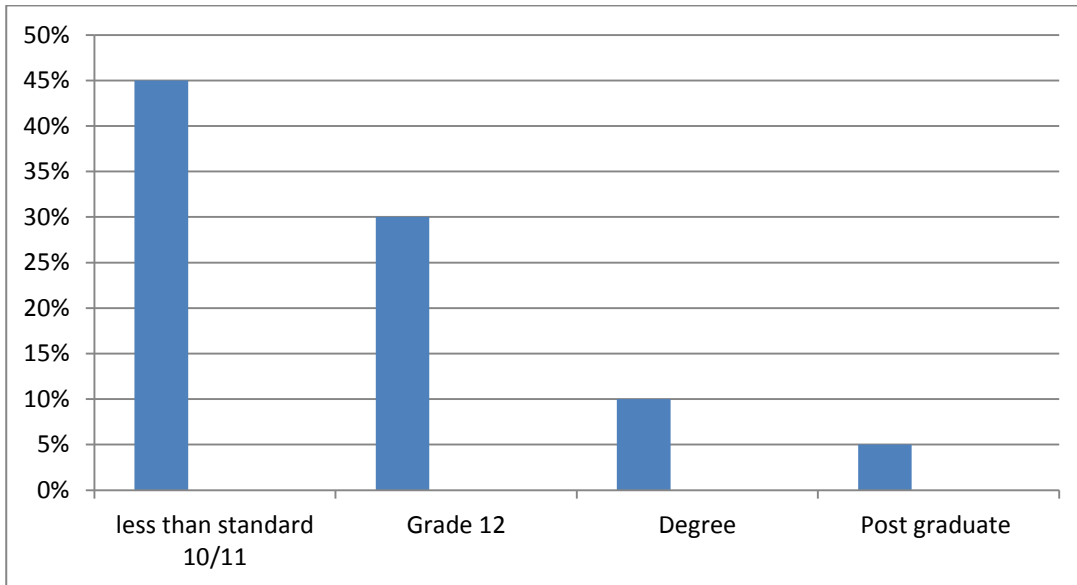


Figure 5: Respondents' educational qualification

The results of the study indicate that 40% of the respondents have less than standard 10/11, 35% grade 12, 10% degrees and 5% post graduate qualifications. This illustrates that the majority of the respondents have lower grades. This challenges their knowledge about advanced methods of coping with current climate change. Most community members have low level of education, which under privileges their knowledge about adaptation to climate change.

4.2.7 Respondents' subsistence production practices

Table 1: Presentation of respondents' subsistence production practices

Kind of subsistence agriculture	Kinds of crops and livestock	Percentage (%) of respondents
subsistence food production	spinach, green pepper, butternut, cabbage, spring onion, green beans, bananas, beetroot, carrots, chillies, maize, <i>Mokhwaripa</i> , <i>Mafela</i> (maize), <i>dimake</i> (nuts), <i>ditloo marapo</i> (njugo beans), <i>lerotse</i> (pumpkin) and <i>nawa</i> (bean)	65%
Livestock	<i>Dikgomo</i> (cows), <i>Dipudi</i> (goats) and <i>Dikgogo</i> (chickens)	10%
Mixed farming	All the farmers practice cultivation and Livestock	25%

The results of the study indicate that at least 65% of the respondents are subsistence food producers, while 25% practise mixed farming. About 10 % of the respondents argued that they are practising livestock farming, although they are experiencing high rate of death due to increasing weather condition. 15 % of the respondents indicated that they are fulltime farmers where they practise mix cropping in one small piece of land. Most farmers do full time farming because they are cultivating each season, but different vegetables. The table below summarises the participants' subsistence economic status and each subsistence agriculture produce.

4.3 Responses to the research questions

Three research questions were used to guide the data collection process. Data presented here are responses to the main research questions.

4.3.1 Description of the perceptions of Motupa community members on climate change

4.3.1.1 Perceptions of climate change

The results of the study indicated that the respondents reported remarkable environmental changes on the increase of temperatures in the community. 80% of the respondents acknowledged that rapid environmental change has been caused by current climate change. The community members argued that the increase in temperature patterns coupled with unpredictable rainfall, which is responsible for prolonged drought and excessive heat, threatens their livelihood pattern.

The majority of the respondents add that the current changing climate condition impacts their livelihood pattern because they are depending on subsistence farming for survival. Furthermore, they illustrated that the change in climate condition drastically affect their subsistence farming and economic growth. Therefore, respondents concluded that the changes in climatic condition hindered them from producing enough to sustain both their families and the community.

“Ka 2005 le 2015 e be e lengwaga wa komelelo, ga se ka bjala selo ka ge o be o sena meetse a go nošetša dimelana mo polaseng”.

English version: “In 2005 and 2015 was the most drought year, where I did not even cultivate anything because there was no water to irrigate seedlings in my farm”.

This means that during the year 2005 through to 2015, the community’s socioeconomic activities declined drastically because of the drought. The respondents observed that

drought did not affect their subsistence farming only, but also the community at large. The results of the study found that Thapane dam is the main water supplier for the community, subsistence farmers and the surrounding communities. The water is commonly used for household consumption and for watering gardens. The respondents stated that the current water status of Thapane dam is unstable due to climate change. Thapane community dam is the largest dam that supplies more than 14 surrounding villages in Bolobedu South.

The respondents explained that through current drought experienced lately, the water decreased in high volume due to lack of rainfall. They indicated that they are suffering because of unpredictable climate condition and it is hard to adapt to this change, especially in rural areas. The results of the study showed that because of the current decrease in water level at the community dam, few households have drilled boreholes in their homes. Although they have drilled the boreholes for their household purposes, they also sell the water to other community members at R1 for 20 litres and R2 for 25 Litres or water. This is a threat to households, especially those who are vulnerable and live in abject poverty in the community. Majority of respondents indicated their livelihood is threatened and vulnerable for survival with the current rapid climate change.

The majority of the participants acknowledged that they buy water to do all house chores because the dam and rivers are dry due to unpredictable rainfall.

One of the respondents stated that:

“Nna a kena chelete ya go reka meetse, bjale ke emela ditrucker tš’a masepala ge di tlisa meetse a nawoo a tee ka beke. Mara meetse a gona a retsebe gore a tš’wa kae kalebaka la gore ka morago ga matšatš’i a mararo a thoma go ba le dilo tsa go sepela ka gare. Ga Motupa re sokola meetse kudu”.

English version: “I do not afford to buy water, therefore, I rely on Municipality Water Trucks that bring water once a week which after three days it starts to have moving things. We are lacking water at Ga Motupa”.

The community's lives are at threat due to unclean water that delivered by municipality truck because after three days they are not healthy to drink. In addition, it is the responsibility of both the community and the municipality to ensure that the health of community members is safe. 90% of the respondents explained that they understand the erratic changing weather condition which is beyond their control. The study observation shows that the impact of climate change affects community subsistence farming and households' social economic activities.

The respondents designated that although it is hard to cope with the current changing climate condition, they are trying to use indigenous knowledge to adapt to current climate change. Fewer respondents, specifically those who own farms, indicated that they are mostly using their indigenous knowledge to measure the amount of rainfall per month and year. They confirmed that they are using the sky to predict weather changes using indigenous knowledge that they have learned from each other.

4.3.1.2 Indications of climate change

The results of the study showed that the respondents outline fewer indicators of climate change that affected the production of crops, livestock and households. Indicators such as physical, ecological and societal can be used to assess how environmental conditions are changing and vulnerable to the impact of climate change. These indicators result in unstable changing weather condition, increase in temperature, viruses and diseases that hinder economic growth in the community. In addition, the majority of the respondents argued that these indicators are depriving production and make them economically less active.

One of the community members stated that:

“Go fetoga ga leratadima o bakela dimelwa tsa rena malwetši, ka ge morogo wa gona o tla hwetša o ne dibokwana e bile o sa gole botse”.

English version: “the change in weather condition causes disease on our plants, as our vegetables will have small worms and not growing well”.

These indicators are the results of increases in temperature and unpredictable rainfall which influence shifts in seasons. Subsistence farmers observed that due to increases in temperature, they have experienced dry seasons which brought different viruses and diseases to their crops. Furthermore, they observed that they are experiencing high crop wastage due to increases in high temperatures. These indicators threaten the effectiveness of the livelihood and economic activities of Motupa community members. The study indicated that the indicators are interdependent and one result in the other because of increasing temperatures.

4.3.1.2.2 Changing rainfall patterns

The results of the study indicated that the current rapidly changing weather condition results in unpredictable rainfall which left the community dam (Thapane) at risk in terms of water supply to the whole community. The observation of declining water levels in Thapane dam threatens the livelihood and subsistence economy of the community and the surrounding communities. During summer seasons, the dam will be full of water from the rain, which would sustain the winter season for the survival of the community. The unpredictable rainfall has become a threat to the winter season in order for the community to have enough water.

