



**CLIMATE CHANGE ADAPTATION AND WATER SECURITY IN THE CASE OF
RURAL WOMEN IN ZONYAMA VILLAGE, KWAZULU-NATAL, SOUTH AFRICA**

School of Built Environment and Development Studies

**Thesis presented in fulfilment/partial fulfilment of the academic requirements for the
degree of Masters in Development Studies, in the School of Built Environment and
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ABSTRACT

Climate adaptation involves the development of policy and practices for a set actions that the local state and communities in a geographical location can employ to limit and control both expected and unexpected climate change impacts. These impacts differ in scale and extent, and vary according to set conditions at a given location. This thesis presents the results of qualitative research based on the Community-based Adaptation (CbA) practices as adopted by women of the rural Zonyama village of KwaZulu-Natal, South Africa. The main objective of this research was to identify the practices that the women of Zonyama village employ in efforts to secure their household water consumption needs during a drought period as brought about by climate change.

This thesis uses Community-based Adaptation theoretical approach, , to investigate the practices employed by the women of Zonyama village in addressing their household water consumption needs. The theory is also used to assess the impact of these practices and the challenges that the women may experience as a consequence. Using field observation and the semi-structured interview method, the research concludes that women have the agency to determine how to access water for their household consumption needs, although women continue to rely on the voices of men to advocate for policy to be actioned on behalf of the women, regardless of marital status. The problem-solving and decision making centred around issues of water and access remains a female problem with little contribution and action from men and hence is gendered in its practices. This research contributes to the understanding of some issues of access to places without sufficient and reliable water for household consumption from the perspective of rural women in addressing climate adaptation.

The participants for the research were purposively selected and excluded persons over the age of 18 years old, due to ethical considerations. The research acknowledged the sensitivity around the conservative nature of the community, avoiding questions that may challenge the social security of the participants. A total of 30 interviews representative of 30 households from the village community out of 107 households were conducted.

The research found that place attachment to the land is a major factor that shapes water security in Zonyama village. Households would rather not have water for prolonged periods than to relocate away from their village. Poverty is also a constraining factor, as the desire to relocate may exist, but the means to do so may not be readily available. Women are less likely to participate in the planning and decision-making surrounding the greater community's water

needs as these engagements are determined by the men in the community and the village Indunas, the Chief and the Councillor, and a Traditional Council largely made up of elected men of the community.

DECLARATION

I declare that this study represents the original work of the author under the supervision of Professor Catherine Sutherland at the University of KwaZulu-Natal, and has not been submitted in any form, for a degree, to another University or institution. Where the work of others has been used, acknowledgements in the text have been duly provided.

.....

1 February 2022

Linda Natasha Hlengwa

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DECLARATION - PLAGIARISM

I, Linda Natasha Hlengwa (209508587) declare that:

1. The research presented in this thesis in the entirety of the work contained except otherwise indicated is of my own original work.
2. I have not previously in its entirety or in part submitted this thesis for obtaining any qualification at any other university.
3. This thesis does not contain other persons' writing, data, pictures, graphs or information unless specifically acknowledged and written sources quoted.
4. This thesis does not contain text, graphics or tables copied and pasted from the internet, unless specifically acknowledge, and the source being detailed in the thesis and in the References section.

Student Signature

Date

Name of Supervisor

Date

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"We rise by lifting others."

-Robert Ingersoll-

DEDICATION

To my perfect children, Abonga, Elihle and Onalenna. When I thought of giving up, it is your warm smiles that gave me the courage to push through. You are my strength.

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CHAPTER ONE

INTRODUCTION AND RATIONALE OF STUDY

Introduction

Water security issues are a major concern for the sustenance of life and wellbeing. The depletion of vital water resources is a clear indication of the global climate change crisis. Climate change is a global phenomenon that threatens the lives of many communities and raises risks to the livelihoods of the most vulnerable. The range of patterns and trends identified, and the projected impacts of climate change have helped to establish plans around the globe to better respond to climate change (Intergovernmental Panel on Climate Change (IPCC), 2014). Some degree of climate change is inevitable, which ensures that people must adapt and protect communities and the natural environment against the consequences of climate change (United Nations Global Compact (UNGC), 2009). Vulnerability to the impacts of climate change and resilience approaches can be considered in the field of adaptation.

Reports from the International Panel on Climate Change confirm that climate change is real, with the most vulnerable continent to predicted warmer temperatures over the century being Africa (IPCC, 2014). Global predictions show that warm temperatures will be higher than the mean annual global warming, with regions that heat up faster than the tropics (UNGC, 2009). Rankoana (2020) confirms that South Africa's weather stations have shown that average annual temperatures have increased over the seasons and that higher temperature and intermittent cycles of rainfall with regular droughts have clear effects on South Africa's climate. Madzwamuse (2010: 2) argues that "South Africa is particularly vulnerable to these variations because of its dependence on climate-sensitive economic systems" while Turpie and Visser (2013) argue that these changes cause additional pressures from poverty and compromised livelihoods.

Recognising the implications of climate change on access to water sources and associated impacts on the wellbeing of human populations and places, the concept of adaptation is increasingly identified as a key response to addressing climate challenges. Contrary to the notion of adaptation being a key response, Madzwamuse (2010) indicates that adaptation has been given little consideration, although, this is where Africa and other developing countries need to concentrate in terms of facilitating the alleviation of poverty and enhancing food and water security.

The International Union for Conservation of Nature (IUCN) reports that the drought season that was then followed by the torrential flooding season in South Africa ravaged all regions of the country, most harshly in rural communities (IUCN, 2017). The drought season alone presented itself as a much warmer, drier climate with below-normal rainfalls than the country has ever witnessed (South African Weather Services, 2015). According to the World Meteorological Organization Assessment report of 2013, the warmest years are shown to be between the period 2001 to 2012 with an anticipated rise in global average temperatures by 2 degrees Celsius over the two decades (Rankoana, 2020). This suggests community resources, in particular water, will continue to be negatively impacted by climate change.

It is equally important to consider gender integration when thinking and planning for climate adaptation, especially in the rural context. It is essential to ensure that processes and actions of adaptation are relevant to women as much as these are for men (Care International, 2016). This statement is supported in a report published by the United Nations Development Programme (UNDP) on Gender and Adaptation which indicates that “women often face social constraints, receive less education and are excluded from political and household decision-making processes that affect their lives” (UNDP, 2013: 2). Coping with climate change impacts on men and women, but particularly women who live at the interface of water security and meeting the needs of everyday lives.

Scholars such as Alston and Witney-Soanes (2008) as well as Trenberth (2011)) have shown that the trends in global climatic change, temperature and weather patterns are one of the key contributors that compromise the well-being of many people around the world (Alston and Witney-Soanes, 2008). Coupled with economic uncertainties, climate change is said to increase vulnerability to water scarcity, food insecurity and loss of livelihood (Ahmad *et al.*, 2022). In parts of South Africa, a series of flash floods and long dry spells are a frequent occurrence in the country. This often results in the loss of livestock and even the loss of human life (Trenberth, 2011; Bauer, 2014). Such events raise a number of security concerns, particularly to the issue of securing water access and better management of existing water reserves (Ahmad *et al.*, 2022). It is thus crucial to act quickly in responding to climate change effects.

Adaptation to climate change is commonly thought of as a way to manage the many risks associated with climate change impacts. Adaptation is generally defined as a set of responses that help to reduce vulnerability and enhance resilience (Wilson *et al.*, 2020). On the other hand, vulnerability is defined as the degree to which a human system is susceptible to adverse

impacts and is unable to cope with them (Naylor, 2020). The ability to adapt is thus important for the human system's ability to respond effectively to climate variability and change, specifically in the case of water security. As such, experts in the field of adaptation to climate change often specialise in disaster management, risk perception, geography-related field management and land use planning (Füssel, 2007; Field and Barros, 2014). Adaptation is essentially local in focus where benefits of the actions mainly increase to a clearly defined group of people or space (Wilson *et al.*, 2020). This essentially promotes adaptation as the best approach to coping with climate change impacts by any given community, when applied in already existing practices.

In a bid to conserve water in an already water insecure country, the government of South Africa imposed water rationing in many parts of the county as a deliberate attempt to address the challenge of water scarcity. Municipalities are compelled to implement such adaptive measures to moderate the demand and supply of water (Stolley, 2015). In observing and exploring the country's environmental services capacity to assist with adapting to climate change, one may pose the question of, how best can the duty to conserve water be better dealt with in a fundamentally altered climate system? This study will attempt to respond to this question in the following sections.

In response to the above, many benefits can be derived from the community-based adaptation approach, particularly within a rural community context. Community-based adaptation (CBA) is considered "a form of adaptation that aims to reduce the risks to climate change to the world's poorest people by involving them in the process of planning and adaptation" (Forsyth, 2013: 2) Other literature defines community-based adaptation as a process that includes communities in the process of accessing needs, designing project activities, and having a stake in the management of projects linked to climate change adaption (Owen, 2020).

Community participation is considered paramount in maintaining positive outcomes that contribute to long-term impact (McNamara and Buggy, 2017). The identified community for the this study is the rural women of Zonyama village, who head households and ensure that water consumption needs for their households are met on a daily basis. Rural women are the fibre of social construct linked to climate change and adaptation (Klemmer and McNamara, 2019). WithCommunity-based adaptation as the preferred theoretical concept based on the tenets of inclusion and participation of people in determining their objectives to adaptation practices, this will frame the guiding literature for this study.

1.1. Rationale and Background of the Study

Community-based adaptation is the preferred theory that is recommended in framing and observing the means to adaptation of human systems to climate change in securing water consumption needs for this study (IUCN, 2017). As a country reliant on the agroecosystems, agricultural crop yields and livestock numbers, South Africa makes a good choice for understanding the relationship between climate change adaptation and water security among women in a rural community.

This study seeks to explore the relationship between climate change adaptation and water security through practices employed by the women of rural Zonyama village of the KwaGumbi Traditional Authority in KwaZulu-Natal. As with most rural places in the province, the community of Zonyama village is largely dependent on certain goods and services that the natural environment offers in meeting the community's basic survival and adaptive needs. Additionally, the high levels of poverty and low levels of service delivery coupled with the lack of infrastructure in the area further increase the community's vulnerability to social poverty and ultimately climate change.

Zonyama village is a useful case study because it is part of the greater KwaGumbi community, making it one of six villages that form part of the traditional area (Wild Trust, 2018). The greater KwaGumbi community was part of a successful land restitution process in 2005, made possible through South Africa's land reform policy (Wild Trust, 2018). Land use of the area ultimately changed from subsistence agriculture and rangeland practices to mostly protected area management in the form of nature and game reserves, as well as commercial farming. The restituted land was ultimately committed to the restoration of land under protection for ecosystems and biodiversity conservation (DEAT, 2013 and Wild Trust, 2018).

The restoration of rural landscapes in South Africa is a contentious issue and one that is greatly politicised and viewed as an instrument that is used to facilitate a new kind of natural resources enclosure (Hansen, Islar and Krause, 2015). Hansen *et al* (2015: 287) refer to this as the redefining of "conditions for the access and control of land and forest for tribal and indigenous communities". Hansen, Islar and Krause (2015: 287) define enclosures as "the capture of common resources and the exclusion of the communities to which these common resources belong; using the concept to demonstrate the neoliberalisation of nature". This in effect could bring about challenges for communities that are water stressed, that under circumstances of drought, would have had the option to access water reserves in enclosed spaces.

Although the communal and restituted land was proclaimed a Protected Area under its official name Somkhanda Game Reserve (SGR). The need to restore the historical injustices and the dignity of the people who had lived off the land for survival and benefit was acknowledged, yet a greater portion of the existing community of people remains regulated in areas which may have previously allowed the use and gain of access to environmental resources such as firewood and most importantly water.

The study focuses on climate change adaptation in the context of rural communities because rural communities are faced with challenges of water security. These challenges are caused by water scarcity and issues of access to water in the KwaZulu-Natal province among other issues. Statistics on water supply in rural settlements reveal that, the rural population's dependence on water is unevenly distributed due to lack of infrastructure (Statistics South Africa, 2019). Rural populations further lack access to reliable water supply, despite having to rely on natural resources including the supply of water for their livelihoods. Zonyama village remains a traditional rural community.

1.2. Location of the Study

Zonyama village is in northern KwaZulu-Natal and about 50 kilometres south of the eSwatini border. Zonyama village is situated in the Zululand District and is administered by the uPhongolo Local Municipality under the traditional leadership of the Gumbi Traditional Authority (uPhongolo Local Municipality, 2015). Zonyama village makes an interesting case in that, unlike its sister villages, this community abuts the Somkhanda Game Reserve, and is further surrounded by a number of private Game Reserves and a few commercial farms, all of which depend on reliable water sources for survival.

The Zonyama community is a rural village that remains traditionally conservative. The community prides itself in the empowerment and the development of its people, the greater community of the Gumbi Traditional Authority (Department of Environmental Affairs and Tourism, 2007). The greater area of Gumbi is home to commercial farming and residential settlement, and also to both a communal Game Reserve and a few private Game Reserves (Department of Environmental Affairs and Tourism, 2007). In light of this, Zonyama village makes an interesting case to draw from perceptions surrounding the securing of water consumption needs in relation to climate change adaptation and in the context of enclosed spaces, as per the lived experiences of many people living in rural places in South Africa.

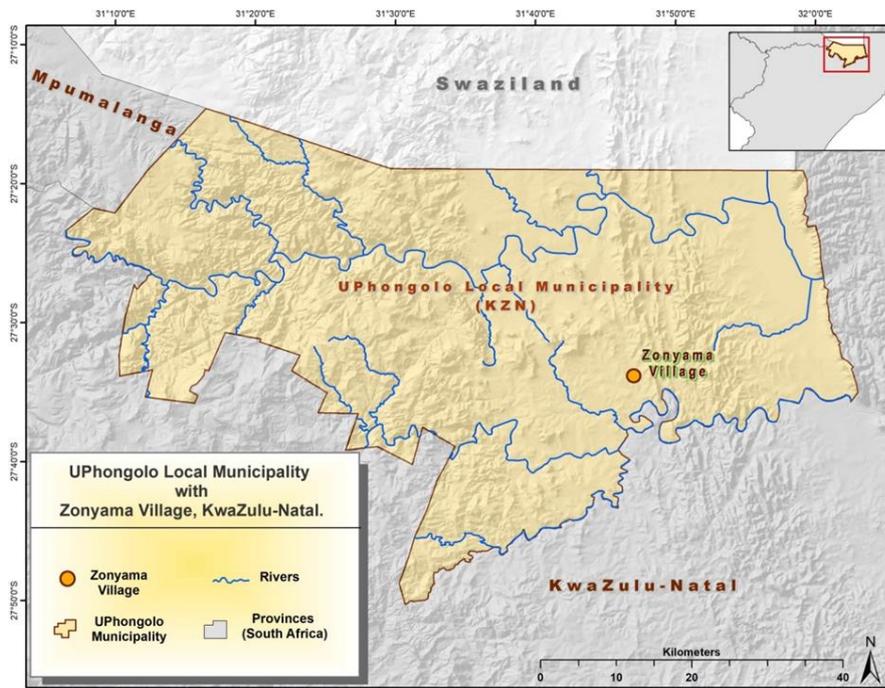


Figure 1: Map of uPhongolo Local Municipality with Zonyama Village, KwaZulu-Natal

Source: Author's Map

Table 1 presents the demographic information of Zonyama village based on data that was released by Statistics South Africa from a census conducted in 2011. There is no updated demographic statistics of the area since 2011 as the census is only conducted every decade in South Africa (Statistics South Africa, 2020).

