

Climate change responses in urban low-income groups, Pietermaritzburg, KwaZulu-Natal, South Africa

by

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Abstract

South Africa is urbanising at an unsustainable rate such that the levels of urban poverty and inequality are rising, taking the country further from its attainment of the sustainable development goals, mainly, the elimination of poverty alleviation (Goal 1) and the reduction of inequalities (Goal 5). Climate change, which was voted the second greatest threat to national security in 2017, is exacerbating the situation, making it difficult for governments to juggle the demands of the increasing population with responses to climate-related impacts. Hence, urban low-income groups, due to the pre-existing high levels of poverty and inequality, lack the resources to respond to the current and future impacts of climate variability and change. They are disproportionately vulnerable and these impacts are not gender-neutral as gender inequalities and women's socio-economic vulnerability contribute to their susceptibility to climate-induced impacts. Attempts are being made by the global community to address this 'wicked problem' via mitigation and adaptation measures, however, given the complexities and multi-scalar nature of the issues, the governance system is met with challenges. Central to addressing climate change are local governments who are at the forefront of vulnerability and are better positioned to design and implement climate change response strategies that minimise the impacts on local livelihoods and vulnerable communities. In light of this, the research investigates how low-income groups in the urban areas of Pietermaritzburg, South Africa, and their local governments, are responding to the current and future impacts of changing climatic conditions. Pietermaritzburg is an inland city and the second largest urban centre in the province of KwaZulu-Natal, a province that has a high vulnerability to climate-related risks and a low adaptive capacity. In addition, the city is confronted with growing rates of urban poverty, unemployment and unequal development. Using a case study approach, a questionnaire survey was conducted within four socio-economically marginalised urban communities. The respondents identified eight climate stressors that negatively impact their lifestyles and livelihoods, however, they lacked the knowledge as to the causes of climate change and how to cope. As a consequence, less than half of the respondents had adopted coping strategies, many of which were stop-gap reactive-type measures that provide limited capacity to build resilience and response capacity.

In-depth interviews were conducted with local governments responsible for the case study communities, to assess their responses to climate variability and change. The municipalities have adopted measures to institutionalise climate responses, however, they are relatively new and implementation is slow, complex and fraught with limitations and competing socio-economic demands. In view of these findings, it is argued that with South Africa's rapid rate of urbanisation and the projected climate changes, there is an urgent need to create enabling conditions for the adoption of engendered, cost-effective, long-term and sustainable coping strategies that are responsive to the needs of vulnerable groups. Furthermore, local governments must transform their governance structures and enlarge their knowledge base by engaging non-state actors, including the citizens, non-governmental organisations, community-based organisations, faith-based organisations, research institutions, and the private sector in the policy-making and implementation process. A transdisciplinary approach and a hybrid and inclusive governance are

necessary to holistically address the combined impacts of climate change and rapid urbanisation. Moreover, the local government must increase investment in urban pro-poor climate change projects, which have, to some effect, been successful, and educate the communities on climate-related risks so as to increase their knowledge and response capabilities.

Declaration

The research described in this dissertation is the work of the author's own research investigations, under the supervision of Professor T.R Hill. The research has not been submitted in any form for any other degree or diploma, to any other University. Where the work of others has been used, it has been duly acknowledged in the text.

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Professor T.R. Hill
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Date

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“Being confident of this, that He who began a good work in you will carry it on to completion until the day of Christ Jesus”- Philippians 1 v 6

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Acronyms

CBD	Central Business District
CC	Climate Change
CDH	Cliffe Dekker Hofmey
CDRF	China Development Research Foundation
CIP	Climate Information Platform
DAC	Durban Adaptation Charter
DEA	Department of Environmental Affairs
DM	District Municipality
IDMC	Internal Displacement Monitoring Centre
IDP	Integrated Development Plan
IIED	International Institute for Environment and Development
IPCC	Intergovernmental Panel on Climate Change
KZN	KwaZulu-Natal
LM	Local Municipality
MDGs	Millennium Development Goals
NCCRS	National Climate Change Response Strategy
OECD	Organisation for Economic Co-operation and Development
RSA	Republic of South Africa
SSA	Sub-Saharan Africa
SDGs	Sustainable Development Goals
TERI	The Energy and Resources Institute
UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UN-HABITAT	United Nations Human Settlements Programme
UMDM	uMgungundlovu Municipality
UNRISD	United Nations Research Institute for Social Development
WEDO	Women's Environment & Development Organization
WMO	World Meteorological Organization (WMO)
WRC	Water Research Commission

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Thesis contents

This doctoral thesis consists of an introduction, literature review, three appended papers and a synthesis.

List of papers

- I. Hlahla, S. and Hill, T.R. “We cannot tell the difference between summer and winter”: Urban poor responses to climate variability Pietermaritzburg, KwaZulu-Natal, South Africa. Submitted to *SAGE Open*, manuscript under review.
- II. Hlahla, S., Nel., A. and Hill, T.R. Assessing Municipal-level Governance Responses to Climate Change in KwaZulu-Natal, South Africa. Submitted to *The Journal of Environmental Planning and Management*, manuscript under review.
- III. Hlahla, S., Simatele D. and Hill, T.R. The impacts of climate variability on marginalised urban women in KwaZulu-Natal, South Africa. Submitted to *Climate and Development*, manuscript under review.

Paper I was co-authored by two authors, with Hlahla as the lead. Hlahla was responsible for the research idea, data collection and analysis and report writing. Hill and Hlahla were responsible for the identification of study sites and the designing of the research tool. Hill was responsible the editing the paper. Hill gave his permission for the paper to be included in the thesis.

Paper II was co-authored by three authors, with Hlahla as the lead. Hlahla and Hill were responsible for the identification of study sites. Hlahla and Nel were responsible for the research idea, designing of the research tool used and data collection. Hlahla, Hill and Nel were responsible for data analysis, report writing, discussion, overall conclusion and editing of the paper. Nel and Hill gave their permission for the paper to be included in the thesis.

Paper III was co-authored by three authors, with Hlahla as the lead. Hlahla was responsible for the research idea, data collection and analysis and report writing. Hill and Hlahla were responsible for the identification of study sites. Simatele and Hill assisted with the designing of the research tool, contributed to the discussion and edited the paper. Simatele and Hill gave their permission for the paper to be included in the thesis.

CHAPTER ONE
Introduction

1 Introduction

1.1 Introduction

Cities are hubs of economic growth that have been associated with improved livelihoods, education, living standards, social and economic independence, and human development (Boadi *et al.*, 2005). However, this ‘promise’ of a better life has propelled the urban growth rates to unsustainable levels which can result in poverty and widening inequalities (Frye *et al.*, 2011; SACN, 2016). The challenge to address urban poverty has been compounded by climate variability and change which are exacerbating vulnerabilities to produce direct impacts on livelihoods, health, incomes, living conditions and assets (social and economic), with the poor bearing the brunt of these impacts (Eriksen *et al.*, 2007; Satterthwaite *et al.*, 2007; Chuku, 2010; National Planning Commission, 2012). The Intergovernmental Panel on Climate Change (IPCC) postulates that some of the most severe impacts of climate change will be experienced in cities and towns in the global south “where processes of global environmental change may not only lead to extreme events but also exacerbate chronic problems of poverty and environmental stress” (Bulkeley, 2010, p. 230; Carmin *et al.*, 2012; Olsson *et al.*, 2014; Di Ruocco *et al.*, 2015).

Many of the impacts of climate change are already being experienced and include; an increase in temperatures, rainfall variability, water scarcity, food insecurity, increase in the frequency of extreme events such as floods and droughts, sea level rise in coastal regions, increased incidence of grassland and forest fires, health risks due to heatwaves and increased prevalence of vector-borne or water-borne diseases such as cholera and malaria, the increase in non-communicable diseases such as cardiovascular and respiratory diseases, and the loss of habitats and the increase of extinction rates of plant and animal species (Nelson *et al.*, 2002; Adger *et al.*, 2003; Satterthwaite, 2007; Earthlife Africa and Oxfam International, 2009; Lisk, 2009; Midgley *et al.*, 2011; RSA, 2011; Schulze and Kunz, 2011; World Bank, 2011; DEA, 2013). These impacts exacerbate chronic environmental threats such as deforestation, soil degradation and water scarcity (Satterthwaite, 2007; UNDP, 2011; Habtezion, 2012; UNDP, 2015). In addition, climate-related disasters pose a threat to human security by displacing people or forcing them to

compete for resources such as food and water, and this has the potential to lead to conflict and political and economic instability (Lisk, 2009; Madzwamuse, 2010).

Many of the impacts on the urban poor are weather-related and tend to be gradual and difficult to detect or track using standard climate observations due to the lack of adequate data (Simatele, 2010; Olsson *et al.*, 2014). Equally difficult to identify are the measures that the vulnerable groups have adopted to cope with these climate-related events (Simatele, 2010). Examples of such events include “short periods of extreme temperature, minor changes in the distribution of rainfall, and strong wind events” (Olsson *et al.*, 2014, p. 796). As a result, minor changes in climate can have devastating consequences for low-income groups in urban areas in terms of loss of livelihoods and increased poverty (Eriksen *et al.*, 2008; Earthlife Africa and Oxfam International, 2009).

Greenhouse gases (GHG) emissions have been on the rise despite the numerous climate change mitigation and adaptation policy interventions that have been undertaken, prompting the IPCC to issue a warning regarding the reduction of emissions (Connor, 2014; Fillmore, 2014). Failure to produce a zero-carbon society by 2100 will result in irreversible changes in the climate system and dire consequences for society, in particular, the poor; the reversal of developmental gains, including the fulfillment of some of the Millennium Development Goals (MDGs) and; the failure to fulfill the sustainable development goals (SDGs) by 2030 (African Development Bank *et al.*, 2002; Chikulo, 2011; Heinrich Boell Foundation, 2012; IPCC, 2014; Ansuategi *et al.*, 2015; UNDP, 2016). The main SDGs that will be affected are goals 1, 2, 5, 10, and 11, which pertain to the elimination of poverty, the elimination of hunger, gender equality, reducing inequality and, the creation of safe, sustainable and inclusive cities, respectively (UN, 2015).

South Africa’s high dependency on coal for energy and its people’s carbon-intensive behaviours such as the over-reliance on cars and electricity, have contributed towards the high ecological footprint of many urban areas, in particular, metropolitan areas (Earthlife Africa and Oxfam International, 2009; RSA, 2015). This has led RSA (2015, p.15) to describe the nation’s urban areas as “resource intensive, highly polluted, and wasteful” as resources are utilised inefficiently. In addition, South Africa has the highest urbanisation rate in Sub-Saharan Africa, with the expectation that

approximately 80 percent of the nation will be urban by 2050 (Mafusire *et al.*, 2014; RSA, 2015; SACN, 2016). There are already high levels of urban poverty and inequality in the country and approximately 60 percent of the urban population resides in areas that suffer from structural deficiencies and poor service provision (Hickmann and Stehle, 2017) and this is where “much of the health risk and vulnerability to climate change is concentrated” (Revi *et al.*, 2014, p. 544).

The lack of socio-economic advancement within urban populations in South Africa is predominantly due to the absence of systematic and effective urban planning, combined with the rapidly growing population, which have resulted in the increase of urban poverty levels and unemployment, the proliferation of informal settlements, inadequate service provision and infrastructure, increasing pressure on the environment, and an increased vulnerability to climate-related risk (Boadi *et al.*, 2005; Chikulo, 2011; Taylor *et al.*, 2014; United Nations Economic Commission for Africa, 2014; UN-HABITAT, 2014; Di Ruocco *et al.*, 2015; RSA, 2015). Furthermore, the failure of policy-makers to effectively plan for urban growth has led to inequitable and low levels of economic development, causing further socio-economic divisions within societies (Bartlett *et al.*, 2012; United Nations Economic Commission for Africa, 2014). Taylor *et al.* (2014, p. 33) adds that “there is already some evidence of new spatial and social divisions, with new patterns of vulnerability emerging alongside on-going urban expansion,” which are unintentionally reinforcing the Apartheid marginalisation. This new form of marginalisation is likely the result of the social and political pressure the governments are under to provide housing and services within a short space of time and this cumulative effect is much more difficult to reverse now than it was in 1994 when South Africa gained its independence (RSA, 2015). Hence, the majority of urban centres in South Africa are not only faced with an adaptation deficit but a development deficit as well (Revi *et al.*, 2014).

In spite of these complex challenges, cities are hubs for development and innovation and they, and their local governments, have a vital role to play in redressing the injustices of the past, alleviating poverty, addressing climate change and achieving the goals of sustainable development (Satterthwaite 2007; UN-HABITAT 2011; Revi *et al.*, 2014). Moreover, the South African National government recognises the important role of local governments in the strengthening of local adaptive

capacity and building resilience, and asserts that climate change will only be effectively addressed if sustainable development and poverty reduction are mainstreamed into climate change responses (RSA, 2011). Fay *et al.* (2015) concur by stating that efforts to eradicate poverty will not succeed if climate change and its impacts on low-income groups are not integrated into poverty-reduction policies, and the strategies to stabilise the climate will fail if poverty eradication is not prioritised. Furthermore, successful responses to climate change in urban areas is highly dependent on “the competence and capacity of local governments and a locally rooted iterative process of learning about changing risks and opportunities, identifying and evaluating options, making decisions, and revising strategies in collaboration with a range of actors” (Revi *et al.*, 2014, p. 541).

1.2 Research problem, aim and objectives

The aim of the research is to investigate, through local case studies, how urban-based low-income and marginalised groups in Pietermaritzburg, KwaZulu-Natal (KZN), and their local governments, are responding to the current and future impacts of climate change. KwaZulu-Natal is one of nine provinces in South Africa, with the 2nd highest population (Statistics SA, 2016). Climate change projections for the province suggest that there will be an increase in temperatures and in the occurrence of extreme events, and precipitation patterns are likely to alter (Schulze and Kunz, 2011; KZN EDTEA, 2014). The high levels of poverty (65%) and inequality within the province have contributed to high levels of human vulnerability to climate-related risk and low adaptive capacity (Statistics SA, 2011; Msunduzi Municipality, 2012; Wilk *et al.*, 2013). KZN has the highest provincial human vulnerability to climate risk in the country and the 3rd lowest adaptive capacity (Wilk *et al.*, 2013; KZN EDTEA, 2014).

The objectives of this research are to (i) determine the climate change risks that the urban poor in Pietermaritzburg, KwaZulu-Natal, are currently facing; (ii) investigate the impact of climate variability and change on urban poor in Pietermaritzburg; (iii) investigate climate response practices that the communities have adopted in response to these impacts (iv) assess the municipal climate response frameworks of the municipalities governing the communities and;

(v) investigate the impact of climate variability and change on vulnerable groups within the communities, in particular, women.

Studies on urban climate risk, vulnerability, response, and resilience in South Africa, and the rest of Africa, have tended to focus on larger, coastal, and often metropolitan, cities and not on smaller, non-metropolitan inland cities (Ziervogel *et al.*, 2016), such as Pietermaritzburg. This research aims to contribute to filling this gap given the important role that smaller cities and towns will play in the strong urban growth trajectories projected for Africa over the coming decades and in transformative climate change governance (SACN, 2012; Roberts, 2014; Wisner *et al.*, 2015; Ziervogel *et al.*, 2016).

1.3 Structure of thesis

The thesis was written using a research paper-based format. Three research papers were developed and these have been submitted to peer-reviewed journals. Therefore, there is a repetition of facts and information, and some contradictions may exist as new ideas and thoughts emerged during the research process.

Chapter One (Introduction) provides introductory comments on the impacts of climate variability and change on cities in South Africa, in particular, the interaction between climate risks and urban poverty. The chapter presents the research aim and objectives.

Chapter Two (Literature Review) provides a conceptual framework for the study by reviewing literature on climate change, urban poverty and urban climate governance in South Africa.

Chapter Three (Methods) provides a summary of the research strategies adopted for the research

Chapter Four (Paper I) investigates the impacts of climate variability on low-income and marginalised urban communities within Pietermaritzburg. This paper addresses the research objectives, (i), (ii), and (iii).

Chapter Five (Paper II) examines the municipal climate response frameworks of the municipalities governing the communities, *i.e.*, uMngeni and Msunduzi local municipalities and uMgungundlovu District Municipality. This paper addresses research objective (iv).

Chapter Six (Paper III) examines how marginalised women and female-headed households in urban areas in Pietermaritzburg are affected by changing climatic

conditions and how they are coping. This paper addresses research objective (v).

Chapter Seven (Synthesis) summarizes and discusses the findings, how they link to theory, integrate with previous studies, build on existing literature and contribute to new knowledge. This is followed by a research conclusion.

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CHAPTER TWO
Literature Review

2 Literature Review

2.1 Introduction

“South Africa is faced with a difficult challenge in trying to juggle three imperatives – development (conventionally based on fossil fuels), poverty eradication and climate change. On the one hand, the country has to fast track provision of adequate transport, power, communication networks, water, sanitation and other infrastructure services. Much of this development implies that South Africa’s greenhouse gas emissions will increase. The provision of these services is essential to improving people’s well-being and for the reduction of poverty.” - Earthlife Africa and Oxfam International, 2009, p. 4

Climate change is likely the greatest human developmental challenge that the global community has faced and will be for many decades to come (UNDP, 2007; Chikulo, 2011; Romero Lankao, 2011). The phenomenon is threatening to reverse decades of developmental gains, including the fulfillment of some of the global commitments to the Millennium Development Goals (MDGs) (African Development Bank *et al.*, 2002; Chikulo, 2011; Heinrich Boell Foundation, 2012; UNDP, 2016). A global survey conducted by the Pew Research Center in 2017, determined that, globally, climate change is the second leading threat to national security, after terrorism (Pew Research Center, 2017). Furthermore, the World Economic Forum (2017) ranked extreme weather events as the most likely global risks to occur while major natural disasters are ranked 2nd. The impacts of climate change will have far-reaching consequences for current and future generations, in particular, those in developing countries (World Bank, 2010). The phenomenon, which Termeer *et al.* (2013, p. 28) have identified as a “wicked problem” due to its intractable nature, will delay progress in the attainment of the Sustainable Development Goals (SDGs), and this will likely reduce the “resilience and adaptive capabilities of African individuals, communities, states and nations” (Niang *et al.*, 2014, p. 1211).

2.2 Urbanisation in Africa

Urbanisation in Africa is demographically driven and is, therefore, largely unplanned and unsustainable (Cobbinah *et al.*, 2015). Rural-urban migration and natural population growth are the primary reasons for the high growth rates and these come in the face of low levels of economic growth (Masika *et al.*, 1997; ADB, 2012). A myriad of pull and push factors are driving rural-urban migration. The pull factors include; socio-economic benefits such as employment opportunities, the ‘perceived’ better quality of life, and access to basic social amenities, which attract people to cities (Cobbinah *et al.*, 2015). The push factors include; the failure of agricultural activities/ decreased crop yield which is accompanied by a lack of livelihood options, inadequate basic services, and poor infrastructure (Yuen and Kumssa, 2011; Cobbinah *et al.*, 2015). There are numerous challenges associated with the high growth rate and these include, *inter alia*, increased demand for basic services (affordable, durable and safe housing, education, sanitation, health care and water) and infrastructure, efficient transport systems, and formal employment (Boadi *et al.*, 2005; Yuen and Kumssa, 2011; UN DESA, 2015). Urban governments lack the institutional capacity to meet the accelerated demands of premature urbanisation and this has led to the proliferation of informal settlements, increased urban poverty levels and inequalities, over-exploitation of resources, poor quality of life, rising unemployment, and the growth of the informal sector (Boadi *et al.*, 2005; Turok and Borel-Saladin, 2014; Revi *et al.*, 2014; UN-HABITAT, 2014; Cobbinah *et al.*, 2015; Tacoli *et al.*, 2015; UN DESA, 2015; Croese *et al.*, 2016; SACN, 2016). Due to a lack of skills and an excess of labour, 78% of the urban population in Africa, many of whom are migrants, is forced to join the informal economy, with the majority being women (UNFPA and IIED, 2012; Cobbinah *et al.*, 2015; Tacoli *et al.*, 2015). The jobs within the informal sector include; waste picking, domestic work, petty trading, street vending, and home-based micro-enterprises, and are vulnerable to recession and climate variability and change (Boadi *et al.*, 2005; Tacoli, 2012; UNFPA and IIED, 2012; Cobbinah *et al.*, 2015). Moreover, the jobs lack financial security as they are low-paying, insecure, unstable and of poor working conditions (Cobbinah *et al.*, 2015).

Therefore, it comes as no surprise that rather than being viewed as a driver for socio-economic and sustainable development, urbanisation in Africa is increasingly being labelled as a threat that is eroding the “socio-economic and environmental benefits” that have been gained (Cobbinah *et al.*, 2015, p. 63; Tacoli *et al.*, 2015). The rapid urbanisation has not been accompanied by economic security and improved quality of life and this places increasing pressure on the urban poor and increases their vulnerability to socio-economic, political and environmental hazards (Revi *et al.*, 2014; Cobbinah *et al.*, 2015; Tacoli *et al.*, 2015). In view of this, the urban low-income groups have been identified as one of the vulnerable social groups who will be impacted significantly by climate change (IPCC, 2007; Ziervogel and Frayne, 2011).

In spite of the failures of urbanisation to promote socio-economic development in Africa, urban areas are still considered to be engines for economic growth, key players in the fight against poverty, and centres of innovation, political and entrepreneurial activity (De Sherbinin *et al.*, 2007; World Bank, 2009; Hunt and Watkiss, 2011; Romero Lankao, 2011; Revi *et al.*, 2014; Cobbinah *et al.*, 2015; SACN, 2016). To perform their multiple functions, urban centres consume more than half (67%) of the world’s energy and their activities contribute to more than 70 percent of the global anthropogenic greenhouse gas (GHG) emissions (While and Whitehead, 2013; UN DESA, 2015). Boyd and Juhola (2015, p. 1234-1235) note that “urban areas act as engines of change by altering ecosystems and utilizing energy and natural resources both within and outside their geographical area”. However, in spite of their major role in driving climate change, they are not immune to the risks and impacts associated with the issue, regardless of their size, socio-economic status or location (De Sherbinin *et al.*, 2007; Hunt and Watkiss, 2011; Revi *et al.*, 2014; Cobbinah *et al.*, 2015). All urban centres and their populations will be affected, however, they will differ in terms of their vulnerability, and those areas that are not impacted directly may be forced to accommodate climate refugees from rural and surrounding urban areas, both nationally and internationally (While and Whitehead, 2013; Boyd and Juhola, 2015). For example, in a study carried out by Kolmannskog (2009) on climate change, disaster, displacement and migration, it was found that drought and the ensuing environmental conflict

in Somalia forced many to migrate to Kenya, and similarly, drought in Burundi was primarily responsible for the movement of people across the border to Rwanda. Moreover, Schwartzstein (2016) notes that there is strong evidence pointing to the fact that extreme weather is the reason for the high levels of migration in sub-Saharan Africa, and in 2008 and 2016, climate-related sudden-onset disasters were responsible for the displacement of at least 20 million and 24.2 million people, respectively (Kolmannskog, 2009; IDMC, 2017). Inter- and intra- migration are expected to become more prevalent as impacts of, and vulnerability to, environmental stressors increases as evidenced by a study carried out by the Internal Displacement Monitoring Centre (IDMC) in 2017 which estimated that on average 13.9 million people will lose their homes or livelihoods annually to weather-related sudden on-set disasters such as floods (IDMC, 2017).

2.3 Urban vulnerability to climate change

Climate change consists of short- to medium-term climate variability and gradual long-term change in statistical distribution of weather patterns (*i.e.* changes in average annual temperature and rainfall) and the extreme weather events that occur such as floods and droughts (Nelson *et al.*, 2002; Rout *et al.*, 2013). Urban areas are vulnerable to climate-related risks such as the increase in temperature, sea-level rise, air pollution, increase in the frequency of flooding, pro-longed droughts, water scarcity, food insecurity, heat waves, and increased prevalence of diseases such as cholera and malaria (Hunt and Watkiss, 2011; While and Whitehead, 2013; Shackleton *et al.*, 2015; Knieling and Klindworth, 2016). Such risks tend to “compound and reinforce existing socio-economic and health inequalities, and create new urban vulnerabilities” (While and Whitehead, 2013, p. 1327; Adger *et al.*, 2003). African urban centres, due to their high exposure to climate-related risks and low adaptive capacity, are the most vulnerable and will experience the greatest negative impacts which will undoubtedly alter socio-ecological systems (African Development Bank *et al.*, 2002; Niang *et al.*, 2014; Gasparatos *et al.*, 2017).

Many large African cities are located in low-lying areas, on or in close proximity to the coast, which are centres for trade, or close to the mouths of major rivers or situated on estuaries (De Sherbinin *et al.*, 2007; Hunt and Watkiss, 2011; Cobbinah *et al.*, 2015). As a result, a large proportion of the urban population resides in coastal cities and these are areas increasingly vulnerable to climate-related risks and hazards such as flooding, sea-level rise, cyclones, storm surges, coastal erosion, high winds and saline penetration into surrounding freshwater systems (De Sherbinin *et al.*, 2007; Cobbinah *et al.*, 2015; UN DESA, 2015; IDMC, 2017). Hunt and Watkiss (2011) note that floods are one of the most severe climate-related impacts due to the large number of people that reside in urban areas. Droughts can be equally impactful as they affect both those who are dependent on natural resources for their livelihoods and for food, and those who do not produce their own crops (Habtezion, 2012; Tacoli, 2012; Rout *et al.*, 2013).

Rain-fed and irrigated agriculture are climate sensitive sectors that are impacted negatively by climate and weather variability (UNDP, 2011). Moreover, the major sources of food consumed in urban areas are rural areas and imports, thus climate change will impact food production, availability and accessibility (Ziervogel and Frayne, 2011). The decrease in crop yields threatens food security and urban livelihoods, and the resulting increase in food prices will affect the population as more money is spent on acquiring food. The hardest hit will be the marginalised who already spend a disproportionate amount on food (Caesar *et al.*, 2013; Fay *et al.*, 2015). Caesar *et al.* (2013) found that the urban population in the city of Pietermaritzburg, South Africa, spend a minimum of one-third of household income on food and the remainder covers other household costs such as monthly payments for electricity and water, transport, fuel, medical costs and school fees. Thus, any increase in food prices could have devastating impacts on household budgets. The UNDP (2011) projects an increase in food prices by 30-50% in the coming decades and the urban poor will be the worst affected as such increases bear health implications. Niang *et al.* (2014) report that, in 2009, global increases in food prices contributed to the deaths of approximately 30 000 to 50 000 malnourished children in sub-Saharan Africa. Malnourishment and starvation are common

in such cases as nutrition is sacrificed in favour of survival (UNDP, 2011).

Heat waves are another example of climate change impacts that have devastating impacts for urban livelihoods and are responsible for numerous deaths (Koppe *et al.*, 2004; Depietri *et al.*, 2012; Heaviside *et al.*, 2016). Heat waves refer to prolonged periods of high temperatures that are significantly higher than the average maximum temperature for the hottest month within a region and can have a negative impact on human and animal health, with regards to mortality and morbidity, the economy, infrastructure, food and water security, and the ecosystem (Depietri *et al.*, 2012; eNCA, 2015; Heaviside *et al.*, 2016; Ceccherini *et al.*, 2017). The World Meteorological Organization (WMO) reports that the years 2011-2015 were the warmest five years in history and 2016 is recorded as the warmest year thus far, followed by 2015 and 2014 (Ceccherini *et al.*, 2017; NOAA National Centers for Environmental Information, 2017). Therefore, under current climatic conditions, it is anticipated that extreme temperatures will become more frequent (Ceccherini *et al.*, 2017).

Globally, heatwaves have been responsible for numerous deaths. For example, in August 2003, heat waves in Europe caused in excess of 70 000 deaths, with the majority of deaths occurring in France which reported over 15 000 deaths (Koppe *et al.*, 2004; Depietri *et al.*, 2012; Heaviside *et al.*, 2016). More recently, in 2015, India experienced what is now called the fifth deadliest heatwave, killing 2 422 people after temperatures soared to over 45°C. The majority of those who fell victim to the heatwaves were the elderly, the socio-economically marginalised, those who work outside, and the homeless. The poor are sensitive populations who do not have the luxury of staying indoors and following precautions to cope with the high temperatures (Ebrahim, 2015; Meyers, 2015). Nor can they afford the protection required to work in extremely hot conditions (Zell *et al.*, 2015). Unfortunately, they need to go to work so they can feed themselves and their families, even if the cost might be death (Ebrahim, 2015; Meyers, 2015). Therefore, poverty is speculated to be one of the reasons so many people lost their lives during the 2015 heatwave in South-east Asia, and as such extreme events become more prevalent, poverty will perpetuate the impacts (Ceccherini *et al.*, 2017).

Within Africa, it is anticipated that the frequency and intensity of extreme temperatures will increase, in particular, in cities, affecting mortality rates, crop production and increasing the occurrence of grassland and forest fires (Russo *et al.*, 2016; Ceccherini *et al.*, 2017). This will undoubtedly affect the already tenuous resilience and adaptive capacity of the continent (Niang *et al.*, 2014; Shackleton *et al.*, 2015). Russo *et al.* (2016, p. 9) asserts that “given that adaptation and resilience measures presently undertaken in most African countries are already reaching their limits under current climate, the projected increase in extreme heat waves in the coming decades can result in humanitarian crises of unknown dimensions,” including increased levels of intra and inter-migration as different regions become uninhabitable. Therefore, there should be a greater focus on improving the response capacities of the African populations.

Though ill-prepared to respond to climate change, many vulnerable urban communities have developed a myriad of coping mechanisms or self-help measures in response to climate change (Satterthwaite, 2013). These range from; migration to the building of houses on stilts or building barriers across front doors to prevent floodwaters entering their homes or digging ditches to divert flood waters or increasing the height of furniture and shelves or switching to drought-resistant seeds during seasons of drought (Jabeen *et al.*, 2010; Satterthwaite, 2013). However, there has been little consideration for pro-poor climate change adaptation in cities compared to rural areas (Moser and Stein, 2011). Moreover, adaptation or vulnerability reduction is noticeably absent from poverty alleviation strategies, yet such strategies will be unsustainable in the long-term if they fail to address vulnerability reduction (Adger *et al.*, 2003; Eriksen *et al.*, 2007; Lisk, 2009; Fay *et al.*, 2015).

Climate impacts and hazards will produce new pockets of urban poverty and shift urban households in transient poverty to chronic poverty, thus it is important that the issues be understood and addressed (Lisk, 2009; Olsson *et al.*, 2014). African countries currently face an adaptation deficit and the filling of this gap will most likely rely on the knowledge that local communities have, knowledge matured from past experience dealing with climate-related risks, insecurity and vulnerability (Adger *et al.*, 2003; Jabeen *et al.*, 2010; Midgley *et al.*, 2011;

Ziervogel *et al.*, 2014). Adger *et al.* (2003, p. 192) contend that “much adaptation by farmers, fishers, coastal dwellers and residents of large cities will be autonomous and facilitated by their own social capital and resources”. Building on the capabilities of these vulnerable groups can contribute towards the building of sustainable adaptive responses locally, nationally and globally. Wicked problems such as climate change cannot be solved by drawing from a single knowledge base (Vogel *et al.*, 2016). An interdisciplinary, transdisciplinary, collaborative, and cross-scalar approach is required, whereby the governments engage with non-state actors, including the citizens, to develop and implement solutions (Vogel *et al.*, 2016; Ziervogel *et al.*, 2016).

2.4 Urban climate governance in South Africa

After years of debating the existence of the climate change phenomenon, the global community finally agreed that action needs to be taken to address the issue and in 1988, the Intergovernmental Panel on Climate Change (IPCC) was established (Segal and Cloete, 2012). As it became increasingly obvious that climate change is a political (intergovernmental) and developmental issue, the climate change governance regime was formerly launched in 1992 at the Rio Earth Summit with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) (Bodansky, 2001; Madzwamuse, 2010). The effects of changing temperatures and variable rainfall on socio-economic development, biodiversity, food and water security, health, and on the livelihoods of vulnerable groups spearheaded global response, with the UNFCCC and Kyoto Protocol underscoring the fact that special attention needed to be given to the poor and vulnerable groups (Madzwamuse, 2010). The global movement to address climate change encouraged urban governments, particularly in the North, to respond.

Urban areas, although they are the principal drivers of climate change, have an important role to play in global responses, in particular, climate change mitigation and adaptation (Romero Lankao, 2011). Bulkeley (2010) reports that urban governments have been performing this role since as early as the 1990s, with municipalities in Europe and Northern

America developing climate change responses. Municipalities in the global South started to show interest in climate governance in the 2000s (Bulkeley, 2010). Anguelovski and Carmin (2011, p.1) define urban climate governance as “the ways in which public, private, and civil society actors and institutions articulate climate goals, exercise influence and authority, and manage urban climate planning and implementation processes”. More specifically, it refers to strategies employed to mitigate and adapt to the impacts of climate change (Boyd and Juhola, 2015).

Climate change mitigation refers to the reduction of GHG emissions to limit the pace of change, stabilise global temperatures and reduce climate risks (Rogelj *et al.*, 2013; IPCC, 2014). This has been the primary focus of many global climate policies, including South Africa’s, who are the highest GHG emitters on the African continent (Bulkeley, 2010; Niang *et al.*, 2014; Ziervogel *et al.*, 2014). However, given the severity of climate change, mitigation is no longer sufficient to curb the impacts as some levels of change are unavoidable and irreversible. Hence, the focus has shifted towards adaptation which refers to efforts to reduce the vulnerability of human and natural systems to observed and anticipated impacts of climate change (Adger *et al.*, 2005; Bulkeley, 2010; IPCC, 2014). In developing countries such as South Africa, adaptation measures are crucial as they can reduce vulnerability in the context of existing socio-economic developmental challenges (Ziervogel *et al.*, 2014).