The results of the study illustrated that most community members practising subsistence agriculture, and who are cultivating in their home gardens use water from the community dam to irrigate their vegetables. This indicates that the decline in water levels in the community dam threatens the livelihood pattern of the community and their subsistence economy. A few farmers who are planting vegetables explain that they are using water from the community dam to water their vegetables which is not allowed by the Department of Water Affairs as they regard it as stealing. The Department of Water Affairs allows the farmers to drill borehole 100 meters away from the dam, therefore

some local farmers are using community water because their farms are next to the dam.

One of the farmers stated that:

“Taba ya meetse ke stress, kalebaka la gore mmušo o gana ka meetse a Thapane. Bare molao wa bona a go dumela go bora pompi ka gare ga letamo. Bjale nna re rekile mechine ya go pompa meetse, re šomiša go na kua letamo le ge bare re ya utswa ba hla re faina, mara re tla dirang? ke mathata a mangwe a re nago le gona”.

English version: “the issue of water is stress, because the government refuse with water dam. They say their law does not allow borehole to be drilled inside the dam. Therefore, I bought machine to pump water straight from the dam and government said we are stealing they will fine us, but what will we do? that is some of the challenges we are currently facing”.

Local subsistence farmers that are ploughing next to the community dam are facing the challenge of water because it is illegal for them to have boreholes next to the dam. Thus they are using community water to sustain their vegetables which are in danger because of the current decline in water levels. One of the subsistence farmers stated that she applied for a water license from the Department of Water Affairs but they have refused because the farm is next to the dam, which means that if they allow her to drill the borehole, she will have to do so inside someone’s farm. She is therefore, using community water from Thapane dam to water her vegetables at the farm. The farmer use generator and connected pipes to pump water into the dam to the ploughing field. Although the quantity of water is low but production is able to work efficiently.

The changing rainfall patterns threaten the community’s livelihood and their economic activities because subsistence farming is their primary activity for survival. Therefore, most subsistence farmers are relying on crop production and livestock for their economic activities. Unpredictable rainfall and unreliable changing weather condition have brought pressure to the economy of the community. Disadvantaged community members are discouraged to practise subsistence farming because of rain scarcity and severely hot weather condition. Community members have observed that current

changing weather conditions have a severe impact on crop production and livestock. There is increased mortality of livestock and pests on crops due to unpredictable weather change.

The study result indicate that change in rainfall patterns makes land unsuitable for cropping because seed takes time to germinate while others germinate with viruses. The land becomes dry and unable to produce enough food for survival. Most community members cultivate their gardens as preferred to the fields because in the gardens, they are able to water their gardens. The changing rainfall pattern has also influenced the cultivation season in the community. Livestock death increases daily because most rivers at the grazing land have dried up due to the unpredictable rainfall. Subsistence farmers are threatens by the change in patterns of rainfall due to their dependence on nature.

4.3.2 An analysis of the impact of climate change on subsistence economy

4.3.2.1 Land ownership

The results of the study indicated that the land ownership various per the location and how is being allocated to community members. The respondents indicated that they are practising subsistence agriculture on the farms, fields and home gardens.

i. Farms

The study found that 60% of males own the land compared to 40% of females. This illustrates that most males own farms compared to females. This was motivated by the cultural beliefs in the late centuries where land was allocated and inherited in a paternal rather than maternal lineage. Some of the female respondents possess land due to the death of their spouses or through parents. Most farms were allocated to families that were able to maintain the land. The study found that in the last century, most families were grouped according to their surnames as one tribe, and land was distributed amongst each other. This was influenced by the apartheid era where people were grouped according to homelands.

ii. **Fields**

The results of the study illustrated that the majority of the respondents do not own the land that they are ploughing on the farms. White local farmers would borrow them a piece of land to cultivate their crops. This can happen over five years while the owner of the land still decided what to do with the land. After five years if the land is still available the owner will continue to borrow the community members piece of land, but if not the community members will start to find the other farm owner who volunteer to borrow them pieces of fields.

The size of the field given to the respondent is measured by counting three lines of mango trees for each to enable the entire subsistence agriculturalist to have space to plough. The allocation of fields is given at the beginning of September each year, on first come first serve. The field size can vary following agreement with the owner of the land during the day of allocation.

Some of the subsistence farmers take more land due to the demand of crops they are cultivating. The results of the study indicated that most female subsistence farmers have small piece of field compared to their male counterparts. This small fields are inherited through lineages and marriages. Furthermore, culturally the land is inherited

by men rather than women. Land access is still a major issue in Motupa community, and threatens the economic activities of subsistence farmers, especially women.

iii. **Home-gardens**

Most households are headed by males regardless of those that are headed by females due to inheritance or loss of a spouse. The respondents indicated that they are cultivating vegetables in their home-gardens; others explained that they are ploughing maize, beans, nuts and pumpkins. Fewer respondents indicated that they cultivate only for sustainability, while the majority showed that they plough to sell their products to the community and other surrounding communities. The results indicated that products that are sold include spinach, cabbage, beans, bean leaves and fresh maize. They commonly sell spinach at R10 per pack, one cabbage at R15, beans R15, bean leaves at R10 and fresh maize at R10. Most respondents indicated that their markets include social security grant pay points, streets and in town.

One of the respondents stated that:

“Nna ke reka spinach, cabbage le mafela toropong ka lebaka la gore batho ba bantšhi ba ya gone tšatšhi ka le tšatšhi e bile o kaone o rekiša toropong ka lebaka la gore ba reka go feta mo gae”.

English version: “I sell spinach, cabbage and maize in town because people are going there every day and are better to sell in town because they buy more than at the villages”.

Furthermore, respondents emphasised that competition is high and their products the same which disadvantaged most of the community members to engage in economic activities. Therefore, they rely on the market. This helps to improve the community's social economic growth. Most community subsistence farmers' socio economic inflation rises because of the demand within the market place. Some are suppliers of big supermarkets in Tzaneen town.

Most respondents indicated that due to absence of properly fenced boundaries, the community livestock is a threat to their vegetables. Although it is the responsibility of the field owner to fence their fields and also their home garden. The majority of the respondents reported that they are practising mixed cropping farming in their home gardens. They emphasised that mix cropping farming brings opportunity to grow a variety of vegetables at the same time. Fewer indicated that they are practising mix cropping farming due to lack of land which allows them to grow different vegetables in small space. They asserted that they save water to irrigate their home gardens in drums and use it to water their gardens. They add firewood ashes in the water in order to reduce soap chemicals inside water to prevent vegetables from being effected by waterborne viruses.

One of the respondents stated that:

“Ke tšhela melora ka gare a meetse a re tlapile lego le go hlatswa di bjana go bolaya sesepe gore se se ke sa bakela dibjalo malwetš’i”.

English version: “I put firewood ashes inside used water for bath and dish washing in order to kill the foam or acid to cause viruses on cultivate plants”.

4.3.2.2 Land cultivation

The study found that the respondents are using different methods of cultivating the land such as hoes and tractors. The respondents also illustrated ways of preparing soil to ensure that the texture is rich to produce quality products.

i. Hoe cultivation

Hoe cultivation is being practised to date. The majority of the respondents who own fields and home-gardens use hoes for cultivation purposes. Although it is a small tool that needs strength when using it, it can be able to make a difference. The majority of the respondents argued that they are experiencing challenges in cultivating by using a hoe. This was because most respondents are old and unable to plough anymore.

Therefore, some have taken a major shift to change from traditional hoe, to tractor, cultivation.

Most respondents stated that they hire other community members to plough their fields and pay R300 per hectare. While other community members have indicated that they are using spades or forks to plough, especially in their home gardens. This improved their vegetation because they are able to work the soil about 8 inches deep to allow moisture in the soil.

One of the respondents stated that:

“Matšatši a lehono a re sa šomiša mohoma go lema mašemo ka le baka la gore o tšea sebaka, re thola derekere go re lemela ma šemo. Seo se hlohloletša ke go se tsepagale ga leratadima le go fetoga ga nako”.

English version: “These days we are no longer using hoe to plough because is taking time, we hire tractor to plough our fields. This is influence by the change in weather condition and time”.

ii. Tractor Cultivation

The results of the study showed that some subsistence farmers are using tractors to till the land. They adopted this method because it is easy and less time consuming. Moreover, they prefer the method of tractor cultivation because it is fast and easy to adapt to unstable current changing weather condition. This will help the respondents to grow and harvest their crops in time. The shift in seasons forces the subsistence farmer to adapt to change in ways of ploughing, preparing the soil and planting their seedlings and seeds.

These transformations come at expenses because the participants must hire tractors to plough the land. The respondents indicated that they pay tractor owners about \$150 per hectare. This illustrates that the old method of hoe cultivation is shifting towards advanced methods of tractor cultivation as a way of adapting to climate change. They

stated that by implementing this method, it will enable them to cultivate huge pockets of land in order to produce in large quantities.