Table 1: Demographic Information of Zonyama Village

Population	400
Number of households (approximate)	107
Population Group	(%)
Black African	96.0
Coloured	0.0
Indian	0.0
White	0.4
Population by Gender	(%)

Male Population	48.5%
Female Population	51.5%
Municipal Ward Number	14

Source: Statistics South Africa: Census (2011)

1.3. Research Objectives and Problem Statement

1.3.1. Aim

To understand climate change adaptation by identifying water security practices used by women of rural Zonyama village.

1.3.2. Objectives

- To study climate change adaptation as a concept along with water security amongst the women of Zonyama village.
- To evaluate the coping mechanisms adopted by women in Zonyama village when facing climate change adversities such as drought and overall water scarcity.
- To assess factors contributing towards the exclusion of neighbouring communities from accessing water from the Somkhanda Game Reserve.
- To identify approaches that can be used to target and potentially overcome impediments associated with climate change and water scarcity in Zonyama village.

1.4. Problem Statement

With climate change identified as a global threat to all forms of life, impacts and the risks associated with the change pose a significant threat to places and their water supply (Kundzewicz *et al*, 2014). Community-based adaptation as an approach helps with understanding the relationship between climate change and water security, offers an opportunity for examining the challenges for meeting water security needs within a rural context, and it provides research for supporting a practical course of action to help better manage water needs at the interface of climate change (Guerreiro *et al*, 2018).

The urgent need to adapt to climate, weather and temperature changes come at a huge cost, and threats of its effects worsen, particularly in rural communities of developing nations across the world. Population groups that are affected differently by climate variability and change are women and children, hence the study focus on women in particular. Literature suggests that

places in Asia, Latin America and Africa are among the regions of the world that experience the harshest effects of climate change, and it is in these places that women are more vulnerable to the harmful effects of climate change due to gender disparities (UNDP, 2012 and Guerreiro *et al*, 2018). Literature also suggests that climate change appears to intensify current gender inequalities in rural places, and that in the processes of adaptation to climate change, the differentiated impacts of climate change on gender need to be carefully considered in policy development, planning and financing of climate change adaptation programmes (UNDP, 2012).

This study draws on the premise that climate change impacts women differently from men. Literature indicates that “women’s productive and reproductive activities make them disproportionately vulnerable to changes” and further suggests that women and children are victimised by disasters related to climate change (Koolwal and van de Walle, 2010). Bryan *et al* (2018) advocate for interventions relating to climate change adaptation to be gender oriented, in noting the differences in challenges faced by women from men, and to apply appropriate gender focused responses accordingly. Typically, people living in rural areas often have the lowest incomes and are the poorest, with increased vulnerability to climate shocks and making them more susceptible to climate change (Nyahunda and Tirivangasi, 2022).

Linked to the extent of vulnerability, climate change is cited as being a global woman problem, with the responsibility of securing household water needs falling disproportionately to women and young girls in rural areas (Bryan *et al*, 2018). Global, as well as local literature, continues to suggest that sourcing water for women in rural locations is one likened to an obligatory task (Giddens, 2008; Bryan *et al* 2018). In West Africa, women’s vulnerabilities to climate change as framed in the academic literature as a patriarchal issue (Nyantakyi-Frimpong, 2020). It is for this reason that this study chooses to employ a gendered perspective, one which captures how women secure their household water consumption needs during adverse climate conditions.

1.5. Definition of Terms

Climate Adaptation

Climate Adaptation is a term that is defined as adjusting natural and human systems for actual and/or expected climatic conditions that can have an effect of moderate or severe harm to people and their wellbeing as a result of global warming (European Union Climate Action, 2018). In rural South Africa, community wellbeing is largely determined by the land on and

environment within which people live. With little financial resources in the said communities, people significantly depend on the natural environment for shelter, food, and livelihood generation.

There are globally recognised adaptation approaches to climate change that are considered appropriate in helping rural communities cope better during climate change events such as drought. These practices are linked to the global Sustainable Development Goals as prescribed by the United Nations Development and Environment Programme (International Institute for Environment and Development, 2020). These approaches serve to support sustainable development and include Ecosystem-based Adaptation (EbA) and Community-based Adaptation (CbA) amongst others. These adaptation approaches are different yet similar in the development outcomes each approach aims to achieve.

While EbA is a policy framework that considers the sustainable management and restoration of ecosystems as a nature-based solution to increasing people's resilience to climate change, CbA is a diverse theoretical concept, drawing from participatory approaches and methods for disaster risk reduction, and forms part of adaptation policy which seeks to build capacity among communities, using their own knowledge and methods of practice in the process of taking action to deal with climate change (International Institute for Environment and Development, 2020).

Water Security

Scholars acknowledge that the application of the term, water security, has increased quite significantly in over ten years, as it continues to be recognised and used across multiple disciplines of study (Cook *et al.*, 2012). By definition, water security can be defined as an emerging paradigm that considers the access and affordability to sufficient and of good quality water by people in a given environment (Cook *et al.*, 2012). The term is integrative in that it considers the impact of water in satisfying the needs of human consumption while trying to maintain a good ecological health balance (Grey and Sadoff, 2007).

Due to an uncertain future surrounding climate conditions, a burgeoning global population, increasing water demands, changes in social welfare, and changes in human lifestyle, water security may decrease. In his assessment on water security under climate change for large watersheds, Naderi (2020: 10) indicates that available water will decrease overtime and further states that "climate change will also increase mean annual mean evapotranspiration" This

suggests that during periods of drought water for consumption will be less available at normal periods, and that groundwater recharge will be lower during rainy periods (Naderi, 2020).

South Africa is also exposed to extreme climate events also known as the El Nino events. These events cause overall climate extremes such as the hard drought and torrential rains, as well as an overall warming climate which can lead to changes in both the quantity and quality of water being transferred in the environment and, thus shaping the change of ecosystems (Trenberth *et al.*, 2015). These changes in turn disrupt food systems, altering food prices, livelihoods and international trade which escalate vulnerabilities especially among marginalised groups (Trenberth *et al.*, 2015).

Access to clean drinking water and sanitary facilities is a key component of water security. It is intricately tied to food and energy, both of which are crucial for sustainability and people (Babel *et al.*, 2020). Climate change brings a significant negative impact on these elements as it fuels instability. Water security is crucial for energy production, agriculture, safe drinking water, and the ecosystem in terms of our rivers and lakes (Babel *et al.*, 2020).

Good governance and the set of livelihoods that exist in a community are perceived as fundamental to reducing vulnerabilities associated with water insecurity and in helping improve participation of communities in the decision-making related to processes of water management and water supply (Soussan *et al.*, 2004). Access to land and other natural resources also influence the capabilities of successful water security in a community. The influenced by the sort of livelihood actions form the basis of action in the investments and knowledge needed to access resources, social and institutional structures (Sullivan *et al.*, 2006).

1.6. Dissertation Structure

This section provides a summary of how this dissertation is structured in each chapter. The dissertation is structured as follows:

Chapter One: Introduction and Rationale of the Study

This chapter of the dissertation provides an overview of the study, on how the study is outlined. This chapter introduces the different aspects that are covered in the entire dissertation such as the objectives and research questions, the background of the study area inclusive of a map, as well as an overview of the rationale behind the study.

Chapter Two: Theoretical Framework and Literature Review

This chapter of the dissertation gives focus to the theory that was identified and applied in guiding the study. This chapter also gives focus to the literature and scholarly contributions used in similar studies, in guiding the theme that this study focuses on.

Chapter Three: Research Design and Methodology

This chapter focuses on the methodology considerations used for this dissertation. It highlights the technique in design in the way in which participants were selected and how data was collected. This chapter includes the research instrument that was used in the study.

Chapter Four: Findings and Data Analysis

This chapter introduces and presents the findings of the dissertation based on the data that was collected and analysed. In the context of the objectives and questions outlined in Chapter One, a discussion on the analysis of the results is provided.

Chapter Five: Implications and Conclusion

This chapter presents a summary of the study, including a discussion on the extent to which both the objectives and questions of the study were addressed. This chapter makes recommendations towards remedying the issues highlighted and explored in the study.

CHAPTER TWO

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Introduction

This chapter establishes the theoretical framework and further reviews the relevant literature related to this study. The chapter provides the concepts within which the study was designed, and critically explores the role played by gender and place in the practice of adaptation to climate change within a rural setting. This chapter introduces community-based adaptation as the theoretical framework against factors that motivate climate change adaptation research. The literature discusses the challenges faced by a community living adjacent to protected areas in addressing the community's water needs during a drought period.

A rural area can be defined by The National Geographic Society (2011) as an open swath of land that has a few homes or other buildings and not so many people. Rural communities are characterised by low population density, with homes and business amenities located far away from one another. A primary feature of most rural areas is the practice of agriculture as the main industry and economic driver. Over recent years protected areas in the form of Game Reserves and National Parks have become significant features that make up the rural aesthetic. According to Curtin and Cohn (2015), rural communities are often perceived as serene, rustic and isolated, suggesting protection from the problems of the modern world, which in effect is unlikely as reality suggests that rural places are under-resourced and poorly serviced due to the lack of infrastructure that is found in these remote areas (Curtin and Cohn, 2015). These stereotypical impressions are often the key drivers to increased vulnerability to climate change events that are experienced by people living in rural communities.

It is worth highlighting that rural communities often share higher rates of poverty, unemployment and underemployment as compared to urban areas, which further emphasises the state of vulnerability that drives these communities (Sumberg *et al.*, 2005). Limited access to opportunity, education and healthcare further worsens the complex problems faced by people in rural communities who wish to access basic resources such as potable water and sanitation (Sumberg *et al.*, 2005).

Adaptation to climate change among communities that are most vulnerable to water insecurity requires consistent planning and action within policy and research. Harnessing water security in rural communities becomes a necessary priority among other development needs that

support or safeguard community livelihoods, the regeneration of the natural ecosystems and quality of life. Grey *et al* (2007: 546) define this as the duality of limiting destructive impacts to water while addressing societal priorities that speak to the “availability of an acceptable quantity and quality of water.”

The impacts on the productive potential of water continues to worsen at an unprecedented rate at a global scale. Urama *et al* (2010) suggest that rural populations face significant risk due to the increase in climate unpredictability related to extreme weather events such as flash floods and drought. These climate-induced hazards consequently pose threat to the lives and livelihoods of rural people, and without an identified plan of action, lives can be destroyed.

Consequently, the Sustainable Development Goal of vision 2030, goal number 13 on Climate Action stipulates targets of; enhancing resilience and adaptability in all countries to climate-related threats and natural disasters. This chapter comprises of two sections which are the theoretical framework and the literature review for this study. The starting point of this chapter is the theoretical framework, which focuses on Community-based Adaptation (CbA) approach as the framing theory to offer a better understanding of this study’s objectives. The theoretical framework will further review existing bodies of information and knowledge in supporting the objectives in the study. The second section of this chapter is the literature review, which will seek to respond to the relational and contextual importance of the study. The literature review will seek to evaluate climate change adaptive measures, thus facilitating a discussion on the gendered motivations around water security during a drought period by women in a predominantly rural landscape.

2.1. Theoretical Framework

The theoretical framework is the conceptual framing of literature based on proponents of a model or paradigm that serves to elaborate the basis of a study (Levinson and Wilkins, 2006). As such, Community-based adaptation is the preferred approach for this study’s theoretical framing on the basis of elaborating the study objectives. Community-based adaptation is defined as “a form of adaptation that aims to reduce the risks of climate change to the world’s poorest by involving them in the practices and planning of adaptation” (Forsyth, 2013: 439).

Community-based adaptation can be both a framework and an approach that is informed by policies of building resilience to climate change and reduction of risks associated with climate disaster (Shammin *et al.*, 2020).. Community-based adaptation is founded on the premise of helping communities become more resilient to climate change. The approach helps illustrate

the condition of natural resources that remain and how these resources can be better managed to optimise use and aid with adapting to changes in the environment (Weiskopf *et al.*, 2020).

By the same token, Ecosystems-based Adaptation is a policy framework that considers the sustainable management and restoration of ecosystems as a nature-based solution to increasing people's resilience to climate change, CbA forms part of adaptation policy which seeks to build capacity among communities, using their own knowledge and methods of practice in the process of taking action to deal with climate change (International Institute for Environment and Development, 2020).

Ecosystem-based Adaptation is said to have rapidly evolved in understanding the value of services provided by nature for human wellbeing (Vasseur, 2021). This section will seek to explore both Community-based Adaptation and Ecosystem-based Adaptation in the context of climate change adaptation and water security, in understanding the relationship women of rural KwaZulu-Natal, South Africa have with the environment in securing water at the interface of climate change events.

In a glossary of important terms as provided by the South African Biodiversity Institute (SANBI), the term Ecosystem-based Adaptation is in two parts; 'ecosystem' and 'adaptation' and will therefore be defined accordingly to arrive at the meaning of the term. The ecosystem, which considers the biological makeup of a natural environment is defined as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit" as according to the Convention on Biological Diversity in 1992 (Enright *et al.*, 2020)

Adaptation is the process of changing to suit different conditions. Within the context of ecosystems, it is defined as the "use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change" (South African National Biodiversity Institute & Department of Environmental Affairs, 2016: 6). The focus of this section is through the lens of ecosystem services, in understanding the demands which challenge the use of these services and limitations to restoration thereof.

Popularised by the essential need to develop practical implementation plans for adaptation at a community scale (thus allowing for close observation and control), the EbA approach builds on values of social-ecological systems, building resilience to vulnerabilities as caused by environmental and social change (Vignola *et al.*, 2009). In other words, this approach is

important in contemporary adaptation discourse in respect to the approach's extension to include environmental ethical morality.

In surveying existing literature on Ecosystem-based Adaptation, it is evident that there is a plethora of scholarly examination on this theoretical approach, which links this approach to climate change and development issues in the world (IUCN, 2018). Poverty and inequality are significant challenges faced in developing countries and the world, similarly translating to challenges to adapting to climate change (Vignola *et al.*, 2009; Scarano, 2017). From this, one can formulate that environmental goods are commonly used across the global scale, for sustenance or otherwise. Hence, the need to better manage the world's ecosystems is well established, yet methods of adaptive management to address changes of the global climate in the different regions of the world remain complex.

