Climate Change Vulnerability Assessment and Response Plan

March 2018

Version 2

Developed through the Local Government Climate Change Support Program

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
of the Federal Republic of Germany

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Department:
Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

Report Submitted to

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

of the Federal Republic of Germany

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This project is part of the International Climate Initiative (IKI) and is supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

Version Control

Version	Date Submitted	Comments
1	1 November 2017	Draft version with desktop review information
2	14 March 2018	Current Version Included stakeholder feedback from Vulnerability Assessment workshop

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1 Executive Summary

Harry Gwala District Municipality recognises climate change as a threat to the environment, its residents, and to future development. Therefore, measures should be implemented to reduce or eliminate carbon emissions or enhance greenhouse gas sinks (mitigation) (Böckmann, M 2015). However, due to lag times in the climate and biophysical systems, the positive impacts of past and current mitigation will only be noticeable in the next 25 years (Jiri, O 2016). In the meanwhile, adaptation is regarded as inevitable and a necessary response to the changes that are projected to take place in the District. Harry Gwala District Municipality has therefore prioritised the development of a Climate Change Vulnerability Assessment and Climate Change Response Plan.

The Climate Change Vulnerability Assessment and Response Plan was developed through the Local Government Climate Change Support (LGCCS) program (http://www.letsrespondtoolkit.org/). The LGCCS is led by the Department of Environmental Affairs and is part of the International Climate Initiative (IKI) and is supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

Through this program key climate change vulnerability indicators for the Harry Gwala District Municipality were identified. These indicators demonstrate areas that maybe at high risk of climate change impacts.

A summary of the key vulnerability indicators is provided in the table below.

Table 1: Key Vulnerability indicators for Harry Gwala District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
7	Agriculture	Change in other crop production areas (e.g. vegetables, nuts, etc.)	Yes	High	Low
10	Agriculture	Increased risks to livestock	Yes	High	Low
12	Biodiversity and Environment	Loss of High Priority Biomes	Yes	High	Low
15	Biodiversity and Environment	Loss of Priority Wetlands and River ecosystems	Yes	High	Low
25	Human Health	Increased malnutrition and hunger as a result of food insecurity	Yes	High	Low
32	Human Settlements, Infrastructure and Disaster Management	Increased migration to urban and peri-urban areas	Yes	High	Low
33	Human Settlements, Infrastructure and Disaster Management	Increased risk of wildfires	Yes	High	Low
37	Water	Less water available for irrigation and drinking	Yes	High	Low
38	Water	Increased impacts of flooding from litter blocking storm water and sewer systems	Yes	High	Low

Based on the key indicators identified in the table above, the following objectives and projects are prioritised as a response to each of the indicators.

1.1 Agriculture

The Harry Gwala District Municipality's agricultural sector will be adversely affected by climate change. Increased temperatures, drought, and the increase in frequency and severity of storm events will impact on the crops that can be grown and potentially result in a loss of livestock.

The following key agricultural objectives and projects were identified:

Objective	Project	Priority
Manage the change in other crop production	Department of Agriculture to improve farming techniques for water saving, production capacity and organic farming.	Priority
Manage increasing risks to livestock	Harry Gwala District Municipality together with farmers to improve firebreaks and create awareness around the importance of maintaining firebreaks.	Priority

1.2 Biodiversity and Environment

Climate change predictions include the shifting of biomes across South Africa. In the Harry Gwala District Municipality, it is projected that, with the changes in climate under a high-risk scenario, the Savanna biome will replace large areas of the Grassland biome. Terrestrial, wetland, and river ecosystems and their associated species will be negatively impacted. Furthermore, development and changes in land use will impact negatively on the environment in the District.

The following key biodiversity objectives and projects were identified:

Objective	Project	Priority
Manage Loss of High Priority Biomes	Establish a Natural Resource Management Committee for the District Municipality which will be coordinated by the delegated individuals in the Local and District Municipalities.	Priority
	The environmental and social development departments to establish an alien plant removal programme in each Local Municipality by 2022. The Programme should focus on the identification of priority areas and securing funding from NRM.	Priority

1.3 Human Health

Climate change impacts affect the social and environmental determinants of health and will therefore affect human health in several ways in the Harry Gwala District Municipality. Projected temperature increases due to climate change will negatively affect the young and elderly population of the district. People working in the informal sector usually work outdoors and are therefore exposed to all weather elements and are particularly vulnerable to temperature increases.