4.3.2.3 Preparation of soil

The majority of the respondents argued that they prepare the soil first before planting their seeds and seedlings. They argued that they use manure before and wait for fewer days before they can plant their seeds. This is done to prevent the heat of manure to burn the small plants. Subsistence farmers that plough at the fields argued that they till the land and plant their seeds without putting manure. Additionally, the garden seedbed is prepared at the corner and after two to three weeks, the seedlings are ready to plant. The study observed that field subsistence farmers use traditional medicine to ensure that wild animals and pests do not feed on their plants and vegetables in the fields. Some respondents showed that they design a doll and put it in the field as a symbol of a person to chase away wild animals that feed on their crops.

One of the respondents stated that:

“Nna ke monna wa setšo ke tshireletše mašemo a ka, batho ba tsenela mašemo a botho ba diriša dihlare tša bona gore o seke wa buna ka mo gotletsego. Nna kua mašemo ke no lema a ke tšele selo kalebaka la gore ge ke buna ke tlogela mahlakala a mafela mo mabung bjale a dira mutedi ka bo gona. Seo se dira gore mmu o none o kgone go mediša dibjalo tša botse”.

English version: “I am the man of tradition I protect my fields, people are entering others fields using their traditional herbs not to produce in large quantity. At my fields I just plough without putting anything because when I harvest I leave the leafs on the ground use as manure on soil. These make the soil more fertile and produce fresh plants”.

4.3.2.4 Seasonal plantation

The respondents indicated that they plant vegetables throughout the year, which differs per season. The majority of subsistence farmers said that most of their crops are winter seasonal, and others are spring seasonal. Crops such as spinach, cabbage, green beans and carrots are mostly grown during the beginning of the winter season. This indicates that winter is a good season for these crops because soil will be already moist and ready for plantation. The respondents indicated that it is good to grow more vegetables in winter than in summer. There are fewer diseases in winter than in summer.

Additionally, subsistence farmers showed that to prevent these diseases, they go to vegetable specialists to seek advice on the kinds of chemicals they can use to prevent pests and viruses. The study showed that some of the crops such as cabbage and maize meal can be grown throughout the year. These crops are able to cope with the current unpredictable rainfall and increases in the weather condition. The study observed that most farmers already have knowledge of different diseases, pests and viruses that attack their vegetables each season.

Some of the home-garden respondents argued:

English version: “That they are using cow dung (*mutedi*) mixed with water to sprinkle their vegetables to prevent diseases and pests”.

“Ke hlakanya maloko a Kgomo le meetse ka gašetša godimo ga merogo go thibela malwetši le dibokwana”.

4.3.2.5 Irrigation System

The majority of the respondents indicated that they use several irrigation methods on their small holder farms and gardens. Subsistence farmers commonly use rain-fed irrigation which relies on natural rainfall. Most subsistence farmers use sprinkler irrigation on vegetables such as spinach, carrots, beans and cabbage to ensure that water goes deep to soil. This type of irrigation method is fast with high pressure but

expensive to maintain because it uses more advanced machinery. The study observed that garden subsistence farmers use manual irrigation which uses watering cans and manual labour to water their gardens. This method is labour intensive but cheaper to maintain. Most farmers irrigate early in the morning or in the afternoon rather than during the day. A few respondents indicated that they are still using old methods of furrow irrigation to irrigate. Furrow irrigation requires more water and labour. Irrigating during the night is best because it allows excess water to soak into the landscape so that the leaves will dry in the normal time.

Most respondents assert that they are using drip irrigation and traveling gun to water their farms. This type of irrigation is the most water-efficient irrigation method because it is near the root zone of the plant drop by drop. The study observed that furrows misuse water but cheaper to use rather than sprinkler which must be monitored and changed over period of months to maintain effectiveness. Home-garden farming mostly still uses buckets and furrows to irrigate their vegetables. Others indicated that they are forming ring around the plant so that they can be able to irrigate.

4.3.2.6 Distribution of harvested crops

Harvested crops are distributed in different ways according to each subsistence farming decision. The harvest style also differs according to the type of crops and livestock of the subsistence farmer. Observations indicated that harvested crops are sold and exchanged among individuals because there is no market place within the community but in the township. The study observed that some crops are freshly harvested for food purpose, while the dry ones are harvested for storage, exchange and economic activities. The majority of the respondents argued that when they harvest they leave leaves on the ground to cause manure for the next seasonal cultivation.

The majority of the subsistence farmers indicated that they are selling vegetables to for the supply of community schools feeding scheme projects. Suppliers commonly buy

vegetables such as cabbage, spinach, green beans and tomatoes. Few respondents stated that they supply supermarkets in Tzaneen town such as Spar and fruit and vegetable stores with various crops. One of the subsistence farmers stated:

“Ke kgona go iša dikgabishi tsa go lekana 900 ka beke kua Spar supermarket”.

English Version: “I am able to supply Spar supermarket with 900 cabbages per week”.

The demand therefore is high; so as the supply should increase but due to unpredictable rainfall the demand target is too low. The results of the study show that some of the fresh crops are sold for street market business community members. They are able to buy in bulk at lower prices and be able to sell at reasonable prices in order to survive. The impact of climate change threatens the economic activity exchange between the subsistence farmers and the small business community members due to increases in inflation that influences increases in market price. The results of the study indicated that some of the community members are using the pay day social security grants point in the community as a place for market exchange.

Waste vegetables are traded to community members who raise pigs at R200 per load. Some of the community members gather indigenous vegetables at R10 per bag of maize meal size and sell them to other community members. Indigenous vegetables such as *theepe*, *mopshee*, *motshitji* and *dikobomapapa* and mixed together and scaled per pack and sold at R10.

4.3.2.7. Challenges of subsistence crop and livestock production in the community

Climate change affects subsistence crop production and livestock in complex ways. It affects crop production directly through changes in agro ecological conditions and indirectly growth on economic activities. Subsistence crop production and livestock in Motupa community is negatively impacted by drought, scarce rain, excessive heat, soil erosion and barrenness. However, community members are coping with these hazards to lower their impacts on their crop yields for sustainable livelihood. The results of the study indicated that challenges experienced in the production of subsistence crops and

livestock is very high because of the rapidly changing weather condition. Unreliable rainfall and increasing weather condition threatens the subsistence economy of the community.

i. Changing temperature patterns

Changes in temperature and precipitation associated with unreliable rainfall brought changes on sustainability and crop yields within the community. Due to the impact of climate change, most vegetables are facing extinction because of transition of time and change of weather. Most community members stated that they rely on natural vegetables for survival though most vegetables are unable to germinate under current weather conditions. As a result, the increase in weather condition makes unsuitable cropping, while the rise of temperature will expand the range of many agricultural pests to attack crops. Moreover, the increase in temperature will reducing livestock productivity and mortality.

The change in weather condition results in drought, which makes it impossible for community subsistence farmers to cultivate in time and harvest in plenty. The respondents argued that if these severely changing weather conditions continue in the next coming years, it will result in food insecurity and threat to their subsistence economic activities. Furthermore, they emphasised that the current weather condition threatens their food production system and storage strategies. Most subsistence farmers argued that the current heat condition influences food storage spoilage. Most respondents assert that they are still using traditional ways of putting firewood ashes inside the crops and seeds when storing them.

Two third majority of the respondents who are practising subsistence farming, specifically those who grow cabbage, green beans, spinach, butternut, carrots, beetroot, spring onion, green pepper and maize indicated that this current weather changing condition brought different kinds of diseases and viruses. One of the subsistence farmers stated that:

“Gona bjale ke itemogela virus mo spinach mara e ka sekgone go fetela godimo ga merogo ye mengwe kalebaka la gore morogo o mongwe le o mongwe o na le bolwetši bja gona”.

English version: “Currently I am experiencing the virus over the spinach but it will not spread to other vegetables because each kind of vegetables have its own kind of virus”.

The increase in weather condition and unpredictable rainfall influences the market and exchange activities in the community. The results of the study indicated that most community members prefer to exchange their crops with progress milling store with exchange of maize meal. This is influenced by little knowledge of storage strategies by respondents.

ii. Changing temperature pattern

The respondents indicated that the changing temperature patterns threaten the livelihood of the community. The respondents observed that changes in environment due to increases in temperature disadvantage community members to grow economically because they depend on rainfall to water their gardens and fields. Few subsistence farmers find it difficult to cope with the current weather condition because they rely on natural resources and rain to survive and be economically active within the community. Livestock farming respondents insisted that the change in weather condition affects their livestock because they do not have enough grass to graze. The respondents argued that major climate hazards, drought, lack of rainfall, flooding and soil erosion hinder the community to produce plenty.

Moreover, the respondents indicated that the current changing weather condition brought different diseases to their crops. In early March 2017, most farmers observed a massive green worm eating their crops in large numbers. This worm affected community production to be harvested in plenty as expected because many crops were

used. In addition the provincial government assisted in preventing green worm by educating and offer free medicine for the farmers and fields cultivators. Community subsistence farming declined in productivity because of infertile soil and excessive heat which results in food insecurity. Livestock farmers are experiencing challenges because of increase in temperatures. The high temperature currently causes different viruses to their livestock, which results in high death rate. Most farmers are affected and unable to adapt to the change to maintain their livestock.