The observed climate trends for South Africa suggest that there has been an increase in mean annual and daily minimum and maximum temperatures and in extreme weather events such as floods and droughts (National Planning Commission, 2011; RSA, 2011 DEA, 2013). These impacts will exacerbate the already existing levels of poverty and inequality, affect the economy, and impact national development (Madzwamuse, 2010; Ziervogel *et al.*, 2014). For example, it is anticipated that climate change will further reduce the contribution of agriculture to the country’s gross domestic product (GDP) which currently stands at two to four percent (Segal and Cloete, 2012). This will undoubtedly have dire consequences for food security for the nation and consequently the health of its citizens. In the face of these impacts, opportunities to attract economic investment and improve production in the crucial agricultural sector

are likely to diminish (Bauer and Scholz, 2010). Left unmitigated, the frequency and intensity of such events are projected to increase (DEA, 2013). Hence, following the Nation’s ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and its accession to the Kyoto Protocol in July 2002, the South African government prepared and released a National Climate Change Response Strategy (NCCRS) in 2004 which focussed on climate response in the key sectors of agriculture, energy, transport, water services, and health. The aim of the strategy was to address climate change in a manner that would support national and sustainable development (RSA, 2004). Succeeding the NCCRS was the National Climate Change Response (NCCR) White Paper of November 2011 that was preceded by the NCCR Green Paper in 2010. Both papers set-out the foundation for climate change governance. The overarching objective of the White Paper is:

“To build the climate resilience of the country, its economy and its people and manage the transition to a climate-resilient, equitable and internationally competitive lower-carbon economy and society in a manner that simultaneously addresses South Africa’s over-riding national priorities for sustainable development, job creation, improved public and environmental health, poverty eradication, and social equality” (RSA, 2011, p.11)

2.4.1 Climate governance structure in South Africa

Climate change governance within South Africa incorporates the three levels of government-national, provincial and local, all of which are expected to co-ordinate in the implementation of responses to climate change (**Figure 2.1**) (Segal and Cloete, 2012). The national tier is responsible for formulating and implementing a response strategy or framework, evaluating progress and co-ordinating actions (RSA, 2011). The national government’s framework is used as a template on which provincial and local governments can formulate localised responses, provided they have the capacity and resources to do so and where capacity is lacking, “programmes to build capacity for local and provincial governments’ climate response strategies will be prioritised” (RSA, 2011, p. 38).

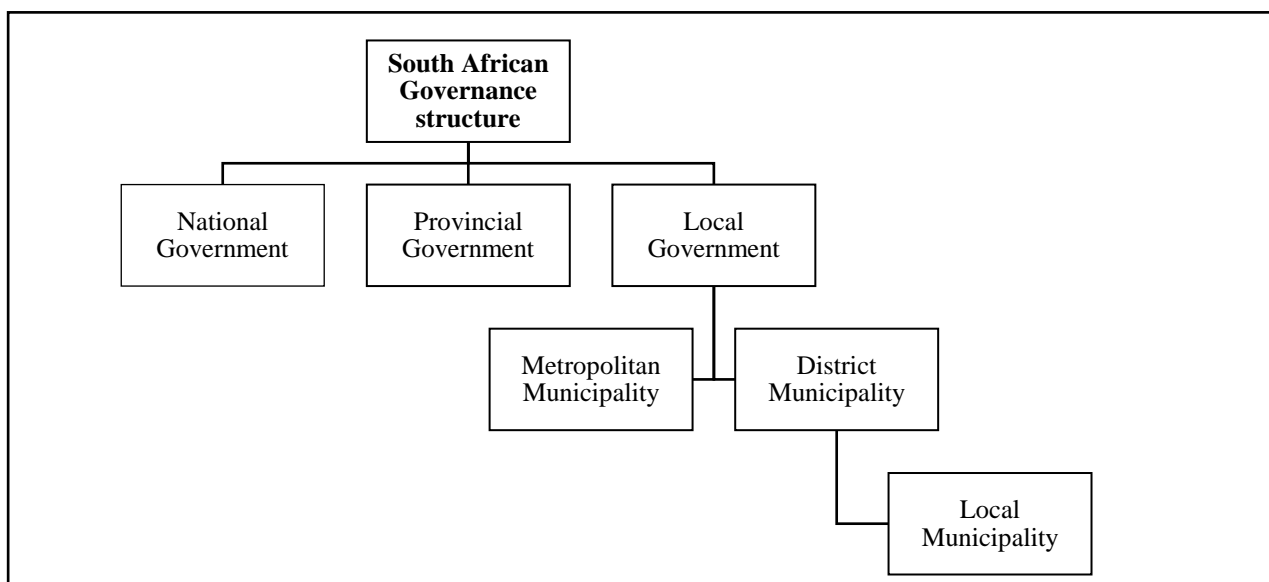


Figure 2.1: South African Governance Structure

Each of the nation’s nine provincial governments are expected to produce a climate response strategy and coordinate adaptation and mitigation actions within their departments and across municipalities within each province (RSA, 2011). The local government, which comprises of metropolitan, district and local municipalities, are not mandated to produce localised climate response strategies. However, it is anticipated that they will embed climate change considerations within their municipal planning development tools, such as the Integrated Development Plans (IDPs) (RSA, 2011). At the time the White Paper was approved in 2011, it was noted that the “fiscal mechanisms to support local government capital and operating expenditures currently do not incentivise municipalities to mainstream effective climate change responses into local government activities” (RSA, 2011, p. 38). Li and Song (2016) accede that central government incentives play a fundamental role in the development of provincial and municipal plans and programmes, particularly in developing countries. The lack thereof has led to the deprioritisation of climate change in South Africa, where it is often referred to as an “unfunded mandate” (Leck and Simon, 2013; Ziervogel *et al.*, 2014, p. 614).

In spite of the challenges in institutionalising climate responses, South African local governments, in particular, urban municipalities, are at the helm of efforts to address environmental and climate-related issues (Pasquini and Shearing, 2014; Taylor *et al.*, 2014). A three-tier governance structure exists at the local level, within South Africa (**Figure 2.1**). One tier exists in metropolitan areas- the metropolitan municipality, and in non-metropolitan areas, there is a

two-tier local government system which comprises of the district municipality (DM) and the local municipality (LM) (Steytler, 2003; Cameron, 2006). Metropolitan municipalities have jurisdiction and legislative authority over the large metropolitan areas, while DMs have the same authority within their districts and over LMs that fall within the districts (RSA, 1998). DMs are mandated to build the capacity of LMs where there is limited capacity to perform municipal functions (RSA, 1998).

There are a total of 257 municipalities in South Africa, comprising of eight metropolitan municipalities, 44 DMs and 205 LMs (Main, 2017). Some of the larger and better resourced, urban municipalities have made innovative strides in mitigating and adapting to climate change. Examples include eThekweni Metropolitan Municipality in Durban and the City of Cape Town Metropolitan Municipality (Dodman and Satterthwaite, 2011; Hickmann and Stehle, 2017). EThekweni municipality developed a Municipal Climate Protection Programme in 2004 which initiated a conversation, in South Africa, on localising adaptation at a time when adaptation was viewed as solely a national priority (Satterthwaite *et al.*, 2007; Roberts and O’Donoghue, 2013). After successfully hosting the UNFCCC 17th Conference of Parties (COP17), in 2011, the metropolitan municipality, in partnership with the South African Local Government Association (SALGA), the South African Cities Network (SACN), South African Department of Environmental Affairs (DEA), Department of Co-operative Governance and Traditional Affairs (COGTA) and the International Council for Local Environmental Initiatives (ICLEI),

developed the Durban Adaptation Charter for Local Governments (eThekweni Municipality, 2012). The Charter formalised the role of local governments in the adaptation agenda (eThekweni Municipality, 2012; Roberts and O'Donoghue, 2013; Aylett, 2015).

2.4.2 Challenges of municipal climate change governance

Climate change governance faces many challenges, more so in the global South where climate governance is competing with socio-economic developmental issues such as high rates of poverty, unemployment and rapid urbanisation. This explains why, nearly three decades after the global community agreed that climate change required global attention, the issue is still one of the most impactful challenges that the world is facing. The climate governance structures are not functioning as effectively as they should, given the uncertainties that persist regarding the nature and scale of risks climate change imposes and the potential success of proposed solutions (Termeer *et al.*, 2016). This is a worrying trend as climatic conditions are changing and the solutions of today may not work tomorrow. Furthermore, “poor governance increases vulnerability” (Segal and Cloete, 2012, p. 83).

The failures of the current climate change governance systems are due to systemic challenges and are similar to those of environmental governance (Najam *et al.*, 2006). The challenges include, *inter alia*, a lack of human capacity and expertise in dealing with climate variability and change, political/institutional instability, a high staff turnover within government departments, a lack of funds to hire and retain qualified employees, skills migration, poor communication, corruption, and a lack of co-ordination between different sectors and between the different tiers of government (Madzwamuse, 2010; Schaeffer *et al.*, 2013; Ziervogel *et al.*, 2014; Leck and Roberts, 2015; Pasquini *et al.*, 2015; Shackleton *et al.*, 2015; Li and Song, 2016). The climate response regime lacks effective (political) leadership which is necessary to spearhead climate responses within the municipalities, in particular, in the face of competing socio-economic imperatives, and to co-ordinate response efforts (IPCC, 2014). Climate change has garnered interest from government bodies, non-governmental organisations, the private sector and research institutions, however, many of these organisations are failing to engage with each other and co-ordinate their mandates, resulting in confusion, a duplicity of responses and conflicting advice given to

policy-makers, leading to the fragmentation of governance systems (Najam *et al.*, 2006; Madzwamuse, 2010; Segal and Cloete, 2012; Ziervogel *et al.*, 2014). Given the complexity of climate change issues and its linkages, some form of co-ordination and co-operation is mandatory to effectively address the issues (Najam *et al.*, 2006). Adding to the confusion is the uncertainty surrounding the nature of the projected climate change impacts and differing opinions or perceptions of what climate-related risk entails (Christoplos *et al.*, 2009; IPCC, 2014). Adger *et al.* (2007, p. 735) concur and state that “uncertainty about future climate change combines with individual and social perceptions of risk, opinions and values to influence judgment and decision-making concerning climate change”. This lack of co-ordination and incoherence has resulted in the failure to utilise climate-related financial resources efficiently, disincentivising donors and compromising the credibility of the governance system (Adger *et al.*, 2005; Segal and Cloete, 2012). A lack of financial resources and capacity can severely cripple a governance system and compromise its ability to address climate change in an effective manner. Similarly, at a community-scale, financial poverty can hinder the adoption of even ‘cheap’ adaptation responses by community members (Adger *et al.*, 2007).

The climate change governance regime has produced numerous policies, agreements and environmental instruments, many of which are increasing in complexity and ambiguity, and lack an implementation and enforcement mechanism (IPCC, 2014; Knieling and Klindworth, 2016). Furthermore, in many cases, few of the funds are spent on implementation, with more being spent on administration (Najam *et al.*, 2006; Knieling and Klindworth, 2016). This is not unique to climate governance but to the global environmental governance system as a whole which is notorious for having a “dismal record of turning agreements into actual change on the ground in terms of either the quality of the environment or the lives of those who live in those environments” (Najam *et al.*, 2006, p. 46). Perhaps this shortcoming can be rectified by an increase in accountability and transparency? The lack thereof, and the high levels of corruption within government and non-state structures in Africa, present another barrier to effective climate governance (Segal and Cloete, 2012). The Global Corruption Report on Climate Change reports that the countries that are the most vulnerable to climate change and have low adaptive capacities often have the highest global corruption ratings (Transparency International, 2011). In light of this, the

UN System Task Team (2011, p. 30) asserts that “like other developmental priorities, corruption and ineffective governance can derail efforts to combat climate change”. It, therefore becomes necessary to monitor financial flow and climate-related spending (Segal and Cloete, 2012).

Climate change is commonly dubbed as a strictly environmental issue to be tackled by the ministry of environment, which is not the case today given the strong links between climate change and sustainable development (Meadowcroft, 2009; Heinrich Boell Foundation, 2012; Ziervogel *et al.*, 2014; Knieling and Klindworth, 2016). This is a general trend in South Africa and other African countries and is detrimental to the building of sound adaptive capacity as the environmental departments tend to lack the political clout to garner support to address climate change, particularly when the problem is perceived as being in competition with development (Segal and Cloete, 2012; Taylor *et al.*, 2014; Aylett, 2015; Baudoin and Ziervogel, 2016). This has resulted in weakened incentive to address the issue and a lack of political will. Where there is no political will, very little investment will go into climate-related planning and programmes (Segal and Cloete, 2012). Therefore, in the face of such political marginalisation, climate-related responses tend to be underdeveloped, while interventions at the local level are minimal, in particular, in Africa (Segal and Cloete, 2012; Leck and Simon, 2013). Baudoin and Ziervogel (2016) postulate that the understanding of climate change by government and local organisations as an issue unique to the environmental sector as opposed to a socio-economic and environmental one, creates a barrier to the implementation of response strategies. Furthermore, Leck and Simon (2013, p. 1223) caution on the manner in which climate change is framed, be it an environmental, social, security, economic or a developmental issue, as this will have “profoundly different implications for policy and practice,” and will compromise government’s potential to respond to climate change within the context of poverty reduction (Heinrich Boell Foundation, 2012).

Some climate change responses, in particular, those relating to adaptation, have a propensity to trigger new problems in other areas, increasing vulnerabilities, hence an increased reluctance to implement solutions (Termeer *et al.*, 2016). For example, Fay *et al.* (2015, p. 1) note that “some emissions-reduction policies can increase energy and food prices, which represent a large share of poor people’s expenditures”. This barrier is aggravated by the lack of climate research, in particular,

pertaining to risks, vulnerabilities and adaptation, and limited understanding of climate system science, in particular, in Africa (Mukheibir and Ziervogel, 2007; IPCC, 2014; Revi *et al.*, 2014; Ford *et al.*, 2015; Tsega, 2016). Revi *et al.* (2014, p. 563) note that data are not collected frequently, leading to fragmentation and the “existing climate models are not always downscaled to the city-level”. Moreover, there is insufficient monitoring, evaluation and observation of adaptation initiatives and a lack of adequate funding and technical know-how to do so (Schaeffer *et al.*, 2013; IPCC, 2014; Ziervogel *et al.*, 2014). These limitations impact the dynamic capability of an organisation or government body where dynamic capability refers to the ability and flexibility to learn from, and adapt to, a changing environment (Teece and Pisano, 1994; Baudoin and Ziervogel, 2016). Such capabilities are crucial for the effective governance of a ‘wicked problem’ such as climate change, given its complexities. Baudoin and Ziervogel (2016, p. 8) accede that a low flexibility is common in most governmental bodies, especially those that “operate within certain legislative acts that prescribe the activities in which they engage and how they can spend their funds”.

Less than three percent of African cities, organisations, non-governmental organisations and civil society organisations participate in the development of global climate change initiatives and this presents a barrier to global governance in African countries (Ha and Zeitz, 2015; Tsega, 2016). Furthermore, many of the participants lack the skills to negotiate on a global platform (Tsega, 2016). As a result, the majority of initiatives are developed by countries in the North and are not unique to the socio-economic development status of the continent and the African states do not benefit from the numerous climate initiatives that are being developed (Ha and Zeitz, 2015). African countries need to have an equal and effective voice at international climate change conferences and in the development of global agreements and initiatives “to ensure that development and poverty reduction agendas are included in the outcome and follow-up action at national, regional and global levels” (Tsega, 2016, p. 16). Moreover, the countries need to overcome the barriers they encounter in implementing climate responses, namely the lack of climate finance, and inadequate human and institutional capacity (Tsega, 2016).

2.5 Conclusion

The challenges to address climate change are numerous, however, they need to be overcome if climate change is to be addressed in a manner that is socially just and inclusive, economically viable and environmentally sound (Aguiar, 2012). In addition, urban governments must increase their capacity to address the problems that are associated with urbanisation. UN-HABITAT (2003, p. 5) asserts that “slums and urban poverty are not just a manifestation of a population explosion and demographic change, or even of the vast impersonal forces of globalisation. Slums must be seen as the result of a failure of housing policies, laws and delivery systems, as well as of national and urban policies”. Rectifying these failures will help build the resilience of cities.

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CHAPTER THREE

Methods

3 Methods

3.1 Introduction

This chapter outlines the research strategies that were adopted to fulfill the aim of the study. The methods are provided in greater detail in Papers I, II and III. A brief

3.2 Description of the study sites

3.2.1 Case study communities

The research is based in the city of Pietermaritzburg in the province of KwaZulu-Natal (KZN). KZN has the second largest provincial population in South Africa, with a population of 11.1 million (Statistics SA, 2016b). The province reports a poverty level of 65 percent with women forming the majority of the low income groups and those living in low-income households (Statistics SA, 2011). Its capital, Pietermaritzburg, is the second biggest city in the province with a population of approximately 223 448, which is predominantly female (52%) (Statistics SA, 2016a; Statistics SA, 2016b). Primarily an urban centre, Pietermaritzburg is confronted with growing rates of urban poverty, and unemployment and unequal development, particularly in the townships (i.e., underdeveloped urban areas) (Statistics SA, 2011; Msunduzi Municipality, 2012).

Pietermaritzburg is characterised by summer rainfall and its climate is said to be warm and temperate with an average annual rainfall of 865.3 mm while the average maximum temperatures range from is 22.6 -24.5°C and the minimum temperatures range from 9.9 -16°C (World Weather Online, 2016; CIP, ud). Intermediate

3.2.2 Case study municipalities

The uMgungundlovu District Municipality (UMDM) is one of eleven metropolitan and district municipalities (DMs) located within the province of KZN, South Africa. At 9 513km², the UMDM is the largest DM in KZN, and the second largest municipality, after eThekweni Metropolitan Municipality (UMDM, 2015; Main, 2017). Moreover, the municipality is the fastest growing municipality in terms of population and economy within the province (UMDM, 2015). UMDM is primarily rural in nature and has seven local municipalities (LM) under its jurisdiction (**Figure 3.2**). Msunduzi and uMngeni, two of the seven LMs, contribute the most to the District's gross domestic product (GDP) with Msunduzi contributing 73 percent

description of the case study sites and research techniques adopted for data collection and analysis are provided.

future climate scenarios anticipate a temperature increase of 2.25°C between 2045 and 2065, which will impact livelihoods, food and water security, and human and livestock health (UMDM, 2016). There have been increases in short-term high-risk rainfall hazards such as lightning/thunder/hail storms and floods and it is highly probable that the hazards will recur (UMDM, 2013b; Singh and Bartholomew, 2014; UMDM, 2016).

The locations selected for the research are considered to be urban and peri-urban and include the France, Mpophomeni, Sobantu and Willowfontein suburbs (**Figure 3.1**). France, Sobantu and Willowfontein are located outside Pietermaritzburg's central business district, under the jurisdiction of the Msunduzi Municipality, and Mpophomeni, is located on the periphery of Pietermaritzburg, under the jurisdiction of the uMngeni Municipality. Both municipalities function under the uMgungundlovu District Municipality (**Figure 3.2**). The major population group residing in these areas is predominantly female and black African (86.6%) and their vernacular isiZulu (Statistics SA, 2011; Msunduzi Municipality, 2012).

and uMngeni, nine percent (UMDM, 2016). uMngeni LM is an inland municipality which covers 1 567 km², making it the third largest LM within UMDM (Main, 2017). Approximately 85% of the municipality is urban and within the District, uMngeni has the highest population growth rate (UMDM, 2016; StatsSA, 2017). The majority of uMngeni's population is female (52%) (StatsSA, 2017).

Msunduzi LM is an urban municipality and at 634km², is the smallest LM within UMDM (Main, 2017). However, it encompasses the city of Pietermaritzburg, which serves as the seat of UMDM (Msunduzi Municipality, 2012; UMDM, 2013a). With a population of 618 536, the LM contains the highest population

(61%) of the LMs in UMDM (StatsSA, 2017). Moreover, the majority of the population is female and

there is a high proportion of female-headed households (Msunduzi Municipality, 2012; StatsSA, 2017).

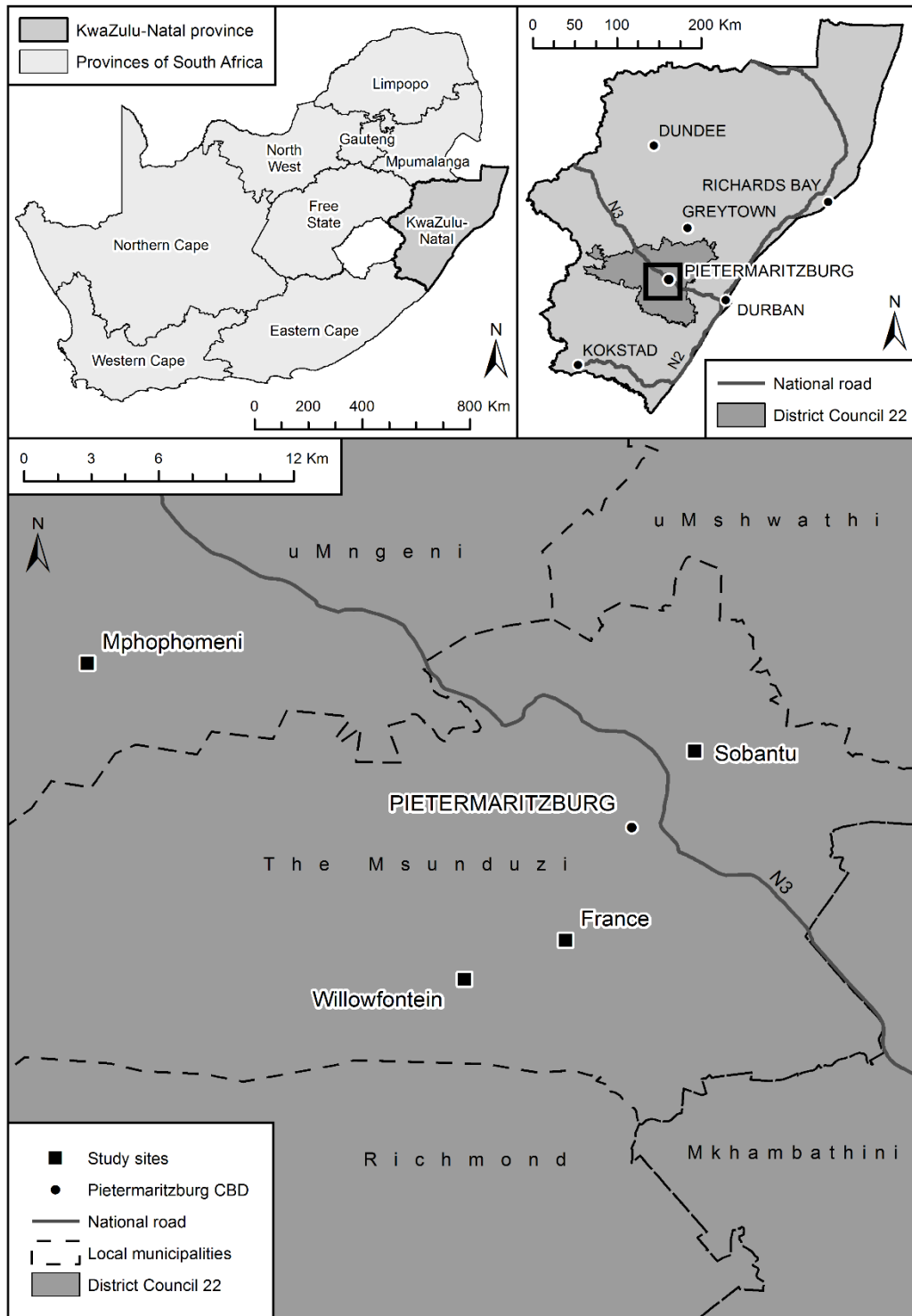


Figure 3.1: Map of the study areas France, Mphophomeni, Sobantu and Willowfontein, Pietermaritzburg, KwaZulu-Natal, South Africa

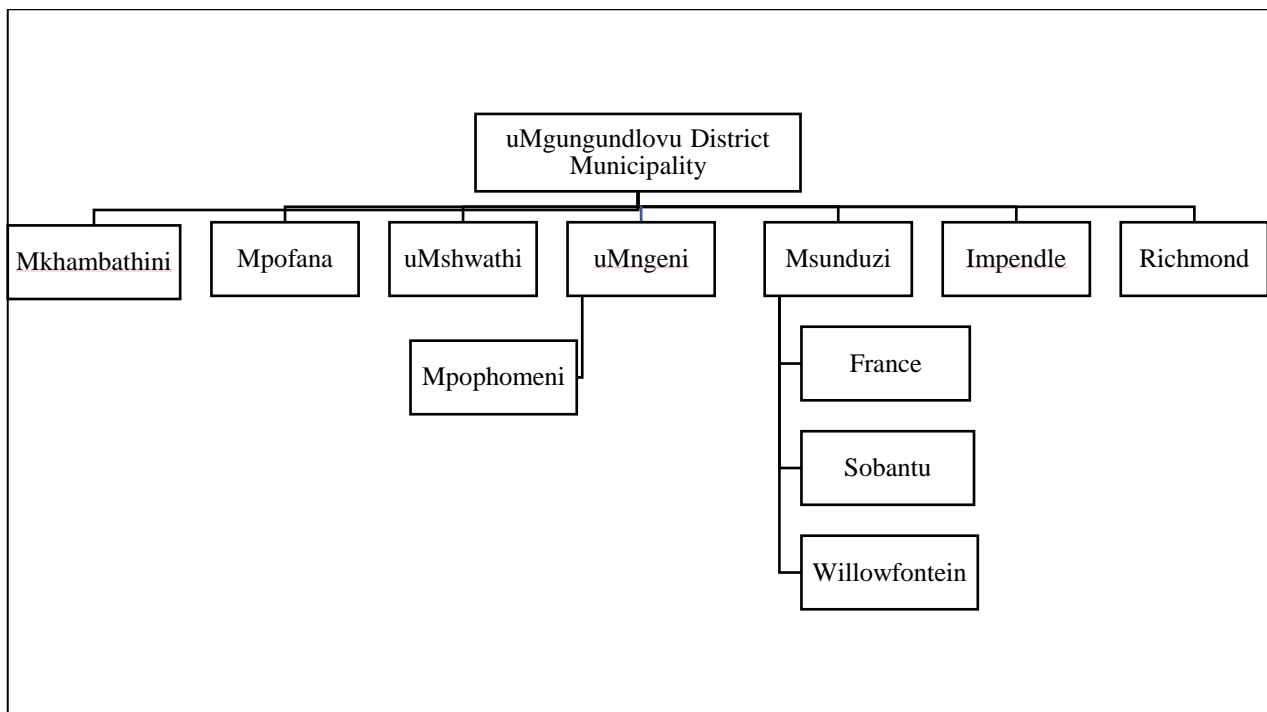


Figure 3.2: Case study municipalities and study communities

3.3 Data collection and analysis

3.3.1 Data collection

A case study approach was selected for the research. Primary data were collected via a questionnaire survey which was conducted within the four communities, France, Mpophomeni, Sobantu and Willowfontein between September and December 2015. Ten field assistants who are conversant in the local language, isiZulu, and the culture, were hired and trained to administer the semi-structured questionnaire (Appendix 2). A feasibility study was conducted in September and followed by a de-briefing session prior to the full-scale questionnaire survey carried out from November to December 2015. The questionnaires were administered orally to the community members based on their availability and willingness to participate in the study. Before responding to any questions the respondents were informed about the study and had to verbally consent to their participation. Though written in English, the questionnaire was administered in isiZulu and the responses were translated back to English. The final sample size consisted of 378 respondents from 378 households, 70 percent of whom were female and the majority were within the 16-45 and over 65 age groups. Approximately 61 percent of the households surveyed were female-headed and each

interview was conducted with the self-identified head of the household. Where the head of the household was unavailable, the interview was conducted with whomever was available and above 16 years of age. The questionnaire survey examined demographic information such as age, education, marital status, socio-economic information and issues pertaining to the communities' perception of climate variability and change and how they engage with any resultant impacts.

To supplement the survey data, exploratory semi-structured and in-depth interviews were conducted with key personnel directly involved with the municipal climate change response portfolios within the uMgungundlovu District Municipality (UMDM) and the Msunduzi and uMngeni local municipalities, between September 2015 and November 2016. These included individuals from the climate change and environmental units of the three municipalities- two from UMDM, four from Msunduzi and one from uMngeni. The interview schedules are attached as Appendices 3, 4 and 5. The interviews were followed up by e-mail communication, where necessary. The interviews were supplemented by documents supplied by the interviewees, including climate change response and environmental management plans and municipal integrated development plans (IDPs).

3.3.2 Data analysis

The questionnaire comprised of both structured and open-ended questions. Quantitative data from the closed questions were coded and placed into categories for statistical analysis using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics such as frequency data were incorporated into the results to establish trends in the data. The qualitative, open-ended responses and the interview questions were analysed using thematic analysis (King and Horrocks, 2010). In addition, there was document review of policy documents supplied by the municipal officials.

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CHAPTER FOUR
Paper I

***“We cannot tell the difference between summer and winter”:
Urban poor responses to climate variability Pietermaritzburg,
KwaZulu-Natal, South Africa***

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Abstract

South Africa's rising urbanisation has exacerbated the levels of urban poverty and inequality. The urban poor are increasingly vulnerable to the impacts of climate variability, and have weak household risk response capacities. The study, through the use of a questionnaire survey, investigated how climate stressors are impacting four socio-economically marginalised urban communities in Pietermaritzburg, KwaZulu-Natal. The respondents identified eight stressors that impact lifestyles and livelihoods, however, the majority do not have the means to cope adequately. Moreover, the coping strategies that were adopted were stop-gap reactive-type measures and provide limited capacity to build resilience and response capacity. With the projections that climate stressors will increase in frequency and duration in the region, the local government, must increase investment in urban pro-poor climate change projects, which have been successful in some rural and urban areas, and educate the communities on climate-related risks so as to increase their knowledge and response capacities.

KEYWORDS: urban poor; climate variability; response capacity; coping strategies; resilience

4 Paper I

4.1 Introduction

South Africa, much like the rest of sub-Saharan Africa (SSA), is undergoing a large-scale urban transformation with the anticipation that 71 percent of the population will be urban by 2030 (RSA, 2015). The high rates of urbanisation are met by governments that are under-prepared to address the challenges and complexities that are associated with urban growth (World Bank, 2009; United Nations Economic Commission for Africa, 2014; Ruocco *et al.*, 2015; Wahba, 2015). As the urbanisation rates continue to exceed the rates of economic and infrastructure development, unemployment levels are increasing and there has been a proliferation of low-cost housing where the people are often denied access to basic infrastructure and services (UN SystemTask Team, 2011; Turok and Borel-Saladin, 2014; Ruocco *et al.*, 2015). Approximately 60 to 70 percent of the urban population in SSA reside in informal settlements, making them more vulnerable to the impacts of climate variability (Bulkeley, 2010; UN SystemTask Team, 2011; Mafusire *et al.*, 2014; Olsson *et al.*, 2014; Wahba, 2015). The Intergovernmental Panel on Climate Change (IPCC) anticipates that by 2100, climate impacts and hazards will produce new pockets of urban poverty, shift urban households in transient poverty to chronic poverty, jeopardise development endeavours and poverty alleviation efforts, and threaten the fulfilment of the sustainable development goals (SDGs) (Olsson *et al.*, 2014). Against this backdrop, this paper investigates the impacts of climate variability on marginalised urban communities within the city of Pietermaritzburg, which serves as the capital of the second most populous province in South Africa, KwaZulu-Natal, and to investigate how these communities are responding.

Studies on the impacts of climate variability on the poor have focussed on the impacts within low-income countries with little attention paid to middle-or high-income countries (Olsson *et al.*, 2014), such as South Africa. The country is unique in that, though it is categorised as middle-income, it is grappling with high levels of poverty and inequality which have been inherited from a history of colonialism, and climate variability aggravates the stresses, making it more difficult to rectify the injustices of the past.

4.2 Urban vulnerability to climate variability in South Africa

Cities are hubs of economic growth that have been associated with improved livelihoods, better education, living standards, social and economic independence, and human development (Boadi *et al.*, 2005). However, this ‘promise’ of a better life has propelled the urban growth rates to unprecedented levels in a nation that is already grappling with high urban poverty levels and widening inequalities (Frye *et al.*, 2011). The spatial divisions that were inherited from the Apartheid regime in South Africa have contributed towards the high levels of inequalities within its cities (Goebel, 2007; Frye *et al.*, 2011; Taylor *et al.*, 2014; RSA, 2015; Hickmann and Stehle, 2017). As a result, approximately 60 percent of the urban population resides in areas that suffer from structural deficiencies (Hickmann and Stehle, 2017). However, the living conditions under which the urban poor are surviving have done nothing to quell the movement of people from rural to urban areas and it is projected that approximately 80 percent of South Africa will be urban by 2050 (Mafusire *et al.*, 2014; RSA, 2015). Currently, South African cities are struggling to meet their developmental goals, redress poverty and inequality, and to meet the needs of the growing population (Taylor *et al.*, 2014; RSA, 2015). This is predominantly due to the lack of financial and institutional capacity to effectively address the multi-dimensional challenges of urban development, namely demographic, social, economic and environmental (RSA, 2015). This *status quo* has been exacerbated by the impacts of climate variability which are likely to reverse developmental advances of the post-Apartheid regime and increase the socio-economic vulnerability of the marginalised, making the reduction of poverty difficult (Heltberg *et al.*, 2008; Bartlett *et al.*, 2012; Olsson *et al.*, 2014; United Nations Economic Commission for Africa, 2014; Wahba, 2015; Hickmann and Stehle, 2017). Many of these impacts are already taking place and tend to exacerbate vulnerabilities to produce direct impacts on livelihoods, health, incomes, living conditions and assets (social and economic), with the poor bearing the brunt of these impacts (Satterthwaite *et al.*, 2007; Chuku, 2010; National Planning Commission, 2012).

The vulnerability of the urban poor to climate variability in South Africa is attributed to non-climatic and socio-economic factors, namely exclusion from social and economic opportunities, low income, poor housing and infrastructure, food insecurity, land degradation, high

rates of population growth and poor service delivery (Satterthwaite, 2007; Alber, 2011; RSA, 2015; UNDP, 2015; Wahba, 2015; Hickmann and Stehle, 2017). Unlike high-income populations who can utilise their savings or insurance or sell assets to cope with climate risks, the ability of the urban poor to cope depends on the assets that they have at their disposal on a short-term basis to respond to such risks (Alber, 2011; Habtezion, 2012). Those with fewer assets are less likely to cope or adapt to the impacts of climate variability and have to make difficult decisions which include decisions to sacrifice on food consumption, opting for quantity rather than nutrition, the sale of productive assets or reducing costs such as their children's education (Heltberg *et al.*, 2008; UN SystemTask Team, 2011). These kinds of coping strategies or maladaptation are destructive to the household unit as they not only reinforce inequalities, but also perpetuate poverty and inequality across generations (Heltberg *et al.*, 2008). Taylor *et al.* (2014, p.33) note that “new patterns of vulnerability are already emerging alongside on-going urban expansion,” therefore, adequate responses that aim to reduce the vulnerability of the urban poor, improve their response and adaptive capacities, and increase their resilience, are required.

The urban poor, in particular, marginalised women, children, outdoor labourers and the elderly, contribute the least to the causes of climate variability and change, yet face a “double vulnerability in the forms of climate variability and poverty” (Jabeen *et al.*, 2010, p. 429; Mearns and Norton, 2010). Moreover, “they are disproportionately affected by their exposure to climate-related risks and by the limited resources at their disposal to respond to such risks” (Jabeen *et al.*, 2010, p. 429). As climate risk increases in intensity, frequency and duration, the role of city governments in climate risk management will grow as will the reliance of low-income households on policies and institutions for assistance (Heltberg *et al.*, 2008).

