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Assessing climate change adaptation measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province.



Degree: Master of Science (Coursework)

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Research Report submitted to the Faculty of Science, University of the Witwatersrand, in partial fulfilment of the requirements of the degree of Master of Science.

September 2020

DECLARATION

I, Muofhe Ravhura, declare that this Research Report is my original work and is being submitted to the University of the Witwatersrand, Johannesburg for the partial fulfilment of the Degree of Master of Science. It has not been presented before to any other university for any examination or degree.



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Signature of Candidate

Signed on the 28 September 2020

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ABSTRACT

There exist a considerable body of literature on climate change and these studies have indicated the sensitivity of natural resources (water and land) to climate change. Regardless of several studies on climate change impacts, there has been insufficient work on climate change adaptation, perspectives and impacts with a focus on young adults from rural areas. These young adults perspectives should be included in climate change adaptation initiatives in order to establish sustainable strategies to cope with the changes. The aim of this study was to assess the impact of climate change on rural young adults and their household within the Thulamela Local Municipality (TLM) of Matangari Village in Limpopo Province, South Africa and review their climate change knowledge. Qualitative and quantitative methods were used to understand the perspective and knowledge of these young adults about climate change, to investigate how climate change affects their lives and livelihoods, and to assess the barriers and opportunities they face in implementing adaptation strategies to cope with climate change. Quantitative methods indicated that out of the 40-household surveyed, 10 % indicated to have more knowledge about climate change, while 55% indicated to only have heard about it during the survey. However, 98% reported witnessing extreme climate changes. Focused groups discussions with young adults indicated that 22% of the male participants had knowledge about climate change whilst only 11% of the female had knowledge about climate change.

The study established that loss of income in households due to climate change directly and indirectly affected the lives of the young adults at Matangari Village. Households that depended on agriculture have abandoned farming activities due to low crop yields and loss of income. The loss of income in households has created financial pressure for the young adults to provide and support their families financially. The study also found that climate change puts more pressure on the existing conditions in the households. Key impact findings include disruption of schooling, unemployment and increasing food insecurity (Table 10). Additionally, the young adults are implementing coping strategies such as migrating to cities, changing diets, changing work routines and finding alternatives incomes (Table 11). It was concluded that the young adults of Matangari village are aware of the changes in the climate and their understanding of the causes of climate change are different and are influenced by various elements; level of education, gender and household background. Young adults are all worried about climate change, particularly its implications for their future but they their level of urgency and preparedness is low.

Keyword: Adaptation, Young Adults, Climate Change, Climate Change Impacts, Households, Coping measures and Rural Communities

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ABBREVIATIONS

ABA:	Asset-based Adaptation
DEA:	Department of Environmental Affairs
CBA:	Community-based Adaptation
CRM:	Climate Risk Management
DRM:	Disaster Risk Management
DRR:	Disaster Risk Reduction
ECA:	Ecological-Based Adaptation
IDP:	Integrated Developmental Plan
LEDET:	Limpopo Department of Environment and Tourism
UNFCCC:	United Nations Framework Convention on Climate Change
UNICEF:	United Nations Children Fund
UNDP:	United Nations Development Program
NCCRS:	National Climate Change Response Strategy
NCCAS:	National Climate Change Adaptation Strategy
NDP:	National Development Plan
NYP:	National Youth Policy
STATSA:	Statistic South Africa
TLM:	Thulamela Local Municipality
VDM:	Vhembe District Municipality

CHAPTER ONE: INTRODUCTION

The 21st century has been marked by several challenges affecting the African continent, and climate change has been identified as the biggest one (Barnett & Adger, 2007; IPCC, 2013). The rate and intensity at which it is experienced is alarming and scientific evidence confirms that climate change is happening due primarily to increasing anthropogenic greenhouse gas emissions (Blignaut & van der Elst, 2009; Davis-Reddy, 2017). Climate change impacts are known to affect human health, and the environment (Barnett & Adger, 2007). In fact, climate change is particularly challenging to vulnerable, poor rural communities who live in close contact with nature, and whose livelihoods depend on those natural resources (Olesen & Bindi, 2002; Filho, 2011). Thus, there is a pressing need for mitigation and reinforce adaptation.

Living standards in sub-Saharan Africa have dropped by 25%, with more than 57% of the population living in absolute poverty. As climate change progresses, it is evident that unemployment levels, social unrest, infrastructure decline and political uncertainty are worsening in most developing countries (ref). Climate change bears negative effects on poor rural communities and the South African rural communities are no exception to those effects (Adam, 2001; Erickson *et al*., 2009; IPCC, 2007). Many rural communities in South Africa depend greatly on rain-fed subsistence agriculture, which is sensitive to climate change effects (Letete *et al.,* 2009).

Climate change is not only detrimental to rural agriculture but also to the livelihoods of rural young adults as it imposes short- and long-term obstacles for the young adults towards by disrupting several dimensions within their journey to sustainability (Hood *et al.,* 2011; IISD, 2019). It damages their social and physical infrastructure, decreases food production, increases water scarcity and undermines the sustainability of projects and investments, thus disrupts public health, human safety and overall quality of life (Hood *et al.,* 2011; Hu & Chen, 2016). In terms of all aspects of vulnerability to climate change, rural young adults are likely to be more negatively affected than the young adults in urban areas. Throughout developing countries, most of the rural youth live as dependents within large households (Hood *et al.,* 2011). These households in the rural communities are highly dependent on agriculture and are projected to suffer significantly from extreme heat stress and water scarcity. This will particularly increase the vulnerability of rural young adults who have limited options outside of agriculture to other impacts of climate change. The effect of climate change on households in rural communities vary according to size, assets, skills and income etc (Berhe *et al.,* 2017). These characteristics help shape the obstacle mitigation for the challenges that the young adults face in their journey towards their socio-economic growth (El Zoghbi & El Ansari, 2014). Households with a lack of non-agricultural skills, education, finance, social capital are more sensitive to the changing climate

(Adger, 2003; Brooks 2003). The adaptive capacity of the rural young adults is dependent on access to resources like insurance, land, livestock and credit, once again placing them at a disadvantage (Gasparri & Muñoz, 2018; Yeboah *et al.*, 2018).

1.1. Research problem and significance

Over the years many studies have focused on how climate change is perceived by older people in the rural communities and the adaptation strategies they implement. In terms of the impacts of climate change on rural household livelihoods, there is an abundance of literature available that focuses on children and the elderly, whereas there is only limited research with regards to the adolescent and young adult population (15–34 years old) (Perenzinto *et al.*, 2011; UNICEF, 2011; NYP, 2015; Sanson *et al.*, 2019). However, there has been a lack of research on how climate change affects the young adults in rural communities, in the short, medium and long term, and how they are coping with the changing climate. This tends to suggest that they are not able to take action against climate change (UNICEF, 2011; Corner *et al.*, 2015). Nonetheless, a study done by Mouton (2019) has suggested that the youth are capable and aware of changes happening around them, if given a chance they would play a greater role in combating the challenge of climate change and should be engaged as they are battling the effects now and will continue to do so in the future. The effects of climate change are believed to be disproportionately felt by young people in rural communities because they rely mostly on natural resources for employment, income, cultural practices and food and less likely to be felt by young people in urban areas who are well represented in the service sector that is not as affected by climate change (UNDESA, 2010; Ayanlade, 2016).

This research aimed to understand how impacts of climate change on rural household livelihoods affect the lives of the young adults in a rural community of Limpopo Province, South Africa. Limpopo Province is one of the poorest provinces in South Africa, with approximately 70% of rural households relying on subsistence farming (LEDET, 2016). Subsistence farming depends mainly on weather and climate-sensitive factors such as water availability and soil moisture (LEDET, 2016). Changing climate conditions put more pressure on the volatile socio-economics of the province, that are already under stress with food price increases, water scarcity, scarcity of food, lack of local markets, high rates of unemployment, poor infrastructure and severe levels of poverty (LEDET, 2016; Stats, 2016). It is believed that, as communities become vulnerable to climate change, so does the livelihoods of the young adults. In addition, their vulnerability is multidimensional in that it is shaped by their emotional, social and the physical changes that occur during childhood (UNDESA, 2010; UNICEF, 2011; Ojala, 2012). Climate change has a complex and far-reaching effect on the social, economic, political and cultural future of the young adults, their households and their communities. Therefore, further research concerning the impacts of climate change on the young adult population in rural areas is necessary.

1.2. Aim and Objectives

The aim of the study was to assess and review how young adults in a rural community in Matangari Village, Thulamela Local Municipality think about climate change issues and how they adapt to these issues. The specific objectives were:

- to understand the perceptions and level of knowledge of rural young adults on climate change;
- to investigate how climate change affects the lives and livelihoods of the rural young adults;
- to identify the coping and adaptation strategies implemented by the rural young adults;
- to identify what influences the rural young adults response to impacts of climate change;
- to assess their level of adaptive capacity to cope with climate change; and
- to assess the available opportunities and barriers faced by the rural young adults when implementing their coping and adaptation strategies.

1.3. Structure of this research report

This research report follows the following structure: Chapter one outlines the rationale of the study, chapter two provides a detailed literature review of the topic, including new and existing climate change literature. Chapter three outlines the research methodology applied in the study, Chapter four presents the results and findings from the survey, focus groups discussions and interviews, and Chapter five discusses the findings of the research, provides the conclusion and final remarks. Figures and Tables are numbered consecutively, and additional information and data are presented in an Appendix after the reference list.

CHAPTER TWO: LITERATURE REVIEW

2. Introduction

Studies have shown that climate change will hit Africa the hardest as evident several areas of this region will be troubled by massive harvest reductions by 2020 due to an increasingly drier and hotter climate (IPCC, 2007; Nkomo *et al.*, 2006; Niang et al., 2014; IPCC, 2018). As a result of these increasing temperatures, people's livelihoods, natural resources, human health, food security and sustainable development are threatened (IPCC, 2007; Maponya & Mpandeli, 2013). Climate change has become one of the major challenges in rural households and poses an enormous challenge for household members who are dependent to household providers. Especially the youth who will also face the consequences of climate change. There have been many debates around climate change, yet there are still individuals who are not well informed about the impacts of climate change on their livelihoods and how to deal with such changes (Fraser, 2006; Barnett & Adger, 2007; Hahn, Riederer & Foster, 2009; Jones & Thornton, 2009). However, they have recorded good observations such as, a rise in temperature and changes in wet and dry seasons. Rural households' livelihoods will be impacted upon and in turn affect the members living within those households, especially the children, youth and elderly who are dependent to others to provide for them. Several types of research have defined climate change to their understanding (Pieke, 2004; Fraser, 2006; Barnett & Adger, 2007; Hahn, Riederer & Foster, 2009, Jones & Thornton, 2009) but this research will use the definition by the IPCC (2001:21) which describes climate change as "a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer".

2.1. Climate change observations and projected impacts

The earth's climate system comprises of the ice, ocean and land surface temperatures (IPCC, 2001; IPCC, 2007). Human origins have been identified as the primary drivers of the fast change in various aspects of global climate, however this has caused a lot of debate because some argue that climate change is not only caused by human activities but also due to natural variability (IPCC, 2007; Singh 2012; Leggett, 2018; Trenberth, 2018). Comprehensive evidence has been compiled by scientists all over the world using water balloons, satellites, surface station temperature readers, and several other methods to monitor the earth's climate (Rennie *et al.*, 2014; Davis-Reddy, 2017; IPCC, 2017, McCabe, 2017). It has been observed that the global average yearly temperatures have risen since 1880 by 0.85°C and are expected to increase by 2.5°C in 2050 (Stocker *et al*., 2013). The years recorded as the warmest include 1998, 2010, 2015, 2016, 2017, 2018 and 2019 (Davis- Reddy, 2017; WMO, 2019). Temperature increase distribution is different from place to place and some areas have experienced higher temperatures than others. The latest studies for Africa have indicated a massive

increase in surface temperatures, twice the global rate (Jones *et al.*, 2012; Reddy, 2017, WMO, 2019). In southern Africa, temperatures have been observed to have significantly increased throughout the 21st century, with summer temperatures exceeding 40°C (Davis-Reddy, 2017). Temperatures have been projected to continue to increase, resulting in severe impacts on water availability and quality (Matsouka *et al.,* 2011). Over the past decades rainfall patterns have been difficult to predict, resulting in insufficient observational rainfall pattern data in most African countries to help us project future rainfall patterns. Furthermore, the rainfall seasons have shifted, and in many areas' rainfall intensity is greater than before. There has been an observed rainfall decline during the autumn months within all the water regions (Fauchereau *et al*., 2003).

South Africa has experienced an increase in temperatures and these temperatures are expected to increase even further. The projected future temperature changes will result in an increase in human disease, poverty and local vulnerabilities of poor communities (Wright *et al.,* 2014). A decline in the number of days of rainfall, decrease in the overall number of rainy days, an increased rainfall intensity as well as a longer and harsher dry season have been observed in certain areas of the country (Hewiston & Crane, 2006; Davis-Reddy, 2017). The effects of the changing climate in South Africa will be evident through changes in the characteristics of extreme weather events, such as frequent occurrences of cut-off low related flood events; most of the interior areas will experience more regular occurrence of dry spells, and in warmer climates more intense thunderstorms are projected to happen more frequently (Christensen *et al.,* 2007; Engelbrecht *et al.,* 2009).

Climate change impacts predicted for South Africa include significant negative impacts on the health of animals and humans due to heat stress; increases in energy demand as cooling machinery will be used more frequently. Furthermore, it will also have a negative impact on water security due to drought and increased evaporation; and higher risks of forest and veld fires (Engelbrecht, 2016). A decrease in rainfall will negatively affect water availability, therefore increasing water insecurity (Engelbrecht, 2016).

2.2. International Climate Change Framework

The United Nations Framework Convention on Climate Change (UNFCCC) was created in 1972 to develop better alternatives for adaptation and mitigation of climate change through strategies and policies (Bulkeley & Kern, 2006; Mulaudzi, 2016; DEA, 2019). It requires all parties to formulate, implement and update adaptation measures and publish climate change response policies and regulations. Unfortunately, the UNFCCC had no legally binding targets to reduce greenhouse gases (GHG) and it was highly criticised for that. Due to the criticism, the Kyoto Protocol was then established, its primary purpose being to decrease GHG emissions by setting legally binding GHG emission objectives and targets (Wang & Wiser, 2002). The Paris Agreement was adopted in

December 2015 and its main aim is to set up a worldwide goal of enhancing adaptive capacity, improving resilience and decreasing vulnerability to the changing climate. It entails that all parties should design and implement adaptation plans, to record their adaptation plans and report if they require any support (Wang & Wiser, 2002; EBRD *et al.,* 2012; Mulaudzi, 2016). However, there is no authority in the international context that coerces nations to develop or enforce policies, so it is a choice a country has to make (EBRD *et al.*, 2012; Mulaudzi, 2016).

2.3. South African response policies and legislative framework

The South African government has been involved at the local, national and international frameworks in developing plans, policies and strategies in response to increase awareness of climate change impacts. The South African government signed the Paris Agreement in 2015. The South African national policies and legislative frameworks that relate to climate change responses include: The Republic of South Africa Constitution (Act 108 of 1996) which generally institutes as the foundation for developing and implementing climate change adaptation and mitigation approaches. The Constitution does so by granting the provincial and national governments statutory authority in Section 4 for areas that will be affected by the administration of physical and natural interfaces. This include agricultural development, management of natural resources and disaster management, while also protecting the environment for all citizens of South Africa in Section 2 of the Bill of Rights (Averchenkove *et al.,* 2019). The National Development Plan (NDP) which is established by the National Planning Commission (NPC) includes plans to eradicate poverty and decrease inequality before 2030 and stresses climate change as one of the main contributors while acknowledging that South Africa is one of the contributors to GHG emissions (DEA, 2011; NDP, 2011; DEA, 2019). The National Climate Change Response Strategy (NCCRS) describes strategic objectives, gives direction for action and outlines responsibilities for an effectual response to changing climate and the long-standing conversion to a climate resilient and lower carbon economy and society (DEA, 2011).With an objective to adequately deal with the unavoidable effects of climate change while also reducing its carbon emissions. It is centred on three elements, namely mitigation, adaptation and incorporating sustainable and climate resilient development (DEA, 2004, Madzamuse, 2010).

In 2017 a draft of the National Climate Change Adaptation Strategy (NCCAS) was released for public comment (Averchenkove *et al.,* 2019). It was established in alignment with South Africa's pledge to the Paris Agreement to implement steps to respond to climate change effects while simultaneously reducing greenhouse gas emissions and limiting temperature increases to 1.5°C (DEA, 2017). The concept of the NCCAS is derived from the NDP, NCCRS, with the NDP contributing to most pledges of adaptation made on the Nationally Determined Contributions (NDC) and other adaptation plans from different government levels (DEA, 2017). The NCCAS encourages shared goals for climate

change adaptation and climate resilience, and outlines focus areas for achieving this vision (DEA, 2019).

The Provincial Government of Limpopo has introduced its own policies for responding to climate change, including the Limpopo Development Plan and Limpopo Green Economy Plan. The Limpopo Development Plan objective is to decrease the level of poverty, inequality and decrease unemployment levels through sustainable development (LEDET, 2016). Through job creation, the Limpopo Green Economy Plan aims to grow the economy and increase employment. Sustainable use of natural resources while trying to overcome issues confronting the Limpopo province. The province's population has been the priority for the Limpopo Provincial Government. This is indicated in the steps the government took to build climate change resilience. Through the Limpopo Green Economy objectives, it is evident that the Limpopo provincial climate change strategy aims to build a strong foundation for a climate-resilient economy through reducing carbon footprints and strengthening various sectors' capabilities to respond and adapt well (i.e. reducing vulnerabilities, enhancing adaptive capacity and building resilience; LEDET, 2016).

Studies have demonstrated that the implementation of climate change adaptation strategies is effective when conducted by the local government, specifically municipalities (Revi, 2008; Carmin *et al.*, 2009; Madzivhandila, 2015; Chikosi *et al.*, 2019), as the municipalities work with the communities and understand the communities' needs and livelihoods (Mokwena, 2009). It is evident from South African literature that has identified local government as the main player in executing climate change policies (Gordon, 2005; Revi, 2008; Mokwena, 2009; Madzivhandila, 2015; Mulaudzi, 2016). The NCCR requires that the local government integrate climate change into their Integrated Development Plan (IDP). The Limpopo Provincial Climate Change Response Strategy will constantly be checked to determine improvement against set goals or objectives (LEDET, 2016).

The South African climate change policies whether on a district, provincial or national level, make no reference to the young adults and do not specifically consider the challenges of the youth, their unique need and the role they can play as agents for change, both at home and in their society (Mouton 2019; UNICEF, 2011). There seems to be a common presumption in policy papers that the youth will benefit from interventions targeting vulnerable and disadvantaged households as well as from the economic and social growth within the community (UNICEF, 2011; Savaresi & Scott, 2019). While the youth will benefit from these interventions at the community and household level, they are likely to be influenced differently by other members of the family due to their specific vulnerabilities and dynamics in the home (UNICEF, 2011, IFAD, 2019). In spite of the commitments referred to in the UNFCCC, the Sustainable Development Goals (SDGs), the Paris Agreement that was held in the

Sendai Framework on Disaster Risk Reduction 2015-2030, has left out the opinions of the youth and children in climate change policies(Savaresi & Scott, 2019).

Various components are vital to making adaptation a reality. The success of adaptation approaches will depend on an enabling policy setting; however, the absence of suitable legislative frameworks and policies, efficient adaptation strategies may present obstacles (Madzwamuse, 2010). Mokwena (2009) argues that the current legislative and regulatory framework presently in South Africa has a high possibility of being unsuccessful. This is because its success is depends on if the institutional mechanisms and economic resources designed to ensure execution are inadequate and implementation of adaptation strategies is ineffective. This means that, for adequate implementation of adaptation strategies, the local governments should fast track initiatives that will help rural communities to better respond to the changing climate. While they are providing sufficient support and meeting the basic needs of those communities and small-scale farmers, particularly the water, housing, health, livelihoods, sanitation, security and food production aspects (Mokwena, 2009). However, it would be ineffective and not feasible if government was to make all decisions without the involvement of all stakeholders and local communities to mitigate climate change (Revi, 2008).

