



Mbhashe
Local Municipality
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DRAFT CLIMATE CHANGE STRATEGY & RESILIENCE PLAN

2016 – 2021

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ABOUT THIS DOCUMENT

Within the National Strategy for Sustainable Development and Action Plan (NSSD 1) 2011- 2014 is a vision for a sustainable society which states that, “South Africa aspires to be a sustainable, economically prosperous and self-reliant nation that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration”. Five strategic priorities have been identified, namely, enhancing systems for integrated planning and implementation; sustaining our ecosystems and using natural resources efficiently; towards a green economy; **and responding effectively to climate change**. All these priorities call for an integrated approach through various programmes and other multi-stakeholder initiatives in order to attain sustainable economic development.

It is thus in this light that the Mbhashe Local Municipality seeks to develop a Climate Change Strategy & Resilience Plan resulting from its recognition that climate action is “particularly important in rural areas, where the link between people and the environment that supports them (placing them at risk in terms of floods, droughts and fires) is far more direct in its area of jurisdiction than in more urbanised environments. Developing plans for regional development, taking into consideration how the climate may change is therefore crucial for informing all strategic and investment plans of the municipality”. The following were identified as key objectives by the municipality:

- To identify major causes and priority impacts of climate change in Mbhashe Local Municipality;
- To recommend means of addressing issues identified as priority impacts of climate change in Mbhashe Local Municipality with specific reference to health, water, agriculture, energy, and tourism sectors responding to climate change impacts;
- Set realistic climate change targets for clean energy which officials are required to report on;
- Set realistic targets for protecting wetlands, donga rehabilitation and land care;
- To ensure all projects within the municipal Integrated Development Plan are motivated for in terms of their contribution to climate change;
- To compile a literature review including all relevant legislation that affects the plan;
- Develop a Resilience Plan for Mbhashe Local Municipality;
- Develop an implementation plan including the objectives & strategies with identified time frames and costs;
- Develop a monitoring and evaluation plan with clear roles and methods; and
- Spatial mapping

FOREWORD BY THE EXECUTIVE MAYOR

FINAL DRAFT

“The air we breathe, the water we drink, the land we use, the energy we consume – sustainability is our increasingly strong remembrance that we share a civic responsibility not only to our neighbours here and living, but to generations that have yet to be born.”

- Martin O'Malley, 2007

EXECUTIVE SUMMARY

Change has become a reality and change always implies both opportunities and threats. South Africa has undeniably for many years been foremost among the world's most deeply polarized and pathologically stressed societies. The present document reflects the Mbhashe Local Municipality's commitment to climate change mitigation and adaptation, and its recognition of climate change as one of the major challenges currently faced by humankind. The hidden costs of climate change, and the costs of not responding, are substantial. Drags on our local economy such as higher costs for materials and insurance, infrastructure loss and damage, and strain on public services are consequences we must aim to avoid.

Climate change in rural areas will take place in the context of many important economic, social, and land-use trends. Impacts of climate change on the rural economic base and livelihoods, land use, and regional interconnections are at the latter stages of complex causal chains. Major impacts of climate change in rural areas will be felt through impacts on water supply, food security, and agricultural incomes. Migration patterns will be driven by multiple factors of which climate change is only one. Given these multiple drivers of migration (economic, social, political, demographic, and environmental) and the complex interactions that mediate migratory decision making by individuals or households, establishment of a relation between climate change and intra-rural and rural-to-urban migration, observed or projected, remains a major challenge. Climate policies, such as increasing energy supply from renewable resources, encouraging cultivation of biofuels, or payments under Reducing Emissions from Deforestation and Forest Degradation (REDD), will have significant secondary impacts, both positive (increasing employment opportunities) and negative (landscape changes, increasing conflicts for scarce resources), in some areas.

Through ensuring we have the clearest data, the most robust actions and the most realistic approach; by working together, accepting our limitations but developing our skills and abilities and by using sound communication and realistic economic appraisal whilst building on the best that our country and Mbhashe Local Municipality has to offer and the great work that has already been done, climate change is a challenge we can rise to. It is a problem we can face and an issue we can deal with. We can help reduce the changes and where we cannot; we can adapt to the impacts and deal with the consequences. This Strategy and Resilience Plan sets out why and how. It also begins to set out different roles and responsibilities for various sector departments within the municipality. Responsibility for ensuring the implementation of the strategy and action plan extends well beyond the Council and monitoring processes need to reflect this and include partners.

Since climate change is expected to affect all sectors of society in Durban, the response outlined in this strategy represents a Durban-wide response, which seeks to create an enabling environment for partnerships across different sectors and stakeholders. In order to realise this approach, the strategy content was developed through a participatory process that included the following key steps:

- **Initial phase of consultation:** In this phase, sector departments were invited to provide input on which climate change issues should be addressed by the Mbhashe Local Municipality in order to best address the challenges faced in their respective departments. This was done through internet-based surveys and, in some cases, face-to-face meetings and telephone interviews.
- **Analyses and close orientation with the Terms of Reference:** The key themes identified in the specification included: Water; Health; Agriculture; Energy; and Tourism. Some cross-

GLOSSARY

Adaptation: The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects. (IPCC AR5)

Ecological infrastructure: Naturally functioning ecosystems that deliver valuable services to people, such as climate regulation, water provision, improved water quality, flood management and fertile soils. It is the nature-based equivalent of built infrastructure and is as important in supplying basic services, socio-economic opportunities, and in underwriting human well-being.

Ecosystem services: Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.

Tonnes of carbon dioxide equivalent (tCO₂e): A measure for describing how much global warming a given type and amount of greenhouse gas may cause, using an equivalent amount of carbon dioxide (CO₂) as the reference (i.e. CO₂e). For example, methane is a greenhouse gas that has a stronger effect on climate change than CO₂. To be able to compare it with the effect of CO₂, it is converted into CO₂e. In this way it is possible to say that 1 tonne of methane has the same effect on climate change as 25 tonnes of CO₂, or 1t methane = 25tCO₂e.

Integrated Development Plan (IDP): In terms of South Africa's Municipal Systems Act, an IDP is defined as a strategic planning instrument that guides and informs all municipal planning and development in the municipality. It is a five year plan that consists of a long-term vision, and details the development priorities and objectives that contribute toward achieving this vision. These are implemented through allocation of budget, a process that must be linked with the IDP.

Gini coefficient: A measure of inequality of a distribution of income among individuals within a country. The higher the number is, the higher the inequality in that country is. A value of 0 represents a perfectly equal society, whereas a value of 1 indicates a highly unequal society.

Green economy: An economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive (UNEP Green Economy Initiative).

2. INTRODUCTION

Climate change is the wildcard in South Africa's efforts to maintain a functioning environment and the ecosystem services it provides for all human endeavor and particularly in the fight against poverty. Similarly, many countries in different parts of the African continent are facing urgent environmental threats to their economies due to the phenomenon of climate change. South Africa, despite its relative wealth and greater endowment of financial resources and infrastructure, also faces similar problems and threats to its economy. It is acknowledged in South Africa that climate change poses a range of human, environmental and economic security challenges that call for decisive and coordinated action by government. To this end, and in keeping with Goldblatt and Middleton's (2007) observation, the formulation of effective climate change responses requires 'multi-level governance' structures that span the entirety of the policy process. From the design of policy tools and interventions to their actual implementation, such a multi-level governance agenda must necessarily include the elaboration of these and other climate change interventions at local level as well; that is, at the level of municipal decision-making and responses to climate change.

The magnitude and immediacy of the challenge is presented by the opening words of the UNDP's Human Development report 2007-2008:

"What we do today about climate change has consequences that will last a century or more. The part of that change that is due to greenhouse gas emissions is not reversible in the foreseeable future. The heat trapping gases we send into the atmosphere in 2008 will stay there until 2018 and beyond. We are therefore making choices today that will affect our own lives, but even more so the lives of our children and grandchildren. This makes climate change different and more difficult than other policy challenges".

While much of the research carried out on the challenges of climate change has tended to focus on the international governance framework, particularly through analysis of governance instruments such as the 1997 Kyoto Protocol¹, it is clear that in order to reach the stipulated targets of the protocol, individual nation states would have to formulate, adopt and implement their own local policies and strategies. A global environmental and climate change governance regime is thus only as meaningful as the concrete policy steps that national governments take to realise these global goals. However, even as central governments establish extensive policy frameworks and responses to climate change, such efforts are often implemented by other levels of government, most notably at local level, where the effects of climate change are most immediately manifested.

As climate change, and the related environmental threats that it poses, increasingly become central to public debates on sustainable developmental strategies across Africa, it is important that an assessment is made of the role of local authorities in combating, managing, and adapting to these threats, especially as these local authorities are closer to the communities most immediately affected by the threats of climate change. However, an assessment of this nature must take into consideration the other (competing) social policy priorities that face local authorities, particularly in a post-apartheid South Africa, where these authorities are saddled with enormous responsibilities to address social service backlogs for impoverished communities.

It is thus in this light that the Mbhashe Local Municipality appointed Limitless Strategic Solutions (PTY) LTD t/a Limitless Advisory Professionals to conduct research and make science-based policy recommendations to enable the municipality to effectively address climate change challenges. Effectively addressing climate change requires a multi-pronged approach that drastically shifts from a business-as-usual approach. Firstly, there needs to be rapid investment in a national initiative to

support constant modelling of our vulnerability to and the consequences of climate change. Second, the government must develop adaptation plans to mitigate the worst impacts as we achieve insights into these and ensure these are rolled out. Third, although not yet required to do so, the government must take rapid steps to initiate a macro-policy response across all sectors to replace our reliance on fossil fuel energy and reduce South Africa's substantial contribution to the greenhouse gases responsible for climate change. All of these actions should not interrupt striving to attain South Africa's many other pressing obligations such as poverty reduction, economic development, and the need to provide for housing, electricity, and water for many of its citizens. Indeed, being proactive in combating climate change can provide the basis for a completely new range of economic benefits, by for example, massive investment (and thus job creation) in clean renewables such as solar. Thus fourth, in addition to critical and urgent adaptation and mitigation responses, there is a need to simultaneously, and equally quickly, grasp the opportunities presented by the global transition to a post-carbon society (Fuggle and Rabie, 2009).

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South Africa's constitutional structure divides the powers and functions of government into three parts – national, provincial and local. In terms of this division, the national government usually formulates broad policies and sets policy parameters for the country as a whole, while the provincial and local governments are mandated to formulate their own specific policies and programmes and to implement them within these national policy parameters. Broadly, this scenario holds for powers and functions that are enumerated and implied in the Constitution, except those that are allocated exclusively to each sphere of government. But even in those powers and functions that are allocated exclusively, the Constitution provides the national government with certain powers to override the provinces and municipalities for purposes of maintaining national norms and standards, uniformity, national security, economic unity of the country, and a number of other key considerations identified in section 146.

The area of environmental policy falls within the group of 'concurrent functions' allocated by the Constitution to be shared between the national and provincial spheres of government. However, even in this case, the usual practice is for the national government to set the broad policy framework,

including determining national norms and standards, while allowing the provinces (together with the municipalities falling within their areas of jurisdiction) to formulate and implement their own specific policies, programmes and strategies. Much of the focus of available studies is primarily directed at the opportunities presented by or limitations inherent in the Kyoto Protocol, with pressure to see a post-Kyoto consensus negotiated, as well as the development of appropriate national interventions. However, there continues to be a noticeable lack of focus, combined with what appears to be limited interest, in the role and capacity of local level government structures to deal with the challenges of climate change.

Under the Kyoto Protocol, South Africa – like all the other developing countries – has been classified as a Non Annex I country, meaning that the country is not obligated to comply with the Protocol's targets of reducing GHG. Some critics have argued that this provision is unfair, since the global fight against climate change should be undertaken by all countries, irrespective of their economic and development status. Furthermore, this differentiated approach to addressing the challenges of climate change has been identified as a possible impediment to reducing GHG emissions, since it fails to serve as a disincentive (by penalising) for developing nations that fail to adopt more ecologically sound economic development models. This differentiation under the Protocol is, however, justified on a number of grounds. Firstly, some of the leading developing countries argue that accelerated economic development cannot be achieved without the levels of industrialisation which are, to a significant extent, not ecologically sound. Indeed, they argue, developed countries themselves could not have reached their current levels of economic success had it not been for similar patterns and levels of industrialisation.

Secondly, it is argued that most developing countries do not have the financial resources and human capacity in terms of the necessary technical skills to invest in the types of technological innovation through which to introduce strategies for adapting to and mitigating the effects and impacts of climate change. For these countries, it is argued, the more pressing challenges are poverty alleviation and economic development and growth, both of which are unlikely to be adequately addressed in a context where onerous climate change mitigation steps – as expected of Annex I countries – are similarly imposed.

That said, however, South Africa represents an interesting case as the second largest emitter of carbon dioxide on the continent, after Libya. Owing to its predominantly coal-based energy production methods, the country “has one of the most carbon-intensive economies in the world” (Warburton et al 2007; DEAT 2006). South Africa is the second highest emitter of GHG in Africa, with carbon-dioxide emission levels that are higher than those of France, and tending towards those of Japan and the United Kingdom (UNEP/GRIDArendal, 2005).

South Africa has also been identified as one of the countries that will experience considerable water scarcity by 2025 (UNEP 1999). Turton (2008) notes that South Africa's levels of precipitation are about half the global average of 860 mm per year, a situation that he argues is likely to have dire consequences for the country's economic development and probably socio-political stability (as well as for the development of southern Africa more generally). Rather than being a peripheral side issue in policy debates in South Africa, Turton argues that the challenge of water security (as with other environmental concerns) should be treated as integral to the country's development policy goals.

The effects of climate change in South Africa are not limited to increased water scarcity in some parts of the country and drastic qualitative changes in the water supply, but extend to losses in biodiversity and rangelands, which impacts on maize farming and the agricultural sector, as well as possible increases in infectious and respiratory diseases. With these considerations in mind, it is clear why

South Africa is one of the leading role players in Africa on the challenges posed by climate change, having also agreed to commit to the recommendations and targets of a possible post-Kyoto climate change mitigation regime. However, critics of the South African government point to what they see as rhetorical commitments and mere declarations of intent, rather than real political will on the part of policy-makers.

2.1. CLIMATE CHANGE EXPLAINED

The Earth's climate is highly variable from place to place and over short and long terms. These changes have remained within a fairly consistent range through the last 10,000 years or so i.e. the period through which human society as we know it has developed. However, in the last century, and especially in the last few decades, a disturbing trend of continued warming of the global atmosphere has been recorded. Scientifically significant increases in global average air and ocean temperatures, widespread melting of ice, and rising global mean sea level are apparent. The Earth's average surface temperature has risen by over 0,7°C since 1850. The scientific evidence that this is as a result of human activity, largely industrialisation, is unequivocal – in its Fourth Assessment Report, published in February 2007, the IPCC projected that, without immediate action to reduce greenhouse gas emissions, the global average surface temperature is likely to rise by an additional 1,1 to 6,4°C this century. Even the lower end of this range would take the temperature increase since pre-industrial times above 2°C, the threshold beyond which irreversible and probably catastrophic changes become far more likely. Moreover, with so much inertia in the system, some of the impacts of climate change are inevitable.

The basic theory of climate change is relatively straightforward even if the consequences are complex and difficult to predict. The Earth's atmosphere acts as a transparent, protective covering to the planet, letting in sunlight and retaining heat. Without this 'atmosphere', the sun's heat would strike the Earth and rebound into space, leading to temperatures on Earth that would be approximately 30°C colder. The retention of heat within the atmosphere is known as the 'greenhouse effect'. Responsible for this effect are the 'greenhouse gases', primarily carbon dioxide, methane, and nitrous oxide. During the past 150 years or so, human activity (primarily industrialisation) has produced greenhouse gases in ever-increasing amounts. As a result, their atmospheric concentrations are much higher than 'natural', trapping more heat within the atmosphere and raising the planet's average temperature. While there is uncertainty about precisely how this global average will manifest itself regionally, on a global basis climate change will bring with it changes in temperatures, rainfall intensity and seasonality, drought, sea-levels, and generally more extreme weather.

The principal 'greenhouse gas' of global warming is carbon dioxide (CO₂) which is created in vast quantities by human activities that include the burning of fossil fuels such as coal, oil and natural gas. The global atmospheric concentration of CO₂ had increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. This exceeds the natural range over the last 650 000 years or more as determined from ice cores (± 180-300ppm) and whilst the difference appears small it is in fact a critical change in concentration in a gas which 'triggers' climate change. Other important contributors to global warming are methane (CH₄) and nitrous oxide (N₂O). These gases are released from human activities such as waste landfills, stock farming, rice cultivation and certain agricultural fertilization methods. In addition, fluorinated gases, sulphur hexafluoride (SF₆), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs), are manufactured for a variety of uses, including use in refrigeration and air-conditioning systems.

Climate Change is thus defined by the UNFCCC as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods”.

Global warming is defined by the UNFCCC as “the increase in the Earth’s temperature, in part due to emissions of greenhouse gases (GHG’s) associated with human activities such as burning fossil fuels, biomass burning, cement manufacture, cow and sheep rearing, deforestation and other land-use changes.”

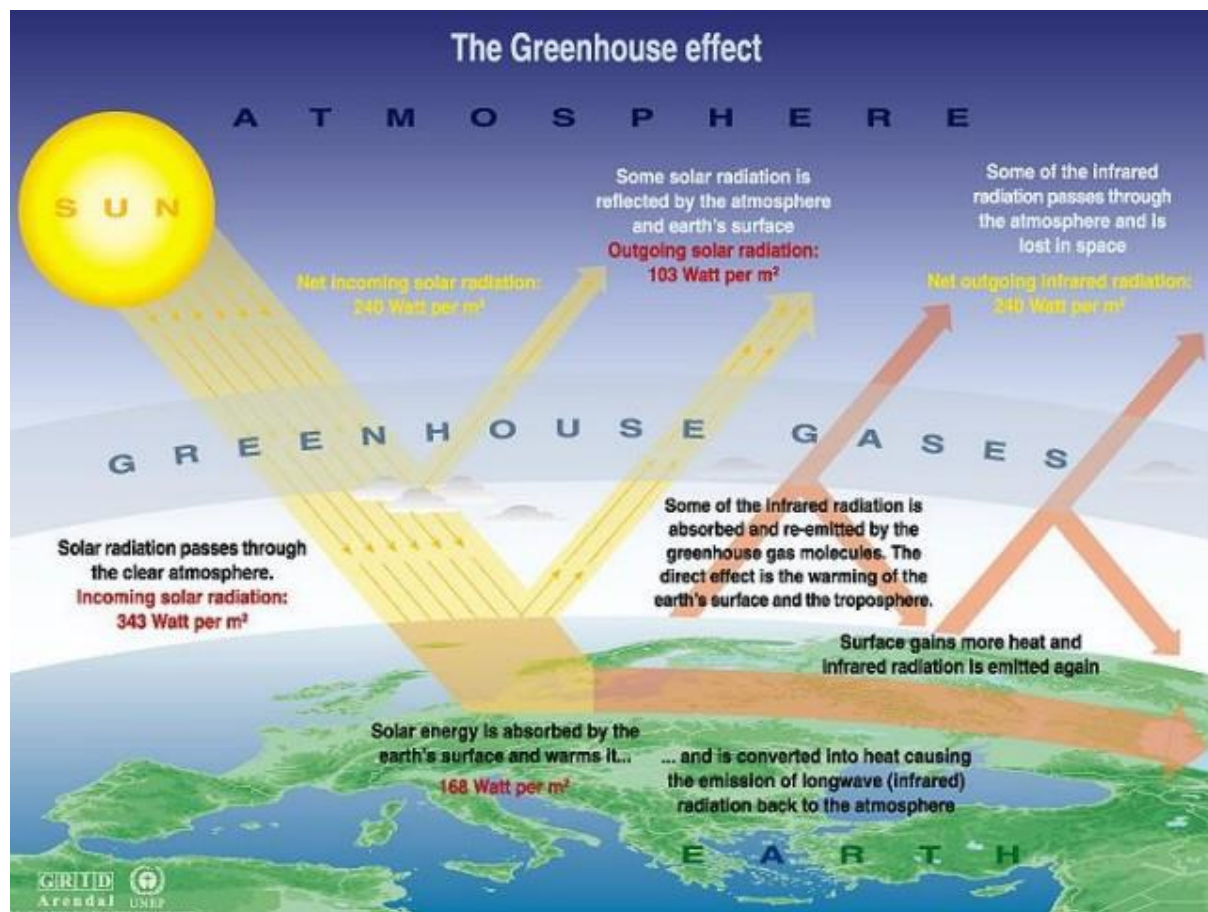


Fig.1. the Greenhouse effect (Source: United Nations Environmental Programme, 2009: adapted from the Amathole District Municipality Climate Change Vulnerability Report).

Ozone depletion is not to be confused with global warming, although they are connected. The ozone within the stratosphere performs the essential task of filtering out most of the sun’s biologically harmful ultraviolet (UV-B) radiation. High UV can lead to skin cancer and other health problems; affects terrestrial and aquatic ecosystems, altering growth, food chains and biochemical cycles, and has a negative impact on certain crops. Depletion of the ozone layer by man-made chemicals, primarily chlorofluorocarbons (CFCs), has been known for decades. CFCs have a variety of uses, including as coolant in air-conditioning units and as aerosol propellants in antiperspirants, hairsprays and deodorants. Some ozone depleting substances are also greenhouse gases. Ozone depletion of the stratosphere does not directly contribute to climate change but is related to it.