The current changing temperature pattern threatens the economic activities of the community in crop production and livestock. Most livestock farmers are grazing their cows and goats in the fields, especially after the harvest. Therefore, changing weather conditions cause drought, which results in food insecurity for livestock. This indicates that the majority of the respondents come accord that increases in weather condition affects their livelihood pattern in subsistence economy.

Few respondents who sell chickens indicated that the current changing weather condition has effect on their livestock because they die in high numbers due to unpredictable heat. Those farmers who own cows and goats emphasise that if the changing weather condition does not change to be normal, they will be forced to sell their livestock at lower prices because it is expensive to feed livestock.

4.3.3 Livelihood pattern under current subsistence farming

4.3.3.1 Subsistence farming

Subsistence farming in the current situation is characterised by poor production. Furthermore, the results of the study indicated that the extent of production of crops and livestock in the community is on unstable condition due to erratic changing weather condition. The majority of the respondents indicated that in before 2005, they could produce crops in large quantities, and the grass for cows and goats for grazing was plenty. But due to the current drastic change in weather condition, members of the

community are no longer able to produce as much as it was expected. The respondents acknowledge that they are aware of climate change and its economic impact on subsistence farming.

Subsistence farmers said that the current increasing weather conditions result in retrenchment of employees from their farms. Those who work in the fields stated that it is hard to practise subsistence farming under current conditions. Moreover, this shows that the community is affected not on subsistence farming but there is also a high rate of unemployment. Already many families relied on farms for survival, but due to the climate change they are facing poverty. Although they were not earning enough, they could take care of their livelihood.

Subsistence crop production and livestock in Motupa community is negatively affected by the current changing condition that results in climate change and environmental crisis. However, community members indicated that challenges experienced in the production of subsistence crops and livestock is very high because of the rapidly changing weather condition. The results of the study indicate that subsistence farmers of livestock, food gatherers and those involved in mixed farming have acknowledged that drought and unpredictable rain is a major threat to crop production.

The majority of the respondents indicated that it is important for them to practise subsistence agriculture because it is part of their cultural activities. The products that they produce at the farms, fields and back home gardens are some of the most cultural aspects that Motupa community is proud. The changing weather condition makes some of the indigenous vegetables and livestock to face extinction because they cannot survive under this condition. The respondents believe that their children must know their cultural subsistence agricultural activities in order to be able to teach the next generation. The majority of the respondents indicated that young people are not agriculturally active because the majority of them are working in urban areas and depend on their income for survival.

One of the respondents stated that:

“Bana ba rena ga ba sa lema ka lebaka la go fetoga ga leratadima. Ba bona bo kaone e le go hwetša mereko ka go re o lema a gona kgwebo. Go bothata gore bana ba rena ba tsebe dibjalo tsa setšo ka ge ba sena nako ya go ruta setšo sa bona”.

English version: “Our children do not cultivate because of climate change. They see is better to find employment because to cultivate does not have business. It is hard for our children to know indigenous plants or vegetables as they are not invest time for learning their own culture”.

i. Home-gardens

Subsistence farming in home-gardens decline rapidly because of increasing weather condition. The majority of participants grow their vegetables during winter seasons. They grow vegetables such as spinach and cabbage which is good for winter season. The current increasing temperature threatens changes in rainfall. The respondents argued that if this severely changing weather condition continues in the next coming years, it will result in food insecurity and threat to their subsistence economic activities. Few community members indicated that they cultivate in their home-gardens because they have drilled boreholes, while the majority explained that they are discouraged to cultivate because of lack of water.

ii. Fields

The results of the study suggested that few community members cultivate their fields. This shows that the majority of community members are hopeless to cultivate the fields due to climate change. Most crops are burnt, which results in poor production. The current increasing weather condition puts pressure on subsistence farmers because they mostly rely on rainfall for water to water their gardens. The current increasing temperature condition results in poor soil, which is not able to produce quality products.

4.3.3.1.1 Sustained /Improved production

i. Use of kraal manure

The majority of home-garden subsistence farmers are using kraal manure as the major fertiliser in their garden. Community members stated that kraal manure is the most common fertiliser that they use in their home-garden. They mix soil with kraal manure to maintain the texture and moisture of the soil to enable seedlings or seeds to germinate quickly. The respondents argued that they also mix kraal manure with water and sprinkle it over vegetables to prevent goats and indigenous chickens from feeding on them. Kraal manure has been used from ancient times; therefore it is a culturally based practice.

One of the respondents stated that:

“Nna ke šomiša maloko Kgomo le a Dipudi o dira motedi ka mašemong”

English version: “I use cow dung and gout to make manure inside fields or home garden”.

To add more, community subsistence farmers are using chemical fertilisers to prepare the soil at their farms before growing their crops. Farmers explained that they buy chemical fertilisers for more production in order to supply both the community and the market. Although, it is costly to use chemical fertilisers due to transportation, rural farmers are using them. Community farmers argued that they have advanced to chemical fertilisers from kraal manure. Most farmers have knowledge of using chemical manure because they indicated that they attended workshops organised by the municipality about the use of manure. This helps the community to produce quality products and be able to compete with other farmers at the market level.

ii. Mulching

Community members stated that under this current changing weather condition, mulching is helping to improve the status of crops. The majority of home-garden respondents indicated that they commonly use mulching when preparing seed-beds for

plantation. They explained that it helps to retain moisture in summer and to keep water at the root of vegetables for a long time. Home-garden subsistence farming respondents stated that mulching enriches and protects the soil by providing better growing environment for vegetables. The respondents showed that mulching is the simplest, cheapest and most beneficial practice that they use in the gardens.

One of the respondents stated that:

“Nna ke dira peteni ya spinach le cabbage pele ga ge nka gaša ka di line ka mo mašemong”.

English version: “I do mulching with spinach and cabbage before I can plant the vegetables in lines inside the field”.

The results of the study indicated that in this current unpredictable rainfall and lack of water, most community members are opting for mulching to conserve moisture on the vegetables. This helps in reducing the need for frequent watering, protects the soil from erosion, maintains soil temperature, prevents weed growth and allows vegetables to be remaining clean. Community members’ use mulching is an important method of saving water and adapt to current changing climate condition.

iii. Growing of short – season crops

Most subsistence agriculture in Motupa community has shifted towards crop production in short – seasons. Crops such as maize, indigenous vegetables, nuts and beans can be sustainable in the current increasing weather condition. They are opting for such crops because they are the most traditional sources of staple food in the community. The respondents indicated that they are no longer grown crops that require plenty of rain and therefore easily damaged. The farmers have shifted to growing crops that mature early and drought tolerant varieties to reduce crop failure, loss, damage and loss of money. Frequent drought and unpredictable rainfall make subsistence agricultural farmers to choose short season crops and lower water depend crops to coincide with the irregular rain pattern.

The traditional method of multi-cropping is practised in Motupa community, especially by the farmers. The seeds of maize, nuts and beans are mixed and thrown simultaneously in the same field to maximise the chances of the parallel growth of the crops. This is done because the land in which members of the community grow their crops is small, and they want to cover all variety of crops. The majority of respondents stated that in their home-gardens, they cultivate mostly spinach and cabbage because these need low water in terms of irrigation. Short season crops are mostly adapted to the community because of climate change.

iv. Preservation of seeds for planting in the next season

Practising field subsistence farmers stated that they use various methods of preserving seeds, depending on the kind of seeds and temperature needed to keep these seeds fresh. The seed of nuts, beans, njugo beans and pumpkin are preserved through sun drying for use in the next season. The sun-dried seeds are mixed with ashes of firewood to prevent them from being attacked by insects. The seed will be stored inside a bottle, plastic bag and bucket. This will ensure that they last up to the next season when it is time for cultivation. Dried maize is collected, put on the sun to dry and preserved inside an empty maize meal sack with firewood ashes to prevent insects and to maintain its freshness for the next season.

One of the respondents stated that:

“Ge re rekiša mafela, ditloo, dinawa le ditloomarapo re šadiša tsa peu, gomme ra hlakantsha peu yela le melora go thibela diphetli go fehla peu gore e seke ya mela”.

English version: “when we sell the maize, beans, ground nuts and njugo beans we leave the seed to plant next season, therefore we mix seed with firewood ashes to prevent insects to eat the seed”.

The community members explained that to preserve pumpkin seeds, they break them open and remove the seed, which they will put under running water, rubbing them between their fingers to remove any stringy material and membrane, then lay it out on the plate to sun-dry it. Pumpkin seeds are sun-dried and put inside the ash, and then

kept in clay pots, bottles and containers to protect them from weather conditions. These seeds can stay for a year without being attacked by insects. The dried products are kept until the next season, and the crushing is done towards the next season.