2.4. Climate change effects on household livelihoods

It is anticipated that people's livelihoods will be impacted by climate change and literature points out that the changing climate has a significant negative impact on rural households (see Desanker, 2002; Davies *et al.*, 2008; Chikosi *et al.*, 2019). Natural resources, such as fuelwood and water resources, and activities like agriculture, are climate sensitive; arable farming will be significantly affected by climate change and variability (UNICEF, 2011). This will create an economic problem such as increased food prices that adversely affect households' livelihoods globally. In line with this is the idea that climate variability and climate change have a negative impact on growth and increase challenges faced in achieving the goals of sustainable development (IUCN, 2003; DEA, 2010).

Every individual household livelihood consists of a variety of activities, skills, resources, as well as assets which enable them to sustain their well-being and exploit every opportunity within their surroundings. This is supported by Carney (1994) who states that a livelihood is made up of three components namely: activities, assets and the necessary capabilities needed as a way of living. From the view of sustainable livelihoods, sustaining the livelihood of a household within a certain area entails the accessibility of a variety of suitable capitals (social, natural, financial, physical and human), capacity to access those policies, capitals, processes, institutions and social norms which (Ayers & Huq, 2009; UNICEF, 2009). In addition, they are an appropriate setting for a household to produce productive results. In considering vulnerability with regards to poor communities in South

Africa, there is a need to recognise the effects climate change would have on the complex portfolio of activities of a household (Ellis, 2000).

The impacts of climate change at household level would result in loss of food security and income. This might lead to an increase in dispute over vital natural resources, with both internal and external consequences for further displacement and migration. The extent to which climate stressors will affect a household differs based on the available adaptation and coping mechanisms, along with the household's ability to react to or absorb the shock (DEA, 2010). Local capability consists of a variety of distinct interconnected features, with regards to asset availability and access to the assets. Additional features should contain information on possible developments and the technological expertise to take appropriate action, the capacity and desire to experiment and acquiring new skills (Jones *et al.*, 2010).

Such characteristics are closely linked to the underlying vulnerability engines. Factors such as fragile markets, fluctuations in key product prices, household contributions and health emergencies directly endanger households and reduce their capacity to cope with the effects of the changing climate. When a climate shock, like flooding, impacts an already fragile lifestyle, a household might not have the capacity to adapt (DEA, 2010; UNICEF, 2011; Gharabaghi & Anderson-Nathe, 2018). The methods households implement to adapt with these impacts and pressures will ultimately impact intra-household relationships and characteristics, and at all stages of their growth will have important and gendered, indirect consequences for the well-being of children. For example, because children and women remain to be under-represented within the income-generating activities, they may have to adjust or cope in various ways, possibly contributing to an increase in the 'feminisation of farming'. Taking this into account, the changing climate needs to be regarded to be among the several overlapping stress factors impacting households at the regional level in the light of broader growth pressures (UNICEF, 2011; Gharabaghi & Anderson-Nathe, 2018).

The larger part of Limpopo province is rural, dominated by poor households practicing subsistence farming for household food production system. Building household adaptive capacity requires a better understanding of household socio-economic circumstances, access to resources, demographic composition, access to facilities, services and employment opportunities, and it must involve those at risk (Leary et al., 2008). Studies have shown that every household adaptive capacity is different (Tuppie & Visser, 2013; Mpandeli & Maponya, 2014; Rankoana, 2016; Louis & Mathew, 2020). However, they also found that irrespective of the geographical location or wealth Limpopo rural households are relatively asset poor and highly dependent on agriculture. Furthermore, they are further constrained by ongoing changes in economic and political structures and processes (Tuppie & Visser,2013; Rankoana, 2016; Louis & Mathew, 2020). Although poverty usually exists in rural communities, the heterogeneity of these communities means that different households have different

levels adaptation. An example of this is seen in the different levels of education between households. In households were education is present, adaptive capacity is higher due to knowledge regarding implementable technologies to maintain existing livelihoods. In households where members of the households are employed, where possible, financial provisions can be made towards adaptive measures to climate change (Babugura, 2005; Žurovec & Vedeld, 2019).

The ability to adapt to climate change effects, disturbances and other shocks is very vital in order to improve the resilience of both the agricultural sector at large and for individuals to secure and improve their livelihoods (IPCC, 2007; Žurovec & Vedeld, 2019). To be able to implement effective climate change adaptations measures it depends on various factors including knowledge and skills, adaptive capacity, access to appropriate institutions resources, and robustness of livelihoods and alternatives. Assets and debts also play a crucial role in the vulnerability of households and their potential to create adaptive capacity. Although there has been a growth in technological advancement, government initiatives, and insurance schemes need higher public and private sector investments to be subsequently adopted by farmers, several possible responses are included in climate change adaptation at the farm level. This may include improvements in crop and livestock management methods, land use and land management, and several mixed or diversified subsistence strategies, both on-farm and off-/non-farm.

2.5. Young Adults and climate change

The rural communities have already been exposed to high levels of poverty, having less access to better basic services such as sanitation and health (Madzwamuse, 2010; UNICEF, 2011; Gharabaghi & Anderson-Nathe, 2018; IFAD, 2019). The youth (15-24 years) disproportionately suffer from adverse effects on natural and human capital through environmental pressures (Chalwa, 2002; APA, 2009; Johnson *et al.*, 2013). The spreading of airborne diseases, diarrhoea and malnutrition may be exacerbated by extreme climatic changes such as droughts and floods, resulting in the shortage of clean and safe drinking water. This in turn affects their development and can have long term consequences on their health and future. Over the years the impacts on the young adults were not taken into consideration and it was believed that they were spoken for by the elders. They have never had a voice on the climate change matters (Ojala, 2012; Gharabaghi & Anderson-Nathe, 2018).

With climate change putting more pressure on the already strained economy of the rural communities, it presents threats to the young adults as it risks obstructing access to food, security, health, water and sanitation among other things (Christensen *et al.*, 2007; UNICEF, 2011; Ojala, 2012; Teixeira *et al.*, 2013; IPCC, 2014). Continued exposure to extreme weather events such as high temperatures, floods and strong winds affects areas where the rural young population is concentrated and the industries in which they are searching for job opportunities. While climate change affects all, some industries and

parts of the population are more vulnerable to the threats it poses to their livelihoods. The young adults are vulnerable to the changing climate and they will deal with the associated risks into the future. Rural-to-urban migration has increased significantly as a result of declining natural resources and the inability of subsistence farming to provide a stable income. This trend has undermined the financial, community and family resources available to young people, as it is always the young people who move to town to find work (Johnson *et al.,* 2013; Sanson *et al.,* 2019). As a result of impacts of climate change on livelihoods, the youth face prostitution, forced labour, substance abuse, high unemployment, and homelessness. This is because they left their homes to urbans areas to try and improve their livelihoods by securing employment. However, the migration data are poorly obtained, weakly evaluated and sometimes deceptive in South Africa (Polzer, 2010; Hayes & Tanner, 2015).

As temperatures continue to increase, it is believed that by 2050 the young adults will be experiencing 60 additional days of heat stress (Ojala, 2012; IFAD, 2019). Heat stress affects crop and livestock production, and its effects across agroecological systems and regions differ significantly (Rust, 2013; Rojas-Dowing, 2017; Lewis *et al.,* 2018), with substantial negative impacts expected. Reductions in agricultural yields and an increase in water scarcity are mainly expected for rural areas that are populated by already vulnerable poor communities, many of these young people live in areas that currently have a large agricultural potential (with small markets), but that potential is threatened by climate change. In addition, adaptation steps in the agricultural sector would have to be taken if they are to find jobs there (Ojala, 2012; Hayes & Tanner, 2015). In South Africa, with the current inequalities in the health status, climate change might worsen the situation. It has been reported that over 30% of the economically active youth live with HIV/AIDS as it lessens their capacity to work and provide for their families (UNICEF, 2011). The poor will suffer more than the rich who have more options when it comes to health facilities, have better access to good nutritious food and do not rely on the government for support. It is also essential to note the gender disparities in climate vulnerability, as most women and the population of South Africa are located in rural areas with restricted capacity to adjust to the changing climate due to social discriminations, with disproportionate lack of employment, low level of education and access to information and resources (Mwebaza & Kotze, 2009). As result of extreme weather events, studies have shown a reduced engagement in education, particularly by the young women, because the burden of schooling costs is growing and the need for adolescents and young people to contribute economically to households is increasing (Mwebaza & Kotze, 2009; Pereznieto *et al.,* 2011; Johnson *et al.,* 2013).

Poverty has clearly been linked to vulnerability to climate change and the capacity of societies to respond to climate change. Poverty makes access to water, proper housing, education, food, better health care and basic services like sanitation difficult to achieve (Gharabaghi & Anderson-Nathe, 2018; Sanson *et al.,* 2019). Therefore, an interruption of or reduction in access to these

supplies/services would have a direct effect on their lives. Young people, particularly those who are facing systemic difficulties and extremely crisis-ridden labour markets are more likely to be affected as climate change intensifies these conditions. For instance, young people from less fortunate households feeling pressured into looking for work in informal sectors which are already over saturated, exposing them to high risk low paying jobs. (Ojala, 2012, Hayes & Tanner, 2015; Sanson *et al.*, 2019).

2.6. Responses to climate change impacts

With the aim to address and respond to the challenges of climate change, people now implement coping and adaptation strategies. However, often the terms "coping" and "adapting" are used interchangeably. It is essential to know that these two differ in definition. When a disaster occurs, often people are worried about their ability to adapt and cope and less worried about the magnitude of damaging agent. More attention is put on who is affected and their ability to survive and recover from the loss (Hewitt, 1997).

The idea of coping was established from development studies, specifically from the sustainable livelihood framework, and has been used to demonstrate emergency responses to threats to livelihoods as a result of changing climate at spatial scales that are small with short-term effects (Berkes & Jolly, 2002; Smit & Wondel, 2006; Vincent *et al.*, 2013). Coping is described as the capacity of individuals, organisations and systems to deal with and handle negative circumstances, emergencies or disasters that may lead to disaster risk reduction, using available resources and skills (UNISDR, 2009). Coping focuses on short-term or temporary strategies in response to changes to livelihood activities where distinct actors react to shocks or harmful stress linked to the changing climate to ensure survival, but their responses are restricted by accessible resources (Corbett, 1998; de Stage *et al.*, 2002; Vincent *et al.*, 2013). Adaptation on the other hand is defined as “a process of designing, implementing, monitoring, and evaluating strategies, policies, and measures intended to reduce climate change-related impacts and to take advantage of opportunities” (Odede, 2015: 21). Adaptation focuses on long-term responses to strategies needed to compensate for environment changes while offering measures to help reduce risks and damage resulting directly or indirectly from climate change (Ahmed & Long, 2010; de Stage *et al.*, 2002). Coping and adaptation have contributed in various ways to addressing social vulnerability and risks linked to the changing climate (Bosello *et al.*, 2009; Ahmed & Long, 2010).

The ability of households to cope is influenced by quite a few factors and they vary according to the biophysical and socio-economic settings (Smit & Wandel, 2006; Mubaya, 2010). Several elements influence coping measures that a community, households and individuals use such as organisations (both informal and formal), age, gender, access to land, community structures, cultural and social

norms and social entitlements (Berman *et al.*, 2012; Pelling, 2013). In 2015/2016 Limpopo Province was hit with severe periods of drought, wherein the dam water levels dropped below 50% and the earth dams were also drying up (LDARD, 2016). At the time, most farmers also lost their livestock as they weren't enough water and grazing land. As a result, most farmers came together to put ways on how to cope with the changes while being able to still meet their family needs. There is evidence that various adaptation methods were being implemented at a local scale. The adaptation methods that were considered at the local scale were increasing irrigation, supplementing livestock feed, planting different crops, changing the amount of land grazed or under cultivation, changing planting dates and diversifying crops (Maponya & Mpandeli, 2016; StatsSA, 2016). For instance, it was reported that in the Sekhukhune District of Limpopo Province, small-holder farmers were developing adaptation strategies for the changing patterns by developing food seed banks to help sustain food security (Maponya & Mpandeli, 2016).

To be able to manage the effects of climate change, communities implement several strategies. Some strategies implemented are community based while others use their own individual methods. For example, pastoralists in Ethiopia and Niger have developed their own cut and carry feeding system. It is a joint community initiative, wherein members contribute money to rent carts (Michael *et al.*, 2010). The forage is then distributed within the community. In some cases, some community members (mostly women and children) are now relocating to areas close to water resources to have free access to water. However, other community members have man-made water resources in the form of ground cisterns, they use it as an approach to cope with the changing climate and it is a trend increasing in the Somali region of Ethiopia. It is unfortunate that due to changing climate, some pastoralists involuntary sell their animals to buy water, as it becomes very expensive to feed and maintain during drought periods. The government agencies and NGOs have established communal sources of water through digging deep wells, harvesting water run-off and also establishing community birkas (Michael *et al.*, 2010). Similarly, in response to changing climate, the communities in India and Nigeria have created ways to adjust to flooding by constructing on high plinths, using flood-resistant materials, constructing trenches, drains, and walls to divert water. They also buying furniture unlikely to be damaged and washed away during flooding. Moreover, they have built elevated shelves above anticipated water levels and have suitcases ready to put in valuables and have also developed ways to evacuate the area using specified routes and procedures (Stephens *et al.*, 1996; Adelekan, 2010).

Not everyone agrees with the notion of adaptation and it had been condemned for putting blame on victims and putting the obligation on defenceless households or social groups to adjust to the changing climate (Ribot, 2010; MacDowell & Hess 2012). For the vulnerable communities, adaptation is a necessity and not a choice; however, the same vulnerable people are given the least

attention and left out of adaptation policy decisions (Adger *et al.*, 2006). Some households do not embrace any adaptation measures towards the effects of climate change. This is not because they are not aware or ignorant, but due to absence of assets such a finance to help them recover after disaster has occurred (Tambo & Abdoulaye, 2013). Patt & Schroter (2008) argue that it is not only a matter of assets but the fact that these households do not perceive climate change as severe. Coping strategies are vital aspects of rural systems, even though they do not enable the communities to cope in longer terms and compromise their ability to recover (Campbell *et al.*, 1989). They are an immediate response to a shock. Some of the common coping strategies include selling of assets such as livestock/furniture or temporarily migrating for opportunities to earn an income (SADC, 2002). However, coping strategies are not sustainable because when another shock occurs, they might find it hard to cope with it because they are still recovering from the previous disaster. Therefore, adaptation maybe a key to the long-term reduction of vulnerability to climate change and be sustainable.

As temperatures continue to increase, climate change effects are felt harshly by the vulnerable communities in the rural areas. It impacts human health, natural ecosystems and agriculture. Policy makers and researchers are encouraged to explore adaptation, particularly in developing nations where there is a need for adaption as people there depend more on natural resources sensitive to changing climate (IPCC, 2001; Sokona & Denton, 2001; Beg *et al.*, 2002; El Raey, 2004; IISD, 2005). When coping and adaptation methods are combined, they have a high chance to provide optimum results. Developing nations are in serious need of climate change adaptation, particularly those that are natural resource dependent and are sensitive to the changing climate (Adger, 2003).

Adaptive capacity can be described as the human system's ability to adapt to the changing climate and variability to moderate possible harm, while taking advantage of opportunities or deal with the aftermaths (IPCC, 2001). Emphasis on adaptive capacity has prompted a growing acknowledgement of the connection between sustainable development and climate change adaptation. Presently there is recognition that adaptive capacity entails the implementation of several activities linked to sustainable development (Smit & Pilifosova, 2001). It is known that adaptive capacity is one of the attributes (or "determining factor") of a system that would affect the frequency and development of adaptation strategies (Smit *et al.*, 2000: 236). Vulnerability, stability, sensitivity, resilience, range of coping, flexibility and susceptibility are other determinants (Adger *et al*., 2004). Due to minimal access to latest technology, minimal level of social institutional growth, and also the highest historical and current pressures related to the changing climate, developing nations are considered to have the lowest adaptive capacity (Chagutah, 2010). Several factors indicate individual or household vulnerability or ability to adapt such as access to resources, availability of and access to public health facilities, infrastructure, community organisations, income, insurance mechanisms, education and warning systems (Downing *et al.*, 2001; Yohe & Tol, 2002; Klein, 2003).

2.6.1. Past and Current Adaptation Frameworks/Approaches to Climate Change

The spectrum of adaptation to climate change approaches is broad and has been outlined in several complementary ways, each having developed from within various research disciplines (McGray *et al.,* 2007; Ayers & Forsyth, 2009, Warrick, 2011). These adaptation approaches have evolved over time, from a focus on reducing the effects of climate change to a focus on vulnerability reduction (McGray *et al.,* 2007). Past studies have classified these two broad methods as 'first generation' and 'second generation' also known as ‘top-down' and 'bottom-up' or 'impact-led' and 'vulnerability-led' (Kelly & Adger, 2000; Burton *et al,* 2002; Smit & Pilifosova, 2003; Adger *et al.,* 2004; Dessai *et al.,* 2004). Table 1 therefore aims to summarize some of these various approaches to adaptation in terms of the historical period being developed, the main priorities and current focus, as well as other features.

Disaster Risk Reduction (DRR) and/or Disaster Risk Management (DRM) cultures played a role in disaster management before climate change was even recognized as a target for global development. (Moser, 2010). With its roots in humanitarian emergency relief, DRR later became Disaster Risk Management (DRM) and has 30-year track record in disaster management (Moser *et al.,* 2010). Climate Risk Management (CRM), which aimed to adapt to the risks associated with climate change, was also closely associated with DRM (Moser & Stein, 2011). The goal of CRM is to resolve both the risks and vulnerabilities that configure particular risk scenarios and range from actions to manage local manifestations of global climate risk to global risk mitigation initiatives (such as reducing greenhouse gas emissions) and vulnerability reduction (by increasing the social and economic resilience of vulnerabilities) (Hossain, 2014).

The Community-based adaptation framework (CBA) to climate change is a community-led process based on the needs, capacities, priorities and knowledge of a community which can enable them to plan and cope with the effects of the changing climate (Huq & Reid, 2007; Prowse & Scott, 2008). It is a bottom-up approach that derives from the fact that policies for adaptation do not necessarily need to start from scratch because for years people have been managing climate-related threats (Adger *et al.,* 2003; Prowse & Scott, 2008; van Aalst *et al.,* 2008). Community-based adaptation therefore builds upon individuals and communities’ current technical knowledge and coping strategies (Mortimore & Adams, 2001; Chatterjee *et al.,* 2005; Prowse & Scott, 2008). CBA is emerging as a distinct form of adaptation, centred within a wider conceptual ‘vulnerability-led’ approach to adaptation (Warrick, 2011).

Ecosystem-based adaptation (EBA) involves the use of biodiversity and ecosystem services by people to adapt climate change and reduce disaster risk while promoting sustainable development (Vignola *et al.,* 2015). Similarly, to CBA, EBA focuses is on people. It also uses participatory and culturally

appropriate methods to address challenges. However, the distinctive aspect of EBA is that it connects traditional biodiversity and ecosystem conservation methods with sustainable socio-economic growth.

Asset-based approaches to development are not new and, as with poverty, definitions are rooted in the 1990s international debates. Unlike CBA and EBA, Asset based adaptation framework (ABA) it is based on conceptual work on assets and poverty and requires action at all levels: household or community level; at municipal or city level; and at a regional and national level (Zimmerman & Carter, 2003; Siegal, 2005; Carter & Barnett, 2006; Moser, 2007). It also recommends actions for the various phases of interaction between a threat and a vulnerable population: long-term threat exposure, short-term hazard avoidance, short-term post-hazard resilience, and long-term post-hazard reconstruction (Prowse & Scott, 2008). ABA is not only intended to illustrate the (lack of) asset holding (and how these can be supported) of individuals, households and communities, but it does so across time and at several levels. It strongly associates assets with the ability to cope with disaster. Assets can be referred to as the human, physical, financial, natural and social capitals which allow individuals to act and meet their needs (Moser & Satterthwaite, 2008; Moser, 2010; Moser 2011). These assets give an individual a sense of meaning and power to act and to reproduce, challenge or change the rules that govern the control, use and transformation of resources" (Bebbington 1999). The more assets a person has, the greater their resilience and the less vulnerable they are to the ill-effects of climate change (Prowse & Scott, 2008; Moser, 2011). Therefore, assets are not just resources used by individuals to generate livelihoods: they provide them with the ability to be and act.