In setting the scene on the Ecosystem-based Adaptation framework to this study, it is important to briefly define key components which make up this overall theoretical approach. Ecosystem services are referred to as offering provisioning, regulating, supporting and cultural services, made available by material and energy outputs from ecosystems (IUCN, 2018). To highlight a few, these services extend from food provisioning, raw materials, fresh water, medicinal resources and ensuring local climate and air quality.

Ecosystem services in terms of their value, are not limited to moderation of extreme events brought on by climate change, aesthetic appreciation and inspiration for culture, art and design which intimately relates to human history, and extending spiritual experience and sense of place for sacred and religious meaning (South African National Biodiversity Institute, 2017; IUCN, 2018). They also provide regulating and support functions. In essence, the context in which Ecosystem-based Adaptation is placed is in the fundamental principle of navigating ways in which ecosystems in the form of the natural environment, can work best in providing vital services for the nurturing of human life, and vice versa.

2.1.1. Community-based Adaptation and Climate Change

In developing responses to climate change, South Africa is said to have grown its research focus in unpacking medium and long term changes to the climate in the context of adaptation and mitigation. However, Ziervogel *et al.* (2014) points out that practical solutions to implementation of long-term adaptation programmes are rather small-scale whereas the focus is still maintained in reducing vulnerability to present-day climate exposure in the form of disaster risk reduction, managing water demand and facilitating early warning systems.

Monitoring and evaluation accounting for climate adaptation is also said to be limited, despite this prioritisation in policy (Ziervogel *et al.*, 2014). There is a scarcity of documented information that explicitly reports on employed programmes of action to navigate climate change management in South Africa.

Adaptation to climate change can facilitate the reduction of atmospheric greenhouse gases while restoring biodiversity and ecosystem services. Scarano (2017) stipulates that these outcomes are most achievable through the Ecosystem-based Adaptation approach, particularly in developing nations as these nations are already stewards of important elements of nature. In conjunction, Fisher *et al.* (2014) validates Scarano in finding relevance to ecosystem services and poverty, for example, linking these with climate change and the influence which the existence of climate change has on the relationship between the two concepts.

Consequently, Fisher *et al.* (2014) asserts Scarano's argument on developing nations as being stewards of ecosystems thus the need to discuss science and policy challenges relating to adaptive transition towards sustainable adaptation. The scholars do however warn on the limited scale at which ecosystem services and the nature of these services are recognised in adaptation literature. It is thus argued that the multiple dimensions of poverty linking to climate change effects are not fully recognised in literature, hence ignoring the complex linkages and systems in the relationship between poverty and climate change (Fisher *et al.*, 2014; Scarano, 2017).

In illuminating pathways of ecosystems in poverty alleviation in the context of development and climate change Fisher *et al.* (2014: 102) identifies that, "loss of ecosystem services affects poor and vulnerable people disproportionately and is a significant barrier to reducing poverty". Further to this response, it is recognised that the characteristics of a particular environmental location determines the accessibility to and benefits from ecosystem services (Fisher *et al.*, 2014). Accordingly, well-managed ecosystems can offer impetus in realising poverty alleviation, particularly for the most vulnerable, and whose livelihoods are determined by the natural environment.

Ecosystem-based Adaptation is thus recommended as an approach to coping with climate change, as it allows for vulnerability-based scenarios together with impacts-based scenarios to complement each other in incorporating future assessments of impact models to vulnerability. Ziervogel *et al.* (2014) criticise the national approach of climate adaptation as failing to consider vulnerabilities to climate impacts across national sectors which may continue to

compromise a set of provisioning benefits that can be offered or received from ecosystem services. It appears that much is yet to be done by policy-makers and development practitioners (Ziervogel *et al.*, 2014). In response to this study, the Ecosystem-based Adaptation theory will attempt to examine pathways into which rural women transcend in attempts to cope with climate change in the context of water security.

2.1.2. Ecosystem-based Adaptation in South Africa

In the context of land reform in South Africa, the environmental characteristics of certain land-use systems, such as that of protected areas in the form of communal and private game or nature reserves, are often criticised as being a form of barrier to entry among those locals who depend on ecosystem services of critical importance in adapting to climate change (Hansen *et al.*, 2017).

In recognition of this, Hansen *et al* (2017) allude to the politics of natural resources with particular reference to South Africa and Ecuador. They identify how the state can be perceived as a facilitator that encourages enclosure, limiting the access to and use of natural resources. This can be seen as challenging for both development and environmental sustainability, further highlighting the challenge to mainstream Ecosystem-based Adaptation as an approach into policy in developing countries (Hansen *et al.*, 2017).

Ecosystem-based Adaptation interlinks with factors of development in that it links the functionality of healthy ecosystems to that of human welfare. In other words, the characteristics of a well-functioning ecosystem define the operational interests of those who depend, use and manage that particular ecosystem (Scarano, 2017). Critical to decision-making, this assumption thus places pressure on ecosystems to provide the service of aiding adaptation and ultimately mitigation to natural disasters as when prompted by climate change, such as that of the drought experienced in many parts of South Africa in 2009 (Fisher *et al.*, 2009).

As argued by Fisher *et al* (2009) this calls for a classification scheme for the characteristics of ecosystem services and ecosystems that produce these services. This can be achieved in a manner that clearly and consistently defines the measures, models and mapping of ecosystem services that are a threat to destruction and depletion. In the South African context, it is recognised that human life faces only two responses to climate change, through adaptation to effects or mitigation to causes of climate change (DEA and SANBI, 2016). The South African agency for environmental affairs promotes Ecosystem-based Adaption in its linkages to ecosystem services, biodiversity and climate change as having value in supporting co-benefits

that are of critical importance to human development thus sustaining livelihood benefits whilst coping with climate extremes (Department of Environmental Affairs, 2016).

Although there appears to be not many existing EbA interventions across sectors, South Africa's White Paper on National Climate Change Response of 2011 coherently outlines the national government's responsibility to mitigation and adaptation strategies (Ziervogel *et al.*, 2014). With this, the Department of Environmental Affairs has identified and documented successful outputs resulting from EbA project outcomes; as seen in Zambia with food security incentives offered through assisting small-scale farmers to encourage better land use management. This has been done in efforts to reduce climate change impacts, as well as projects in urban environments as in the case of eThekweni Metropolitan Municipality, where improving the state of wetland ecosystems in securing water and carbon sequestration for climate change mitigation co-benefits offers improvement in the quality of life and extending business opportunity (DEA and SANBI, 2016).

Ecosystem-based Adaptation linked projects in rural communities, appear to be less documented thus resulting in little or no evidence. One is not able to formulate conclusions on the influence, both positive and negative, of ecosystem-based approaches in contextualising rural communities to climate change adaptation (DEA and SANBI, 2016). According to the National Integrated Water Information (NIWI) system of South Africa, there are a number of national climate interventions by province namely; mitigation, adaptation, research-mitigation, and research-adaptation. From these, Kwazulu-Natal shares 39 out of a national total of 275 mitigation interventions; 61 out of a national total of 223 adaptation interventions, only 3 out of a national total of 77 research-mitigation research and 14 out of a national total of 108 research-adaptation interventions (Department of Water and Sanitation, 2017). With this information, there is no detail on these types of interventions attempting to reach any rural settings in KwaZulu-Natal and this is where this information is highly flawed.

2.1.3. Community-based Adaptation and Water Security

The water security debate in South Africa is one that is noticeably contentious surrounding water stress and water scarcity. This is a result of climate change effects on changing weather patterns and altered ecosystems. Water scarcity is foreseen to affect most of the world's population by 2025, with an estimate of 1.8 billion people living in absolute water scarcity (International Water Management Institute (IWMI), 2000). With this analysis from the IWMI, it is projected that South Africa is most likely to also face water-scarce conditions by 2025.

This is rather concerning, considering the contentions surrounding the water supply debate in South Africa, relating to financial and fiscal policy aligned to the privatisation and commercialisation of water pricing (Bond, 2010).

Water is life, and every living entity desires to see this critical natural resource in its abundant form. Human well-being and most of the world's economic climate depends on a healthy and functioning environment. Ecosystem services such as fresh water systems play a pivotal role in regulating global hydrological cycles of critical importance, in allowing one to appreciate the “direct and indirect ways in which we depend on the natural environment” (Crow and Sultana, 2002).

The anthropocentric perspective on water security is one that recognises the integral role that water plays in the human life (Cook *et al.*, 2012). As adapted from the Food and Agricultural Organization (FAO), Cook *et al.*, (2012) however argue that this outline of water security is negligent of risk to limiting ecosystems within the ‘human needs’ approach in which ultimately water security is then compromised. Both the human and water elements are of crucial importance to sustaining functional and healthy ecosystems which are critical to adapting to climate change, and ultimately mitigating risks associated with climate disaster (Cook *et al.*, 2012).

The distribution, timing and quality of water is changing, impacting livelihoods and health, food and energy production, and environmental sustainability (Abounaga *et al.*, 2019). It is thus projected that by the year 2050, coastal cities which are home to over three hundred million people will be facing sea-level rise of at least half a metre (McMichael *et al.*, 2020). The results to such disaster are the contamination of freshwater supply and infrastructure. Water and vector-borne diseases increase, in turn affecting new communities (McMichael *et al.*, 2020).

The failure to realise intersectional linkages between functional ecosystems which promote water security, food security, energy security, and disaster risk reduction can potentially put millions of lives at risk (Parkes *et al.*, 2010). It is therefore considered of utmost importance that local governments in their policy making and implementation processes, relay progressive and inclusive plans to “increase conservation measures and improve biodiversity management in light of climate change” (Parkes *et al.*, 2010).

Reflecting on South African institutions of power and influence, local governments in South Africa are well placed in developing effective adaptation strategies, despite forecasts of immense challenges and recent climate events (Crow *et al.*, 2002; Costanza *et al.*, 2017).

Furthermore, local government is well placed in challenging decision-making process in light of protecting ecosystem services in improving resilience to climate change (Crow and Sultana, 2002). An example of such is the role of the South African National Biodiversity Institute in ensuring the smooth adoption of EbA in both policies, and in identifying potential partners to implement activities in accordance with stipulated international standards.

Through a carefully devised strategy and integrated policy, collective efforts of local governments can help influence the safeguard of ecosystems services for human well-being and resilience to climate change (Crow *et al.*, 2002). Given such intimate relationships between societies and water, the implications are said to be profound and altered with varying weather, climatic patterns and climate-induced ecological change (Costanza *et al.*, 2017). It is, for this reason, that ecosystem services are to be considered in policy making as this will not only enhance the quality of life of the rural poor, but will secure livelihoods and save municipal costs in future (Crow and Sultana, 2002). It is for the aforementioned statements to which human agency should align with policy, so as to allow synergy in both policy and practice for better adaptation.

2.2. Climate Change and Climate Adaptation

Climate change is not a new area of development debate, and threats of its effects are appearing to be worsened (Weisser, 2014). A sense of great urgency in the need to protect ecosystems as well as to think and learn of ways of adapting to climate extremes is realised not only locally but internationally as well (Weisser, 2014).

Accordingly, this section of the chapter will define aspects considered as key concepts of the study. Relating to this study, these concepts are important in cultivating critical areas of contribution, assertion and contestation outlining international and local debates applicable to the subject of research. Considering this, it is important to examine key debates, theories and literature relating to climate change generally, and rural women specifically.

Key concepts are considered in this section, specific to climate change, gender, climate change adaptation, ecosystem services and water security. There is considerable literature that has contributed to the understanding of these concepts, from an array of disciplines that have derived meaning in the contrasting ideals related to the theory of the aforementioned concepts (Weisser, 2014).

2.2.1 Defining Climate Change

Climate change at the interface of development is defined by the Intergovernmental Panel on Climate Change (IPCC) as “any change in the climate over time, whether due to natural variability or as a result of human activity” (Klausmeyer and Shaw, 2009). Using ecological considerations, climate change is defined as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, observed over comparable time periods” (Klausmeyer and Shaw, 2009) The commonality in these two definitions is the element of human existence, and for varying considerations, the usage and understanding of the term and its definitions may be used interchangeably.

Historical events of climate change can be traced back to the early existence of man, through evident impacts on the planet from activities such as hunter-gathering, mechanised farming and extremely toxic industrialisation among other human-induced activities (Weisser, 2014; Birkenholtz, 2014; Ziervogel *et al.*, 2014). Hence, climate change is also perceived to be representative of a series of environmental drivers of human conflict, when comparing agricultural management practices across different scales of water use and water management across the world, and in Africa.

Early reviews on climate change have reported a common issue in water increasingly becoming a scarce resource, fast-paced by human activities and observed through the lens of typically changing weather patterns (Taylor, 2014). Water insecurity as a consequence of climate change is said to result in social impacts such as migration and land abandonment due to drought conditions affecting land-users in spaces such as that of rural regions of South Africa (Sigenu, 2006). In the case of the aforementioned, this may suggest that the greater implications to water security as a consequence of climate change yields greater social constraints to realising human development (Sigenu, 2006; Gleditsch and Nordås, 2010).

With reference to a study conducted in Mexico and Spain by Campos, McCall and González-Puente (2013) on land-user perceptions on climate change in the context of water, environmental problems in the region were seen to be greatly linked to the rise in average temperatures and highly variable annual rainfall patterns thus indicating a shift in the region’s climate and consequently impacting on surface water depletion and limiting agricultural activities (Campos, McCall and González-Puente, 2014: 813). As an indication of global warming, such events significantly change environmental landscapes, the nature of ecosystems and the relationship people have with their immediate environment. The ability to control these

effects as a result of climate change becomes difficult (Campos, McCall and González-Puente, 2014: 813).

International debates on climate change reflect that there is increasing concern raised around major security threats in the world, these threats specifically are linked to climate change (Gleditsch and Nordås, 2010). International discourse on this narrative appears to be quite intensive as reviewed by the IPCC in a summary for policymakers that, the likelihood of climate change producing a significant hazard to peace and security is projected to increase in future (Klausmeyer and Shaw, 2009). The United Nations Development Programme (UNDP) similarly stresses that, as climate change is now an established scientific fact, this phenomenon is certain to affect life in the world as we know it, particularly the life of the poor and most vulnerable (UNDP, 2008).

Concerns are raised in the profound reduction to the levels in quality of human life, a causal link resulting from human-induced climate change among many other causes (Campos, McCall and González-Puente, 2014). At the same token, the sense of urgency by global states in responding to climate change is heavily criticised and highly contested (Campos, McCall and González-Puente, 2014). It is repeatedly argued that global states take on a stance of ‘reacting’ versus ‘responding’ in their actions to effectively responding to climate change events, where early preparedness in efforts to mitigate risks associated to climate change is compromised (Gleditsch and Nordås, 2010).