The following key human health objectives and projects were identified:

Objective	Project	Priority
Manage increased malnutrition and hunger as a result of food insecurity.	Environmental Health Practitioners to conduct awareness campaigns on food insecurity in rural areas and informal settlements in the District by June 2019.	Priority
	LED to initiate a project that supports the development of	Priority

	SMMEs in order to reduce the unemployment rate by June 2020 in the District Municipality.	

1.4 Disaster Management, Infrastructure and Human Settlements

Climate change impacts will affect Disaster Management, Infrastructure and Human Settlements in several ways in Harry Gwala District Municipality. Increases in the severity of storm events and increase in flooding will damage infrastructure which may result in a loss of industrial productivity and service delivery disruptions. The impacts of storm events will particularly affect communities located in informal settlements, on flood plains and where there is poor drainage infrastructure. In addition, communities in rural areas that depend on subsistence farming may be unable to grow crops that they have grown in the past due to the changing climate. It is predicted that there will therefore be an increase in rates of rural-urban migration. Rural communities may also become more physically isolated due to extreme events impacting on key infrastructure.

The following key human settlement objectives and projects were identified:

Objective	Project	Priority
Manage potential increase migration to urban and peri-urban areas.	The Department of Water Affairs and the Harry Gwala District Municipality to investigate the possibility of assisting small scale and subsistence farmers in rural areas by providing infrastructure such as boreholes, water harvesting initiatives, JoJo tanks, water trucks/tankers in order to contribute towards sustainable subsistence farming and food production by 2025.	Priority
Manage potential increased risk of wildfires	Municipalities to increase public awareness on fire preventions by investing in the procurement of equipment to be distributed through traditional leaders before each winter season.	Priority

1.5 Water

Water resources are the primary medium through which climate change impacts will be felt by South Africans (Schulze et al., 2014). Climate change will affect Harry Gwala District Municipality's water accessibility, quantity, and quality (Parikh, J 2007). Drought, reduced runoff, increased evaporation, and an increase in flood events will impact on both water quality and quantity.

The following key water objectives and projects were identified:

Objective	Project	Priority
Manage the quantity of water available for irrigation and drinking.	Conduct awareness campaigns that promote water saving.	Priority
Manage the increased impacts of floods due to litter blocking the sewer system.	The Department of Environmental Affairs to assist the District with developing an Integrated Waste Management Plan.	Priority

1.6 Cross-Cutting

The projected impacts of climate change for Harry Gwala District could ultimately negatively impact the economy of district. Since the Agricultural sector is an important contributor to the district economy and the projected impacts of climate change on agriculture could negatively impact on the district economy. It should also be noted that the project impacts of climate change could also

negatively impact on the finances of the municipality. For instance, water shortages will require the implementation of demand management measures by the district resulting in lower water sales.

No	Objective	Project	Priority
63	**Generate knowledge and disseminate information on climate change**	Commission a research report into the potential impacts of climate change on the district economy and municipal finances.	

2 Introduction

This document outlines key climate change vulnerabilities and responses to address these vulnerabilities for Harry Gwala District Municipality. The Climate Change Vulnerability Assessment and Response Plan were developed through the Local Government Climate Change Support Program (LGCCSP), an initiative of the National Department of Environmental Affairs and the International Climate Initiative (IKI) and is supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

The three primary objectives of the LGCCSP are to:

- Perform a desktop analysis of the municipality to provide context on change vulnerabilities and responses;
- Undertake district municipal specific engagements to draft climate change vulnerabilities and responses;
- Facilitate capacity building and knowledge-transfer throughout the program to enhance implementation of prioritised climate change adaptation options.

For more details on the LGCCSP please visit the website: http://www.letsrespondtoolkit.org/.