Table 1: Summary of Selected Approaches to Climate Change Adaptation

Name of the approach	**Period of development**	**Key objectives and current emphasis**	**Focus on Assets**
DRR/DRM	1980s	Reducing the underlying threats, severity and/or frequency of pre-disaster and post-disaster environment and/or non-climatic disasters (development, relief and response). The current aim of disaster risk reduction (DRR) is to be combined with the development planning of the country.	Assets are a priority in the context of enhancing the capacities of households and communities.
Climate Risk Management	1990s/2000s	Addressing vulnerability to climate risk by maximizing the positive effects and mitigating the negative effects of climate change, with the overall goal of encouraging sustainable growth.	Assets are discussed due to its focus towards group adaptation and institutional capacity building.
Climate change adaptation	1990s/2000s	Tackling the impacts of climate change formed as a response to the GHG debate in the 1990s that supported the mitigation agenda.	Assets are discussed by an interest in local awareness and skills.

		The focus is on addressing the physical effects of climate change.	
Community-based adaptation	2007(adapted From poverty focused CBA of 1990)	Support to the knowledge and coping strategies of individuals and communities based on an individual and community awareness of climate variability, to reduce climate risk vulnerabilities.	Due to its bottom-up approach that emphasizes people's abilities and skills, assets form a core theme.
Climate smart disaster risk management (CSDRM)	2008	In order to evaluate the efficacy of current DRM initiatives, programs and programmes in the context of a changing environment, it offers a guide to strategic planning, program implementation and policy making.	In fostering the capacity of the vulnerable to alleviate their poverty and insecurity, assets are the main theme.
Asset adaptation	2008(building on asset vulnerability of 1990s)	Asset vulnerability and asset adaptation analysis related to the degradation and/or protection of social, financial, , human, physical assets at the individual, household and community level for resilience, limitation of pre-disaster harm, immediate post-disaster response, and reconstruction.	At various levels, assets are the primary target, including the position of external organizations, such as municipalities, NGOs and the private sector

Source: (Sabates-Wheeler *et al.,* 2008; Mitchell *et al.,* 2010; Moser, 2010; Polack, 2011)

2.6.2. Sustainable Livelihood Framework

The notion of livelihood strategies being affected by climate change is now commonly accepted. Numerous studies have been performed on asset adaptation in rural societies, and it was found that most rural households in developing nations depend mostly on natural resources for their livelihood and social structures that are impacted by climate change (Blaike, 1994; Scoones 1996; O'Brien *et al.,* 2000; IPCC, 2001; Simatele & Simatele, 2005; Lyimo & Kangalawe, 2010; Wunder *et al.,* 2018). Due to their dependence on natural resources, recent studies indicate that rural communities are now moving away from farming activities (Dumenu & Obeng, 2016; Lei et al., 2016; Shisanya & Mafongoya, 2016; Van Aelst & Holvoet, 2016).

The goal is to achieve a sustainable livelihood, characterised as one which can adapt with and recover from trends, shocks and seasonal cycles, maintain or improve its abilities and resources, both now and in the future, and which adds net benefits to other livelihoods at the international and local standards (Chambers & Conway, 1992). The utilisation of the Sustainable Livelihoods Framework (SLF) is a useful way to assess adaptation. Sustainable Livelihoods Framework is used to examine how households, individuals, and communities earn a living and identify ways that make their livelihoods more sustainable in the long term (Smith, 2012).

The SLF is a holistic approach and is represented by five types of household assets/capital, which include the natural, social, physical, human and financial assets that can be attained, developed, and enhanced by people to earn a living and can also be transferred from one generation to another (Chambers & Conway, 1992; Scoones, 2009). The social resources which people depend on to secure livelihoods and these can be in the form of networks, connections, memberships, and formalised groups, is known as social capital. Human capital includes health, nutrition, skills, time, education, and knowledge upon which the communities rely to secure livelihoods (Goh, 2012). To the local communities, human capital is a major asset in the form of labour (Ellis, 2000). Natural capital refers to the supply of natural resources which individuals depend on to secure their livelihoods (Moser & Stein, 2011). Physical capital refers to the physical assets the individuals depend on and includes houses, water supply, agricultural inputs, and sanitation services (Goh, 2012). Studies have shown that access to these assets influences a household's resilience; the more assets the community has, the more options and strategies there are to adapt to the changing climate impacts (Ahmed & Fajber, 2009; Goh, 2002; Ahmed & Fajber, 2009).

CHAPTER THREE: METHODOLOGY

3.1 Introduction

In this chapter, the methodological approaches and various methodological components used for this study will be discussed. The chapter highlights two major methodologies, that is the quantitative approach for survey, and qualitative approach which included focus groups. The selection of methods was guided by the nature of the problem and time constraints. Finally, this section will address limitations in the methodology, and the execution of the study.

3.2. Research Design

Research design is a framework in research studies which describes how the research was carried out, while defining the general data collection structure and steps to be taken in the data collection process (Strauss & Carbin, 1990). There are different methods available that can be used in this type of research such as protocol analysis, questionnaires, observations, critical incident techniques and interviews as indicated by Creswell (2009). For this study I used a mixed methodology as proposed by Starr (2012) who refers to mixed methodology as the use of both qualitative and quantitative methods in an integrated manner to conduct a study. Therefore, this study integrated both quantitative and qualitative research questions in individual as well as focus group interviews. A questionnaire survey helped gather quantitative data, whilst group discussions were used to collect qualitative data. The use of mixed methodology for this study helped with understanding climate change impacts, adaptive capacity of different households and individuals, and how this affects the wellbeing of the young adults in a rural community. Data were gathered through primary sources. The primary data were collected through household surveys and group discussions. The findings from both phases were integrated during the interpretation phase, through comparisons and connections.

3.2.1. Study Area

The study was conducted at Matangari Village, located northeast of the Vhembe district within Thulamela Local Municipality in the Limpopo Province of South Africa (Figure 1). The study area is located approximately 40 km from Thohoyandou, at the borders of the Mutale and Mudaswali Rivers. The province occupies an area of about 123 910 km^2 and shares borders with three other countries, namely Mozambique to the east, Zimbabwe to the north and Botswana to the west (TLM, 2018). Thulamela Local Municipality (TLM) covers has a population of approximately 497 237 people of whom 53.3% are female and 46.7% male (Stats SA, 2016). The district largely relies on subsistence agriculture for food production and is mostly dependent on rain for agriculture (Stats SA, 2016).

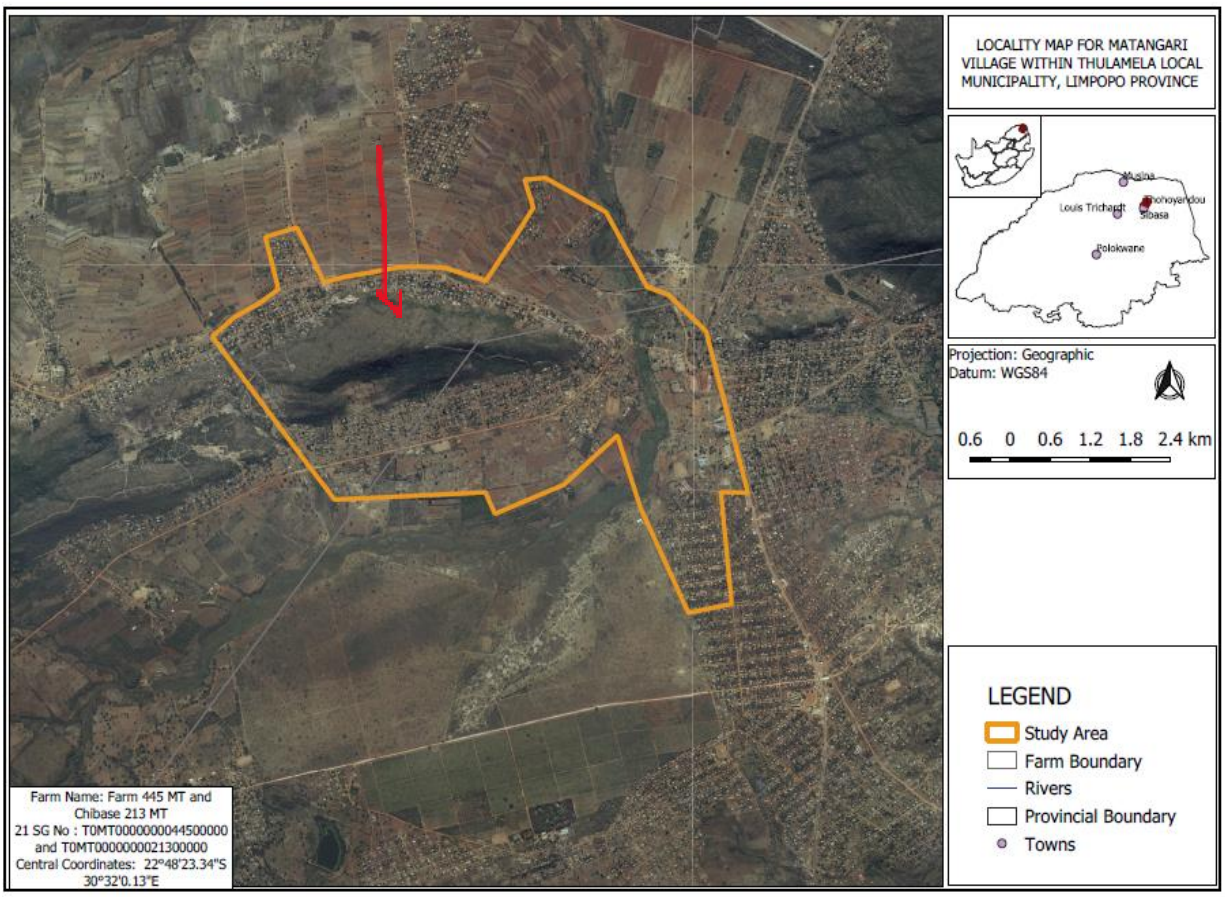


Figure 1: Location of the study area (Source: GoogleEarth, 2019)

The Limpopo Basin's climate is spatially diverse, whereby most regions are mainly temperate, with the eastern regions semi-arid, the western regions arid (Nel & Nel, 2009). Furthermore, regions on the north-west are left much drier. Thulamela is situated in an area with a subtropical climate and it is therefore prone to fires, drought, thunderstorms and floods (Mulugisi, 2015; Musyoki, Thifhufhelwi & Murungweni, 2016, Nell & Van der Walk, 2017). Due to its complex topography, Thulamela is usually exposed to high rainfall with a yearly average rainfall ranging between 300–1000 mm (Nell & Van der Walt, 2017). The rainy season runs from October to February; however, floods are expected when the rainfall trend peaks, which is between January and February (Nel and Nel, 2009; TLM, 2018). The mountainous areas, however, receive huge quantities of rainfall annually, with an average of about 1329 mm (Marete, 2003). Summer temperature can sometimes reach 40 ˚C in TLM (Nell & Van der Walt, 2017; TLM, 2018).

Various climatic effects within the area are enhanced due to topographical characteristics (altitude and relief) (Louw & Flandorp, 2017; Nell & Van der Walt, 2017). With prominent mountains like the Soutpansberg, the topography of Thulamela is gentle and undulating. Its topography is a significant feature when taking into consideration the parameters of the agricultural environment in the region

(Mulugisi, 2015; Louw & Flandorp, 2017). Furthermore, the region is largely covered by sandstone and quartzite soils that are in general well-drained, gravely, shallow with low nutrients and are acidic in nature (Mucina and Rutherford, 2006; Mulugisi, 2015; Louw & Flandorp, 2017). Thulamela has various types of soils which include loamy soils, sandy soils, clayey soils and silty sands. Some areas in Thulamela have arable fertile soil which is dark brown in colour, and loam sand, with a high infiltration capacity suitable for agricultural purposes (both crop and fruit production). However, this type of soil is easily eroded by wind or rain (Mulugisi, 2015; Louw & Flandorp, 2017).

In terms of hydrology, the district of Vhembe is characterised by perennial and non-perennial rivers that occur during heavy rainfall events and dry out when there is no rainfall to keep them flowing (Mulugisi, 2015). As a result of its dendritic perennial rivers (Tshinane, Mutale, Mutangwi and Mutshindudi), the Thulamela area is well drained. All of these rivers discharge their waters northwards into the Limpopo River which separates Zimbabwe and South Africa. Water supplies in the municipality for domestic and agricultural purposes are provided by the various dams that include Vondo, Albasini, Mambedi, Nandoni and Damani (Mulugisi, 2015). These dams collect water from the rivers in the region. The groundwater exists in broken and intergranular interstices of alluvial and talus deposits in Sibasa basalt and intergranular interstices (Mulugisi, 2015).

3.2.2. Overview of Study Area

3.2.2.1. Human Capital and Demographics

Demographic changes in developing areas can have long term impacts on the economy. Thulamela is estimated to be home to approximately 497 237 people, with close to 39% being youth and young adults between 15- 34 years of age (StatsSA, 2016; TLM, 2018). The population has decreased by 16% between 2011 and 2016 (StatSA, 2016; TLM, 2018). The decrease may have been due to emigration in search of job opportunities and educational opportunities, or due to decreases in economic nodes around the municipality (TLM, 2018). The population within the municipality is distributed according to ward sections (StatsSA, 2016). According to the StatsSA (2016), Matangari village is home to approximately 11 407 people.

TLM consists of several ethnic groups with 99% being African and 1% Indian/Asian (StatsSA, 2016). The majority of the population of the municipality are found in the rural areas where poverty is very high, and they depend mostly on natural resources for their livelihood (Mpandeli, 2014). This makes them even more vulnerable to the threats of climate change. The study focus is on Matangari Village under TLM which has over 1049 households with an average of 3.8 people living in each household. Most of these households are headed by women (54.6 %) and 2.6 % are child headed (under the age of 18). This may be a consequence of the migration of men between the cities and the village, as the cities have more job opportunities (StatsSA, 2016). The dependency ratio of Matangari is 74% which

is higher than the overall 64% dependency ratio of the Municipality, indicating that the economic growth of Matangari is very slow. Below Table 1 shows the demographic summary of both the Thulamela Local Municipality and the Matangari Village.

Table 2: Demographic summary of Thulamela and the selected study area

Demographic Summary	Thulamela Local Municipality	Matangari Village
Population	497 237	4026
Household numbers	130 320	1049
HH size	3.8 %	3.8 %
Density Persons /Km2		533 persons/km^2
Dependency Ratio	62.5 %	74 %
F headed HHs (%)	50.4%	54.6 %
Gender Ratio	84.6%	80.5%

Source: (StatsSA, 2016)

The level of education within the municipality has increased; however, the number of pupils who manage to complete their matric is still relatively low in Matangari - 39% (Stats, 2016). Approximately 9.1% of those who matriculated managed to further their studies and complete an undergraduate degree (Stats, 2016). Moreover, approximately 36% of the youth do not complete secondary school (StatsSA, 2016). Low levels of education usually decrease their employment opportunities and it also has a negative impact on viable strategies for local economic growth (UNDP, 2014). Table 2 below indicates the level of education within Matangari.

Table 3: Summary of Education status at Matangari

Group	Percentage
No schooling	16,2 %
Some Primary	11,8 %
Completed Primary	5,3 %
Some Secondary	39 %
Matric	18,6 %
Higher Education	9,1 %

Source: (StatsSA, 2016)

3.2.2.2. Financial Capital and Economic Aspects

High rates of poverty and inequality are said to have been exacerbated by economic trends and have affected semi-skilled and unqualified workers hard (Madzivhandila, 2015). Matangari is characterised by high levels of poverty and unemployment (Table 3), with an 18% rate of employment and an average household income of R15 000 (Census, 2016). Approximately 56% of the population of Matangari are not economically active with 10% having no income at all (StatsSA, 2016). There are large inequalities between the different communities in terms of their developmental plans, and this has been worsened by the size of the municipality, in that there are villages that are genuinely established in contrast to other rural areas, which are developing at a slow pace.

Table 4: Employment status of the area

Employment status of the area

Employment status	**TLM**
Employed	24 %
Unemployed	17 %
Discouraged work seekers	8 %
Not economically actively	51 %

Source: (StatsSA 2016)

The subtropical climate of TLM allows for cultivation of tropical fruits such as bananas, lemons, avocados and mangos (Louw & Flandorp, 2017). Most communities between the towns in the TLM depend highly on agricultural activities, resulting in these areas being under continual risk of environmental degradation (Thulamela IDP, 2018). With the great economic dependence on agricultural activities, Matangari is more vulnerable to aspects of the changing climate. The community's main economic activity is based on small-scale agriculture, mainly growing crops such as sweet potato, groundnuts, and maize to support their livelihoods (Mudau, 2018; Thulamela IDP, 2018). The community keeps livestock for selling and own use such as goats, chicken and cattle. However, due to lack of rain, most crops are only grown during rainy seasons as they have a serious problem of water shortage in the community. In order to sustain their livelihoods, the residents of Matangari depend greatly on farming and micro-enterprises such as traditional beer making and sewing (Mudau, 2018).

3.2.2.3. Infrastructure: Physical Capital

The Republic of South Africa Constitution (Act 108 of 1996) affords basic human rights to all South Africans, including rightful access to basic services and infrastructure. The municipality is given the

task to provide free basic municipal services to households that cannot afford to pay/get basic municipal services like housing, water, roads, electricity, and solid waste management. In general, the municipality has a serious backlog on infrastructure. One of the reasons is due to the fact that most of the land in rural areas is under the control of tribal authority and the municipality has no access/control over them (Thulamela IDP, 2016). The majority of the population reside in formal dwellings with over 82.7% owning/paying off their houses (StatsSA, 2016).

Many households (94%) within Matangari have access to electricity, however a huge proportion of the residents prefer other sources of energy such candles for lighting (66.5%), wood for heating (66.5%) and wood for cooking (80.6%). For other energy uses they depend heavily on firewood, which indicates their high reliance on natural resources. There is a lack of adequate infrastructure for sanitation within Matangari, with only 2.5% having access to flushing toilets connected to a sewage system, while 70.6% use pit latrines with no ventilation and 9.6 % have no access to any toilets (StatsSA, 2011).

Vhembe District Municipality (VDM) purchases water from the Department of Water Affairs and it is the responsibility of VDM to supply water to its local municipality and service providers (Mulugisi, 2015; Thulamela IDP, 2016). TLM receives water from VDM and distributes it to the communities under its jurisdiction. Due to poor water supply infrastructure, the communities around Matangari established a local water scheme (Tshiombo water scheme) to supply water to their communities; however, only 25% of the Matangari community have access to water from that scheme (Mudau, 2018). This leaves the majority of the community relying on water from the river (45.9%) and the spring (18%). With the continuation of climate change effects and increases in population, this has placed even more pressure on the water resources (Mulugisi, 2015; Mudau, 2018).

Refuse removal is very essential for health and environmental purposes. There is no service for removal of refuse in Matangari, however there is a collection place in a close-by village. StatsSA (2016) indicates that approximately 98.6% of the population of Matangari use their own refuse dump and this indicates the population still do not have access to formal removal of solid waste (StatsSA, 2013).

3.2.3. Sample Selection

The study area was selected through purposive sampling based on its susceptibility to climate change impacts. The community selected is largely dependent on subsistence and commercial farming for the daily lives. Because “normal” climatic conditions are prerequisites for effective farming, the community is therefore, dependent on “normal” climatic conditions. As a result, massive climatic changes threatened the community’s wellbeing.

For this study, a total of 40 households were surveyed. A random interval sampling technique was used to select these households in the following manner: initially, 10 households were selected for surveying, after the 10th household was surveyed, the rest of the households were selected at an interval of four, until the 40th household was reached. To add on the randomness and avoid bias surveying, for every selected 4th interval household, its opposite household was used for the survey. This form of sampling is also known as chance sampling, where each individual household has an equal chance of being sampled and each one has the same probability of being selected. An inclusion criterion was created to select eligible participants. Participants were only eligible if they had resided in the study area for 10 or more years and are dependent on natural resources for livelihoods.

Focus group discussions were undertaken with the young adults of Matangari to gain a deeper understanding of their coping mechanisms, knowledge and attitude towards climate change. The youth is defined as those between ages of 14 to 35 by the National Youth Policy (NYP, 2015). This study defines young adults as those between the ages of 20-35. Purposive sampling was used to select participants for the Focus Group Discussions (FGD's), because this method allowed for the targeting of the right participants for the study (USAID, 1996). A total number of 18 individuals participated in the discussions and were divided in two groups. A participation criterion was established and applied when selecting participants for the FGDs such as age group (between 20-35 years), gender, dependence on natural resources, living in the community over 10 years and availability to participate during the time allocated. There is considerable evidence that women speak far less when men are present in group settings (USAID, 1996). For this study, women were separated from the men for the FDGs to allow them to express themselves freely, voice their opinions without influence and to encourage participation without intimidation from the other gender.