4.3 Methods

4.3.1 Study sites and data collection

A questionnaire survey of 378 households was carried out amongst four communities in the surrounds city of

Pietermaritzburg, in the province of KwaZulu-Natal (KZN), South Africa. These communities were France, Swapo, and Willowfontein that are located outside the central business district (CBD), and Mpophomeni township which is on the boundary of the city (**Figure 4.1**). France, Swapo and Willowfontein are classified as urban while Mpophomeni is peri-urban.

The communities were chosen as they are urban and peri-urban in nature and are located in a province associated with high levels of poverty, high rates of unemployment, socio-economic vulnerabilities, and low adaptive capacity (Gbetibouo *et al.*, 2010; Golder Associates Africa, 2013; Wilk *et al.*, 2013). A pilot survey was conducted in September 2015, which was followed by the full-scale study in November and December 2015, during the summer season. The majority of respondents (33%) were from Willowfontein and the remaining respondents evenly distributed between France, Swapo and Mpophomeni. The questionnaires were administered in the local language of isiZulu.

The questionnaire survey examined socio-economic information and issues pertaining to the communities' perception of climate variability and change and how they engage with any resultant impacts. More specifically, this paper focusses on the types of climate impacts that the community members have encountered; how the impacts affect the livelihoods and lifestyles of the communities; the level of concern for the impacts of climate variability; the positioning of climate variability and change among the communities' list of priorities; the coping strategies and; the reasons for not adopting any coping mechanisms. Approximately 61 percent of the households surveyed were female-headed and respondents were either the head of the household or an individual who served as a representative of the head. Seventy percent of respondents were female and the majority of respondents were within the 16-45 and over 65 age groups. Furthermore, more than half of the respondents (55%) have received a secondary level of education where climate change, or some aspects of it, are a part of the school curricula.

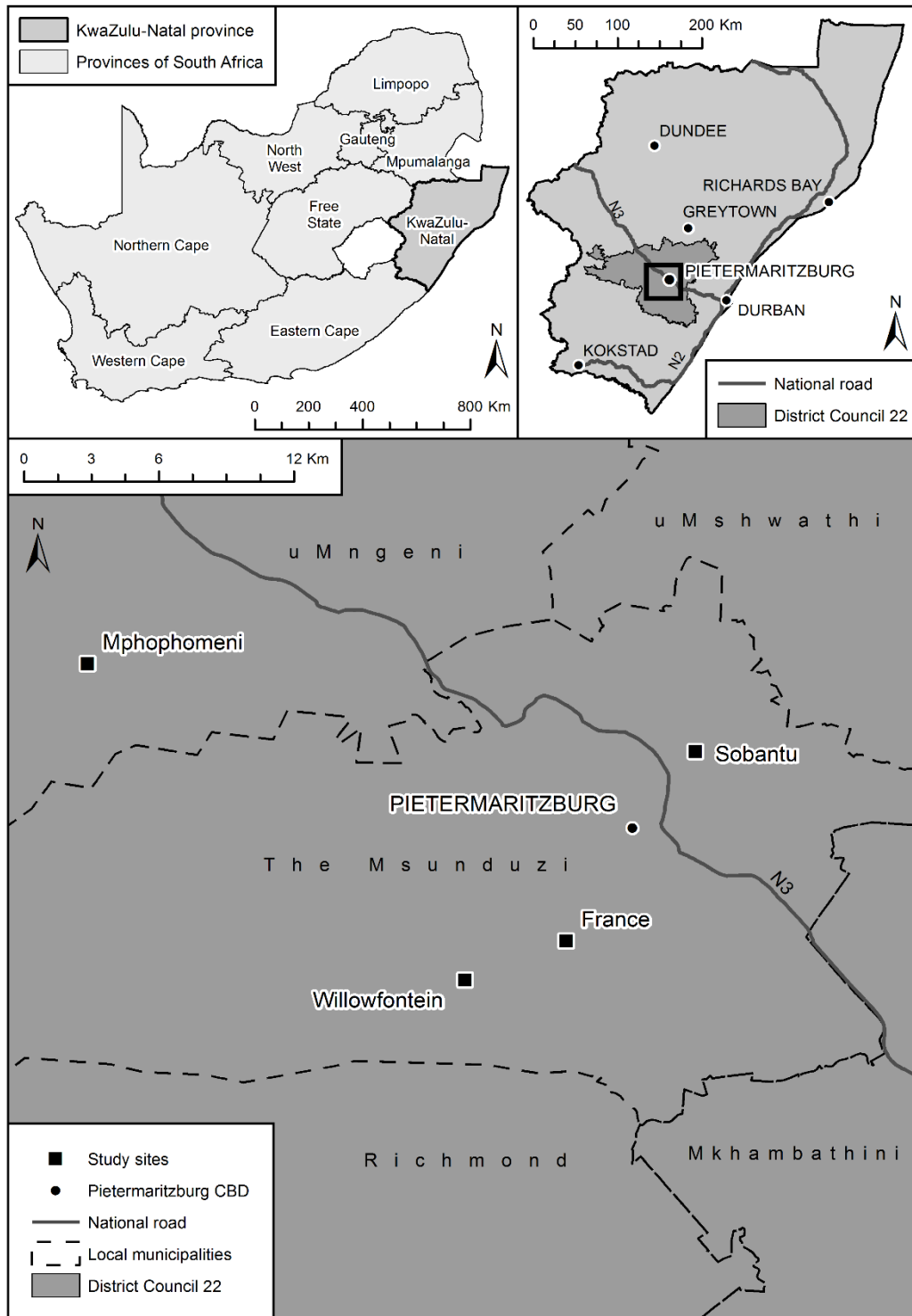


Figure 4.1: Map of the study areas France, Mphophomeni, Sobantu and Willowfontein, Pietermaritzburg, KwaZulu-Natal, South Africa

Pietermaritzburg is the capital of KZN and is one of the major urban economic and service hubs of the province (UMDM, 2015; UMDM, 2016). South Africa's 2011 census document found the population of

Pietermaritzburg to be 223 448 and approximately 52% female (Statistics SA, 2011). The city has high levels of socio-economic vulnerability due to the growing population and increasing levels of poverty and unemployment (Msunduzi Municipality, 2012). Climate

variability exacerbates this vulnerability and has contributed to the city's low adaptive capacity (Golder Associates Africa, 2013). Furthermore, the local government, Msunduzi local municipality, is facing backlogs in service delivery and there is a significant proportion of the urban poor residing in substandard low-cost housing with limited access to quality service delivery (Msunduzi Municipality, 2012; Caesar *et al.*, 2013; Taylor *et al.*, 2014). Moreover, 93% of the urban poor within Msunduzi are considered to be food insecure (Caesar *et al.*, 2013).

average annual rainfall of 865.3 mm while the average maximum temperatures range from is 22.6 -24.5⁰C and the minimum temperatures range from 9.9 -16⁰C (World Weather Online, 2016; CIP, ud). Intermediate future climate scenarios anticipate a temperature increase of 2.25⁰C between 2045 and 2065, which will impact livelihoods, food and water security, and human and livestock health (UMDM, 2016). There have been increases in short-term high-risk rainfall hazards such as lightning/thunder/hail storms and floods (**Table 4.1**) and it is highly probable that the hazards will recur (UMDM, 2013; Singh and Bartholomew, 2014; UMDM, 2016).

4.3.2 Bio-physical environment

Pietermaritzburg is characterised by summer rainfall and its climate is said to be warm and temperate with an

Table 4.1: Climate stressors and extreme weather events in KZN, since 1978, that affected Pietermaritzburg and surrounds

Date	Climate stressor	Details
12 February 1978	Thunderstorm	At least ten people were killed and hundreds left homeless after a severe thunderstorm. Damage was estimated at USD76790 (USD1= ZAR13.02) at the time
1982	Drought	Worst drought since the 1920s
4 February 1986	Tornado	A tornado travelled 86km from Pietermaritzburg to Ixopo
22 March 1987	Floods	Heavy rains in Pietermaritzburg caused flooding
27 September 1987	Floods	Floods described as the worst disaster ever to have struck KZN, leaving an estimated 388 people dead and 68 000 homeless. Homes were either washed away, collapsed or buried by mud and 14 bridges were washed away (Grobler, 2003). The province was declared a disaster area, with total damage estimated at USD253.4 million (USD1= ZAR13.02)
30 October 1989	Hailstorm	Hail destroyed fruit and vegetable crops to the value of USD383 951 (USD1= ZAR13.02)
1991/1992	Drought	At the time, was declared the worst drought in the 20 th century
21 June 1994	Fire	60 grass and bush fires were reported in Pietermaritzburg
6 August 1995	Cold spell	A cold spell felt across South Africa resulted in snow falling in KZN, Western and Eastern Cape, Free State and Gauteng
25 December 1995	Floods	60 mm of rain fell in 30 minutes, causing the Msunduzi river, which runs through the centre of Pietermaritzburg, to burst its banks, with 130 fatalities. The region was declared a disaster area
July 1996	Cold spell	Large areas of the country experienced cold weather during July, leading to several deaths
4/5 August 1996	Cold spell	Cold spell felt across South Africa

23 January 1997	Thunderstorm	The storm uprooted trees and damaged electricity and telephone cables
20 April 1997	Floods	At least 100 people were left homeless in Pietermaritzburg
10 June 1997	Cold spell	A cold spell resulted in unusually heavy snowfall in the Eastern Cape and KZN interior
2 February 1999	Floods	Informal settlements were flooded and two people drowned
15 November 1999	Floods	In Mpophomeni, 200 families were left homeless and at least one person drowned
23 August 2003	Fire	Grass fires across KZN caused the deaths of 6 people
December 2003	Drought	Above-normal temperatures and below-normal summer rainfall caused widespread drought over most of the summer rainfall region
11 January 2004	Heat wave	A number of people reportedly suffered from dehydration and heat exhaustion and were hospitalised
16 January 2004	Drought	Following the extreme dry conditions, the following provinces were declared disaster areas: KZN, North West, Mpumalanga, Free State, Eastern Cape, and Northern Cape
6-7 September 2004	Cold spell	50 schools and a number of roads were closed as a result of the snow
22 November 2004	Hailstorm	Buildings and crops were damaged by the golf-ball size hailstones
25 December 2004	Hailstorm	80 families were left homeless after a hailstorm
3 January 2005	Thunderstorm	Strong winds blew roofs off buildings and uprooted trees
23 September 2005	Fire	Grass fires were reported across KZN, Free State and Limpopo
27 January 2007	Hailstorm	Heavy rain and hail were experienced across the KZN interior
17 February 2007	Heat wave	Drought conditions prevail after a prolonged hot and dry summer season
27 November 2011	Flood	Six people were killed and property damaged during the flood. Over 100 homes were flooded and damaged (Mail and Guardian, 2011)
6 February 2015	Hailstorm	In what has been described as one of the worst hailstorms in three decades, golf- and cricket- ball sized hailstones damaged homes and cars in Pietermaritzburg (OUTsurance, 2015). Some smashed through roof tiles, allowing for rain to enter the houses, causing severe water damage (OUTsurance, 2015)
2015	Drought	With a total rainfall of 403mm, 2015 was the driest year in South African history. Drought disaster was declared in five

		of the nine provinces in South Africa, including KZN and Free State which were the hardest hit (BBC News Africa, 2015 ;WRC, 2015). It was estimated that at least 2.7 million households were affected by this drought (Essa, 2015)
25 December 2015	Heat wave	Temperatures reached 42 ⁰ C in Pietermaritzburg. The public were advised to stay hydrated and avoid strenuous physical activity
16 March 2016	Thunderstorm	A severe thunderstorm resulted in flash floods. Strong winds uprooted trees, collapsed walls and flooded streets (Times LIVE, 2016)
21 October 2016	Hailstorm	Severe hailstorms in Pietermaritzburg

Sources: UMgungundlovu District Disaster Management Plan, Final Draft 2013 (UMDM, 2013); Newspaper and online articles of extreme weather events within Pietermaritzburg and its surrounding areas

4.4 Results

This section presents the survey results under the following themes: (i) the types of climate impacts that the community members have encountered; (ii) how climate-related risks are impacting on the livelihoods and lifestyles of the communities; (iii) the level of concern for the impacts of climate variability; (iv) the positioning of climate variability and change among the communities' list of priorities; (v) the coping strategies and; (vi) the reasons for not adopting any coping mechanisms.

4.4.1 Exposure to climate-related stressors

The community members identified eight climate-related stressors, namely; increasing temperatures, longer summers and shorter winters (76%), drought (60%), heat waves (59%), hailstorms (44%), flooding (41%), cold spells (27%), disease outbreaks (9%) and grass fires (3%) (**Figure 4.2**). With regards to heavier rains and flooding events, the respondents listed six flooding events that were of significance and had devastating consequences. These occurred during the

years of 1985, 1986/1987, 1989, 1995, 1997 and 2005. Some respondents noted that, "*houses and crops were damaged during the flood of 1985 and 1987, and assets were lost*" (Pers. comm, 2015) and another stated that "*in 1995 and 1997, there were serious floods in which many people lost their lives and property. Some people were living in the local primary school*" (Pers. comm, 2015). One more recalled that "*the floods of 1987 and 1995 were severe. Elders had to be rescued by helicopters. Imbali suffered the most during the 1995 flood*" (Pers. comm, 2015). Imbali is a township outside Pietermaritzburg's CBD which is in close proximity to Willowfontein and Sobantu. In 1995, there were two major flood events, one in January and another in December. The December flood resulted in 169 fatalities and displaced 6 000 families, earning the name the Black Christmas floods (Eveleth, 1996). Prior to this, in September 1987, there was a flood which has been described as the worst disaster in the history of KwaZulu-Natal as it killed 388 people and displaced 68 000 (Grobler, 2003; UMDM, 2013).

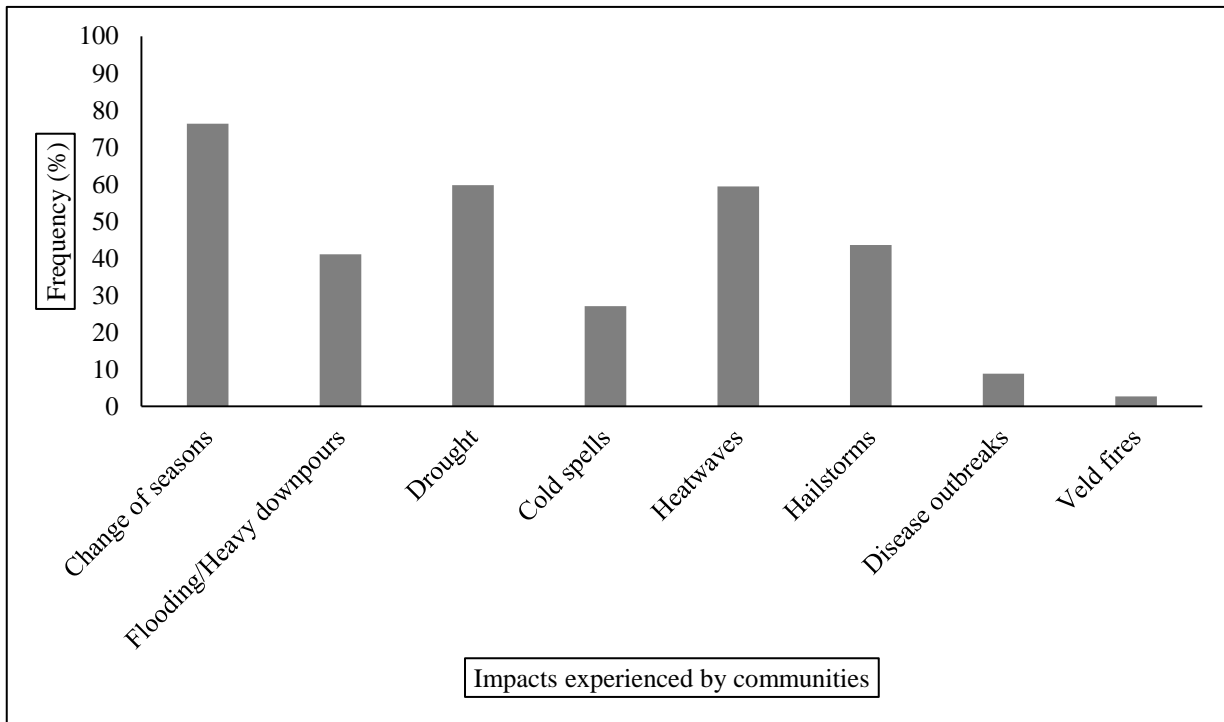


Figure 4.2: Climate-stressors experienced in the communities

4.4.2 Impact of climate variability on the communities

Half the respondents (50%) reported being impacted upon by climate variability, either directly or indirectly. Approximately 61% (Figure 4.3) of these respondents stated that climate stressors had damaged their crops thereby affecting their agricultural activities and ranked it as the activity most impacted by climate variability. These crops include; maize, cabbage, spinach, potatoes, beans, butternuts, beetroot, carrots, and onions and are grown in the respondents' gardens. The crops are grown for personal consumption or for sale within the

communities. Approximately one-quarter of respondents stated that climate variability has had an impact on their health (24%), general well-being and comfort (25%), income (26%) and their property and infrastructure (25%) (Figure 4.3). Fewer respondents stated that their education (2%), livestock (3%) and water supply/price (9%) have been affected (Figure 4.3). With regards to health, the community members complained that their children are of ill-health while others complained that the high temperatures and erratic weather changes cause skin rashes, influenza, headaches and worsened their blood pressure, diabetes and epilepsy.

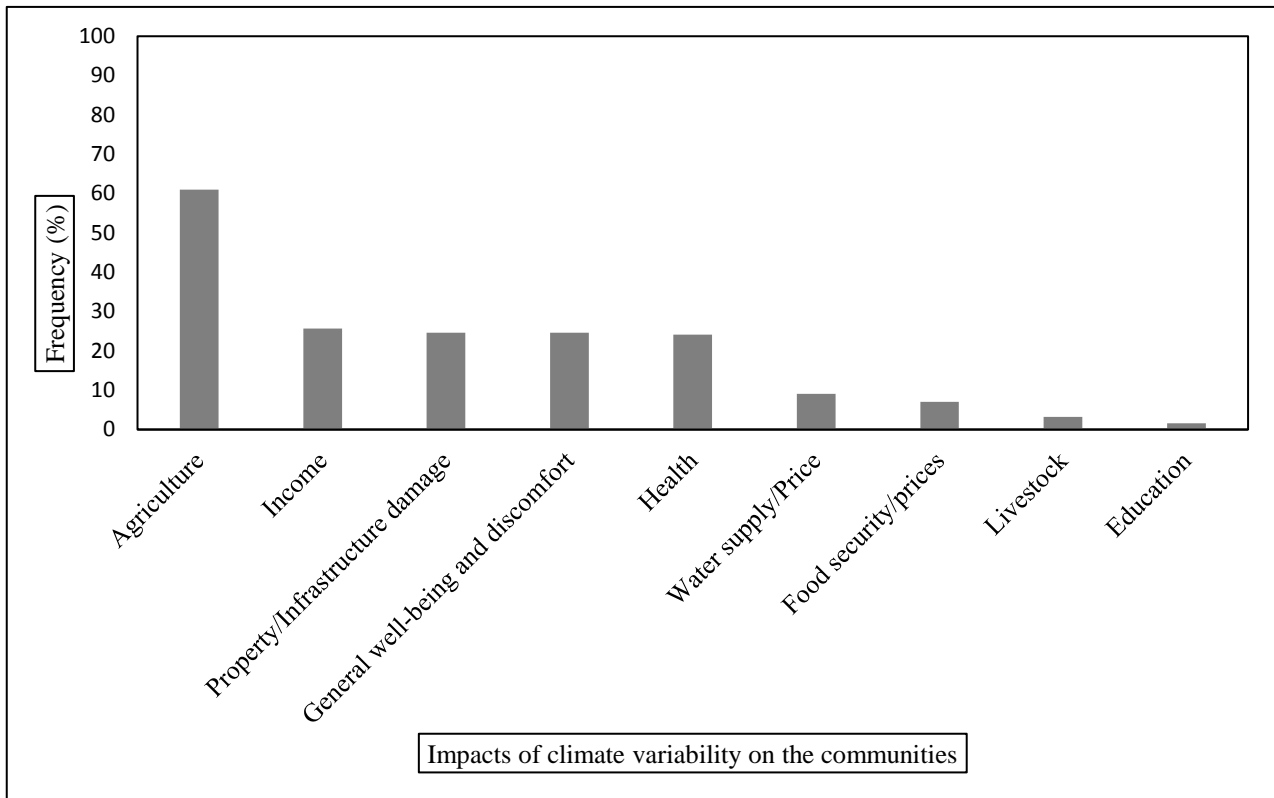


Figure 4.3: Impacts of climate variability on community members

4.4.3 Level of concern for the impacts of climate variability

Seventy-nine percent were concerned with climate variability and its impacts and pointed out that their lives have become significantly difficult as they are facing challenges that they have not faced before. Interestingly, contrary to the previous finding where only seven percent identified food insecurity as a potential impact of climate-related change on their livelihoods, the majority of respondents identified food security (33%) as the primary reason for their high level of concern for climate variability (Figure 4.4). One respondent expressed concern for the impact of climate variability on rural food security (Table 4.2) as during a drought, or any other climate-related impact, urban populations are forced to send financial remittances to their relatives in rural areas to enable them to purchase food (Pers. comm, 2015). In many cases, these funds are sent in addition to remittances that they are sending on a monthly basis. Hence, the household incurs additional costs on already limited funds.

Other reasons for the high levels of concern were the impact on crops and gardens (32%), health (28%), extreme weather events (24%) and increasing temperatures (20%). A few respondents (2%) expressed

concern for future generations while others feared that the world is coming to an end. Interestingly, one respondent pointed out that climate variability can have an impact on tourism (Table 4.2). Two older female respondents from Willowfontein noted how the Wilgerfontein River is drying up and “getting wider” (Pers. comm, 2015).

One community member expressed concern with regards to climate variability but complained that while they are affected, they have “no platform to raise their concerns” (Pers. comm, 2015). Two other respondents expressed a similar concern by stating that “the changing of climate is a big problem for us because we are neglected by the local government” (Pers. comm, 2015) and “climate change affects us a lot. We don’t have information as it is not given to us. So when the weather fluctuates, it is difficult to cope” (Pers. comm, 2015). Another noted that “it is very difficult to adapt to the changes”. Those who were not concerned (21%) argued that damage had already been done and cannot be reversed, while others asserted that “climate variability and change are natural things so nature will fix itself” (Pers. comm, 2015). On a positive note, one respondent confessed that while he is concerned, climate variability benefits him as “every time heavy rains destroy houses, the residents call me to fix so I make money from it”. (Pers. comm, 2015).

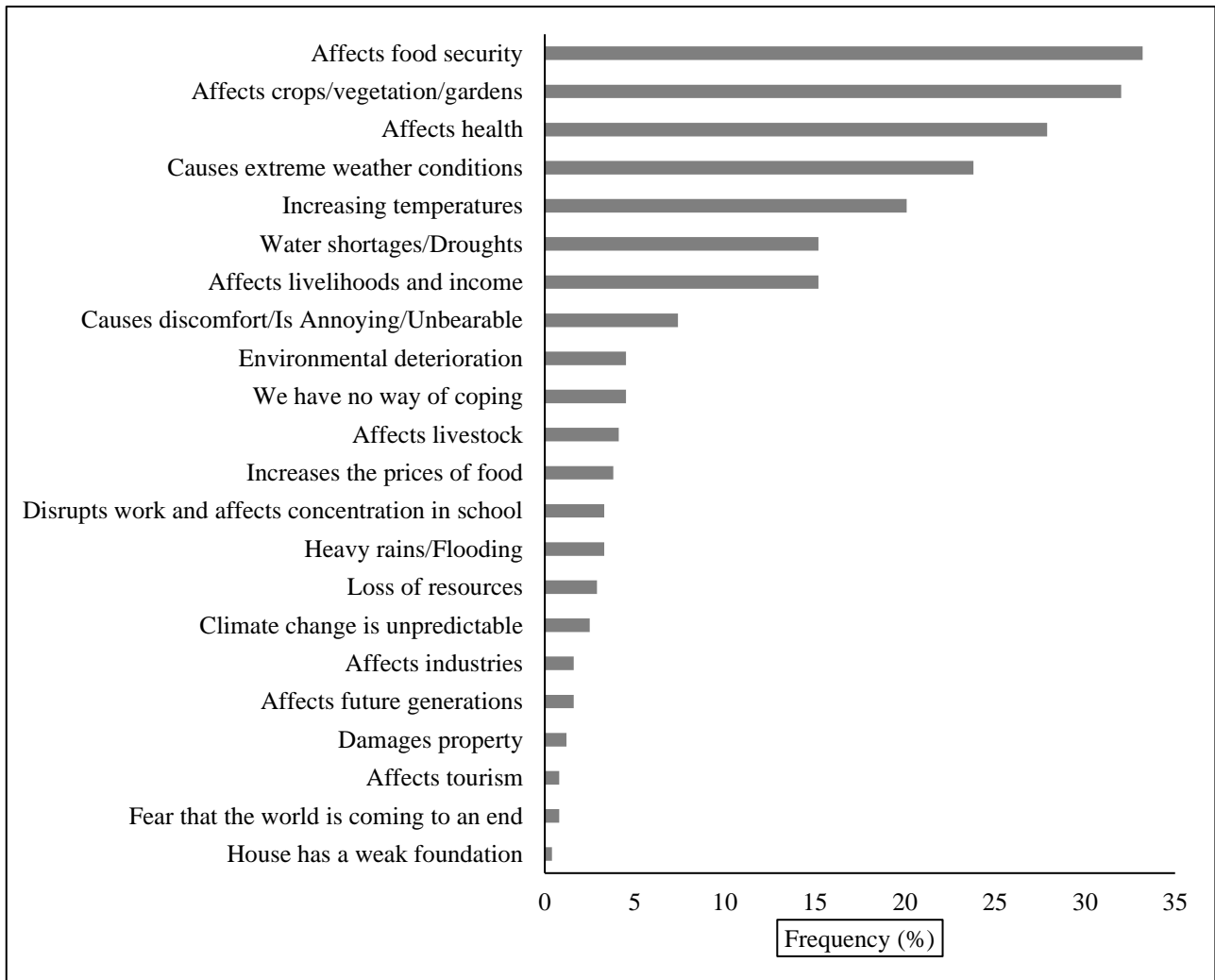


Figure 4.4: Reasons for concern for the impacts of climate variability

Table 4.2: Reasons for concern for the impacts of climate variability

Concern	Quotes (Personal communication, 2015):
Food security	<p><i>“It affects our food and we have to use fertilisers”</i></p> <p><i>“Because in time there will be hunger because crops are already dying”</i></p> <p><i>“Very concerned because of the issue of food supply. We have family living in the rural areas so when there is rainfall, it gives us hope that plants will grow and they will have access to food”</i></p> <p><i>“People in the neighbouring areas do not harvest any more. Food prices have increased”</i></p>
Agricultural activities	<p><i>“We can’t plant anymore and that’s a big problem because food is expensive”</i></p> <p><i>“Because I’m a farmer and everything I do depends on the weather”</i></p>
Health	<p><i>“Health issues that affect my income. The weather also makes it difficult to plough”</i></p> <p><i>“We are getting sick more often than usual”</i></p> <p><i>“Many</i></p>

	<p><i>people are getting diseases from weather fluctuations”</i></p> <p><i>“Moderately concerned because it affects our lives and lifestyles. It affects our health, our ability to access water. It causes TB (tuberculosis)”</i></p> <p><i>“Spring rains tend to be very violent and cause flooding which leads to high health complications”</i></p>
Increasing temperatures	<p><i>“The nights are hot and as a result we cannot sleep well. Children get sick often so more money is spent on health care”</i></p> <p><i>“Heat waves are not healthy for human life”</i></p> <p><i>“The heat causes us to be less productive in terms of household chores”</i></p> <p><i>The heat limits our ability to concentrate at school</i></p>
Water	<p><i>“It changes our livelihoods and affects our health. There used to be a lot of rainfall because the river used to flood more often. Now the river systems are drying up and we have less water”</i></p> <p><i>“We might not get enough water”</i></p> <p><i>“The water shortages threaten our survival”</i></p>
Future generations	<p><i>“As the years go by, I worry about the drastic change in climate, the future and how bad it will be in the next 10-15 years or so”</i></p> <p><i>“It limits and decreases opportunities for future generations”</i></p>
Tourism	<p><i>“It affects tourism. People in England like to visit coastal areas here”</i></p>

4.4.4 Ranking of climate variability and change amongst the communities’ priorities

When the respondents were asked to list and rank the issues their households and communities are facing, they listed nine common issues- climate change, poverty, unemployment, food security, crime, lack of clean drinking water, refuse collection, sanitation and affordable health services (**Figure 4.5**). One respondent mentioned housing and infrastructure, and another complained about drug use among the youth. Poverty is

the most challenging issue affecting the communities, followed closely by unemployment and climate change. One respondent stated *“poverty is the first challenge because it’s caused by a lack of skills. If one is not educated or does not have the skills, they do not qualify for jobs. Then crime is result of poverty and unemployment”* (Pers. comm, 2015). Regarding climate change, while it is in the top three of the most challenging, it is also among the top two of the least challenging problem the respondents are facing (**Figure 4.5**).

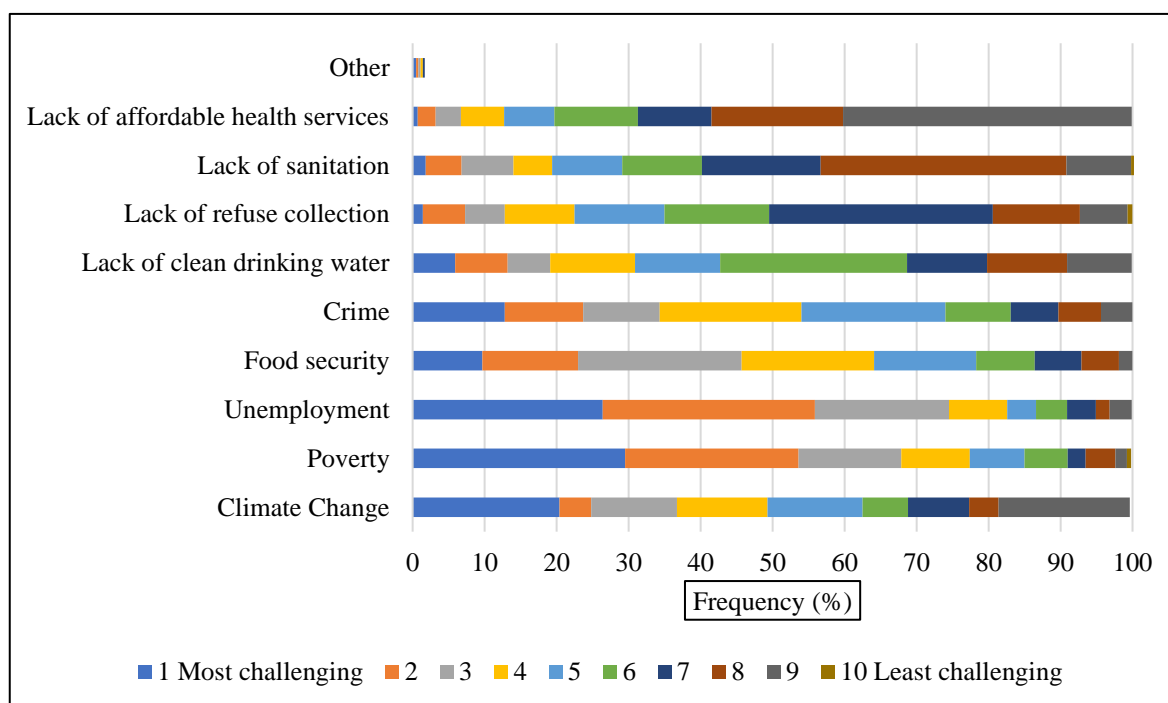


Figure 4.5: Ranking of the main issues that the community members identified

4.4.5 Coping strategies

Even though half the respondents (50%) reported that climate variability impacts upon their lifestyles and livelihoods, less than half, i.e. 37%, are taking steps to cope with or respond to the changes (Table 4.3). The strategies are short-term responses to the eight climate

stressors to which they have been exposed. These stressors are; change in seasons, flooding, drought, heat waves, cold spells, hailstorms, disease outbreaks and grass fires. It is important to note that the respondents did not have coping responses for each of the climate stressors. They only provided responses for the stressors to which they have been exposed and for which they felt they have adequate responses.

Table 4.3: Community members' response strategies

Coping responses	Climate-related impact (%)							
	1	2	3	4	5	6	7	8
Use more fertiliser to hold the soil	2		1					
Water the plants more- at least twice a day			13	12				
Plant more crops	5	4	5	3		2		
Adjust planting times	4							
Avoid planting non-indigenous trees	1		1					
Do not plant at all	4	2	5	4		4		
Purchasing of goods rather than planting	2		2	2		2		
Find alternative means of earning income because crops are not growing	1	1	1	1		1		
Store water in large containers (for plants and household use)			10					

Stay indoors (during hot and cold weather)	9	8		11	10	13		
Stay hydrated- drink more water				37				
Use fans	11			9				
Use sunscreen/wear hats/stand under the shade	1			7				
Use heaters/make fire/use the stove to keep warm	10				13			
Work early before it gets too hot	1			1				
Create drainage furrow		12						
Plant trees around the yard to protect the house from damage. Plant grasses to protect the soil		4						
Move property to a safe position and close the window, including cars		7				2		
Keep livestock indoors and cover crops to protect them from hail and heavy rain		2						
Putting buckets under leaks in the house in case of heavy rains		3						
Put a lightning conductor in the yard						1		
Change the way we build- from flat roof to pointed one		2						
Reinforce walls of the house		1						
Evacuation		52						
Use grant money to cope	1	1	1	1	1	1		
Rely on funding and seeds from NGOs	1	1	1	1	1	1	1	1
Request assistance from local government and councillors		4						
Request assistance from community		2						
Insurance		1				1		
I take the children to the clinic when they fall ill	1	1	1	1	1		1	
Minimise waste to reduce impact	10		9	10	9			
KEY:								
1=Changes in seasons			3= Drought		5= Cold spells		7=Disease outbreaks	
2= Flooding			4= Heat waves		6=Hailstorms		8=Increase in grass fires	

In response to the 'change in seasons', a stressor the majority (53%) claim to have the least difficulty coping with, the majority of strategies focussed on agricultural activities, with more respondents stating that they would

plant more crops (5%) to replace those damaged by the unpredictable seasonal changes. Other strategies related to increasing respondents' comfort, namely the use of fans and heaters as the temperatures changed, or staying

indoors. One-tenth of respondents stated that they would reduce their household carbon footprints by a reducing the amount of waste their households produce.