Furthermore, to note on international debates on climate change is the issue of engaging with appropriately diverse and tailored responses to climate change within academia and wider society. In his paper on ‘Disagreement and Responses to Climate Change’ Long (2011) argues for scientific and ethical debate, that is to be founded in diversity rather than on “straightforward error.” Long (2011: 504) adds that “consistent resistance to ‘easy’ resolution on climate change has become a temptation of many key role players in responding to the phenomenon”. Additionally, he then argues that, without diverse formulations in responding to climate change, effective strategies in tackling serious problems and policy decisions regarding the human response to climate change cannot be clearly effective (Gleditsch and Nordås, 2010; Long, 2011).

Gleditsch and Nordås (2010) support Long’s realisation on how global climate change poses a great threat in the quality of life around the globe. It is then alluded by Gleditsch and Nordås (2010: 8) that implications of climate change together with the harmful consequences of this

phenomenon have firmly established themselves on the global political agenda. In realising such significant thinking in the case of rural community spaces, Long (2010) then supports the aforementioned as political and socio-economic influencers of change having disputes over social implications to climate change as well as to risks associated in efforts to early mitigation (Gleditsch and Nordås, 2010; Long, 2011).

African debates on climate change share similar claims to that of international debates on compromised peace and security. The African continent is equally as conflicted (Leichenko and O'Brien, 2002; Foote, 2010; Besada and Werner, 2017). As many African states are reliant on agricultural means and production for securing food and economic means, climate change threatens the physical and socio-economic makeup of these states (Besada and Werner, 2017). Food and water systems are severely impacted thus exposing African populations to unfamiliar conditions (Leichenko and O'Brien, 2002). By this, it may be understood that unfamiliar conditions in climate behaviour may imply an increased state of vulnerability among African populations.

Foote (2010) further recognises that climate change is set to negate progress for many developing countries in achieving the Sustainable Development Goals (SDGs). With particular reference to Africa, Foote (2010) observed the food security crisis in the continent as one that was exacerbated by facing further dwindling water reserves and other essential resources much needed for sustenance and ultimate survival (Foote, 2010). One may deduce that not only does climate change pose a threat to the world's water and food security systems but may pose dire consequences in life through the outbreak of diseases and even ultimate death.

Moreover, there has been a slight shift from the common understanding of climate change as a "rise in temperature" issue, to one that is a development issue and model as acknowledged by both African leaders and scholars of climate change mitigation and migration studies (Besada and Werner, 2017). Water scarcity as framing for understanding development issues relating to the agricultural industry in Africa is said to be overlooked and often drives the undermining of sustainable livelihoods across the continent (Foote, 2010). Conversely, it is criticised that advances taken by African leaders in exercising their freedom and power to engage in critical debate which inform contributions to climate change mitigation in global conferences are often ignored (Foote, 2010). Effects of climate change affect every nation in the world, thus the need for every nation's leader in the global arena to be heard and insights considered to the matter.

In support of Foote (2010), Madzivhandila and Niyimbanira (2016) maintain that the rejection of African contributions to global climate change mitigation debate tends to impede on the progress towards potentially achieving an end to climate change, in a way that hampers the socio-economic transformation of developing countries. They further contend that, as compared to their developed counterparts, developing countries are biasedly forced to improvise on climate adaptation strategies while developed countries continue to emit pollution at unprecedented rates (Madzivhandila and Niyimbanira, 2016). Consequently, this has resulted in millions of African people being forced to leave their homes and migrate in search of a better life in better environments. In return, this consequence sets a deepened issue of an already escalating global migration crisis, which is already referred to at the global scale as a pending climate calamity (Gleditsch and Nordås, 2010).

Similarly, Southern Africa bears witness to challenges in the development of the region, as preceded by an increase in compromised livelihoods of many Africans (Foote, 2010). Climate extremes such as unpredictable and untimely rainfall, drought, floods and decline in agricultural production, dwindling resources in water reserves and outbreak of diseases, has worsened the conditions of those who are most vulnerable and unable to respond proactively to negative effects of climate change (Foote, 2010; Solar and Irwin, 2010). Accordingly, this may then result in an outbreak of disease and or even death, consequently disintegrating communities and increasing compromised circumstances in community wellbeing (Solar and Irwin, 2010).

The climate change debate in southern Africa is confronted with the issue of policy, and as one that has brought about an immediate urge in seeking ways to effectively respond to climate change (Chandani *et al.*, 2011). Policy on climate change in Southern Africa is often discredited on the basis of committees which continue to exist and yet lack coherence in application to set up legislative and policy frameworks (Chandani *et al.*, 2011). In addition, the knowledge base around effective response mechanisms around climate change remains criticised, particularly in the context of African responses to mitigating climate change (Madzivhandila and Niyimbanira, 2016).

As it can be understood, the climate change narrative has evolved over the years. It can be witnessed that climate change has become multidisciplinary and multifaceted. This can be indicative of the need to access information from a diverse range of knowledge systems sourced internationally, regionally and locally, as to perhaps enable discussion and dialogue in

effectively responding to, and adapting to climate extremes (Foote, 2010; Chandani *et al.*, 2011; Madzivhandila and Niyimbanira, 2016).

2.2.2 Climate Change Adaptation

Adapting to climate change has singularly become the most sought after response to coping with climate extremes. Highly popularised by the Intergovernmental Panel on Climate Change (IPCC), adaptation is noted as the second most sought after aspect in response to climate change extremes after mitigation (Maddocks, 2009; Madzwamuse, 2010). The climate is constantly changing, and over a period of time, significant climate extremes such as that of the KwaZulu-Natal floods in 2010, global warming has led to significant impacts which often result in the compromise of people's livelihoods, safety and shelter of the poor and marginalised (Madzwamuse, 2010).

Adaptation is comparatively defined as the process of behavioural change in helping cope with, better functionality and survival of life amongst humans, animals and other organic matter in environments that are otherwise compromised by certain climatic changes (Hendry and Gonzalez, 2008). In an earlier study on human perceptions and responses to floods near Durban, South Africa in 1994, it was noted that human acknowledgement on dangers associated with floods was understood and regarded as of utmost importance as a way of informing response to flooding (de Villiers and Maharaj, 1994)

The study found that there were indeed certain limitations in human agency, resources, and lack of capacity to effectively respond to disaster in the case of a flood event. De Villiers and Maharaj (1994) at the time also referred to the September 1987 flood in Natal, of which they heavily criticised the lack of awareness and sufficient warning to disaster occurrences. This may bear truth in current times and this study will attempt to address this in the following discussions (Smit *et al.*, 2001; Dixon, Smith and Guill, 2003).

Critical components to climate change adaptation are adaptation and resilience. Resilience is defined as “the capacity or ability of something, someone, or some group to anticipate, accommodate, cope, adapt, or transform when exposed to specified hazards” (Archer *et al.*, 2020). Resilience refers to the ability to recover quickly from change, disaster or adversity, whereas adaptation and mitigation refer to defined elements of action towards lessening the effects of severity and seriousness of an event (Smit *et al.*, 2001; Madzwamuse, 2010). In addition, adaptation is defined as “the process of changing something to make it suitable for a new situation” whereas mitigation refers to “making something less serious” or “the reduction

of an unpleasant, harmful, or serious situation” (Longman Dictionary of Contemporary English, 2003). As important and relevant contributions to the construction of climate change in the framing of adaptation for this study, both terms ‘resilience’ and ‘mitigation’ will be referenced throughout the study (Klein *et al.*, 2015).

In a paper titled “*The state of adaptation through the lens of adaptive landscape and contemporary evolution*”, Hendry and Gonzalez (2008) regard adaptation as complex, when considering issues of prevalence and strength of adaptation in nature. Both Hendry and Gonzalez share a similar perspective to adaptation, arguing that adaptation “can be seen almost everywhere and that evidence for it is overwhelming and ubiquitous” (Hendry and Gonzalez, 2008: 673). An approach which cannot be isolated from the human element, climate change adaptation continues to be recognised as an important subject matter at a global scale.

Clearly defined adaptive terms and measures of control in efforts to build resilience against climate change extremes in Africa remain ambiguous. Madzivhandila and Niyimbanira (2016) criticise this ambiguity by arguing that developing countries remain challenged with limited access to environmental resources whilst pushed to adopt mitigation processes yet, developed countries continue to emit at unprecedented rates, consuming and producing beyond imposed limits (Madzivhandila and Niyimbanira, 2016). This in turn contributes to unmatched use of environmental resources, thus limiting the socio-economic transformation of a developing society which equally depends on the consumption and production of environmental resources to sustain and survive (Klein *et al.*, 2015).

2.2.3 Water Security

In a meticulous review on water security, Cook and Bakker (2012) have found that the concept can be reviewed two fold; through academic and policy literature. They have also found an increase in the use of the term across a number of disciplines. As with climate change, water remains a contentious issue across the globe. One can fundamentally perceive water as the single most vital natural resource and in many cases the cause of conflict in the world, followed by the need for securing food and energy. Generally, the rise in concern over seeking knowledge and methods to better secure water is telling of associated risks to water scarcity from direct human interference and extreme conditions brought on by the changing climate linked to global warming (Cook and Bakker, 2012).

In most parts, water scarcity is broadly defined as the lack of access to adequate quantities of water for human and environmental uses (White, 2014). Water scarcity can also refer to

scarcity in the availability of water due to either physical shortage or in access to water due to the failure in the capacity of institutions to ensure a regular supply (World Health Organization, 2014). It is then determined that water security and water scarcity exist in complement with each other in the sense that the absence of one determines the presence of the other.

Global statistics on water security reveal that 90% of all-natural disasters are water-related of which since 1990, over 11 million people across the world have died as a consequence of drought (UN Water, 2014). Moreover, it is reported that more than 2 billion people in the world have been affected by drought in their lives (FAO, 2009). What becomes most concerning with these statistics is the fact that developing countries are understood to be among those countries most prone to water-related disaster, thus the increased vulnerability towards water scarcity and fatalities. South Africa does not fall short of this ‘developing country’ spectrum, and it is for this reason among others that robust adaptation strategies are to be firmly set in policy.

In his review on the impacts of climate change on water security in rural communities, Patrick (2020) noted that climate change can trigger conflict as a coping mechanism, where he sourced 385 surveys to inform this statement. He noted that the varying climate patterns increases the vulnerability of rural communities to the realities of water insecurity, and these vulnerabilities are intensified by poverty, poor infrastructure and high dependence on climate climate-sensitive resources (Patrick, 2020).

In other international water-related statistics, it is reported that almost one-fifth of the world’s population live in areas of scarcity, lacking the necessary infrastructure to draw from water sources such as rivers and aquifers (FAO, 2009). A common reality in poor rural areas, it is often women who are left with the daunting task of having to walk long distances to collect water for the household (UN, 2012). In a fact sheet relaying statistics on the world’s water standards, the World Health Organisation reports that it takes as much as 6 hours every day for rural women and girls to collect water (WHO, 2018). Alarming as this data on the world’s water security may be, it remains critical to clearly formulate contextualised understanding to the climate change and water nexus in solving local problems, which can then be carefully refined and translated into sound actions elsewhere in the world.

2.2.4 Gender

Gender as a category of analysis and prominent field of conceptualising social interactions is defined as “one’s social classification according to their identity based on one’s behaviour, presentation of self and interactions with others” (Hoffman, 2006: 358). Climate change interacts with humans at different levels and different scales, and as gender is constructed behaviour as a result of what is culturally produced, it is at this point of departure that climate change is to be investigated through the lens of gender relations (Sigenu, 2006; Schipper, 2016).

The concept that is gender is pertinent in understanding the intersection between climate change adaptation and water security, as it is a reality that men and women are affected and respond to climate extremes differently from one another (MacGregor, 2010; Goh, 2012). The current state of literature suggests that women are the most affected by phenomena such as that of climate change (Nelson *et al.*, 2002). It further alludes to women located in the South to having the greatest challenge in responses to climate change as compared to women in the North (Nelson *et al.*, 2002).

Literature suggests that women are considered vulnerable, as prominently perceived by social sciences protagonists. The assumption made by literature is that women show limited capacity for adapting to climate change due to certain societal constraints, thus resulting to a least resilient recovery (Leichenko and O’Brien, 2002). The sense of women’s state of vulnerability is differentiated according to level, extent and scale, where the state of vulnerability can be observed by weighing climate conditions as a measure according preventive actions in recovering from loss or damage (Leichenko and O’Brien, 2002). This however does not begin to imply that women are not capable nor able to lead in responding to systems of adaptation, thus suggesting that, channels towards enabling climate change adaptation at a grassroots level should be context specific, in effectively and viably responding to the specific community challenges.

Supplement to the aforementioned, Goh (2012) reports that women in particular face high risks in responding to the negative impacts of climate change; as gendered social norms prescribe rural women with roles such as household obligations of childcare and the collection of natural resources such as water and firewood. In turn, this often impedes on rural women’s adaptive capacity and continued inaccessibility to land and inputs of adaptive techniques (Taonameso *et al.*, 2019; Goh, 2012). And also, in considering scales of development in rural spaces within

the South African context, the social and economic dynamics in rural places do not significantly change over time and even at times remains stagnant. Thus, the continued cycle of rural women remaining with challenges to accessing and improving on efficient climate change adaption techniques in securing their household water needs (Taonameso *et al*, 2019).

MacGregor (2010) reveals that there is regular appearance in concepts of class, poverty, and race in understanding climate change, whereas there appears to be little mention of gender dimensions to climate change. MacGregor (2010) further argues that gender related contributions to climate change discourse are narrow in nature, fixated upon tangible and quantifiable impacts which so often portray women in the developing world as “victims of ecological crisis” instead of shifting the focus on “discursive constructions” shaping climate change and climate politics in present day (MacGregor, 2010: 223). This may be suggestive of limitations in policy in considering gaps in translating gender relations in policy that yields transferable and effective action to climate change adaptation.

In light of the above, (Terry, 2009) identifies the greatest challenge to gender analysis within the climate change discourse. Terry (2009) probes the potential of mainstream gender relations in climate change policy discourse. Social scientists have referred to this obscurity in policy as one that disregards alternative approaches to understanding climate change narrative in the context of social aspects predominated by gender equity, a kind that is “policy discourse that is stereotypically masculine” (Terry, 2009). It can thus be argued that progress towards impactful climate change discourse is to be understood through the lens of differentiated societal roles and responsibilities of both genders.

Over the past decade, there has however been a slight emergence on gender inclusive literature in analysing climate change, with particular reference to water security in the context of rural women (Jerneck, 2018). Regrettably, the gender inclusivity narrative towards climate changed debates remains insufficient, in contributing to sustainable development that is linked to the climate change adaptation discourse (Glazebrook *et al*, 2020; Fosado, 2020; Jerneck, 2018). Although climate change affect all countries, its impacts differ in terms of its distribution across and among different regions, generations, age, class, income groups, occupations and gender (Jerneck, 2018). It is for the aforementioned that this study considers the role of rural women in exploring the different dynamics between climate change and water security.