3.4. Research data collection

The fieldwork for primary data collection consisted of two phases which are discussed in detail below. The first phase involved the collection of quantitative information through household surveys, whilst the second phase entailed the collection of qualitative information through focused group discussions.

3.4.1 Household Survey

Phase one of the field work took place from September 23rd to 28th 2019. Household interviews were conducted using semi-structured questionnaires with open and closed ended questions to collect quantitative information which could be subjected to statistical analysis in order to complement and triangulate the more qualitative information given by FDGs. This technique was used to obtain: information about the general demographic characteristics of households, household vulnerability to climate change, household assets and livelihood strategies, to understand their perceptions and

knowledge of the changing climate, experiences on climate variability and associated impacts, and methods they implement to respond to the impacts of climate change.

Questionnaires have been reported to be time consuming and, in some cases, it has been found that respondents are not cooperative in completing the questionnaires due to this. Yet, questionnaires are found to be more common and reported to be used by most researchers to collect data from potentially large number of respondents because it is an inexpensive method (Babbie, 1992; Jackson, 1996; Creswell, 2009). Even though the questionnaires proved to be time-consuming, the respondents were extremely responsive and completed the questionnaire. However, during the survey, four households refused to part-take in the survey and indicated their disinterest, giving several reasons including that "you come collect information from us, but you never come back to report back to us your findings". No problems relating to the questions on the questionnaire were experienced which could have led to the approach and questionnaire being modified. The questionnaires were administered by the appointed research field assistant and the researcher. This was done so that we could assist the respondents if they needed clarity on anything in the questionnaire. On completion of household surveys, focus group discussions were scheduled.

3.4.2. Focus Group Discussions

The second phase used a qualitative data gathering method known as focus group discussion. This method was chosen as it has proven to have the advantage of obtaining more information from local people, as it encourages engagement and interaction between local people and researchers, as well as local people among themselves (Campbell, 2008; Reenberg *et al.*, 2008). Two focus group discussions (FGDs) were conducted in the study and 18 individuals (nine individuals per group) participated in the discussions. These took place at the community court, a natural setting for them. During the discussions, the groups were separated according to their gender to avoid the influence of responses between the groups, as women may not speak freely when men are around due to cultural restrictions. The focused discussions were conducted in the Tshivenda language as it is the local language in Matangari. Open-ended questions were used to avoid restricting the responses of the participants and to give the participants control over what they wanted to say and how they wanted to say it (*see Appendix E*). Each discussion took approximately 45 minutes, however before commencement, the researcher explained to the participants the objective of the discussion and consent forms were signed. Discussions took place during the weekend so as to accommodate participants, however due to time constraints and unavailability of young adults; only two group discussions were conducted.

The discussions were conducted for the researcher to identify and evaluate the following: the degree to which the young adults have heard of the phrase climate change; the current knowledge and

perceptions of climate change by the young adults; the extent to which participants feel that climate change would harm them directly and how they view their specific level of risk in terms of climate change impacts; the key livelihood strategies by the young adults; how climate change is or has affected the wellbeing of young adults; the coping and adaptation measures the young adults are implementing; the young adults' key barriers to climate change adaptation; and the awareness of climate change awareness programs and support for the young adults.

One disadvantage about group discussions is that they are not confidential and can prevent an individual from voicing their opinion due to fear that some individuals may reveal what has been discussed outside the group (Jackson *et al.,* 2007; Murungen, 2008; Nyiraruhimbi, 2012). For this study, it was found that the female group was more reserved and some of the individuals indicated that they had so much to say but would only give information in private. However, the males were more confident and gave more information with no hesitation.

3.5. Data Analysis

Data obtained in Tshivenda were translated into English before analysis. Data collected through recorder were transcribed and documented. A thematic analysis was used to identify themes and make comparisons of verbal responses from the participants. The thematic analysis allows for two ways to analyse data: inductive or deductive approach (Braun & Clarke, 2016). An inductive approach was applied, and I allowed the data to determine the themes as there were no preconceived themes based on theory or existing knowledge. Codes were assigned to different phrases; once the coding was concluded, all the phrases were collated into groups. The quantitative data from the household survey were arranged and coded. The analysis was done in Excel using a mix of descriptive statistics such as frequencies and percentages.

3.6. Ethical Clearance

Before the commencement of the data collection phase commence, ethical clearance was obtained from Witwatersrand (see Appendix A). Prior to interviews being conducted, permission was granted from the traditional authority from Matangari Village. All participants were made aware that to take part in the study was voluntary. Participant's responses of the study were confidential and they remain anonymous. A letter of consent was given to all participants to sign before interviews (Appendix C).

3.7. Limitations

It was difficult to secure an interview with the key informants, and after numerous attempts, it was unfortunate that these interviews could not be conducted. Their information would have helped us better understand the setup of the community, what is being done and what is being planned to help

the young adults adapt and cope with climate change. Most of participants did not want to participate as they raised concerns that researchers come and collect information from them and never come back to report to them their findings. Time was also a contributor factor to the length of focus group discussions conducted as a wider range of young adults would have been preferred. Moreover, terminology was also a problem; most words are translatable to Tshivenda, which made it difficult for the researcher.

CHAPTER 4: RESULTS

4.1. Household demographics

The age of the household respondents ranged from 24 to 70 years with approximately 53% of them being 44 years of age. The results also demonstrated that most of the household members were aged between 16-25 years followed by 0-15 years (Table 4). The household survey results indicate that majority of the households (53%) within the study area are headed by females. The survey indicated that many of the households were headed by single women. The survey findings show that the average household size in Matangari is 5.95 persons per household. The smallest household had three occupants while the largest one had 14 people residing in it (Table 4). Most household heads were self-employed while only three of the household heads were in formal employment (Table 4); one female is a nurse, one male is a teacher and the other a government official. The main source of income for the household's was child grant and old age grant (Table 4). Household respondents also indicated to own various businesses.

The results demonstrated that 20% of the respondents had basic education. Majority of the respondents (52.5%) were found to have some form of secondary education but did not complete their secondary education. Of the respondents that completed their secondary education, only 7.5% were able to further their studies (Table 4).

Table 5: Household socio-demographic characteristics

Household Socio-demographic	**Frequency (n=40)**	**Percentage**
Demographics		
Age n=238		
0-15	46	19.3 %
16-25	77	32.4 %
26-35	54	22.7 %
36- 59	32	13.4 %
>60	23	9.7 %
Gender of household population n= 238		
Male	112	47.1 %
Female	126	52.9 %
Household Head Gender		
Female	27	67.5 %
Male	13	32.5 %
Marital status of household head n=40	Male Female	Male Female

Married	8	5	20.0 %	12.5 %
Single	2	12	5.0 %	30.0 %
Divorced	1	2	2.5 %	5.0 %
Widow	2	8	5.0 %	20.0 %
Household Size	3 smallest household 14 largest household		5.95 %	
Education level of household heads n=40				
None	2		5.0 %	
Further/Tertiary	3		7.5%	
Completed Secondary	8		20.0 %	
Some Secondary	21		52.5%	
Completed Primary	2		5.0 %	
Some Primary	4		10.0 %	
Occupation of household heads n=40				
Unemployed/Looking	8		20.0 %	
Unemployed/Not Looking	7		17.5 %	
Self employed	12		30.0 %	
Formal employed	3		7.5 %	
Farming with own crops	2		5.0 %	
Unemployed/Studying	2		5.0 %	
Working on farm	2		5.0 %	
Other-Pensioner	2		5.0 %	
Farming with own livestock	2		5.0 %	
Household income				
<R1000	1		2.5 %	
>R10 001	8		20.0 %	
R1001-R3000	8		20.0 %	
R3001- R7000	19		47.5 %	
R7001-R10000	4		10.0 %	
Sources of income				
Child Grant	31		77.5 %	
Old Age Grant	16		40.0 %	
Formal Employment	3		7.5 %	
Own Business	9		22.5 %	
Selling Wood	3		7.5 %	
Selling Vegetables	8		20.0 %	
Migrant Remittance	5		12.5 %	
Other	13		32.5 %	

4.2. Household Assets

The results also show that most of the households belonged to burial scheme and stokvel social organisations (87.5%, 52.2% respectively) (Table 5). Only 38% of the respondents indicated to own livestock, while 62% reported not to own any livestock (Table 5). Poultry is owned by 40% of the households, whilst 35%, 12.5% and 12.5% reported to keep goats, pigs and cattle respectively (Table 5). Majority of the household respondents 55% reported not to own land and of those that own land, 7.5 % indicated to be renting it out (Table 5). The most common crops planted by household respondents included sweet potato *(ipomoea batatas)* (62.5 %), ground nuts *(Arachis hypogaea*) (57.5 %), tomatoes *(solanum lycopersicum)* (55.0 %), mustard green *(Brassica)* (55.0 %), spinach *(Spinaca oleracea)* (22.5 %) and maize *(Zea Mays)* (22.5 %). Table five shows that most of the households depend on river/dam (75.5%) and spring as their sources for water. Majority of household respondents have access to credit by means of borrowing money from the friends and family (62.5 % and 50.0 % respectively) (Table 5)

Table 6: Household Assets (Multiple responses were possible)

Social Groups		
Burial Scheme	35	87.5 %
Stokvel	21	52.5 %
Youth Organisations	9	22.5 %
Grocery Schemes	12	30.0 %
Cultural Groups	18	30.0 %
Agricultural/Farming Groups	7	17.5 %
Women's Organisation	13	32.5 %
Community Policing Forum	2	5.0 %
Sources of communication within the community	39	97.5 %
Community Meetings	17	42.5 %
Social Network	34	85. 0%
Cell phones		
Physical Capital		
Types of house		
Mud House	18	45,0%
Face brick/Tile House	10	25,0%
Cement/Corrugated House	20	50,0%
RDP House	4	10,0%
Concrete House	1	2,5%
Livestock Ownership		
Chicken	16	40.0 %

Pigs	5	12.5 %
Cattle	5	12.5 %
Goats	14	35.0 %
Natural Capital		
Land ownership		
Own land	15	37.5 %
Lease land	3	7.5 %
No land	22	55 %
Sources of water		
River/Dam	30	75.5 %
Buy	23	57.5 %
Spring water	28	70.0 %
Household borehole	9	22.5 %
Rain tank	25	62.5 %
Other	15	37.5 %
Financial Capital		
Access to credit		
Borrow from friend	25	62.5 %
Borrow from family	20	50.0 %
Banks	5	12.5 %
Loan shark	15	37.5 %

4.3. Household climate change knowledge, perceptions, impacts and responses

4.3.1. Knowledge of climate change amongst Household respondents

Of the 40 households surveyed, about 22 household respondents reported that they had never heard about climate change until the survey (Figure 2; Table 6). Only four respondents reported that they had a broad knowledge about climate change and two respondents had little knowledge. Household survey results indicated that there is low knowledge of climate change and this might be because of the low level of education among the household heads. Of the respondents that stated to have heard about climate change, only 12 indicated to have heard about climate change from research students (Table 7).

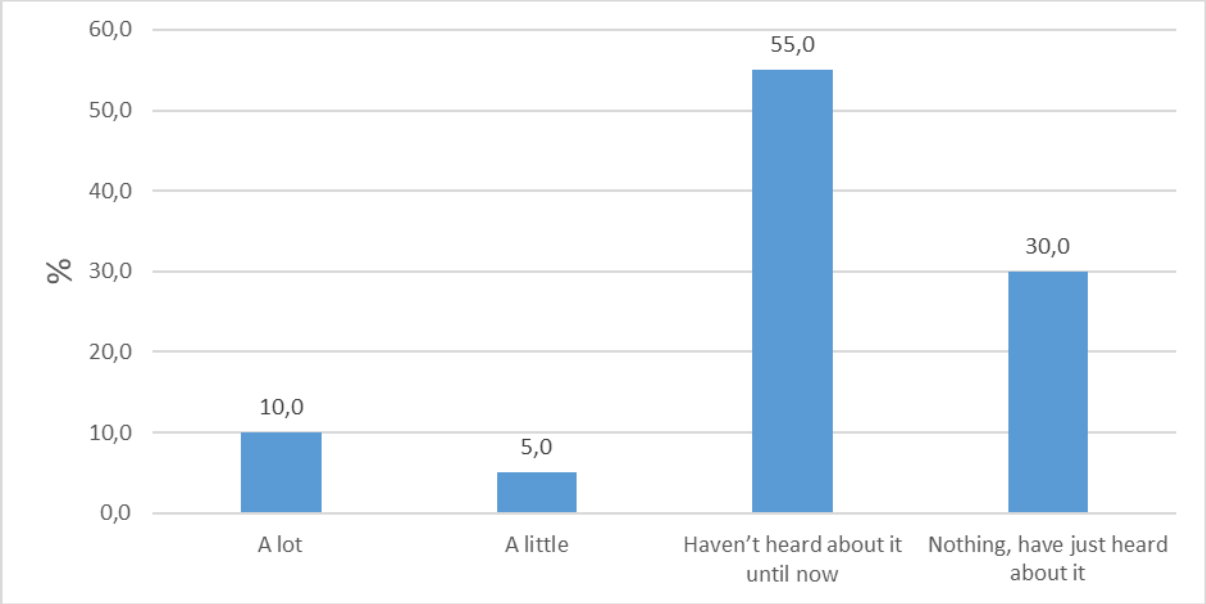


Figure 2: Climate change level of knowledge of household respondents

4.3.2. Changes in climate experienced and observed over the past 10 years by Household respondents

To understand whether rural communities are aware of climate change and its effects on them, the Matangari villagers were asked about their observations of climatic conditions over the past 10 years and whether they noted any changes in the conditions. Results indicate that the all household respondents (100%) from the surveyed households have observed temperature increases over the past 10 years as well as recurrent heatwaves (Figure 3; Table 8). In addition to increases in temperatures, 90.0 % of the respondents reported to have observed increases in flooding events. However, about 5.0 % of the respondents stated that there has not been a change in rainfall over the past 10 years (Figure 3). This suggests that the villagers are generally aware of changes in climatic conditions and used most of their personal experiences and observation they made over the years to describe the changes.

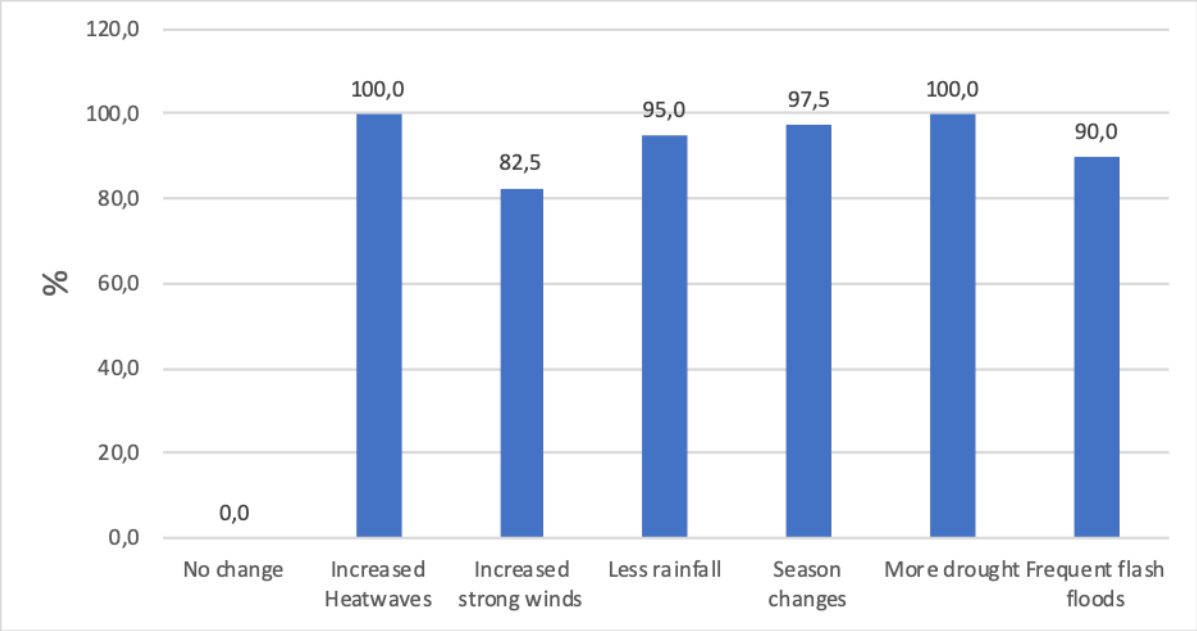


Figure 3: perceived changes of climate by household respondents (multiple responses were recorded)

4.3.3. Household perceived causes of climate change

To further test, their knowledge of climate change, the same respondents were asked whether they were aware of what might have been causing these changes in climatic conditions. Of all household respondents, abandoning of traditional/cultural customs, disrespecting ancestors and lifestyles changes as the primary causes of climate change (90.0 %, 82.5 % and 77.5 % respectively; Figure 4). Only a few household respondents reported scientifically proven causes of climate change deforestation and pollution (12.5 % each) (Figure 4). Results indicated that the people in the area have a wide spectrum of possible causes of climate change, owing this to indigenous knowledge, how knowledge is passed on as well as beliefs. From the surveys it was evident that the community was aware of both the scientifically common causes and non-scientifically proven causes.

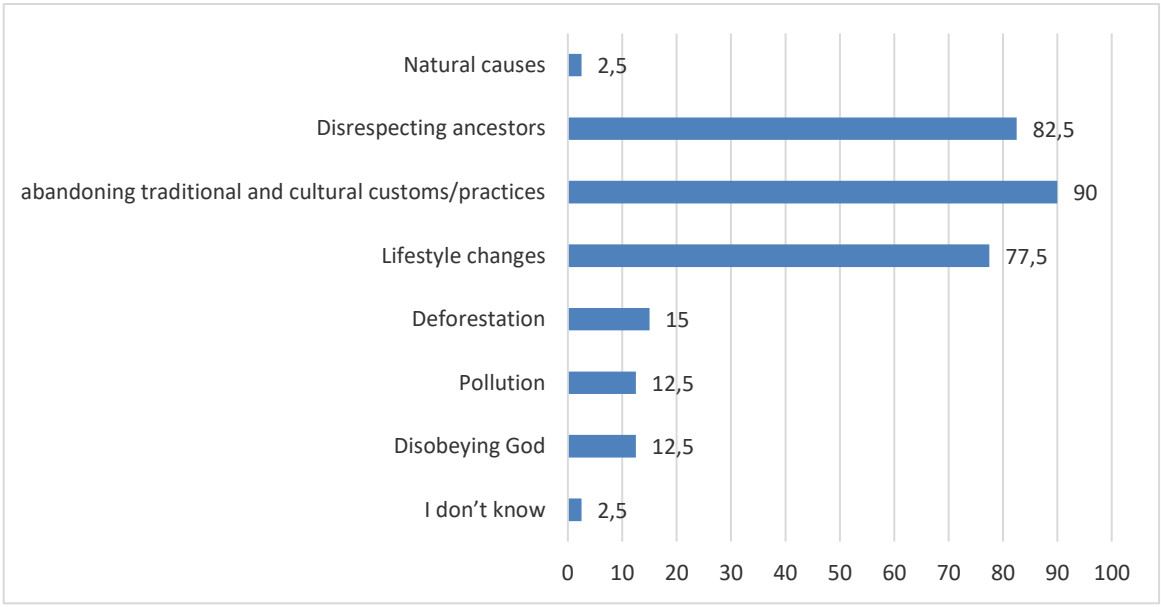


Figure 4: Household respondents perceptions of causes of climate change within the study area (multiple responses were recorded).

4.3.4. Perceived Climate change impacts on household livelihoods

The household survey results indicate that climate change has been directly and indirectly affecting households environmentally, economically, and socially. Majority of the respondents indicated that climate change impacted more on their income (97.5 %). Furthermore, reduced agricultural production, increased water shortage and decline in natural resources were also mentioned by majority of household respondents (95%; 95% and 92.5 % respectively)(Figure 5; Table 10). The household respondents felt these were the most impacted by climate change and have led to a decline in household income and job losses. The most important finding was that all household respondents (100.0 %) felt that climate change was impacting more on food security compared to all other aspects.