In response to ‘flooding’, a stressor the majority (38%) have the greatest difficulty coping with, more than half of the respondents (52%) would evacuate to higher ground or to the community hall, where they believe the local government can tend to their needs, or move in with their relatives in other areas. They stated that they would make sure that they carry their valuables and important documentation with them and seven percent would move their property to a safe place. Approximately, 12% of respondents stated that they would create drainage furrows to divert flood waters while eight percent of respondents confessed that they would rather stay indoors in their homes than move. Part of the reason for opting to stay indoors during a flood event was that the respondents believe that the media reports false weather information.

Five respondents (4%) stated that they would “*plant trees around the yard to protect the house from damage and plant grasses to protect the soil*” (Pers. comm, 2015). Only three respondents (2%) stated that they would rely on social networks to cope with flooding. The social networks include their neighbours and relatives, receiving greater assistance from the former than the latter. The type of assistance provided is predominantly non-financial and entails the provision of labour to drain water that would have entered the houses, building trenches, moving and keeping assets, providing building materials to rebuild, mostly iron, assisting with the rebuilding, where necessary, providing temporary accommodation, and helping to raise funds for those affected. Moreover, community members can sometimes provide food, clothes, furniture, basic necessities and money.

Interestingly, even though 60 percent of respondents perceive that it is the responsibility of government, in particular, local government to address climate-related issues, only five respondents (4%) reported that they would seek government assistance and one would seek assistance from non-governmental organisations (NGOs). Only one respondent (1%) stated that she would utilise insurance to respond to flooding.

In response to ‘drought’, a stressor that the majority (38%) have some difficulty coping with, the more popular responses were to water the crops more (13%), store water for household use (10%) and minimise waste to reduce impact (9%) (**Table 4.3**). The latter refers to the recycling of water whereby the respondents would use greywater to water crops. Approximately five

percent of respondents opted to plant more crops while another five percent opted to not plant at all, in which case food will need to be purchased. However, only half of those no longer planting admitted that they would purchase food.

The majority of respondents expressed that they have great difficulty in coping with ‘heatwaves’ (41%) and no difficulty in responding to ‘cold spells’ (43%). In response to the latter, 13% opting to use heaters or make fires or use the stove to keep warm, while 9% stated that they would implement measures to reduce household’s carbon footprint (**Table 4.3**). Thirty-seven percent of respondents stated that they would stay hydrated to cope with heatwaves and to reduce their levels of discomfort, some respondents would stay indoors (11%) or use fans (9%) or use sunscreen, wear hats or stand under the shade (7%) (**Table 4.3**). Regarding their crops in the event of a heatwave, 12% of respondents would water the plants more, while 3% would plant more crops if their crops are damaged by the heat and 4% would not plant at all. Approximately 10% stated that they would take steps to reduce their household’s carbon footprint.

In response to ‘hailstorms’, a stressor the majority (42%) have great difficulty coping with, 13% of respondents would opt to stay indoors and 2% would move property such as cars to safe positions. If crops are damaged during the storm, 2% stated that they would plant more crops to replace the crops that have been lost, while 4% would not plant at all (**Table 4.3**). Only one respondent (1%) stated that she would use grant money, another would request assistance from NGOs and the other would use insurance to cope.

The majority of respondents (46%) stated that they face medium difficulty in responding to ‘disease outbreaks’ while 70% do not face any difficulty in responding to ‘grass fires’. The reason for latter is that grass fires are quite uncommon in Pietermaritzburg, hence the majority of respondents do not feel that it is a threat and do not know how they would respond to such a stressor. However, one participant (1%) asserted that he would rely on funding from NGOs to cope. In response to disease outbreaks, one respondent (1%) stated that she would take her child to the clinic when ill and another stated that he would rely on assistance form NGOs to cope (**Table 4.3**). The respondents feel that children are most vulnerable to climate shocks, hence they believe that children are most likely to get sick from climate stressors.

When asked whether they felt that their coping strategies were effective, more than half (57%) of the respondents admitted that they were not.

4.4.6 Reasons for not coping

In spite of the growing acknowledgement that climate is changing and impacting on their livelihoods, 63% of respondents stated that they have no means of responding to the impacts. This is mainly due to a lack of knowledge (20%) and the belief that nothing can be done to deal with climate variability and change (16%) (Figure 4.6). One respondent stated that “while climate change has been on the global agenda for decades, for many within the community, it is a relatively new concept, hence attempting to cope is difficult, without assistance” (Pers. comm, 2015). Some respondents (1%) believe that since climate variability and change

are natural processes and that “the nature can fix itself” (Pers. comm, 2015). Others believe that only God can address the issue: “God is the one person who can control the weather” (Pers. comm, 2015).

A lack of funding (9%) and resources (11%) were other barriers identified by the community while 8% of respondents (Figure 4.6) felt that climate variability do not affect their livelihood, therefore, there is no reason to worry. Others (1%) have chosen to respond when the need arises. One respondent noted that the community members had no traditional way of coping with climate variability.

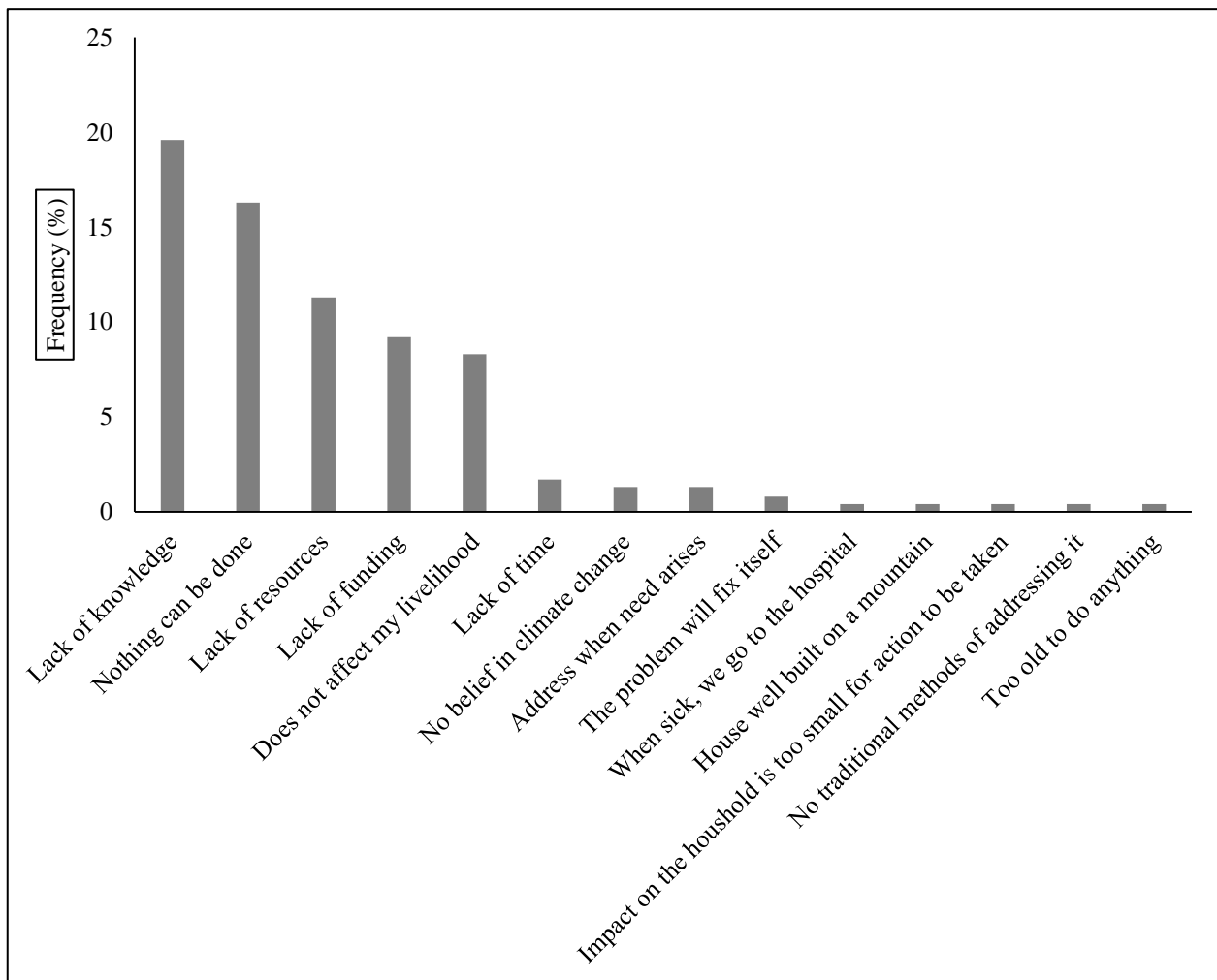


Figure 4.6: Reasons for not coping

4.5 Discussion

While respondents acknowledge that climate is changing and impacting on their livelihoods and lifestyles, the issue is not as much a priority as poverty

and unemployment. Moreover, the respondents’ opinion of climate variability and change is divided as an equal number view it is as one of the most challenging issues as those who do not. This will undoubtedly impact on the manner in which they respond and accounts for why only half the respondents felt that they have been

impacted. Shackleton *et al.* (2015, p. 4-5) concur by stating that “how climate change ‘sits’ in relation to other, possibly more immediate and context-specific stressors, on people’s lives is also an important factor influencing the decision to take action or not in response to climate stimuli; often, other problems may take priority particularly in poor regions such as SSA”. One thing is clear, the respondents want jobs and to get out of poverty. As of 2017, 9.3 million people in South Africa are unemployed, and the number continues to grow (StatsSA, 2017), meaning that the government is falling short of meeting its goal of “eliminating poverty and reducing inequality by 2030,” by creating 5 million jobs by 2020 and 11 million by 2030 (National Planning Commission, 2011, p.10). Drastic measures need to be taken to not only create employment but address climate variability and change which, if not addressed, will serve to reverse any developmental gains. There is need for greater investment in the implementation of well-designed community-based projects that can link poverty with climate variability and change, allowing one to leverage co-benefits from the other. The South African national government is already implementing such projects in rural areas, in partnership with local authorities, environmental organisations, NGOs, and conservation groups to generate green jobs in the rural economy and protect the environment by employing rural communities to remove alien plants and trees (Maia *et al.*, 2011; Musyoki, 2012; Poverty-Environment Partnership (PEP), 2012). The initiative is known as the Working for Water Programme (WfW) and has created employment for, and skills, approximately 20 000 people per year, rural women comprising 52% of the total (Maia *et al.*, 2011; Musyoki, 2012; Poverty-Environment Partnership (PEP), 2012). Similarly, a few respondents mentioned that such projects are already underway in other communities, under the tutelage of local non-governmental organisations (NGOs)- projects that focus on waste collection and recycling in exchange for money or on teaching community members how to grow food for subsistence or indigenous trees that can be sold to the NGOs (Hlahla *et al.*, 2016). Lim *et al.* (2004, p. 24) note that “piggy-backing” climate-related response strategies onto poverty alleviation and development activities will garner the public’s interest in addressing climate change and the implementation of policies will be met with less resistance. However, these projects have not reached all the communities, hence partnerships are necessary. The government and private sector need to partner with local NGOs and the communities to implement such initiatives in urban

areas and teach the communities to adapt as opposed to merely responding with stop-gap measures. This will help to reduce poverty levels and increase household response capacities within the communities.

Urban agriculture promotes dietary diversity and by extension, food security (Zezza and Tasciotti, 2010). The study revealed that the agricultural activities of the majority of respondents have been compromised by the changing climate and weather patterns, threatening food security due to reduced harvest and the increase in food prices. In a study carried out by Caesar *et al.* (2013) within households under the jurisdiction of the Msunduzi Municipality, Pietermaritzburg, it was found that the households most impacted by an increase in food prices were female-headed households and the households were forced to compromise on food quality, trading dietary nutrition and diversity for quantity. Similarly, in a study conducted by Tibesigwa and Visser (2015) in South Africa, it was found that urban female-headed households are more food insecure than male headed ones due to the prominence of off-farm employment in male-headed households. This is cause for concern as majority of households within the current study are female-headed and likely to fall into a similar trap unless measures are found to cope with the climate stressors and increase resilience.

Less than half of the respondents were able to identify means of coping with climate variability and the majority of the strategies were reactive and will not sustain the communities. This is a reflection of the limited knowledge that communities have regarding climate variability and change and how to respond. The respondents confirmed this when the majority identified a lack of knowledge as the main reason as to why they have not adopted any coping strategies and stated that nothing can be done to respond. Admittedly, the lack of knowledge is a surprising finding given the fact that more than half of the respondents (55%) have received a secondary level of education where climate change, or some aspects of it, are a part of the school curricula. Moreover, they can access climate information via the television and radio. Perhaps the respondents are more concerned with surviving financially than they are about climate issues. Notwithstanding this finding, a few respondents have greater understanding of the issue and have adopted response strategies that are mitigative and risk averse, such as the use of greywater to reduce their household carbon footprints. Such measures have potential for long-term effects.

Only one respondent stated that she would utilise insurance to respond to flooding and hailstorms, which

is unsurprising. Insurance is only a viable option for those who can meet their daily basic needs and set some funds aside for savings. According to the study, only 18 percent of respondents have savings, hence the majority cannot afford insurance. Furthermore, even though some insurance companies in South Africa offer insurance for property damaged during weather-related catastrophes such as floods, fires, thunderstorms and hailstorms, the unpredictability of weather conditions, makes it difficult for insurance companies to model the risk and underwrite any extra costs (CDH, 2014 ; Hollard, 2014).

In response to heatwaves and cold spells, air conditioners are reported to be the most effective way to shield people from the impacts of heat waves and cold spells, however, poverty prevents access to such technologies (Kim *et al.*, 2012). Hence, staying hydrated, staying indoors, using heaters or making fires or using the stove to keep warm, are more feasible options for the communities. However, some of the strategies such as the use of fans and heaters, consume much energy and are not environmentally friendly. Therefore, as climate stressors, such as heatwaves, are expected to increase in severity, frequency and duration, the call to find cost effective solutions that cater to the socio-economically vulnerable has become even more urgent (Ceccherini *et al.*, 2017).

Interestingly, unlike in rural areas, there is little reliance on social networks for assistance with coping in this urban setting. A decrease in social capital is one of the by-products of urbanisation (McKenzie, 2008; OECD and CDRF, 2010) and the use of social capital as a coping mechanism depends on the scale of the stress. If the stress affects most members of the community, as is the case with flooding and droughts, social networks cannot be relied on for coping (Delisle and Turner, 2016). Moreover, each household differs in their coping or risk management capacities. Those with a greater coping capacity are able to assist those who are unable to cope. In a study carried out by Delisle and Turner (2016) in the northern rural mountainous parts of Vietnam, it was found that social capital was an important coping strategy and central to household safety nets. However, in the event of weather extremes such as droughts and floods, these networks are not dependable, unless a household has access to extensive social networks (Delisle and Turner, 2016).

Surprisingly, very few respondents stated that they would seek assistance from the government and non-governmental organisations (NGOs) to respond to the climate stressors. This may be attributed to a lack of

trust in the government and community-based organisations. The respondents even doubt the government, via media, is providing them with correct information regarding weather forecasts. The unpredictability of the weather may lead to the release of inaccurate information and the more this occurs, the more likely the public are to lose faith in the hazard predictions and early warning systems. Failure to heed the warnings of early warning systems could have catastrophic consequences for households.

Brinkerhoff *et al.* (2017, p. 4) note that “citizen’s assessments of government quality and trustworthiness may become negative as service access and quality decline”. Hence, the lack of tolerance for the local government’s poor service delivery has generated a lack of belief that the government are willing and able to meet their basic needs. Therefore, they have no reason to believe that the government ‘will come to their rescue’ with regards to climate variability, even though the majority feel believe that it is the responsibility of government, in particular, local government, to address the issues. A few respondents stated that they cannot rely on government to assist them and they have no platform to raise their concerns. Implementing community-based projects that link poverty with climate variability and change, as mentioned earlier, would be a good starting point for the government to help to rebuild the trust that has been lost. As it stands, the communities are socio-economically vulnerable to climate variability and though they feel that it is the responsibility of the local government to address the issue, they do not trust them to do so.

Another interesting finding or ‘coping mechanism’ was the belief that only God can address the issue of climate variability and change. This response stems from a long-standing belief held by some people that climate is God’s way of punishing mankind for their sins. Simatele (2010) and Debela *et al.* (2015) reported similar findings in studies carried out in Zambia and South Ethiopia, respectively. The respondents stated that mankind is not powerful enough to influence weather or change the climate, hence only God or other supernatural forces must be responsible (Simatele, 2010; Debela *et al.*, 2015). This, once again, points to the lack of knowledge and awareness pertaining to climate change and such a belief can act as a barrier to adaptation “through creating misunderstanding and mistrust” between government and the communities (Shackleton *et al.*, 2015, p. 334). Hence, it is necessary to educate the public to increase their knowledge and garner community interest in the topic. This can be facilitated by visiting the communities and discussing the issue with them. It is quite possible

that hearing about climate change on the television or the radio makes it hard for them to relate to it and makes it less of a reality, whereas a discussion in person can help them to grasp and understand the severity of the issue.

In a study carried out by Cutter *et al.* (2016) on the urban-rural differences in disaster resilience in the United States, it was concluded that disaster resilience in urban areas is driven in by human and financial resources while in rural areas, it is driven by social capital, community knowledge and ties to the environment. In this regard, rural areas are said to be self-reliant (Cutter *et al.*, 2016). This is not the case in urban poor communities in the global South. As is evident from the study, the urban poor lack access to human and financial resources to cope, lack strong social networks and feel they cannot rely on their political capital. As a result the communities have low adaptive capacities and remain vulnerable to the climate-related impacts, many of which are weather-related and tend to be gradual and difficult to detect or track using standard climate observations due to the lack of adequate data (Simatele, 2010; Olsson *et al.*, 2014). Unless measures are taken to improve their capacities to respond to climate variability, the communities and the future generations will remain vulnerable and entrenched in poverty, as climate risk increases in intensity, frequency and duration. In the face of this, the role of city governments in climate risk management will have to grow.

Local governments in South Africa have taken cognisance of this and where capacity and resources are available, have begun to institute measures to respond to climate risk. However, this process has not been without its challenges. Responses to climate-related risk and weather extremes in urban areas is taking place in the context of social injustices and disproportional vulnerabilities that are product of Apartheid (Taylor *et al.*, 2014). Hence, local governments are under pressure to rectify these injustices and fulfil the socio-economic needs of the communities under their jurisdiction, making climate risk less of a priority, especially in smaller, non-metropolitan municipalities. Moreover, poverty and inequality make it difficult for the people to pay city rates which form part of municipal revenue and local governments' capacity for revenue generation is further compromised by institutional inefficiency and inadequacies (Mafusire *et al.*, 2014). Notwithstanding these barriers, local governments have an important role to play in building local level resilience against the unavoidable impacts of climate variability and change

and strong governance structures are crucial for fulfilling this role.

4.6 Conclusion

Post-colonial South Africa is characterised by unsustainable urbanisation rates which has been accompanied by an increase in urban poverty. Poverty is one factor that stands in the way of effective responses to climate variability, whose impacts are increasing in magnitude and frequency (Olsson *et al.*, 2014). The study revealed that while nearly half the respondents are being impacted by eight climate stressors, even fewer have adopted some form of coping mechanisms. Moreover, the responses are merely stop-gap measures that are taken in response to the stressors. The communities, who are more concerned about poverty and unemployment than they are about climate-related risk, need assistance from their local governments and community-based organisations in order to improve their adaptive capacity. Central to decreasing their vulnerability is poverty alleviation and green job creation.

The local governments must increase investment in projects that reduce poverty levels and address climate issues in urban areas. Such programmes are being implemented by the national government in rural areas and some in urban areas, however, too many communities have not had the opportunity to participate or benefit from such initiatives. These initiatives are important as they can, in addition to empowering the communities economically, provide a platform to educate the communities about climate variability and change and how to adapt to it, knowledge which was found to be lacking. Furthermore, effective pro-poor urban planning and pro-active policies are required to improve access of the urban poor to basic services, infrastructure and affordable, adequate housing that is climate proof. This will help to improve urban households' response capacity and enable them to recover their assets quickly after extreme events.

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CHAPTER FIVE
Paper II

Assessing municipal-level governance responses to climate change in KwaZulu-Natal, South Africa

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Abstract

The 2011 Durban Adaptation Charter for Local Governments calls on local governments, worldwide, to institutionalise climate response, with the aim of minimising the impacts of climate change on local livelihoods and vulnerable communities. This paper, through the use of case studies, in-depth interviews and document review, assesses how three non-metropolitan municipalities in KwaZulu-Natal, a district municipality, and two local municipalities under its jurisdiction, are responding to this call. The results suggest that while the municipalities have adopted measures to institutionalise climate responses, the responses are relatively new and implementation is slow, complex and fraught with limitations and competing demands. Furthermore, there appears to be a lack of co-ordination of responses between the two levels of government, which has the potential to lead to duplication. Given the multi-scalar nature of climate change, emphasis on co-ordination and the inclusion of all municipal departments in the development and implementation of responses is necessary.

KEYWORDS: climate response; local government; district municipality; local municipalities; co-ordination

5 Paper II

5.1 Introduction

Termed the “chief ecological challenge” (National Planning Commission, 2012, p. 92) within South Africa, the direct and indirect impacts of climate change (CC) are real, here, and are being experienced. The immediate impacts of CC are felt at a local scale and this has prompted local governments, due to the vulnerability of the communities under their jurisdiction, to spearhead efforts to manage the unavoidable risks associated with the global issue (Baynham and Stevens, 2014; Du Plessis and Kotzé, 2014; Taylor *et al.*, 2014; Pasquini *et al.*, 2015). However, this comes in the face of competing socio-economic development priorities that include, *inter alia*, reduction of poverty and inequality, job creation, and the provision of basic services and infrastructure. These conflicting demands, and the absence of a mandate or “explicit policies and legal arrangements” for governing the issue (RSA, 2011; Du Plessis and Kotzé, 2014, p. 145), have led to a lack of comprehensive climate response policies and legislative frameworks (Segal and Cloete, 2012; Leck and Simon, 2013) and, where present, the existence of such frameworks does not guarantee action on the ground (Knieling and Klindworth, 2016).

Within the province of KwaZulu-Natal, the eThekweni Metropolitan Municipality (City of Durban) has pioneered efforts to institutionalise CC response strategies at the municipal level and, in 2011, played a key role in the development of the Durban Adaptation Charter (DAC) for Local Governments (EThekweni Municipality, 2014). Due to the growing realisation that local governments are necessary for the strengthening of local adaptive capacity, the Charter provides municipalities, globally, with the opportunity to formally commit to the cause (eThekweni Municipality, 2012). In addition, South Africa’s national government recognises the importance of local governments in building local level resilience, and has underscored this fact in the country’s 2011 CC response strategy.

The local government structure in South Africa is divided into three tiers. One tier exists in metropolitan areas- the metropolitan municipality, and in non-metropolitan areas, there is a two-tier local government system which comprises of the district municipality (DM) and the local municipality (LM) (Steytler, 2003; Cameron, 2006). Metropolitan municipalities tend to be better-resourced and equipped than their non-

metropolitan counterparts and this has facilitated the early institutionalisation of CC within metropolitan municipalities such as eThekweni and the City of Cape Town, who are considered as climate leaders in the country (Taylor *et al.*, 2014). Numerous studies have been conducted on the municipal institutionalisation of CC by metropolitan municipalities, however, little has been undertaken on district and local municipalities. Hence, this paper, using case studies, examines how the two-levels of non-metropolitan municipalities within the KwaZulu-Natal province of South Africa are managing CC. The municipalities are uMgungundlovu District Municipality (UMDM) which is the second largest municipality in the province after eThekweni, and the largest district municipality, and two of the seven local municipalities that fall under its jurisdiction, the Msunduzi and uMngeni local municipalities. The district was chosen due to its high level of vulnerability to the impacts of CC, but more importantly, in order to evaluate the progress of municipalities in immediate proximity to the climate leader and southern African regional hub for the DAC, eThekweni (EThekweni Municipality, 2014); a ‘ground-zero’ for municipal adaptation. The Msunduzi and uMngeni local municipalities were selected due the fact that, though, they function within the same district, they differ in their capacity to respond to CC. Msunduzi is the only municipality within UMDM that has a CC response policy whereas uMngeni does not and is, therefore, considered representative of the other local municipalities within the district.

The paper identifies five core components that can facilitate CC response action at the local level and uses these components to gauge the progress of the three municipalities. The components are: building strategic capacity; integrating climate change into development decision making; societal mobilization; ‘learning how to do’ CC governance; and access to financial resources. The components are discussed in the following section, followed by a description of the three case studies and their CC response portfolios, a discussion of the findings and a conclusion which highlights the importance of non-metropolitan municipalities in responding to CC and the need for a co-ordinated and holistic approach to CC governance.

5.2 Criteria for CC Governance

Responses to CC have taken an increasing multi-scalar character which involves numerous stakeholders (Mukonza and Mukonza, 2014). The causes of, and the risks associated with, CC need to be governed and this

will require sound decision-making, the building of trust, effective communication and for governments to bring about transformational change within their jurisdiction, in addition to fulfilling their assigned functions (Fröhlich and Knieling, 2013; Du Plessis and Kotzé, 2014; Mukonza and Mukonza, 2014). Climate change impacts all spheres of the South African government, national, provincial and local, however, the local sphere is at the forefront of vulnerability to CC and is, therefore, better positioned to effectively design and implement CC response strategies (Mukonza and Mukonza, 2014; Pasquini *et al.*, 2015; Local Government Programme 4 Climate Change, 2016). The management process will differ for each municipality as it is based on the unique socio-economic, political, environmental and cultural contexts of the affected areas

(Taylor *et al.*, 2014; Aylett, 2015). However, though there is no blueprint or agreed upon ‘best practice’ for CC governance, there are some core ingredients that can aid successful climate response action at the local level (Meadowcroft, 2009; McCarney *et al.*, 2011). Several authors have identified important components for a CC governance structure (see Roberts, 2008; Smith *et al.*, 2009; Madzwamuse, 2010; McCarney *et al.*, 2011; Pasquini *et al.*, 2015) and this study focuses on five: the building of strategic capacity; integration of CC into development decision-making; societal mobilisation; learning how to do CC governance; and access to efficient financial resources (Roberts, 2008; Meadowcroft 2009; Smith *et al.*, 2009; Madzwamuse, 2010; McCarney *et al.*, 2011) (**Figure 5.1**).

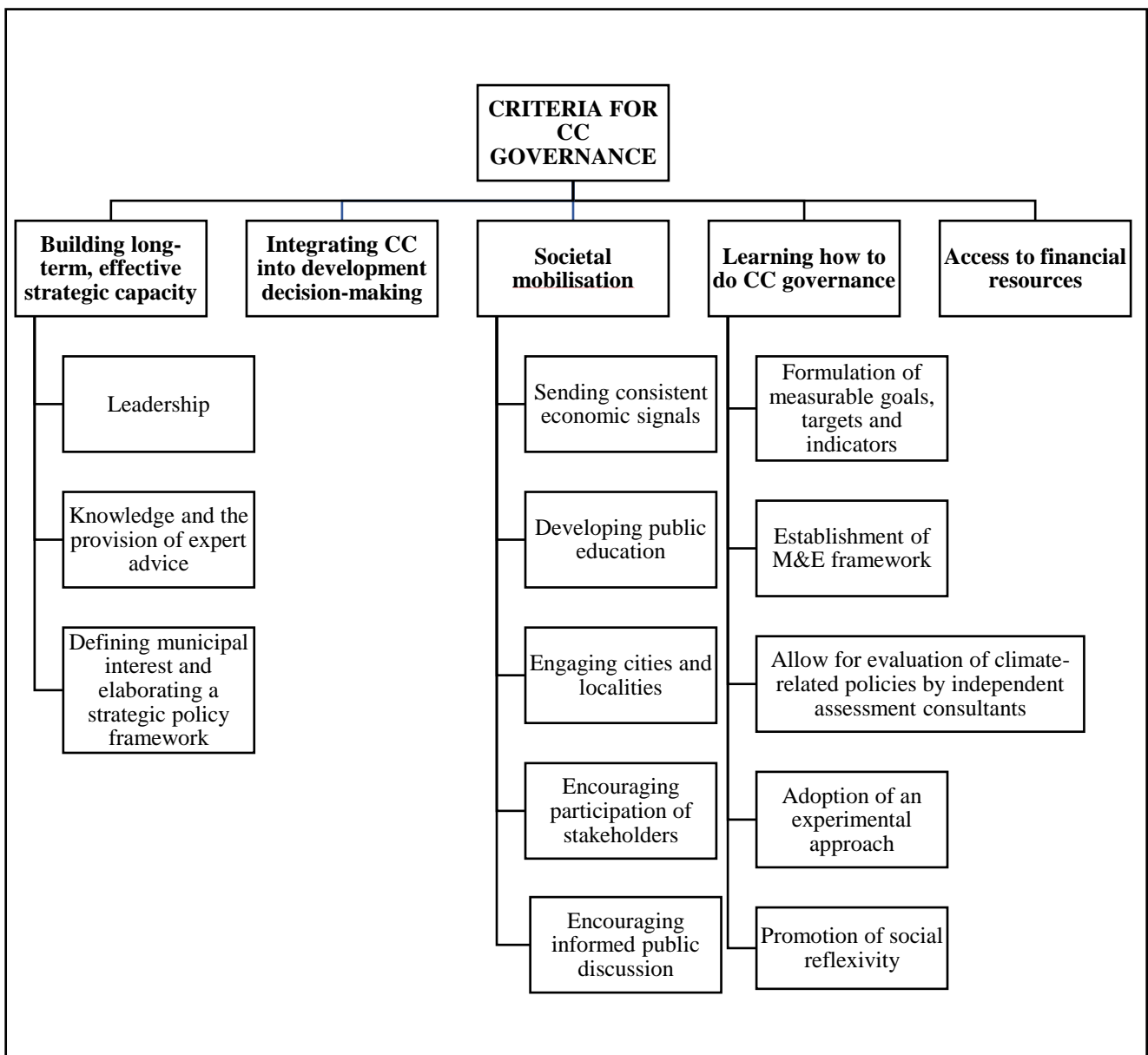


Figure 5.1: Criteria and sub-criteria for CC governance

More specifically, the criteria are:

- **Building long term, effective strategic capacity:** CC governance requires strategic capacity. Essential to developing this capacity is effective political and administrative leadership and support; access to, and the availability of, the best available information (Smith *et al.*, 2009; Pasquini *et al.*, 2015); and the ability to define municipal interest and incorporate CC into decision-making and develop a strategic climate policy response framework (Roberts, 2008; Meadowcroft, 2009).
- **Integrating CC into development decision-making:** CC should be mainstreamed into municipal plans, economic and social policies and into the mandates of non-environmental departments or public bodies with the aim of achieving sustainable development (Roberts, 2008; Meadowcroft, 2009; King *et al.*, 2012). At the municipal level in South Africa, this refers to the Integrated Development Plan (IDP). All levels of local government, district, local and metropolitan municipalities, are mandated to prepare IDPs to set-out their activities and budgets for a five-year period, which is the term of the elected political council (Harrison, 2006; Taylor *et al.*, 2014).
- **Societal mobilisation:** A holistic approach to CC governance entails engaging the public and non-government bodies to convince them that their role in the climate challenge is critical to CC governance (Meadowcroft, 2009; Mukonza and Mukonza, 2014; Li and Song, 2016). Communities, families, individuals, businesses, research institutions, meteorological stations and civil society groups shape policy outcomes as they will have to “change their carbon-emitting behaviours and provide the social and technological innovations required to reduce greenhouse gas emissions and to adapt to a changing climate” (Meadowcroft, 2009, p. 18; Madzwamuse, 2010; Knieling and Klindworth, 2016; Li and Song, 2016). In addition, an informed public is less likely to undermine or oppose the implementation of the policy frameworks (Meadowcroft, 2009).
- **Learning how to do CC governance:** The team responsible for CC governance should be willing to adopt a learning-oriented approach to governance, given the uncertainties and complexities of CC and our limited experience with addressing the issue (Meadowcroft, 2009; Fröhlich and Knieling, 2013; Termeer *et al.*, 2016).

- **Access to financial resources:** The ability of a local government to design and implement a climate-related response framework not only hinges on the presence of a capable and highly-skilled team who will be responsible for the framework, but requires access to stable and sustainable financial resources (Roberts, 2008; Meadowcroft, 2009; Smith *et al.*, 2009).

These criteria are not a panacea for localised CC governance but rather form a foundation on which the issues can be effectively addressed. In the following section, the governance structures of the case study municipalities are discussed, using the criteria as the basis for the assessment.

5.3 Methods

5.3.1 Description of case studies

The uMgungundlovu District Municipality (UMDM) is one of eleven metropolitan and district municipalities (DMs) located within the province of KwaZulu-Natal, South Africa, and is one of the three DMs in the province that are planning for CC. At 9 513km², the UMDM is the largest DM in KZN, and the second largest municipality, after eThekweni Metropolitan Municipality (UMDM, 2015a; Main, 2017). Moreover, the municipality is the fastest growing municipality in terms of population and economy within the province (UMDM, 2015a). UMDM is primarily rural in nature and has seven local municipalities (LM) under its jurisdiction. Msunduzi and uMngeni, two of the seven LMs, contribute the most to the District’s gross domestic product (GDP) with Msunduzi contributing 73 percent and uMngeni, nine percent (UMDM, 2016a). uMngeni LM is an inland municipality which covers 1 567 km², making it the third largest LM within UMDM (Main, 2017). Approximately 85% of the municipality is urban and within the District, uMngeni has the highest population growth rate (UMDM, 2016a; StatsSA, 2017). The majority of uMngeni’s population is female (52%) (StatsSA, 2017).

Msunduzi LM is an urban municipality and at 634km², is the smallest LM within UMDM (Main, 2017). However, it encompasses the second largest city in KZN, Pietermaritzburg (PMB), which serves as the seat of UMDM (Msunduzi Municipality, 2012; UMDM, 2013b). PMB is the capital of KZN and is the primary economic, administrative, political and service hub of the province (Msunduzi Municipality, 2012; UMDM,

2015a). Although the LM covers the smallest area, with a population of 618 536, it contains the highest population (61%) of the LMs in UMDM (StatsSA, 2017). Moreover, the majority of the population is female (52%) and there is a high proportion of female-headed households (42.7%) (Msunduzi Municipality, 2012; StatsSA, 2017).