Climate change does not affect men and women in the same way and it is in this way that impacts to climate change are gender differentiated (Ahmed and Fajber, 2009). Considering

this, aspects related to climate change; for example, adaptation, mitigation, and decision making around how and when to adapt must include a gender perspective. A review on “gender-differentiated impacts of climate change on women’s and men’s assets and well-being in developing countries” Goh (2012) tests two hypotheses; first, differences in the way in which climate related events affect the well-being of men and women in developing countries, and second, “climate-related shocks affecting women more negatively than men” in these countries (Goh, 2012). Revealing the aforementioned hypotheses to be true, it remains uncontested that the empowerment of women regarding efforts to solving the world’s water crisis is impetus in realising gender concerns to social and climate change.

Accordingly, Bob and Babugura (2014) argue against limited advancements made to considering gender perspectives addressing climate change, consider related content as insufficient and concerning. Limited data, extensive research and case studies exposing gender biases to climate change impacts, by linking men and women to their related experiences to mitigation and adapt remains inadequate (Bob and Babugura, 2014). This confirms the argument made by Goh (2012) that literature disassociating the differentiated societal roles by virtue of one’s gender identity, hence, a difference to women's experiences in adapting to climate change to those experiences of men.

At a glance, publications on gender statistics in South Africa, Statistics South Africa (Stats SA) reveals that black African women face a particular disadvantage, where one’s geographical location often presents a strong determinant in situations of opportunity or disadvantage (Statistics South Africa, 2011). The publication recorded women to have been slightly better off than men in educational achievement and yet, reported a small proportion of women being employed with a larger proportion of women not being economically active, particularly in rural locations in South Africa (Statistics South Africa, 2011). This could perhaps be suggestive of efforts and strategies used in securing livelihoods when comparing urban places to that of non-urban places, regardless, this suggests that the burden of responding to climate change falls most harshly on rural women.

Another interesting find as presented by Statistics South Africa’s publication is that, official unemployment rates of the South African population amongst those of working age shows that women were more likely to be unemployed than men, of which unemployment rates of women were most pronounced among women in rural areas and urban informal areas (Statistics South Africa, 2011). One can perhaps assume the extremity in challenges to which women face at the

interface of climate change. Similar statistics elsewhere in the world reveal that, women are paid less for the same work as their male counterparts and the gap appears to be persisting (Alber, 2011). This could further exacerbate means to which women support their livelihoods at the interface of climate change, among those who live in rural areas and cannot afford alternative means to a livelihood.

Looking closely at critical issues of gender in the context of climate change, women are not part of decision-making bodies as are the men in their societies and that is to the detriment of women. With this said, Nelson and Stathers (2009) put it that women's empowerment is challenged by the little evidence reflecting successes in gender sensitive approaches to adapting to climate change. These gender sensitive approaches are said to explore issues of "division of labour, access to resources, and knowledge" drawing on insights from an 'agricultural adaptation to climate change' study in Tanzania (Nelson and Stathers, 2009). It is clearly understood that women face vulnerabilities to climate change more than that of men. Hence, Reyes concedes with Nelson and Stathers in realising obscurity in government policy reflections on gender-specific lessons learned in particular to rural communities.

2.2.5 Rural women in the context of change and security

At the interface of social dimensions to climate change and climate related disasters, it is well documented that the connection between women and climate change has received great attention only in the past decade, with social scientists regarding rural women as "experts in lived experiences to climate change, facing daily threats to their livelihoods" who are less visible and yet withhold in-depth knowledge of climate events such as the recent drought (Olsson and Karlsson, 2010; Arora-Jonsson, 2011; Bryan and Behrman, 2013).

Rural women, who are defined by the United Nations (2012) as agents of economic and social change and environmental protection who are, in many ways and to various degrees, constrained in their roles as farmers, producers, investors, caregivers and consumers, are reported to mainly survive on livelihood activities that are dependent on resilient ecosystem services such as crop farming, livestock rearing, wild fruit picking, firewood collection and medicinal plant harvesting amongst other things (Olsson and Karlsson, 2010). In the event of changing climatic conditions that are not favourable for subsistence production, a serious threat to rural-household livelihoods is presented. It is for this reason that when policy is analysed and new policy in managing environmental challenges is constructed, poor rural women's

voices are to be involved and considered (Olsson and Karlsson, 2010; Bryan and Behrman, 2013).

Rural women tend to be the most vulnerable groups to climate change, as women are often dependent on natural resources for their livelihoods through agricultural work, and are burdened with other household chores such as child minding and collecting water walking long distances (Dankelman, 2002; Arora-Jonsson, 2011). Rural women are said to be people whose livelihoods are threatened, and even sometimes decimated by a single climate event. It is for this reason that rural women are considered in this study, in critically seeking to understand their coping strategies in line with stipulated policy.

Rural women are almost seen as invisible, and are less considered as part of a collective that contributes to the understanding of climate change events in the world, and in developing countries specifically (Olsson and Karlsson, 2010). Marginalisation of women exists across the world as rural women continue to do an overwhelming duty of domestic work, household upkeep, caregiving for the elderly and children (Olsson and Karlsson, 2010).

As the general viewpoint is that of women in the South being most affected by climate than that of men in the same region, it is important to examine the recurrence of new forms of a gender sensitive climate debate in tackling the climate issues at hand (Arora-Jonsson, 2011). This is in favour of claims suggested earlier on gender sensitive and gender inclusive perspectives to establishing effective approaches to adapting to climate change and or even mitigating climate events before they can even occur (Reyes, 2009; Terry, 2009; Arora-Jonsson, 2011).

Arora-Jonsson (2011) does however mention that focusing on the vulnerabilities of women can easily deflect attention from pertinent social aspects of attending to climate change, such as that of inequalities in decision-making. The author further alludes that "assumptions reinforce North-South biases" and that generalisations have a way of increasing the burden of "women's responsibility without corresponding rewards" (Arora-Jonsson, 2011: 744). As compared to other contributors in this debate, Arora-Jonsson provides a renewed perspective to understanding the global discourse on gender and climate change as the world has come to understand.

Conclusion

The climate change discourse continues to evolve through academia and continues to affect our daily lives. Climate change continues to negatively affect the lives of people of the world through unplanned migration, disease, and death. Those most harshly implicated by climate change effects remain to be those who are poor, and in particular most likely to be woman. Ecosystem-based Adaptation as policy and approach to mitigating vulnerabilities and adapting to changes brought on by climate change promises to play an impetus role to assuming sound international and national discourse for improving environmental management and in turn realising water security.

Water security remains a contentious issue in the generation of development, and with this, issues relating to water security such as water scarcity and gender dynamics are to be treated with the greatest deliberation. In transforming discourse, inclusivity in all aspects of gender relations is of crucial importance to not undermine gender-specific lessons necessary to robust adaptation and mitigation interventions.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Introduction

This chapter presents the methodology that was adopted for this study. It outlines the methods employed including the sampling technique, data collection, and data analysis of the study. Moreover, the process of ethical measures that were followed in conducting the study are briefly discussed, detailing the study's approach to validity and reliability. In addition, the limitations of the study are highlighted.

3.1. Research Design and Methods

The research was conducted in Zonyama village, a rural community located in the municipal area of uPhongolo Local Municipality, in the north of KwaZulu-Natal province, South Africa. In an effort to determine local constructs of climate change adaptation in relation to water security in the context of a rural settlement, qualitative methods were employed to investigate and interpret the meaning of climate change adaptation as understood by women living in the village.

Qualitative research methods are systematic in approach. These identify and describe life experiences by way of giving meaning to these experiences. According to Bricki and Green (2007:2) "qualitative research relates to the understanding of aspects of social life, using words and language to generate data required for analysis, rather than numbers". Qualitative research methods are flexible and fluid, obtaining content rich information, and gaining insight into complex and inherent social constructs (Guba and Lincoln, 1994). In addition, qualitative research is valuable in developing theory and determining shared interpretations on a given social phenomenon. This research adopted a constructivist approach as its paradigm of inquiry.

The constructivist approach, which is also referred to as the interpretive paradigm, is considered as a collection of ideas and understanding of the world as it is known and revealed by actors embedded in the space being studied (Havercamp and Young, 2007). This is strongly based on assumptions about our place in the world, inclusive of culture and ideology stemming from human generation of knowledge and meaning through everyday interaction, experiences, and ideas (Baxter and Jack, 2007).

The constructivist approach seeks to contextualise opinions valued in claiming truth that is subjective and relative based on an individual's perspective (Havercamp and Young, 2007). There is relevance in adopting the constructivist approach in this study as it creates meaning based on experienced events and the interpretations of these by the subjects of this study.

3.2. Data Sources

3.2.1. Interviews

This study used face to face interviews as a method of data collection, as interviews are considered as being aligned to the constructivist paradigm (Baxter and Jack, 2008). Moreover, in considering the nature of this study, semi-structured interviews were employed as a suitable method in obtaining the narratives relating to the topic that was being investigated. The open-ended nature of the questions provided the opportunity for both the researcher and the participants to discuss the topic in more detail (Baxter and Jack, 2008). In this way, the researcher was fully aware of the cultural and contextual framework that existed in the study area prior to investigation.

During the interviews, the researcher was mindful of gaining insights on key concepts of the research as provided by the interviewees. The interview schedule was used consistently as both a guide to lead discussion and a prompt to encourage the interviewees to respond to the questions further. The researcher had an assistant to record and take notes on each interview schedule (Plooy-Cillers *et al*, 2014). The interviews were conducted in isiZulu to allow the interviewees to talk without restriction about any experiences relating to the topic. As anonymity was a concern, there was no mention of any names and also no names were recorded (Kouzmin, 2005). After all the interviews were done, the researcher transcribed all interviews with verbatim, and captured all notes that were taken during the interviews.

3.2.2. Limitations of Interviews

It is important to note some of the limitations that arise from conducting interviews as a technique of inquiry. Becker (2000) admits that interviews hold a potential weakness in that, even in the most confidential of interviews, the respondent may still not be willing to bear truth in responses. In noting this flaw, this limitation was taken into consideration during the interviews. This was further recognised by the researcher in the number of respondents who, at first, did not consent to being recorded during the interviews. After some careful explanation on the nature of the study, the participants would then agree to being recorded. Everyone that

was approached to be part of the study was treated and questioned with greatest sensitivity. The researcher refrained from probing on sensitive issues such as one's financial status and/or religious beliefs.

3.2.3. Participant Observations

The use of participant observations was considered as being sufficient to supplement the interviews and to improve on the validity of findings and to ground truth them (Kawulich, 2005). Participant observation is also useful in understanding participants' daily engagements and how they relate with one another as a community, if at all. Schmuck (1997) indicates how participant observation as a tool, can provide a collection of data based on people's processes and culture in qualitative research.

The researcher spent a period of five days in Zonyama village. The first two days 28 to 29 August 2016 were dedicated to getting to know the women of Zonyama village and in scouting the area. This was important so that a relationship of trust could be built prior to data collection. The researcher was accommodated by the family of one of the two data-collection assistants that were recruited for the study. This was valuable for the researcher to better understand the women of Zonyama in relation to the village and the community at large.

There are inevitable limitations to participant observations. Seim (2020) suggests that participant observation presents more opportunity in terms of positioning and perspective based on outward gazing while observing presents more fixed positioning. The researcher thus had to rely on the key participants' views which may be less accepting of others' views. Often times, the researcher may not be easily accepted in the community of study due to the researcher's appearance, gender, and perceived class. This was evident when many of the participants in the study indicated that they did not want to be recorded during the course of the interviews.

Participant observations identified were noted and documented to support the understanding of attitudes and perceptions held by the women of Zonyama village linked to climate change and adaptation to the long drought season in the community..

3.3. Sampling

A study sample is taken from a full set of cases in a population where the population may consist of individuals, groups, and organisations. According to Bertram and Christiansen (2014: 59) "sampling involves making decisions about which people, settings, events or

behaviours to include in the study.” In a qualitative study, a number of factors influence the selection of the sample such as ease in accessing potential participants (Welman *et al*, 2005). As such, a sample is considered representative of the population. Women of Zonyama Village made up the representation of water users in the community.

The sampling method that was used for this qualitative study was the purposive sampling technique. This technique is considered as a credible sampling method that is not aimed at identifying statistical representativeness nor the generalisation of results (Patton and Cochran, 2002: 9 and Turner, 2010). By definition, purposive sampling is the selection of participants who are likely to generate useful data for a study, in selecting key demographic variables that are said to impact a participant’s worldview of the study’s topic (Tongco, 2007: 147).

In realising this, the participants were carefully selected by the researcher in order to obtain a sample that best represents the objectives of the study based on sound judgment (Saunders *et al*, 2012). Women of adult age, between the ages of 18 to 65 years old, were selected to be interviewed. A woman from every third household in the village was selected, given the dispersed settlement pattern of the village.

A total number of 30 women of adult age were sampled from 30 different households out of 107 households in Zonyama village. Prior to conducting the interviews, all 30 of the women were visited by the researcher to inform them of the intention to conduct the study and to receive the consent of each participant’s willingness to participate in the study. This was done in the company of the Zonyama village’s *Induna*. Once consent was declared, an appointment was then set up for the interview at a time convenient to the participant, as women often had to tend to housework and household chores each day. The interviews were conducted between 30 August and 2 September 2016.

3.4. Data collection and analysis

By way of collecting data, interviews were conducted by both the researcher and an assistant enumerator that was recruited in the Zonyama community. The interview schedule used was semi-structured in the sense that it had both closed and open-ended questions. Open-ended questions are of value because as Patton (1990: 165) suggests, open-ended questions are in-depth in nature and allow a respondent to construct their responses.

The interview schedule was translated from English into isiZulu, as isiZulu is the most commonly spoken language in the area, and also to allow for engagement with participants in

a language they would be most comfortable engaging in. Responses were then transcribed and translated back into English for data capturing on Microsoft Excel and on NVIVO. Questions specific to the topic were asked yet allowing for the interviewees to add comments and/or views based on lived experiences.

A sum of 28 of the interviews was recorded and two of the interviewees did not consent to have their interviews audio recorded. Confidentiality was exercised at all times. The length of the interviews varied as some of the women had to share their time between the interview and taking care of their young children and household duties. The researcher however did ensure that patience was exercised and that all questions were answered in full to allow for consistent analysis.

On average, each interview took a little over an hour and thirty minutes to conduct. All complete interviews were then later coded and captured into Microsoft Excel and transposed into NVIVO for data analysis. NVIVO was used to draw from the application the thematic content from the interview responses. The responses were grouped according to the questions that were asked and to analyse the main points that were made. The data was analysed by use of a combination of descriptive statistics and interpretive enquiry and presented in frequency tables. As such, this study adopted a mixed-methods approach considering the objectives and the techniques used (Howell, 2013: 193).