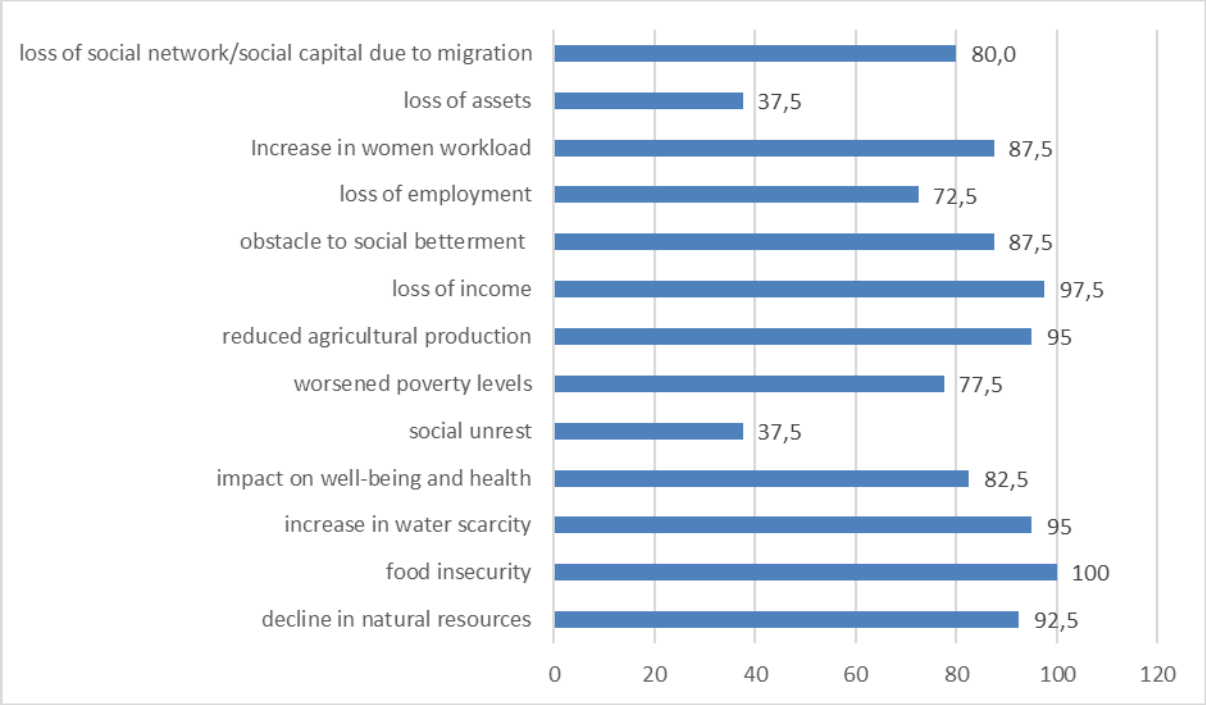


Figure 5: Climate change impacts on household livelihoods within the study (multiple responses were recorded).

4.3.5. Household responses to the effect of climate change.

The respondents were asked about their adaptive strategies to climate change and its impacts. All household respondents reported that droughts, temperature increases and changes in rainfall had affected their livelihoods and had implemented coping and adaptation methods to respond and enhance their resilience to the adverse effects of the climatic shocks (Table 11). Goat manure and change of diet (both 87.5%), crop diversification, use of more suitable crop varieties (82.5%) and reduction of food consumption (80.0%) were the most common coping an adaptation strategy surveyed households implemented. Other important but less commonly applied coping and adaptation strategies included, borrowing from friends/family/or village saving (32.5 %), temporal migration (25.0), water harvesting (22.5 %) and reduction of livestock sizes (15.0 %). A significant finding was that all household respondents indicated to either plant trees or use fruit trees for shade. Households indicated that, as result of loss of income due to climatic related problems, they are now actively involved in non-farming activities such as selling firewood, selling traditional beer and construction. However, to supplement the loss of income, child grants and old age grants were mostly mentioned by household respondents (70.0 %) as their alternative income. Interestingly, the household respondents indicated that the reason why temporal migration was not common was because it is commonly practiced by men, especially young adults. About 44.3 % of the household respondent indicated that they use individual adaptation strategies, 33.3% reported to use collective adaptation strategies (Table 11).

4.3.6. Household information sources of responses to climate change

When the household respondents were asked to mention different sources of knowledge for climate change adaptation strategies and whether they were done individual or collectively, 87.5 % of the respondents acquired their knowledge on the changing climate either through personal experiences or self-taught (Figure 6). Most of respondents indicated that they acquired their knowledge from their parents/family. Furthermore, the respondents stated that, as the effects of climate change worsen, it has prompted them to learn show to adapt to these changes from friends/neighbours and social groups. No formal sources such as schools, NGOs and extension staffs were mentioned as sources of information for acquiring adaptation strategies.

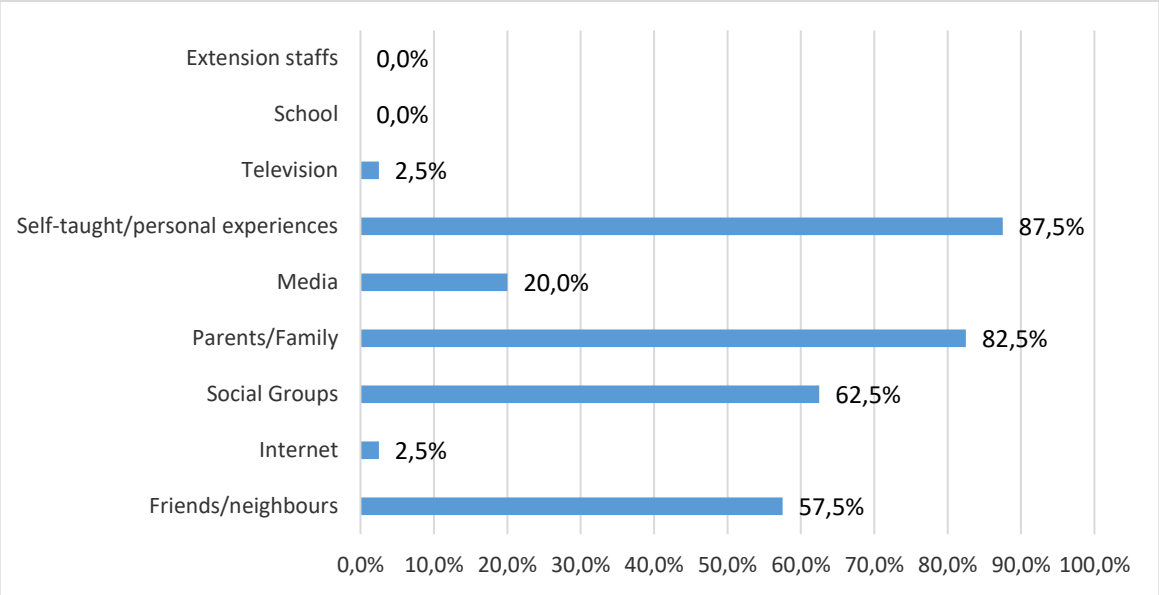


Figure 6: The different sources that household respondents acquire their knowledge of climate change adaptation practices.

4.3.7. External Support to cope with Climate change Impacts

To enhance their adaptive capacity, the results of the study demonstrated that over 86% of the household respondents are part of social groups/organisations. Most of the household respondents belong to burial scheme (87.5%) and stokvel (saving group; 52.5 %). Furthermore, some respondents indicated be part of women's organisations, grocery schemes and cultural groups (32.5 %, 30.0 % and 30.0 % respectively; Table 5). Only 17.5 % of the household respondents mentioned that they are a part of the agricultural/farming group. According to results from the survey, it is evident that most of the respondents are part of social groups that allow communities to access credit so they can start small businesses and encourage members to save money and communities use them to protect their livelihoods against flash floods, prolonged drought spells to fight poverty and improve their livelihoods. Accordingly, if well-established, these groups are central to the communities as a result

of livelihood activities. Majority of the households indicated to receive support from family and friends (Figure 11). No household respondent indicated any external support from government or NGOs to cope with climatic shocks.

4.3.8. Solutions to effective adaptation to climate change

Better access to water and provision of crop seeds and fertilizers were the two common solutions among household respondents to improve their adapting capacity. This shows their interest to continue farming (Figure 7).

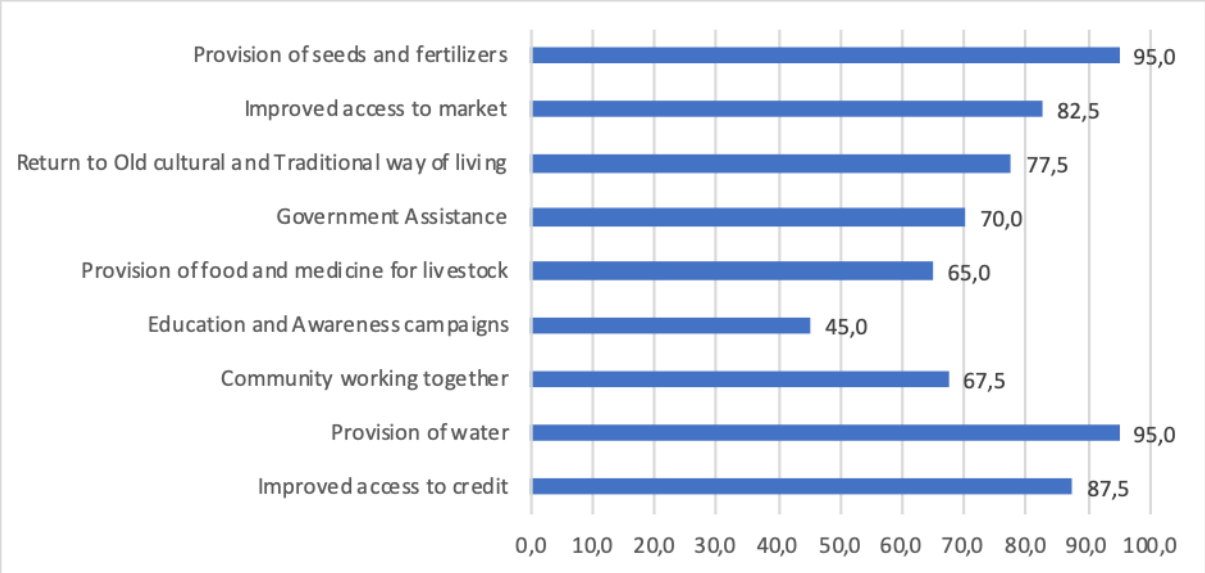


Figure 7: Household solutions to effective adaptation

4.4 Focus groups

The focus groups were made up of the community's young adults. The age of the young adults making up the focus group ranged from 20 to 33 years. A total of 18 young adults (9 males and 9 females) participated in the focus group discussions. All the young adults completed primary school in terms of education, very few completed secondary (16%) or even tertiary education (7%).

The results from the study revealed that the majority of the young adults (55.6%) around the study area are unemployed with only 5.6% indicating that they are still studying. The unemployment rate amongst young women is 33.3% and men 66.7%. From the focus groups, it was evident that the participants obtain income from multiple sources. Only 11% of the young adults are self-employed. The self-employed young women indicated that they sell snacks, vegetables, and termites, while the men stated that they fix electronics and work as plumbers. The remaining 27% are employed in non-formal employments; women may take care of children, work part-time as domestic workers, assist with home-based care, while men may wash cars, herd livestock and work on farms. Of the

unemployed young adults, 26% of the women said they depend on their child grant as their source of income.

4.4.1 The young adults' perspective of life and their future

The first thing the participants of the young adults focus group were asked to describe during the discussion was how their life is. The responses from the young adults were mostly negative and from a place of discouragement and anger. They were not asked to use specific words, but the most common words used to describe life were "hard", "tough", "difficult", "painful" and "challenging". Four of the respondents indicated that they were not living but surviving; others said there cannot even express and say anything about life. However, one respondent showed that they are taking a day at time, trying to figure out "this thing called life". They linked their hardships to financial difficulties, lack of employment, skills, and education which has resulted due to loss of income in their households. They indicated their dissatisfaction of living in the study area and their dream of the leaving and looking for better opportunities. They stated that before the area was a good place to live, with many farms, water and it was green. However, things have changed, they do not have water, and do not farm anymore. It is dry and very hot. Most of the young men respondents, when explaining their life, would start by saying for example "life here is hard, I want to leave this place, and there is nothing for me here." Interestingly, the majority of the young women indicated that life was indeed hard but went on to explain that they would wish to leave the community, however they cannot because they need to take care of elderly parents. Two young women respondents stated that "life is hard here, but I won't leave this place unless I am married. I would rather struggle in a place I know, and people know me than be in a place I would struggle alone with no one to help me".

When the young adults were asked about their future, almost all the respondents asked what was meant by "the future"? One respondent indicated "there's no future here". It was evident from the start that the young adults were negative about the future in the community. They were then asked if they see themselves living in the same area in the next five years. The results were interesting in that there was a quick response with no hesitation. About 98.0 % of the young men indicated that they do not see themselves living in the area, whilst 88.7 % of the young men indicated that they are not leaving their community. The young men indicated that they do not see themselves farming in the future, while most of the young women indicated that if there is availability of water, they would go back to farming.

Female respondent: "*I want to go back to school, complete my matric and further my studies and become a chartered accountant*".

Male respondent: *"I want to leave this place and go look for employment and help my parents"*.

The young adult also indicated that there is nothing to do in the community which motivates them to do better. When asked what kind of activities they do around the communities, there was a considerable variation in answers across the genders. Almost 88.0 % of young women were more active in social activities and part of social organisations or groups, mainly burial schemes, stokvel, women's organisation (tshisevhevhe) and grocery schemes and are part of the community cultural dance group. However, most of the young men were part of a youth organisation and activities they did around the community were more for entertainment such as playing pool, drinking with friends, and watching soccer. About 27.7 % of the young men reported not being part of social organisations or participating in any activity in the community. When asked why, they indicated you need to have money to be part and they do not have it.

The young women indicated that they were taught from a young age that they need to be part of the social organisations so that they can be part of the community and also network with other women. They were taught the importance of networks and how groups such as stokvels and burial schemes are savings and would help them in times of need. One female respondent stated "I am part of a burial scheme; it will help me during a death in the family. I will get financial assistance and also labour assistance from the women in the scheme."

The young adults were asked if they see themselves still living in the community in five years' time. Most of the young men respondents (98.0 %) said no, they want to leave the community. Various reasons were given that included low earnings, reduced food availability, getting skills and better opportunities. Only two young men respondents indicated their preference for staying in the community. The remaining 16.7% said they would consider leaving if the right circumstance or opportunities come up. However, the household findings do not align with these data as most of the household respondents indicated their desire to remain in the community and continue farming, with the hope that things will get better in the community.

In turn, 88.7 % of the young women indicated that they would still be living in the community and gave reasons such as fear of change (the community is familiar to them), staying home to take of the elders, no opportunities for women out there and security (people struggle more when they are away from home). About 7% of the young women indicated that they might consider leaving only if circumstances force them to leave or a better opportunity arises. The remaining 13% indicated their desire to leave the community as they are tired of living in poverty and want to improve their livelihoods; they have dreams beyond living in the community and also indicated that they are not interested in farming activities.

The results above show that the youth do not just migrate, they take into consideration the negative implications of migration (i.e. low earnings and loss of home social network) while also recognising

the opportunities that migration can bring such as learning new skills which their community cannot offer them.

4.5. Young adults climate change knowledge, perceptions, impacts and responses

4.5.1. Knowledge of climate change amongst Focused Group Discussion Participants

One of the research objectives was to identify the level of knowledge regarding climate change amongst young adult participants. The young adults were asked what they knew about climate change. Results show that 22.2 % of the young adults had not heard about climate change before the discussions, 38.9 % of the young adults said they had little knowledge about it. Only 16.7 % of the young adult participants indicated to fully understand what climate change were (Table 6). The results indicate that the young men (22.2 %) had more knowledge about climate change than the young women (11.1 %; Table 6). There was a large variance between the young adults' and household knowledge, with over 55% of the household respondents reporting not to have any knowledge of climate change.

Table 7: Young adults and Household respondents knowledge of climate change (multiple responses were possible).

Knowledge of climate change	Young Men (N=9) (%)	Young Women (N=9) (%)	Combined Young adults (N=18)	Household (N=40)
A lot	2(22.2 %)	1(11.1 %)	3(16.7 %)	4 (10.0 %)
A little	4(44.4 %)	3(33.3 %)	7 (38.9 %)	2 (5.0 %)
Haven't heard about it until now	2(22.2 %)	2(22.2 %)	4(22.2 %)	22 (55.0 %)
Nothing, have just heard about it	1(11.1 %)	3(33. 3 %)	4(22.2 %)	12 (30.0 %)
Total	9 (100 %)	9 (100 %)	18(100 %)	40 (100 %)

4.5.2. Information Sources

The focus group participants were asked where they acquired their knowledge about the climate change. There was a huge variation on the sources used between the young men and young women. Most of the young men participants (57.1 %) reported to have learnt about climate change from the internet (Table 7). The majority of the young female participants indicated that they learnt about climate change from radio (66.7 %), students that come to conduct research in the area and social

groups (50.0 %); Table 7). This suggests that there is a vast variation in how young men and women acquire information and might reflect an unequal access of information and lack of awareness. All participants reported that no local NGOs or local government had ever conducted any climate change awareness campaigns. No participant reported to learn about climate change from school and there was no extension officer in the area of study. There is a huge variation in sources used by the young adults and households. The findings from the household survey were similar to the data collected from the young adults which indicates that their source of information was not through formal education. Also, the household data agrees with the young females whose common source of information was research assistant, social groups and friends and neighbours (Table 7).

Table 8: Young adults and Household respondents sources of information on climate change (multiple responses were possible)

Sources of knowledge	Young Men (N=9) (%)	Young Women (N=9) (%)	Combined Young adults (N=18)	Household (N=40) (%)
TV	2	1	3	4
School	0	0	0	0
Research Student	1	3	4	12
Internet	4	0	4	1
Friends/Neighbours	1	2	3	5
Social Groups	0	3	3	8
Radio	2	4	4	7
Other	2	2	2	2

4.5.3. Changes in climate experienced and observed over the past 10 years

The young participants were asked to identify and explain the changes they had observed and experienced in the past 10 years. The findings revealed that the young had different perceptions of climate change from that of the household respondents. The majority of the young adult participants associated more strongly to the current climate crisis than the past. They indicated that they have conversations of the increasing temperatures, drought and changes in rainfall patterns with their parents, especially during the planting and harvesting periods.

Most of participants indicated that the weather trends they are witnessing currently are different from what they have been experiencing 10 years ago. The majority of the participants were of the view that there has been an increase in heatwaves and drought periods (88.8 % each) and 83.3 % also reported that the amount of the rainfall they received had decreased over the years (Table 8). The young expressed how difficult it is currently to predict the weather and stated their mistrust of the weather forecast relayed to them on the radio or television, as they are often incorrect. The most interesting finding was that two participants felt that there had been no change in the climate and that it had always been like that. The results show that the young people are aware and have a better understanding of the weather change patterns occurring around them. For instance, one young man participant indicated that temperatures have increased averaging from 26 °C - 32 °C and now temperatures are averaging between 38 °C to 44 °C, whereas a typical hot day before would be 30 °C.

When asked what their main source of weather predictions were, 96 % of young adult participants indicated that the radio was their preferred and common source of information for weather prediction, while observation was the least preferred method for all young participants.

Table 9: Young adults and Household respondents perceptions of climate change (multiple responses were possible).

Perceived changes	**Young Adults (N=18) (%)**		**Household (N=40) (%)**	
	YES	**NO**	**YES**	**NO**
No change	2	16	0	40
Increased Heatwaves	16	0	40	0
Increased strong winds	8	10	33	7
Less rainfall	15	3	38	2
Season changes	14	2	39	1
More drought	16	2	40	0
Frequent flash floods	10	8	36	4

An assessment of how the participants consider the intensity of climatic change in terms of weather was conducted. About 27.7 % of the household respondents were not sure if climate change was serious (Table 9). However, the majority of the young adults 38.95 %, reported to take the changes of climate seriously and related it to how the prolonged drought, increased temperatures and lack of

rainfall has impacted their livelihoods. Participants showed some level of fear relating to worsening of climate change impacts upon their lives if nothing is done with the current crises. Climate change impacts that they worried about included the disruption of schoolwork, job losses, decline in food quality and quantity, decline in natural resources, increased workload for young women, water shortages and increasing financial burden that will increase the level of poverty within the study area.