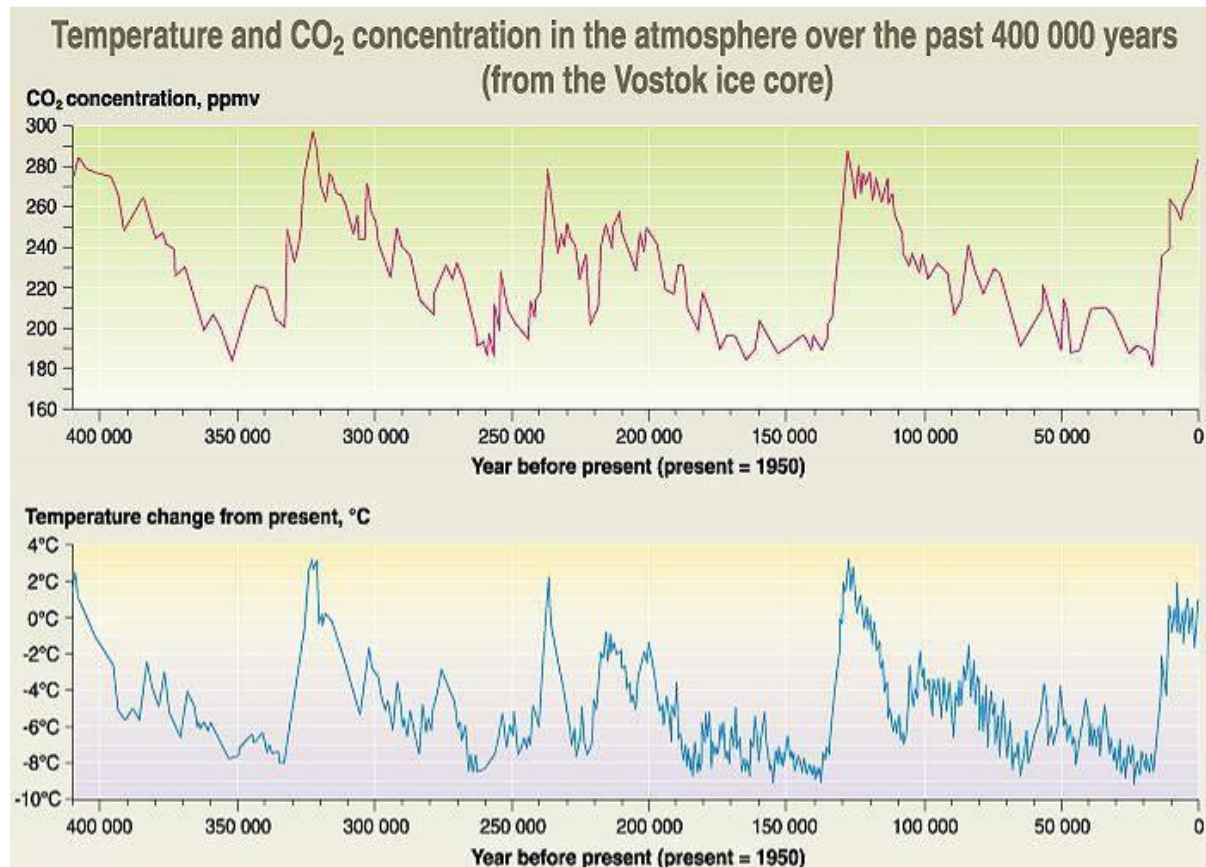


Fig. 2. Direct relationships between changes in the Earth's temperature and CO₂ atmospheric concentrations (Source: United Nations Environmental Programme, 2009)

2.2. CLIMATE CHANGE PHENOMENON FROM AN AFRICAN PERSPECTIVE

Africa regards the global climate change crisis as the defining development challenge of our time. From the evidence of science and the scenarios projected by the world climate experts and the community of scientists, it is acknowledged that Africa as a region will bear the greatest brunt and suffer the worst devastating effects from the virulent excesses caused by the world's most gigantic externality. African countries have been the aggrieved party all along considering that they virtually played no part in precipitating the menacing global threat. This has been all the more excruciating because the historic emitters have shown no factual interest in assisting Africa evolve resilient economics. Moreover, many of the historic emitters are expected by Africa to demonstrate greater sensitivity towards the principle of common but differentiated responsibilities, because their acceptance would mean subscribing to the canon of equity.

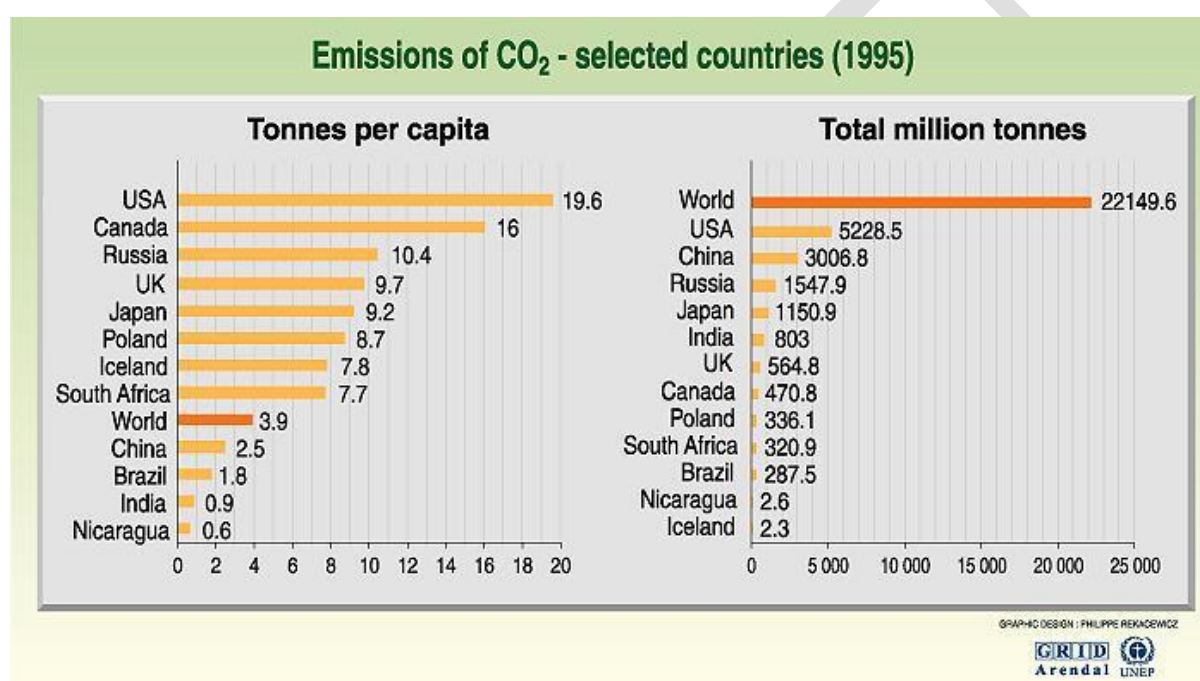
But Africa's deep commitment to global scientific evidence in appreciating the global gravity of the climate bogey is also demonstrated in the manner in which it has sought solutions to confront the climate externality. Africa thus regards science as the basis for decision-making whenever the challenge of climate change is to be comprehended or when solutions are to be developed.

Due to these adverse trends, climate models anticipate that Africa will experience a median temperature rise of up to 4°C in the 21st century. As noted above, Africa's adaptive capacity is extremely low. The region is bearing the brunt of climate excesses precipitated by forces of production outside our shores.

2.3. SOUTH AFRICA'S VULNERABILITY TO CLIMATE CHANGE

Not only does South Africa have one of the highest per capita greenhouse gas emission rates in the world and thus needs to take drastic action to reduce this, but the country will suffer the impacts of climate change more severely than many others. The 2007 IPCC report on impacts, vulnerability and adaptation to climate change in Africa, released by the Secretariat of the UNFCCC, indicates that Africa's vulnerability to climate change is greater than had previously been calculated. The consensus is that sub-Saharan Africa will experience the greatest negative effects of global warming and possesses the least capability and resources to adapt to these impacts:

"The impact of climate change will fall disproportionately on the world's poorest countries, many of them here in Africa. Poor people already live on the front lines of pollution, disaster, and the degradation of resources and land. For them, adaptation is a matter of sheer survival".



Source: International Energy Agency, 1996.

Fig. 3. South Africa's Emissions per capita (adopted from the ADM Climate Change Vulnerability Report)

As required by the Kyoto Protocol, in 200 South Africa submitted to the United Nations a report outlining the anticipated impacts of climate change on the country. The Initial National Communication report to the UN, based upon the information contained in the South African Country Studies Programme, stated that areas of greatest vulnerability to climate change are the health sector, maize production, biodiversity, water resources and rangelands. The report then proposed very generally, suitable adaptation measures to offset adverse consequences.

According to this report, potential changes to the South African climate over the next 50 years include: a warming of between 2-6°C over the next century, a potential reduction of approximately 5-10 per cent of current rainfall; increased daily maximum temperatures in summer and autumn in the western half of the country; increased incidents of flood and drought, and enhanced temperature inversions exacerbating air-pollution problems. The poor are the least able to mobilise resources to adapt to such dramatic changes and thus climate change is first and foremost a social imperative to address.

2.3.1. CONSEQUENCES OF CLIMATE CHANGE FOR THE HEALTH SECTOR

Climate change will bring serious health consequences to South Africa as the warmer temperatures facilitate the spread of several vector-borne diseases. For example, the area of the country prone to malaria is predicted to more than double in the next 50 years, putting 7, 8 million people at risk; 5,2 million of these people will live in areas not previously considered to be malarial. In addition, with the predicted flooding and temperature increases, the habitat for the snail host of schistosomiasis (bilharzia) will expand, thus also exposing a greater proportion of the population to this disease.

2.3.2. CONSEQUENCES OF CLIMATE CHANGE FOR THE WATER SECTOR

South Africa is a water-stressed country, officially classified as 'semi-arid' in receiving just over half the world's average annual rainfall and, even without climate change, demand is outstripping supply as the country's population and industrialisation grows. Many areas already suffer regular periods of drought (or simply lower rainfall than required, e.g. rain-fed crops). A warmer climate will alter the intensity and seasonality of rainfall, leading to increasing water shortages, increased desertification, and, at times, flooding. While some regions may receive more surface water flow, water scarcity, increased demand for water and water quality deterioration are very likely to be increasing problems in the future. The arid and semi-arid regions, covering more than half of South Africa, are particularly sensitive to changes in precipitation. Desertification, which is already a problem in South Africa, will be exacerbated as climate changes.

2.3.3. CONSEQUENCES OF CLIMATE CHANGE FOR RANGELANDS

Rangelands are a landform whose natural vegetation is dominated by grasses and shrubs; they are not usually used for growing annual crops (such as corn) but for grazing. As patterns of precipitation shift with warmer temperatures, the productivity of the rangelands will decline, having a negative impact on the cattle-ranching industry. Moreover, animal disease will spread, causing additional losses. Drier grasslands will lead to rangeland fires of increased intensity.

2.3.4. CONSEQUENCES OF CLIMATE CHANGE FOR MAIZE PRODUCTION

Maize production, contributing around 70% of South Africa's total grain production, is predicted to fall by up to 20% over the next 50 years as a result of the hotter and drier conditions, even as growing population increases food demand. Diseases and pests that threaten the maize crop are likely to be greater problem as temperature rises.

2.3.5. CONSEQUENCES OF CLIMATE CHANGE FOR COMMERCIAL FORESTRY

As only 1, 5% of South Africa's land is suitable for commercial afforestation, the reduced rainfall and higher temperatures brought by global warming will have significant negative impacts on the forestry sector. The already limited land suitable for timber crops will shrink, as will the associated timber industries, such as pulp mills and saw mills.

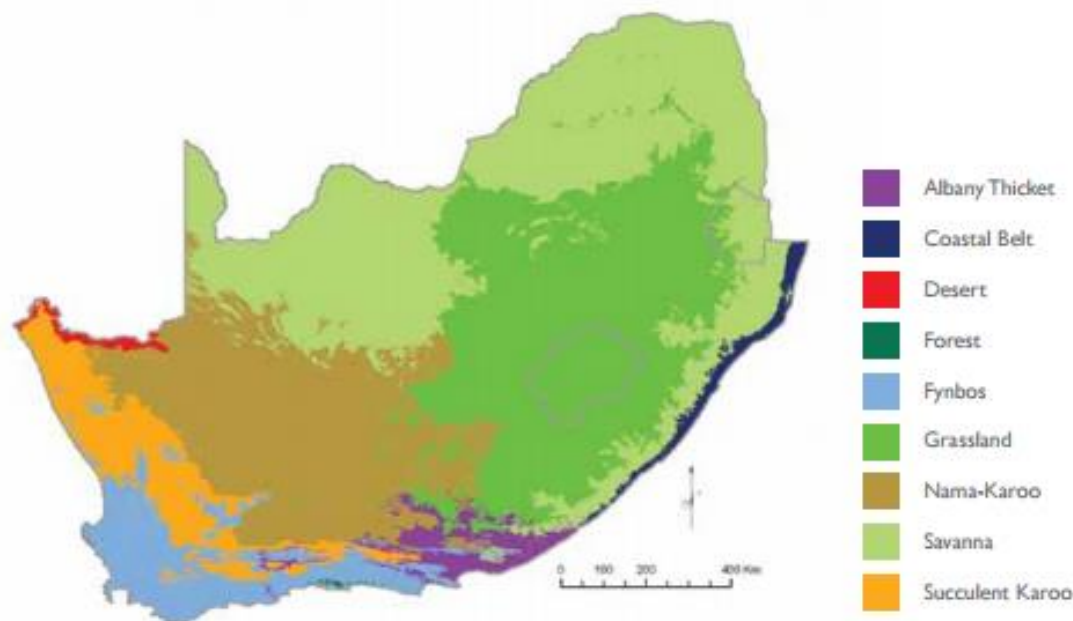
2.3.6. CONSEQUENCES OF CLIMATE CHANGE TO BIODIVERSITY

The impacts of climate change on biodiversity are expected to be severe. Plant and animal species and biome distribution depend largely on the climate, including rainfall amounts and seasonality and temperature range. With the predicted shift in climate, the current biomes of South Africa are predicted to shrink by up to 55% of their current area by the year 2025.

The changes to particular South African biomes over the next 50 to 100 years are predicted to be as follows:

- *Succulent Karoo*: expected to become so dry that it will largely turn into a desert environment unsuited to the species of which it is currently comprised.
- *Grasslands*: a warmer climate will allow woody plants to move into grasslands, transforming them into savanna.
- *Nama-Karoo*: predicted to become drier and more desert-like, especially in the west.
- *Fynbos*: the rich flora of the fynbos, recognised as one of the six floral kingdoms of the world, will be transformed as the warmer temperatures cause the northern portion of the biome to disappear and kill the more drought-sensitive plants. Many endemic species will become extinct. The range of most fynbos plants will both shift and decline as the plants attempt to move to higher altitudes in search of cooler temperatures; potential ranges are very limited however, and habitats available and suitable for dispersal are highly fragmented.
- *Savanna*: the savanna consists of a wide range of vegetation types, usually with large populations of macro-herbivores. As climate changes, the distribution of the vegetation upon which these herds rely will change, altering the area's ability to support the current diversity of game.

The South African National Biodiversity Institute (SANBI) undertook to identify which ecosystems are most vulnerable to climate change and how climate change will affect ecosystem processes and species. Vivid representations of these data are set out in the maps below.



Map. 1. The biomes of South Africa (adapted from Cadman et al 2010)

Economic activity, human security, health, well-being and quality of life depend on healthy functioning and biodiverse ecosystems. Ecosystems provide important services to society, such as the formation of soil; the provision of food, fresh water, wood, fibre and fuel; the regulation of climate, flood and disease; protection from storm surges and floods; and a range of cultural, spiritual, educational and recreational services. While biodiversity and healthy ecosystems provide wide-ranging benefits to society on the whole, many communities globally, and especially in Africa, depend directly on the

products from local ecosystems for the majority of their food, energy, water and medicinal requirements (Murombedzi, 2008).

Climate change poses severe challenges for ecosystems, both as a direct threat and by heightening their existing stresses, which include degradation of habitat and landscapes through vegetation clearing, introduced pest animals and weeds, highly modified and overcommitted water resources, altered fire regimes, widespread use of fertiliser and other chemicals, urbanisation, mining and, for some species, over-harvesting. The degradation of ecosystems affects their ability to deliver ecosystem services, which in turn has a direct negative impact on human well-being as well as socio-economic conditions, especially for the poor. Climate change is likely to cause stress to ecosystems by altering their functioning and by compromising individual species (IPCC, 2007c).

The potentially adverse environmental and social impacts of these changes can be offset to some degree by applying principles that enhance the potential for ecosystems to adapt to a changing climate, which by extension includes maintaining the biodiversity within those ecosystems. This set of principles is termed 'ecosystem-based adaptation'. In order for policymakers and practitioners involved in biodiversity and ecosystem management to design appropriate policy and management measures that support ecosystem-based adaptation, there is a critical need to assess the vulnerability of ecosystems and their component species to climate change and its associated impacts. 'Vulnerability' in this context can be defined as the degree to which an ecosystem is exposed and susceptible to the adverse effects of climate change, including climate variability and extremes, which is offset by its 'adaptive capacity', defined as the extent to which an ecosystem can reduce its exposure and/or its susceptibility to these adverse effects (Madzwamuse, 2010). Vulnerability assessments serve as a guide for spatially prioritising species conservation, ecosystem protection, and ecological restoration, and can facilitate the development of appropriate adaptation measures that can be integrated into existing sustainable development strategies.

3. SITUATIONAL ANALYSIS

3.1. LOCALITY CONTEXT

Mbhashe Municipality (EC 121) is a category B municipality which falls within the Amathole District Municipality (ADM) and consists of 31 wards and 61 Councillors. The municipality is strategically located in the South Eastern part of the Eastern Cape Province, and is bound by the Qhora River in the south to Mncwasa River in the north along the Indian Ocean.

Mbhashe occupies a strategic geographic position within the Amathole District municipality and covers approximately 3200 km² in extent (after the last national elections). It is estimated that the new additions of few villages from Intsika Yethu and Mnquma could be estimated to about 200 square kilometres of land. There are three main urban centres, namely Dutywa, Willowvale (Gatyana) and Elliotdale (Xhora). Dutywa is the administrative head centre of the municipality.

Mbhashe has earned the name from the beautiful river called Mbhashe which flows from the banks of Ngcobo flowing through Dutywa, Gatyana (Willowvale) and Xhora (Elliotdale). Mbhashe is comprised of the three towns of Dutywa, Gatyana and Xhora and numerous rural settlements. The area also boasts the head offices of the AmaXhosa Kingdom at Nqadu Great Place.

The statistics also reveals that the population is female dominating with a Male to Female ratio of 46:54, which is graphically presented in below figure.

Population Distribution by Gender

Total Population 254,909

Ref: Stats SA Census 2011

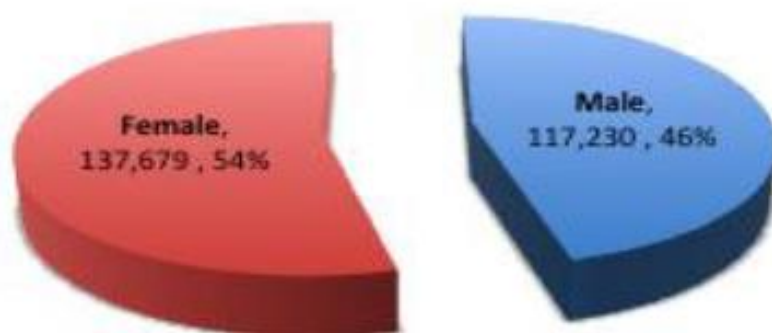


Fig. 4. Population Distribution by Gender

3.2.1.2. ENERGY SOURCES

Mbhashe is earmarked as populated with the highest number of poor population in the province of Eastern Cape, which is revealed by the 2011 Stats SA Census that identifies that the unemployment rate as 93%. This is the result of high illiteracy rate. Only 5% of population engaged in the formal sector and at 1% in each of informal and private households.

According to the Stats SA Census 2011, electricity is used by about 50% households for lighting, which in other words mean that the electricity backlog is about 50% (30 262) of households. Wood is used predominantly for cooking and heating purposes at 40% and 50% of households respectively, causing a high pressure to environmental balance. For cooking next favourite is electricity 37% followed by paraffin at 15%. Paraffin and Candle are competing at 14% each for lighting next to electricity. Paraffin and electricity are the second and third sources of heating at 23% and 15% respectively.