McNeill (2017: 1) indicates that relationship-based data seeks to recognise the influence of one variable over another, for example, how one's age and level of schooling may or may not necessarily determine one's understanding of what climate change is and its effects on ensuring water security for human consumption. McNeill (2017: 2) further indicates that interpretive enquiry seeks to "gather feedback on a certain topic or concept without influencing the outcome". From this analysis, data was presented in bar graphs and pie charts. Closed-ended questions were considered as quantitative content and were analysed as such.

3.5. Validity and Reliability of the Study

It is essential for both validity and reliability to be maintained during the period of research. It is in this regard that the action of collecting and analysing the data of this research was aimed at ensuring validity and reliability, to avoid simple preference of certain viewpoints over others. trustworthiness of the findings. As Gilbert (2008) indicates, it is important to maintain consistency in measuring the outcomes of a study to ensure that data bias is reduced.

3.5.1. Validity

Qualitative research is often criticised for not being able to carefully address issues of validity and reliability as much as quantitative research can do (Shenton, 2004). It is thus for this reason that participants who were selected for this study were systematically chosen on the criteria of; a) having been a permanent resident of the Zonyama community for a period of no less than five (5) years, and b) by them being a woman. As far as validity is concerned, it is worth noting the study aimed to identify the form of knowledge surrounding climate change adaptation related to water security techniques among the women of the Zonyama village community.

In another effort of ensuring validity for this study, participants of this study were informed of the study and how their participation which would then inform the findings of the study was on an entirely voluntary basis. This was done to address the issue of expectations that could have been potentially raised, and to ensure that participation in the study was to solely provide honest information to the best of the participant's ability.

In a further attempt to ensure validity, this study supplemented participant interviews with participant observation. Observations are said to improve the validity of findings by providing an improved mechanism to check for non-verbal expressions in understanding the effort to which a participant spends on an activity (Schmuck, 1997 and Kawulich, 2005). An example of such an activity in which the researcher both observed and participated in was the accompanying of women to go collect water from the water-drums that would be left out on the side of the road for most of the day in anticipation for the municipal water-truck, affectionately known as the '*waterkan*' to come fill the water-drums with water as sourced from the Phongolo River. In most cases, the water-truck would arrive with very little water that would be enough to only fill a few water-drums or none at all.

3.5.2. Reliability

Owing to the qualitative nature of this study, the perceptions held by women on climate change and the nature of the women's experiences linked to securing water needs in a geographically rural context were to be determined through ensuring reliability by way of testing and locating consistency to methods applied in the collection of data. The interviews that were conducted for this study revealed consistency as a sum of five interviews were piloted with five participants who would then form part of the initial study, prior to the actual data being collected (Patton, 2002). This iterative process was done to assure the reduction of data bias. The researcher also made use of media sources such as local newspaper articles and radio broadcasts as to illustrate the generalisation of attitudes and behaviours of the participant through patterns observed during the process of interviews (Patton, 2002).

The reliability of the research instrument was further assured in the wording of the questions. Kumar (2011) highlights that such a factor that can affect the reliability of a research instrument is the wording of questions. To ensure this was realised, the researcher translated the interview schedule from English to IsiZulu, in a wording simplified for the participants to understand. Also, the interviews were conducted in the participants' homes, in an environment most comfortable for participants and allowing them to express themselves freely in the privacy of their homes. Participants were never asked to make mention of their name during the interviews to again ensure confidentiality.

3.6. Ethical Considerations and Informed Consent

It is of pertinent conduct for any research study to confirm honesty and integrity through realising ethical considerations and informed consent (Alasuutari *et al*, 2008). As ethical issues tend to transform over time, such transformations are to be recognised as these are often influenced by the change of the research environment (Kumar, 2011). In noting this, this research study ensured that ethical issues such as confidentiality and informed consent were warranted to the participants.

As Zonyama village forms part of a rural community that is under the authority of traditional leadership, a gatekeeper's letter was issued to the Gumbi Traditional Authority, and all participants were informed of the study by the village's Induna who is assigned to the delegation of the KwaGumbi Chief. All participants signed the informed consent forms which were translated from English to IsiZulu. Given the participants' rights to self-determination, all participants were given the freedom to withdraw from participating in the study at any stage.

Alasuutari *et al* (2008) stress that informed consent is essential to the moral necessity of obtaining the participation of participants in a study in a way that is both rational and voluntary. This affords the participant the chance to understand the purpose and focus of the study and the nature and terms of their participation.

Sufficient time spent in the field to learn of and understand the social setup, the culture and the interests of the community that is being studied is important (Sarantakos, 2005). The identity of the researcher and the intentions of the study were known and understood by members of Zonyama village, as the community had a former work relationship with the researcher on a Community-Based Natural Resource Management (CBNRM) related project. Also, as the ethical principle of self-determination dictates, participants of the study were treated as independent agents of information which allowed for their choice to voluntarily participate in the interview process.

In efforts to respect the privacy of the study participants, the confidentiality of all participants was recognised by ensuring that anonymity of the respondents throughout the study was maintained. Welman *et al* (2005) maintain that “confidentiality is the major safeguard against the invasion of privacy through research” and as such, the need for avoidance from potential “harmful and unfair conflicts of interest between the researcher and participants” (Alasuutari *et al.*, 2008: 97). For the intent of anonymity, participants were informed of the meaning of confidentiality when conducting research and were assigned pseudonyms to protect their identity.

Approval for this study was granted from the University of KwaZulu-Natal’s Humanities and Social Sciences Research Ethics Committee, in compliance with the University’s code of conduct and ethics. As per the University of KwaZulu-Natal’s data collection policy, all data is to be stored at the university and is to be accessed by the researcher and the supervisor of the study. Again, as per the University’s policy, the data will be disposed of after five years.

3.7. Limitations of Study

The study was conducted in only one of six villages that make up the larger Gumbi community. With that said, due to the design of this qualitative study, responses were drawn from a limited number of participants whose perceptions of climate change adaptation and water security along with their lived experiences cannot be generalised for the entire Gumbi community population. Furthermore, the distances between households were wide. Finding willing

participants for the study was challenging as most individuals are sceptical about answering research questions.

Conclusion

The primary aim of the study was to understand the relationship between climate change adaptation and water security among women living in Zonyama village. Two forms of qualitative study methods were employed to determine women's experiences towards securing water for household consumption needs in a rural context. As with many rural communities, Zonyama village is yet another example of a socio-economically challenged rural community experiencing a variety of service delivery issues, where even the lack of access to safe drinking water remains a constant. The use of participant interviews and participant observations allowed for deeper insight into the general struggles faced by the community.

CHAPTER FOUR

RESEARCH FINDINGS DISCUSSION AND ANALYSIS

Introduction

This chapter provides an analysis and discussion of the research findings based on the fieldwork that was conducted in the Zonyama village of the greater Gumbi community, north of KwaZulu-Natal, South Africa. This fieldwork was conducted in the week of 30 August to 2 September 2016. This chapter presents the results of the data collected against the set objectives outlined in Chapter One of this research. This section explores the linkages of the findings to existing literature based on climate change adaptation and water security.

4.1. Demographic Background of Respondents

The demographic attributes of participants are key to understanding why certain social systems exist. Table 2 denotes the gender and age group of women in Zonyama village that were selected as participants for the study. This table illustrates that the respondents selected for the study were primarily women as per the aim of the study which is to understand climate change adaptation by identifying water security practices used by the women of rural Zonyama village. It is significant to show this in an effort to understand the experiences of the respondents in understanding their social world (Williams, 2007).

Unemployment and poor education levels are some of the factors that affect socio-economic development in the area. Emerson *et al.* (2021) states that gender performs a primary function in social differentiation of economically active adults of society. As such, 60% of the respondents rely on the child support grant as the primary source of income, 20% depend on the old-age social grant accounting for 80% of women without a secondary income due to unemployment. This may suggest how the social security in these homes is compromised due to the lack of social assistance aimed at confirming a reasonable standard of living (Emerson *et al.*, 2021). This finding may further illustrate how vast assistance may be required in terms of building the capacity and resilience of women to ensuring water security within the context of climate change.

Rural women often engage in low productive work in support of their households' livelihoods as poverty tends to be more widespread in rural communities (Brown, 1996). Intrinsically, age also plays an essential role in household activities and responsibilities taken on by younger

women as compared to the older women. The younger women take on the majority of household work such as the act of collecting water from a water source, collecting firewood and cooking and cleaning the household (Brown, 1996). Older women often engage in caregiving work such as medicating and nursing family members back to health (Mathibela *et al.*, 2015). Regardless of age, women take on the greater responsibility in ensuring the well-being of the household.

Table 2: Demography of respondents in Zonyama Village, KwaZulu-Natal, South Africa

Demographics	Category	Total
Gender	Females	30
Age Group	18 – 25 years	3
	26 – 35 years	5
	36 – 45 years	8
	46 – 55 years	6
	56+ years	8
Total		30

Education plays a crucial livelihood role, a determining factor in how one copes better during a period of difficulty such as a climate change event. Education equips one with basic skills, and with better economic opportunity and access to better resources and also allows for income generation (Moeng and Potgieter, 2011). From the women that were interviewed, only 3% of the women received a formal tertiary education after completing their secondary schooling. Of the total respondents, 37% indicated to have completed secondary education and only 27% indicated to have received primary education. Figure 2 below attests to this submission.

“I could not reach secondary school level because unlike other kids I did not have relatives who lived nearby to the secondary school that I could live with. Even now we are still in need of things like a clinic and a high school in the area as our children walk long distances or have to hitchhike to get to school” (45-year-old respondent, 2016).

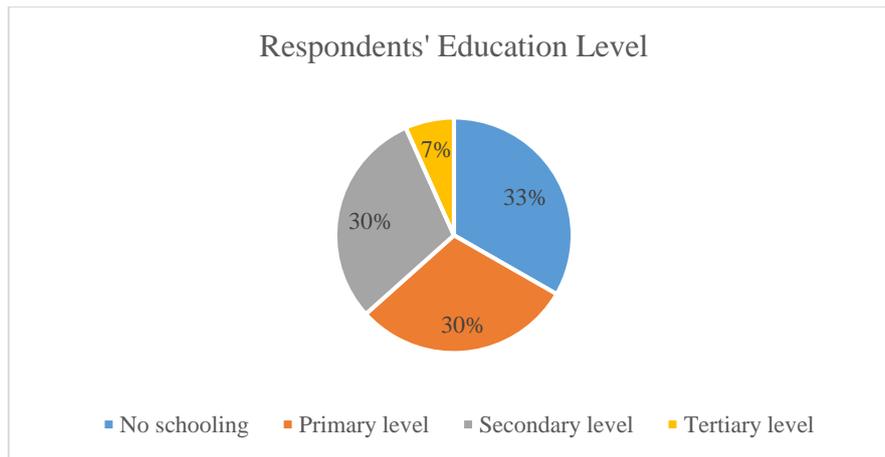


Figure 2: Respondents' Education Levels

An individual's socio-economic background plays a part in determining access to opportunity and the completion of school (Moeng and Potgieter, 2011). Zonyama village is part of a poor rural community that has inadequate education facilities. As such, physical conditions at schools and learner performances become weak (Gardiner, 2008). Poor access to education or a lack thereof may manifest in most of the women experiencing challenges in understanding policy that is designed to improve their lived conditions. They may have limited information, capacity, and resources to be able to mobilise for meaningful change in their circumstances.

The education profile of the respondents also reflects the social and political elements that influence people's realities (Merriam, 2002). This tends to have a direct impact on the socio-economic status of the women in Zonyama later in their lives. Figure 2 below shows the income sources of the respondents to this study. When looking closely at the socio-economic aspect, it can be granted that sources of income in the area can be attributed to the lower education levels. As illustrated by the respondents' sources of income, social grants in the form of child support grants and the old-age social grant account for 77% of the primary income sources collectively, with only 13% of income being generated through means of work in the neighbouring commercial farm and 10% received from remittances from spouses for those who are married. The women in Zonyama village have limited income sources and these are constrained by the severe environmental changes in the area.

"I own cattle and during the years when we got good rains, I was able to supplement my social grant money by selling one of the cows for extra cash. Now, nobody is willing to buy these skinny cows. Some of them just die of thirst" (72-year-old respondent, 2016).

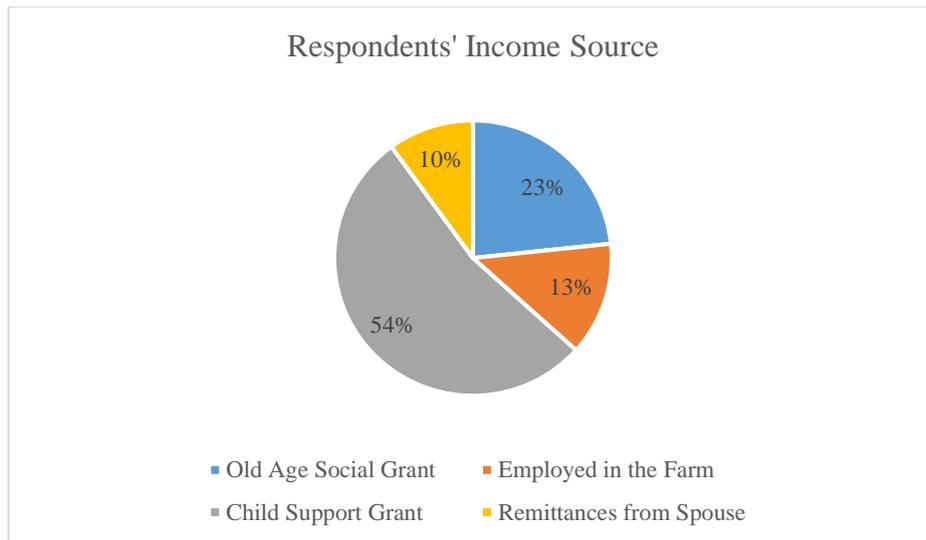


Figure 3: Respondents' Sources of Income among the women of Zonyama Village

4.2. The Family Structure

Among the respondents, 80% of the respondents indicated that they are the head of their households. Although not by the reflection of marital status, many of the households in Zonyama village are headed by women due to a number of factors; a) women that widowed, b) women that have never married and, c) women that are married yet living apart from their husbands as they had migrated to urban areas or other provinces to seek jobs. Women that have never married all indicated that, although they were not married, they were in a cohabiting living arrangement. Table 3 below provides the distribution of women in the different social arrangements to better understand the household family structures in Zonyama village.