Table 10: Young adults risk perceptions of climate change

Perceived Risk	Young Males Frequency (N=9)	Young Females Frequency (N=9)	Combined Youth Frequency (N= 18)
Not Sure	2 (22.2 %)	3 (33.3 %)	5 (27.8 %)
Don't know	1 (11.1 %)	2 (22.2 %)	3 (16.7 %)
Serious	2 (22.2 %)	1 (11.1 %)	3 (16.7 %)
Very serious	4 (44.4 %)	3 (33.3 %)	7 (38.9 %)

4.5.4. Perceived causes of climate change by the youth participants

Due to the different daily activities and differences in interactions the two genders have, the two genders would be expected to have different views towards climate change and hence the observed differences in perceptions. The young men claimed that the top two causes of climate change are pollution (88.9 %) and deforestation (77.8 %), while less than 25 % of the young men mentioned disobeying God, abandoning tradition, lifestyle changes and natural causes to be contributors (Figure 8). No young male participant indicated disrespecting ancestors as one of the causes (Figure 8). Amongst young females, abandoning tradition, disrespecting ancestors, lifestyle changes and disobeying God were the most mentioned causes of climate change with less than 25 % also mentioning pollution, deforestation and natural causes (Figure 8). There was a great variation between the young males and household survey responses, young males felt that human activity was the main cause of climate change, while household respondents linked causes to supernatural powers. However, there was no huge variation between the young females and household responses (Figure 8)

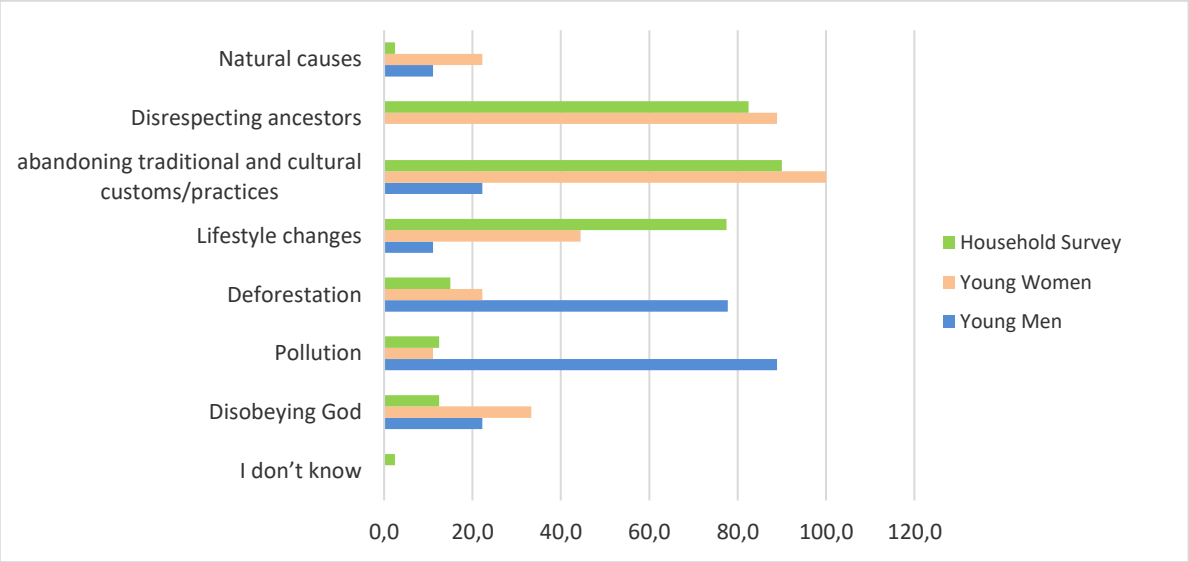


Figure 8: Young adults and household perceptions of causes of climate change

4.5.5. Effects of climate change on the young adults' lives and livelihoods

The involvement of young adults in agricultural activities promotes an awareness of the impacts which climate change has on the community and their livelihoods. Results show that the young males and young females have different viewpoints of the effects of climate change. The participants indicated that prolonged drought periods, erratic rainfall patterns and increasing temperatures caused lower crop yields. In turn lower crop yields have not only affected household income, but have affected food security, health and wellbeing, school and education related activities as well.

All these impacts which climate change impose are interlinked and may contribute to the worsening or lessening of the other. Results in this study indicate such a chain. According to the young male participants, climate change was causing a decline in natural resources, worsening the level of poverty in the community, as well as worsen the loss of income (77.8 % each; Table 10). According to the young women participants, climate change increases food insecurity (100.0 %), reduces the availability of natural resources such as firewood (88.9 %), thus increasing the workload women would have regarding their daily activities (88.9 %) within the area. Moreover, both gender groups indicated that there were climate change impacts that were of least concern, this could be due to the little importance these factors play on the participants' daily lives. The young men were least concerned about the health and wellbeing (22.2 %) and increase in women's workload (11.1 %). The young women were least concern about the social unrest (11.1 %; Table 10). This further elaborates on the differences in daily activities the two groups have and thus, the differences in their worldviews. However, both young men and women were more concerned about the effects of climate change their future, stating that it is an obstacle for social betterment in terms of future opportunities and their

education (100 %; Table 10). The young adults further explained that extreme weather events and loss of income were the cause of reduction in school attendance and an increase in school dropout rate.

The data collected by questionnaire surveys supports the data collected during the focus groups. Results from the household survey also show that climate change has reduced the income generated at home by households and that it has effects on the social betterment of their children particularly education, and future employment opportunities.

Table 11: Young adult and household respondents perceived climate change impacts within the study area. (Multiple responses were recorded)

Climate change impacts on the youth	Young Men (n=9) Frequency (%)	Young Women (n=9) Frequency (%)	Combined Youth (n=18) Frequency (%)	Household (n=40) Frequency (%)
Decline in natural resources	7 (77.8 %)	8 (88.9 %)	15 (83.3 %)	37 (92.5 %)
Food insecurity	4 (44.4 %)	9 (100.0 %)	13 (72.2 %)	40 (100.0 %)
Increase in water scarcity	6 (66.7 %)	7 (77.7 %)	13 (72.2 %)	38 (95.0 %)
Impact on wellbeing and health	2 (22.2 %)	6 (66.7 %)	8 (44.4 %)	33 (82.5 %)
Social unrest	3 (33.3 %)	1 (11.1 %)	4 (22.2 %)	15 (37.5 %)
Worsened poverty levels	7 (77.8.6 %)	8 (88.9 %)	16 (88.9 %)	31 (77.5 %)
Reduced agricultural production	5 (55.6 %)	7 (77.8 %)	12 (66.7 %)	38 (95.0 %)
Loss of income	7 (77.8 %)	7 (77.8 %)	14 (77.8 %)	39 (97.5 %)
Obstacle to social betterment	9 (100.0 %)	9 (100.0 %)	18 (100.0 %)	35 (87.5 %)
Loss of employment	6 (66.7 %)	5 (55.6 %)	11 (61.1 %)	29 (72.5 %)
Increase in women workload	6 (66.7 %)	8 (88.9 %)	14 (77.8 %)	35 (87.5 %)
Loss of assets	4 (44.4 %)	3 (33.3 %)	7 (38.9 %)	15 (37.5 %)
Loss of social network/social capital due to migration	5 (55.6 %)	7 (77.8 %)	12 (66.7 %)	32 (80.0 %)

4.5.6 Young Adults responses to the effects of climate change

Considering the impacts that climate change has on the youth's livelihoods and life decisions, the individuals are bound to have counteractive measures, so the impacts are not severe. Both groups seem to be responding to climate change through dropping out of school or changing their diet and lifestyle (Table 11). Most young men participants reported that a coping mechanism to climate change impacts was dropping out of school to pursue an income-earning activity, however, most young women reported to cope through changing their diet and lifestyle (Table 11). The data collected from the household surveys supported the findings from the focus group discussions with the young adults. However, there were some huge variations between young men responses and household responses in terms of water use efficiency, temporal migration and alternative livelihood.

Change of diet

Both young men and women indicated that to cope with food shortage, they have reduced their number of meals they have a day or skip meals, change their diets to food that do not require refrigeration and have switch to consuming cheaper and less nutritious food (Table 11). This finding correlate with the household interviews results where most of the households reported to have changed their diets and reduced their food consumption to cope with food shortage (Table 11).

Alternative livelihood

To supplement their loss of income due to low crop yields, the results show that both young men and young women have moved to non-farm activities (Table 11). The young women reported to be more involved in petty trading, and young men were moving into construction related activities. A few young men reported to had been involved in theft to get money. While young women, reported to had fallen pregnant to receive the social grant, as it allows them to attain monthly income that is guaranteed. Interesting finding was both young men and women reported dropping out of school as a way to adapt to financial difficulties. The findings also show that women are more economically active than men because men tend to be picky of what kind of jobs, they were willing to do.

Alternative farming methods

Young adults reported to be moving away from big gardens to having small gardens at home, planting a variety of different crops (Table 4-0-7). Use of goat manure as fertilizer was common among young men and young women to keep the soil moisture and fertilizer the soil. The data collected from the household surveys agree with the findings from the focus groups.

Extreme weather conditions

Most of the young men participants (55.6%) plant trees in the homesteads to protect their houses and crops from strong wind as well as to enhance the vegetative cover while creating shade (Table 11), a strategy learnt from the elders and farmers. To cope with flash floods, young participants (72.2 %) indicated to use different materials to protect their houses and properties from getting damaged. Some of the young adults reported to sleep with windows open at night as it is too hot. All the young women participants indicated that they had to adjust their working schedules due to heat stress experienced during the day, while only one male participant reported that he changes his working schedule due to the heat. The young women participants reported that they now do their house chores early in the morning before sunrise and late afternoon to avoid the heat (Table 11). The responses from the household correlates with both young males and young female responses.

Water use efficiency and water supply

To cope with the increasing water shortage, young adults reported to be implementing water efficiency methods such as using buckets to water their small vegetable gardens in their yard's early morning or in the evening, harvesting water in tanks, buying water from households with boreholes. Interestingly, re-cycling of used water is more common among the female participants (66.7 %). As water availability declines the female participants have reported that they now must walk long distances to collect water from the river and springs (88.9 %; Table 11). They further pointed that firewood as a natural resource is also declining in its availability thus, they now must walk long distances to collect it, and the available firewood is often wet. There was no variation between the young female and household responses, however there is a huge variation between young men responses and household responses.

Other adaptations

Temporal migration was form of adaptation was found to be more common in young men. Only two young women reported praying to God as a form of coping to climate change (Table 11).

Table 12: Young adults and household responses to climate change within the study area (Multiple responses were recorded).

Responses to climate change impacts on the youth	Young Men n=9 Frequency (%)	Young Women (n=9) Frequency (%)	Combined Youth (n=18) Frequency (%)	Household (n=40) Frequency (%)
Change of diet and lifestyle				
Reduction of food consumption	7 (77.8 %)	7 (77.8 %)	14 (77.8 %)	32 (80.0 %)
Change of diet	6 (22.2 %)	8 (88.9 %)	14 (77.8 %)	35 (87.5 %)
Change of working times	1 (11.1 %)	9 (100.0 %)	10 (55.6 %)	31 (77.5 %)
Efficient water use and water supply				
Water harvesting	4 (44.4 %)	7 (77.8.6 %)	12 (66.7 %)	25 (62.5 %)
Re-use of water	1 (11.1 %)	7(77.8 %)	8 (44.4 %)	30 (75.0 %)
Buy water	5 (55.6 %)	5 (55.6 %)	10(55.6 %)	23 (57.5 %)
Alternative Livelihood				
Informal trading (Petty trading)	3 (33.3 %)	7 (77.8 %)	10 (55.6 %)	29 (72.5 %)
Construction	6 (66.7 %)	2 (22.2 %)	8 (44.4 %)	9 (22.5 %)
Child grant	1 (11.1 %)	8 (88.8 %)	9 (50. 0 %)	31 (77.5 %)
Owning small business	6 (66.7 %)	6 (66.7 %)	12 (66.7 %)	25 (62.5 %)
Selling assets	5 (55.6 %)	2 (22.2 %)	7 (38.9 %)	27 (67.5 %)
Theft	4 (44.4 %)	0 (0.0 %)	4 (40.0 %)	0 (0.0 %)
Alternative farming methods				
Crop diversification	3 (33.3 %)	6 (66.7 %)	9(55.6 %)4	33 (82.5 %)
Use of fertilizers and pesticides	4 (44.4 %)	2 (22.2 %)	6 (27.8 %)	17 (42.5 %)
Mulching	1 (11.1 %)	4 (44.4 %)	5 (27.8 %)	25 (62.5 %)
Goat Manure	5 (55.6 %)	6 (66.7 %)	11 (61.1 %)	35 (87.5 %)
Other				
Temporal migration	8 (88.9 %)	2 (22.2 %0	10 (55.6 %)	7 (17.5 %)
Borrowingfrom friends/family/or village saving	3 (33.3 %)	7 (77.8 %)	10(55.6 %)	13 (32.5 %)
Tree planting or fruit trees for shade	5 (55.6 %)	3 (33.3 %)	8 (44.4 %)	40 (100.0 %)
Dry wood at home	1 (11.1 %)	8 (88.9 %)	9(55.6 %)	30 (100.0 %)

Responses to climate change impacts on the youth	Young Men Frequency (%) n=9	Young Women (n=9) Frequency (%)	Combined Youth (n=18) Frequency (%)	Household (n=40) Frequency (%)
Walking long distances to fetch water and gather firewood	2 (22.2 %)	8 (88.9 %	10(55.6 %)	33 (82.5 %)
Blocking water from rain	6 (66.7 %)	6 (66.7 %)	13 (72.2 %)	36 (90.0 %)
Dropping out of school	8 (88.9 %)	8 (88.9 %)	16 (88.9 %)	0 (0.0 %)
Use of substances (alcohol and weed)	5 (55.6 %)	0 (0.0 %)	5 (27.8 %)	0 (0.0 %)
Drinking water for heat	7 (77.8 %)	7 (77.8 %)	14 (77.8 %)	40 (100.0 %)
Sleeping with open windows at night	7 (77.8 %)	4 (44.4 %)	11 (61.1 %)	16 (38.1 %)
Praying to God	0 (0.0 %)	2 (22.2 %)	2 (11.1 %)	5 (12.5 %)

4.5.7 Influences on coping/adaptation strategies

The participants were asked where they learnt their coping strategies and what influenced them to implement such strategies. Both gender groups noted that the radio was their most popular source information (55.6 % from each gender; Figure 9). Most of the young participants were either self-taught/personal experiences (56.6 %) and through their social groups (56.6 %; Figure 9). One of the most interesting finding was that the female participants (88.9 %) felt that they were most influenced by their parents/grandparents in most decisions, from how they perceive the causes of climate change to how they implement coping strategies (Figure 9). This suggests that most of the knowledge the young female participants hold might be indigenous knowledge and learnt through informal sources. During the discussions they would always state "my grandparents said", or "my parents said"; it was rare for them to say something without reference of their elders' influence. However, the male respondents learnt a lot of their coping strategies from social media, radio and friends. When asked why they rarely refer to their parents, 89.1 % of the male participants indicated that "*our parents thinking isn't modern and keep referring all these changes of climate to ancestors and ritual practices which they the youth do not believe*".

On the other hand, most of the male participants indicated that they obtained their knowledge from internet (55 %) through mobile phones (Figure 9). Both male and female participants showed less interest in using print media as their source of knowledge. Most of the young women in the area, do not use mobile phones with internet, which might be the reason for them not relying on the internet

for information. Interestingly, no young participants reported to have learnt any adaptation strategies they implement from formal sources such NGOs, extension staffs/officers and school.

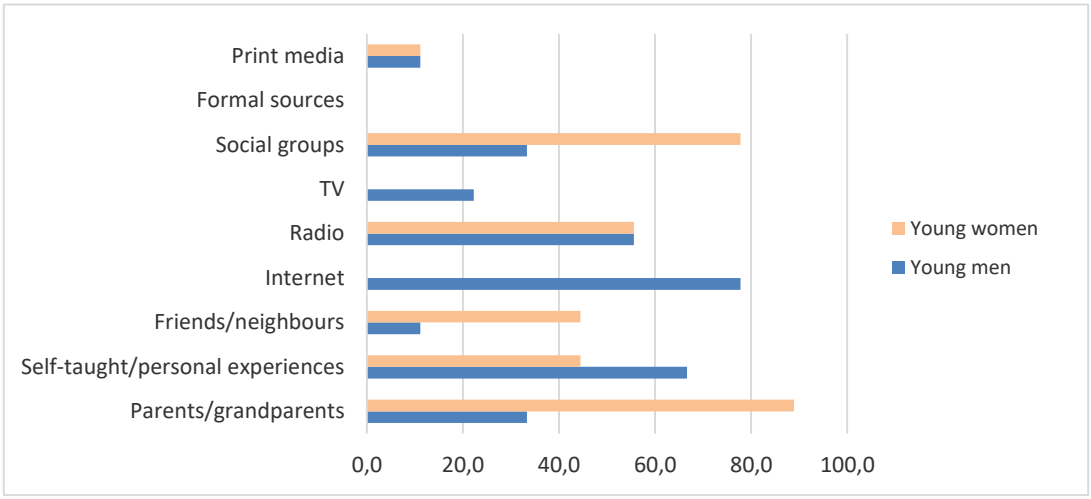


Figure 9: Sources that influence adaptation strategies implemented by young participants within the study

4.5.8 Climate change response barriers

This study found that various challenges hampered the responses to climate change in Matangari. All young participants cited lack of access to credit and money as their primary challenge to implementing effective adaptation strategies (Table 12). After lack of access to credit and money, 88.9 % of the young participants in the study area cited lack of support for implementing effective adaptation from government, while 88.9 % reported lack of knowledge and awareness (Table 12). Only 11.1 % of the young participants cited that there are no barriers that they are aware of. Other challenges cited included unemployment, lack of education and skills, lack of water and poverty (Table 12). One of the significant contrasts in the finding was in cultural/traditional norms. Only 33.3% of young men participants saw cultural norms as a barrier, whereas all young women participants saw this as a barrier (Table 12). For instance, during the discussions young women participants indicated that "*due to culture we are not expected to relocate to look for employment, we are however, expected to stay in the village and take of the households and work in farm. Only the males are expected to relocate to cities and work."*

One male participant also indicated that *"young women don't have access to resources as us men. Culture to inherit land because it is believed that they will get married to another household where the husband will have inherited land."*

Table 13: Barriers identified by the young participants to implementation of effective coping/adaptation

Barriers to effective adaptation	Young Men (n=9) Frequency (%)	Young women (n=9) Frequency (%)	Combined Youth (n=18) Frequency (%)
Lack of education and skill	7 (77.8 %)	7 (77.8 %)	14 (77.8 %)
Lack of water	5 (55.6 %)	6 (66.7 %)	11 (61.1 %)
Lack of knowledge and awareness	8 (88.9 %)	8 (88.9 %)	16 (88.9 %)
Cultural/traditional norms	3 (33.3 %)	9 (100.0 %)	12 (66.7 %)
Lack of support from institutions	9 (100.0 %)	7 (77.8 %)	16 (88.9 %)
No barrier	1 (11.1 %)	1 (11.1 %)	2 (11.1 %)
Lack of access to credit/finances	9 (100.0 %)	9 (100.0 %)	18 (100.0 %)
Unemployment	5 (55.6 %)	4 (44.4 %)	9 (50.0 %)
Lack of market access	4 (44.4 %)	5 (55.6 %)	9 (50.0 %)
Poverty	7 (77.8 %)	7 (77.8 %)	14 (77.8 %)
Lack of education and skill	7(77.8 %)	7 (77.8 %)	14 (77.8 %)

4.5.9. Solutions to climate change to implementation of effective coping/adaptation strategies

The results finding show that most (94.4 %) of the young participants see getting support and assistance from the government will increase their capacity to implement effective adaptation strategies (Figure 10). Furthermore, the youth participants felt that education and awareness (88.9 %), early warning forecast (72.2 %) and easy access to information (66.7 %) would help them be better prepared for extreme weather events (Figure 8). However, 11.1 % of the young participants felt that there was nothing they could do. The young participants also felt that regulations of natural resource use in their community (61.1 %) would help with the decline in resources (Figure 10). Only a few young participants (44.4 %) felt that the return to old cultural and traditional practices would stop climate change from happening (Figure 10).