5.3.2 Impact of CC on the Municipalities

Based on CC projections, UMDM and the seven LMs under its jurisdiction, are expected to experience severe climate-related impacts and increasing threats to food and water security (UMDM, 2016b). The DM will become warmer as average annual temperatures are projected to increase by 1.75-2.5⁰C by mid-century, and there will be an increase in rainfall within some parts of the District, in particular, uMngeni LM, and a decrease in others, and an increase in extreme events such as floods and severe storms (UMDM, 2013b). Agricultural land covers forty percent of the municipality, therefore, commercial and subsistence agriculture, which are an important aspect of UMDM's economy, are expected to be affected (UMDM, 2015b). In addition, CC poses a serious risk to water availability as the district includes most of the greater uMngeni River catchment which supplies approximately half the population of KZN with potable water (UMDM, 2015b). Hence, the communities within UMDM are reported to be highly vulnerable to the impacts of CC due to their over-dependence on natural resources for their livelihoods (Golder Associates Africa, 2013; UMDM, 2015b). The community members' low adaptive capacity can be attributed to the high levels of poverty and unemployment, a low level of formal education and a lack of knowledge pertaining to CC and its impacts

(UMDM, 2015b). Furthermore, approximately half of the households are female-headed, exacerbating their susceptibility to the negative impacts of CC (UMDM, 2015b).

5.3.3 Data collection

To investigate how the three municipalities are tackling impacts of CC, exploratory semi-structured, in-depth, interviews were conducted with key personnel directly involved with the municipal CC response portfolios within each municipality, between September 2015 and November 2016. These included individuals from the CC and environmental units of the three municipalities—two from UMDM, four from Msunduzi and one from uMngeni. The interviews lasted for approximately one hour and were followed up by e-mail communication, where necessary. The interviewees supplied numerous documentation, including CC response plans and municipal IDPs, which were reviewed. The data collected focussed on the five criteria deemed necessary for sound CC governance, which are: building strategic capacity; integrating climate change into development decision making; societal mobilization; 'learning how to do' CC governance; and access to financial resources.

5.4 Findings

The findings incorporate the five criteria and sub-criteria that constitute an effective local CC governance system. Where a municipality is actively responding to CC, some of the criteria and sub-criteria have featured in the development and implementation of the municipal response portfolios (**Table 5.1**)

Table 5.1: Utilisation of criteria for CC governance by the municipalities

Criteria and sub-criteria for CC governance	UMDM	Msunduzi	uMngeni
Building strategic capacity:			
Does the municipality have a CC Leader?	✓	✓	✗
Does the municipality have access to knowledge and is expert advice provided?	✓	✓	✗
Has the municipality defined municipal interest and elaborated a strategic policy framework?	✓	✓	✗
Has CC been integrated into development decision making?	✓	✓	✗
Societal mobilisation:			
Is the municipality sending consistent economic signals?	✗	✗	✗
Is the municipality developing public education?	✓	✗	✗
Is the municipality engaging cities and localities?	✓	✓	✗
Is the municipality encouraging the participation of stakeholders in key socio- economic sectors?	✓	✓	✓
Is the municipality encouraging informed public discussion?	✓	✓	✗
Learning how to do climate change governance:			

Has the municipality formulated measurable goals, targets and indicators?	✓	✓	✘
Is there a monitoring and evaluation (M&E) framework in place?	✘	✘	✘
Has there been an evaluation of the state of the environment, human pressures and effectiveness of policy by the municipality or independent assessment organisations or consultants?	✘	✘	NA
Has the municipality adopted an experimental approach?	NA	NA	NA
Is societal reflexivity promoted?	✘	✘	NA
Does the municipality have access to adequate in-house financial resources to design and implement a strategic CC response portfolio?	✘	✓	✘

✓ = Yes ✘ = No NA = Not applicable

5.4.1 UMgungundlovu District Municipality (UMDM)

CC is among the top ten priorities of UMDM and the municipality initiated plans to respond to the issue in 2011 when external consultants were commissioned, over a two-year period, to conduct a vulnerability assessment (VA), and produce a CC Response Strategy and Plan (Golder Associates Africa, 2013; UMDM, 2013a). The use of consultants was necessitated by the absence of an in-house environmental unit and expert staff, at the time. This has since changed and currently, a team of three environmental scientists have been employed and are directly involved with the municipality's CC portfolio. CC is a function that falls primarily under the Climate Change and Resilience Project Management unit within the Department of Community Services of the municipality and is championed by the municipal manager. When necessary, the team of CC team receives assistance from those working in related fields in the same department, such as the environmental health, town and regional planning and disaster management.

The VA, which was used to support the municipality's bid to qualify for grant funding from the Global Adaptation Fund, identified the areas within the District that are most vulnerable to climate-related impacts and have the least adaptive capacity (Golder Associates Africa, 2013). The bid was successful and the municipality received approximately USD7.5 million to implement a five-year project, called the uMngeni Resilience Project. The project, which commenced implementation in 2015, is a CC adaptation initiative that aims to build the resilience and reduce the vulnerability of rural communities and small-scale and emerging farmers to CC (UMDM, 2015b). This is achieved through the development and implementation of early warning systems, climate proofing of settlements, the introduction of climate resilience crops

and agricultural practices, and the capacity building of municipal officials. The sites selected for implementation are rural, differing in their topography and socio-economic characteristics, and are the most vulnerable to climate-related risk, according to the VA (UMDM, 2015b).

UMDM published its CC Response Strategy and Plan in 2013 (UMDM, 2013a), making it one of the first district municipalities in the province to develop a CC response strategy. Only four of the eleven metropolitan and district municipalities and three of the DMs in KZN are planning for CC, and UMDM is one of them. The strategy proposes two responses to CC: mitigation and adaptation, and the vulnerable sectors identified were; water and infrastructure, natural resources, agriculture, communities, health and housing, disaster management, and the economy (UMDM, 2013a). Although both mitigation and adaptation are addressed in the plan, the municipality is primarily focussed on adaptation as is evidenced by the uMngeni Resilience Project. As yet, due to the newness of climate responses in the municipality, there are no monitoring and evaluation (M&E) frameworks in place to track climate-related changes and the impacts of policy, nor have any policy appraisals been undertaken. However, a key informant stated that "*there are plans to review the policy within the next four years to see whether it is still relevant and whether there is any new information that can improve the policy*" (Pers. comm, 2016)

To further the municipal climate agenda, UMDM has incorporated CC into the municipality's IDP where CC has been identified as a threat to the district and local economic development. In addition, the municipality acknowledges that it requires assistance in responding to CC and encourages the involvement and participation of both internal and external stakeholders from key

socio-economic sectors related to CC. In an effort to increase capacity for CC response and to create partnerships, UMDM has participated in local environmental forums such as the District Environmental Forum where environmental issues were discussed, the District Disaster Management Advisory Forum, and the Central KwaZulu-Natal Climate Change Compact (CKZNCCC). The CKZNCCC, which is headed by eThekweni Municipality, is a learning exchange and capacity building forum that was launched in February 2014 where municipalities in the province can meet and share information on their successes and challenges with regards to CC adaptation and mitigation within their communities (DAC, 2014). The forum meets every three months and has been beneficial for UMDM. The municipality admitted to having adopted some of the models presented at the forum, such as the biodiversity planning model.

UMDM communicates and engages with the public with regards to CC via their website, newspapers and community radio stations, however, they are not running any campaigns to promote or discourage certain behaviours within society. For example, promoting water- or energy-saving and discouraging the burning of waste. The municipality hosts community meetings, particularly on environmental days, such as World Water Day, where they discuss the impacts of CC on water quality and availability with community members and how the communities can adapt.

The municipality is still on its first attempt for CC response, therefore, it is not possible, at this stage, to ascertain whether an experimental approach to climate-related policy response and formulation has been adopted. There is no societal reflexivity relating to CC governance, however, within the uMngeni Resilience Project, UMDM is attempting to integrate the concerns of the communities within project implementation:

“We have certain targets that we need to meet, but the approach is that we cannot go into a community and tell them that this is how it is going to be. So, we are having meetings with communities to discuss CC and the work we will be undertaking in their areas. We then ask them what their goals are and in which areas will they allow us to work and which areas do they want us to leave out. This is the only way a sense of community ownership will be developed. The project needs to address their needs

and not just the needs we have identified” (Pers. comm, 2016).

With regards to fiscal support, CC is not allocated funding from the municipal budget, and funds must be externally sourced. The officials anticipate that the success of the uMngeni Resilience Project will be the catalyst that is needed to drive the municipality to budget for CC.

5.4.2 Local municipalities (LMs)

Msunduzi and uMngeni, though functioning within the same District, differ in their levels of CC response and the prioritisation of the issue. For Msunduzi, CC is a priority while, due to numerous institutional challenges, it is not a priority for uMngeni. Therefore, uMngeni is lagging behind in CC response action. With regards to institutional positioning of CC, it is situated within the Sustainable Development and City Enterprises Department of Msunduzi Municipality where it is managed by the Environmental Management Unit. Championed by the head of the unit, a team of seven functions within the unit and are responsible for the drafting of CC-related documentation and responding to CC-related queries. The team comprises of social and environmental scientists who have *“the support of the mayor in certain aspects”* (Pers. comm, 2016). Within uMngeni, CC response is in its infancy and is the sole responsibility of the Environmental Management Officer who, by default, has become the CC officer. The officer functions within the Department of Economic Development and Planning. There is no expert team, however, CC is championed by the Mayor, with assistance from the municipal manager. The officer, Mayor and municipal manager have not received any formal education or training on CC and have no prior experience in dealing with the issue. Moreover, in addition to addressing environmental issues, the officer is in charge of social housing, affording little time to address CC issues. Furthermore, the officer’s post has been downgraded to a non-critical post. This led the official to confess that due to the heavy workload, *“I’m lucky if I am able to dedicate one hour a week to climate change-related issues”* (Pers. comm, 2016).

The information provided by the VA conducted by UMDM facilitated the development of a CC policy by Msunduzi in November 2014. The goal of the policy is to ensure that the municipality’s carbon footprint *“is reduced and the city is able to adapt to CC- related impacts and ensure there are options available when decisions need to be made regarding adaptation and mitigation”* (Singh and Bartholomew, 2014, p. 13). The

policy aims to ensure that all municipal business units embed CC into their daily operations (Singh and Bartholomew, 2014). However, the policy identified barriers to fulfilling this aim as there is a lack of “adequate response and capacity building within the units to do so and a lack of strategies to predict CC impacts in order to implement strategic adaptive and mitigative programmes in the event of climate-related natural disasters” (Singh and Bartholomew, 2014, p. 8). Moreover, the personnel from the Environmental Management Unit stated that they face challenges in implementing the municipal CC response portfolio as “the majority of council officials are not aware of CC and the threats associated with this, thus CC has not been viewed as a priority” (Pers. comm, 2016).

In 2016, Msunduzi published a final draft of its CC adaptation and mitigation strategy that provides information on policy implementation, however, it has, to-date, not reached the implementation stage. Nine goals are identified that are related to the different sectors within the municipality that would be most affected by CC, these are: biodiversity and ecosystems, water, health and air quality, energy, waste management, infrastructure, agriculture and food security, awareness and research, and governance (Singh and Bartholomew, 2014). Although uMngeni makes reference to the VA and the resulting response strategy within its municipal IDP, it does not inform on the implications for uMngeni and has not developed a CC response portfolio. However, according to uMngeni’s 2016/2017 IDP, the municipality has commissioned consultants to develop a CC response strategy and plan (UMngeni Local Municipality, 2016) and the official has requested budgetary support from the municipality.

It is difficult to ascertain whether the Msunduzi LM has adopted an experimental approach to policy formulation as the policy was recently developed. However, societal reflexivity has not been promoted. An official from the Environmental Management Unit stated that this is because “the policy was developed internally within the municipality and is specific to municipal business units” (Pers. comm, 2016). Moreover, there are no M&E frameworks in place to track climate-related changes and the impacts of policy, nor have policy appraisals been undertaken.

In addition to having a CC policy, Msunduzi’s IDP underscores the need to mainstream CC mitigation and adaptation into all municipal functions to reduce the susceptibility of communities to CC. Furthermore, involvement and participation of both internal and

external stakeholders, such as the local university, the private sector and non-governmental organisations, is encouraged. The LM ensures that the drafts of CC documentation are made available to all business units and the public sector to comment and provide input. Similar to UMDM, uMngeni and Msunduzi are signatories to the CKZNCCC where they are creating partnerships, sharing information and building their capacity to respond. The official from uMngeni stated that forums such as the CKZNCCC have been particularly beneficial for his education on CC and has enabled him to form networks that will help him to mainstream CC within the municipality. The municipality is receiving assistance from the CKZNCCC to increase the municipality’s capacity to address the issue and has been able to identify potential funding opportunities via this ‘community of practice’. The official stated that he receives technical assistance from other surrounding municipalities, including eThekweni Municipality and Msunduzi LM.

Msunduzi is not implementing its own CC-related projects, however, it is a stakeholder in projects run by local non-profit organisations and is active in the uMngeni Resilience Project. The municipality participates in the UMDM’s steering committee meetings and provides input and feedback. Msunduzi Municipality’s Environmental Management Unit has submitted a report to the municipal council advising members of the initiative and requesting council to support the uMngeni Resilience Project. Due to time constraints and a lack of human capacity, uMngeni is unable to participate in the uMngeni Resilience Project.

Msunduzi and uMngeni have not yet developed a formal means of educating the public regarding CC nor are they running any campaigns to promote or discourage certain behaviours within society. The official from uMngeni is hoping to commence with a number of projects during the latter part of 2017, depending on whether the proposed budget is approved. These projects will relate to measures to reduce the municipality’s electricity consumption by, *inter alia*, erecting solar panels and having LED lighting within the municipality and the implementation of solar heating project for social housing. Msunduzi’s CC policies and strategies have been made available to the general public on the municipal websites. The documentation is available in isiZulu, which is the vernacular of the province, and a key informant stated that “efforts are being made to ensure that future CC-related documentation will be available in isiZulu” (Pers. comm, 2016). Moreover, the municipality makes an effort to provide the public with the opportunity to comment and/or provide feedback on

CC documentation before publication, however, in many cases, few people respond.

With regards to financial resources, CC is included within the Msunduzi's municipal budget and not in that of uMngeni. This is a result of competing budgetary allocations as there is a growing fear that funding meant for other mandates, such as social housing, will be allocated to CC management hence the lack of priority and reluctance of council members within the municipality to pursue it. Moreover, the municipality encounters difficulties in sourcing external funding as the official admitted that he lacks the experience to motivate for funding.

5.5 Discussion

The study, with the aid of five criteria, assessed the CC response portfolios of three municipalities, uMgungundlovu District Municipality (UMDM) and two local municipalities under its jurisdiction, Msunduzi and uMngeni. The criteria proved to not only be useful as units of assessment, but they helped to identify the barriers the municipalities encounter. However, the criteria for 'learning how to do CC governance' is better suited to assess municipalities whose portfolios are at least five years old as they would have had some time to experiment with responses and test different approaches. Presently, the three municipalities are yet either to develop or to implement or have just started implementing CC responses. Hence, they require more time before it can be ascertained whether they are actually learning how to undertake CC governance. The findings above do, however, raise a number of questions for discussion, regarding, the reasons and context for slow progress in climate response framework development; the relevant scale of operation and the form of institutionalisation for response action; the role of consultants and best practice networks; the balance between flexibility and replication in approaches; and finally, the integration of CC activities into municipal development budgeting and planning.

First, there are considerations regarding the balance between flexibility, innovation and replication. The successful institutionalisation of CC requires local governments to formulate solutions tailored to their unique socio-economic, political and biophysical conditions. This requires innovation and experimentation, in particular, in South Africa, where local governments have no legal mandate for CC response (Taylor *et al.*, 2014) and no distinction has been made between how the three tiers of local

government should manage the issue. The study suggests that CC response is in its early stages within the three municipalities, however, UMDM and Msunduzi have advanced further than uMngeni, with three and four of the five criteria, respectively, having facilitated the development of their response portfolios. Despite this progress, the municipalities have set ambitious goals within their CC plans and policies and are lagging behind with regards to implementation and monitoring and evaluation. Moreover, the strategies that are being employed seem to be replicas of what eThekweni, a better-resourced, metropolitan municipality, has undertaken, which is unsurprising, given the proximity of the uMgungundlovu District to eThekweni. Experimentation and innovation requires time, which the municipalities realistically do not have, and resources, which are limited. Hence, the most attractive option is to adopt strategies that have already been vetted. Such knowledge transfer is important for any governance system, however, in implementing these strategies, the municipalities need to take cognisance of fact that eThekweni is a metropolitan municipality with access to more resources. The metropolitan municipality's CC portfolio receives greater budgetary support than that of DMs and LMs, and at least 21 skilled personnel have been employed to work on the portfolio. Furthermore, UMDM, Msunduzi and uMngeni need to take into consideration the fact that some CC issues are site-specific, *i.e.*, the problems encountered by the three municipalities may be different from those experienced by eThekweni, even if they function within the same province and are in close proximity to each other. Moreover, 86% of eThekweni (Taylor *et al.*, 2014) is urban, meaning that a municipality like UMDM, which is primarily rural, may not experience similar successes due to differing capacities and access to resources. These differences and municipal limitations need to be taken into account before implementing any strategies that have been successful in other municipalities.

Regarding how we contextualise limitations in progress at the municipal level, there are a number of factors to consider, and uMngeni Municipality provides a good example. Due to the absence of a CC response portfolio, the municipality has not engaged with the criteria. The failure to adequately institutionalise climate action is attributed to the lack of capacity, priority, municipal support, co-operation and political will. Unlike UMDM and Msunduzi, the burden of environmental and CC response currently falls on the shoulders of one official who is already over-whelmed and lacks the expertise. In this light, Goebel (2007) asserts that a human resources

crisis exists within South African municipalities which will take time to overcome and compromise policy implementation. Ranked 7th, CC response is the last priority on the list of KZN provincial priorities and this has likely contributed to the lack of incentive within the municipality to address it or to allocate already stretched financial resources towards hiring a team capable of doing so. The absence of a mandate has not helped matters as it has “downplayed the seriousness of the need for climate governance and action” (Du Plessis and Kotzé, 2014, p. 173), making municipal authorities reluctant to act. Moreover, Leck and Smith (2013) note that the important developmental role that local governments in South Africa play in attempting to undo or rectify the injustices of a colonial past means that they are likely to view CC, and by extension, environmental management, as a potential threat to their developmental mandates. Lethoko (2016, p. 6) adds that it is difficult to garner the support of decision-makers when CC projections “cover a longer time frame than the political and development agendas of the municipalities”. As a result, projects which require medium- to- long-term planning and will likely exceed the short political life of policymakers, are usually not considered (Lethoko, 2016).

Aside from the politics, inadequate budget support and funding has constrained municipal climate action. UMDM has been unable to secure funding for climate action from the municipal budget as DMs in South Africa are heavily dependent on intergovernmental/national transfers for municipal revenue. While they can generate income from charging user rates (water, electricity and refuse removal), and licences and fines, they, unlike their metropolitan and urban LM counterparts, are not permitted to levy property. Moreover, the high levels of poverty in the region make it nearly impossible for the socio-economically marginalised to pay their user rates, decreasing the municipal revenue (Mafusire *et al.*, 2014) and forcing UMDM to supplement the revenue with funds from the national government. South Africa’s National Treasury (2016) estimates that nearly 80% of district municipal revenue is from the national government (National Treasury, 2016), and as a result of competing socio-economic demands, little of this revenue has been allocated to CC response within UMDM. Hence, the DM is forced to source external funding to address CC, as was the case with the uMngeni Resilience Project. While such funding partnerships are essential for spearheading the process of CC response within municipalities where CC is not prioritised, they should not sustain the CC response

portfolio. Leck and Simon (2013) warn that a reliance on outside organisations for financial backing is not sustainable. There is need for “less *ad hoc*, more consistent and long-term budget allocations” from national government (Leck and Simon, 2013, p. 1235).

Due to a lack of capacity, skilled professionals, and time, municipalities tend to be becoming increasingly dependent on consultants, social networks, information-sharing forums such as the CKZNCCC, and formal and informal partnerships to build capacity, with varying implications. Consultants have played an integral role in the development of policy responses within municipalities, in particular, UMDM, and uMngeni is engaging with consultants to develop a CC response strategy and plan. Local governments utilise consultants when the municipality lacks the domestic capacity, expertise, and time to undertake a specific activity, which is the case in many municipalities in South Africa (Momani and Khirfan, 2013). The absence of an environmental unit and staff at the time the VA was commissioned, necessitated the use of external expertise, by UMDM, which is costly. Outsourcing allows for overburdened local governments to focus on their other developmental goals and ongoing daily demands, while enabling the use of an expert-driven knowledge base, external to municipalities. However, the use of consultants can hinder in-house skills development, creating an over-reliance on external expertise who are afforded the authority to shape the municipal CC policy climate. Therefore, in future, officials should aim to reduce their reliance on consultants and focus on developing in-house skills to create a sense of ownership of the process and outcomes. Ownership is important as it will fuel the municipal commitment necessary to sustain the CC response portfolio (Carmin *et al.*, 2012). In-house skills development can occur with the assistance of external expertise, who have a greater awareness of CC issues, however, the consultants should have limited authority with regards to policy development and implementation within the municipality.

Whilst policy development through external consultants is not ideal, partnerships, (knowledge) networks and political champions have been shown to be important to increase the adaptive capacity of weaker organisations (Baudoin and Ziervogel, 2016) and in the institutionalisation of green governance (Pasquini and Shearing 2014). CC champions have been instrumental in driving local climate action, however, in the absence of political support and approval from the municipal council, policy plans cannot evolve into implementable policy (Aylett, 2015; Pasquini *et al.*, 2015; Hoppe *et al.*,

2016). In the case of the example of eThekweni municipality, the CC champion garnered the political support of Durban's previous and current mayors to facilitate the implementation of many climate-related programmes developed by the municipality's Environmental Planning and Climate Protection Department (Taylor *et al.*, 2014). Both UMDM and Msunduzi have CC champions, however, the question remains as to how politically connected these champions are? Msunduzi has the support of the mayor, *in certain aspects*, meaning that CC will not always be viewed as a priority, in particular, if interventions are seen as obstructing development or are costly. Nonetheless, such support has allowed the team within the Environmental Management Unit to develop a climate response portfolio and has earned CC a place within the municipal budget. The presence of an in-house CC champion and adequate political support are necessary to spearhead policy action in uMngeni.

Apart from looking inward at personnel and networks, inclusive citizen participation is an important ingredient for the institutionalisation of CC as inclusivity can ensure "equitable planning processes and just adaptation outcomes" (Chu *et al.*, 2016, p. 1). The results suggest that Msunduzi and UMDM have had limited engagement with the public regarding CC. Comments from Msunduzi reveal that the public have not been active participants in CC-related discussions and this may be due to numerous reasons. For example, a lack of interest or they are not receiving the information timeously or a lack of access to the websites where the information is made available. The internet is viewed as a luxury item for the socio-economically marginalised and if the public are not informed about climate matters, they are unlikely to change their carbon-emitting behaviours. Therefore, the municipality needs to do more to transfer the information to the people, in particular in the marginalised communities. Campaigns such as those run by UMDM on environmental days, though they do not occur frequently, can help to initiate a conversation about CC. Another manner by which municipalities can garner interest would be to implement community-based projects which leverage co-benefits, such as the uMngeni Resilience Project which, for example, encourages the adoption of climate-resilient and environmentally friendly agricultural practices. Such practices will ensure that community members are food secure and can generate income from the crops.

Turning to the broader context of municipal concerns, climate response must take cognisance of local conditions and developmental needs into account. By

way of illustration, CC management continues to be seen as an environmental issue, separate from socio-economic imperatives and is viewed as being in direct competition to issues relating to development and social justice. This perception is making it increasingly difficult for CC champions and teams to implement CC plans and policies. The public have developmental concerns such as poverty, unemployment and food insecurity, in particular in a region such as KZN where the poverty and unemployment levels are high. Moreover, the marginalised have fewer resources at their disposal to "prepare for, cope with and recover" from climate-related risks (Chu *et al.*, 2016, p. 4). Hence, it is important that CC plans and programmes are integrated into development plans. CC needs to feature more prominently within the municipal IDP and there needs to be a greater focus on implementation, which is lacking. Developing and implementing projects that protect the environment, create green jobs and alleviate poverty would likely increase public involvement in the formulation and implementation of CC-related plans and programmes, and increase their capacity to respond. In a study by Hlahla *et al.* (2016), it was found that community members in Pietermaritzburg have more pressing needs and tend to only be concerned with environmental issues in as much as they can receive some form of remuneration from environmental services. This may be the reason for UMDM's primary focus on implementing adaptation projects as opposed to mitigation. Community adaptation projects yield more development-related co-benefits which would make it easier to garner political support for CC responses within the municipality (Taylor *et al.*, 2014). This was a technique employed by the eThekweni Municipality and has proved successful. Lim *et al.* (2004, p. 24) note that "piggy-backing" CC response strategies onto development activities will likely make implementation of policy more efficient. The authors contend that in the absence of such 'pairing', nascent policies, such as municipal CC response strategies, are likely to fail in the face of competing priorities (Lim *et al.*, 2004). Moreover, such initiatives can help to bridge the gap "between social justice and local adaptive capacity" (Chu *et al.*, 2016, p. 4) and serve as good starting points to adequately manage CC (Button *et al.*, 2013). The 'quick wins' produced by the initiatives can increase the confidence of the CC team to experiment with more CC responses and encourage communities and municipal climate action to support future CC-related experiments. Thereby, removing any barriers to the mainstreaming of CC within municipal departments, which is pivotal (Button *et al.*, 2013). Therefore,

UMDM anticipates that the uMngeni Resilience Project will play a role in the removal of the financial barriers that they are currently facing.

The successful institutionalisation of CC requires a co-ordination of responses. While UMDM and Msunduzi have taken steps to tackle CC, and uMngeni is intending to follow suit, there is a lack of co-ordination in their responses. First, with regards to the institutional positioning of CC. Within UMDM, CC sits within the Department of Community Services, and within the Department of Economic Development and Planning for uMngeni, and the Sustainable Development and City Enterprises Department for Msunduzi. A more successful and co-ordinated approach would be to have CC positioned within similar departments to provide some form of uniformity. Second, there is a fragmentation in policy responses. The DM has developed its own response framework and each LM within the DM is expected to develop its own unique CC policy as opposed to adopting the DM's CC framework, resulting in a diversification of responses. A community of practice is required where the municipalities work together to fulfill the common goal of CC response and, ultimately, sustainable development. While the CKZNCCC provides the municipalities with the opportunity to share knowledge and discuss CC, it caters to numerous municipalities across KZN, leaving little room for accountability. A smaller forum is required whereby representatives from the UMDM and the LMs under its jurisdiction, can pool their resources and co-ordinate to generate ideas with regards to climate risk management, and hold each other accountable for their level of action or inaction. Furthermore, a conducive CC response framework that takes cognisance of the different biophysical and socio-economic environments in which the municipalities function, can be developed to allow for a more co-ordinated and holistic approach. This would avoid a duplication of responses, which is wasteful of resources, and relieve pressure from LMs, such as uMngeni, to develop a response portfolio and enable them to channel more resources towards implementation, thereby spearheading response efforts. The added advantage would be that the DM would be making progress with regards to fulfilling its mandate to build the capacity of LMs where there is limited capacity to perform municipal functions, in this case, building capacity for climate action (RSA, 1998). CC affects multiple spheres, therefore, municipalities cannot afford to work in isolation. Internally, municipalities need to find a way to incentivise the non-environmental municipal departments to work with them to generate ideas with regards to implementing

programmes that will benefit them all and the communities under their jurisdiction. Weak governance is an institutional barrier to local climate response, in particular, adaptation (Du Plessis and Kotzé, 2014; Shackleton *et al.*, 2015). Hence, local governments need to work to strengthen their governance structures, in particular in non-metropolitan municipalities, which do not have access to the same resource base as their metropolitan counter-parts, but have an equally important role in managing the risks associated with the issue and in building sustainable local-level resilience.

5.6 Conclusion

The research assessed how two levels of non-metropolitan municipalities in the province of KwaZulu-Natal, South Africa, are managing climate risk. CC will impact all municipalities, however, the impacts and the manner in which they respond differs. District and local municipalities have different municipal responsibilities and differing capacities to manage CC. This has led to a lack of co-ordination in CC responses, a process which is resource-intensive and wasteful, in particular when the municipalities in question have the common goal of addressing CC. Mukonza and Mukonza (2014, p. 178) describe climate governance as a “multifaceted and multi-stakeholder management process”, hence, a strategic approach to CC governance within the case study municipalities will entail a more co-ordinated response, in addition to the creation of a district-level ‘community of practice’ to share knowledge and generate ideas with regards to CC management, unique to the District.

That said, the greatest impacts of CC will be felt in the global South and the important role that local governments play in responding to these impacts cannot be discounted. Despite limited capacity, competing socio-economic priorities and the absence of a mandate or support from government, local governments in KZN are beginning to include CC in their municipal conversation. Going forward, however, the national government needs to play a greater role in incentivising local level climate action, increasing capacity, and developing specific mandates for each of the three types of local government, metropolitan, district and local municipalities, to address CC. Such a mandate will serve to increase the urgency with which municipalities implement responses, in particular as climate risks are projected to intensify and increase in frequency (Du Plessis and Kotzé, 2014). Moreover, the successful management of CC will require capacity-building and an enabling environment that supports the integration of

CC into the municipal development framework and facilitates the inclusion of CC in all municipal departmental portfolios as opposed to exclusion, which is the status quo, and responses should incorporate social justice and policy alleviation. This will ultimately change the perception of CC as a solely environmental issue and allow for greater municipal and budgetary support. Furthermore, the public need to have a greater voice in CC decision-making and need to hold their local governments accountable.

Given the cross-cutting and global nature of CC, innovation and a holistic response to CC is required and barriers to local CC governance need to be confronted and addressed, if the goals of sustainable development are to be met. Even though local-level climate response within South Africa has been driven by metropolitan municipalities, the study has illustrated the importance of non-metropolitan municipalities in CC-response and how they are managing risks in the face of fewer resources and less capacity. As the impacts of CC intensify, localised responses to the global issue will be instrumental in facilitating the successful global management of the problem (Du Plessis and Kotzé, 2014).

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CHAPTER SIX
Paper III

The impacts of climate variability on marginalised urban women in KwaZulu-Natal, South Africa

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Abstract

The impacts of climate variability are not gender neutral. Gender inequalities and women's socio-economic vulnerability contribute to their susceptibility to climate-induced impacts as they have no or limited resources to respond to current and future changes. This study set out to document the different ways in which marginalised women and female-headed households in urban areas in KwaZulu-Natal, South Africa, are affected by changing climatic conditions and the means by which they are responding to these changes. Using data collection tools inspired by the tradition of participatory research, the findings suggest that climate variability has both direct and indirect negative impacts on women's livelihoods and well-being. Furthermore, the results revealed that a considerable number of women (i.e. 37%) had adopted some short-term adaptation measures while the majority lacked any form of formal safety nets to adapt to climate-induced shocks and stresses. In view of these findings, it is argued that there is an urgent need to create enabling conditions for the adoption of engendered, cost-effective, long-term and sustainable coping strategies that are responsive to the needs of vulnerable groups (women) within society. This will serve to increase their adaptive capacity and resilience against climate variability related risks and hazards.

KEYWORDS: climate variability; vulnerability; women; female-headed households, adaptation, resilience

6 Paper III

6.1 Introduction

Climate change consists of short- to medium-term climate variability and gradual long-term change in statistical distribution of weather patterns (*i.e.* changes in average annual temperature and rainfall) and the extreme weather events that occur such as floods and droughts (Nelson *et al.*, 2002; Rout *et al.*, 2013). Multi-dimensional in nature, it is arguably the greatest developmental challenge that the global community has ever faced and will be for many decades to come. It is on par with challenges such as poverty and rapid urbanisation and is already having negative impacts on human beings, the natural and built environment, infrastructure and economies (TERI, 2007). Efforts to address the issues via climate change mitigation and adaptation policy interventions have been minimally successful as the level of greenhouse gas (GHG) emissions continues to rise (IPCC, 2014). Population growth and the increasing rates of production and consumption are primarily responsible for the increase in emissions, worsening the situation (UNDP, 2011; IPCC, 2014). Developing countries, despite their low contribution to global GHG emissions, are exposed to greater climate risks due to their low-income economies, the over-reliance on climate-sensitive sectors by a large percentage of their population, low adaptive capacity and their geography (Heltberg *et al.*, 2008; Rout *et al.*, 2013; RSA, 2011). Therefore, these nations are more vulnerable to the negative impacts associated with the changing climate.

Women and female-headed households tend to bear the brunt of climate variability related impacts due to the fact that women, predominantly in developing countries, have limited access to resources that can facilitate their ability to respond appropriately and adapt (Lambrou and Piana, 2006; Roehr, 2007; Kakota *et al.*, 2011; UN-HABITAT, 2011; Bradshaw and Linneker, 2014; Ribot, 2009). This status quo will be difficult to improve as the changes in climate are projected to intensify while the adaptive capacity and resilience of the most vulnerable groups of people in society are likely to be reduced due to the high prevalence of poverty and deprivation, particularly among women and female-headed households (Eriksen *et al.*, 2007; Nelson, 2011). Bartlett *et al.* (2012) and Ncube *et al.* (2016) contend that the majority of poor women in the developing world will most likely be unable to cope

with current and future climate change shocks and stresses (Eriksen *et al.*, 2007; Nelson, 2011; IPCC, 2014). On the premise of this observation, this paper, using field-based materials, examines the different ways in which marginalised women and female-headed households in urban areas in KwaZulu-Natal, South Africa, are disproportionately affected by changing climatic conditions and the myriad of coping or adaptation measures they employ to reduce the impacts of climate variability on their livelihoods, income generation activities and well-being.