Source	Cooking	Lighting	Heating
None	131	288	4,331
Electricity	22,096	29,862	8,990
Gas	1,936	237	730
Parafin	9,119	14,988	14,100
Candle	-	14,621	-
Wood	24,348	-	30,148
Coal	125	-	646
Animal dung	2,170	-	1,112
Solar	84	128	58
Other	115	-	9
Total	60,124	60,124	60,124

Table 2: Sources of Energy (adopted from the Municipal IDP, 2016:37)

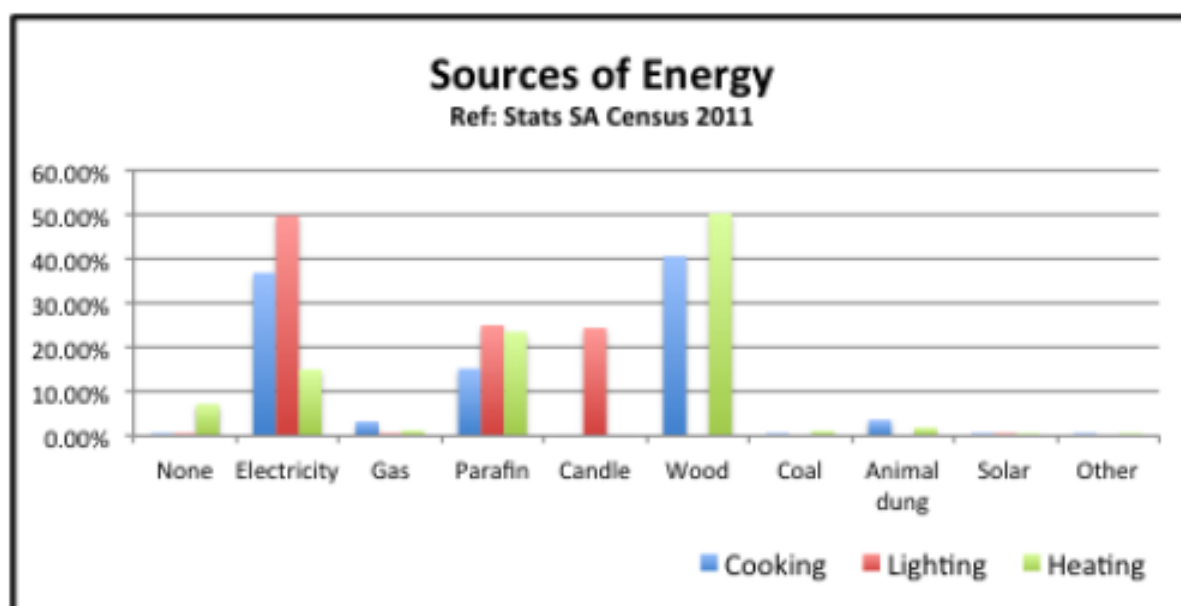


Fig. 5. Sources of Energy (adopted from the Municipal IDP, 2016:37)

3.2.1.3. ACCESS TO WATER

Source	Household	Percentage
Water Schemes	10,610	18%
Boreholes	1,932	3%
Spring	1,228	2%
Rain Water Tank	9,720	16%
Dam/Pool/Stagnant Water	1,760	3%
River/Stream	30,518	51%
Water Vendor	593	1%
Water Tanker	2,797	5%
Other	966	2%
Total	60,124	100%

Table 3. Household by Water Source (adopted from the Municipal IDP, 2016:38)

Only 21% households has access to piped water supply in the form of water schemes (18%) and boreholes (3%) resulting a backlog of 47 882 (79%) households. The main water sources as used by households are river/ or stream (51%) followed by rainwater (16%).

The use of sources by households is presented in the figure below.

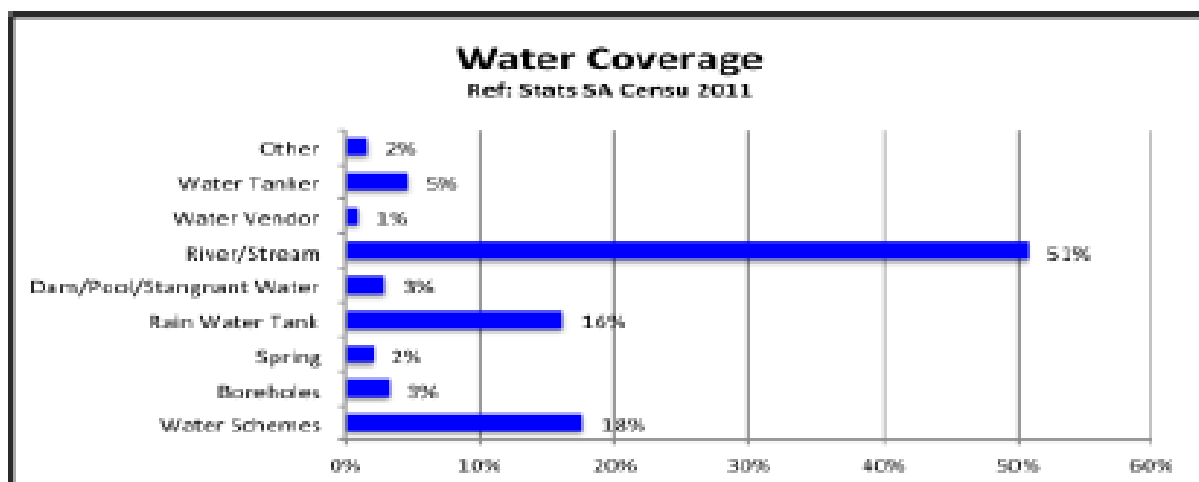


Fig. 6. Household coverage by water source (adopted from the Municipal IDP, 2016:38)

3.2.1.4. ACCESS TO SANITATION

Households covered by waterborne sanitation are only 4% and only in core area of Dutywa town one of 3 of the municipal towns. Considering waterborne, Flush Tank (septic tank), Chemical Toilet, VIP and Pit Latrine as hygienic sanitation systems, due to vast rural areas of the municipality, the total sanitation coverage is 42% resulting 58% (35 086 households) backlog. It is worth noting that 45% (27,288) households do not have any means of sanitation facility causing pollution to environment.

Sanitation Category	Household	Percentage
Flush Toilet (Sewerage)	2,261	4%
Flush Tank (Septic Tank)	460	1%
Chemical Toilet	1,897	3%
VIP	8,533	14%
Pit Latrine	11,887	20%
Bucket Toilet	336	1%
Other	7,462	12%
None	27,288	45%
Total	60,124	100%

Table 4. Sanitation coverage (adopted from the Municipal IDP, 2016:38)

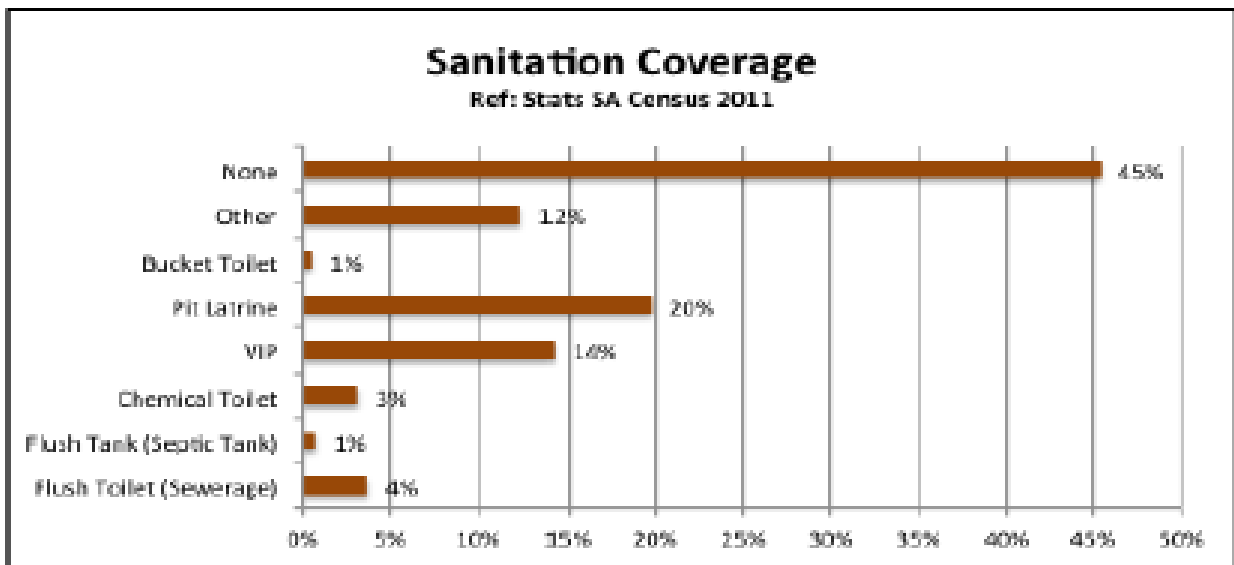


Fig. 7. Sanitation coverage (adopted from the Municipal IDP, 2016:39)

Many people in the Mbhashe Local Municipality are unable to access adequate water – i.e. ‘social water scarcity’, however the municipality forges on with its commitment to provide its citizens with adequate water and sanitation services, even as the backlog grows and even in the face of complex dynamics as a result of the mostly rural nature of the municipality. The unenviable legacies of the erstwhile government also lays a huge burden on Mbhashe Local Municipality in that there still exists great spatial separations and disparities between towns, townships and rural areas, and urban sprawl increase the costs of service provision and transport enormously. There are huge backlogs in service infrastructure in Mbhashe, requiring municipal expenditure far in excess of the revenue currently available within the local government system.

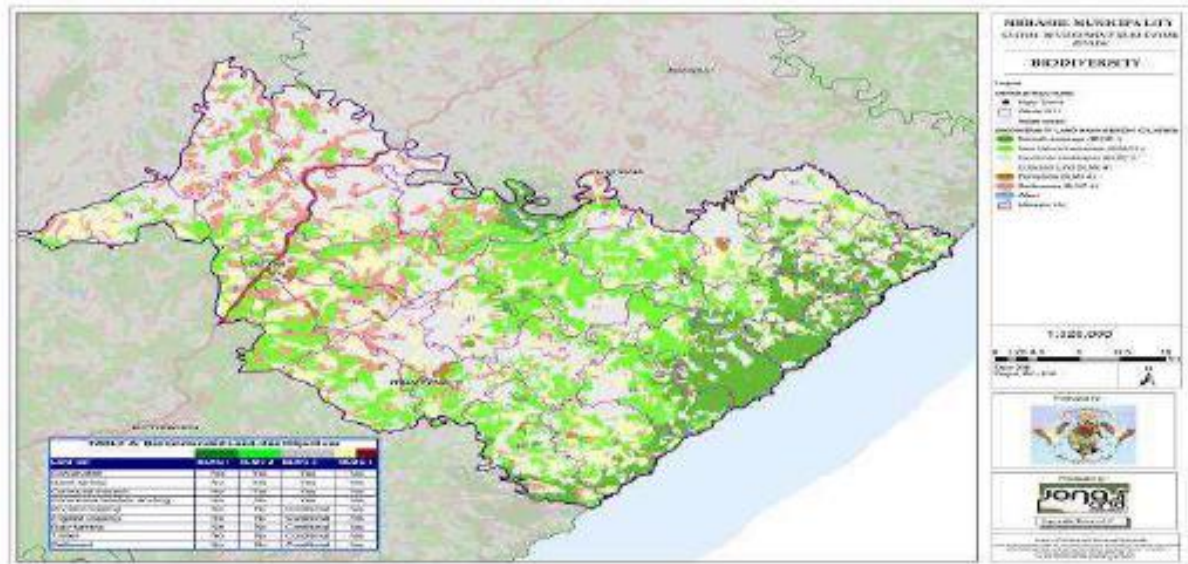
It then becomes increasingly critical that as we move towards a more just and sustainable society and one that is resilient to climate change, we understand the complexity of factors leading to water scarcity at a household level. Thus we need to expand our thinking to incorporate concepts of ‘social’ water scarcity beyond traditional understanding of resource and infrastructural scarcity.

“In South Africa inequality in access to basic services was, and still is, a stark reality, in spite of South Africa being a middle income country. At the dawn of democracy there were some 12 million people without adequate water and 20 million people without adequate sanitation services. However, our inequalities have specific historical roots and our ability to deal with the services backlog is greater than most developing countries. South Africa has made great strides in reducing this gross inequality. It is estimated that more than 10 million people have been provided with basic water supplies in rural and urban areas during the last eight years. This is an impressive achievement. Unfortunately progress with sanitation has been much slower and great challenges remain. Some 38% of the population is still without adequate sanitation.”

3.3. BIO-PHYSICAL ENVIRONMENT

The biodiversity of Mbashe shows that most of the natural and near-natural landscapes are located along the coast and adjacent interior. The more degraded areas are found in the north-western portion of Mbashe.

The map below confirms the above assertion:



Map. 3. Mbashe Land Cover Map (adopted from the Municipal SDF)

Land cover indicates that there are large tracts of degraded land in the northern portions of Mbashe, and that there is evidence of semi-commercial / subsistence farming with pockets of agricultural land across the municipal area. The southern portion of Mbashe adjacent to the coast is characterised by large forested areas and rivers dissecting the landscape, posing problems for access and settlement.

*“Changing land cover is a phenomenon that is growing in magnitude and significance, both globally and in South Africa. Changes in land cover include the conversion of natural vegetation to agricultural crops and forest plantations, changes to natural vegetation through bush encroachment and overgrazing, soil erosion, invasion by alien plant species, and accelerating urbanisation. **Land-cover changes increasingly relate to climate and atmospheric changes** in ways that are currently poorly understood but potentially significant, especially in terms of compromising or enhancing the delivery of vital ecosystem services from rangelands, agricultural croplands, water catchments and conservation areas.”*

Some of the services provided by biodiversity assets and ecological infrastructure that assist in the delivery of municipal services and augment the adaptive capacity of Mbhashe Local Municipality include:

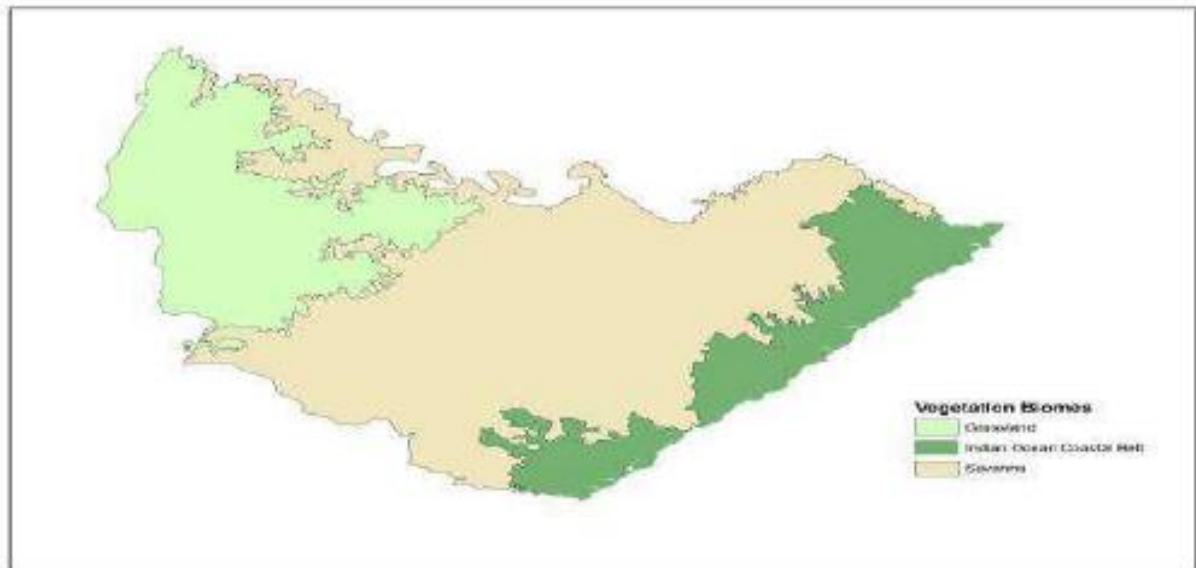
Municipal function	Functions provided by biodiversity assets and ecological infrastructure
Water and sanitation	<p>Water supply: Effective biodiversity conservation facilitates the maintenance of water supply. Poorly maintained ecosystems can result in less and poorer quality water downstream.</p> <p>Water quality: The vegetation and soils in healthy wetlands can help to improve water quality. Healthy ecological infrastructure can reduce expensive investments into water purification.</p> <p>Reduced erosion: Soil protection provided by vegetation reduces the siltation of rivers and dams, lengthening the life of existing built infrastructure, such as dams.</p>
Roads and transport	<p>Flood prevention: Frequent heavy rainfall results in overflowing drains and urban flooding, damaging roads and infrastructure. Properly restored or maintained wetland ecosystems can absorb a proportion of the floodwater and reduce damages.</p>
Solid waste	<p>Breakdown of pollutants: If there is a human settlement or livestock rearing in a catchment, then the effluent needs to be adequately managed. Ecosystems such as wetlands can support engineered solutions by filtering effluents and breaking down toxins and pollutants. Through the biological activity of micro-organisms in the soil, most waste is broken down and pathogens eliminated.</p>
Housing delivery	<p>Product source: Ecosystems provide a great diversity of materials for construction and fuel.</p>
Disaster management	<p>risk</p> <p>Buffer from extreme weather: Ecosystems create buffers against natural disasters, thereby preventing or reducing damage from extreme weather events or natural hazards including floods, storms, etc. Fore-dunes in coastal systems may protect buildings from storm surges but poor planning will not allow these systems to function properly.</p> <p>Reduced fire risk: Fires are common in grasslands and fynbos. Control of invasive plants may help reduce fuel loads and thus reduce the risk of high-intensity, unplanned fires.</p> <p>Climate change resilience: Healthy ecosystems are likely to improve the climate change resilience of urban and rural areas.</p>

Health	<p>Medicinal plants source: Biodiverse ecosystems provide many plants used as traditional medicines as well as providing raw materials for the pharmaceutical industry.</p> <p>Air quality regulation: Trees and green spaces lower the temperature in cities and play an important role in regulating air quality by removing carbon dioxide and other pollutants from the atmosphere.</p> <p>Recreation: Natural areas provide for healthy recreational options for the human population.</p>
Agriculture	<p>Food security: Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems, while marine and freshwater systems, forests and urban horticulture also provide food for human consumption.</p> <p>Soil protection: Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply soil with nutrients required to support plant growth.</p> <p>Pollination: Insects and wind pollinate plants, which is essential for the development of fruits, vegetables and seeds.</p> <p>Pest control: Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural pest controls.</p> <p>Grazing lands: Biodiversity contributes to ecosystem function, landscape resilience and water quality, and consequently to the sustainability of the grazing enterprise.</p> <p>Reduced fire risk: Control of weeds help reduce fuel loads and thus reduce the risk of high intensity unplanned fires.</p>
Economic development/Tourism	<p>Species habitats: Each ecosystem provides different habitats that can be essential for a species' lifecycle. Species of economic importance rely on intact habitats.</p> <p>Eco-tourism: Natural areas play an important role for many kinds of tourism, which can provide considerable economic benefits, poverty alleviation and job creation.</p>

Table 5. Benefits of Biodiversity (adopted from the SANBI Municipal Strategy, 2015)

There is overwhelming evidence that climate change will lead to a loss in Biodiversity. The predicted changes in the natural environment for South Africa include a reduction in the ranges of species by up to 80% as well as 30% of endemic species being increasingly vulnerable to extinction.

Projected changes to the Biomes within the Mbashe Municipality are shown in the map below:



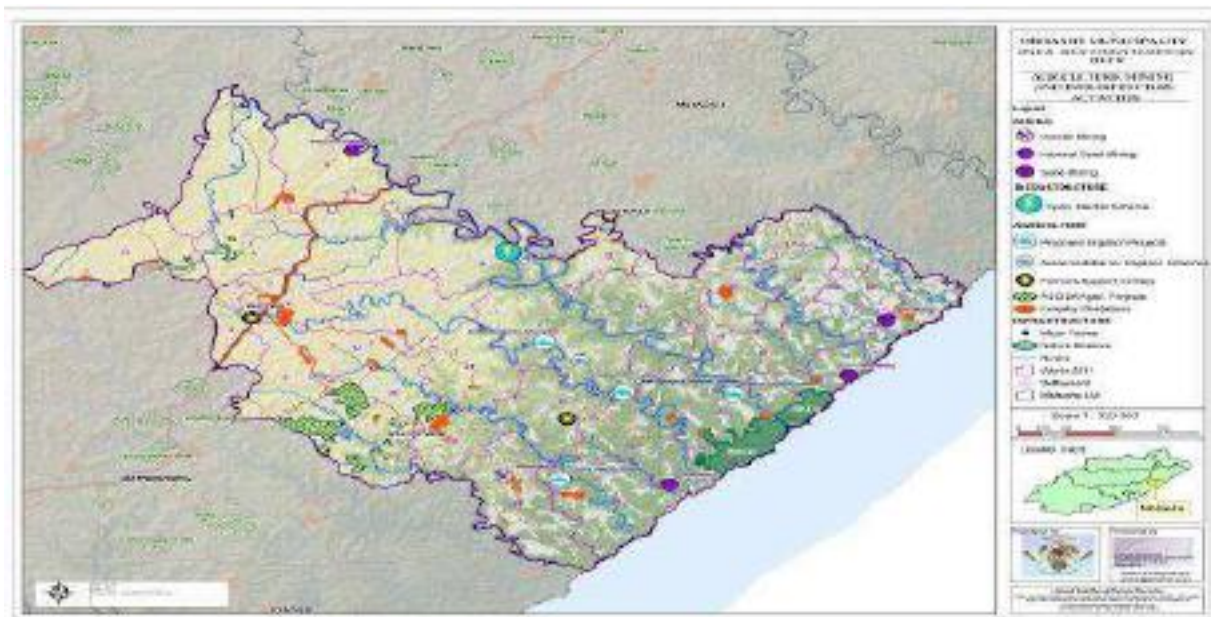
Map. 4. Biomes in the Mbashe Local Municipality (adopted from the Municipal IDP, 2016:46)

The three Biomes in Mbashe are Indian Ocean Coastal Belt, Grassland and Savanna (Mucina and Rutherford, 2010). Due to increasing temperatures and changes in trends of precipitation resulting from climate change, species richness may be reduced. In addition, the Grassland Biome is likely to be reduced in spatial extent, while the spatial area of the Desert Biome is predicted to increase (UNEP, 2011). The decreased spatial extent of the Grassland Biome is also likely to be reduced due to the invasion of trees and woody species. This would ultimately lead to a shift towards Savanna type characteristics.

Possible responses to mitigate against the effects on the biodiversity and tourism sector include:

- I. Awareness regarding the worth of utilising biodiversity to help in societal adaptation to the effects of climate change, needs to be increased
- II. The establishment and expansion of protected areas needs to happen, as well as the creation of partnerships to allow for the effective management of areas which are not formally protected, particularly those in the Grassland Biome.