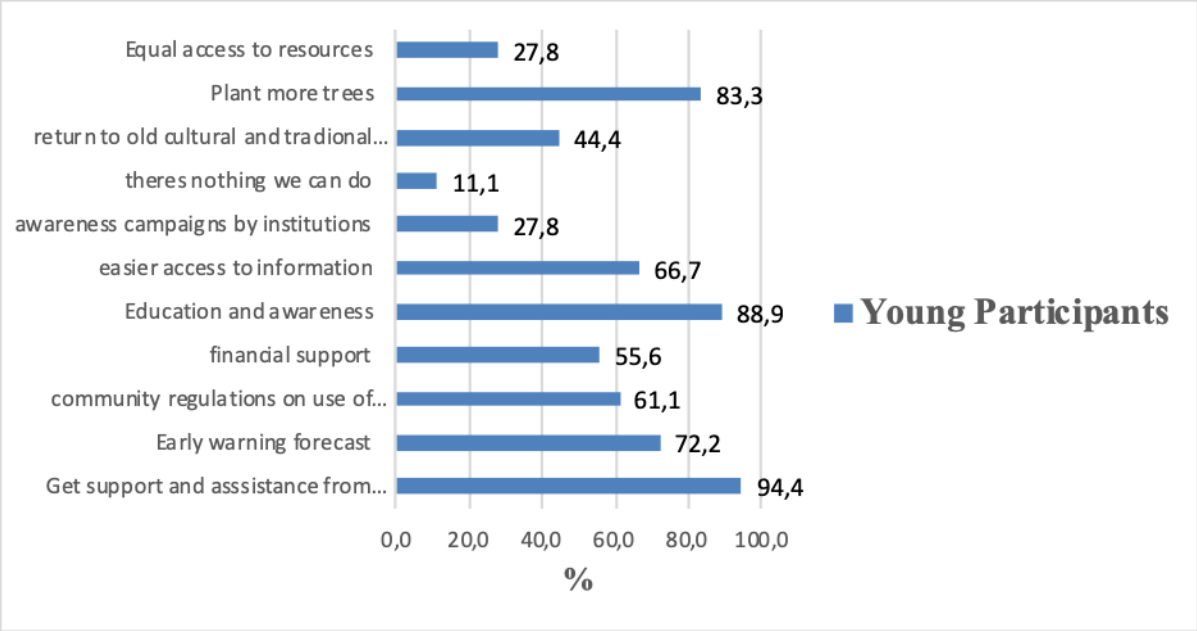


Figure 10: Young participants' views on solutions to climate change impacts

4.5.10 Institutional Support

They young people were asked if they receive any institutional support to adapt to climate change. All the young participants indicated that they did not receive any support from the institutional support such as NGO's or the government. An analysis of the 2015/16–2018/19 IDP Municipality of Thulamela and the Limpopo Climate Response Review shows that local governments have prioritised water, sanitation and waste disposal infrastructure backlogs, which is not related to climate change nor being narrated by analysis of a specific groups such as the young adults. The National Climate Change Adaptation Strategy (2017), addresses the challenges climate change poses and proposes adaptation strategies for rural communities, however, within these strategies the young adults need and challenges to climate change are not well established.

The results show that the young adults preferred external institutional support where from schools and NGO's (Figure 11). The results show a huge variation of preferred support between the young adults and household respondents (Figure 11).

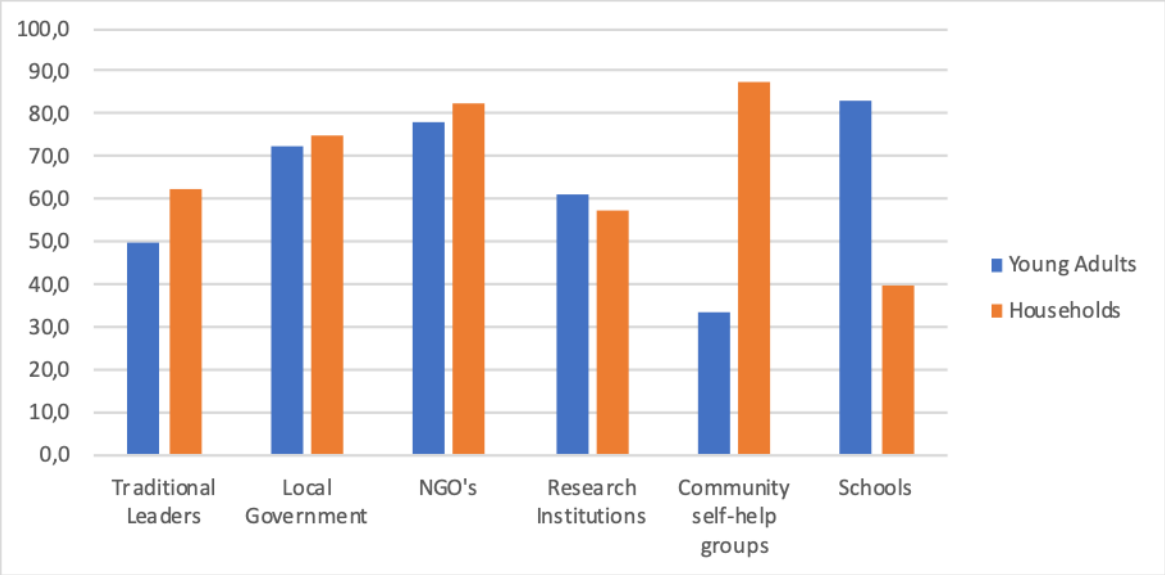


Figure 11: Preferred Institution support for climate change adaptation

CHAPTER FIVE: DISCUSSIONS AND RECOMMENDATIONS

2.5. DISCUSSION

This section discusses the study findings on climate change adaptation measures in Matangari Village of Limpopo Province in South Africa. The research assessed the climate change knowledge and perceptions of young adults and households. It further explored the impacts of climate change on young adults and households, their adaptation measures, barriers and solutions to effective adaptation.

The research findings show that the changing climate directly and indirectly affects the household income and impacts the lives of the young adults. One unanticipated finding was that in many cases, the household responses differed quite significantly from the young adults' responses. Furthermore, the study found variations regarding the level of knowledge amongst young men and women (Table 6). Their views on the causes of climate change (Fig 8), sources of information (Table 7) and adaptation measures implemented (Table 11) also differed. The above-mentioned research findings are also linked with existing broader literature available.

Households in Matangari Village were headed more by females than males (Table 4). These findings support the StatsSA (2016) findings which found that majority of the households in Matangari are headed by females. This indicates that most of the households are headed by single parents, particularly females. The results show that the females in these households are either single or divorced. The households that are headed by married females are due to the fact that their husbands are working out of town. Data collected on socio-economic characteristics of young adults and household heads indicates that there is no difference between them in terms of education and employment. With regards to education, the research findings demonstrate low level of education among young adults and household heads as most participants did not complete their secondary education (Table 4). Thenya (2014) found that majority of the educated individuals from rural communities mostly move to cities in search of better employment opportunities to better their lives. The findings further illustrate that most of the young adults and household heads are not economically active, while those that are economically active are mostly not employed in formal sectors (Table 4). Studies have shown that the lack of formal education and proper skills makes it difficult for them to compete for employment in formal sectors with better paying wages and opportunities (Babagura, 2003).

Past and recent literature has shown that for households to maintain their livelihood and increase their capacity to adapt with climate change, they need to have access to assets (Smit & Wandel, 2006; Ospina & Heeks, 2010; Lemos et al., 2013; Sujakhu et al., 2019). Their findings indicate that having restricted access to those assets decreases a household's adaptive capacity. This has been confirmed by this study. Majority of the households in the study area have limited access to social, financial,

political, natural and physical assets, indicating that they are more vulnerable to climate change impacts and might find it hard to recover after climatic shocks.

The findings of the study show that the households lack both physical and financial assets that can be used as a guarantee to access credit from formal credit and financial institutions (Table 5). This confirms the findings of Ospina & Heeks (2010) that majority of female-headed households in rural areas lack assets that can be easily converted into cash. This causes them to rely on family or friends for credit and/or to borrow from informal financial services such a loan sharks with high interest rates, which they are unable to pay back in most cases. According to Smit & Wandel (2006), participation of female headed households in social organisations is less than that of male headed households. However, this finding does not apply to the findings of this study as most households within the study area are members of social and community-based organisations (table 5). A study by Sujakhu et al. (2018, 2019) found that female headed households from rural communities are less likely to use technology to access information and implement scientifically proven adaptation measures which is confirmed by this study (Figure 6) as most household heads and the young women from the focus group indicated that they use indigenous knowledge.

The young adults showed less interest in their formal education (i.e. school) and more interest in finding some form of income generating activity so that they are able to help provide for their families. This was a common response across both gender groups. Most young adults said they wanted to start farming and/or to find other income generating activities rather than continue with their studies. This was despite their love for formal education, dreams to build careers, and dreams to move to the cities where opportunities were greater. A study by Thomas (2011) found that young adults from rural areas in India showed more interest in going to school and building professional careers rather than being trapped in the farming industry. This clearly indicates that farming or other forms of employment that these young adults engage in are as a result of their financial circumstances. Moore (2015) and Lauterbach (2016) reported that young female adults would rather relocate to cities than stay at home to face all the financial difficulties. However, this study showed that the young female adults are not allowed to relocate or migrate to cities due to cultural believes while men are allowed to go seek employment elsewhere (Table 12). This could be the reason why most households in the study area are headed by females (Table 4).

The findings revealed that the young adults had different perceptions of climate change from that of the household respondents (figure 4 Table 8). The majority of the young adult participants related more strongly with the current climate conditions than those of the past. From the results, it is evident that although the young adults are aware of the changes in climatic conditions that had occurred over the past 10 years, their scientific knowledge of climate change effect was absent or limited. The young adults' observation was closely linked to the current changes in weather conditions. Moreover,

both gender groups indicated some kind of knowledge on the topic. According to the results (Table7, Figure 9), the young adults learnt about climate change mostly through personal observation, common media communication modes (i.e. cell phones, radio and television), and social groups. However, this mode of obtaining information also varied across the two gender groups; the men relied more on their cell phones, while the women's main source of information were their mothers, grandparents, social groups and friends (Table 7). These results are supported by studies which also indicated that young women's behaviours are mostly influenced by people they are familiar with and trust (Moore, 2015; Lauterbach, 2016). In comparison to the household results, the young adults were less knowledgeable about climatic changes which happened over the past 10 years in their area (Table 6), probably because they were too young to notice any climate changes at that time. Moreover, most household members reported to have learnt about these changes mainly through observation. The differences may be attributed to the variations in the participants individual ages within each category, as well as the variations in their educational background. This is supported by a study by Herman-Mercer et al. (2016) which found that different generations observe and understand weather changes in different ways. The elders observed weather changes through experiences and what they were told while growing up, whilst the young adults observed it as weather variables (temperatures, wind, precipitation, clouds etc).

In addition to that, this study found that the causes of climate change are believed to be different by the older and younger generation. However, the young females shared similar beliefs to that of the older generation either. The young men believed that pollution, deforestation, natural causes are the main causes of climate change, while the older generation and young female adults believed that disrespecting ancestors, abandoning traditional/cultural practices and lifestyles changes were responsible for climate change (Figure 8). Literature indicated that different beliefs of causes of climate change might result in different responses with regards of adaptation to the changing climate (Grothmann & Patt, 2005; Herman-Mercer, et al., 2016) The household respondents attributed it to supernatural powers while young men attributed it to scientifically proven human activities. This indicates the different worldviews of the different generations. The association of environmental and social change shows that household heads identify various threats of climate change to the community before the young men do. Household heads believe that if they change their ways of living, climate change will end. While the young men feel that the changes happening will not stop and are beyond their control and no ritual can stop them and are instead finding ways to cope with these changes (Figure 9). The findings are similar to those by Lorenzoni et al., 2006 who found that different understanding and opinions on climate change often act as barriers for effective implementation of adaptation strategies.

The young adults associated their risk to climate change with their social, future and professional lives, thus influencing how they react to the changing climate effects (Table 9). Furthermore, it was

evident that the concerns regarding the changing climate varied across the genders; the young women were more concerned about impacts on things such as food insecurity, insufficient water, increases in their day-to-day duties. On the other hand, the young men were more concerned about the decreases in employment and income as consequences of climate change. This suggests that men are more concerned about their role as providers (breadwinners) of their households, while women are more concerned about the day to day running of the households. And this is because of cultural hierarchy in the community. In general, one can conclude that the level of concern and attitude of an individual towards the environment is mostly influenced by one's family background (Lorenzoni, 2007; Semenza et al., 2008; Hulme, 2010; Erikson, 2016).

The study established that there is a disparity in attitude between young men and young women with issues that relate to the environment. The young men's attitude and behaviour towards their environment developed through their observations and experiences, while the young women's attitude and behaviour have been largely influenced and passed down to them by their elders. The results (Table 6) show that some of the young adults from the study area had a fair amount of knowledge on climate change and were worried about the long-term effects of the changing climate on their lives and livelihood. However, their attitude and perceptions towards climate change risks did not align with their behaviour towards implementing strategies to reduce the impacts of climate change. This is shown by the several reasons given as to why they had not changed their behaviour to respond to climate change accordingly. In the group discussions one of the participants reported that "they cannot stop cutting down trees as they use firewood to cook and electricity is expensive." The findings of this study correlate with several other studies which demonstrated that if an individual has information about climate change, it does not necessary mean that they are to do anything about it (Lorenzoni, 2007; Hulme, 2010; Whitmarsh et al., 2011; Erikson, 2016). This behaviour could be due to the negative attitude surrounding climate change or the uncertainty of how big the risk is.

The effects of climate change have resulted in lower crop yields and therefore decreased household incomes (Table 10). Reduced household income has caused numerous repercussions to the lives and livelihoods of the young adults. They young adults also mentioned food insecurity and a decline in natural resources, in addition to loss of household income, as a consequence to climate change (Table 10). Studies in rural communities show that reduction of household income affects the education of the young adults as households cannot afford to cover the costs for education, and this was also seen in this study (Hanna & Olvia, 2016; Barbier & Hochard, 2018). Reduced household income forces young adults to seek employment, rather than going to school, to assist in providing for their families and their younger siblings education. Secondly, studies also show that reduction of income results in reduced in food consumption/or portions, leading young men to commit crime or young women falling pregnant to get money from child grant to buy food (UNICEF, 2015; Hanna & Olivia, 2016). During this study, most young females indicated that when households encounter financial

difficulties, the girls are the first to be removed from school. Subsequently gives the young females chance to fall pregnant. Young female adults fall pregnant in order to qualify for government grants to help with household costs. Mzimela (2015) states that most rural household have become more reliant on social grants which are a guaranteed source of income as a means to improving their financial status. This further elaborates on a study in the same village by Lahiff (1997) who found that it is common in rural communities for young women to fall pregnant at a young age.

This gives reason why young male adults perceptions about climate change causes are scientifically aligned since they stay at school and are exposed to the educational side of the environmental effects. Whereas female young adults are pulled out of school as a consequence of climate change effects.

Climate change adaptations and coping strategies implemented by young adults include, re-use of water, borrowing money, drying and selling of firewood, changing diet, theft, reducing meals and buying water to drink (Table 11). These have been found to be common strategies among young adults and rural households to cope with the climate changes effects. Studies by Sajakhu et al. (2018) and Assan et al. (2018) support the study findings that both young female adults and young male adults have been adopting coping measures such as changing diet, searching for and selling wild fruits, vegetables and firewood to ensure their food security and financial status to offset the effect of changing climate when the harvesting of crops is low. Research has shown that hunger has forced young males to engage in risky activities to obtain an income including petty crime and joining gangs (Babagura, 2005; Barnett & Adger, 2007; Hood et al., 2011; Pereznieto et al., 2011). This study agrees with Pereznieto et al., (2011) loss of household income due to extreme weather-related events caused financial difficulties, often leaving the young adults dropping out of school.

Furthermore, findings of the study suggest that the household head gender, level of education and age are more likely to influence strategies implemented to respond to climate shocks. Literature has shown that household setups will define the choice of strategies available for coping with climate related stresses (Buyinza & Wambede, 2008; Deressa et al., 2011). These studies found that households headed by women were more likely to implement coping strategies such as reduction of food consumption, re-use of water, and water harvesting because that is what is available to them and they have to use their resources in a sustainable manner. During the household surveys, the respondents indicated that the response techniques they implemented were short-term and they were aware that it cannot sustain them for a longer period.

The adaptation strategies of the household members differed from that of the young adults, and the latter were biased to specific gender groups. Adaptation strategies included planting trees for shade, crop diversification, moving to small gardens and water harvesting (Table 11). The study also shows that most of the households have diversified their sources of income streams through non-farming activities using the skills they have such as carpentry, building, sewing, cooking, and trading to help

them adapt (Table 11). However, the findings show that young female adults are more involved in petty trading, while young men are more involved in wage-based employment such as construction. A study done in Botswana by Babagura (2005) confirms these findings indicating that young men feel that they need to do hard labour jobs and this thought is culturally embedded amongst men in rural areas. Differences in roles and responsibilities are shown in the choices of adaptation strategies implemented by the young people and indicate that environmental stress and changing climate are factors known to intensify pre-existing problems, disparities in development and gender inequality within the community. In this regard, studies have demonstrated that young female adults would be more impacted upon by the changing climate than men because young male adults have more access to resources (Nelson et al., 2002; FAO, 2019; Babagura, 2005).

The young adults mentioned limited access to resources, unequal distribution of resources, access to finances, and socio-cultural norms as their major barriers in implementing effective adaptation measures (Table 12). This was also seen in past studies done by Goh, (2012); Mzimela, (2015); Assan et al., (2018). However, socio-cultural norms can also be seen as additional barriers particular for young female adults since they restrict them from performing certain activities (Goh, 2012; Assan et al., 2018). The study also found that these barriers in turn have a major influence in attitude and adaptation responses of young adults towards the impacts of climate change. Previous literature correlate with the results of this study that indicate that the rural young adults face several challenges such as high levels of poverty and unemployment and as a result do not necessarily see climate change as a priority over those issues (Shaw, 2006; Dulal et al., 2010; Pereznieto et al., 2011; Kirkbyshire & Wilkson, 2018). It was found that most of the young adults implement coping strategies as a means of survival (Table 11). In this case, during the discussion, the young participants indicated that they know that they shouldn't cut down healthy trees for firewood, but they need it as they use it for cooking, light and heating. So that is the sacrifice they are willing to make because electricity is expensive.

Female household heads and young adults, particularly young female adults are part of social organisations such as stokvels and burial schemes that assist them during times of need; whether financially or otherwise (Table 5 Figure 9). Furthermore, the study shows young male adults and male households head coped by selling their cattle and other livestock to improve their financial status during periods of drought and other extreme weather events. Households mentioned that they are improving their housing structures using stronger materials. The above indicates that even though rural households have limited access to resources, they still find means to feed their families and provide security. Even though their coping strategies do not enable them to cope for longer terms, they provide them with immediate response to shock as adaptation is a need for them not a choice. Some of the young female adults, during the group discussions, gave explanations that supernatural powers were responsible for climate change and it was only through performing rituals that climate

change can be stopped. Earlier studies finding showed that with support of formal institutions and awareness campaigns that deal with climate change, an individual's attitude and behaviour would change (Shaw, 2006; Dulal et al., 2010; Perenznieto et al., 2011; Kirkbyshire & Wilkson, 2018). These studies indicated that with support and awareness, an individual can become more cautious and play a huge role in combating the impacts of climate change, while also empowering themselves with better skills and strategies to adapt to the changes.