6.2 Women in a variable climate

Climate-related risks are experienced differently by different regions, socio-economic groups, races, generations, age classes and genders (Lambrou and Piana, 2006; Roehr, 2007; Satterthwaite, 2007; Ribot, 2009; Rout *et al.*, 2013). People who are marginalised are the most vulnerable and are limited in their capacity to prepare for, or respond to, the observed and anticipated risks (Demetriades and Esplen, 2010; UN-HABITAT, 2011; IPCC, 2014). Furthermore, climate variability amplifies gender inequalities, in particular in key areas that Demetriades and Esplen (2010) identify as being necessary to respond to climate-related changes, increasing the vulnerability of women (Kakota *et al.*, 2011; Nkoana-Mashabane, 2012; Edvardsson Björnberg and Hansson, 2013). Within the household, gender inequalities exist as a result of the differing roles of men and women, with the latter being primarily responsible for domestic, care and reproductive activities (Lambrou and Piana, 2006; Tacoli, 2012). Given their historic disadvantages, namely 'unpaid' social roles within the household and community, their muted voice, lack of rights and access to resources, and the fact that they represent a large percentage of the poor, women are observed to be more vulnerable to the impacts of climate variability than men (Nelson *et al.*, 2002; Demetriades and Esplen, 2010; UNDP, 2010; Kakota *et al.*, 2011; World Bank, 2011; Edvardsson Björnberg and Hansson, 2013). However, very little has been done to mainstream gender into climate change policy despite reports from the United Nations Development Programme (UNDP) that state that women and children are 14 times more likely to die in a climate disaster than men and that disasters lower female life expectancy significantly, compared to males (Nelson *et al.*, 2002; UNDP, 2010; Bradshaw and Linneker, 2014). Moreover, women make up 80 percent of those who are displaced by climate change either via extreme weather events or gradual changes such as

drought, and 70-80 percent of those needing assistance post-disaster (Rout *et al.*, 2013; UNDP, 2015).

While some scholars have argued that there is no definitive evidence to suggest that women are disproportionately affected by climate change, Alber (2011) and Rout *et al.* (2013), contend that there is evidence that gender differences exist during climate change-induced disasters or weather events. It has been observed that during the pre-disaster phase, women seldom receive information from early warning systems and weather alerts on time, affecting their ability to respond effectively, and as such they find it difficult to escape safely as they are responsible for the family and community. Post-disaster, particularly in natural resource-dependent households, women's workloads tend to increase by at least two to three times as they are required to compensate for the shortfall of resources and are responsible for the household's subsistence activities and welfare (Lambrou and Piana, 2006; Roehr, 2007). Another challenge is that of economic insecurity which affects the women's ability to recover from the climate-induced disasters or weather events and its resulting economic losses (Lambrou and Piana, 2006; Hope Sr, 2009). More often than not, many women lack the financial resources to rebuild their homes or replace damaged property or pay for alternative accommodation as they await the re-construction of their homes (Edvardsson Björnberg and Hansson, 2013).

Climate-related shocks and weather variability serve as 'exacerbating stress factors' which make women more vulnerable by impacting health, education and access to economic opportunities (World Bank, 2011; Nkoana-Mashabane, 2012). Households that are dependent on agriculture for subsistence and income will be negatively affected by changing weather and climate conditions as a result of environmental degradation, water scarcity and the lack of fertile land on which to plant, in particular in the tropical regions (Nelson *et al.*, 2002). The decrease in crop yields and resulting increase in food prices will affect the entire population as more time and money is allocated to acquiring food. The UNDP (2011) estimates an increase in food prices by 30-50% in the coming decades and the worst affected will be in the poor in developing countries. It is expected that malnourishment and starvation will become more prevalent as nutrition tends to be sacrificed in favour of survival. It is expected that "by 2050 sea level rise, droughts, heat waves, floods and rainfall variation will increase the number of malnourished children by 25 million" (UNDP, 2011, p. 53). The climate risk associated with agriculture may lead to migration of males in a bid to diversify livelihoods and search of

better income opportunities leaving women in charge of the household and agricultural activities (Lambrou and Piana, 2006). This alters the gendered division of labour, increasing women's responsibilities in a profession where they have been historically disadvantaged as they are denied access to credit to purchase newer technologies, and lack the rights to property and land (Demetriades and Esplen, 2010; Lambrou and Piana, 2006). Hence, the uncertainty associated with agricultural yield capacity and the limited options available to branch into other livelihoods, impacts on income and food security, and will possibly affect women's health via poor nutrition and decreased resistance to disease (Nelson *et al.*, 2002; Kakota *et al.*, 2011). Moreover, the economic insecurity that is associated with climate variability may force a significant number of vulnerable women to cut back on their expenditure on certain costs such as health, food and education (World Bank, 2011; UN-HABITAT, 2011). This will have significant impacts on household members, in particular, for the girl child. In some cases many children from poor and vulnerable female-headed households will have to remain at home to assist with the workload, reinforcing the gender roles that have previously kept women vulnerable and perpetuating poverty and inequality (Heltberg *et al.*, 2008; Rout *et al.*, 2013).

Other impacts of climate variability on women's livelihoods include water shortages; increased incidence of disease such as diarrhoea and respiratory conditions; heat stress; and damage of household assets (Satterthwaite, 2007; Hope Sr, 2009; IPCC, 2014). The impacts are greater for households that lack access to basic services and reliable infrastructure (IPCC, 2014). In response to declining availability of fresh water, many governments may opt to reduce supplies available to marginalised groups, forcing these groups to purchase water, or, alternatively, the price of water may be increased (Satterthwaite, 2007). This will force households to spend more of their incomes on acquiring resources necessary for the survival of the household (Satterthwaite, 2007). The increasing financial burdens via the purchase of food and water or the loss of productive assets in a hazard, can cripple a household forcing women to seek employment in labour-intensive, low income jobs, generally in the informal economy. Sixty percent of women in developing countries are employed under the sector and 72% in Sub-Saharan Africa (Boadi *et al.*, 2005). While the informal economy promotes the survival of the marginalised and those without skills to enter the formal sector, it, too, is vulnerable to climate variability and is the least able to

recover after a climate-induced disaster (Boadi *et al.*, 2005; Tacoli, 2012). The result of this is the disempowerment of women by affecting their incomes and livelihoods and, inadvertently, locking them within the poverty cycle (Tacoli, 2012; Nelson *et al.*, 2002).

Although women may be disadvantaged in the face of climate-induced impacts, they are not helpless victims. Lambrou and Piana (2006, p. 2) assert that despite their vulnerability, women “exhibit surprising resilience”. Should the need arise, they are willing to take on more male roles to ensure the well-being of their families and communities (Nelson *et al.*, 2002). Moreover, they possess valuable knowledge, experience and skills that have placed them in a unique position where they can make a contribution towards sustainable and cost-effective climate change responses, decreasing vulnerabilities and increasing resilience (Habtezion, 2011; Nkoana-Mashabane, 2012). Despite the ability of women to respond positively and adapt to the impacts of climate change, global, regional and national climate change policy response has largely been gender-blind. There are numerous reasons as to why gender has received limited consideration in climate-related policies and strategies. These may include, *inter alia*, the lack of sufficient data on the wider social, economic and environmental implications of climate variability and change; a lack of skills and knowledge on the dynamics of climate variability and change; and budgetary constraints to fund specific programmes and projects that would contribute to the building the resilience and adaptive capacity of those most at risk (Roehr, 2007; Alber, 2011).

Women are grossly underrepresented in international climate change negotiations and in the implementation of measures, namely for adaptation and mitigation, as men continue to outnumber women (Demetriades and Esplen, 2010; Edvardsson Björnberg and Hansson, 2013; Loftus-Farren, 2013). An example of this is the United Nations Framework Convention on Climate Change (UNFCCC) where between 2008 and 2013, only 19 percent of the delegation heads were women and 32 percent of participants in national delegations were female (Loftus-Farren, 2013; WEDO, 2013). This trend is reflected at the national policy level where female participation tends to be low (UNDP, 2011). Thus, more often than not, men’s perspectives are taken into account in planning and decision-making processes at the expense of women (Demetriades and Esplen, 2010; Edvardsson Björnberg and Hansson, 2013; Rout *et al.*, 2013).

Adaptation to climate variability and change is not gender-neutral as it is highly dependent on factors in which women from developing countries are highly disadvantaged, namely, technology; education; economic security; access to, control and ownership of resources; and access to information (Lambrou and Piana, 2006; Roehr, 2007; Demetriades and Esplen, 2010; Rout *et al.*, 2013). Therefore, marginalised and economically disadvantaged women have the least capacity to adapt. However, utilising the resources they have at their disposal and knowledge gained from previous encounters with climate-induced risk, many vulnerable communities have and continue to develop a diversity of coping mechanisms or self-help measures in response to climate stress (Nkoana-Mashabane, 2012; Satterthwaite, 2013). As the nature of climate risk continues to evolve, it will become necessary to create awareness and provide access to more resources and improved technologies to enable vulnerable groups to adapt in the long-term (Nkoana-Mashabane, 2012).

Effective adaptation actions should involve the removal of socio-economic and political barriers so as to allow women to participate in decision-making, thereby increasing their capacity to adapt, reducing existing vulnerabilities and increasing their resilience (Lambrou and Piana, 2006; Demetriades and Esplen, 2010; Nkoana-Mashabane, 2012; Rout *et al.*, 2013). The vulnerable and marginalised groups need to be prioritised and included in any adaptation initiative or project that is implemented and they should be allowed to participate in all stages of the local adaptation process (Edvardsson Björnberg and Hansson, 2013). The resulting adaptation measures that are adopted should be unique to the women who are impacted as climate variability and change impact women differently depending on the location, region and cultures and this needs to be taken into account when finding adaptation measures (Roehr, 2007; IPCC, 2014). Targeting adaptation actions in this manner will not only contribute towards the political legitimacy of the policy process but will empower women by providing them with a voice and during climate-related hazards, reduce the number of injuries and fatalities, and decrease the level of assistance required for post-disaster relief (Ribot, 2009; Alber, 2011; Edvardsson Björnberg and Hansson, 2013). The level of expertise that women can bring to climate policy cannot be taken for granted. Failure to integrate gender into climate change policies and plans will result in unsustainable and ineffective solutions (Demetriades and Esplen, 2010; Alber, 2011).

6.3 Methods

6.3.1 Description of the study sites

The KwaZulu-Natal province of South Africa has the second largest provincial population in South Africa, with a population of 11.1 million (Statistics SA, 2016b). The province reports a poverty level of 65%, with women forming the majority of the low income groups and those living in low-income households Statistics SA, 2011. Its capital, Pietermaritzburg, is the second biggest city in the province with a population of approximately 679 800, which is predominantly female (52%) (Statistics SA, 2016a; Statistics SA, 2016b). Primarily an urban centre, Pietermaritzburg is confronted with growing rates of urban poverty, and unemployment and unequal development, particularly in the townships (*i.e.*, underdeveloped urban areas) (Statistics SA, 2011; Msunduzi Municipality, 2012).

The climate in Pietermaritzburg is said to be warm and temperate, with an average annual rainfall of 863.4mm while the average maximum temperatures is 27.9°C and the minimum temperature is 13.25°C (World Weather Online, 2016). The city has previously experienced flooding, lightning/thunderstorms, hail, drought, heatwaves and wildland fires and the probability of these hazards recurring is high (Singh and Bartholomew, 2014). Currently, the city and the rest of sub-Saharan Africa is experiencing a drought that has been pegged as one of the worst droughts that the region has experienced in 30 years, with numerous households facing food and water shortages as temperatures continue to increase (BBC News Africa, 2015; Zwinoira, 2015).

The data on which this paper is based were collected between September and December 2015 in four selected locations in Pietermaritzburg. The locations are considered to be urban and peri-urban and include France, Mpophomeni, Sobantu and Willowfontein suburbs. Three are located outside Pietermaritzburg's central business district, under the jurisdiction of the uMsunduzi Municipality, and the fourth is located on the periphery of Pietermaritzburg, under the jurisdiction of the uMngeni Municipality. Both municipalities function under the uMgungundlovu District Municipality. The major population group residing in these areas is predominantly female and black African (86.6%) and their vernacular isiZulu (Statistics SA, 2011; Msunduzi Municipality, 2012). These areas are characterised by high rates of poverty, with poverty

levels reaching 65%; unemployment; and crime (Statistics SA, 2011).

6.3.2 Data collection and analysis

A mixed methods approach was adopted for the study. Primary data were collected through questionnaires. Ten field assistants who are conversant in the local language, isiZulu, and the culture, were hired and trained to administer a semi-structured questionnaire. A feasibility study was conducted followed by a de-briefing session prior to the questionnaire survey carried out in November to December 2015. The sample size consisted of 264 female respondents from 264 households, 81 percent being female-headed. The households were selected randomly and an individual from each household was interviewed. Each interview was conducted with the self-identified head of the household. Where the head of the household was unavailable, the interview was conducted with whomever was available and above 16 years of age. Before responding to any questions, the respondents were informed of the study and had to verbally consent to their participation.

To supplement the survey data, semi-structured in-depth interviews with key informants including officials from the uMsunduzi and uMngeni Municipalities were conducted. The questionnaire comprised of both structured and open-ended questions. Quantitative data from the closed questions were coded and placed into categories for statistical analysis using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics such as frequency data were incorporated into the results to establish trends in the data. The qualitative, open-ended responses and the interview questions were analysed using thematic analysis (King and Horrocks, 2010).

6.4 Results and Discussion

6.4.1 Household characteristics

The respondents' age varied from 16 years of age to over 65. Seventy-five percent of households earn an annual income of over R15000 (US\$1115.77 17 August 2016) which supports, on average, 4.95 dependents, with more than half of the households catering for at least 4-6 dependents. The primary sources of income were found to be employment (67%) and government grants (75%). Twenty-nine percent were employed within the formal sector and 38 % in the informal. One-third of the respondents were unemployed.

6.4.2 Impacts of climate variability

Approximately 74% of respondents had some understanding of what climate change ('ukuguquka kwesimo seZulu') is, with some respondents stating that it refers to "a hole in the ozone layer" (personal communication, 2015a) or "changes in weather that cause illnesses" (personal communication, 2015b) and "it's getting hotter-the weather forecast is becoming more inaccurate over time" (personal communication, 2015c). One participant insisted that "It's a condition that we don't understand and God is responsible" (personal communication, 2015d), and another, when asked about the cause of climate variability, stated that, "firstly, it's because God is angry at the world because we do not praise him well. Secondly, because there are gay people in the world" (Pers. comm, 2015e). A similar finding was found by Simatele (2010) in a study in Zambia in which the change in climatic conditions was attributed to God's anger at humanity for sin. They mentioned that God is the only one who can change the weather, therefore, climate change cannot possibly be anthropogenic. Similarly, Debela *et al.* (2015), in a study in South Ethiopia on the perceptions of climate change by smallholders in pastoral and agropastoral systems, note that the majority of smallholders believed that supernatural forces were the driving force of climate change, in particular, drought. They believed drought to be divine punishment for deviating from God's rules. This illustrates the level of knowledge and awareness regarding the causes of climate change. The respondents

are well-aware of the impacts of climate variability but are unsure of its causes. They do not believe that anything other than a supernatural force is changing the weather and climate. It is, therefore, important for the level of awareness be increased within these communities as this will factor into how the women will respond to climate variability and how they can work to prevent further environmental damage.

Regarding the impacts of climate variability (**Figure 6.1**), the majority of women in the case study (76%) reported experiencing a change in the weather or seasons to the extent that some respondents reported that they, "could no longer tell the difference between the seasons as they are all the same" (personal communication, 2015f). More than half the respondents stated that they have experienced drought (61%) and heatwaves (61%) while 40% have experienced hailstorms and 37% flooding or heavy downpours. Fewer respondents have experienced cold spells (26%) and less than a tenth have faced disease outbreaks and wild grass fires (**Figure 6.1**). The most significant flooding events mentioned by the respondents were the floods of 1985, 1986/1987, 1989, 1995, 1997 and 2005. There were two floods in KwaZulu-Natal (KZN) in 1995- January and December. The latter, aptly named the Black Christmas floods, killing 169 people and displacing 6000 families (Eveleth, 1996). This incident spearheaded efforts to address environmental issues in the region.

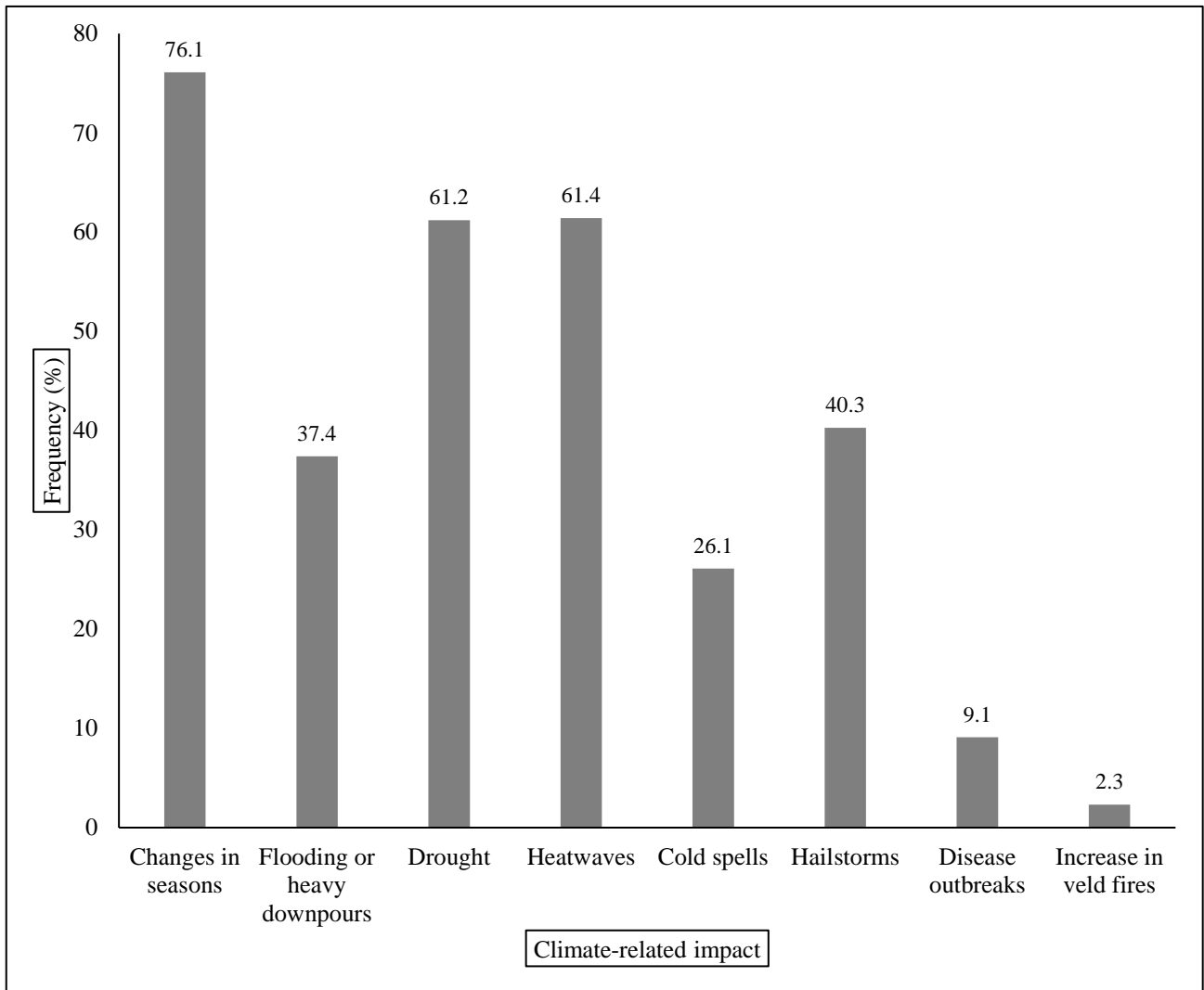


Figure 6.1: Climate-related impacts experienced by the respondents

Climate variability has impacted the livelihoods, either directly and indirectly, of more than half of the respondents (54%). The direct impacts have manifested in the form of property loss (23.1%) due to flooding and hailstorms which are perceived as being more frequent (**Figure 6.2**). Indirectly, climate-induced change has affected agricultural activities (57.3%); health (23.1%) and general well-being (23.1%); income (18.9%); water (7%) and food security (6.3%); livestock (3.5%) and education (2.1%) (**Figure 6.2**). The majority of women acknowledged that their agricultural activities were affected by the increasing temperatures and decreased and/or delayed rainfall, with many expressing concern regarding their food security as their food supplies are diminishing, forcing them to purchase more food. Female-headed households within the Msunduzi Municipality already spend 53% of their incomes on food (Dodson *et al.*, 2012) leading some respondents to complain that they now have to use their “small

incomes” (personal communication, 2015g) to purchase more food which some have observed to be becoming expensive. In the face of such challenges, the women are forced to make decisions regarding the types of foods they consume, in some cases sacrificing nutrition in favour of greater quantities of cheaper, less nutritious foods. In a study carried out by Dodson *et al.* (2012) on gender and food insecurity in southern African cities, it was noted that there is a direct correlation between the level of household expenditure on food and the level of poverty and food security. Hence, many households within this current study are considered to be food insecure with high levels of poverty. The need to fulfil the household’s immediate dietary requirements will take precedent over other longer term needs such as education and leaves little room to prepare for price or income shocks, for example, in response to climate or weather variability (Dodson *et al.*, 2012). In addition, water is becoming a scarce resource within these communities, causing a few respondents (7%) to be

fearful that they may have to purchase water in the future, further diminishing their incomes.

Twenty-three percent of the women stated that the perceived changes in weather and climate have impacted their health, damaged property and infrastructure and caused them great discomfort, making day-to-day activities difficult (**Figure 6.2**). Many complained that their children are of ill-health while others stated that the unpredictable changes in the weather have given them skin rashes, influenza, headaches and worsened their blood pressure, diabetes and epilepsy. Education is impacted as extreme events such as floods “*damage schools and children’s books and road networks that the children use to get to school*” (personal communication, 2015h). Nineteen percent of women agreed that climate change does have a negative impact on their incomes as agricultural yields decrease (**Figure 6.2**). Furthermore, additional costs are incurred within the household as a result of the need to purchase food and water and to pay for additional health/medical care costs that may arise. A decrease in household income of this level can result in the participation of women in risky behaviours such as transactional sex for

food or income (Ziervogel, 2016). In other cases, the elderly may be forced to forfeit their old age social grants to support the household. The use of social grants was identified by some women within the communities as a coping response.

Some respondents commented that the increasing temperatures make them lethargic, decreasing their work output and 23% complained that climate change and variability is affecting their general well-being and causing them great discomfort (**Figure 6.2**). Studies have suggested that, due to biological differences, women tend to be more sensitive to heat stress than men (Edvardsson Björnberg and Hansson, 2013). This is evidenced by the 2003 heatwave in France which killed approximately 14800 people, 64% of whom were women, due to dehydration, hyperthermia and sun stroke, and in an analysis of the impacts of heat waves on the health of the elderly in Madrid over the 1986-1997 time period, it was found that the rate of female mortality was higher than that of men as temperatures increased (Díaz *et al.*, 2002; Edvardsson Björnberg and Hansson, 2013).

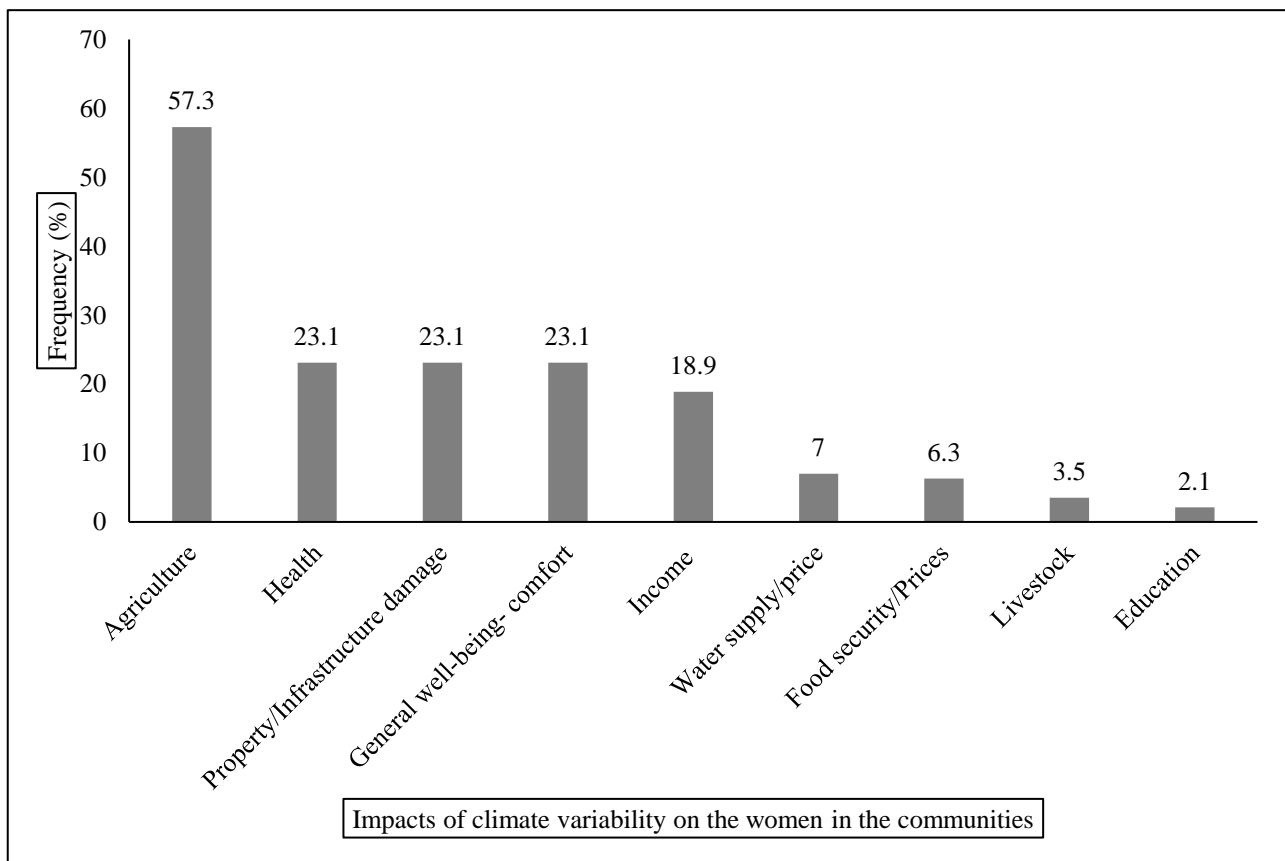


Figure 6.2: Impacts of climate variability on the women in the communities

Despite these identified negative consequences impacts, only 37% have found means of coping, with 60% of

those with coping or adaptation strategies considering the methods as relatively ineffective. Ravindranath and

Sathaye (2002, p. 86) assert that “adaptation is not a response but a portfolio of responses that will provide options and alternatives and measures can occur at

population, community or individual level”. Against this backdrop, the coping measures adopted by the community members are listed in **Table 6.1**.

Table 6.1: Coping strategies adopted by the communities

Coping/adaptation strategy (%)	Climate-related impact (%)							
	1	2	3	4	5	6	7	8
Use more fertiliser to hold the soil	3							
Store water in large containers (for plants and household use)			19					
Stay indoors (during hot and cold weather)	8	15		5	20	17		
Stay hydrated- drink more water				52				
Put a lightning conductor in the yard								
Water the plants more- at least twice a day	24		25	11				
Create drainage furrow		15						
Move property to a safe position and close the windows, including cars		4				8		
Minimise waste to reduce impact	11		11	5	20			
Plant trees around the yard to protect the house from damage. Plant grasses to protect the soil								
Keep livestock indoors and cover crops to protect them from hail and heavy rain		4				8		
Insurance		4		1		4		
Plant more crops	8	11	8	4		13		
Adjust planting times	8							
Putting buckets under leaks in the house in case of heavy rains		4						
Purchasing of goods rather than planting	8	11	8	4		13		
Don't plant at all	14	15	14	6		17		
Change the way we build- from flat roof to pointed one. Also, I have moved soil to direct it away from the house		4				4		
Use sunscreen				1				
Use fans/wearing hats	5			5				
Use heaters/make fire to keep warm	8				50			
Don't plant non-indigenous trees	3		3					
Rely on funding and seeds from NGOs	3	4	3	1	5	4	33	50
Use grant money to adapt	3	4	3	1	5	4	33	50

Work early before it gets too hot	3			1				
I take the children to the clinic when they fall ill							33	
Find alternative means of earning income because crops are not growing		7	6	3		8		
KEY:								
1= Changes in seasons	3= Drought	5= Cold spells	7= Disease outbreaks					
2= Flooding	4= Heat waves	6= Hailstorms	8= Increase in veldfires					

Source: Field-based materials, 2015

The community members identified over twenty strategies to cope with the array of climate risks that they identified. The most popular strategies were the use of grant money and reliance of funding from NGOs, illustrating the need for financial resources to assist with coping with climate variability and change (see **Table 6.1**). Some respondents referred to how they can mitigate climate change by reducing their waste footprint. Various methods were identified such the “*use of greywater to water plants to recycle water*” (personal communication, 2015i), “*the limiting of the burning of waste or using CFCs (chlorofluorocarbons)*” (personal communication, 2015j), and *using buckets to bath and do the dishes in order to save water*” (personal communication, 2015k). This is indicative of the fact that though many respondents do not understand the causes of climate change, a few acknowledge that the accelerated rate of climatic change is a result of human influence and as such they contend that they have a responsibility to reduce their environmental impact. This knowledge was gained from the radio, television and newspapers, which many of the respondents have access to but only a few have taken an interest in climate change issues. This highlights the need to incentivise climate change mitigation responses as was reported by Hlahla *et al.* (2016) in a study carried out in Pietermaritzburg on the use of green economy to alleviate urban poverty and safeguard the environment. The study found that some financial incentive motivated women in the study to recycle waste rather than burn it, and to grow indigenous trees as part of a re-afforestation project to contribute towards the creation of carbon sinks which are necessary for carbon sequestration. Such incentive may prove necessary to garner mass interest in climate change issues in the urban developing world where climate change is competing with other more pressing and immediate concerns such as poverty and food security.

A few women noted that they had insured some of their movable and immovable property and this should help them to replace anything lost or damaged during a climate-related event. The option to insure is only plausible for those who can meet the basic needs of the household and can save some money. In this case study only 16% of women were able to put some money into their savings monthly, making insurance difficult for them. Moreover, climate change insurance is relatively new to insurance companies in South Africa. Therefore, there is no guarantee that all property lost will be replaced as the uncertainty of climate change makes it difficult for insurers to underwrite the extra costs that climatic change could incur (CDH, 2014).

In response to extremely hot days and cold spells, to ensure their comfort, many respondents opted to use fans and heaters (**Table 6.1**). However, the prolonged use of electricity is not only costly to the household but contributes to environmental degradation. The respondents may not be aware of this, making environmental education necessary. Moreover, a lack of financial resources hinders their ability to purchase and install more expensive, environmentally and energy saving adaptive equipment such as air conditioners (Edvardsson Björnberg and Hansson, 2013). Some of the respondents dependent on subsistence agriculture for their livelihood and food security, opted to plant more crops to replace the ones that have been lost through flooding, drought, seasonal changes, hail and heatwaves, and to ‘*water the crops more*’ (personal communication, 2015l) to ensure their survival, in particular in times of drought. This is an unsustainable and short-term solution as water shortages are looming in South Africa and likely to worsen with the current drought. Moreover, planting more than once requires more time and additional resources. Therefore, the participants will be forced to buy food rather than plant

it, leading numerous households to cut costs to ensure that the household is fed. Hence, given women's roles in food provision within the household, the impact of climate change on agriculture affects their livelihoods. In the face of reduced agricultural yield, food prices are likely to increase, further crippling households. Harvey *et al.* (2014) reported that while small-holder agricultural farmers in Madagascar had adopted coping strategies to cope with flooding, droughts and hail, the strategies were ineffective as the farmers were still food insecure. Their strategies ranged from seeking off-farm employment, to harvesting different crops to supplement food supplies to a reliance social networks, all which are limited in their capacity to protect them from climate risks.

The majority of coping strategies identified in the present study are classified as reactive adaptation strategies as they were undertaken in response to climate change impacts that are already observed (Ravindranath and Sathaye, 2002). Few strategies are proactive and anticipatory, *i.e.*, actions taken in preparation for potential or anticipated impacts, and precautionary. An example of precautionary measures are the attempts to reduce waste footprint. Therefore, these strategies are inadequate to address the increasing magnitude and frequency of climate hazards. However, the fact that the respondents have adopted some strategies illustrates their acknowledgement that the climate is changing and that they have some capacity to do something about it, though limited. Assistance from the local government and community-based organisations could help build capacity and elevate basic reactive coping strategies to ones that are proactive and sustainable. As is stands, however, one of the local governments has responded to climate change with a policy document which is yet to be implemented. The other municipality does not have any climate responses but anticipate that they will have drafted a policy by 2019. This means that the marginalised are yet to receive any assistance from the

public sector with regards to climate change adaptation-assistance which is crucial if they are to strengthen their resilience. Other local institutions such as local churches and NGOs provide some assistance, however, it is not sufficient to reduce poverty and decrease vulnerabilities. Effective adaptation requires collaboration between different actors so as to prevent the loss of lives, homes and livelihoods in the face of climate change as has been previously the case in KwaZulu-Natal.

When asked why they did not have any coping strategy, the community members cited numerous reasons but the major barriers they are facing a lack of knowledge (19%), a lack of resources with which to adapt (10%) and economic insecurity in the form of a lack of funding (8%) (**Figure 6.3**). Approximately 17% of respondents felt that climate change is inevitable and nothing can be done to prevent it. This is illustrated via the following comments:

“God is the one person who can control the weather” (personal communication 2015m).

“People do not comply with the methods of adaptation and prevention”- (personal communication, 2015n).

“We live next to the river and this doesn't give us a choice or advantage”- (personal communication, 2015o).

“The impact of climate change on the household is not enough to take action” (personal communication, 2015p).

“We cannot access water so there's nothing that can be done to provide for the crops” (personal communication 2015q).

“We can't change what's happening” (personal communication 2015r).

“I am renting so I do not have the right to misuse the owner's property” (personal communication, 2015s).