Increased migration is common in rural areas, especially during a climate crisis. Migration in Zonyama village has manifested itself in two ways, from husbands migrating to towns and other urban areas around the country to support their family needs and, households being forced to move to areas within the village that are less affected by environmental degradation. The United Nations factsheet on Women and Climate Change as according to Dankelman (2010: 5) states that “while migration is a survival response to climate change, frequent human resettlement further exacerbates the loss of biodiversity and ecosystems”. This certainly does affect the physical modification of areas considered critical for ecosystem goods and services use in communities, however, little is considered on the social disruption and even in some instances social destruction of communities as an implication of migration.

Table 3: Respondent Family Structure

Category		Total
Head of Household	Male	7
	Female	23
Marital Status	Never Married	7
	Married	17
	Widowed	6
Total		30

4.3. Community Dynamics and Land Use

People in rural communities carry with them a wealth of information about their surroundings and how to make marginal land more sustainable. However, a number of interconnected dynamics place pressure on people resulting in populations being negatively impacted by economic and political issues such as privatisation of common property resources and inappropriate land use policies (Sherbinin, Carr, Cassels and Jiang, 2007). Undoubtedly, this condition has contributed to the alteration of how people use land and water, contributing to the widespread degradation of resources' condition and productivity, and also transforming community relations.

4.3.1. Perceptions on the Somkhanda Game Reserve

It was important to determine the relationship between the respondents and the Somkhanda Game Reserve to understand how preconceived limitations to access and obtaining of natural resources impacts on the livelihoods and well-being of the women of Zonyama village. As immediate users of and managers of rural ecosystems, rural households are often closest to the environment and have the potential role to protect land and water resources (Pimbert and Pretty, 1997).

Is Somkhanda Game Reserve good for environment of Zonyama village?

From the total respondents, 50% strongly agree and 27% agree that the existence of the Somkhanda Game Reserve is good for the environment of Zonyama village and the Gumbi

community at large. These respondents state that pre their historical displacement, they had been living with wildlife for many generations.

“I remember when I was growing up when we were young girls collecting firewood in the forest, we would meet all kinds of wild animals but fortunately they would not harm us” (72-year-old respondent, 2016).

“My father was a hunter, so we were used to seeing wild animals like impala and wild pigs. The wild pigs were dangerous, and they still are. There are many more dangerous animals in the reserve now” (70-year-old respondent, 2016).

Contrastingly, 23% of the respondents, disagreed with the point that the Somkhanda Game Reserve was good for the environment, expressing concern over not being granted entry into the reserve. Traditionally, people were able to hunt for bushmeat as a subsistence alternative, catering for the people’s nutritional needs. There were also concerns raised over the safety of their livestock as some of the respondents argued the risk of living with high predators that can kill their livestock and also people.

“There never used to be that many wild animals in these reserves. Animals like Buffalo and Leopard kill our cattle. How then will I make money for my grandchildren?” (55-year-old respondent, 2016).

“Our cattle are suffering as there is no water from the outside. I would like to be able to send my cattle inside the reserve for them to have water” (32-year-old respondent, 2016).

Somkhanda Game Reserve can improve the community’s attitude towards wildlife and the balance of nature by holding engagements with the community to allow them to raise their concerns and forge a way forward.

Table 4: Perceptions on Somkhanda Game Reserve in its relationship with Zonyama Village

Relation	Category	Total
Environment	Strongly Agree	50%
	Agree	27%
	Disagree	23%
Community	Strongly Agree	61%
	Agree	9%
	Disagree	30%
Total		100%

Is Somkhanda Game Reserve good for the community?

With reference to Table 4, 61% strongly agreed and 9% agreed that Somkhanda Game Reserve is good for the community for a number of reasons. The majority of the respondents indicated how the reserve can provide employment for the youth in the community, while others expressed how they can find opportunity in generating income from wildlife although they were not entirely convinced on how the opportunities could be arranged. This indicates that 70% of the community perceives Somkhanda Game Reserve as a supporter of the community's livelihoods.

Moreover, 30% of the respondents stated that they disagree with Somkhanda Game Reserve being good for the community. This group of respondents expressed that there is not enough that is done by the reserve in terms of development for the community. The issue of exclusion was raised concerning access to the reserve. Since the change in land-uses, members of the community are no longer able to enter the reserve to collect natural resources like firewood, medicinal plants and thatching grass that they may have been able to easily harvest in the past. Hansen *et al.*, (2015) argue that the introduction of property regime changes in common lands in the form of Protected Areas, and in this context the Somkhanda Game Reserve, redefine the conditions for access and control of land and the forest for communities, and how this construction of the protection of land negatively affects people and communities.

Based on the responses, it can be deduced that the respondents perceive themselves as having a relatively good relationship with the Somkhanda Game Reserve. There may however be a need for the community to also be able to access some important areas inside the reserve such as water and cultural sites. The policies of Somkhanda Game Reserve need to be implemented in such a way that benefit is not only enjoyed by non-Gumbi community members, this includes employment opportunities. The respondent stated that they are willing to support the operations of Somkhanda Game Reserve in exchange for the institution supporting the welfare of the community's basic natural resource needs.

4.3.2. Relationship dynamics with Zonyama Village and other Key Economic Players

Other key economic players exist in the greater Gumbi community, from commercial farmers which farm crops for commercial use and private nature and game reserves. This dynamic is worth noting to understand the relationship dynamics that exist in the community. Commercial farms and private game reserves are the two main land use systems which exist in the community, and are the main economic drivers in the area which are perceived to be addressing

all environmental and socio-economic challenges are encountered by the community of Zonyama village. This in reality is not always the case. The local municipality in the area is also perceived as contributing little to nothing in the development of the Gumbi community, and for the Zonyama village specifically.

“Mkuze Ranch took our land and made so many promises, but they don’t keep them. Our cattle are dying because there is no water in our village but there is water in these reserves” (52-year-old respondent, 2016).

“There farmer promised us that he would give us work but he has never kept that promise” (35-year-old respondent, 2016).

“We can go weeks without the waterkan coming to give us with water in our village, but we have seen that it does regularly go to other villages to give them water” (35-year-old respondent, 2016).

The respondents perceived their relationship with other actors that exist in the community as relatively negative to that of Somkhanda Game Reserve. They expressed feelings of neglect from the entities that had previously promised to address the needs of socio-economic welfare and well-being, thus worsening land use conflict in the area. Community development is usually a fundamental issue in rural spaces, particularly pertaining to access, lack of investment in community structures and meaningful distribution of resources such as the basic use of water (Valencia-Sandoval, Flanders and Kozak, 2010).

As a recommended way forward, key economic players that exist in the community need to manage and support better community relations. From the responses, it can establish that the respondents want to feel valued and as somewhat equal partners in the decision-making processes pertaining to the development of their community in efforts to ensure harmonious relationships in the community. Respondents recognised the significance in the existence of these key economic players in the area and strongly feel that they can be able to contribute to the community’s development.

4.3.3. Access to Water and Natural Resources

The fragile state in the nature of water resources in Zonyama village could easily be observed. The prolonged drought period, the lack of available water infrastructures and the average number of household sizes were a major element of constraint in terms of water security and access.

Figure 4 below illustrates the average household size in Zonyama village as according to the sample size of the study. The respondents revealed that they depend on three ways to access water in their village; a) obtaining water from the communal water trough that is shared with livestock, b) receiving water from the municipal water truck, although not a consistent endeavour from the municipality and c) paying money in the form of R50 per trip, to people in the community with small utility vehicles to help collect water from neighbouring water sources, about three kilometres out of Zonyama village.

Only a few households had a Jojo tank mounted next to their house. A total of 4 households were observed to have a Jojo tank attached to the house. All four of the respondents expressed how ineffective their JoJo tanks were considering that it had been a long time since enough rain had occurred to be able to capture sufficient water. In the absence of rain, these households equally depend on either buying water or collecting water brought by the local municipal water truck. (Heltberg, Siegel and Jorgensen, 2009). Figure 4 below also shows how the action of collecting water is not only a woman and young girl responsibility, but young boys are also tasked with the responsibility to collect water for the household.

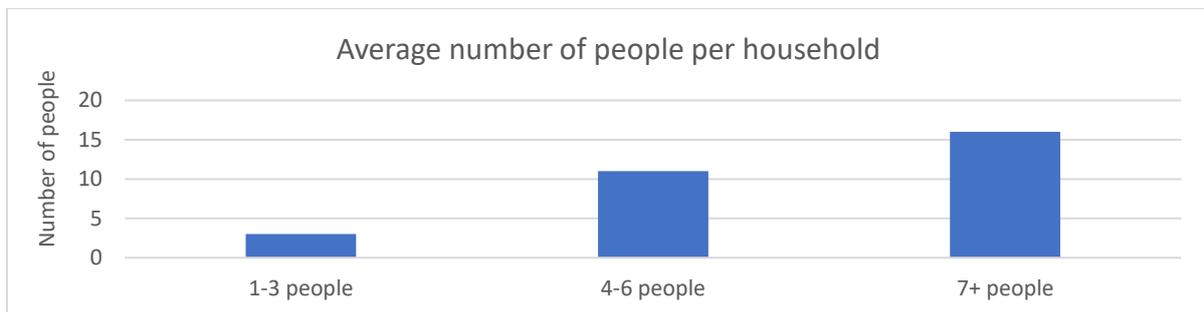


Figure 4: Average number of people per household in Zonyama Village



Figure 5: Water trough used by livestock



Figure 6: Young boy collecting water from the local municipal water truck.



Figure 7: A Jojo tank mounted outside a home for the capturing of rainwater.

4.4. Understanding of Climate Change and its impact on Zonyama Village

Rural women depend on their natural environment for natural resources and livelihoods through activities such as collecting natural materials to construct their houses, crop farming for the subsistence of their families and rearing livestock. Climate change negatively impacts this dependency as livelihoods are threatened and natural resources are slowly diminishing. According to a study titled “Gender and Climate Change: South Africa Case Study”, it is revealed that “women were found to have extra workload when faced with climatic as they made efforts to cope with them” (Babugura, Mtshali and Mtshali, 2010: 3).

4.4.1. The influence of Climate Change on Gender Roles

The responsibilities for many of the household work, caregiving for family members and the maintenance of assets such as livestock and rebuilding of homes have disproportionately become the role of the women. The case in Zonyama village is no different. Women have had to divide the money between the different needs of the household. Without income alternatives and with the poor condition of livestock, women have little incentive to cope better to climate change.

Figure 8 below shows the extent at which cattle are affected by the lack of water in the area. Cows are severely emaciated resulting in many cattle deaths in the community. The dying cattle was another factor that had influenced migration among the men in the village resulting in a significant number of those women who are in married and in never married social arrangements having to take on the duty of maintaining a dying population of livestock.

“I just let my husband’s cows roam around to wherever they can find grass and water to drink because either way they are just going to die. He is away working in Pongola town as a petrol attendant to make money so we can buy food and other resources we would have found easily in our village” (46-year-old respondent, 2016).



Figure 8: Emaciated cattle rolling water drums to get water

4.5. Comprehension of Climate Change as a Concept

Understanding is defined as “the perceived intended meaning of words” (Cambridge English Dictionary, 2021). Babugura *et al.*, (2010: 37) declares that “it was important to establish participants understanding of climate variability and change.” As such, the respondents were asked if they understood what is meant by climate change. Based on the majority of responses, the respondents well understood the concept of climate change within the context of their community.

The ability to understand and comply to standard practices of climate change adaptation is to a certain extent influenced by an individual’s level of exposure to awareness and training interventions. Regardless of the levels of schooling, the respondents showed that they understood climate change and its impacts on the environment and their lives. The women were able to clearly define the concept of climate change and contextualise its impacts on the lived experience in isiZulu.

“The weather has changed for the worst over the years. About two years ago we have a really heavy storm. It was 12:00 midday and it became dark like it was night time. There was a terrible wind that blew away everything, our houses were left bare. After that a heavy rain landed on us. This never used to happen when we were growing up over the years. And now, we are left with dry land that we cannot even farm to feed our children and grandchildren. Things are changing at a very scary rate. I worry about the future” (65-year-old respondent, 2016).

The response provided above was from a 65-year-old who did not even complete the primary level of schooling. Her response to the question of understanding what climate change is shows how she is able to contextualise the event which took place in her own interpretive way. As supported by the “Women and Climate Change: South Africa Case Study” respondent views are “not so detached from what is found in the climate change literature” (Babugura *et al.*, 2010: 38).

4.6. Impacts of Climate Change in Zonyama Village

Implications of climate change in the village were visible from observation. From expressing difficulty in obtaining a sufficient supply of water to the inconsistencies in the local municipal truck delivering water, it was expressed across all the respondents that accessing water was indeed a difficult endeavour.

In a study that looked into water service provision and social equity in a South African rural district municipality, it was found that there was less attention given by rural municipalities in addressing water service provision. This impacted significantly on demands of water service quality and attention to dimensions of social equity (Hutete *et al.*, 2022).

4.6.1 The deteriorating nature of resources

Rural communities commonly use resources obtained from their environment to construct or rebuild their homes. This traditional form of construction is not only free but is also provides a buffer effect on days and nights when temperatures become extremely hot or cold. Figure 9 shows how natural resources such as rocks, mud, logs and stick were used to build homes.



Figure 9: Housing structures built from natural resources.

Although economical for the community in that no money is spent in building these houses, the cost to the environment was not considered as a factor for worsening the conditions of

climate change impacts in the area. The greater part of Zonyama village laid bare as many trees were cut down to use as building material. With the absence of the trees, the village has little buffer as protection from harsh weather conditions. The infrastructure can however be viewed as an adaptation measure in response to limited livelihood alternatives and the construction of shelter using whatever resource available. The construction of these houses is climate smart as they have good passive thermal design.

4.6.2 Women's approaches to coping to Climate Change in Zonyama Village

From the data, it was analysed that the respondents employed a number of adaptive approaches to coping to the apparent changes brought on by climate change in their village. The adaptive measures used by the respondents were to encourage water security in meeting their household water consumption needs. Those with livestock resorted to selling off their cattle for close to nothing as a way to transfer the risk of having to maintain dying cattle and to generate a bit of money to allow them to pay for the service of getting their water delivered by the owners of utility vehicles. Most of the respondents indicated that they had to significantly reduce their scale of farming, as farming at a larger meant that more water would be used to water their crops. This suggests that crop yields were consequently reduced, leaving little for the respondents to sell as a way of generating more income.

I had to sell 4 of my cows last year so that I could have enough money to erect a proper roof in my house using corrugated-iron sheeting. It is not always the best because it is more expensive than if I had got thatching grass, and it is not safe for my family as this place can become very windy (43-year-old respondent, 2016).

This strategy was used by many of the households to help cope with the cost implications of the drought. Nyahunda *et al.* (2022) mentioned that as a community-based adaptation strategy, other women in their study area resorted to “destocking their livestock through selling or slaughtering for consumption.” The findings in this study show that the women of Zonyama village employed the same strategy, although to assist them to be able to afford better building materials. This strategy did not prove to be sustainable though as this implied that the women experiencing loss in wealth.