Climate change effects also have an impact on cultural rules and norms because the female household heads are advising their daughters to move out of the community to search for better opportunities even though this is against the cultural norms. Studies by Shackleton et al. (2014) and Anuga & Gordon (2016) indicated that cultural norms and beliefs act as a barrier because people are not exposed and therefore lack scientific knowledge; if people are given access to scientific information, this can promote better understanding and application of better adaptation methods. There is a link between social status, culture and gender in shaping the young adults' access to control of vital resources for adaptation to climate change. In particular, the fairly low involvement of young women in some climate change responses such a migration or selling of assets is embedded in socio-cultural standards and gender inequalities. The gender inequalities were also shown in the household ownership of land, where most of the female household heads reported not to have owned land because culture does not allow them to own land, while the female heads that did own land indicated that they had inherited their land from their husband (Table 5 Table 12). Despite the current inequalities, the vulnerable young females show resourcefulness in decreasing their vulnerability to the adverse effects of the changing climate. These results agree with the other studies that have reported that, despite inequalities that women face with the access to resources, they implement a variety of coping strategies to reduce their vulnerability to the effects of climate change on their households and livelihoods (UNDP, 2010; Assan et al., 2018; Jin et al., 2015; Wringley-Asante et al., 2017).

The majority of the young participants and household respondents had dropped out of school in their secondary level and do not possess a matric certificate (Table 4). Based on their level of education, it is expected that their level of adaptation strategy implementation? to climate change will be fair but not efficient (Babagura, 2005; Ayanlade, 2006; Blankespoor et al., 2010; Walmse et al., 2012). Previous studies have found that with adequate formal training, formal education and qualifications, household and individual adaptive capacity to cope with disasters can be improved while offering better options to support families and increasing opportunities to get better paying jobs. However, a more common adaptation strategy developed by all community members includes the shifting of day-activities to morning or night to reduce the health impacts climate change might have on them (Adger et al., 2004; Walmse et al., 2012; Thenya, 2014) which was also noted in this study (Table 11) .

The community (household heads and young adults) of Matangari Villag in Limpopop, South Africa expressed that social organisations were the preferred support for climate change initiatives. Some of the young participants indicated that their parents had previously received support in the form of seeds and fertilizers from external sources. These external sources include the government, relatives and friends. It was established during the discussions that those that indicated that they had received support from the government or other external sources were referring to "Tshiombo Irrigation Scheme". This was a government initiative that helped the community with tractors, seeds, water bailiffs and skilled people to monitor the water distribution. However, this support from the government has been withdrawn and it is unclear as to why it has been withdrawn. According to Adger et al. (2003), Aalst et al. (2008) and Ziervogel et al. (2016), the relationships between government, communities, researchers and other external agencies are important to help communities implement successful and sustainable climate change adaptation. These indicated that a collective action is better than individually pursued action.

Findings from the study show that young adults have no support from external agencies and climate change is not part of their school curriculum (Table 12). Studies have shown that in areas where young adults are given support from government and NGO'S, it is easier for them to cope with climate change (Hargreaves et al., 2003; DEFRA, 2003). It has also been shown that climate change education should be part of school curriculum (Hargreaves et al., 2003; DEFRA, 2003). This was supported by a study done by Mugambiwa (2018) on students from rural areas and concluded that if rural students are taught about climate change, they have the potential to contribute effective coping strategies and be agents of change within their communities. So, it is evident that if the young adults of Matangari village are well informed about climate change, they have the potential to implement better adaptation strategies and also educate their communities and be the voice of change within their community. The young adults indicated their preference of climate change being part of school curriculum and getting support and access to information from external agencies such as government, research institutions and NGO's. Interestingly, household respondents raised concerns that research institutions only come to get information from them while conducting research, but never come back to them to educate them on what they have found through their research. They reported that they would prefer to get reports of research that is conducted in their community because whatever they find affects them.

The young adults indicated their lack of interest in farming and indicated that even though they were to get support they would not practice farming. They were more interested in gaining skills which would improve their chances of getting better job opportunities for them and improving the financial situations in their households. In Contrast the household surveys indicated that the household respondents would like to go back into farming as this is what they know. The household respondents also indicated that while they receive assistance from relatives and social groups, there is an urgent

need for immediate intervention from external organisations to help them cope with the impacts of climate change and improve their food security. Participants explicitly stated that they required food assistance, small ruminants, farm products, health care services, water and credit (Figure 7, Figure 11). Literature has shown that as climate change intensifies, more and more rural communities will abandon their farming activities and move to non-farming activities, opting for wage employment (Babagura, 2005; Ayers & Huq, 2009; Thomas, 2011; Wilson et al., 2013).

From the above discussion, it is evident that all the young adults of Matangari village are aware of changes in the climate. However, their understanding of the causes of climate change are very different and are influenced by different elements. They are all worried about climate change, especially about its implications in the future but their level of urgency and preparedness for future climate change impacts are very low. This also means that their coping response to climate change impacts may differ, as coping methods implemented are influenced by how one observes, understands, and perceives the changes and risks.

It was evident that even though 44 % of the participants indicated that they had not heard about climate change until the study, they were still aware of the changes in climate change and adaptation strategies that they could implement to mitigate its effects.

2.5. Conclusion

Climate change has affected the lives and livelihoods of young adults of Matangari village in Limpopo, South Africa through loss of income of their households. The study findings demonstrated that they are not really worried about climate change but were more concerned about whether they will still have better opportunities to improve their livelihoods and education. This study was able to show that finances, inequality, and cultural norms were barriers for young adults to adopt proper adaptation strategies. These have impacted them negatively as they are currently still implementing coping strategies that will affect them now and in the future. The study was also able to determine that most of the adaptation and coping strategies they implemented were not their preference but were determined by their situations and backgrounds. Additionally, lack of awareness and lack of access to proper information played a huge role in their perspectives on climate change and response to risk caused by climate change.

5.3. Recommendations

Based on the conclusions reached by the study findings, I would make the following recommendations:

- The young participants lack knowledge and understanding of the concept of climate change and lack of concern indicates that there is limited access to scientific knowledge and

information. It is recommended that there are regular awareness campaigns targeting rural areas by local government, NGOs, and other agencies. Climate change programs should be included in school curriculum from primary to secondary level. There should be regular climate change education awareness programs on radio, target the youth. If climate change awareness programs are done regularly, this would improve the young people's access to information.

- The lack of proper skills was of concerns for young adults who indicated that it is difficult for them to get proper employment as a result of dropping out of school. It is recommended that proper support is provided in rural areas that motivates them and provides them with platforms to identify other opportunities. This could also help them to engage on matters of climate change, share adaptation and coping strategies to climate change. It is also recommended that there must be more resources allocated to develop young adults and increase their participation in matters involving climate change. The government and non-government organisations should lessen the accessibility and communication barriers for vulnerable communities by establishing internet and technology access
- Further research is recommended to understand on a broader context, the implications of climate change on rural young adults livelihoods, their beliefs and constraints they encounter from implementing effective adaptation measures.
- Further research is recommended to understand the heterogeneity of rural households, their adaptive capacities and the range of land-based livelihoods they deploy in the context of a changing climate in the Limpopo province.

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APPENDENCES

Appendix A: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF ANIMAL, PLANT AND ENVIRONMENTAL SCIENCES ETHICS COMMITTEE CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: 1911**
PROJECT TITLE	Assessing climate change adaption measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province.
INVESTIGATOR	Muofhe Ravhura
SCHOOL/DEPARTMENT OF INVESTIGATOR	Animal, Plant and Environmental Sciences
DATE CONSIDERED	18 October 2019
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	Date of submission of the project report
ISSUE DATE OF CERTIFICATE	**CHAIRPERSON** (Dr Shalini Dukhan)

cc: Supervisor/s : Dr Ute Schwaibold

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

Signature _____ Date 22 / 10 / 19

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix B: Participant Information Sheets

Household Interviews: Participant Information Sheet

Title: Assessing climate change adaption measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province.

Dear Participant

My name is Muofhe Ravhura. I am a student studying towards a Master's of Science in Environmental Sciences Degree, at the University of the Witwatersrand (WITS) in Johannesburg. My research project is on assessing the perceptions and adaptive capacity of youth to climate change in rural areas. I am interested in knowing what the different understanding of climate change and different methods implemented to cope with climate change, as well as also how the government or traditional authorities in the Thulamela local municipality manage the challenges of climate change and build resilience against these challenges in the rural communities.

I would like to invite you to participate in my research. The information you provide during the research will be safely protected. By participating in this study, you agree that there will be no benefits gained from this study. Apart from contributing to the academic research, the outcomes from this study maybe accessible for policymakers and other interested parties working on similar projects. Results of this research may possibly be published on journals and presented in seminars and conferences. This interview will take approximately one and hour in length. The target participants of this research are the head/spouse/eldest of households (male/female/children above 18 years). Participation in this research is completely voluntary. You may withdraw at anytime or not answer any question if you do not want too. I would like to record the interview and take photographs for accuracy purposes, but will do so if you consent. No incentives or rewards will be provided for participation in this research.

If you have any questions or concerns about my research, please feel free to contact me or my supervisor via the following email addresses:
Student: Muofhe Ravhura: 0606259Y@students.wits.ac.za
Supervisor: Dr Ute Schwaibold: Ute.Schwaibold@wits.ac.zaUniversity Human Research ethics committee (non-medical): Shaun.schoeman@wits.ac.za

Kind regards,
Muofhe Ravhura

School of Animal, Plant & Environmental Sciences

Private Bag 3, Wits 2050, South Africa ·Enquiries: Tel.: +27 (0) 11 717-6403 | Fax: +27 (0) 11 717-6494

Title: Assessing climate change adaption measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province.

Dear Participant

My name is Muofhe Ravhura. I am a student studying towards a Master's of Science in Environmental Sciences Degree, at the University of the Witwatersrand (WITS) in Johannesburg. My research project is on assessing the perceptions and adaptive capacity of youth to climate change in rural areas. I am interested in knowing what the different understanding of climate change and different methods implemented to cope with climate change, as well as also how the government or traditional authorities in the Thulamela local municipality manage the challenges of climate change and build resilience against these challenges in the rural communities.

I would like to invite you to participate in my research. You will be required to participate in a group discussion with myself and youth members (above 18 years). The discussion will take approximately one and hours. The information you provide during the discussion will be safely stored in a secured computer. Please note that participation is completely voluntary and that there will be no benefits gained for participation or penalties for the lack thereof. Apart from contributing to the academic research, the outcomes from this study maybe accessible for policymakers and other interested parties working on similar projects. Results of this research may possibly be published on journals and presented in seminars and conferences. You may withdraw at anytime or refuse to answer any question if you do not want to. I would like to audio-record the discussion and take photographs for accuracy purposes, but I will do so with your permission.

If you have any questions or concerns about my research, please feel free to contact me or my supervisor via the following email addresses:

Student: Muofhe Ravhura: 0606259Y@students.wits.ac.za

Supervisor: Dr Ute Schwaibold: Ute.Schwaibold@wits.ac.zaUniversity Human Research ethics committee (non-medical): Shaun.schoeman@wits.ac.za

Kind regards,

Muofhe Ravhura

School of Animal, Plant & Environmental Sciences

Private Bag 3, Wits 2050, South Africa ·Enquiries: Tel.: +27 (0) 11 717-6403 | Fax: +27 (0) 11 717-6494

APPENDIX C: CONSENT FORM

Title: Assessing climate change adaption measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province.Researcher: Muofhe Ravhura

CONSENT FORM FOR HOUSEHOLD INTERVIEWS

The research aims and objectives have been explained to me and I am aware that by signing at the bottom of this page I agree to participate in this study. By participating in this research project, I agree to the following (tick the correct box):

	YES	No
I confirm that I have been informed of the research and the project		
The interview is purely voluntary		
I agree that this interview is confidential		
I can stop if I'm not comfortable at any time		
I agree to be honest and answer what I am comfortable with		
I am able to understand this document or, if not, I am able to hear and understand when the form is read or translated to me		
I will be recorded during the interview or I do not agree to be recorded. I can stop or erase any information of my recording that I do not want to be recorded		
I agree that pictures can be taken or cannot be taken		
My participation in this study will take approximately one and a half hour		

Name of the interviewer: ……. Gender: M/F

Date of interview: ……

Interview start time:…….

Interview end time: ……..

Signature:……..

School of Animal, Plant & Environmental Sciences

Private Bag 3, Wits 2050, South Africa ·Enquiries: Tel.: +27 (0) 11 717-6403 | Fax: +27 (0) 11 717-6494

Title: Assessing climate change adaption measures in rural areas: A case study of Matangari Village, Thulamela Local District, Limpopo Province. Researcher: Muofhe Ravhura

CONSENT FORM FOR FOCUSED GROUP DISCUSSIONS

The research aims and objectives have been explained to me and I am aware that by signing at the bottom of this page I agree to participate in this study. By participating in this research project, I agree to the following (tick the correct box):

	YES	No
I confirm that I have been informed of the research and the project		
The interview is purely voluntary		
I agree that this interview is confidential		
I can stop if I'm not comfortable at any time		
I agree to be honest and answer what I am comfortable with		
I am able to understand this document or, if not, I am able to hear and understand when the form is read or translated to me		
I will be recorded during the interview or I do not agree to be recorded. I can stop or erase any information of my recording that I do not want to be recorded		
I agree that pictures can be taken or cannot be taken		
My participation in this study will take approximately one and a half hour		

Name of the participant: ……. Gender: M/F

Date of discussion: ……

Discussion start time:……. Discussion end time: ……..

Signature:……..

Appendix D: Questionnaire survey form (Household)

Household Interview Information

Name of interviewer: Date of Interview:

Gender: M/F house number/ GPS Coordinates:

1. Demographic

1.1 Person number	1.2 Age	1.3 Gender	1.4 Marital status	1.5 Relation to household	1.6 Resident status	1.7 Education status
1.						
2.						
3.						
4.						
5.						
6.						
7.						

Name of household head

What is your home language?

What is the size of the household?

2. Human Capital

What kind of skills do you have?

How did you acquire those skills?

When you or anyone in the household gets sick where do you first look for treatment/assistance?

Do you have any medical facility close by where you live?

How far is it to walk from your house?

Do you have any medical condition that requires you to need medical facilities? YES/NO

If yes, which one?

Was there a time in the past year, when you had no food? YES/NO

If yes, what was the cause?

3. Social capital

Do you have relatives around the village? Yes/ No

Are you part of any social organisations/groups in the village?

Social group	Please tick
None	
Burial scheme	
Stokvel	
Youth Organisations	
Grocery schemes	
Cultural groups	
Agricultural/farming groups	
Women's organisation	
Other (specify)	

How do you as a community communicate?

Form of communication	Tick
Social network	
cell phones	
Community meetings	

Other (specify)	

4. Physical Capital

What type of housing is available?

How many structures are owned by the household?

What is the main roof material and wall material of the house where the household is staying?

What kind of sanitation does the household have?

Where you get your water for household/domestic use from?

Do you own any livestock? Yes/No

Please list them.

Types of assets the household posses

ASSETS	YES/NO
Bed	
Chair	
Television	
Stove	
Car/van	
Radio	
Wheelbarrow	
Cell phone	
Sewing machine	
Generator	
Solar panel	

Table	
Bicycle	
Donkey cart	
Water well	
Cupboard	

5. Financial Capital

What are the main sources of income in your household?

1. First source
2. Second source
3. Third source

What is the monthly household income?

Income	tick
< R1000	
R1001- R3000	
R3001- R7000	
R7001- R10000	
>R10001	

Do you have access to credit facilities? YES/NO

What type of credit facilities are close to you?

Have you ever applied for a personal or business loan? YES/NO

If yes, what was the reason for it?

What kind of businesses do you own?

Where do you sell your products?

How do you transport your products?

6. Natural Capital

Do you have any farming land available?

What do you use your land for?

What are the main crops you plant?

Is there water available close to your land?

How far is this land from your house?

How much harvest have you sold from the land?

7. Knowledge about climate change

Before this discussion had you had about climate change?

Yes No Maybe

If yes, do you understand what climate change is?

A lot A little nothing I've just heard about it

How did you hear about it?

Do you believe climate change is happening?

How has the climate or weather changed in the last 10 years?

What do you think is causing climate change?

How has it affected you and your livelihoods?

Do you talk to your parents about these changes?

What are you doing to cope with these changes?

If no, why are not doing anything?

Where did you learn the coping measures you are implementing?

Do you receive any support to cope with the changes?

What do you think should be done to help you cope with the changes?

Do you have collectively adaptation methods as a community or individual adaptation strategies?

Code sheet

Age 0-15= 1 16-25= 2 26-40= 3 41-60= 4 61 and above= 5	Gender M=1 F=2	Marital status Single= 1 Married= 2 Divorced= 3 Widow= 4	Relation to household Household head =1 Spouse= 2 Daughter=3 Son= 4 Parents to the head= 5 Aunt= 6 Uncle= 7 Niece= 8 Nephew= 9 Other (specify)= 10	Resident status < 6 months= 1 1-5 years= 2 6-10 years= 3 > 11 years= 4	Education level (only above 16) None=0 Primary= 1 Secondary= 2 Tertiary level= 3 Other (specify) = 4	Employment status Unemployed= 1 Self-employed= 2 Formal employed= 3
Types of skills	Types of illness or condition	Reason for shortage	Health facility	Reason for choice of treatment	Type of Sanitation	Where water is obtained?

None= 0 Computer skills= 1 Driving= 2 Plumbing= 3 Carpentry= 4 Electrical= 5 Construction= 6	s None=0 High blood pressure= 1 Low blood pressure= 2 Diabetes= 3 HIV/AIDS=4 TB= 5 Depression/ mental illness= 6 Alcohol abuse= 7 Substance abuse= 8 Disability =9 Other (specify)= 10	of food Lack of money=1 Lack of employment= 2 Poor health= 3 Livestock dying due to lack of water= 4 Vegetables dying due to lack of water= 5 Lack of markets= 6 Lack of credit= 7	None= 0 Traditional healer= 1 Clinic= 2 Hospital= 3 Pharmacy= 4	Don't have access/transport = 1 Don't like the health facility = 2 Don't have money = 3 Prefer to use traditional healers = 4 Prefer to self-treat = 5 Not necessary= 6 Husband did not give permission = 7 Other (specify)= 8	None= 0 Pit latrine=1 Flush latrine= 2 Bush= 3	Communal taps=1 Tap in the household= 2 Communal Boreholes=3 Household borehole=4 River/dam= 5 Rainwater tank=6 Other (specify)= 7
Social Group	Source of income	Types of credit	Different types of businesses	Types of livestock	Types of crops	Types of house Mud= 1

None=0 Burial scheme=1 Stokvel=2 Youth organisation =3 Grocery schemes=4 Cultural schemes=5 Agricultural / farming groups=6 Women's societies=7 Other (specify)=8	None= 0 Child grant= 1 Old age grant= 2 Disability grant=3 Care dependency grant=4 Formal employment= 5 Own business= 6 Selling wood= 7 Selling vegetables=8 Tenants= 9 Artisan=10 Migrant remittance= 11 Other	facilities None= 0 Banks= 1 Loan sharks= 2 Borrow from families= 3 Borrow from friends= 4	Selling wood= 1 Selling vegetable= 2 Selling and sewing clothes= 3 Mechanic= 4 Electricians= 5 Shoe repairer= 6 Store owner= 7 Selling livestock's= 8	Cattle Sheep Chicken Pigeon Pigs	Maize Pumpkin Sweet potato Cabbage Tomatoes Nuts	RDP= 2 Cements/Corrugated= 3 Shack= 4 Face Bricks/Tile= 5 Others= 6

	(specify)= 12					

Appendix E: Focus Group Discussion

Focused Young Adults group discussions

How is life?

How old are you?

What are you currently doing with your life (studying, working or unemployed)?

What are your future plans?

Do you see yourself living here in the next 5 years?

If yes/why?

If no/why?

What do you do in your free time?

What kinds of activities do you do around the area?

Do you have any social organisations you are part of?

Knowledge of Climate Change

Before this discussion had you had about climate change?

If yes, do you understand what climate change is?

How did you hear about it?

Do you believe climate change is happening?

How has the climate or weather changed in the last 10 years?

What do you think is causing climate change?

How has it affected you and your livelihoods?

Do you talk to your parents about these changes?

What are you doing to cope with these changes?

If no, why are not doing anything?

Where did you learn the coping measures you are implementing?

Do you receive any support to cope with the changes?

What do you think should be done to help you cope with the changes?

Have people changed their way of living because of the climatic conditions?

Resource Availability

Is there water available?

Where do you get water from?

Is there electricity in the area?

What do you use for cooking, heating and lights?

Do you still have land to farm?

Social issues

How bad is the crime in the area?

Does the community and local police work together?

Is there alcohol or substance abuse in the community?

If yes are there any rehabilitation facilities close by?