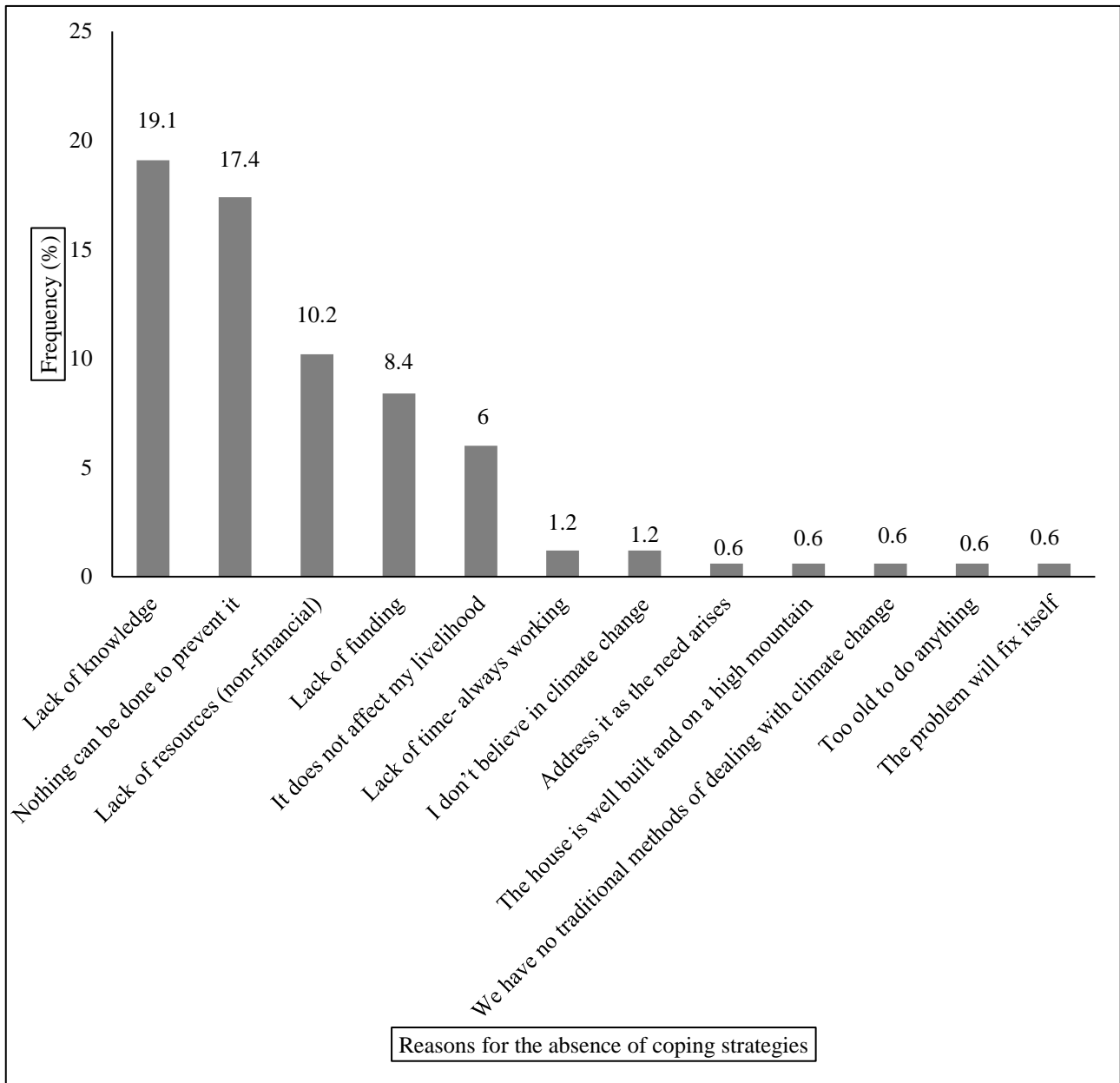


Figure 6.3: Reasons for not having any coping strategies

Six percent of respondents expressed that they felt no need to adapt yet as climate variability and change have not had any negative impacts on them or their livelihoods. One respondent stated:

“We have not yet experienced extreme events such as floods and it’s difficult to adapt to the changes” (personal communication 2015t).

It may be the respondents’ belief that they do not need to adapt, however, it is likely that they have not yet linked climate change to some of its indirect impacts such as the increase in food prices or the water shortages, which can be blamed on poor service delivery by local government. In addition, these respondents may

not have been living in the area at the time when the extreme events occurred.

The respondents in the study were asked whether they felt they were disproportionately impacted by climate change. Interestingly, the majority of female respondents (77%) did not feel they bore the brunt of climate change impacts citing that children are the most impacted by climate change because *“they are weak and vulnerable”* (personal communication, 2015u). This was a view shared by environmental officials from the local municipalities who were female. On the contrary, the male municipal official felt that women were more impacted as they form the majority of the agricultural labour force. In a study by Klasen *et al.* (2011) on the

vulnerability of the rural poor households to shocks in Thailand and Vietnam, very little evidence was found to suggest that female-headed households are more vulnerable than male-headed households. Though this study found similar results, gender inequalities still exist and these differences will manifest in greater magnitude as the climate change risks increase in frequency and intensity. Within Pietermaritzburg and KwaZulu-Natal, female-headed households were more prominent, with women forming the majority of the poor who lack formal safety nets to buffer the impacts of climate variability and change, making them more vulnerable. It is possible that the women are unaware of this and have become immune to hardship. They have accepted their historical roles within the household making it less likely that they feel more impacted, making them unaware. With increasing climate variability, resource scarcity has become a part of their landscape such that they have 'adapted' to the climatic changes. However, adaptation is supposed to increase resilience and decrease existing vulnerabilities. Within these communities, vulnerabilities still exist and their livelihoods have not improved. Ribot (2009, p. 47) asserts that "vulnerability does not fall from the sky," therefore, it is necessary for policymakers to address the causes of vulnerability, namely poverty and development, to find different avenues for creating awareness about climate change within these communities in addition to the use of television, radio and newspapers, and to integrate poverty and gender in climate change policy, which is unprecedented in South Africa. Furthermore, there is a need to create awareness on the gender inequality of climate change impacts within KwaZulu-Natal and to involve the poor, particularly women, in all stages of development and implementation of local adaptation plans and strategies if the strategies are to be empowering and responsive to their interests (Nelson *et al.*, 2002; Edvardsson Björnberg and Hansson, 2013). "Measures are needed that promote increased resilience of poor peoples' livelihoods and that tackle gender inequality *now*, whilst increasing climate change 'preparedness' for the *future*" (Nelson *et al.*, 2002, p.58).

6.5 Conclusion

It is expected that the intensity and frequency of climate change risks will increase, with most risks materialising through variability and extremes. The result of this will be an increase in food, water and income insecurity which will further impoverish the marginalised and exacerbate gender inequalities. This study set out to

explore the different ways in which urban marginalised women and female-headed households in KwaZulu-Natal, South Africa, are disproportionately affected by changing climatic conditions and the various coping or adaptation measures they employ to reduce the impacts on climate variability and change on their livelihoods, income generation activities as well as their general well-being. It was found that the women felt that climate variability and change were impacting their livelihoods, however, they did not feel that they were disproportionately impacted, citing that children were more impacted given their inability to take action to adapt to it. This response may be attributed to the level of unawareness within the communities. The respondents asserted that their livelihoods, health, property, agricultural activities, water and food supplies had fallen victim to increasing temperatures, late and decreased rainfalls, and increasing intensity and frequency of climate hazards. However, less than half were implementing any coping mechanisms. The primary reasons for this were a lack of knowledge and resources and some respondents felt that little could be done to prevent climate change. The bottom-up coping strategies that were adopted ranged from measures to minimise impact such as digging drainage furrows during floods and moving property to safe positions to measures to improve agricultural output such as adjusting planting times or irrigation to measures to decrease discomfort such as the use of heaters and fans. These 'piece-by-piece', traditional measures, however, were found to be ineffective for long-term adaptation as many households lack the resources to adapt effectively, especially as existing impacts are expected to intensify.

The majority of the households in the study were female-headed, with high rates of unemployment, meaning that the households lack formal safety nets to adapt to shocks and are likely to be more impacted in the future as the impacts of climate change become more severe. This makes the call for assistance from the local government and non-state actors necessary to create enabling conditions for the adoption of cost-effective, long-term and sustainable coping strategies. Currently, the local governments in the areas are lagging behind with regards to pro-poor climate change adaptation. Bartlett *et al.* (2012, p. 2) warns of the dangers of this as "in the absence of pro-poor policies, economic growth, inequality and continued levels of absolute poverty can easily co-exist". Therefore, the local governments need to invest more in poverty alleviation, involve both men and women in decision-making, and mainstream gender into pro-poor climate change

responses so as not to exacerbate gender inequalities or vulnerabilities.

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CHAPTER SEVEN
Synthesis

7 Synthesis

7.1 Introduction

“People all over the world are being confronted with the reality of climate change. For some, climate change is simply a matter of changes in weather patterns: things are a bit hotter, a bit colder, a bit more uncertain. For others, it is already a matter of survival: too little water or too much, not enough food to go around, risks to safety and security. The real injustice of climate change is that those who have contributed least to its causes are suffering most from its effects.”
- PECCN, 2011, p. iv

Climate change is a ‘wicked’ developmental problem that the global community is struggling to address (Termeer *et al.*, 2013). Urban vulnerabilities to the phenomenon are more profound in Sub-Saharan Africa, “where processes of global environmental change may not only lead to extreme events but also exacerbate chronic problems of poverty and environmental stress” (Bulkeley, 2010, p. 230). The region is experiencing high levels of poverty and inequality, despite numerous poverty alleviation efforts, and it will be some time before poverty and inequality are eliminated (Gasparatos *et al.*, 2017). Climate change is creating a ‘governance nightmare’ as it is exacerbating the situation, forcing urban governments to experiment with ideas on how to manage climate variability and change in the context of poverty alleviation, the elimination of inequality, rapid urbanisation, disproportional vulnerabilities and sustainable development (Tanner and Mitchell, 2008). Failure to address the issue in an inclusive and transdisciplinary manner will hinder any progress and create new pockets of poverty and potentially cause those who have escaped poverty to slip back (Lisk, 2009; Olsson *et al.*, 2014).

Urban centres, due to their high population concentrations, economic activities and built environment, are highly vulnerable to climate-related risk (Romero Lankao, 2011). Moreover, high levels of population growth are taking place in areas that are at high risk and the population tends to be dependent on climate-sensitive resources such as water and food, and have low adaptive capacities (Boadi *et al.*, 2005; Hunt and Watkiss, 2011; UN DESA, 2015). Although some progress has been made in managing the risks associated with “current climate variability and near-term climate change,” predominantly through mitigation and adaptation, the interventions are insufficient to

adequately respond to long-term impacts (Niang *et al.*, 2014, p. 1202).

Within urban centres, local governments are the fulcrum of urban planning and have to ensure that urbanisation is inclusive and the urban population is provided with equal access to basic services (Revi *et al.*, 2014; Tacoli *et al.*, 2015). However, the high rates of urbanisation are placing increasing pressure on governments, making it difficult to fulfil this mandate, leaving the majority of the population without access to adequate climate-proof housing, infrastructure and basic services, and formal employment (RSA, 2015; Tacoli *et al.*, 2015; SACN, 2016). Furthermore, the urban poor have limited resources to respond to climate-related risks and, therefore, depend on government for assistance. Unfortunately, the governments are ill-prepared to address a phenomenon which not only exacerbates existing challenges but “introduces greater levels of variability and uncertainty into urban planning and development” (UN-HABITAT, 2014, p. 44). It is within this state of disproportional vulnerability that the marginalised urban population are faced with the impacts of climate change.

This study investigated how households from four low-income, marginalised urban communities in Pietermaritzburg, South Africa, and their local governments are responding to the current and future impacts of climate variability and change. This synthesis discusses the results of this research, builds on existing literature and highlights the contribution of the study to new knowledge.

7.2 Discussion

7.2.1 The impact of climate variability and change on the urban poor in Pietermaritzburg

More than half of the South African population resides in urban areas and the country’s high rates of urbanisation have been accompanied by high levels of urban poverty and increased vulnerability to climate-related impacts (Heltberg *et al.*, 2008; Frye *et al.*, 2011; RSA, 2015). A questionnaire survey was conducted with 378 households from four marginalised urban communities in Pietermaritzburg, South Africa and the surrounds. The majority of the respondents were women and it was found that the majority understand climate change or have experienced its impacts, in some form. However, the respondents were not sure as to the causes of the phenomenon, with some believing it is a natural

process and others speculating that God or other supernatural forces must be responsible. The community members identified eight climate change impacts; the change of seasons, flooding/heavy downpours, droughts, cold spells, heat waves, hailstorms, disease outbreaks, and veld fires, which have directly or indirectly impacted on them. The majority complained about the impacts of climate change on their agricultural activities as it pertained to food security. Caesar *et al.* (2013) found that 93% of the urban population within Msunduzi Municipality, where Pietermaritzburg is located, is considered to be food insecure. Furthermore, urban households within the municipal region presently allocate one-third of household income to food (Caesar *et al.*, 2013), hence failed crops and the need to purchase food, and the abrupt increase in food prices due to climate change, will have devastating impacts for the financial and health well-being of the household.

Although most have been affected by climate change, less than half have coping strategies. The strategies were found to be reactive, short-term and unsuitable to adapt to the long-term climate-related risk. PECCN (2011, p. v) point out that “the most vulnerable people to climate change are often the poorest, who lack coping strategies to deal with shocks and stresses and who have to resort to ineffective responses”. A number of community members cited a lack of knowledge and resources as the primary reason for their lack of responses. Many felt that climate change is inevitable and nothing can be done to stop it, moreover, the community members are more concerned with poverty and unemployment than they are with climate change and this likely factored into their responses or lack thereof. Furthermore, many believe that climate change response is the responsibility of the government, although, they do not have confidence that the government will address the issue. This may be a result of the failure of local government to meet the needs of the communities in an adequate and timely manner. Hence, the communities do not trust that the government is willing or able to meet their basic needs. Therefore, they have no reason to believe that the government ‘will come to their rescue’ with regards to climate variability and change, even though the majority feel that it is the responsibility of government, in particular, local government, to address the issues. A few respondents stated they are marginalised and have no platform to raise their concerns, therefore, they are disempowered and have no recourse in the face of changing climate and weather conditions. Implementing community-based projects that link poverty with climate variability and change

would be a good starting point for the government to amend the situation and rebuild trust. As it stands, the communities are socio-economically vulnerable to climate-related risk and though they feel that it is the responsibility of the local government to address the issue, they do not trust them to do so. Moreover, the community members have limited access to social networks that can assist them. The assistance provided in social networks plays a distinctive role in responding to climate risk in rural areas and this appears to have been lost in urban areas.

The IPCC (2007, p. 6) defines vulnerability as “*the degree to which a system (natural or human) is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes*”. The communities, due to their lack of knowledge and resources, low income levels, absence of safety nets, lack of access of social and political capital, and weak household response capacities, are vulnerable to the impacts of climate change and this vulnerability is likely to increase as the impacts of climate change increase in frequency and intensity. Furthermore, the communities are vulnerable to the impacts of rapid urbanisation which have resulted in resource and space shortages in South Africa. Urbanisation has been described as a hindrance to socio-economic development in the country, which is placing increasing pressure on urban low-income groups and increasing their vulnerability to political, social, economic and environmental hazards (Revi *et al.*, 2014; Cobbinah *et al.*, 2015; Tacoli *et al.*, 2015).

7.2.2 Gendered impacts of climate variability and change

The majority of respondents in the study were female, and the majority of households were female-headed. Women-headed households tend to concentrate in cities and towns (UNFPA and IIED, 2012). Men and women in urban areas do not experience the impacts of climate change in the same way due to their different roles within the household (PECCN, 2011). Women tend to be responsible for paid and non-paid domestic and care work within the household and this, undoubtedly, makes them more vulnerable than men to the negative impacts of rapid urbanisation such as the lack of access to basic services (Lambrou and Piana, 2006; Tacoli, 2012; UNFPA and IIED, 2012). This has led several authors to conclude that the impacts of climate variability and change are not gender neutral as gender inequalities within the household and women’s socio-economic vulnerability have contributed towards their limited

capacity to respond to the current and future impacts of climate-related risk (Eriksen *et al.*, 2007; Demetriades and Esplen, 2010; Nelson, 2011; PECCN, 2011). Moreover, women comprise 80 percent of those who are displaced by climate change either via extreme weather events or gradual changes such as drought, and 70-80 percent of those requiring post-disaster assistance (Rout *et al.*, 2013; UNDP, 2015).

Responses to climate variability and change are not gender-neutral as they are highly dependent on factors in which women from developing countries are disadvantaged, namely; technology, education, economic security, access to, control and ownership of resources, and access to information (Lambrou and Piana, 2006; Roehr, 2007; Demetriades and Esplen, 2010; Rout *et al.*, 2013). The study set out to investigate how women in the four urban and peri-urban communities in Pietermaritzburg were impacted by climate variability and their perception of their vulnerability. A questionnaire survey was conducted with women from 264 households, 81 percent being female-headed. The majority stated that climate change had a significant impact on their agricultural activities and food security. However, less than half had adopted any coping mechanism, and though present, the mechanisms were inadequate to cope with the long-term impacts of climate variability and change. The coping mechanisms that were adopted ranged from measures to minimise impact such as digging drainage furrows during floods and moving property to safe positions to measures to improve agricultural output such as adjusting planting times or irrigation to measures to decrease discomfort such as the use of heaters and fans, staying indoors, and keeping hydrated.

In spite of their low adaptive capacity, the women did not feel that their vulnerability was any different from that of men. This is a perception shared by the municipal officials, who are female. This belief may be the reason gendered climate impacts are not afforded attention in the local government climate change policy frameworks. This is not to say that the women are not more vulnerable. It is more than likely that the women have accepted 'their' gender roles and have become immune to hardship. With increasing climate variability, resource scarcity has become a part of their landscape such that they have 'adapted' to the climatic changes. However, adaptation is supposed to increase resilience and decrease existing vulnerabilities. Within these communities, vulnerabilities still exist and their livelihoods have not improved. It is possible that the women have not yet linked climate change to some of its indirect impacts such as the increase in food prices or

the water shortages, which can be blamed on poor service delivery by local government.

Unfortunately, little can be achieved to change the women's perception of their vulnerability, however, the government can assist them by providing the means to respond or improving their response capacity, for example, through education, knowledge-sharing, and providing them with green jobs that allow for skills development to enable them to enter the formal economy. Many of the women in the study, due to a lack of skills and formal jobs, were involved in informal activities for income generation, an economy that lacks financial security as they are low-paying, insecure, unstable and of poor working conditions (Cobbinah *et al.*, 2015). Moreover, it is vulnerable to climate variability and change, and is the least able to recover after a climate-induced disaster (Boadi *et al.*, 2005; Tacoli, 2012). The result of this is the disempowerment of women by affecting their incomes and livelihoods and, inadvertently, locking them within the poverty cycle (Tacoli, 2012; Nelson *et al.*, 2002). Therefore, enabling the women to enter the formal economy will empower them socio-economically and relieve them of the burdens they currently face. These are some of the policy areas that local governments need to focus on.

7.2.3 Local government response to climate change

The causes of, and the risks associated with, climate variability and change need to be governed and this requires sound decision-making, the building of trust, effective communication and for governments to bring about transformational change within their jurisdiction, in addition to fulfilling their assigned functions (Fröhlich and Knieling, 2013; Du Plessis and Kotzé, 2014; Mukonza and Mukonza, 2014). Climate change impacts all spheres of the South African government, national, provincial and local, however, the local sphere is at the forefront of vulnerability to climate-related risk and is, therefore, better positioned to effectively design and implement climate response strategies (Mukonza and Mukonza, 2014; Pasquini *et al.*, 2015; Local Government Programme 4 Climate Change, 2016; Wamsler, 2016). In spite of this, local governments within the country have no legal mandate to address the issue (RSA, 2011; Du Plessis and Kotzé, 2014; Taylor *et al.*, 2014), and climate change management comes in the face of competing socio-economic development priorities that include, *inter alia*, reduction of poverty and inequality, job creation, and the provision of basic services and infrastructure. Local level governance is

further hampered by the fact that climate change is commonly dubbed as a strictly environmental issue to be tackled by environmental departments (Meadowcroft, 2009; Heinrich Boell Foundation, 2012; Ziervogel *et al.*, 2014; Knieling and Klindworth, 2016). Such a perception is detrimental to the building of sound response capacity as the environmental departments tend to lack the political clout to garner support to address climate change, particularly when the problem is perceived as being in competition with development (Segal and Cloete, 2012; Taylor *et al.*, 2014; Aylett, 2015; Baudoin and Ziervogel, 2016). This has resulted in weakened incentive to address the issue and a lack of political will. Where there is no political will, little investment will flow into climate-related planning and programmes (Segal and Cloete, 2012). The study concurs with this analysis as it was found to be true for the municipalities governing the study areas, in particular, uMngeni local municipality where the lack of political will has hindered the development of a framework to respond to climate change. Therefore, in the face of such political marginalisation, climate-related responses tend to be underdeveloped, while interventions at the local level are minimal and the existence of such frameworks does not guarantee action on the ground (Knieling and Klindworth, 2016), another fact that proved to be true in the study. Msunduzi local municipality has developed climate-related policies and strategies which are yet to be implemented.

7.2.3.1 Local government climate response framework

The study revealed that the community members are ill-prepared to cope or respond to the impacts of climate change. The onus then falls on the local government to improve response capacity of the communities. The research set out to establish how the local governments, uMgungundlovu District Municipality (UMDM), and Msunduzi and uMngeni local municipalities, are addressing climate variability and change. Msunduzi and uMngeni are two of the seven local municipalities that fall under the jurisdiction of uMgungundlovu District Municipality. Three of the study communities, France, Swapo, and Willowfontein fall under the jurisdiction of Msunduzi while Mpophomeni, under that of uMngeni. In assessing the climate responses of the local governments closest to the communities, i.e., Msunduzi and uMngeni, it was found that the former has initiated plans to institutionalise climate change response, while the latter, due to numerous barriers which include a lack of resources (human, financial and technological), time, knowledge, political will and low municipal prioritisation, has not. Furthermore,

Msunduzi is the only local municipality within uMgungundlovu that has initiated plans to institutionalise climate change.

Climate change is housed within the Environmental Management Unit in Msunduzi's Sustainable Development and City Enterprises Department and a total of seven environmental scientists are responsible for managing the issue. The personnel developed and published a climate change policy in November 2014 and an adaptation and mitigation implementation strategy in 2016. However, the climate-related policies and strategies have not, to-date, been implemented. Conversely, within uMngeni, the sole environmental management officer, who functions within the Department of Economic Development and Planning, is responsible for climate change and he lacks the skills and expertise to tackle such a task. Moreover, he lacks the time to address the issue as he is responsible for other municipal priorities, such as social housing. In addition, there are no financial resources to facilitate the development of a policy framework as climate change has not been included in the municipal budget. In this light, the study agrees with Goebel (2007) who asserted that a human resources crisis exists within South African municipalities which will take time to overcome and will compromise policy implementation. A decade later and it appears the crisis will not be solved any time soon.

Within UMDM, a higher level of local government which is structurally linked to both higher and lower levels to governance (Wisner *et al.*, 2015), it was found climate response is relatively new and fraught with numerous challenges. The greatest barrier is that of the exclusion of climate change from the municipal budget, prompting the municipal officials to source funds externally. The district municipality, through the use of consultants, conducted a vulnerability assessment in 2011, and published a climate change response strategy and plan in 2013 (UMDM, 2013), making it one of the first district municipalities in the province to develop a climate change response strategy. A team of three environmental scientists have been employed and are directly involved with the municipality's climate change portfolio. The team functions within the Climate Change and Resilience Project Management unit within the Department of Community Services in the municipality, and is currently implementing an externally-funded community-based adaptation project in rural areas, the uMngeni Resilience Project.

It was found that there is no co-ordination of municipal responses as the district and local municipalities are developing their climate change frameworks in isolation

and there is little accountability. Multi-scalar issues such as climate change require co-ordinated and collaborative governance responses. Moreover, district municipalities are mandated to assist local municipalities when they lack the capacity to fulfill their municipal functions (RSA, 1998). A “networked approach” to governance may assist in the fulfillment of this mandate (Wisner *et al.*, 2015, p. 188).

7.2.3.2 Local government and the communities

Responses from the study communities revealed that the public are divided on their prioritisation of climate change, with some viewing it as a priority and an equal number do not. This was confirmed by officials from Msunduzi who revealed that, even though the public were provided with the opportunity to comment on the initial drafts of the climate-related documentation, very few responded. Furthermore, the majority of community members were unaware that environmental, or climate-related documentation existed, at any level of governance (**Table 7.1**). This can be attributed to a lack of interest in climate change issues, which they view as less immediate to their current concerns of poverty and unemployment, or they are not receiving the information timeously or they lack access to the websites where the information is made available. Making climate change a priority for the public is important as it will shape the effectiveness of climate responses (Button *et al.*, 2013). Button *et al.* (2013 p. 717) assert that while the phenomenon may be a priority for city governments, “it may not be perceived at the top priority by low income groups and the ways in which these priorities interact is central to building resilience in rapidly urbanising low-income cities”.

Therefore, the municipality must do more to transfer the information to the people to garner public interest and support. This can be achieved, for example, by implementing community-based projects which leverage co-benefits such as creating jobs that enable the communities to earn an income from environmental services, while safeguarding the environment. Such projects are already underway within the communities, however, they only benefit a few. Larger scale projects need to be implemented and this will require collaborations between the public and private sector. Given the challenges that local governments in South Africa are facing in juggling socio-economic imperatives with environmental ones, non-governmental organisations, faith-based organisations, and the private sector can fill the gap and address the issues that the governments are unable to. Such partnerships can provide the resources necessary to spearhead municipal climate response action and bolster poverty alleviation efforts.

Table 7.1: Community members’ awareness of climate-related documentation (n= 378)

Climate change-related policy documentation	Frequency (%)
National Environmental Management Act (Act 107 of 1998)	6.7
National Climate Change Response White Paper (2011)	5.1
uMgungundlovu District Municipality Disaster Management Plan (2012)	13.9
uMgungundlovu District Municipality Climate Change Response Strategy and Plan (2013)	9.9
Climate Change Policy for Msunduzi Municipality (2014)	5.3
Msunduzi Municipality Disaster Management Plan (2014)	13.9
uMngeni Local Municipality Disaster Management Plan (2007)	14

7.2.4 Citizen engagement and local governance

Transformational and hybrid or collaborative governance is required to address wicked problems such as climate change (Fröhlich and Knieling, 2013; Ziervogel *et al.*, 2016b). An important aspect of this is citizen engagement (Vogel *et al.*, 2016; Wamsler, 2016; Ziervogel *et al.*, 2016b). It is important to involve the public in the decision-making process, policy designing and implementation. They need to have a voice as they are the most vulnerable and may have indigenous technical knowledge and capabilities that can be used to address the issues (Adger *et al.*, 2003; Smith *et al.*, 2009; Jabeen *et al.*, 2010; Midgley *et al.*, 2011; Ziervogel *et al.*, 2014). Communities, businesses, families and individuals shape policy outcomes as they will have to “change their carbon-emitting behaviours and provide the social and technological innovations required to reduce greenhouse gas emissions and to adapt to a changing climate” (Meadowcroft, 2009, p. 18; Madzwamuse, 2010; Knieling and Klindworth, 2016; Li and Song, 2016). In addition, an informed public is less likely to undermine or oppose the implementation of the policy frameworks, or use maladaptive strategies to cope (Meadowcroft, 2009). Therefore, developing and implementing projects that protect the environment, create green jobs and alleviate poverty will not only encourage community interest but will likely increase public involvement, which was lacking in the study areas of France, Swapo, Willowfontein and Mpophomeni, in the formulation and implementation of climate-related plans and programmes. Thereby increasing their capacity to respond and encourage them to change carbon-emitting behaviours (Meadowcroft, 2009). This is important as South African urban areas are “resource intensive, highly polluted, and wasteful” due to the inefficient use of resources (RSA, 2015, p. 15). Within the municipal bodies, such development related initiatives can help the climate change teams to overcome some of the barriers they are currently facing in developing and implementing a climate response framework, in particular, uMngeni.

South African municipalities are working to undo or rectify the developmental injustices of a colonial past and many view climate change management, and by extension environmental management, as a potential threat to their developmental mandates (Leck and Simon, 2013). This was found to be true for uMngeni where climate change has not been prioritised and very few resources have been allocated to addressing the issue. Therefore, climate change projects which help to

bridge the gap “between social justice and local adaptive capacity” (Chu *et al.*, 2016, p. 4) can help change this perception and take climate change out of the environmental box that it has been placed in. Urban governments need to recognise that developing a climate response is not a threat to development, rather it is essential for development (Dodman and Satterthwaite, 2011).

As climate risk increases in intensity, frequency and duration, the role of city governments in climate risk management will grow, as will the reliance of low-income households on policies and institutions for assistance (Heltberg *et al.*, 2008). Shackleton *et al.* (2015) accede that at the local level, community members are limited in their capacity to implement substantial or transformational changes. Adger *et al.* (2007) add that financial poverty can hinder the adoption of even ‘cheap’ adaptation responses by community members (Adger *et al.*, 2007). These facts proved true for the study which revealed that the community members faced resource and knowledge barriers in coping with climate-related impacts. These barriers have led many to believe that they are powerless to do anything in the face of these impacts and that only God or the government can save them. Therefore, to overcome the numerous barriers that they are encountering, they require assistance from their governments, non-governmental organisations (NGOs), faith-based organisations and the private sector to bring about “deep-seated political and economic reform and a more pro-poor agenda” (Shackleton *et al.*, 2015, p. 335). Weak governance is an institutional barrier to local climate response (Du Plessis and Kotzé, 2014; Shackleton *et al.*, 2015), hence, local governments need to work to strengthen their governance structures through information sharing and developing a ‘community of practice’, working with other local governments, and the higher levels of government, and involving non-state actors. The ‘community of practice’ created by eThekweni Municipality, the Central KwaZulu-Natal Climate Change Compact (CKZNCCC), has been instrumental in educating the official from uMngeni with regards to climate change, allowing him to form networks, receive assistance and identify potential funding opportunities to increase the municipality’s capacity to address climate change. Climate-smart development entails the “creation of agencies and systems that are well connected across scales, can easily learn from each other, have space to innovate and experiment with approaches and conduct scenario planning exercises with regularity” (Wisner *et al.*, 2015, p. 188).

Msunduzi needs to implement its policies, and uMngeni to start making plans to institutionalise climate change within its municipality. This can initially be achieved through the municipal integrated development plan (IDP). In the absence of a climate change framework, mainstreaming climate change into the IDP ensures that some level of climate response is addressed. In a study carried out by Aylett (2015) on urban CC governance within 350 municipalities across five continents, it was revealed that the majority of municipalities are more likely to integrate climate responses into their IDPs than create stand-alone climate-related plans, illustrating the importance of utilising the IDP as a tool to effectively address climate change. Such a tool is particularly effective in a country such as South Africa where the absence of a mandate or “explicit policies and legal arrangements” for governing the climate change (Du Plessis and Kotzé, 2014, p. 145), means that the phenomenon is not recognised as a key performance area and few resources are allocated to addressing the issue (Ziervogel *et al.*, 2016a). Integrating adaptation into the municipal IDP can make it a key performance area and resources can be allocated to addressing it (Ziervogel *et al.*, 2016a). This tactic proved successful for Bergriver local municipality in the Western Cape Province of South Africa, where municipal officials created an adaptation plan which was mainstreamed into the municipal IDP (Ziervogel *et al.*, 2016a).

The use of the IDP as a climate response strategy brings forth an interesting debate about the institutional positioning of climate change. The study revealed that climate change is housed within three different departments in the municipalities: UMDM- the Department of Community Services (Climate Change and Resilience Project Management Unit); Msunduzi- the Sustainable Development and City Enterprises Department (Environmental Management Unit); and uMngeni- the Department of Economic Development and Planning. Is it more effective to have a department or unit solely dedicated to addressing climate change as is the case with UMDM and Msunduzi where it part of the greater environmental agenda? Or is an integrative approach more ideal as is the case with uMngeni where it has no specific home within the Department of Economic Planning and the assumption is that it is integrated into the departmental units? Each scenario comes with its own advantages and limitations. The benefits of an integrative approach are that climate change management is decentralised and there is potential to integrate the issue into a wider range of community-level services and development strategies the department is implementing. Conversely, failing to

make climate change one of the priority concerns of an environmental unit, a unit that specialises in environmental issues, may weaken efforts to address the issue. There is a danger of neglecting climate change concerns if they do not align with the goals of future development strategies, and climate response can easily become an afterthought. This proved to be true for uMngeni where climate change is not prioritised and viewed as non-critical. Under the jurisdiction of an environmental unit, climate change and environmental issues are the primary foci of the unit and will be allotted the necessary staffing, time and expertise required to deal with such a complex problem. A paradox exists and there is no correct answer. For example, the climate change response framework of eThekweni Metropolitan Municipality is thriving under the auspices of the Environmental Planning and Climate Protection Department (EPCPD), which contains the Climate Protection Branch (CPB) (Taylor *et al.*, 2014). On the other hand, within Theewaterskloof Local Municipality in the Western Cape, integrating climate response into the Local Economic Development Unit as a green economy agenda has proved to be successful (Taylor *et al.*, 2014). Therefore, each municipality will need to decide on the most suitable positioning of the issue and this will depend on the funding available, political will and capacity.

UMDM, given its structural positioning and links to higher and lower levels of governance (Wisner *et al.*, 2015), has an opportunity to shape climate change response within the district. The municipality needs to assist its local governments with climate response and should implement more community-based adaptation projects, with a view to expand into urban areas. Lastly, local governments must engender their climate response frameworks as this will ensure that the needs of all vulnerable groups are represented. Gender equality is not only important for “democratic, local decision-making”, but combined with sustainable urbanisation, is important for the survival of cities, and the fulfilment of the goals of sustainable development (UN WomenWatch, ud, p. 1)

7.3 New knowledge gained from this research

The research investigated urban climate risk and response in a non-metropolitan and non-coastal city in South Africa, a research area that is lacking. This research contributes to filling this knowledge gap.

It was found that smaller urban municipalities encounter similar barriers to larger municipalities, contrary to the belief that smaller municipalities find it easier to form informal and formal networks that are instrumental in developing and implementing climate response frameworks (Wisner *et al.*, 2015). Moreover, smaller municipalities are under-resourced, and therefore, there is lack of incentive to ‘fight’ for climate change to become a key policy area, in particular, in the absence of a specific mandate.

In addition to the need for public education on climate change, the municipal officials require specific training. Such education is necessary to increase knowledge and awareness, and is particularly important for the removal of institutional barriers to climate governance. Education will help the municipal officials to make better informed decisions and publish more informed policies. With regards the engendering of policies, the women responsible for designing the climate policy frameworks held the belief that women are not disproportionately impacted by climate change. This points to a lack of awareness and demonstrates that the climate experts themselves are unclear. As the world advocates for greater female representation within the climate change negotiations and the policy environment, there is a need to consider going beyond ensuring increased female participation and ensure the representation of the different female socio-economic groups, in particular, the low-income groups. Currently, as the research has shown, decisions are being made for low-income groups by those who are socio-economically stable. This is a policy area that needs to be pro-actively rectified through participatory means.

Municipal officials need to find more effective ways of transferring climate change knowledge to the urban public, in addition to the use of internet, newspapers, radio and television. Low-income groups who live in low-income communities cannot access the internet as readily as higher income groups, and are less likely to purchase a newspaper. Furthermore, the use of television or radio may make it difficult for them to relate to climate change or view it as an issue that can impact them. A more effective and direct approach may be to visit the communities and discuss the issue with them. A discussion in person can help them to grasp and understand the severity of climate change and allow them to ask the important questions.