Seeds are not preserved only for planting, but also for roasting. They are ground and added to cooked vegetables in the absence of groundnuts. The seed powder is used to enhance flavour inside vegetables for nutritional value. Other members of the community indicated that they preserve beans and njugo beans with their covers, store in a sack, clay pots and will last for two years. The community members illustrated that indigenous ways of preserving vegetables and seeds are cheaper, cost free technology, safe, affordable and reliable.

The community farmers indicated that they do not preserve the seed for the next season, but rather prefer to buy seeds and seedlings every season. This is done because most of the time, they collect the crops while they are still fresh. They sell their crops to the community and in the market place. Moreover, their perception was that preserved seeds take time to germinate unlike the one they buy, which is in chemicals that make it to germinate quickly.

V. Preservation of food crops

Community members explained that they have choices in terms of how much to preserve and to sell, depending on the market price, their own consumption need, storage place and their immediate cash. Most respondents preserve their crops at home, and in progress milling for those who have harvested plenty of maize. Those who preserve in the progress milling exchange with one bag of dried maize, which is equal to one bag of maize meal. Some of the perishable food crops such as spinach, green beans and pumpkin may not be stored at all, but are simply left in the ground until they are needed. If other crops are marketed, they will be lifted at once and transported to the market while still fresh.

Community members are preserving food through both modern and traditional ways for the off season. Community members are forced to preserve food in indigenous ways because most food crops are seasonal and there is a lack of processing or value-adding technologies to avoid food wastage. The main methods of preserving indigenous vegetables, grains and seeds are air and sun drying, smoked coating, ash mixing, leaving with their covers after harvesting, shading and freezing.

Seed preservation is cheaper in terms of time and labour compared to grain consumption. This is because the volume of seed preserved is smaller compared to crop yields. The community members explained that they have adopted the modern ways of preserving leafy vegetables by freezing them. The vegetables are chopped and boiled for few minutes depending on the type of vegetable. These vegetables should be blanched before freezing to ensure that they keep well without negative changes in their texture, colour and taste. The beans and pumpkin leafy vegetables are collected, parboiled and sun-dried for few days depending on the intensity of the insolation. The vegetables are dried and used in winter, that is, the time of scarcity in contribution to households' food security. The dried beans and pumpkin vegetables are stored in bags, pots and containers to maintain flavour; they are kept for a period of a year.

The fresh leaves of pumpkin are collected, washed, boiled and used as vegetables to eat with porridge alone, or used as a relish for side dish with porridge. The pumpkin fruits are collected, peeled, cut and boiled mixed with maize meal to make vegetable porridge. The fresh soft leaves of beans are collected, washed and boiled used as vegetables to eat with porridge. The bean leaves and pumpkin leaves are also collected, washed, boiled and sun-dried to preserve for winter season when there is lack of vegetables. Ready and green maize is collected, peeled, boiled and served for eating with salt, while some can braai the maize to eat.

The nuts, beans and njugo beans are collected, washed, boiled and ready to be eaten as a snack. Maize, nuts and tloomarapo are collected, washed and boiled to make samp. The nuts can also be pounded in a mortar with a pestle to make powder and put

inside pumpkin leaves and beans leaves. The dried maize is collected, washed and pounded with the mortar and pestle to make maize meal and a samp.

4.3.3.2 Alternative sources of food

i. Employment

The results of the study suggested that the majority of community members are working in urban areas although some are still practising subsistence farming. The majority of young people are the ones working in urban areas in industries, shops, mines, etc. Community members stated that due to the current erratic changing weather condition, they prefer to work in urban areas than to practise subsistence farming. The respondents indicated that to get salary at the end of the month helps to support their families rather than to rely on farming, which results in no production. The results of the study indicated that most community members adopted new ways of making a living for survival in their households. They are working in urban areas with the hope of making a change in their livelihood because the current increasing temperature condition hinders subsistence farming production. Most respondents argued that they are employed by different shops such as hyper stores, restaurants and Indian shops.

The study result indicated that most community members are working at local farms seasonally. Most local farms are producing fruits and vegetables that are seasonally determined; therefore, they work seasonally to collect both green and ready mangoes for archer and juice. Others are working where they specialised in bananas, green pepper, peri-peri, macadamia nuts and avocados. Most respondents indicated that they are working seasonally at the local farmers to sustain their households.

ii. Self-employment

The results of the study indicated that some of the community members rely on self - employment for livelihood and survival. Few own businesses, selling in streets at the village, and in town. They are making sure that they hustle enough per day to bring food

within the house. Self-employed people sell crops, stock clothes and sell porridge and meat in the streets to sustain their households. Others have opened small shops in the community to survive, but the competition is too high with the current rapid emergence of high volume of shops own by Pakistanis.

Other community members indicated that they are self-employed because they are microloans lenders. They indicated that they are selling firewood at R450 each load. This assists the community with firewood while also bringing household income. This also increases the chances of labour in the community because people will be hired to cut firewood to supply the community with basic needs. Other community members explained that they are selling ice cream at the taxi rank in order to bring food on the table. Others are selling cooked maize and nuts in order to survive daily.

iii. Others

The results of the study presented other alternative sources of food in the community as community members are selling cosmetics and cutlery such as Avon, table charmer, Justine, Butle Bulte cutlery and Tupperware for survival. They have stated that they join the company under someone's name to have access in order to sell to others. Some of the community members stated that they work as helpers in the village and in town. Community members are selling mangoes to the firms that produce archer as a source of income. They also indicated that they sell ready mangoes to firms that produce juice and for people at R80 per box. The mangoes are seasonal fruit; therefore during their season, community members are able to do make money because customers from outside the community are coming to buy from them.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter seeks to present data and to discuss the findings of the research on perceptions of rural communities on climate change and its economic impacts on the livelihood at Motupa village, Tzaneen, Limpopo Province. The data and findings are organised and presented in accordance with the research questions of the study. In this regard, the chapter is mainly centred on three research questions: description of the perceptions by Motupa community members on climate change; an examination of the impact of climate change on subsistence economy; and livelihood patterns under current subsistence farming. There are areas that need more research to come up with a holistic kind of approach in trying to reduce the impact of the current unstable changing weather condition with much focus on vulnerable individuals and communities.

5.2 Study Sample

The data presented was gathered through semi-structured interviews and focus group discussions. Given the complexity of the subject under the study, a wide range of issues was of interest on the land ownership, unpredictable rainfall, current increasing weather temperature, including a variety of socio-economic variables. From this dimensional perspective, qualitative data was generated depending on the research questions, source and nature of data and the data collection instrument employed. In terms of response rate, the sample was reasonably successful. A total of 20 households were successfully sampled out of the targeted households. The entire sample successfully participated in the study. Due to financial and time constraints, the above stated sample size was assumed to be achievable and optimally representative of the perceptions and impact of climate change in the community.

Before addressing the core results and discussion of the findings, a descriptive data of the sampled population is presented in order to provide the impact of climate change, perceptions, background and organisation of the study. Several techniques are employed in order to enhance the reader's appreciation of patterns in the frame of discussion presented. In terms of the sex ratio of the sample, it is notable that the majority of the respondents were women, making up 60% of the total the respondents, whilst men constituted the remaining 40% of the respondents.

The gender sensitivity, the ration of male to female respondents that emerged from the study is considered to be relatively unbalanced. The need for gender balance in the study was taken seriously, particularly based on the argument that women and men face various vulnerabilities in terms of perceptions and impact of climate change. The duration of the stay in the areas was regarded as crucial because it would provide an informed historical profile of knowledge of climate change and experiences of the area. In this case, the majority of the respondents lived in the village for more than 41-50 years. The stated duration makes up the total population sample that enhanced the reliability of data obtained on the community's knowledge and experiences about climate change, consequences on environmental changes, threats on their subsistence farming and the responses on the adaptation strategies on climate change in Motupa community.

5.3 Research Methodology

i. Discussion

Qualitative technique was used to collect data as a primary source. Data collection tools such as interviews and focus group discussions were used to collect in-depth information about climate change and its economic impact on the livelihood of the community. This was aimed at capturing the livelihood activities within the community and the extent of community vulnerability to climate change. A focus group discussion data tool was established to find various perceptions about the changing temperature and its influence on unpredictable rainfall.

The results of the study showed that the methodology used was able to give more information about climate change and its economic impact on the livelihood of the community. The study observed that the communities practise subsistence farming in order to survive at household level and economically active. The data was more informed because most community members were their place of origin. The majority experienced increasing weather condition and unpredictable rainfall, and developed various techniques of coping with climate change. Most community members answered interview questions well because they were in their private spaces where they responded to questions without fear or interruption.

ii. Challenges

The challenge observed during data collection was that the society is still characterised by patriarchy rather than matriarchy. Most households identified men as heads of households. The researcher was required to ask permission from the heads of the families to ask question about the study. This resulted in the researcher not getting some of the information from the households purposively selected. This tampered with the data collected because some of the female participants were brief because their spouses were present.