The most important agricultural and mining activities are indicated on the plan below:



Map. 5. Agricultural and Mining Activities in Mphashe (adopted from the Mphashe Municipal IDP, 2016:29)

3.3. ANTICIPATED CLIMATE CHANGE IMPACTS FOR MBHASHE LOCAL MUNICIPALITY

A brief synopsis of anticipated climate change impacts can be drawn from the specialist report developed to inform the SDF review process for the Mphashe Local Municipality. Specialist climate change tools, literature and data was also reviewed, and based primarily on the Long Term Adaptation Scenarios (specifically for the Mphashe Local Municipality), the following climate change impacts, with high confidence, can be said to be inevitable:

- I. An approximate increase in median temperature of 1.8 - 2 Degrees Celsius during the summer months and approximately 1.6 – 1.8 Degrees Celsius increase during winter
- II. An increase in winter monthly rainfall by 10 - 15 mm and 25 - 50 mm in the summer
- III. The above climate changes could imply that Mphashe Municipality is faced with the following:-
- IV. More frequent and severe flooding as a result of higher intensity storm events and possibly more frequent hail events. This will and will impact on human settlements, infrastructure, human health and place a greater burden on particularly impoverished communities
- V. Higher rainfall may increase agricultural production but water availability could become a limiting factor, requiring increased irrigation. Ground and surface water systems are vulnerable. In this regard small scale farming is likely to be most affected
- VI. Heat waves may result in increased heat stress to plants, animals and humans and will increase associated fire risk placing livestock and grazing capacity under threat.

Furthermore, the Northern Parts of Mphashe are more prone to drought, as evidenced by the recent events and the severe 2015 drought.



Fig. 8. Drought in Mbhashe Local Municipality (Daily Dispatch, 2015)

Drought is a normal recurring event that affects the livelihoods of millions of people around the world and it is regarded as the most important natural disaster in economic, social and environmental terms (Buckland, Eele & Mugwara 2000). A serious drought or a series of consecutive droughts can be a disaster-triggering agent that exacerbates social and economic problems and reduces the overall livelihood security of a society (FAO 2004). These problems are most severe where economies are least diversified and almost everyone depends either directly or indirectly on agriculture, as is the case in Mbhashe. According to the SADC (1999), extended periods of drought can have primary and secondary effects particularly on the household and national economic levels. Drought is among the most costly of all natural disasters as it ranks first in degree of severity, length of event, total areal extent and social effect when compared to other hazards (Wilhite, 2000).

There are four types of drought:

Meteorological: From the meteorological point of view drought exists when rainfall is abnormally low. Meteorological drought is expressed solely on the basis of the degree of dryness in comparison to some normal or average amount and the duration of the dry period. Thus, intensity and duration are the key characteristics of this type of drought. Definitions of meteorological drought are region-specific, since the atmospheric conditions that result in deficiencies of precipitation are highly region-specific. That explains the reason why it is not possible to apply a definition of drought developed in one part of the world to another without any modifications.

Agricultural: Agricultural drought exists when soil moisture is depleted to the extent that crop and pasture yields are considerably reduced (Bruwer 1990; Solanes 1986). **Agricultural drought**, which is of pertinent interest in the Mbhashe Local Municipal area where most of the population is directly dependent on subsistence agriculture; links various characteristics of meteorological (or hydrological) drought to agricultural impacts. Crop growth depends on prevailing weather conditions; Biological characteristics of the specific plant; its stage of growth; and the physical and biological properties of the soil.

Hydrological: In hydrological terms drought exists when the actual water supply is below the minimum for normal operations and reflects a deficit in the water balance (Bruwer 1990; Solanes 1986). Research used by Hazelton et al. (1994) regarding hydrological drought shows that Cunha (1983) supports this where he states that drought occurs when there is a deficit in water, including not only precipitation, but also surface and sub-surface water runoff and storage. Hydrological droughts usually lag the occurrence of meteorological and agricultural droughts because more time elapses before precipitation deficiencies are detected in reservoirs, groundwater and other components of the hydrological system.

Socio-economic: socio economic drought exists when demand for water exceeds supply, usually over an extended period (Solanes 1986). To support this definition Cunha et al. (1983) in Hazelton et al. (1994), also states that socio economic drought occurs when a significant water deficit takes place that is spread both in time and space.

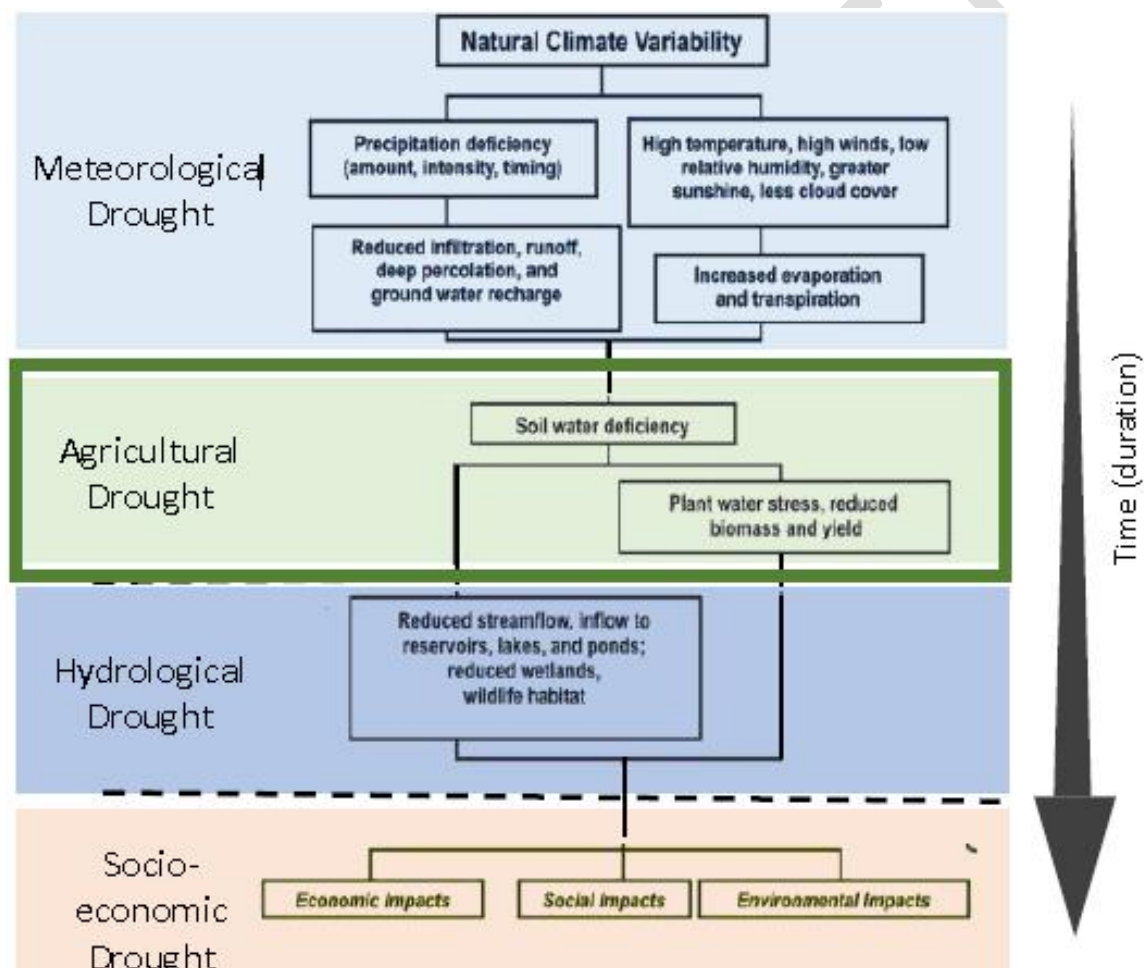


Fig. 9. The different types of drought (adopted from the National Drought Mitigation Centre, 2012)

According to Nowers (1998), the Eastern Cape not only has the biggest cattle and sheep herds in South Africa, but it is also where communal farming is practised on the largest scale. In January 2004, the Eastern Cape Province was one of the six provinces of South Africa that was declared as disaster area by President Thabo Mbeki. The majority of the community in ADM are living in fragile and vulnerable conditions because of the high level of poverty, low standards of living, environmental degradation, poor 10 household economies and lack of access to resources. The whole district experiences very low, erratic rainfall and drought is a common occurrence (ABEM 2006).

Drought is not instantaneous, but associated with a progressive deterioration of conditions (Drought Policy Review Task Group 1990). It can be argued that early intervention would minimise losses and the damage control costs. The character of drought is distinctly regional, reflecting unique meteorological, hydrological, agricultural and socio-economic characteristics (Wihlilite 1993). Drought is furthermore, crop specific, as energy flow differs between ecosystems (Fouche 1992). Schulze (1987) argues that drought should be understood regionally and locally in terms of supply and demand, as well as on long term balances in nature.

The recent droughts in Mbhashe, had the following negative impacts:

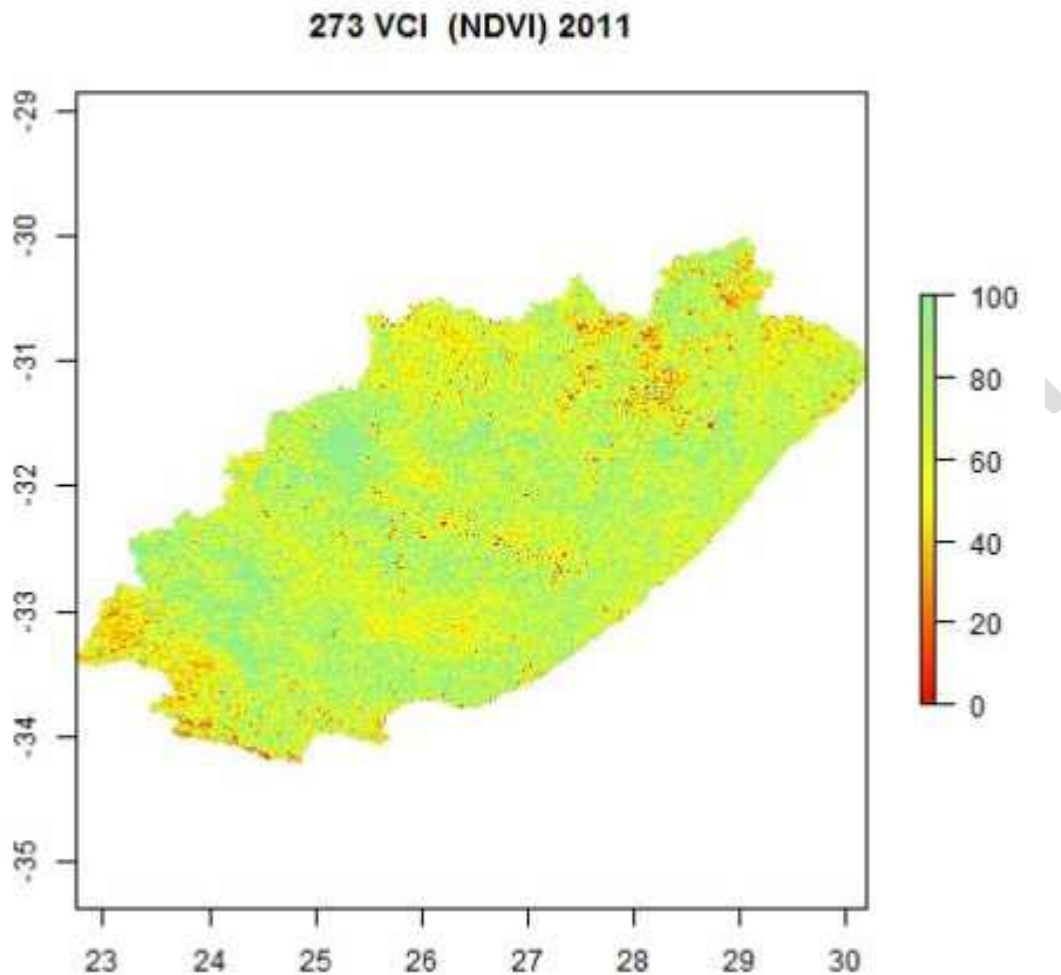
- Very limited crops were planted in communal areas and food security was threatened due to reduced harvest
- Veld fires had a detrimental effect on vegetation growth and that resulted in the malnutrition of livestock
- In some areas stock water dams were empty, fountains dried up and the flow in rivers was very low. Large numbers of livestock were without water supply and had to travel long distances to look for drinking water.

LOCAL MUNICIPALITY	POPULATION AFFECTED	NATURE/EXTENT OF WATER PROBLEM	TOTAL COST ESTIMATES INCL. VAT
Mbhashe	125 000	Unequipped boreholes and contamination of perennial springs.	R1 902 900
Mnquma	85 000	Unequipped boreholes and contamination of perennial springs.	R1,200,600
Great Kei	20 000	Dry boreholes at Mooiplas water supply schemes.	R495,900
Ngqushwa	25 000	Unequipped boreholes and contamination of perennial springs.	R290,400

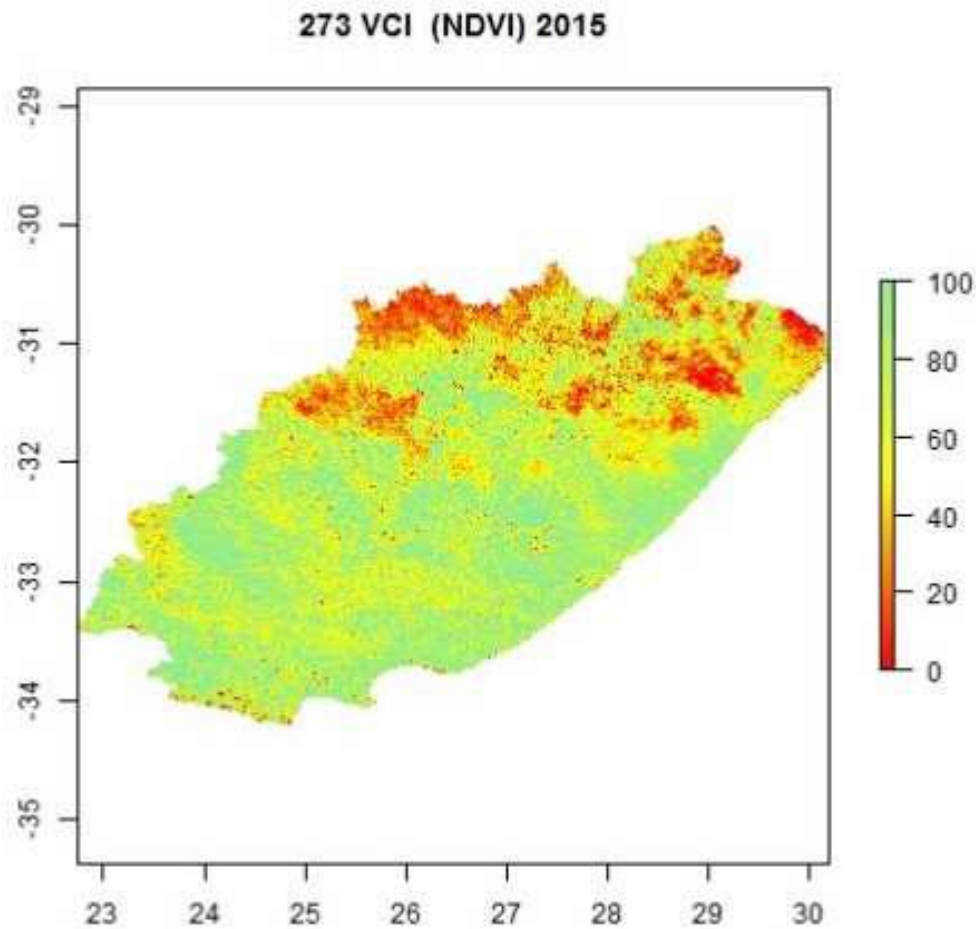
Table 6. Details of Drought Victims and the Financial Costs to Address Water Shortages (adopted from DWAF)

According to the then Department of Water Affairs (DWAF) 125,000 people were negatively affected in the 2004 drought and subsequent effects due to unequipped boreholes and contamination of perennial springs; which cost the municipality R1, 902,900. Severe past drought events took place in 2015/16; 2009/10; 2004/05; and 1991/92. In 2015/16 drought disaster was officially declared in 8 out of 9 provinces (SABC 2016).

In order to provide a valuable insight on water availability and vegetation health during cropping seasons and in addition to rainfall estimates and Normalised Difference Vegetation Indices; the following maps provides a contrast between a normal year of crop production and a year affected by a dry spell, or drought:



Map. 6. VCI (NDVI) from MODIS13Q1 (normal year: 2011/2012)



Map. 7. VCI from MODIS13Q1 (drought year: 2015/2016)

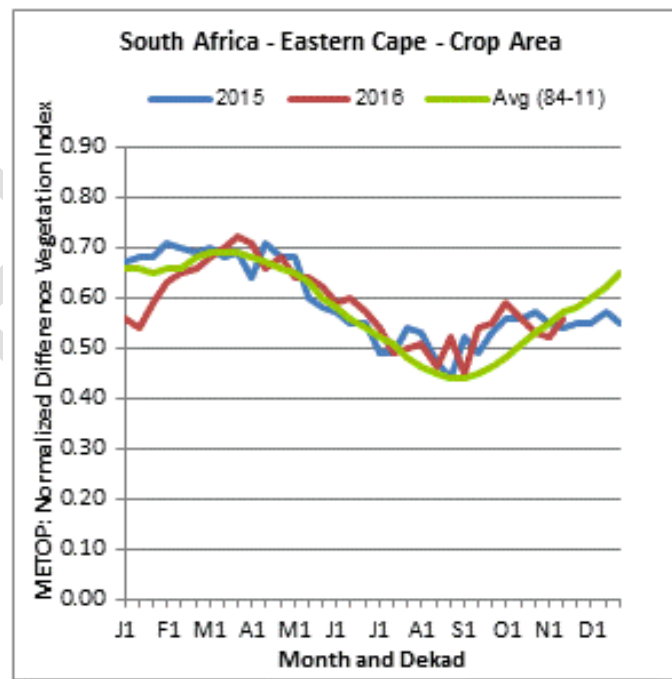


Fig. 10. NDVI profile compared with LTA (1989 – 2012)

4. POLICY FRAMEWORKS AND RESPONSES

Figure 11 below provides a list of some of the key sectoral, national, and global policy instruments and other regulatory frameworks underpinning environmental protection and climate change governance processes in South Africa. Although the list is not exhaustive, it does represent an ensemble of various instruments that are critical for government and other key role players in South Africa to use to address the key challenges posed by climate change. Since the advent of democracy in 1994, particularly since the late 1990s and early 2000s, South Africa has become firmly integrated into climate change and related environmental regimes at regional, continental and international levels by signing and/or ratifying a bewildering array of protocols, treaties, agreements and frameworks that guide its policies, programmes and strategies in this regard. For instance, not only is South Africa a signatory to the Kyoto Protocol, but it also has a trilateral agreement with India and Brazil, one of the components of which is to strengthen the three countries' commitment to combating climate change and advancing the goal of sustainable development in these three countries.

In terms of national policies and strategies, the South African Constitution (Act 108 Of 1996) provides an overall legal framework for government responses to the challenges of climate change and related environmental problems. The promotion and protection of the country's natural environment and the rights of South African citizens to access and enjoy a healthy natural environment is one of the key provisions contained in the Bill of Rights section of the country's Constitution. For instance, Section 24 of the Bill of Rights contains the following environmental rights:

- To an environment that is not harmful to their health or wellbeing; and
- To have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that:
 - Prevent pollution and ecological degradation
 - Promote conservation
 - Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Juxtaposed against environmental protection and the rights to a healthy environment contained in the Constitution of the Republic, are other developmental rights, for example those pertaining to the right to adequate housing and the provision of basic services such as water and other essential services including health care. The need to provide a healthy and safe environment, as well as the attainment of social rights for all South African citizens, is necessary and laudable, but difficult to achieve against a backdrop of the need for adequate (and cheap) energy to meet government priorities of economic and social development. Section 24 of the Constitution is a laudable provision in that it provides a framework for the pursuit of sustainable development, but is quite problematic in that the goal of accelerated economic growth is likely to compromise some of the environmental considerations relating to the advancement of citizens' rights to enjoy a healthy natural environment, especially if the current reliance on coal-based energy remains unchanged. Key in this regard is the confluence of service delivery with energy security, where the latter refers to meeting citizens' and businesses demand for electricity, while ensuring that the source of electrification and energy is sustainable, affordable, and does not further compromise the quality of the natural environment. While South Africa does have a White Paper on the Promotion of Renewable Energy and Clean Energy Development (2002) aimed at shifting the country's energy portfolio away from its reliance on coal to renewable sources of energy, many commentators argue that some of the targets and timeframes

government has set for itself are not far-reaching enough in terms of scope, and that the regulatory and enforcement instruments are insufficient to ensure effective compliance.