The research highlights the complexities that exist within local government spheres in South Africa. District municipalities are financially disadvantaged in comparison to their metropolitan counterparts, even

though they both manage large areas. This makes it difficult to govern climate change which is perceived to be in direct competition with more pressing needs such as poverty alleviation. Methods to increase district municipal revenue need to be explored as poor financial capacity is a major limitation for climate governance and the national government needs to find a way to even out the situation.

The province of KwaZulu-Natal is divided into a metropolitan municipality and ten district municipalities (DMs) which are subdivided into 43 local municipalities (LMs) (Main, 2017). Only four out of the eleven metropolitan and district municipalities are taking action to respond climate change. Of the ten DMs, only three have started a conversation with regards to climate change and have 14 LMs under their jurisdiction, however, not all have climate change frameworks in place. This means less than a third of LMs in KZN are taking steps to respond to climate change. This is a concern considering that KwaZulu-Natal has a low adaptive capacity and local governments are important for local-level climate response (Wilk *et al.*, 2013; KZN EDTEA, 2014). The failure of local governments to respond effectively and timeously will have devastating impacts, hence, it is suggested that municipalities work to integrate climate response into the municipal IDP to facilitate response. In addition, an area that should be taken into consideration is that of each district municipality designing a district-wide climate response framework that will serve as a framework for all the local municipalities within their jurisdictions. The climate response framework should be created in collaboration with the LMs, taking cognisance of the diverse biophysical and socio-economic environments in which the municipalities function. This should avoid a duplication of responses as each LM attempts to develop its own framework, which is wasteful of resources, and relieve pressure from LMs to develop a response portfolio and enable them to channel more resources towards implementation, thereby spearheading response efforts. The added advantage would be that the DM would be making progress with regards to fulfilling its mandate to build the capacity of LMs where there is limited capacity to perform municipal functions, in this case, building capacity for climate action (RSA, 1998). This approach allows for accountability.

The research found that local governments need a mandate to address climate change. Without a mandate, there is no political will to address the issue and it makes it more difficult for climate champions to institute the necessary reforms. Furthermore, there is no

accountability, meaning that a climate policy may exist, however, there is no incentive to implement.

7.4 Conclusion

Climate change is a wicked problem which governments in South Africa are struggling to address, in addition to the problems of poverty and inequality which still persist even though the nation gained its independence over two decades ago (Shackleton *et al.*, 2015). Poverty is taking on a more urban face as cities are failing to deliver on their perceived promise of employment and improved quality of life, leaving many susceptible to climate-related risk. Unfortunately, the research reveals that the government, at the local-level, in addition to dealing with competing pressures and priorities, is still learning how to govern climate change. Those vulnerable to climate change cannot rely on government assistance to improve their climate response capacity. It is up to external stakeholders- such as faith-based organisations, community-based organisations, non-governmental organisations and the private sector to assist where the government cannot. However, this cannot replace government assistance.

The local government is the closest to local communities and are, therefore, better-positioned to provide long-term, sustained assistance. Provided the multi-scalar nature of climate change, emphasis should be placed on building partnerships with non-state actors, and the citizens, in particular, low income and vulnerable groups, who should be integrated into the process, from planning to implementation (Chu *et al.*, 2016). Vulnerable groups need to be offered a seat at the table as this will ensure that responses are gender-sensitive and address the needs of the urban poor, effectively building their resilience.

Climate change and poverty need to be tackled together if interventions are to be successful (Fay *et al.*, 2015) Furthermore, climate change response should be mainstreamed into all governmental departments and policy domains, to ensure long-term, effective, sustained responses. Governance is both a tool for, and a barrier against, local climate response and equitable urban planning, hence municipalities must focus on transforming their governance structures, and building their capacities and capabilities. If the global community succeeds in stabilising the climate and eliminating poverty and inequality, great strides would have been taken towards the achievement of sustainable development (Fay *et al.*, 2015).

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Appendices

Appendix 1 Ethical clearance



3 September 2015

Ms Sithabile Hlahla 211550446
School of Agriculture, Earth and Environmental Sciences
Pietermaritzburg Campus

Dear Ms Hlahla

Protocol reference number: HSS/0522/0150

Project Title: Pro-poor Climate change adaption in the context of urban poverty eradication in Pietermaritzburg, Kwazulu-Natal South Africa

Full Approval – Expedited Application

In response to your application received on 22 May 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted FULL APPROVAL.


Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully


Prof Umhila Boko
University Dean of Research
On behalf of Dr Shenuka Singh (Chair)

/pm

Cc Supervisor: Prof Trevor Hill
Cc Academic Leader Research: Prof Onesimo Mutanga
Cc School Administrator: Ms Marshu Manjoo

Humanities & Social Sciences Research Ethics Committee

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Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville

Appendix 2 Field Questionnaire

FIELD QUESTIONNAIRE: URBAN PRO-POOR CLIMATE CHANGE RESPONSE

Do you consent to participate? Yes No

SOCIO-ECONOMIC INFORMATION

Area (Suburb/ward number).....

House number/ GPS co-ordinates:

Longitude.....Latitude.....

Type of housing:

Formal bricks/concrete block houses Traditional hut Informal/squatter settlements

Other.....

Is your housing RDP? Yes No

How many rooms are in the house?.....

1. Male-headed household Female-headed household
2. Fill in the following for each house-hold member:

Respondent	Age	Sex	Education/Literacy	Employed (Formal)	Any special needs (if yes, indicate)
	1. 16-20	Male	Primary	1. Yes	
	2. 21-25	Female	Secondary	2. No	
	3. 26-30		Higher education		
	4. 31-35		No education		
	5. 36-40				
	6. 41-45				
	7. 46-50				
	8. 51-55				
	9. 56-60				
	10. 61-65				
	11. >65				

3. How many people are living in the house?.....
4. How many people are unemployed and depending on the household income?
5. What are the household's main sources of income? Rank them, 1- most important

Source	Please tick
Employment	
Government grants	
Working in the informal sector (for example street vendors, child care providers, taxi drivers, waste collectors)	
Money received from relatives within South Africa and abroad	

Other, please specify	

6. What is the household's total monthly income?

- R 0-499 R 500- 999 R 1000-1499 R 1500-1999 R 2000+

7. What is the household's total yearly income?

- R 0-5000 R 5001- 10000 R 10001-15000 R 15001-20000
 20000+

8. Below is a list of household expenses. Please tick the ones you pay for on a monthly basis.

Household expenses	Please tick
Food/Groceries	
Clothes	
Rent (if any)	
Education	
Transport costs (Fuel or taxis)	
Electricity	
Water	
Health care	
Savings	
Other, specify	

9. Are you able to cover all these costs every month?

- Yes No

10. If no, what do you do?

11. Do you own property/assets?

Asset	Please tick
House	
Car	
Television	
Radio	

Land	
Telephone/ Cellphone	
Furniture	
Stove	
Refrigerator	
JoJo Tank	
Generator	

12. For how long has the family lived in this area?.....

13. Do you have access to the following? (Please tick)

	YES	NO	COMMENTS/ISSUES
BASIC SERVICES			
Health care			
Affordable Health care			
Health care facilities in close proximity			
Safe, drinkable water Where do you get your water? Municipal tap Spring Borehole Jojo Tank Bought from a truck			
Sanitation and drainage			What kind of toilet?
Weekly refuse removal			How do you dispose of waste?
Electricity			
Infrastructure (roads etc)			
Education			
Affordable education			

Schools in close proximity			
FINANCIAL SERVICES			
Access to credit services			
SECURITY (tenure, personal)			
Land ownership			
Personal safety			
Access to housing			
EMPLOYMENT			
Job availability			
Access to information about jobs			
EMPOWERMENT			
Allowed to participate in community meetings/ government consultations			If no, what barriers do you face? (domestic/government/cultural?)
Access to legal documents, policies			
Female participation in community meetings			

CLIMATE CHANGE

14. What is your understanding of the term climate change?

15. Describe the four seasons in your area throughout the year in terms of the following:

a. Weather b. Activities undertaken during these seasons

October to February (Summer)	
February to April (Autumn)	
May to July (Winter)	
August to October (Spring)	

16. Have you noticed any changes in the weather while you have been living here?

(Example for enumerators: Is it colder? Is it hotter? Is there more rain? Is there less rain? Longer summer? Shorter winters?)

- Yes No I don't know/I don't remember

17. If yes, explain:

18. Is this year's winter different from last year's?

- Yes No I don't know/ I don't remember

19. If yes, explain:

20. Is this year's winter different from 5 years ago, in 2010- the year of the 2010 World Cup?

- Yes No I don't know/ I don't remember

21. If yes, explain:

22. Is this year's winter different from 10 years ago?

- Yes No I don't know/I don't remember

23. If yes, explain:

24. Was this year's summer different from last year's?

- Yes No I don't know/I don't remember

25. If yes, explain:

26. Was this year's summer different from 5 years ago, in 2010?

- Yes No I don't know/I don't remember

27. If yes, explain:

28. Was this year's summer different from 10 years ago?

- Yes No I don't know/I don't remember

29. If yes, explain:

30. Do you know why these changes are occurring? Yes No

31. If yes, explain:

32. Fill in the table below:

Climate hazards and impacts	Which of the following has your household experienced (Please tick)	How frequently has this occurred?	How severe has this hazard been?	How difficult has been to cope with this climate change hazard
		>4 3-4 1-2	High severity Medium severity Not severe	1. High 2. Medium 3. Low
Changes in seasons				
Flooding/Heavy downpours				
Drought				
Heat waves (periods of very hot weather)				
Cold spells/cooler weather (periods of very cold weather)				
Hailstorms				
Disease outbreaks e.g. malaria, cholera				
Increased veld fires due heat and dryness				

33. Have these climate hazards impacted you in any way? (Your livelihoods or how you earn an income?)

- Yes No

34. If yes, how?

Eg.- property damage, crop damage, changing growing seasons, hazards preventing certain activities

35. To what extent has climate change impacted the following in your area? Rank according to level of impact, from 1-7, with 1 being the most impacted and 7 being the least.

Indicators	Ranking
Income/Livelihood	
Agricultural activities/Food security	
Water supply	
Sanitation and drainage	
Food supply	
Health	
Education	

36. Do you have methods of adapting to/ dealing with climate change impacts and hazards?

Yes No

37. If yes, explain

38. If no, why not?

Proceed to Question 42

39. Do you think your adaptation strategies are effective?

- Yes Not really No

If **no**, what else can you do to ensure long-term success? How can you be assisted?

40. What do you feel you are coping with well?

41. What impacts are you having increasing difficulty coping with?

42. What factors are affecting your ability to cope with or manage the changes?

43. Is the government or any other organisation helping you to adapt to climate change?

- Yes No

44. If yes, explain:

45. Are you concerned about climate change?

- Very concerned Moderately concerned Not concerned

46. Explain your answer:

47. Do you feel that you contribute to climate change?

- Yes No

48. If yes, how?

49. Please rank climate change in comparison to other challenges you are currently facing.

(1= Most challenging; 9 = Least challenging)

Challenges	Rank
Climate change	
Poverty	
Unemployment	
Food Insecurity	
Crime	
Lack of clean, drinking water	
Lack of waste collection services	
Lack of sanitation and drainage services	
Lack of affordable health services	
Other, specify.....	

50. Has anyone come to address the issue of climate change with you?

- Yes No

51. If yes, who?.....

52. If yes, what was discussed?

53. Who do you feel is responsible for addressing these climate change issues?

- Industry
 Government
 Community
 NGOs
 I don't know

54. If government, which level of government?

- National Government
- Provincial Government (Premier)
- Local Government (Msunduzi)

55. Explain your answer:

56. Do you know whether the government is already doing anything to address these issues? Yes No

57. If **yes**, what?

58. If **no**, what should they do?

59. Have you seen any projects in your community that are providing help with climate change mitigation and adaptation?

- Yes No

60. If **yes**, what?

61. Do you have access to climate change information? Yes No

62. If **yes**, what kind of information and how do you access it? See Table below

Sources of climate-related information	Please tick	Type of information
School/Teachers		
Radio		
Television		

Newspaper		
Internet		
Visiting climate scientists/experts		
Community leaders		
From family and fellow community members		
Government		
Non-governmental organisations		
Other, please specify.....		

63. If **no**, what kind of information would you like access to?

64. Have you heard of the following documents?

	YES	NO	IF YES, DID GOVERNMENT DISCUSS IT WITH YOU?
National Environmental Management Act (NEMA, 2010)			
National Climate Change Response White Paper			
uMgungundlovu District Municipality (2012) Disaster Management Plan			
Msunduzi Municipality Strategic Environmental Management Plan (2010)			
Climate change policy for Msunduzi Municipality (2014)			
Msunduzi Disaster Management Plan (2014)			
uMgungundlovu District Municipality Climate Change Response Strategy and Plan (2013)			

65. Who is most impacted by climate change?

- Men
- Women
- Children

66. Why?

--

67. Do you feel that as a **woman/man** you are (disproportionately) impacted/affected more by climate change?

- Yes No

68. Explain your answer:

69. Why is it important to grow trees?

70. Why is it important **NOT** to burn waste?

71. Why is it important to collect waste?

SCENARIO-BASED QUESTIONS

72. In the case of a flood, what would you do?

73. Are your assets safe? Yes No

74. Are you close to your community members? Yes No

75. If yes, would they support you if you need assistance during a flood? Socially? Financially?

- Yes No

76. If yes, what kind of assistance are they willing to provide?

77. How would you make up for your losses after a flood?

78. If you were warned that there would be a flood, how would you protect yourself and your assets?

79. Does the community have plans in place to deal with climate related impacts?

Yes No

80. If yes, what are these plans?

COMMENTS FROM ENUMERATORS

**Appendix 3 Interview schedule for official from uMgungundlovu
District Municipality**

INTERVIEW QUESTIONS FOR UMGUNGUNDLOVU DISTRICT MUNICIPALITY

My name is Sithabile Hlahla. I am currently studying towards a PhD in Environmental Sciences at the University of KwaZulu-Natal, Pietermaritzburg campus. I am carrying out a study to find out how climate change is impacting communities in urban/peri-urban areas in Pietermaritzburg, South Africa and how the communities are adapting to these changes. The information will be treated as confidential and your participation in my research is greatly appreciated.

Climate change (responses) and poverty reduction governance in KwaZulu-Natal, South Africa

1. What climate change risks is uMgungundlovu currently facing? Distinguish between the direct and indirect risks.

DIRECT RISKS	INDIRECT RISKS

2. What future risks do you expect?
3. What is the (district) municipality doing to manage the climate change risks?
4. Is the focus more on adaptation or mitigation? Why?
5. What climate change policies do you have in place? Climate change response strategy? (Why does Msunduzi have one and UMDM does not?)
6. Have you been able to implement these policies? (e.g uMgungundlovu District Municipality Disaster Management Plan (2012)?)
7. If yes, examples?
8. Can you comment on the vulnerability of the urban poor to climate change in within the municipality?
9. Who is the most vulnerable to climate change?
10. How are the urban poor coping with these risks?
11. Is poverty reduction addressed in the municipality's climate change response strategies? Are the vulnerable catered for within the municipal plans?
12. If no, why not?
13. Are the marginalized aware of the climate change plans and policies? Were they ever consulted?
14. Is information accessible to the poor?
15. In your opinion, does climate change impact men and women differently? If yes, how?
16. Does the climate change policy at national and local level take these differences into account? Are the policies engendered? (Is gender and inequality mainstreamed into climate policy or responses?)
17. Women, particularly those living in poverty, are the most affected by the environmental crisis and climate change. What is the municipality doing to address women's vulnerability to environmental degradation and climate change?
18. In your opinion, can climate change mitigation and adaptation be successfully mainstreamed into poverty alleviation strategies in South Africa? How can this be done?
19. Is the municipality taking steps to educate the marginalized about climate change? Explain
20. How can their resilience be increased?
21. What barriers does the Municipality face in regarding climate change adaptation and poverty alleviation?
22. What opportunities exist?
23. What does the municipality need to overcome barriers?
24. What is the private sector doing to assist with climate change adaptation efforts and/poverty reduction in the district municipality?
25. What are NGOs or community based organisations doing to assist with climate change adaptation efforts and/or poverty reduction in district municipality? Examples?

Governance-related questions

26. Where does climate change stand in the list of municipal priorities? Please provide the list.
27. Who is primarily responsible for addressing climate change issues within the municipality?
28. Is climate change adaptation solely a mandate of the environmental sector/department? Is it addressed by the finance/economic department as well?
29. Who are the stakeholders in climate change governance within the municipality?
30. What kind of leadership is involved in addressing climate change/environmental issues within the municipality?
31. What kind of expertise is the team comprised of? (Economists? Social scientists? Environmental scientists? Academics?)
32. How does climate change fit into the municipality's budget? Adaptation/mitigation funding
 - a. Is there adequate funding? What can be done?
 - b. Please comment on the status of climate change funding for the municipality.
33. Did the municipality conduct a climate change vulnerability assessment? Please explain your response.
 - a. If yes, did you adopt a participatory approach to the Vulnerability and Adaptation (V&A) assessments and the development of adaptation responses?
34. Did civil society organisations and local communities play a role in the formulation of local climate change adaptation policies?
 - a. If yes, in what capacity?
 - b. If no, why not?
35. Did you adopt a participatory approach to Vulnerability and Adaptation (V&A) assessments and the development of adaptation responses?
36. Are there forums for information-sharing with NGOs or community-based organisations who are involved in climate change adaptation for exchange of ideas and lessons learned? Even at national level? Please elaborate on your response.
37. Do the municipalities meet with national government to discuss climate change and way forward? Please elaborate on your response.
38. What are your methods of public awareness/communication plans? For example, are strategies translated to local languages? Public discussion? Please elaborate on your response and discuss future plans for public awareness.
39. Regarding policy formulation, did you adopt an experimental approach?
40. What role did indigenous knowledge play in policy formulation?
41. Comment on your implementation strategy for the policies?
42. Do you have monitoring and evaluation frameworks to track climate related changes and the impacts of policy? Elaborate on your response.
 - a. If yes, what do you do with the information? Have you ever changed the goals of a policy after an appraisal?
 - b. If no, why not?
43. Have you had any independent appraisal on the effectiveness of the policy?
 - a. If yes, how often and by whom? How did you use the results to improve the policy?
 - b. If no, why not? Are you planning to have an independent appraisal undertaken in the future?
44. Societal reflexivity is defined as a continuing process of collective reflection about social goals and the means of attaining them, involving political forums, policy-making institutions and the public sphere. Do these activities take place within the municipality regarding climate change governance?
45. What barriers have you faced regarding climate change governance in the municipality? Please rank the barriers, with 1 being the greatest barrier.
46. What opportunities have you encountered regarding climate change governance?
47. The councillors- are they involved in climate change issues?
 - a. What do they know about climate change?
 - b. Do they disseminate the information?
 - c. How much power do they have?
 - d. What is their role in the communities?

-
- e. Which departments within the municipality do they interact with?
 48. Referring to the 7 local municipalities under your jurisdiction, what do you require from them regarding climate change responses/adaptation?
 - a. Do they each have to conduct vulnerability assessments
 - b. Do they have to formulate policies?
 - c. How much progress have they made?
 - d. What are the biggest challenges they are facing?
 - e. How can these challenges be overcome and how soon can they be overcome?
 49. What is the endgame? Where do you hope to see municipal level climate change governance in the future? Short-term and long-term goals?
 50. What challenges are the municipality facing with regards to climate change policy compared to eThekweni Metropolitan Municipality?
 51. Is the municipality running any campaigns to promote certain behaviours and discourage others throughout society, to address climate change? If yes, what is the nature of these campaigns and how frequently are they run?

Climate change projects

1. What climate change adaptation and mitigation project does the municipality have in place?
2. What projects in the uMgungundlovu District Municipality are classified as climate change adaptation and/or mitigation with poverty reduction co-benefits?
3. Which ones are local communities a part of?
4. What have been your strategies to involve the local community within your projects?
5. How have these strategies worked out for your projects?
6. Are the projects helping to reduce the impact of climate change?
7. Are the projects helping to reduce the vulnerability and poverty levels of the poor?
8. What barriers are you facing in implementing these projects? How can they be overcome?
9. In your opinion, are the projects sustainable?
10. What socio-economic changes have you observed most amongst participants in your projects? What gains or improvements have been observed (in poverty reduction)?
11. What are your views around incorporating social issues in your biodiversity or environmental programme? And/or climate change policy
12. What role can university research play to assist with the improvement of social issues incorporated within your projects?
13. Why call it uMngeni Resilience project and uMngeni Municipality is not involved?
14. The project has a rural focus. What about urban areas? Do you to expand?

**Appendix 4 Interview schedule for official from uMngeni Local
Municipality**

INTERVIEW QUESTIONS FOR uMNGENI MUNICIPALITY

My name is Sithabile Hlahla. I am currently studying towards a PhD in Environmental Sciences at the University of KwaZulu-Natal, Pietermaritzburg campus. I am carrying out a study to find out how climate change is impacting communities in urban/peri-urban areas in Pietermaritzburg, South Africa and how the communities are adapting to these changes. The information will be treated as confidential and your participation in my research is greatly appreciated.

Study site: Mpophomeni

1. What does climate change mean for the uMngeni Municipality and South Africa?
2. What climate change risks is Pietermaritzburg currently facing? Distinguish between the direct and indirect risks.

DIRECT RISKS	INDIRECT RISKS

3. What future risks do you expect?
4. What is the municipality doing to manage the climate change risks?
5. What climate change policies do you have in place?
6. Have you been able to implement these policies? Examples?
7. Comment on urban poverty in areas under the jurisdiction of the municipality such as Mpophomeni?
8. Does the Municipality have urban poverty alleviation strategies or programmes in place?
9. If yes, do they take climate change into account?
10. Can you comment on the vulnerability of the urban poor to climate change?
11. How are climate change risks impacting the livelihoods of the urban poor?
12. How are they coping with these risks?
13. Will future municipal plans for climate change adaptation take this vulnerability into account? If no, why not?
14. Are the marginalized aware of the climate change plans and policies? Will they ever be consulted?
15. Who is the most vulnerable to climate change?
16. In your opinion, does climate change impact men and women differently? If yes, how?
17. Does the climate change policy at national and local level take these differences into account? Are the (future) policies engendered?
18. Women, particularly those living in poverty, are the most affected by the environmental crisis and climate change. What is the municipality doing to address women's vulnerability to environmental degradation and climate change?

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19. In your opinion, can climate change adaptation be successfully mainstreamed into poverty alleviation strategies in South Africa? How can this be done?
 20. Is the municipality taking steps to educate the marginalized about climate change? Explain
 21. How can their resilience be increased?
 22. What barriers does the Municipality face in regarding climate change adaptation and poverty alleviation?
 23. What opportunities exist?
 24. What does the municipality need to overcome barriers?
 25. What is the private sector doing to assist with climate change adaptation efforts within the municipality?
 26. What are NGOs or community based organisations doing to assist with climate change adaptation efforts within the municipality?
 27. What climate change adaptation and mitigation projects does the municipality have in place?
 28. What projects in uMngeni Municipality are classified as climate change adaptation and/or mitigation with poverty reduction co-benefits?
 29. Which ones are local communities a part of?
 30. What have been your strategies to involve the local community within your projects?
 - a. How have these strategies worked out for your projects?
 31. Are the projects helping to reduce the impact of climate change?
 32. Are the projects helping to reduce the vulnerability and poverty levels of the poor?
 33. What barriers are you facing in implementing these projects? How can they be overcome?
 34. In your opinion, are the climate change projects with poverty reduction co-benefits sustainable?
 35. What socio-economic changes have you observed most amongst participants in your projects? What gains or improvements have been observed (in poverty reduction)?
 36. What are your views around incorporating social issues in your biodiversity or environmental programme? And/or climate change policy?
 37. What role can university research play to assist with the improvement of social issues incorporated within your projects?
 38. Does the municipality hope to implement projects with poverty reduction co-benefits in the future?

Appendix 5 Interview schedule for officials from Msunduzi Local Municipality

INTERVIEW QUESTIONS FOR MSUNDUZI MUNICIPALITY

My name is Sithabile Hlahla. I am currently studying towards a PhD in Environmental Sciences at the University of KwaZulu-Natal, Pietermaritzburg campus. I am carrying out a study to find out how climate change is impacting low income communities in urban/peri-urban areas in Pietermaritzburg, South Africa and how the communities are adapting to these changes. The information will be treated as confidential and your participation in my research is greatly appreciated.

1. What is your understanding of the term climate change?
2. What is your understanding of the term climate change adaptation?
3. What climate change risks is Pietermaritzburg facing? Distinguish between the direct and indirect risks.
4. What future risks do you expect?
5. Comment on urban poverty in Pietermaritzburg
6. Does the Municipality have urban poverty alleviation strategies or programmes in place?
7. If yes, do they take climate change into account?
8. Can you comment on the vulnerability of the urban poor to climate change in Pietermaritzburg?
9. How are climate change risks impacting the livelihoods of the urban poor in Pietermaritzburg?
10. How are they coping with these risks?
11. What is the municipality doing to manage the climate change risks?
12. What climate change policies do you have in place?
13. Have you been able to implement the uMgungundlovu District Municipality Disaster Management Plan (2012) or the Climate Change Policy for Msunduzi Municipality? Examples?
14. The Climate Change Policy for the municipality was only released in 2014. Why is that?
15. Do the marginalized in Pietermaritzburg know about this plan and policy? Were they ever consulted?
16. In your opinion, does climate change impact men and women differently? If yes, how?
17. Does the climate change policy at national and local level take these differences into account? Are the policies engendered?
18. Women, particularly those living in poverty, are the most affected by the environmental crisis and climate change. What is the municipality doing to address women's vulnerability to environmental degradation and climate change?
19. In your opinion, can climate change adaptation be successfully mainstreamed into poverty alleviation strategies in South Africa? How can this be done?
20. Is the municipality taking steps to educate the marginalized about climate change? Explain
21. How can their resilience be increased?
22. What barriers does the Municipality face in regarding climate change adaptation and poverty alleviation? What opportunities exist?

-
23. What does the municipality need to overcome barriers?
 24. What is the private sector doing to assist with climate change adaptation efforts in Pietermaritzburg?
 25. What are NGOs or community based organisations doing to assist with climate change adaptation efforts in Pietermaritzburg?

Climate change projects

1. Are you currently implementing any climate change projects?
2. What socio-economic changes have you observed most amongst participants in your projects?
3. What are your views around incorporating social issues in your biodiversity or environmental programme?
4. What have been your strategies to involve the local community within your projects?
 - a. How have these strategies worked out for your projects?
5. What role can university research play to assist with the improvement of social issues incorporated within your projects?

Appendix 6 Informed consent

School of Agricultural, Earth & Environmental
Sciences
Discipline of Geography
University of KwaZulu-Natal
Informed Consent Document

Discipline of Geography
School of Agricultural, Earth & Environmental
Sciences
University of KwaZulu-Natal, Pietermaritzburg
2016

To whom it may concern,

I, Sithabile Hlahla, am a student registered for a PhD Degree in Environmental Sciences in the Geography Department, Pietermaritzburg campus of the University of KwaZulu-Natal (UKZN). A requirement for the degree is a research dissertation and I have chosen the following topic:

Pro-poor climate change adaptation in the context of urban poverty eradication in Pietermaritzburg, KwaZulu-Natal, South Africa

The aim of this study is to investigate how the urban poor and local government in Pietermaritzburg, KwaZulu-Natal are responding to the current and future impacts of climate change and to investigate just how pro-poor are the current climate change adaptation strategies in South Africa. Information gathered in this study will include secondary data as well as primary data from interviews carried out with personnel from the municipality. Please note that names will not be included in the report as only summary data will be included. Anonymity and confidentiality is of utmost importance and will be maintained throughout the study. The interview may last for about 1 hour and may be split depending on preference.

The participation of the municipality in the interview is completely voluntary. Please note that the interview(s) will be recorded using audio equipment. I appreciate the time and effort it would take to participate in this study. I would be very grateful for your participation, as it would enable me to complete my dissertation and degree.

Please note that that this investigation is being conducted in my personal capacity. I can be reached on sithabileh@yahoo.com or 211550446@stu.ukzn.ac.za or 0729432537

My academic supervisor is Professor Trevor Hill on the Pietermaritzburg campus of the University of KwaZulu-Natal. He can be contacted on HillT@ukzn.ac.za or 0836500057

You may also contact the Research Office through:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: mohunp@ukzn.ac.za

Thank you for your contribution to this research

DECLARATION

Please complete the section below:

I (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Signature of Participant.....

Date.....

Appendix 7 Informed consent 2

School of Agricultural, Earth & Environmental
Sciences
Discipline of Geography
University of KwaZulu-Natal
Informed Consent Document

Discipline of Geography
School of Agricultural, Earth & Environmental
Sciences
University of KwaZulu-Natal, Pietermaritzburg
2015

Dear participant,

I, Sithabile Hlahla, am a student registered for a PhD Degree in Environmental Sciences in the Geography Department, Pietermaritzburg campus of the University of KwaZulu-Natal (UKZN). A requirement for the degree is a research dissertation and I have chosen the following topic:

Pro-poor climate change adaptation in the context of urban poverty eradication in Pietermaritzburg, KwaZulu-Natal, South Africa

Your community is one of my case studies. To gather the information, I am interested in asking you some questions.

Please note that:

- Your name will not be included in the report as only summary data will be included. Your anonymity and confidentiality is of utmost importance and will be maintained throughout the study.
- The interview may last for about 1 hour and may be split depending on your preference.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- The research aims at knowing how climate change is affecting your livelihoods and how you are adapting to the change.
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

	Willing	Not willing
Audio equipment		
Photographic equipment		

Video equipment		
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Please note that that this investigation is being conducted in my personal capacity. I can be reached on sithabileh@yahoo.com or 211550446@stu.ukzn.ac.za or 0729432537.

My academic supervisor is Professor Trevor Hill on the Pietermaritzburg campus of the University of KwaZulu-Natal. He can be contacted on HillT@ukzn.ac.za or 0836500057.

You may also contact the Research Office through:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: mohunp@ukzn.ac.za

Thank you for your contribution to this research.

DECLARATION

Please complete the section below:

I (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Signature of Participant.....

Date.....

Appendix 8 Informed consent in isiZulu

Isikole socwepheshe bezokulima, ezomhlaba kanye nezemvelo

Isigungu esifundisa ngokumakuma komhlaba

Enyuvesi yakwazulunatal

Incwadi eneminingwano yemvume

Discipline of Geography
School of Agricultural, Earth & Environmental
Sciences
University of KwaZulu-Natal, Pietermaritzburg
2015

Sawubona Mhlanganyeli,

Mina, Sithabile Hlahla, ngingumfundi obhalisele ibanga lobudokotela bolwazi oluqondene nezimfihlo zokudabuka kwezinto (PhD) kumkhakha wezemvelo, esigungwini esifundisa ngokuma komhlaba (Geography), enyuvesi yaKwaZulu-Natal emagcekeni aseMgungundlovu. Okudingekayo ukuze ngiphothule lelibanga lokufunda ucwaningo lwezimpikiswano, ngibe sengikhethe isihloko esilandelayo:

Ukusizana nabampofu ukuthi bakwazi ukumelana nokuguquka kwesimosezulu engqikithini yokuqeda ububha emalokishini aseMgungundlovu, KwaZulu-Natal, Eningizimu Afrika.

Umphakathi wakho uyingxenywe yocwaningo lwezigameko zama. Ukuze ngiqoqe ulwazi, ngingathanda ukukubuza imibuzo eyingcosana.

Ngicela uqaphele ukuthi:

- Igama lakho alizukufakwa embikweni njengoba imniningo efinqiwe kuphela ezofakwa embikweni. Ukufihlwa kwegama lakho kanye nezimfihlo zakho zibalulekile kakhulu futhi zizonakekelwa kusosonke isifundo.
- Ingxoxo ingathatha imizuzu elinganiselwa kwihora elilodwa (1 hour) futhi mhlawumbe ingahlukaniswa lokhu kuncike ekutheni wena uthanda kwenzeke kanjani.
- Nanomangabe iyiphi imininingwano osinika yona ngeke isetshenziselwe ukulwa nawe, futhi imininingwano eqoqiwe izosetshenziselwa izinhloso zalolucwaningo kuphela.
- Imniningwano izogcinwa esitoreji abese iyabhujiwa emva kweminyaka eyishlanu
- Unelungelo lokukhetha ukuzibandakanya, noma ukungazibandakanyi noma elokuyeka ukuzibandakanya nalolucwaningo. Angeke uze ujeziswe ngokuthatha lesosinqumo.
- Lolucwaningo lufisa ukwazi ukuthi ukuguquka kwesimosezulu sinamuphi umthelela ekuziphiliseni kwenu, nokuthi nimelana kanjani naloluguquko.
- Ukubandakanyeka kwakho kuyingxenywe yezemfundo kuphela, futhi ayikho inzuzo yemali ozoyithola.
- Uma uzimisele ukuba yingxenywe yalengxoxo, ngicela ukhombise (ngophawu eskhaleni ngezansi) ukuthi imuphi umshini ongathanda ukuba lengxoxo iqoshwe ngawo khetha kulemishini elandelayo:

	Uyathanda	Awuthandi
Umshini wokuqopha		
Umshini wokuthwebula		
Umshini wokuqopha izithombe		

Ngicela wazi ukuthi lokukuhlola, kuzokathwa ngokulingene amandla ami. Ungaxhumana nami kulemeyili: sithabileh@yahoo.com noma 211550446@stu.ukzn.ac.za noma kule nombolo 0729432537. Umqondisi wami uProfesa Trevor Hill osemagcekeni aseMgungundlovu enyuvesi yaKwaZulu-Natal. Umqondisi wami uyatholakala kulelimeyili: HillT@ukzn.ac.za noma kule nombolo yocingo: 0836500057.

Ungaxhumana futhi nehovisi lezocwaningo ngale mniningwano engezansi:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: mohunp@ukzn.ac.za

Ngiyabonga ngeqhaza olibambile kulolu cwaningo.

ISIMEMEZELO

Ngicela ugcwalise lengxenye engezansi:

Mina.....(Amagama aphelele omhlanganyeli). Ngalokhu ngiyaqinisekisa ukuthi ngiyakuqonda okuqukethwe yilombhalo kanye nobunjalo balolucwaningo futhi ngiyavuma ukuhlanganyela kulolucwaningo.

Ngiyaqonda ukuthi ngikhululekile ukuhoxa kulomklamo nanomangabe isiphi isikhathi, umangabe ngifisa ukwenza njalo.

Ukusayina koMhlanganyeli..... Usuku.....