In the event that the subsistence local farmer was temporarily away, the data collector would be kindly asked to come back later to meet him. This posed a threat to the results of the study because of time frame and travelling expenses by the researcher. In families that are headed by widows, it was easy to collect data, as they were approachable. Some of the challenges observed included the issue of community members fighting over land. One of the community household argued that they were unable to provide relevant information due to a dispute relating to fields amongst other community members. Data collection took five weeks instead of four weeks because of re-visitation to some identified households which were perceived to have in-depth perceptions on climate change and its economic impact on the livelihood.

The economic impact of climate change on livelihood emerges as the respondents are blaming government for not intervening in unpredictable changing weather condition. As a result, not all relevant information about climate change and its economic impact on livelihood was gathered. For example, on the probe on climate change and its economic impact on the livelihood, most answers blame government for not initiating programmes or for not providing knowledge on how to adapt to the current rapid climatic condition. To address this challenge, the researcher was as natural as possible. Despite the challenges and weaknesses above, the data collection methods collected sufficient information for this study.

5.3 The results of the study

5.3.1 Perceptions of Motupa community members on climate change

Climate is a primary factor for agricultural productivity and environmental change effects on plant and animal production; therefore it is important to adapt to environmental change to cope with the distress (Shongwe, Masuku & Manyatsi, 2014). The community members acknowledged and observed that current changing weather condition affects their livelihood pattern. The study observed that Motupa is the richest community in producing crops, but the current increasing weather conditions threaten their subsistence farming. The sustainable livelihood approach theory indicated is useful to understand perception of climate change and how it affects subsistence economy and livelihood patterns of a rural community. Furthermore, the IPCC (2013) observed that agricultural production in the rural areas is negatively impacted by the changing climatic condition. Dube and Phiri (2013) attested that Limpopo Province is one of South Africa's richest agricultural area which produces major in vegetables.

Community members argued that unpredictable rainfall and drought are the biggest challenges to their subsistence farming. Rankoana (2016) supports the statement above by observing that the livelihood of rural areas is rapidly changing as a result of unpredictable rainfall and changing temperature patterns. The study observed that increasing weather condition does not affect subsistence farming only, but also the

livelihood of community and surrounding areas. The African Partnership Forum (APF, 2007) support by indicating that climate change can no longer be considered as an environmental problem only; it also becomes a major threat to sustainable development and poverty reduction.

The community members observed that climate change results in lack of water where the community dam is not able to supply water to the needy. Most community members rely on the municipality to supply them with water even when they cannot cover all the people. Roncoli, Ingram and Kirshen (2013) further argued that the impact of low rainfall has negatively affected the agricultural sector, resulting in decreases in agricultural activities, loss of livestock, shortage of drinking water, low yields and shortage of seeds for subsequent cultivation.

5.3.2 An examination of the impact of climate change on subsistence economy

The results of the study indicate that the current increase in weather condition impacts the subsistence farming of Motupa community. The IPCC (2013) report adds that changes in weather conditions impact the livelihood of communities depending on subsistence economy for livelihood. Most community members rely on subsistence farming to sustain their livelihood. Cultural beliefs take a major control in allocation and inheritance of land. Chingarande (2013) supports that when subsistence economy fails, a community 'livelihood assets such as social networks, mutual support, values, belief and practices become vulnerable to shocks.

This is supported by Bhusal (2009) and Rankoana (2016), who state that cultural values, belief systems and practices are compromised as community members adopt non-tested indigenous knowledge systems and new interventions to adapt, cope and mitigate the impact of changing environmental conditions the majority of the community subsistence farmers are practising mix cropping because it allows them to grow various types of vegetables in a small space. All subsistence farmers are using chemical fertilisers, while home-gardens are using kraal manure as fertilisers to enrich their soil

to become moisture. The community has shifted the cultivation season because of the current climate change. Roncoli, Ingram and Kirshen (2013) further argued that the impact of lower rainfall has negatively affected the agricultural sector, resulting in decreases in agricultural activities, loss of livestock, shortage of drinking water, low yields and shortage of seeds for subsequent cultivation. Thus, community members are facing a major challenge of unpredictable weather changing condition.

5.3.3 Livelihood patterns under current subsistence farming

The current subsistence farming threatens the livelihood pattern of the community members because of poor production. Gandure, Walker and Botha (2011) argued that these communities are aware of the rapid climatic change condition and their impacts on people's livelihood. They are however, are trying different ways of adapting to climate change on subsistence farming to sustain their livelihood. The IPCC (2013) report adds that changes in weather conditions impact the livelihood of communities depending on subsistence economy for livelihood. The sustainable livelihood approach recognised that the poor should be involved in designing the policies and projects intended to better their lives because they are the one facing the situation (Krantz, 2010).

The community members opt for short season crops that are easily grown under this climate change. Members of the community use both kraal manure and chemical manure to prepare the soil for cultivation. They have developed various ways of preserving seeds for next season cultivation and food preservation to maintain freshness and quality. The study has indicated that there are other alternative sources of food besides subsistence farming in the community. Sources such as employment and self-employment were identified as the other major contributions for the sustainability of households.

5.4 Conclusion

The researcher concludes that in the community in which the research was conducted, the majority of farmers engaged in subsistence agriculture are female rather than male. They grow vegetables and breed livestock such as maize, beans, nuts, pumpkins and cows, goats and chickens, respectively. The community farming members prefer crop production than livestock farming. Crop production is mostly practised in subsistence farming than livestock farming. The findings indicated that the following types of subsistence economy take place on a seasonal basis: farming (15%), livestock (10%), food gathering (50%) and mixed farming (25%).

The study observed that the increase in temperature in the community threatens the economic livelihood of the rural subsistence farmers. Most farmers rely on unpredictable rainfall to nature their home gardens and fields. The current high temperature influences damage and extinction of other crops. Due to current increases in temperature, water scarcity is the biggest problem of poor rural livelihood. The current intervention on water resources improves the development of rural communities. The majority of government policies on climate change prevention should be based on rural community development focusing on the current increase in weather condition.

The study evaluated the impact of climate change on agricultural productivity in rural communities. Furthermore, the study contributes to a better understanding of the complex effects of climate change on rural communities. Such understanding will not only highlight the level of the challenge, but also improve policy strategies and community-based monitoring and evaluation programmes. The study observed the notion that vulnerability is a function of various types of capital such as human, physical, financial, natural and social capital. Poor households have less capital to cope with climate-change shock in their community. Measures to reduce vulnerability to climate change disasters should focus on households by building adaptation strategies and the capacity to adapt to climate change in rural communities.

5.5 Recommendations

Based on the study, the following recommendations are made:

- For effective crop production, community members should have in-depth knowledge of current unstable changing weather conditions.
- All community members in subsistence agriculture should get more involved in programmes and projects that deal with how to adapt to climate change. The
- Subsistence farmers should ask help from the department of agriculture to assist in marketing their products.
- The Department of Agriculture should visit all types of farmers to support and ensure productivity and economic growth of the community.
- Appropriate agricultural practices of irrigation should be implemented.
- The demonstration, farmer training and extension programmes need to be implemented to strengthen farmers.
- More studies on climate change and its economic impact in rural communities should be conducted, particularly with regard to subsistence farming as it is a primary source of rural survival.

REFERENCES

- African Partnership Forum (APF). (2007) *Climate Change and Africa*. Document Prepared jointly by the APF and the Secretariat of the New Partnership Africa Development for the 8th APF Meeting in Berlin. May 22-23.
- Aljareo, A. (2014). *How is Climate Change Incorporated into Environmental Impact Assessments (EIAs) in South Africa?* Master's Thesis. University of the Witwatersrand.
- Antonius, R. (2013). *Interpreting Quantitative Data with IBM SPSS Statistics*. California USA: Sage Publisher.
- Babbie, E. & Mouton, J. (2001). *The Practice of Social Research*. Cape Town: Oxford University press.
- Beg, N., Morlot, J. C., Davidson, O., Afrane-Okesse, Y., Tyani, L., Denton, F., Sokona, Y., Thomas, J. P., La Rovere, E., Parikh, J. K., Parikh, K. & Rahman, A. A. (2011). Linkages between Climate Change and Sustainable Development. *Climate Policy*, 2(2-3):129-144.
- Bewket, W. (2012). Climate Change Perceptions and Adaptive Responses of Smallholder Farmers in Central Highlands of Ethiopia. *International Journal Environment Study*, 69 (3):507-523.
- Bhusal, Y. (2009). *Local People Perceptions on Climate Change, Its Impacts and Adaptation Measures in Mid-Mountain Region of Nepal. (A Case study from Kaski District)*. Nepal: Tribhuvan University Institute of Forestry.
- Blignaut, J., Ueckermann, L. & Aronson, J. (2009). Agriculture Production's Sensitivity to Changes in Climate in South Africa. *South African Journal of Science*, 105(61): 15-27.
- Braun, V. & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3, 77-101.
- Brown, D., Rance, R. & Chatiza, C.K. (2012). *Climate Change Impacts, Vulnerability and Adaptation in Zimbabwe*. Working Paper No.3: December 2012.