It had appeared from the data that money seemed to be the most common resource in the community which enabled the respondents to be able to cope better with the impacts of climate change. In the absence of it, women had no other alternative to meeting their household needs.

Safety had also become an issue of concern to the respondents as they realised simply how much damage can occur during a disaster event.

Conclusion

It is evident that the women of Zonyama village need an improved social system and mechanisms introduced to assist them with coping better with climate change as an adaptation strategy. According to the analysis and discussion, the existing systems are limiting and could further exacerbate the social and environmental system in which the women exist. Evidence further suggests that a fair climate change adaptation system in Zonyama village needs to be recognised through several responses pertaining to good governance by key stakeholders in the area, in collaboration with the community to ensure effective natural resource management that is non-exclusionary and that is community centred and focused. There is a great opportunity for the promotion of social cohesion, in breaking the barriers of communication that bear the recognition to community-based solutions to a long-term problem. Water insecurity becomes prevalent in an already broken social system, coupled with climate events such as torrential rains and the drought, women continue to be susceptible to these effects.

CHAPTER FIVE

IMPLICATIONS AND CONCLUSION

Introduction

The following chapter aims to identify approaches that can be in effect to target and potentially overcome obstacles associated with adaptation to climate change in ensuring water security in Zonyama village. The study explored how the women of Zonyama village adapt to climate change in their efforts to securing their household water consumption needs in the context of a drought period. The findings here indicate that there is a gap between effective environmental management and complementing rural livelihoods due to the lack of adequate focus on policy and in devising mechanisms to driving education, awareness and application of climate change adaptation. There is a lack of initiatives in the community which formalises any sort of adaptation techniques, and women remain predominantly excluded in participating in decision-making. Climate change is a global crisis that has worsened the inaccessibility to water resources. Essentially, the study examines climate change adaptation in the context of rural women.

For effective sustainable rural development, it is pivotal to adopt strategies that are inclusive and educative, therefore creating self-reliant rural communities. The Community-Based Adaption philosophy was adopted as the study's theoretical framework. There is relevance in placing climate change adaptation and water security in the context of the community-based adaptation approach. Community-based adaption allows for a stewardship and communal approach to tackling environmental issues such as drought and effects such as water scarcity in addition to climate change as a whole. The study was based on the following objectives:

- a) To study climate change adaptation as a concept along with water scarcity amongst the women of Zonyama Village.
- b) To evaluate the coping mechanisms adopted by women in Zonyama village when facing climate change adversities such as drought and overall water scarcity.
- c) To assess factors contributing to the exclusion of neighbouring communities from accessing water from Somkhanda Game Reserve.

- d) To identify approaches that can be used to target and potentially overcome impediments associated with climate change and water scarcity with climate change and water scarcity in Zonyama Village.

To study climate change adaptation as a concept along with water scarcity amongst the women of Zonyama Village

Looking at women's interpretations of climate change in Zonyama village, the study found that there is an understanding of climate change and its impact on the environment and the community at large, regardless of the levels of education and literacy. Women in Zonyama village continue to adapt to challenges imposed on their well-being and livelihoods by climate change. Not only has the phenomenon brought on changes to the natural environment of the community, but it has also compromised the state of food security and livelihood assets of the Zonyama village as well. The findings do reveal that the methods to adaptation for women in Zonyama are both financially and socially strenuous.

To evaluate the coping mechanisms adopted by women in Zonyama village when facing climate change adversities such as drought and overall water scarcity.

There are a number of climate change coping mechanisms adopted by the women in Zonyama Village. With these coping mechanisms, the women are able to sustain households and prevent the loss of assets such as cattle. Women in Zonyama sell their cattle as a means of attaining income whilst preventing the death of cattle due to lack of water resources, which becomes a form of mal-adaptation. The study also found that there is a range of constraints to climate change adaptation, therefore hindering the effectiveness of coping mechanisms.

Amongst many women, the resistance to change and effective decision making is a major constraint. Antwi-Agyei *et al* (2013: 19) notes that “within the same geographical region, different cultural groups may act differently in their response to risks including the adverse impacts of climate change as such responses may be greatly influenced by the pre-existing belief systems and norms of the group”. The dominance of local knowledge may restrict cultural groups from adapting to sustainable methods that could potentially protect them from exposure to risks and vulnerabilities such as environmental degradation and poverty.

To assess factors contributing to the exclusion of neighbouring communities from accessing water from Somkhanda Game Reserve.

The results do present an opportunity for a collaborative effort between Somkhanda Game Reserve, the Zonyama village, and other stakeholders in the area to come together to hold the local municipality accountable to help find a solution to the issue of water security in the area. This action in return may, as a result, reduce the tensions that lie within the relationship between Somkhanda Game Reserve and the Zonyama village. It can be perceived that contentions lie not only with the Somkhanda Game Reserve but also with other entities that operate under other economic activities in the area. One can also perceive that the differences in the way in which the community acknowledges the commercial farmer is linked to service of gratitude. The presence of the commercial farmer in the area is appreciated by the community through the acts of service on the part of the commercial farmers.

5.1. Implications

Based on the data and the findings highlighted from the study, a set of conclusions can be deduced from the responses articulated by the women of Zonyama village.

a) Development of infrastructure

The development of adequate infrastructure is imperative for rural communities. According to the Development Support Monitor (2012: 5) “inadequate and unreliable infrastructure services are common in the majority of rural communities in Africa”. Infrastructure promotes the improvement of rural livelihoods as facilities and services are easily accessible. For example, tarred roads make rural areas easily accessible. Tarred roads stimulate economic growth as the transportation of goods develops local markets. Furthermore, infrastructural development such as the installation of water tanks or taps can improve the livelihoods of women as they do not have to spend hours fetching water. Zonyama village has little assistance from the local municipality in providing infrastructure that can ease the burden of obtaining water. Adequate infrastructure can also reduce the rate of poverty in the community as this will allow for ease of access to other resources and utilities. In addition, infrastructural developments can improve service delivery in Zonyama village. Communication networks, electricity, and tapped water amongst others will improve the living conditions and subsequently the overall standard of living.

b) Skills training

With only 7% of the population with tertiary qualifications, a majority of the women in Zonyama village, do not have the necessary skills or training required for formal and permanent jobs. Skills training programmes are crucial for the growth and development of rural economies in that these help support the capacity building of the community, and advancing people's knowledge around meeting certain capability needs. The training of rural women will expose them to alternative and advanced systems of ecosystems management, complementing existing and new livelihood techniques to climate change adaptation.. The training of the women in Zonyama will expose them to opportunities and skills that will improve their standard of life significantly and better support the women's social capabilities. Skills' training contributes towards employability subsequently promoting the accumulation of household income generation. Furthermore, skills training can result in the reduction of rural- urban migration as the capacity built can contribute skills towards increased employability of rural communities.

The increase in employment opportunities leads to improved self-sufficiency thus the potential for the growth in rural entrepreneurs. Skills development can expand beyond environmental horizons. There is a shortage of skills in tourism and the business sector among the key economic players around Zonyama village, therefore posing a significant challenge for skills development in the community. Skills training can diversify the activities that the women of Zonyama village use to sustain their livelihoods, thus also supporting the capabilities in adapting to climate change variabilities.

c) Government incentives to aid women-headed households

This study documented The community of Zonyama Village lacks adequate government incentives that allow for the growth and development of women, particularly those that head households. With a significant proportion of women depending on child support grants, there is a need for incentives such as unemployment support incentives that can contribute towards the running of households. Incentives will decrease the household financial burdens, therefore, eliminating the potential for school dropping out, exposure to prostitution, depression, and substance abuse as well as numerous other ills associated with poverty. Women who run households are more susceptible to migrating to the city in pursuit of a better life, leaving vulnerable children behind.

d) Women empowerment

Women play an important role in the rural agricultural sector however, patriarchal systems continue to oppress the roles of women within communities and households. Women empowerment within the agricultural sector and also granting access to micro-financing systems is pivotal towards developing agricultural skills, building self-sufficiency as well as overall financial independence for the women of Zonyama. Perera (2020) asserts that micro-finance is significant and essential in empowering women and developing entrepreneurs. Woman-headed households are the most vulnerable to financial shocks such as high food price inflation as well as related consequences including food insecurity. The women of Zonyama are not an exception to experiencing such financial shocks, as they find themselves having to sell off some of their cattle to help sustain their income which is shared between buying water and for their household's subsistence.

The empowerment of women will promote gender equality through the inclusion of women within the Zonyama village community. Gender equality will subsequently stimulate cooperation and cohesion within the community, mobilising good governance and encourage good practice with regards to the application to climate change adaptation techniques. An approach to consider can be the establishment of women-led cooperatives can stimulate the formulation of agricultural cooperatives that can assist in generating income. These cooperatives can eliminate the marginalisation of women. The findings In addition, government funding towards the agricultural cooperatives can stimulate the agricultural sector of Zonyama village, therefore, promoting a sustainable rural approach to adapting to climate change. In addition to agriculture, women empowerment initiatives can allow women to expand to other opportunities including the participation in policy formulation in respect to issues pertaining to climate change adaption.

e) Programmes to promote climate change awareness

There is evidence of inadequate climate change awareness in Zonyama village. This can imply that the women of Zonyama village are less resilient to disaster events brought on by climate change, with little to no resources to responding effectively to climate change. This can also imply that the women of Zonyama village may experience devastation during disaster events, making them more susceptible to losing their livestock which makes up for a major income generator for the women. The limited knowledge on climate change awareness reflects the marginalisation of the women of Zonyama village in accessing knowledge and education

around policy and how it can be applied in addressing environmental challenges in the context of climate change. There is a need for funding towards implementing programmes that will promote climate change awareness.

The development of climate change awareness programmes can improve the community's understanding of existing consequences associated with climate change that particularly affect the environment and the community as a whole. Furthermore, the programmes will stimulate sustainable agricultural practices as farmers can be made aware of the improved methods required towards mitigating challenges associated with climate change. Improved knowledge and awareness can reduce the risk of extreme pressure to ecosystem of natural resources such as water, and potentially minimise environmental degradation, overharvesting of depleting resources as well as unsustainable agricultural practices.

Conclusion and Further Research

The research set out to explore the approaches employed by rural women to climate change adaptation in the context of rural women securing their water consumption needs during a drought period. Findings from the analysis indicate that there needs to be a facilitated process through which the community of rural women of Zonyama village are formally mobilised in efforts to inform structured and sustainable adaptation to climate change.

A women-inclusive community governance structure can help with the understanding of roles and responsibilities of key players in the Zonyama village area and the broader Gumbi community. The findings of this study reveal that there is little that is understood about the mandate in which each key player is meant to fulfil in the community and the capacity of each key economic player. The process of inclusion can help educating and with managing major expectations raised by members of the community on key economic players to effect change, by driving responsiveness and accountability to the local and district municipalities and managing authorities mandated to provide basic services one of which being the provision of clean water.

Evidence also clearly reveals the exclusion of women voices and opinions in decision-making processes regarding the access and supply of water for consumption in rural communities. Cornwall (2016) asserts that "facilitating positive change in women's lives is not possible without changing the underlying structures of constraint." Facilitating positive change in women can be recognised in efforts to eliminate women's subordination while encouraging an enabling environment of awareness and development for women. Gender perspectives need

not to be generalised given that gender relations and context specific. In the context of this study, there is a need for prioritising the needs of women to improve adaptation strategies to climate change.

In the case of the women living in Zonyama Village, an improved system of Community-based Adaptation that compliments existing livelihoods strategies can present a practical opportunity for the formal advancement of women participation within policy and in efforts to address water consumption needs in the community. Community-based Adaptation can further provide the opportunities for local development linked to climate change policies at a community scale.

Based on the findings from the study, there is an opportunity for Community-based Adaptation to be successful with positive impacts to the environment, the animals and to the lives of rural women of Zonyama village. Proper planning, effective decision-making and execution of interventions that seek to address water resource allocation should begin from a local municipal level, and should consider a pre-disaster response to the approach as opposed to post-disaster response. A formalised Community-based Adaptation strategy at a local level is required as an intervention, one that is participatory and inclusive of the most vulnerable persons. CbA can offer opportunity and empowerment to the illiterate, to those who have access to limited social services and those who have feelings of powerlessness. A formalised Community-based Adaptation approach in Zonyama village presents the opportunity to develop further and improve the capabilities and assets of the rural women of Zonyama village.

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APPENDIX

Appendix 1: Research Questionnaire

Zonyama Village

Household Number:.....

1. Age

18 – 25 years	
26 – 35 years	
36 – 45 years	
46 – 55 years	
56 – 65 years	
65+ years	

2. Gender

Male	
Female	

3. Education Level

Primary Schooling	
No Primary Schooling	
Secondary Schooling	
No Secondary Schooling	
Tertiary Schooling	
No Tertiary Schooling	

4. Household structure:

4.1 How many people live in the household?

1-3	
4-6	
7+	

4.2 Head of Household

Gender	Age	Relationship to Household

5. Number of years living in Zonyama:

5.1 How long have you been living in Zonyama?

Less than 5 years	
5 – 10 years	
10+ years	

**If less than 5 years, proceed to answer Questions 5.2 and 5.3*

5.2 Where did you live before coming to live in Zonyama?

5.3 Why did you choose to come live in Zonyama?

6. What are the things you like the most about living in Zonyama?

7. What things would you change in Zonyama and why?

8. How is your relationship with Somkhanda Game Reserve?

Good	
Fair	
Bad	

8.1 Please explain why?

9. Do you own this land?

Yes	
No	

9.1 Please explain.

10. Are there any community structures that exist in Zonyama?

11. Who do you go to when you experience a problem? Please explain.

12. Please provide with 5 things you get from nature in Zonyama. E.g.: river, forest, mountain, park.

Resource	Support
1.	
2.	
3.	
4.	
5.	

13. What do you think is a threat to nature in Zonyama?

14. What do you think can be done to solve the threat to nature that you have mentioned?

15. Who do you think is responsible for solving the threat to nature? Please explain why?

16. How do you access water in this area?

17. How easy is it to access water?

Classification	Explanation
Easy	
Not easy	
Difficult	
Other	

18. Do you know what Climate Change is?

Yes	
No	

19. What is your understanding of Climate Change?

20. Have you noticed any changes to nature in Zonyama from the time you have been here?

Yes	
No	

20.1 What has been the noticeable change?

21. How have the mentioned changes to nature been?

Positive	
Negative	

21.1 Please explain why?

22. What do you think can be done to address these changes?

23. Given the chance, would you move to a nearby village to access water more easily?

23.1 Please explain.

Disclaimer: Your response to this survey is voluntarily and your anonymity will be maintained. You are free to withdraw your participation at any time should you wish to do so.