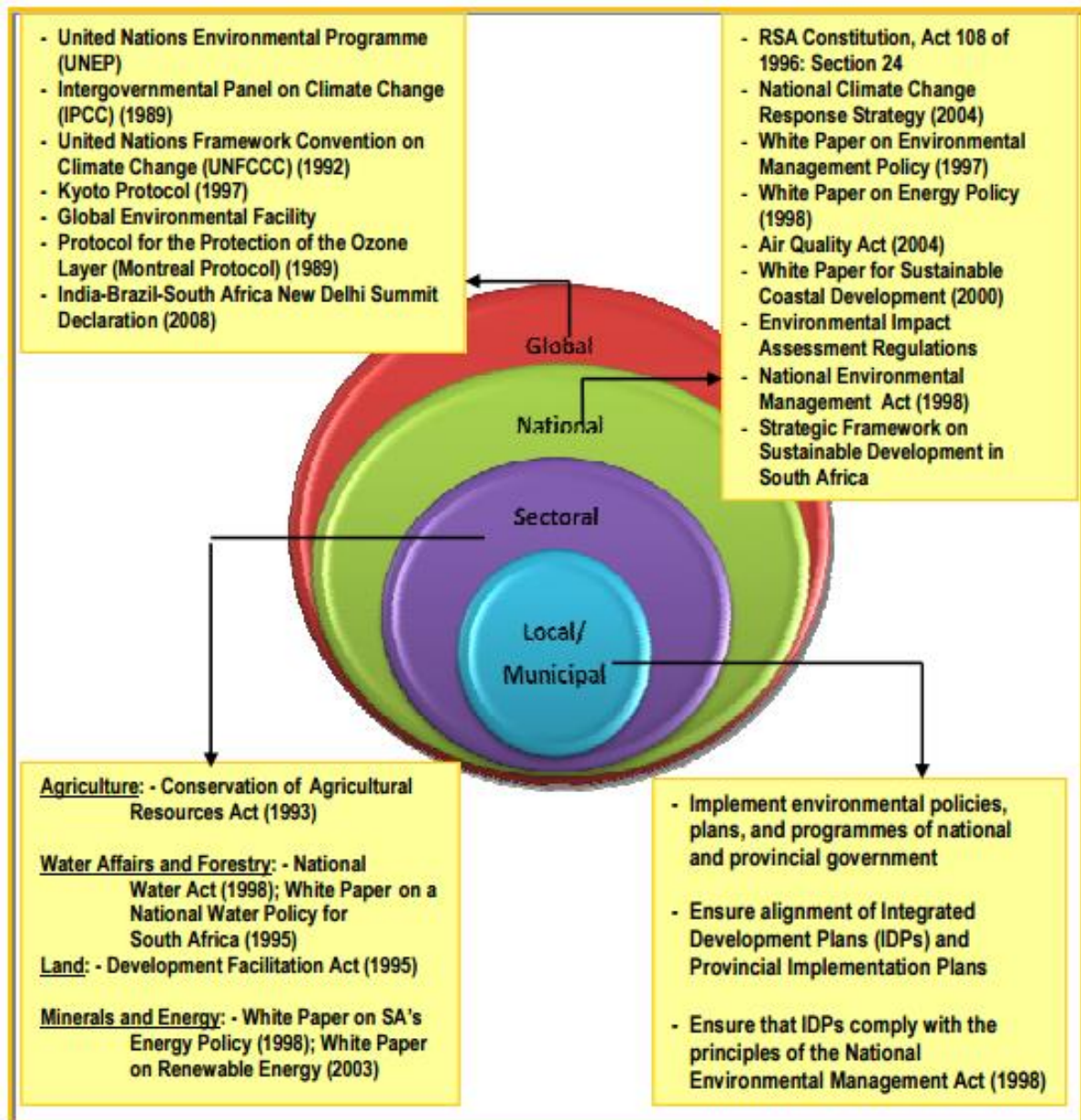


Fig. 11. Policy Frameworks and Responses (adopted from Mokwena, 2009)

Nationally, South Africa has set a goal of achieving a 34% reduction in GHG emissions nationally against business as usual by 2020, and a 42% reduction against business as usual by 2025. This was announced by the Presidency in 2009 at COP15/CMP5 in Copenhagen, Denmark, and is subject to the provision of appropriate financial, technical and capacity building support from more developed countries (Department of Environmental Affairs, 2011). In addition to formally committing to this target, South Africa has published a National Climate Change Response White Paper (NCCRP) which documents the vision and policy of the South African government in developing an effective response to climate change and moving towards a low carbon economy. Both adaptation and mitigation responses are included in the NCCRP.

The Long Term Mitigation Scenarios (LTMS) was a research process undertaken to inform long term climate change mitigation policy in the country. The LTMS focused on understanding the rationale of South Africa reducing greenhouse gases, what options are available to achieve this, and the scope and cost of these options. The LTMS outlined various scenarios for the country's GHG emissions profile ranging from "Growth without Constraints" to "Required by Science". The LTMS also quantified a number of mitigation actions or "wedges" that would be needed to bring the emissions profile of the country to match the "Required by Science" scenario (Scenario Building Team, 2007).

The Long Term Adaptation Scenarios Flagship Research Programme (LTAS) has been established by the Department of Environmental Affairs to develop national and sub-national adaptation scenarios for South Africa. LTAS is in the process of producing a series of reports which present a consensus of climate change trends, projections and key impacts, and identifies response options for primary sectors, namely water, agriculture and forestry, human health, marine fisheries, human settlements, food security, disaster risk reduction and management, economy and biodiversity (South African National Biodiversity Institute, 2014). Climate change also features prominently in the National Development Plan (NDP), the roadmap developed by the National Planning Commission in 2011 that outlines the actions required to eliminate poverty and reduce inequality by 2030. Chapter five, titled *Environmental Sustainability and Resilience*, outlines a number of objectives and actions aimed at ensuring environmental sustainability and an equitable transition to a lower carbon economy. In addition, issues relevant to an effective climate change response also appear in some of the other chapters in the NDP, including Chapter 3: *Economy and Employment*, which includes a focus on the green economy, transition to a low carbon economy and society, and motivation for green product and service development; Chapter 4: *Economic Infrastructure*, which includes reference to the efficient and effective implementation of the environmental impact management governance system. Chapter 6 focuses on the promotion of an integrated and inclusive rural economy, and Chapter 8: *Transforming Human Settlements* focuses on green cities and sustainable development.

The Water and Sanitation Department has drafted comprehensive intervention programmes to deal with water shortages in the Eastern Cape amidst drought due to climate change. The programme includes the integration of national and provincial teams of experts. This comes as much of South Africa remains in the grips of the worst drought in two decades. Water levels at the country's dams continue to fall (SABC, 2015). The Minister of Water and Sanitation, Hon. Nomvula Mokonyane visited Mbhashe local municipality in Dutywa to assess water security. She also handed over much needed water tankers to desperate residents. The Ministry believes that it will address the crisis.

"We have now since agreed that we are going to bring in teams together with MEC (Fikile) Xasa that will deal with Dam safety that will fill assessment of these two sites and whether to proclaim them as dams because they belong to the municipality and the second thing is that municipalities must give us information about the dams that belong to them so that we assess whether they are up to standard."

- Hon. Nomvula Mokonyane, Minister of Water & Sanitation, 2015

5. MBHASHE LOCAL MUNICIPALITY CLIMATE CHANGE VISION AND MISSION

VISION

“To transform Mbhashe Local Municipality’s adaptive capacity and socio-economic development in order to efficiently and effectively respond to climate change”

MISSION

“By 2025, Mbhashe Local municipality must have transitioned towards a low carbon economy. This will be achieved by increasing its adaptive capacity and creating sound economic opportunities for its citizens through adaptation and mitigation responses”

The above strategic intent and direction has been derived from the municipality’s commitment **“to become an effective and efficient municipality able to manage her resources and stimulate economic growth, sustainability, and promote a safe and healthy environment for the betterment of all with a bias towards the poor”**.

Alignment produces good synergies and greatest benefits, and thus the following organization-wide strategic alignment is recommended for Mbhashe Local Municipality:

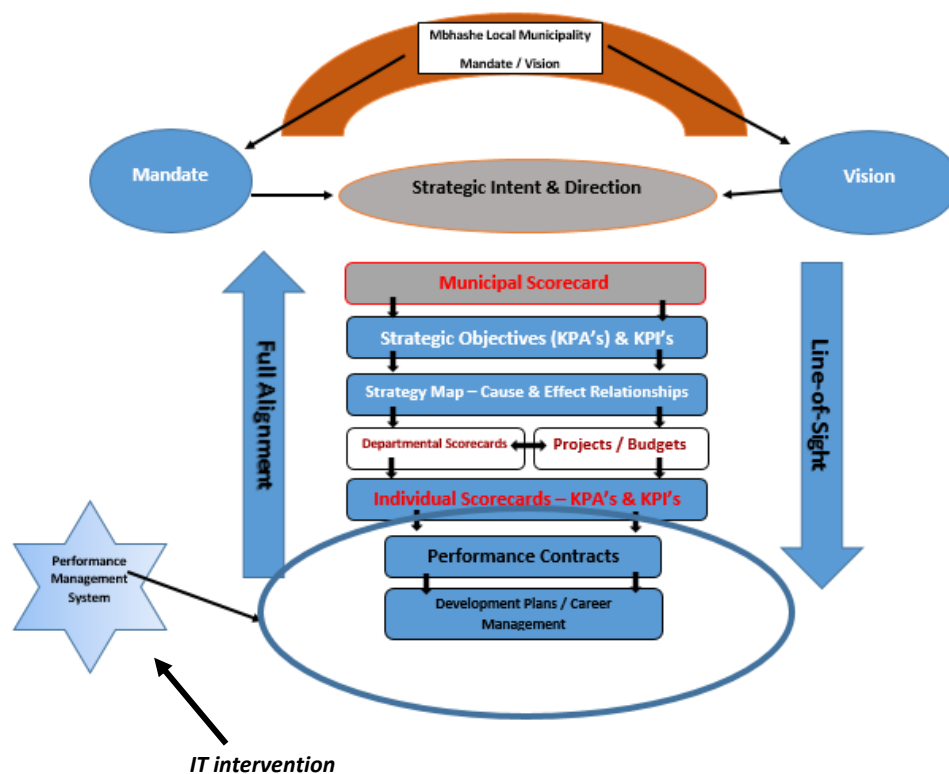


Fig. 12. Organization-wide Strategic Alignment Process for Mbhashe Local Municipality (adopted by Author through literature review during strategy development process)

6. GOALS, OBJECTIVES AND RESPONSES

The mission and vision is converted into tangible actions (objectives) and into results (goals) to be achieved. Objectives are broad categories. They are non-measurable, non-dated, continuous, and ongoing. With objectives the Mbhashe Local Municipality will move from motive to action. Objectives are the general areas in which effort is directed to drive the mission statement.

Strategies were chosen on the basis of the situation analysis and an explicit, recorded analysis of the advantages and disadvantages of possible alternative ways of addressing specific problems and accomplishing particular objectives. They are:

- *appropriate* – address the priority problems and risks effectively, coherently and efficiently in a manner suited to the local context; and
- *feasible* – able to be implemented in the local context and with the resources expected to be available.

Climate change has long-since ceased to be a scientific curiosity, and is no longer just one of the many environmental and regulatory concerns. It is the major, overriding environmental challenge of this time facing decision makers, planners and regulators. Climate change is a growing crisis with economic, health and safety, food production and other dimensions. In the midst of climate change is water which play a central role. Water is the primary medium through which climate impacts are felt.

Climate change manifests itself largely through its impact on water resources i.e. floods and droughts which are increasingly apparent in many parts of Mbhashe Local Municipality. Floods and droughts undermine farm yields and national harvests reducing household and national food availability, and agricultural income derived from crop sales. Their impacts on other sectors of a nation's economy can also be devastating.

Careful analysis was conducted to identify the most appropriate strategies, ones that will achieve the defined objectives while minimizing any potential negative effects. Seven interrelated climate change themes were identified through the strategy development process. This section of the strategy outlines the goals, objectives and responses for these themes. The themes identified include:

- Water,
- Biodiversity,
- Agriculture / Food Security,
- Health,
- Energy,
- Transport, and
- Economic Development.

- **Water** – water treatment, storage and distribution infrastructure is required to prepare for and protect against the impacts of climate change, make provision for vulnerable communities and assure adequate yields of good quality water to service all sectors of the economy (Schulze, *et al.*, 2014). Rural communities that have become established in low-lying areas and flood plains are especially at risk from flooding, as are poor households whose houses are not resistant to extreme weather conditions.

GOAL A: Mbhashe Local Municipality's water resources & infrastructure are effectively managed to ensure optimal protection from climate change impacts

OBJECTIVE A: The impacts of climate change on the security, quality and quantity of water are minimised
STRATEGIES
<ul style="list-style-type: none"> • Incorporate projected climate change impacts into proactive planning of the municipal water supply;
<ul style="list-style-type: none"> • Support and promote the replacement of old and damaged infrastructure with more energy efficient pumps, motors and piping, through further research, information sharing and persistent raising of the issue;
<ul style="list-style-type: none"> • Incorporate projected climate change impacts into proactive planning of the municipal water supply;
<ul style="list-style-type: none"> • Recognise, make use of and manage the role that open spaces, natural areas and agricultural land can play in providing flood and storm water protection services;
<ul style="list-style-type: none"> • Adopt a risk-averse approach to water quality protection by imposing stringent controls on water polluting land uses and activities to ensure that the impacts of climate change are not exacerbated;
<ul style="list-style-type: none"> • Prioritise water service delivery to communities that are most vulnerable to projected climate change impacts such as water scarcity and health risks;
<ul style="list-style-type: none"> • Implement strategic Catchment Management projects towards the eradication of Alien Invasive Species and to ensure water security; and
<ul style="list-style-type: none"> • Promote rain water harvesting through incentivising local farmers and communities with rain water tanks and other mechanisms

- **Biodiversity** – Climate change is expected to influence the ability of natural capital to deliver a sustainable supply of high quality ecosystem services on which Mbhashe Local Municipality's population and economy depends. Low income communities are directly dependent on ecosystem services for their livelihoods and thus will be most at risk.

GOAL B: *Biodiversity is conserved to enhance benefits accrued from Biodiversity Assets and Ecological Infrastructure*

OBJECTIVE B: Biodiversity considerations are incorporated into land-use planning and integrated development planning to reduce climate change impacts on biodiversity and to maximise delivery of ecosystem services
STRATEGIES
<ul style="list-style-type: none"> • Actively manage the spread of alien invasive species in freshwater, marine and terrestrial habitats to protect against the increased spread of these species as a result of climate change;
<ul style="list-style-type: none"> • Restore and manage degraded natural open spaces through government, business and community efforts to improve resilience of ecosystems to climate change impacts;
<ul style="list-style-type: none"> • Identify mechanisms for incentivising land owners to protect and manage natural environments on their properties to maximise ecosystem functioning and resilience in order to withstand climate change impacts;
<ul style="list-style-type: none"> • Prioritise the restoration, protection and management of habitats and ecosystems that are most vulnerable to the effects of climate change;
<ul style="list-style-type: none"> • Promote considerations of climate change in spatial planning and land-use regulation; and
<ul style="list-style-type: none"> • In line with the National Environmental Management: Biodiversity Act, 10 of 2004 identify existing or new invasive alien species that are likely to benefit from climate change and implement a management & eradication strategy to offset future impacts on biodiversity

- **Agriculture / Food security** – The projected climate changes for the North Western parts of the Mbhashe Local Municipality, especially increases in temperature and severe weather events, are predicted to threaten crop yields, and thus, food security. Declining food security is likely to disproportionately impact the poor, since they are more dependent on subsistence agriculture and are less likely to be able to purchase food at higher prices, nor will subsistence farmers be able to adapt to severe dry spells. In response to these projections, it is important to develop a robust and resilient food security system that promotes sustainable local farming in order to increase regional food production and availability.

GOAL C: To promote food security initiatives linked to the Mbhashe Local Municipality (ADM's) Agricultural Management Plan

OBJECTIVE C: Promote sustainable food security programmes

STRATEGIES
<ul style="list-style-type: none"> • Encourage innovative local food production;
<ul style="list-style-type: none"> • Localise food production and distribution through the establishment and preservation of agricultural hubs and small scale local community farming efforts;
<ul style="list-style-type: none"> • Promote ecological and sustainable farming practices as an overarching approach to protecting local food production against climate change impacts;
<ul style="list-style-type: none"> • Make use of indigenous knowledge in combination with latest research to educate communities and farmers about alternative, locally appropriate crops and farming techniques;
<ul style="list-style-type: none"> • Establish food markets at transport hubs and centralised gathering points with local and other farmers supplying local communities;
<ul style="list-style-type: none"> • Facilitate linkages between large retailers and local and community producers;
<ul style="list-style-type: none"> • Educate people about the utilisation and preparation of crop types that may be more appropriate for production under changed climatic conditions; and
<ul style="list-style-type: none"> • Develop early-warning systems for local farmers to reduce their vulnerability to extreme weather events and help minimise losses in production

- **Health** – climate change will directly affect the well-being of the citizens of Mbashe Local Municipality by increasing their susceptibility to health risks. Rising temperatures are likely to cause heat stress, respiratory diseases and cardiovascular diseases, and may exacerbate diabetes, mental problems and infectious diseases. The increase in rainfall and resultant floods, in a mostly rural municipality with vast areas of inadequate and/or inferior infrastructure (roads, bridges, health care facilities etc.) is likely to lead to injuries, and increase in the prevalence of water-borne diseases for both people and livestock. Drought may lead to extreme water shortages and water contamination, and have a negative impact on food security.

GOAL D: Promote adequate public health and safety in response to the challenges of climate change

OBJECTIVE D: Encourage safe and healthy communities that are adaptive and resilient to climate Change impacts
STRATEGIES
<ul style="list-style-type: none"> • Identify communities that are vulnerable to high temperatures, floods and other climate-related events and develop and implement appropriate plans to reduce the vulnerability of these communities;

<ul style="list-style-type: none"> • Provide a support network for the aged, persons living with disability and any other sub-population groups that may require extra care and assistance as a result of climate change impacts;
<ul style="list-style-type: none"> • Develop community emergency plans in response to possible climate related disasters that include use of early warning systems with associated public health advice;
<ul style="list-style-type: none"> • Equip municipal health facilities to handle climate related emergencies and extreme weather events in order to prevent or lessen referrals to tertiary health facilities. Ensure health facilities are able to function under climate related disaster conditions (i.e. potable water reserves, electricity generation back-up, access even during floods, etc.);
<ul style="list-style-type: none"> • Establish adequate stockpiles of medications, medical supplies, assistive devices and other resources that may be required during climate change related disasters and events; and
<ul style="list-style-type: none"> • Design climate change responsive service infrastructure to protect users from climate change related health impacts. Considerations include the appropriate location of new infrastructure, infrastructure design (such as improved shade at public places and transport nodes, building new houses that are thermally efficient and have cross ventilation, providing access to water at public spaces) and choice of materials to provide insulation from heat.

- **Energy** – energy is crucial to the improvement of quality of life. There is a huge electricity backlog [50% (30 262)] in Mbhashe Local Municipality. Wood is used predominantly for cooking and heating purposes at 40% and 50% households respectively, causing a high pressure to environmental balance. For cooking next favourite is electricity 37% followed by paraffin at 15%. Paraffin and Candle are competing at 14% each for lighting next to electricity. Paraffin and electricity are the second and third sources of heating at 23% and 15% respectively. Renewable energy technologies are clean sources of energy that have a much lower environmental impact than conventional energy technologies. Clean energy growth can fuel a future of opportunity and greater prosperity for the citizens of Mbhashe Local Municipality. Generating electricity from renewable energy rather than fossil fuels offers significant public health benefits. The air and water pollution emitted by coal and natural gas plants is linked to breathing problems, neurological damage, heart attacks, and cancer. Replacing fossil fuels with renewable energy has been found to reduce premature mortality and lost workdays, and it reduces overall healthcare costs.

GOAL E: Mitigate the impacts of climate change by investing in renewable energy projects and create sound economic opportunities and sustainable jobs

OBJECTIVE E: Identify and resource renewable energy projects in response to climate change
STRATEGIES
<ul style="list-style-type: none"> • Implement projects identified in the ADM Renewable Energy Strategy for the Mbhashe Local Municipal area

- **Economic Development and Tourism** – sustainable economic development is a priority focus for the Mbashe Local Municipality as evidenced in the Amathole Regional Economic Development Strategy (AREDS) and in the mandate of the Amathole Economic Development Agency's (Aspire) mandate for small town regeneration and economic development and Mbashe's own initiatives. Mbashe is mostly a rural municipality without "industry" and thus residents are exposed to high levels of poverty, unemployment, high commuting costs and lack of skills (due to low literacy levels), which limits their income generation capabilities.

Mbashe Local Municipality is situated squarely in a "maize belt" and thus its economy is typically an agricultural economy. Climate change introduces potential risks and opportunities for this rural economy. For instance, the risk of severe climate events impacting infrastructure, affecting production yields, resulting in water shortages and severe droughts; or the opportunity that lies in developing new economic sectors such as the renewable energy sector.

The Amathole Regional Economic Development Strategy (AREDS) identifies job creation as key to reducing poverty and inequality. Economic drivers in the District and Local Municipality can both be the major causes of, and key solutions for mitigating the impacts of climate change.

GOAL F: Enhance local capacities to adapt to the impacts of climate change and develop socially responsible and environmentally sustainable rural economies

OBJECTIVE F: Mbashe Local Municipality to enable its citizens to actively participate in the mainstream economy
STRATEGIES
<ul style="list-style-type: none"> • Create an enabling environment whereby businesses can network to establish symbiotic relationships with regards to the re-use of resources by other businesses, (i.e. a community of practice such as a "business forum, investment summit, etc.);
<ul style="list-style-type: none"> • Create job opportunities with bias to the poor in the built environment (e.g. resurfacing of roads), in the restoration, protection and management of ecosystems projects;
<ul style="list-style-type: none"> • Ensure that the potential impacts of climate change are taken into account when considering large scale infrastructure projects (e.g. adequate placement of infrastructure); and
<ul style="list-style-type: none"> • Promote and facilitate the promotion of low carbon micro-scale organic food businesses to provide economic opportunities to communities and reinforce food security (e.g. invest in community-based hydroponic production projects)

- **Transport** – Virtually all human activities have an impact on our environment, and transportation is no exception. While transportation is crucial to our economy and our personal lives, as a sector it is also a significant source of greenhouse gas (GHG) emissions.