- Bruckner, M. (2012). *Climate Change Vulnerability and the Identification of Least Developed Countries (LDCs)*. The United Nations Development Policy and Analysis Division Department of Economic and Social Affairs. pp. 3-15.
- Chambers, R. & Gordon, C. (1992). *Sustainable Rural Livelihoods: Practical concepts for the 21st Century*. Institute of Development Studies: United Kingdom
- Chingarande, S.D. (2013). Climate change and rural livelihoods in Guruve District: a gender analysis. *Alternations*, 20 (2): 276-293.
- Dasgupta, P., Morton, J., Dodman, D., Karapinar, B., Meza, F., Rivera-Ferre, M.G., Toure Sarr, A. & Vincent, K.E. (2014). *Rural areas*. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. In Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, ed. Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, P.R., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R. & White, L.L, pp. 613-657.
- Debay, T. (2010). *The Impact of Climate Change in Africa*. Institute for Security Studies: London.
- Department of Environmental Affairs [DEA]. (2011). *South African Second national communication under UNFCCC*, Pretoria: South Africa.
- Department of Environmental Affairs Notice of 2010. (2010). *National Climate Change Response Green Paper 2010*, Pretorius Street, Pretoria: South Africa.
- Dessalegn, O.G. & Akalu, D.S. (2015). The Impacts of Climate Change on African Continent and the Way forward. *Journal of Ecology and the Natural Environment*, 7(10): 256-262.
- Dube, T. & Phiri, K. (2013). Rural Livelihoods under Stress: The impact of Climate Change on Livelihoods in South Western Zimbabwe. *American Journal Contemporary Research*, 3: 5.
- Financial and Fiscal Commission (FFC). (2012). *Annual Submission of the Division of Revenue*, Midrand: Republic of South Africa

- Financial and Fiscal Commission. (2013). *Annual Submission of the Division of Revenue*, Midrand: Republic of South Africa
- Food and Agriculture organisation (FAO). (2003). *Responding to Agricultural and Food Insecurity Challenges Mobilizing Africa to Implement Nepad Programmes, Conference of Ministers of Agriculture of the African Union*, Maputo: Mozambique.
- Food and Agriculture Organization. (2007). *Adaptation to climate change in Agriculture, Forestry and Fisheries: Perspective, Framework and Priorities*. Food and Agriculture Organisation of United Nations. Rome
- Food and Agriculture Organization. (2011). *The State of Food and Agriculture 2010-11: Women in Agriculture*. Rome.
- Foresight, A. (2011). *The Future of Food and Farming. Final Project Report*. The Government Office for Science, London
- Gandure, S., Walker, S. & Botha, J.J. (2011). Farmers' Perceptions of Adaptation to Climate Change and Water Stress in a South African Rural Community. *Environmental Development*, 5: 39–53.
- Getu, A. (2015). The Effects of Climate Change on Livestock Production, Current Situation and Future Consideration. *International Journal Agriculture Science*, 5(3):494-499
- Gyampoh, B. A., Amisah, S., Idinoba, M. & Nkem, J. (2014). *Using Traditional Knowledge to Cope with Climate Change in Rural Ghana*. In Proceedings, Third International Conference on Climate and water, Helsinki, Finland: Finnish Environment Institute (SYKE), pp.205 – 213.
- Hummel, D. (2015). *Climate Change, Land Degradation and Migration in Mali and Senegal-some Policy Implications, Migration and Development*. Institute of Social-Ecological Research, Hamburger Allee: German
- Huq, S., Reid, H., Konate, M., Rahman, A., Sokona, Y. & Crick, F. (2004). Mainstreaming Adaptations to Climate Change in LDCs. *Climate Policy* 4(1):25-43.

- Intergovernmental Panel on Climate Change (IPCC). (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.
- Intergovernmental Panel on Climate Change. (2012). *In Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation in a Special Report of Working Groups I and II of the IPCC*. Cambridge: Cambridge University Press
- Intergovernmental Panel on Climate Change. (2013). *The Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press
- Khanal, P.R, Santini, G & Merrey, D.J. 2014. *Water and the Rural Poor Interventions for Improving Livelihoods in Asia*. Food and Agriculture Organization of the United Nations. Bangkok.
- Kahsay, G. A. & Hansena, L.G. (2016). The Effect of Climate change and adaptation policy on agricultural production in Eastern Africa. *Ecological Economics*. 121:56-64
- Karfakis, P., Velazco, J., Moreno, E. & Covarrubias, K. (2011). Impact of increasing prices of agricultural commodities on poverty. *ESA Working Paper Series*, 11, (14): 56-89.
- Krantz, L. (2001). *The Sustainable Livelihood Approach to Poverty Reduction*. Swedish International Development Cooperation Agency. Stockholm: Sweden
- Krige, E.J. & Krige, J.D. (1980). *The Realm of a Rain Queen: A Study of the Pattern of Lovedu Society*. Oxford: Oxford University Press.
- Kruger, A.C. & Shongwe, S. (2004). Temperature Trends in South Africa: 1960-2003. *International Journal of Climatology*, 24: 1929-1945.
- Kumsa, A. & Jones, J.F. (2010). Climate Change and Human Security in Africa. *International Journal Sustainable Development*, World Ecol. 17(6):453-461.
- Madziwa, B.F., Mabeza, C.M. & Mawere, M. (2013). The Challenge of Global Environmental Change on Grassroots Farmers: Prioritizing Knowledge

- Dissemination in Africa. *The International Journal of Humanities & Social Studies*, 1 (1): 29.
- Madzwamuse, M. (2010). *Climate Change Vulnerability and Adaptation Preparedness in South Africa*. Cape Town: South Africa.
- Madzwamuse, M. (2014). *Climate Change Vulnerability and Adaptation Preparedness in South Africa*. Cape Town: Heinrich Boll Foundation.
- Mapaure, I., Mhango, D. & Mulenga, K. (2011). *Mitigation and Adaptation Strategies to Climate Change*. Namibia: John Meinert Printing, Windhoek.
- Maponya, P. & Mpandeli, S. (2013). Perceptions of Farmers on Climate Change and Adaptation in Limpopo Province of South Africa. *Journal of Human Ecology*. 42: 283–288.
- McCarl, B.A. (2010). Analysis of Climate Change Implications for Agriculture and Forestry: An Interdisciplinary Effort. *Climate Change*, 100(1):119–124.
- Mohale, M.R. (2014). *Khelobedu Cultural Evolution through Oral Tradition*. Pretoria: University of South Africa.
- Mokhem, T. & Janse van Vuuren, A. (2015). *Drought Forces SA to Buy More Maize from Zambia*. Zambia.
- Motshekga, M.K. (2010). *The Modjadji Dynasty*. Johannesburg: Acumen Publishing Solutions.
- Mudombi, S., Nhamo, G. & Muchie, M. (2014). Socio-Economic Determinants of Climate Change Awareness among Communal Farmers in Two Districts of Zimbabwe. *Africa Institute of South Africa, Africa Insight*, 44(2).
- Mutekwa, V.T. (2009). Climate Change Impacts and Adaptation in the Agricultural Sector: The Case of Smallholder Farmers in Zimbabwe. *Journal of Sustainable Development in Africa*, 11(2): 252.
- Nath, P.K & Bhagirath, B. A. (2011). Critical Review of Impact of and Adaptation to Climate Change in Developed and Developing Economies. *Environmental Development. Sustainability*, 13: 141-162.

- National Climate Change Response White Paper. (2016). *National Climate Change Response White Paper 2010*. Pretoria North Tower. Available online: www.environment.gov.za [Accessed on 13 February 2017].
- Ncube, M., Madubula, N., Ngwenya, H., Zinyengere, N., Zhou, L., Francis, J., Mthunzi, T., Oliver, C. & Madzivhandila, T. (2016). Climate Change, Household Vulnerability and Smart Agriculture: The Case of two South African Provinces. *Journal of Disaster Risk Studies*, 8 (2):14.
- Neuman, L.W. (2000). *Social Research Methods. Qualitative and Quantitative Approaches*. United Kingdom: Library of Congress.
- Norgaard, K.M. (2018). The sociological imagination in a time of climate change. *Elsevier B.V*, 163: 171-176
- Olsson, L.M., Opondo, P., Tschakert, A., Agrawal, S.H., Eriksen, S.M., Perch, L.N. & Zakieldean, S.A. (2014). Livelihoods and Poverty, In: *Climate Change 2014: Impact, Adaptation and Vulnerability, Part A*. Contribution of Working Group II to the 4th Assessment Report of the IPCC.
- Rankoana, S. A. (2016). Perceptions of Climate Change and the Potential for Adaptation in a Rural Community in Limpopo Province. *South Africa Journal of Sustainability*, 8: 672.
- Rankomise, A. O. (2015). *Climate Change in Zimbabwe*. Available online: www.kas.de/Zimbabwe [Accessed on 13 February 2017].
- Roncoli, C., Ingram, K. & Kirshen, P. (2002). Reading the Rains: Local knowledge and Rainfall Forecasting among Farmers of Burkina Faso. *Society and Natural Resources*, 15 (5): 409-427.
- Rose, R.M. (2015). The Impact of Climate Change on Human Security in the Sahel Region of Africa. *Donnish Journal of African Studies and Dev.* 1(2):009-014.
- Sango, I. & Godwell, N. (2014). Climate Change Trends and Environmental Impacts in the Makonde Communal Lands, Zimbabwe. *South Africa Journal Science*, 111 (8):6.
- Schlenker, W. & Lobell, D.B. (2010). Robust Negative Impacts of Climate Change on African Agriculture. *Environmental Research Letters*, 5 (1):1-8.