GOAL G: Reduce the impacts of climate change through sustainable transport interventions

OBJECTIVE G: Mbhashe Local Municipality to employ sustainable transport interventions to improve air quality, reduce noise from traffic and increase road safety
STRATEGIES
<ul style="list-style-type: none"> • Paving of identified gravel roads;
<ul style="list-style-type: none"> • Retrofitting and maintenance of existing road infrastructure (e.g. conversion of traffic lights to traffic circles to reduce emissions from idling vehicles);
<ul style="list-style-type: none"> • Promote public transport usage; and
<ul style="list-style-type: none"> • Improve visibility of and enforcement by traffic officers to enhance road safety

7. RESILIENCE PLAN FOR MBHASHE LOCAL MUNICIPALITY

Municipalities are faced with many burgeoning and often conflicting tasks, with poverty alleviation, local economic development and service provision justifiably occupying top priority on most local council agendas. Embedded deep within the fabric of our collective development imperatives, the question of climate resilience forms a central axis around which our development future revolves. A key element of future adaptive capacity is for people to have a range of options available to them to sustain their livelihoods under different conditions. Therefore, diversification of livelihoods, both within agriculture and to non-agricultural (i.e. non-climate-sensitive) activities is a key risk management strategy. Diversification within agriculture could involve incorporating new crops or livestock species, particularly those that are adaptable to climate variability. Outside agriculture, income generating strategies that are not dependent on the natural resource base, such as handicrafts or small enterprises, can provide a source of security when agricultural strategies fail. When identifying and promoting climate-resilient livelihoods strategies, it is important to consider the interaction of hazards. For example, some areas may be affected by both droughts and floods, requiring consideration of both scenarios in order to build resilience.

One of the challenges faced by communities, and particularly vulnerable groups within communities, is simply a lack of access to information that would facilitate planning and risk management. Ensuring that communities are able to access critical information such as seasonal forecasts and early warnings, will support their efforts to manage their livelihoods in a context of uncertainty. Empowering them to use this information is a key part of the process – target populations should be encouraged to adopt and adapt strategies in innovative ways based on current and future evidence, to give them not only the ownership but also the confidence to take leadership of the process. Access to services that support adaptation of livelihoods is a key factor to be considered. For example, accessing credit for start-up costs can make the difference for people in diversifying their livelihoods. Experience has

proven that households with savings are better able to cope in times of crisis when their regular means of survival are not available to them. Therefore, ensuring that target groups have access to financial services such as savings and credit can bring about significant opportunities to build adaptive capacity. In support of household and individual level adaptation, efforts must be made to ensure that local plans and policies provide opportunities for action by target groups. Within all of these efforts, recognition and prioritization of the specific needs and priorities of women and other vulnerable groups, and their empowerment, must be a particular focus.

The Eastern Cape Province has the largest number of livestock in South Africa and it is where communal farming is practised on the largest scale. Thousands of jobs are lost and people's lives are put at stake as a result of malnutrition when drought occurs. The government should move away from being reactive towards a more proactive approach. If drought planning can be improved, thousands of Rands that are being used to provide drought relief can be channelled towards improving the resilience of communities to natural disasters, particularly subsistence farmers. In order to improve the municipal citizens' resilience to drought, the following strategies are recommended:

- Investment in soil and water management, such as the improved development and management of fragile catchment areas and river basins, including small-scale irrigation;
- Reviewing the appropriateness of current crop production patterns and possibilities in support of more intensified crop diversification policies;
- Redirecting research towards more appropriate farming systems;
- Improved rangeland and livestock management; and
- Reviewing institutional arrangements and physical infrastructure

Reducing long-term vulnerability to drought will require a fundamental shift in government approaches, especially towards a multidisciplinary approach in:

- Promotion of drought-mitigating technologies and practices;
- Poverty alleviation;
- Creation of an enabling policy environment; and
- Adequate planning

In the context of long-term socio-economic development, economic diversification is seen to be a major strategy element in drought mitigation. Vulnerability of the rural areas to drought can be reduced through diversification of the rural economy, the expansion of non-farm employment opportunities in rural areas and improvements in agricultural efficiency, especially for smallholders.

The municipality should promote policies that aim at reducing the vulnerability of drought-prone communities by altering or strengthening their land use and farming practices or implementing programmes that promote water and food security to enhance poverty alleviation. A proactive approach involves pre-drought preparation of various measures and is intended to make the water users more resistant to water shortage and deficit of prolonged duration. Contingency plans must be undertaken during the ongoing droughts and relate to changes in water supply and water demand that decrease the impacts of drought. In this aspect, forward planning is important to enable sound decision-making. A critical component of planning for drought is the provision of timely and reliable climate information, including seasonal forecast that aids decision makers at all levels in making a critical management decision.

The drought management strategies recommended should be operationalised through the following initiatives:

- Facilitating sustainable management of natural resources;
- Encouraging crop production only in those areas that are climatically and topographically suitable for particular crops, proper mechanical and biological precautions versus soil loss, good land use practices through educational awareness campaign, and research into promotion of drought-tolerant food crops;
- Ensuring correct stocking rates of domestic livestock and establishment of grazing schemes;
- Supporting current policies and programmes on reforestation;
- Ensuring and enforcing correct protection and management of water catchment areas, construction of more dams and sustainable exploitation of underground water;
- Promotion of small-scale enterprises; and
- Introducing appropriate water resources management and irrigation development schemes

The potential of biodiversity adaptation strategies to provide co-benefits for other sectors could be mainstreamed and integrated across sectors if packaged and communicated appropriately. Implementation of biome adaptation plans would contribute to building climate-resilience at biome level, and would provide support to adaptation in other sectors such as water, agriculture and forestry, and human health by ensuring continued supply of ecosystem services. Vulnerability assessment data should be integrated with spatial data related to ecosystem service delivery, and translated to the local level, based on user-specific vulnerabilities and needs, to inform biome adaptation plans.

The Mbhashe Local Municipality should endeavour to educate subsistence and small-scale farmers on the potential risks of climate change, and support them to develop adaptation strategies with on-farm demonstration and experimentation. Adaptation strategies should include conservation agriculture practices including water harvesting and crop rotation, and must prioritise indigenous knowledge and local adaptive responses. The municipality must empower local communities, particularly women who are often primary producers, in the process of designing and implementing adaptation strategies; and must strive to design and implement economic and livelihood diversification programmes in rural areas.

It is of the utmost importance that these resilience interventions be integrated to municipal-wide planning and development policies. The figure below depicts the integration process recommended to ensure meaningful mainstreaming of climate change action and resilience planning in the Mbhashe Local Municipality.

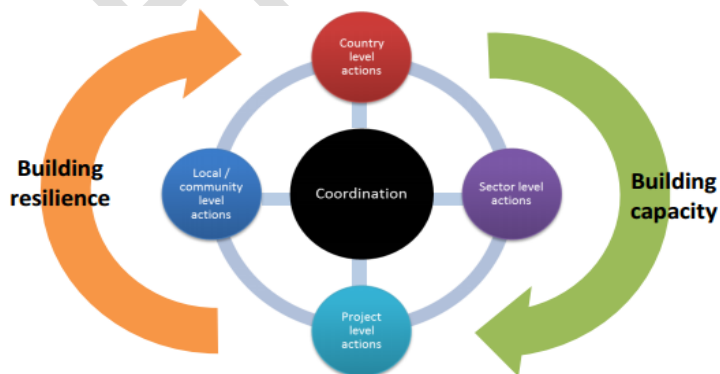


Fig. 13. Process plan for integrating climate resilience and actions into development policies and municipal planning



Mbhashe
Local Municipality
Willovale | Dutywa | Elliotdale

DRAFT CLIMATE CHANGE RESILIENCE PLAN

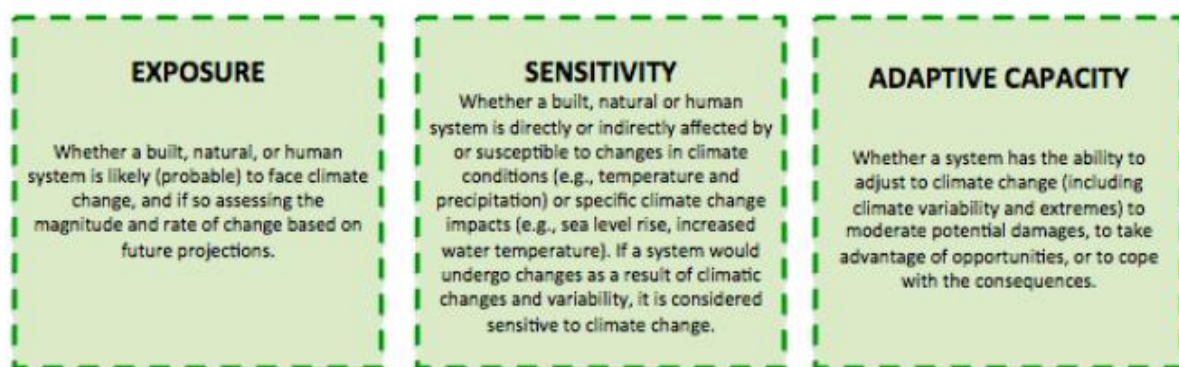
2016 – 2021

As climate change impacts become increasingly apparent in Mbhashe Local Municipality, it is incumbent upon decision makers in the local municipality to gain a strong comprehension of what makes a community, region, sector, or system vulnerable to climate change, the extent of such vulnerability, and then develop strategies and action plans to reduce the level and extent of vulnerability by improving the ability to cope with expected changes. This imperative is at the heart of any climate change vulnerability assessment and resilience strategy development process. The steps involved become easier to grasp when one understands what climate change vulnerability is, and what it is comprised of.

According to the Intergovernmental Panel on Climate Change (IPCC), vulnerability to climate change can be defined as follows:

*“Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is **exposed**, its **sensitivity**, and its **adaptive capacity**.”* (Emphasis added.)

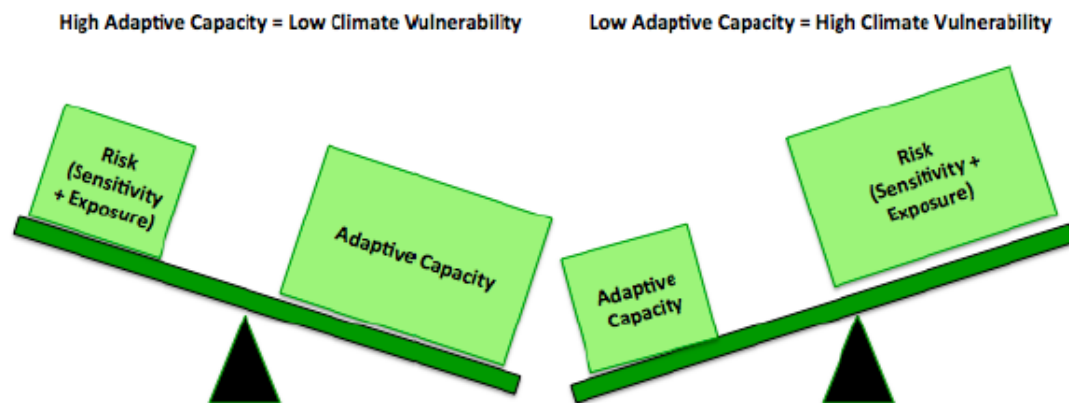
Thus there are some critical constituent elements of climate change vulnerability, each of which has a discrete relationship with the other variables. These elements are defined differently by different sources, but at their core they can be identified as follows (largely as the IPCC does):



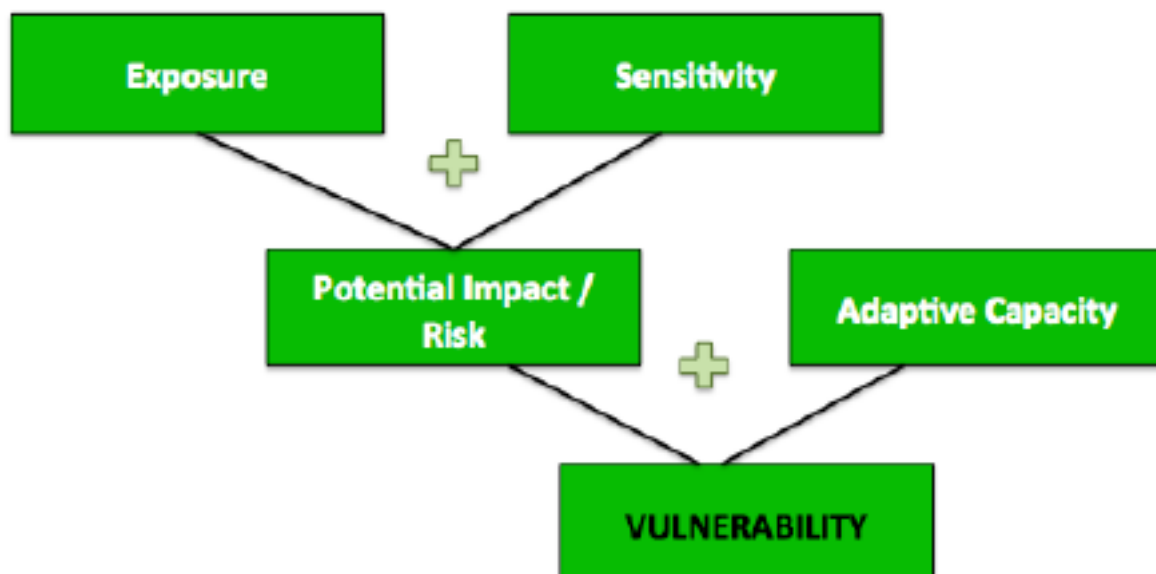
In simple terms, exposure is the extent to which a given system will be subject to or come into contact with a climate change impact – in this case, increased temperatures and changes in rainfall patterns. Sensitivity, then, is the extent to which a given system can be affected by a particular climate change impact. Sensitivity is based on inherent qualities and characteristics of an entity or system, and is an internal feature. In this case, the biophysical characteristics of the sector or sub-sector, which influence how it responds to changes in temperature or rainfall. Together, the combination of exposure and sensitivity amount to the *potential climate impact*, or “risk”.

Merely because a sector or sub-sector (or any entity or system) is exposed to climate change, it does not automatically qualify as being at risk of potential impacts. If the sensitivity to climate is low, then the risk is moderated. (Similarly, if something is sensitive to changes in climate but not exposed to climate change, then risk is low as well. However, this is somewhat moot because all entities and systems on the planet are exposed to climate change – the difference is the degree to which the exposure occurs, i.e. the magnitude and rate, given that some parts of the world are warming faster than the rest or are expected to experience more significant impacts in terms of precipitation changes etc.).

In the same vein, merely because a sector or sub-sector (or any entity or system) faces a risk of climate change impacts, this does not automatically make it vulnerable. Vulnerability in the face of climate risk is also a function the entity or system's adaptive capacity. Put simply, adaptive capacity is the extent to which a system is able to exploit opportunities and resist or adjust to change. Adaptive capacity is often estimated based on proven historical ability to cope with the changes in question, and for the future it is assessed through proxies such as levels of education and income or even effective programs or policies being put in place to help the sector cope with changes in a positive manner. As the figure below illustrates, the greater the adaptive capacity, the lower the vulnerability, and the lower the adaptive capacity, the greater the vulnerability.

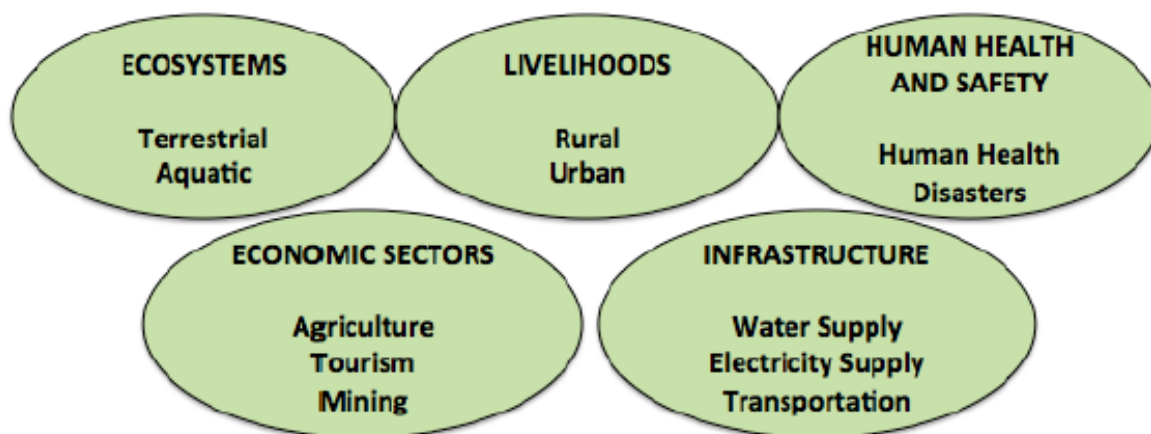


Thus, this process arrived at the determination of vulnerability of various sectors in Limpopo through the process that is typical of most climate change vulnerability assessments:



RESILIENCE PLANNING PROCESS OVERVIEW

This report is the culmination of a five-month project aimed at developing climate change adaptation and resilience strategies for the Mbhashe Local Municipality. The project was conducted in two phases; the first phase of three months entailed conducting climate change vulnerability assessments, focusing on several sectors and sub-sectors:

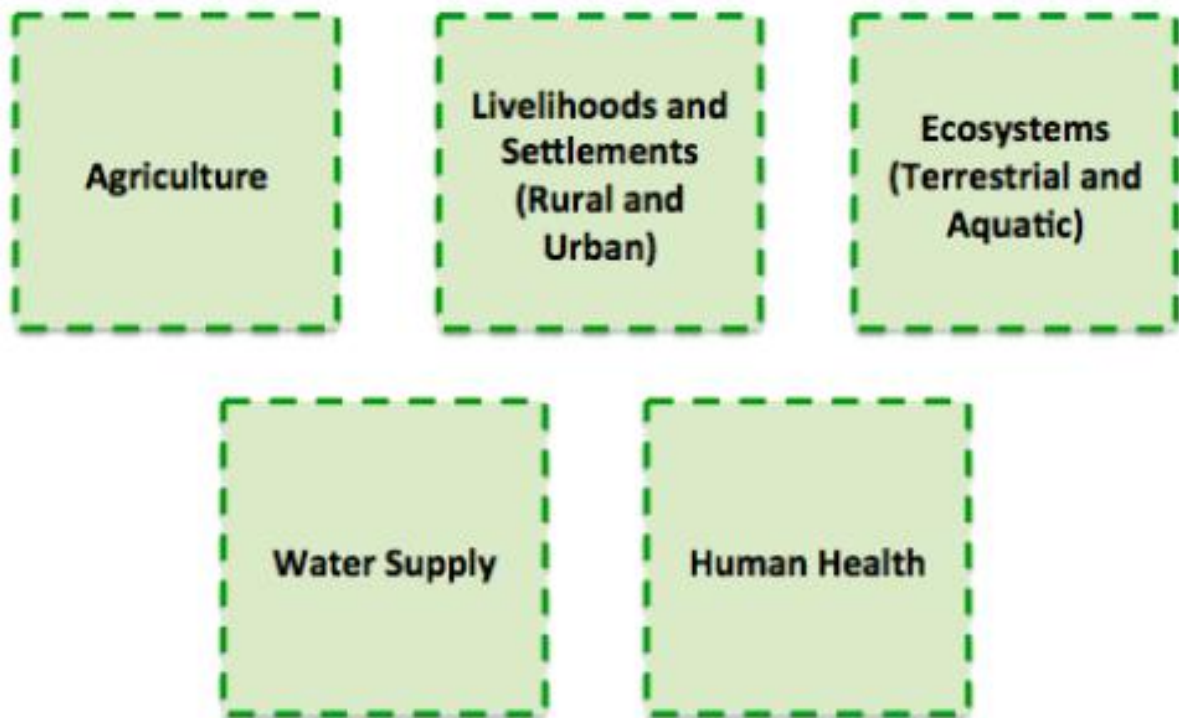


Phase one also involved seeking and integrating stakeholder input from experts and relevant sector officials from different walks of life, through targeted interviews; information requests and literature review. Findings from phase one highlighted specific sub-sectors that display relatively high vulnerability to climate change, relative to other sub-sectors.

As agreed upon at the project inception stage, phase two of the project hones in on these priority sub-sectors, so as to allow more focused work on the development of adaptation strategies for the municipality.

In response to stakeholder interest, the list of target-sectors was expanded from solely those that were identified through the vulnerability assessment process to include additional sectors deemed important to the ADM region and Mbhashe LM (even if their relative vulnerability was lower than the sectors originally evaluated as having High vulnerability in the assessment stage). For instance, even though urban livelihoods and settlements are less vulnerable to climate change than rural livelihoods and settlements, the urban segment has been included in this report as a focus for adaptation strategies, in deference to stakeholders that were consulted who indicated that urban livelihoods and settlements should not be neglected. By the same token, a sector that was originally identified as vulnerable (Disaster Management) does not have strategies attached to it in this report because stakeholders articulated a strong preference for treating disaster management as a cross-cutting theme across sectors, and indicated that specific adaptation strategies should not be developed for this thematic area since it is not an actual sector and a lot of sound strategy development processes and planning had gone into the development of the ADM Disaster Management Strategy / Plan which encompasses all its local municipalities.

Thus for Mbhashe Local Municipality, the final sectors that were chosen for Adaptation Strategies are:



Phase two involved the identification of adaptation measures that can build adaptive capacity in the relevant sectors, and then evolving strategies for the municipality to thereafter take forward into an action plan and into subsequent implementation. Adaptation measures have been identified through literature review of past or current adaptation efforts in the appropriate sector in the Eastern Cape Province or South Africa; an exploration of relevant best practices in the corresponding sectors elsewhere (similarly situated provinces or countries); validation, verification, and guidance of provincial Department of Economic Development Environmental Affairs and Tourism; and input and refinement by stakeholders and sector experts. Strategies have been developed based on this foundation, and with an understanding of governance processes and institutional frameworks in the ADM and Eastern Cape Province in relation to climate change adaptation.

PRIORITY SECTORS FOR ADAPTATION IN MBHASHE

The Long Term Adaptation Scenarios (LTAS) project suggests that the region within which Mbhashe Local Municipality is located could face a potential increase in temperatures by as much as 2°C by 2035, by 1-2°C between 2040 and 2060 (or even 2-5°C in the high-end scenarios), and by 3-6°C between 2080 and 2100 (or as much as 4-7°C in the high-end scenarios) (Bredenkamp *et al*, 1996; Midgley *et al*, 1997; Kraai, 2010). LTAS projects decreased rainfall over Mbhashe in the long term, but rainfall projections in the LTAS project remain within the realm of present-day variability (i.e. they do not show a statistically significant departure from current patterns). Other studies suggest that there may be future increases in rainfall in the region, attesting to the uncertainty in model projections for this region of Southern Africa within the existing body of knowledge. However, what emerges out of such uncertainty is that the region is likely to experience greater variability in rainfall, and will almost certainly witness an increase in evaporation rates, implying a drier future even in the presence of greater rainfall and heavy rainfall events. A recent study noted with concern that even though in South Africa there is a growing body of work focusing on understanding medium to long term changes and

corresponding adaptation required, “most adaptation responses still focus on reducing vulnerability to present-day climate exposure. There is little practical experience of implementing adaptation programs related to longer-term climate change.” Even though the timeframe identified and the scope of this project is through the year 2021, and the recommendations have been framed with a view to their being fully acted on and implemented within the decade (2016 to 2021), an effort has been made to identify adaptation measures (to be effected through adaptation strategies) that would still have relevance even in the mid-century timeframe.

AGRICULTURE

Mbhashe municipality has significant importance in the ADM for high Maize Production potential and Livestock, making it a potential “breadbasket and agricultural engine” of the district. The primary sector agricultural activities taking place in Mbhashe Municipality is mainly focused on very low base crop production and livestock farming at subsistence level and the basic concern is survival. The sector is underdeveloped and not diversified and had a subdued contribution to both the GDP and the GVA. Small-scale and subsistence farmers in the Municipality are not producing at optimal levels, due to a number of constraining factors. It is, therefore, important that emerging farmers are supported in expanding their farming activities into viable and sustainable enterprises that will not only increase the income generated and jobs created by these activities, but will also grow sufficiently to form the basis of further beneficiation opportunities (Mbhashe LM LED Strategy, 2015). Given the favourable humid climate owing to the coastal characteristics in certain areas of Mbhashe Municipality, the horticultural and particularly the vegetable production seasons are significantly longer than in other parts of the municipality, which provides considerable development potential for the expansion of production, as well as the diversification of agricultural production into other commodities. Nevertheless, as noted in the Eastern Cape Provincial Growth and Development Plan, agriculture is a key sector for the province because it is a source of food security, a contributor to exports, and an economic multiplier for the people of the Eastern Cape through income and employment.

According to the Municipal IDP, *“Maize is the mostly used crop/grain in the Mbhashe area mainly because many of the households use it as their staple food. The municipality in partnership with the farmers is now engaged on a massive maize production programme. The programme is done in a way which will not collide with the Department of Agriculture’s massive production. The programme is called “Silimile”, and was piloted in 12 wards and later spread to 25 wards, where the ward identifies a 50ha area. The wards participating in the programme currently are 25. Tractors are then being clustered together for that particular area; the farmers provide money to buy fuel and pay for the driver and the municipality co-ordinates, provides the fertilizer and seed for all the 50ha in 25 wards”* and *“Mbhashe contains arguably the richest land for livestock in the Amathole district. Public private partnerships and improved farming methods can expand commercial livestock farming in the Mbhashe areas. The sheep in the Dutywa area is said to be around 295 000 in numbers making it the largest number in the Amathole district. Cattle are spread all over the Mbhashe area whilst main focus is on improvement on quality of cattle for meat and skin for leather production. Goat is largely in the Willowvale area (about 32 000) and small projects that are aimed at improving quality for milk production are started there”*.

VULNERABILITY TO CLIMATE CHANGE

Mbhashe is well suited to livestock (sheep, cattle and goats) farming. Considerable effort are being put into improving the quality of the livestock, thereby increasing meat and milk production, however, across South Africa, climate change is expected to exacerbate already-rising irrigation demand in the agriculture sector, create spatial shifts in the growing areas for some crops, result in changes in yield for certain crops (on the balance, a fall in yields, especially in a significantly hotter future), and a shift as well as expansion in the range of several agricultural pests and parasites. Additionally, warmer temperatures are expected to increase heat stress amongst cattle, which has been linked to reduced milk yield and fertility in dairy cattle.

The figure below is one illustration (based on two distinct models) of how yields of Maize (one of the Eastern Cape's main crops) may be affected by climate change, with a potential range of a 25% decrease (yield loss) or even a 10% increase (yield gain).

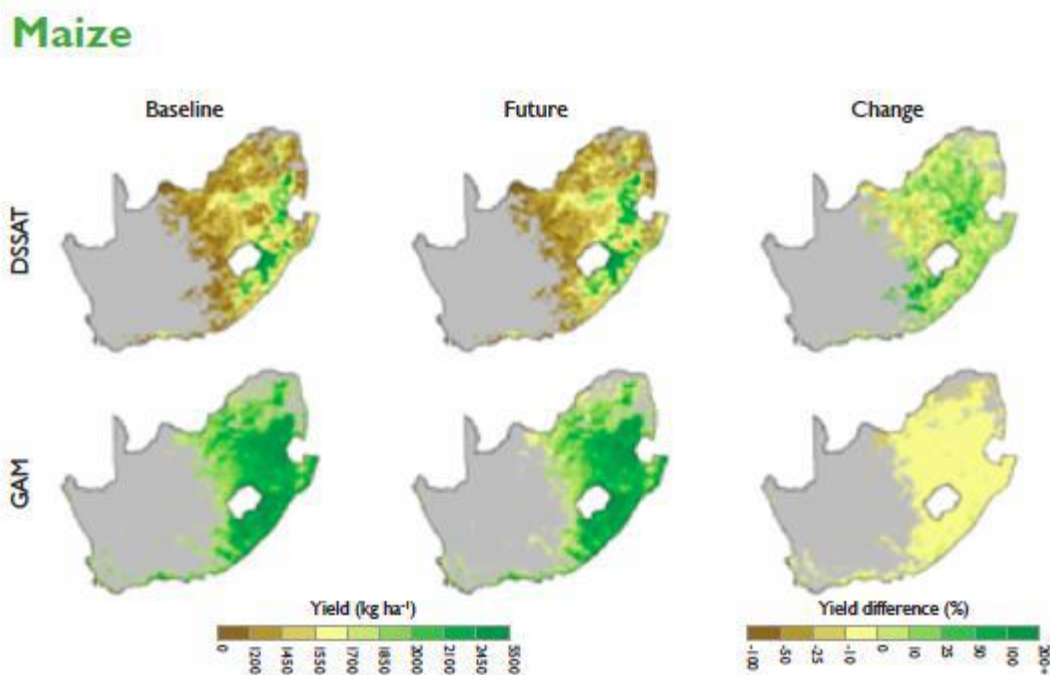


Fig. 14. Median Change in Crop Yield for Rain-fed Maize

An assessment by the International Food Policy Research Institute (IFPRI) identified the Eastern Cape as one of South Africa's most sensitive provinces in terms of the susceptibility of the agriculture sector to climate change, mainly due to the high proportion of small-holder farmers. As indicated in the figure below, along with agriculture in KwaZulu-Natal and Limpopo, this sector in the Eastern Cape is expected to suffer the largest impacts of climate change and variability.

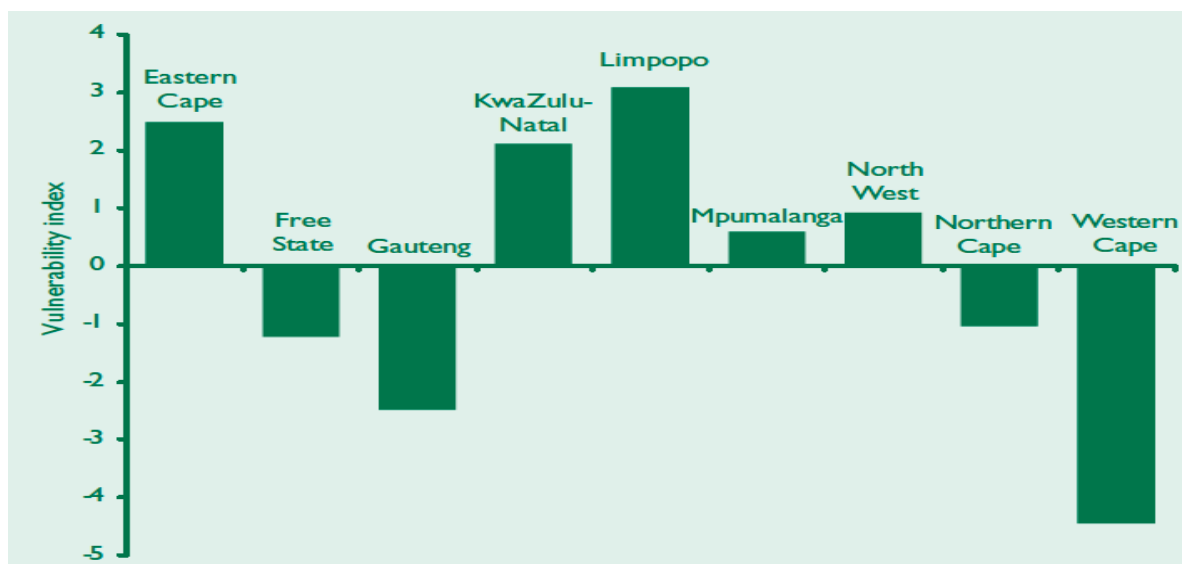


Fig. 15. Climate Vulnerability of Agriculture - Ranking in South Africa by Province (Source: IFPRI) – adopted from IFPRI publications

The LTAS project recommends a host of adaptation practices for the agriculture sector in South Africa: (i) conservation agriculture, climate-smart agriculture, ecosystem-based adaptation, community-based adaptation, and agro-ecology; (ii) sustainable water use and management; (iii) sustainable farming systems; (iv) early warning systems, risk management and decision support tools; (v) integrated and simplified policy and effective governance systems; and (vi) awareness, knowledge, and communications. Detailed descriptions of each may be referred to in the LTAS Agriculture report, to obviate duplication of the list in this present report, whose aim is rather to identify resilience strategies for the municipality going forward.

AGRICULTURAL SECTOR CLIMATE CHANGE RESILIENCE RECOMMENDATIONS

There is still a dearth of province-specific scientific literature on climate change impacts on the agricultural sector and on locally relevant climate change adaptation practices. While there is awareness of Climate Smart Agriculture and agricultural climate resilience more generally amongst responsible institutions, officials, and even some farmers within the Eastern Cape, available literature points to the province being at early stages of engaging with and operationalizing such efforts. The recommendations that follow are closely linked to the concepts of Climate Smart Agriculture, but the specifics of these adaptation strategies have been suggested by stakeholders in various fields bearing in mind overall sustainability of the agriculture sector as well.

- **Create a Climate Smart Agriculture programme to help develop or promote the use of specific seed or plant varieties in specific locations:**

There is a fair amount of agro-climatic diversity even within the Eastern Cape Province. Thus, an applied research program that spurs the development or adoption of specific varieties of climate-resilient seeds or plants should aim to identify different varieties for different parts of the province. This should take into account different soil types, different staple food and dietary patterns, and other such local constraints and preferences. Such a program should involve field trials and other on-the-ground initiatives and train farmers to use these new, locally suited varieties.

- ***Enhance ongoing efforts involving Conservation Agriculture:***

The province is already engaged in great depth with Conservation Agriculture. These activities should be given a boost and such programs expanded and provided greater resources. Sub-programs should be developed and expanded to focus on key components such as mulching, agroforestry, livestock, mixed farming, nutrient conservation, water conservation etc.). These programs should involve a research component to generate much more locally relevant data, and the studies could be carried out by agricultural research centres within the province (e.g. universities) or external experts, or in partnership, and in many cases would include local trials and field tests. But the programs would also involve skills building and knowledge transfer activities to train farmers and build on-farm capacity.

- ***Initiate a dedicated climate change adaptation programme for cattle ranching / livestock rearing in the municipality:***

A multi-year, municipal-specific programme should be launched to help livestock farmers and cattle ranchers adapt to changing climatic conditions. Given the predominance of cattle farming in the Mbhashe region, this is a key area for intervention. Such a campaign would include the production of greater research conducted within the municipality, with results relevant to the local industry, but also include applied research on adaptation measures. It would involve education and training sessions, funding for on-farm adaptation measures, and ongoing assistance to ensure that farmers are maximizing the benefits of the adaptation responses utilized. The Animal and Veld Management Program (AVMP) and the Comprehensive Rural Development Program (CRDP) are key potential funders for such an initiative.

- ***Fund and implement a comprehensive climate change awareness and skills-building programme within the municipality:***

Such an awareness-building programme would be broad based and far-reaching in nature. Its design would include new curriculum (or additions to curriculum) in schools and colleges (in both basic and higher education), to teach students earlier about climate change impacts on agriculture as well as adaptation measures. It would also involve the generation of knowledge materials that could be widely disseminated, especially at key events such as Earth Day, World Environment Day, Arbor Day etc. The programme would also include awareness generation through the use of radio and television and other media, to increase public knowledge of climate change's impacts on agriculture and potential adaptation responses. The programme would not be tailored only towards the public, but would also target farmers themselves, and would involve educational outreach about the impacts of climate change on the specific crops grown in specific areas; it would engage farmers on various practices that can **strengthen climate resilience** (in an effort to lower their resistance to change) on their own land, and train them on best practices (to enhance their ability to reap successful results from adaptation measures).

*****NOTE:** *All of the aforementioned programs could be designed and developed in a one-year timeframe and then implemented on an ongoing, continuous basis (with periodic review and evaluation and recalibration as needed). Funding could be sought from development partners and by seeking grants, but would also be secured from the national treasury. The lead implementation entity would be the Department of Agriculture, Forestry and Fisheries (DAFF), working in close collaboration with the Department of Environmental Affairs (DEA), Eastern Cape Department of Economic Development Environmental Affairs and Tourism (DEDEAT), Department of Water and Sanitation (DWS), Department of Education and the Eastern Cape Rural Development Agency (ECRDA).*

ECOSYSTEMS

Ecosystems in Mbhashe, both terrestrial and aquatic, are highly vulnerable to climate change impacts, particularly in the longer term. Given the large number of people who depend on natural resources for their livelihoods, this is a threat both to human populations as well as the biodiversity of Mbhashe's ecosystems. Preserving these ecosystems in the face of climate change pressures is key, especially in light of the Eastern Cape Green Economy Vision's emphasis on utilizing unexploited biodiversity resources in the province for green tourism and payments for ecosystem services.

VULNERABILITY TO CLIMATE CHANGE

According to the South African National Biodiversity Institute (SANBI), Mbhashe falls within the Maputoland-Pondoland-Albany Hotspot. The hotspot is the remarkable meeting point of six of South Africa's eight major vegetation types. The region boasts an unusually high number of unique species and ecosystems, with one type of forest (sand forest), six types of bushveld and five types of grassland restricted to the hotspot, as well as an entire vegetation type called "subtropical thicket". The hotspot is also home to most of South Africa's natural forests, and with nearly 600 tree species it has the highest tree diversity of any temperate forest in the world. The distribution of the Pondoland centre is closely correlated with nutrient poor sandstone bedrock. The vegetation of this centre is variable and is associated with the grassland, forest and savanna biomes of South Africa. *Lamiaceae* and *Apocynaceae* constitute the bulk of species that Van Wyk and Smith (2001) considered endemic or near endemic, but most plant families have endemic species in this centre. Over 8% of the 1500 species recorded for the centre are endemic (Anderson and Van Wyk 1999). The area is under serious threat from poor land-use practices. Cowling and Hilton Taylor (1994) cited 33 species with Red Data status, although this may be much higher by now.

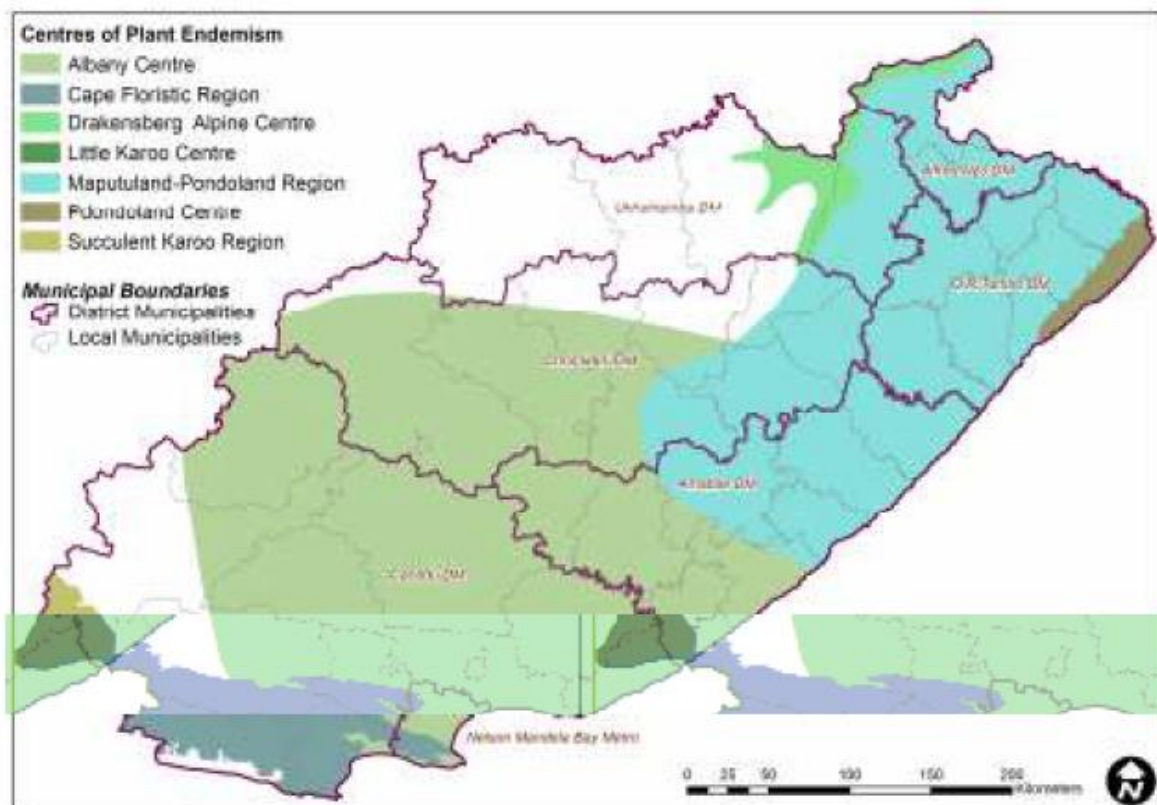


Fig. 16. Centres and region of plant endemism occurring within the Eastern Cape (adopted from the ECPB after Van Wyk & Smith, 2001).

There is also growing evidence to suggest that the grassland areas (key for grazing, as the Mbhashe area has significant potential for livestock production) may face negative impacts from climate change, as a result of encroachment by bush and woody tree vegetation. This type of forest encroachment (or forest colonization), is more likely in a wetter climate scenario, with more rain; while Mbhashe is likely to see an increase in rainfall volume and more heavy rainfall events, rising temperatures and evaporation are also likely to lead to an overall drier climate in the region, leaving it unclear whether its grazing lands may be encroached on by forest ecosystems. A better understanding is required of the impact of changing climatic conditions (carbon dioxide levels, temperature, rainfall, evaporation) in conjunction with non-climate factors (fire, grazing, changes in local megafauna etc.) on different types of ecosystems. Similarly, aquatic ecosystems in an already water-stressed municipality (as evidenced by the spate of recurring and longer drought spells in the municipality) are likely to be negatively impacted by warmer temperatures and greater evaporation rates. Invasive Alien Species (IAS) are also a concern for aquatic ecosystems in the Mbhashe municipal jurisdiction.

ECOSYSTEM CLIMATE RESILIENCE RECOMMENDATIONS

With seven biomes and three global biodiversity hotspots intersecting the province, the Eastern Cape is internationally recognised for its exceptional biodiversity. However, it currently faces unprecedented pressures from a variety of sources, including unplanned development, urban expansion, agricultural expansion, non-sustainable subsistence harvesting, afforestation, and the emerging biofuels industry. Of increasing concern are the impacts that the projected future climate changes will have on biodiversity and ecosystem services.

The Eastern Cape Biodiversity Conservation Plan is a systematic guidance for conservation in the province, comprising maps of Critical Biodiversity Areas (CBAs) and land-use guidelines. Critical Biodiversity Areas (CBAs) are defined by Berliner et al. (2007) as: "CBAs are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning". These areas are classified as natural to near-natural landscapes. In addition to the CBA's the ECBCP also defines Other Natural Areas (ONA) as well as Transformed Areas. A helpful tool that is available to the municipality is the SANBI-developed Biodiversity GIS Land Use Decision Support (LUDS) tool, which provides municipality-level biodiversity information and summaries, enabling planners to better understand the impacts of land use decisions on underlying ecosystems. However, this tool does not integrate information about projected climate change impacts to ecosystems and recommended adaptation measures.