- Schulze, R. E. (2010). *Atlas of Climate Change and the South African Agricultural Sector: A 2010 Perspective*. Department of Agriculture, Forestry and Fisheries. Pretoria: South Africa.
- Seager, T.P. (2008). The Sustainability Spectrum and the Science of Sustainability. *Business Strategy and the Environment*, 17(17): 444-453.
- Shongwe, P., Masuku, M.B. & Manyatsi, A.M. (2014). *Cost Benefit Analysis of Climate Change Adaptation Strategies on Crop Production System: A case of Mpolonjeni Area Development Programme in Swaziland*, Sustainable Agriculture Research, 3:1.
- Signgh, A. & Purohit, B. (2014). Public Health Impacts of Global Warming and Climate Change. *Peace Review Journal Social Justice*, 26(1): 112-120.
- Skoufias, E., Rabassa, M. & Olivieri, S. (2011). *The Poverty Impact of Climate Change: A Review of the Evidence*. Policy Research Working Paper 5615. Washington, DC: World Bank.
- Statistics South Africa. (2009). *Mid-Year Population Estimates. Statistical Release P0302*. Available online: <http://www.statssa.gov.za/publications/P0302/P03022009.pdf>. [Accessed on 28 February 2017].
- Statistics South Africa. (2011). *Local Municipality Greater Tzaneen. census2011.adrianfrith.com/place/962*. [Accessed 18 March 2017].
- Stern, N. (2006). *The Economics of Climate Change*. Cambridge: Cambridge University Press.
- Strydom, H., Fouche, C. B. & Delport, C.S.L. (2005). *Research at Grassroots for Social Sciences and Human Service Professions*. London.
- Tetteh, E.M, Opareh, N.O., Ampadu, R. & Antwid, K.B. (2014). Impact of Climate Change: Views and Perceptions of Policy Makers on Smallholder Agriculture in Ghana, *International Journal Science*, 13(1):79-89.
- Tshiala, M.F. & Olwoch, J.M. (2010). Impact of Climate Variability on Tomato Production in Limpopo Province, South Africa. *African Journal of Agricultural Research*, 5(21): 2945-2951.

- UNDP. (2011). *UNDP in Africa, New York*. United Nations Development Programme.
- Welman, J.C., Kruger, S.G. & Mitchell, B. (2005). *Research Methodology*. Cape Town: Oxford University Press.
- World Bank. (2010). *World Development Report: Development and Climate Change*. Washington, DC: World Bank.
- Yohe, G. & Tol, R. (2002). Indicators for Social and Economic Coping Capacity: Moving Toward a Working Definition of Adaptive Capacity. *Global environmental Change*, 12: 25-40.
- Zambia. *Journal of African Economies*, 20 (5): 781-822.
- Ziervogel, G., New, M. & Van Garderem, A. M. (2014). Climate Change Impacts and Adaptation in South Africa. *WIREs Climate Change* 5:605-620.

APPENDIX A: DATA COLLECTION TOOL

A. Participants' biographical information

a. Gender

Male	1
Female	2

b. How long have you lived in this community?

1-10	11-20	21-30	31-40	41-50	OTHER
1	2	3	4	5	6

c. Economic practices

Farmer	Livestock	Food gatherer	Mixed farming
1	2	3	4

d. Household size

Grandparents, parents & grandchildren	grandparents	Single parent
1	2	3

e. Employment

Employed	Unemployed	Self -employed
1	2	3

f. Educational qualification

Less than standard 10/11	Grade 12	Degree	Postgraduate
1	2	3	4

B. Participants' perceptions about climatic conditions

1.1 Do you notice any change in environmental conditions in your surrounding? Explain.

1.2 Could you please explain your understanding of climate change?

1.3 What are the indications of this change?

1.4 Explain how climate change affects you/your family community.

C. Participants' awareness of the impact of climate change on subsistence economy

2.1 Describe the extent of production of crops and livestock in your community.

2.2 Explain the challenges experienced in the production of subsistence crops and livestock?

2.3 Which indications of climate change explained in (1.3) above affect production of crops and livestock?

2.4 Explain the status of crop and livestock production.

D. Implications of change in subsistence economy on livelihood patterns

3.1 Which cultural activities are dependable on crop/livestock production?

3.2 Give details of how the current livelihood patterns (in 2.4 above) impact the livelihood patterns.

3.3 Explain the current livelihood patterns.

APPENDIX B: CONSENT FORM

I consent to participate in the study on **Perceptions of rural communities on climate change and its economic impacts on the livelihoods: A case of Motupa community in Tzaneen, Limpopo Province**. I understand that participation in the study is completely voluntary. I will be asked to answer questions about the perceptions of climate change and its economic impact in the livelihoods of a rural community.

By signing this form I agree that I have read and understood the information above and I freely give my consent to participate in the study.

Signatures:

Participant.....Date

Witness.....Date

ResearcherDate

SEGOMARETŠWA SA A: THULUSI YA KGOBOKETŠO YA TSEBO

A. Tsebo ya Motšeakarolo

a. Bong

Monna	1
Mosadi	2

b. Ke nako ye kanakang o dula mo setšhabeng se?

1-10	11-20	21-30	31-40	41-50	YE NNGWE
1	2	3	4	5	6

c. Se se phedišago ikonomi

Rapolase	Diruiwa	Mokgoboketši wa dijo	Temo ya go kopanakopana
1	2	3	4

d. Bontšhi bja lapa

Grandparents, parents & grandchildren	Lapa la go etela ke bana pele	grandparents	Batswadi ba go senyalwe
1	2	3	4

e. Maemo a mošomo

Employed	Unemployed	Self -employed
1	2	3

f. Maemo a thuto

Less than standard 10/11	Khereite ya lesome pedi	Degree	Postgraduate
1	2	3	4

B. Maitemogelo a motšekarolo mabapi le maemo a leratadima goba climate

1.3 A o lemoga phetogo ya maemo a tikologo? Hlaloša.

1.4 Hle, hlaloša kwišišo ya gago mabapi le phetogo ya leratadima goba climate.

1.3 Ditšhupo tša phetogo ye ke di fe?

1.4 Hlaloša ka mokgwa wo ditšhupo tše di go amago ka gona goba di amago setšhaba sa geno.

C. Temogo ya Motšekarolo go thulano ya phetogo ya kimate go ikonomi yeo e tiilego.

2.1 Hlaloša ka moo tšweletšo goba puno ya dibjalo le diruiwa mo setšhabeng sa geno.

2.2 Hlaloša ditlhohlo tšeo di ba go gona go tšweletšo goba puno ya dibjalo le diruiwa.

2.3 Ke ditšhupetšo dife tša phetogo ya leratadima goba climate tšeo di hlalošitšwego mo go (1.3 ka godimo) tšeo di amago tšweletšo ya dijalo le diruiwa?

2.4 Hlaloša maemo a bjale a tšweletšo ya dibjalo le diruiwa.

D. Ditlamorago tša phetogo go ikonomi yeo e tiilego go mekgwa ya bophelo.

3.1 Ke ditiro dife tša setšo tšeo di laolwago ke tšweletšo ya dibjalo goba diruiwa?

3.2 Efa ka botlalo ka moo mokgwa wa bophelo bja bjale mo go (2.4 ka godimo) bo amago mekgwa wa bophelo.

3.3 Hlaloša mekgwa ya bophelo ya bjale.

SEGOMARETŠWA SA B: FOROMO YA BOITLAMO

Nna.....ke itlama go tšea karolo mo thutong ye ya **Maitemogelo a setšhaba sa magaeng ka ga go fetoga ga leratadima le khuetšo ya tša boiphedišo mo maphelong a batho: Taba ya Motse wa Ga- Motupa go la Tzaneen, Profentshe ya Limpopo**. Ke kwišiša gore go kgatha tema mo thutong ye ke maithapo. Ke tla kgopelwa go botšišwa dipotšišo mabapi le maitemogelo a go fetoga ga leratadima le khuetšo ya tša boiphedišo maphelong a batho go setšhaba sa magaeng.

Ka go saena foromo ye ke dumela gore ke badile ebile ke kwišišitše ditaba ka moka tša ka mo godimo, e bile ke itlama go tšea karolo mo thutong ye.

Mesaeno:

Motšeakarolo.....Letšatši

Hlatse.....Letšatši

Monyakišiši.....Letšatši