The National Climate Change Response Strategy White Paper notes, in relation to biodiversity and ecosystem adaptation to climate change, that responses to climate change should include the following: (i) strengthening biodiversity management and research institutions for better monitoring and assessment; (ii) conservation, rehabilitation, and restoration of natural ecosystems that improve resilience; (iii) prioritizing impact assessment and adaptation planning; (iv) prioritizing research into climate change ecosystem threats in marine and terrestrial ecosystems, including effective monitoring; (v) expanding the protected area network with a perspective on climate resilience; and (vi) encouraging partnerships for areas that are not under formal protected status.

Across the Eastern Cape and in the ADM & Mbhashe municipalities, a significant amount of attention and resources are already devoted to conservation and ecosystem preservation. However, there appears to be a need for both (a) focused programmes and initiatives that specifically take a climate change perspective when examining ecosystems (terrestrial and aquatic); and (b) further integrating climate change into existing plans, policies, and programs, i.e. climate mainstreaming in conservation

and natural resources management, into Integrated Development Planning. To this end, the following recommendation is offered:

- ***Develop a specialized climate change management programme to focus on protection of Mbhashe's ecosystems in the face of climate change:***

The municipality should consider the development of an Invasive Alien Eradication Strategy and, in partnership with the South African National Biodiversity Institute endeavour to eradicate IAS in its jurisdiction and improve ecosystem goods and services. Wetlands Management and Catchment Management programs should be designed for this purpose (or as part of the IAS strategy development process), and implemented in line with the municipality's LED Strategy.

*****NOTE:** *the above recommendation can be designed easily and a bankable business proposal stemming out of this development process can be used to source funding from the DEA Working for Water & Working for Wetlands Program and implemented on a continuous basis subject to the conditions of the DEA / EPWP funding windows.*

WATER SERVICES SECTOR

The delivery of water and sanitation is the core competence of ADM which is a water services authority as well as a water services provider for all the areas under the Mbhashe municipality. This means that the primary responsibility to ensure that local people have access to water and sanitation services, & infrastructure rests with the district. Mbhashe municipality once it concludes a service level agreement with ADM will have a responsibility over the operation and maintenance of water and sanitation services within its areas of jurisdiction (Mbhashe LM IDP, 2012-2017). The backlog for water supply is unacceptably high and estimated to be between 75% and 78% when combining urban and rural areas that currently do not enjoy access to government defined basic level of 200 meters from a dwelling.

The base assumption about the water impacts of climate change informing the strategic responses is that South Africa's water resources are highly developed, highly stressed and suffer from a certain level of degradation. High water demand and high levels of pollution from a variety of sources have added to the complexities of a fundamentally high risk hydrology. Thus climate change adds a layer of increased stress onto an already stressed system. Preliminary results for national runoff using the Pitman modelling approach suggest a change that lies between a 20% reduction to a 60% increase under an unconstrained greenhouse gas emissions scenario (UCE emissions scenario). If global emissions are constrained to stabilise at 450 ppm CO₂ equivalent, (L1S emissions scenario) the risk of extreme increases and reductions in runoff are sharply reduced, and the impacts lie between a 5% decrease and a 20% increase in annual runoff (LTAS, 2013). Urban and rural water supply currently accounts for 23% and 4% of the national water resource allocation respectively. The Water for Growth and Development Framework (DWAF, 2009b) estimates that due to the projected growth in population, domestic water use will increase from 27% of total national water use to between 30% and 35%. DWAF (2009b) also states that urban municipal areas account for 23% of the national water use, while rural settlements use only 4%. This is partly because service levels in urban areas are much higher, but also because 20% to 30% of water use in urban areas is industrial.

With particular emphasis to the Mbhashe local municipality, challenges include but are not limited to over-abstraction in surface water bodies and groundwater, sometimes tied directly to upstream diversions, reservoirs and deforestation; water resources pollution through inappropriate land-use practices and uncontrolled discharge of pesticides and sewerage effluent which have detrimental impacts on the water services sector, exacerbated by climate change effects. Sediments occur in water

bodies both naturally and as a result of various human actions. When they occur excessively, they can dramatically change our water resources. Sediments occur in water mainly as a direct response to land-use changes and agricultural practices in the Mbhashe area.

VULNERABILITY TO CLIMATE CHANGE

Studies indicate that in most climate change scenarios projected for the Mbhashe area, future water supply availability by 2050 will “worsen considerably” (DWA, 2011). For a province that is heavily agrarian (with significant irrigation needs), as well as a province where nearly half of the population did not have access to piped water within their own dwelling or yard (in 2011), the prospects of increased water stress are significant. It is suggested that future climate change related water stress in the Mbhashe area can be potentially mitigated by improved water infrastructure and management, although it will be difficult to compensate for all the adverse impacts. The ADM has embarked on a district-wide Water Services Infrastructure Provisioning and Refurbishment process for its local municipalities including Mbhashe LM.

There are distinct benefits to using WFW as an adaptation measure, especially as climate change exacerbates water scarcity. However, resources will be required for ongoing management to keep areas alien free and to rehabilitate natural vegetation to ensure that water services are maintained. In light of this, the following recommendations are made for the water sector climate resilience in Mbhashe local municipality:

- ***Strengthen existing Catchment Management efforts:***

Adaptation to climate change in the water sector must go beyond water infrastructure and institutional arrangements, to the source of the water itself. Thus, there is a need to enhance Catchment Management activities already underway in the municipality through the MPAH Climate Adaptation Project of the South African National Biodiversity Institute. Specifically, efforts should be made to stem and reduce deforestation in catchment areas (as well as degradation). Attention should also be given to the removal of alien invasive species in catchments.

- ***Raise performance and efficiency of water service delivery for domestic use, with aggressive quantitative targets:***

A key determinant of overall human vulnerability is access to basic services. The ADM and consequently the Mbhashe local municipality has a lot of ground to cover in terms to providing people adequate access to safe and reliable drinking water for domestic consumption, cooking, bathing etc. Until such time that the population universally enjoys water security, strengthening climate change resilience through other adaptation measures in this or other sectors will be significantly more challenging. Thus, the municipality should set or strengthen targets for provision of universal access (in line with national targets or even more ambitious) and quantitative, measurable metrics for performance and efficiency (such as the reduction of conveyance losses from leaks). These should be annually evaluated and recalibrated based on progress made.

STRATEGIC OPPORTUNITIES / INTERVENTIONS

Global warming and other factors have resulted in a strong movement towards a sustainable or “green” economy across all sectors of the world economy. The United Nations Environment Programme (UNEP) defines a green economy as one that results in an improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In a green economy, economic growth is based on sustainable development, with the current focus being on the following key sectors:

- Renewable energy
- Green buildings
- Clean transportation
- Water management
- Waste management

Any strategy for Climate Change response must be based on two critical concepts:

- Climate Mitigation being the reduction in the emission of Greenhouse Gases and thus over time a reduction in the extent and severity of the impacts of Climate Change; and
- Climate Adaption being described as adapting an area to climate change impacts and thus reducing the vulnerability of the area and its population to the adverse impacts of climate change.

Many of the actions to manage climate variability and reduce climate change impacts, that are identified in South African national policy fall within local government responsibilities as detailed in the Constitution of South Africa (Act 108 of 1996) and the Municipal Systems Act (Act 32 of 2000). Thus it is a priority of local governments to consider climate change responses in their planning, resource allocation and implementation of programmes. Through the incorporation of innovative climate change responses into Integrated Development Plans (IDPs), sector plans and land use planning; communities can ensure that urban and rural resilience is fostered and climate change is viewed as an opportunity rather than a threat. Indeed there are a number of benefits and opportunities for local government to explore in responding to climate change challenges, these include:

- The delivery of new energy services provides an opportunity for an integrated and holistic approach to address the priorities of potable drinking water, sanitation and poverty reduction in the development plans;
- Energy efficiency reduces GHG emissions but also improves the economic competitiveness of a region;
- Business opportunities may arise through new, ‘green’ industries such as amongst others energy efficiency, carbon off-set, waste disposal, sustainable building, biofuels production and biomass harvesting;
- Public transport reduces transportation costs and stimulates economic activity as well as reducing air pollution and congestion;
- Improved building quality, energy efficient building and settlement design can greatly improve health and quality of life;
- Replenishing the natural resource base secures continued extraction of natural resources and maintains ecosystems i.e. rebuilding wetlands, planting trees and clearing alien plants. This supports the region’s tourism, agriculture, conservation sectors as well as rural households who make use of ecosystem services;

- Urban greening absorbs carbon and provides shade and beauty, which can improve aesthetics and value of the properties and offers intrinsic value to communities.

Electricity is one of the primary sources of energy that catalyzes development and remains an important input to a growing economy. Analyzing access to it is therefore central to the understanding levels of prevalent lifestyles and commercial activity in local economies. Supply for electricity in the municipality is hampered by insufficient bulk infrastructure to supply growing demand in especially urban and coastal parts of the municipality. This is both a challenge and an opportunity, as renewable energy technologies provide attractive environmentally sound technology options for the Mbhashe LM and South Africa's electricity industry. Renewable energy technologies could offset a significant proportion of fossil-fuel based electricity generation in South Africa. In addition, renewables are modular and are well suited for meeting decentralised rural energy demand.

According to the Mbhashe LM IDP, Eskom is the licensed distributor of electricity in the entire Mbhashe LM area of jurisdiction. An Integrated National Electrification Programme (INEP) grant under Schedule 5 of Division of Revenue Act for household electrification is being received by Mbhashe LM. As at 2014/2015 financial year, there were about 1354 households remaining at Shixini and 2060 households remaining in Ntsimbakazi. Mbhashe LM became one of the municipalities in the Eastern Cape to provide communities with the Solar System (non-grid electrification). According to Stats SA Census 2011, electricity is used by about 50% households for lighting, which in other words mean that the electricity backlog "at that time" was about 50% (30262) households.

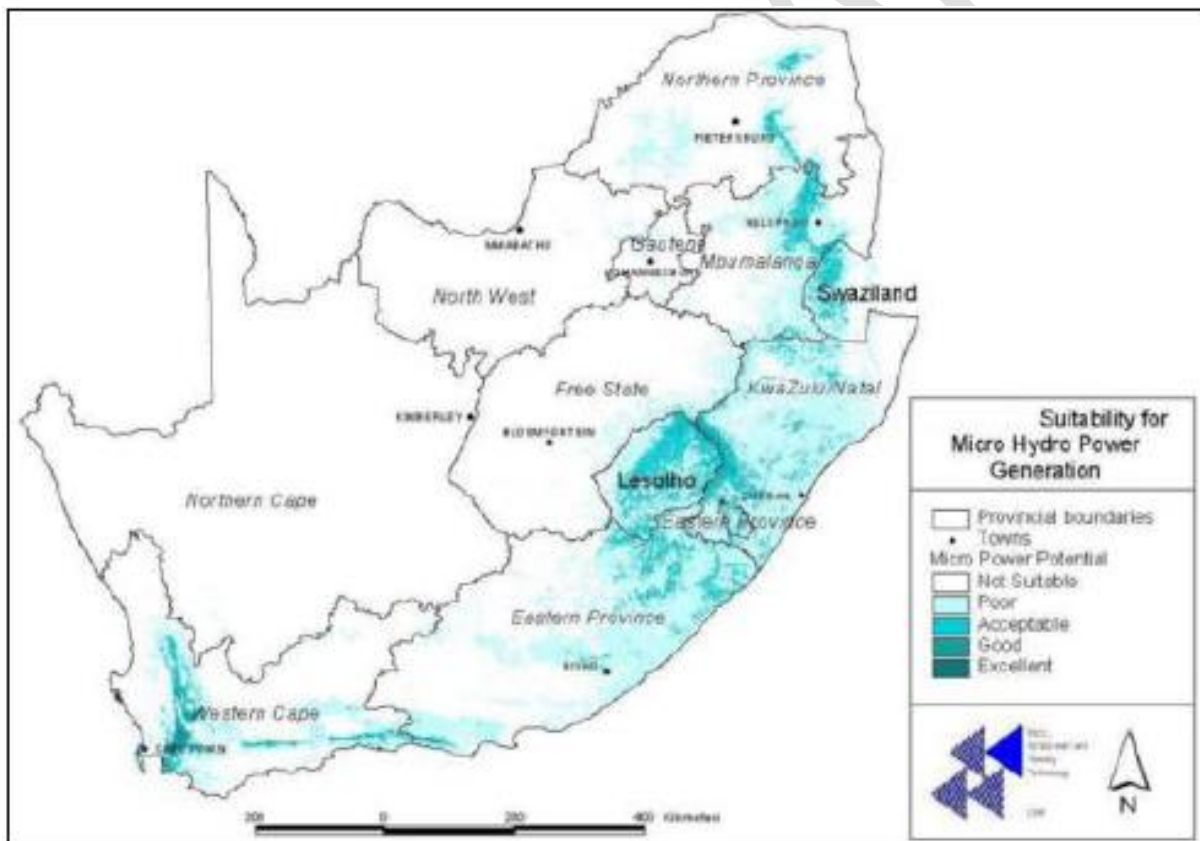
Wood is used predominantly for cooking and heating purposes at 40% and 50% households respectively, causing high pressure to environmental balance. For cooking, next favorite is electricity at 37% followed by paraffin at 15%. Paraffin and candle are competing at 14% each for lighting next to electricity. Paraffin and electricity are the second and third sources of heating at 23% and 15% respectively.

The allocation for 2014/2015, 2015/2016 & 2016/2017 financial years is R3m, R20m & R25m respectively. Initial allocation for 2014/2015 for the Mbhashe LM was R2m inclusive of VAT, which amounts to approximately 110 new connections which will go to Camshe Village which is under Shixini Electrification Project. During the budget adjustment an INEP allocation was adjusted to R3m and three villages (Mafusini, Hlakoti and Lower Mbhangcolo) were then added under Ntsimbakazi Electrification Project. There are huge electrification backlogs of about 20023 households without electricity as per the updated list per village per ward as of July 2014 (Ntsimbakazi and Shixini included).

The most electrification backlog in the Mbhashe LM is in Elliotdale, and the ESKOM electrification plan indicates that some villages in Elliotdale will not be electrified in the next three years. According to the Potential Contribution of Renewable Energy in South Africa (Raps Consulting, Douglas Bank, and Nano Energy, 2006) it is expected that the energy demand will grow significantly in the next 50 years, driven particularly by important changes in livelihood patterns of the millions of people who live at or below the poverty line. There is a projected tripling of total energy and electricity requirements if current government planning projections (up to 2022 are extended to 2050).

South Africa and the Eastern Cape Province hold a strong position with respect to wind resources. The wind resource was estimated by Szewczuk et al (1999) at a 1 km² spatial resolution using a combination of WASA and modified NOABL wind flow modelling. Of the total area of the Eastern Cape Province (169,899 km²), at a height of 60m, 148,056 km² has been estimated to have an annual mean wind speeds greater than 6 m/s, 11,787 km² greater than 7 m/s, 581 km² greater than 8 m/s and 32

The quantities of refuse generation arising from the smaller municipalities are insufficient to consider refuse derived waste generation at a utility scale unless they can be supplemented with additional feedstock arising from other sources such as abattoir waste. Potential however exists for small scale implementation of biodigesters at rural communities. The cumulative potential from wood, agricultural and grass residues however is significant and provided the feedstock can be sustainable, larger scale biomass projects are worth consideration.



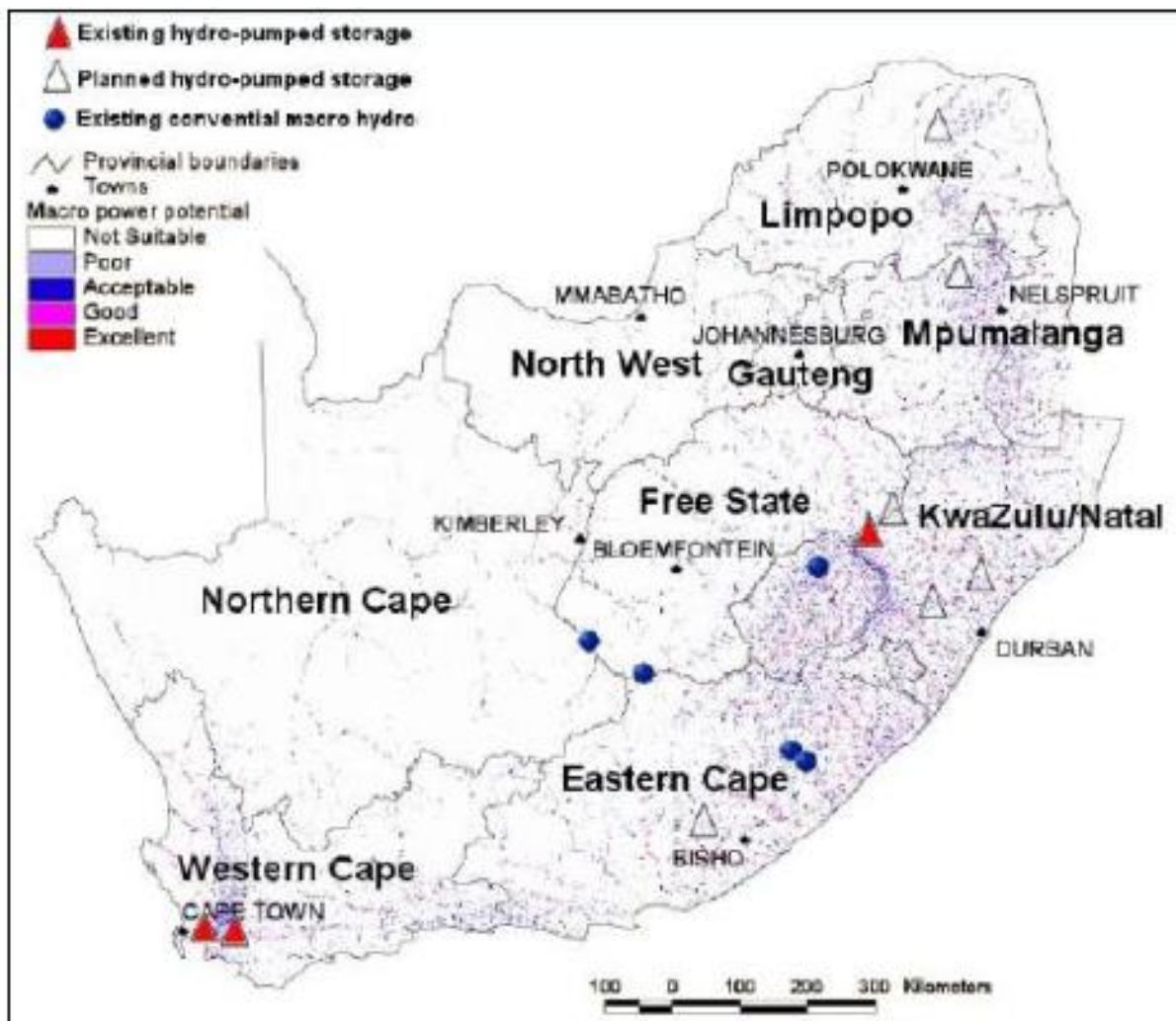


Fig. 17 – 18. Shows suitability for micro and macro Hydro Power Generation & Hydro Power Resources in South Africa (Banks, et al., 2006).

The Industrial Development Corporation (IDC) in partnership with the German Development Bank (KfW) has launched the Green Energy Efficiency Fund (GEEF). The fund includes a R500-million facility that supports the introduction of energy efficiency and self-use renewable energy technologies. Although the fund is only available to business operating or expanding in South Africa, local municipalities can access it through a Public Private Partnership (PPP) or follow a third-party ownership model. The fund will also finance projects by non-enterprises if they provide significant energy and emission reductions. On the other hand, the Central Energy Fund (CEF) established a renewable energy division whose role is to pursue commercially viable investments in the renewable energy sector in South Africa. Upon approval, they channel grants and loans to projects through international development partners.

CONCLUSION

Significant attention has been given to improving our understanding of the real and imminent impacts of climate change. It is accepted that rising temperatures, changes in rainfall patterns, extreme weather events, changes in sea levels and changes in biodiversity will have significant consequences on the world economy, rural livelihoods and development in general. Africa in particular will be hardest hit by climate change yet its adaptive capacity remains low. The continent faces increasing water scarcity, a reduction in agricultural productivity, increased risks of floods and droughts and negative impacts on the health sector among others. Climate change is an additional stressor for a continent that is already struggling with food insecurity, high poverty levels, and a HIV/Aids pandemic. Climate change will have critical impacts on the economies of the region and threatens to reverse the gains of sustainable development in Africa.

South Africa will be equally faced with adverse impacts of climate change in various sectors of its economy. The South African Country Studies Programme identified the energy, mining, health, agriculture (particularly maize production), biodiversity, water resources and rangelands as the most vulnerable sectors.

South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through collaboration nationally, regionally and globally.

Mbhashe LM has heeded the call for this sustainable development vision and commissioned the development of this strategy and resilience plan; to demonstrate its unwavering commitment to being *“a municipality that excels in promoting social cohesion, stimulates economic growth and sustainable development”*.

As this document has shown, climate change is very much likely to result in major environmental changes that will present risks as well as opportunities across Mbhashe LM. For instance, changes in rainfall patterns threatens the future of maize and livestock production. On the other hand, this prompts government departments and the municipality to evaluate the composition of their rural development enabling-infrastructure (e.g. irrigation schemes) and the need to balance these infrastructure choices with scalable employment creation projects.

This document examines two types of solutions to the climate change phenomenon. First, adaptation being described as adapting an area to climate change impacts and thus reducing the vulnerability of the area and its population to the adverse impacts of climate change; and secondly mitigation being the reduction in the emission of Greenhouse Gases and thus over time a reduction in the extent and severity of the impacts of climate change. We recommend that climate action for Mbhashe LM requires that the dependency on fossil fuels-based electricity must be replaced with renewable or alternative energy sources – biomass fuels, hydro energy, wind power and solar energy.

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