Through the LGCCSP, a Climate Change Vulnerability Assessment Toolkit was developed to assist municipalities to identify and prioritise climate change indicators to facilitate the assessment of adaptive capacity. Indicators are a range of potential impacts which have been developed using the Long Term Adaptation Scenario (LTAS) reports (Department of Environmental Affairs 2013e). Indicators are grouped into the following themes:

- Agriculture
- Biodiversity and Environment
- Human Health
- Disaster Management, Infrastructure and Human Settlements
- Water

The LGCCS Toolkit was applied to the Harry Gwala District Municipality to assist with the development of its Climate Change Response Plan.

2.1 Climate Change Introduction

2.1.1 Climate change defined

Climate change is a natural phenomenon that takes place over geological time. However, over the past few decades the rate of climate change has been more rapid and the magnitude of global warming has increased dramatically (Warburton, M.L and Schulze, R 2006; Warburton, M.L 2012). This change has been attributed to increased anthropogenic greenhouse gas emissions (Koske, J and Ochieng, M.A 2013). For example, the burning of coal to generate electricity, the burning of petrol in cars, some chemical processes in industries, and many farming activities all contribute to the increased concentration of greenhouse gasses in the atmosphere.

Climate change is not just an increase in average global temperatures but changes in regional climate characteristics such as rainfall, relative humidity and severe weather extremes (Davis, C.L 2011). Climate change can manifest as a shock or a stress (Ziervogel, G and Calder, R 2003). Shocks are defined as discrete, extreme events (rapid onset) such as floods, while gradual change (slow onset) such as long-term climate variability is classified as a stress (Ziervogel, G and Calder, R 2003).

The negative impacts of climate change "are already felt in many areas, including in relation to, *inter alia*, agriculture, and food security; biodiversity and ecosystems; water resources; human health; human settlements and migration patterns; and energy, transport and industry" (United Nations WomenWatch 2009, 1).

2.1.2 Climate Change Policy Context in South Africa

Climate change is a relatively new area of policy development in South Africa. As policies and structures are developed, it is necessary to ensure that they are evidence-based, coordinated and coherent. This section introduces international and national climate change policies and structures, which are listed below:

- The United Nations Framework Convention on Climate Change (UNFCCC). This international treaty provides guidance on setting agreements pertaining to the reduction of greenhouse gas emissions.

- The Paris Agreement, came into effect on 4 November 2016. This is the first agreement all countries have committed to and stipulates that all countries must reduce carbon emissions to limit global temperature increase to 1.5 degrees Celsius above pre-industrial levels.

- South Africa's Nationally Determined Contributions, came into effect after the Paris Agreement was signed. South Africa is therefore required to report on mitigation and adaptation efforts. Concerning mitigation, South Africa is to reduce emissions by a range between 398 and 614 million metric tons of carbon equivalent by 2025 and 2030. There are several instruments to ensure reduction in carbon emissions including car tax and company carbon budgets among other instruments. With reference to adaptation a National Adaptation Plan is currently being developed, and climate change is to be incorporated in all policy frameworks, institutional capacity is to be enhanced, vulnerability and adaptation monitoring systems are to be in place, vulnerability assessment and adaptation needs framework are to be developed and there needs to be communication of past investments in adaptation for education and awareness.

- The National Climate Change Response White Paper (NCCRWP) was adopted in 2011 and presents the South African Government's vision for an effective climate change response in the long-term, to transition to a climate-resilient and lower-carbon economy and society.

- The National Development Plan, focuses on eliminating poverty and reducing inequality by 2030 and creating an environmentally sustainable country through mitigation and adaptation efforts.

- Long Term Mitigation Scenarios, outline different scenarios of mitigation action for South Africa.

- Long Term Adaptation Scenarios, consist of two phases. Phase one, was the identification of climate change trends and projections as well as impacts and responses for the main sectors. Phase two focussed on integrating issues such as climate information and early warning systems, disaster risk reduction, human settlements and food security.

2.1.3 Climate Change Impacts in South Africa

South Africa's temperature is expected to increase to 1.2° C by 2020, 2.4° C by 2050 and 4.2° C by 2080 (Kruger, A.C and Shongwe, S 2004). Contrary to the global increase in rainfall, South Africa's rainfall is expected to decrease by 5.4% by 2020, 6.3% by 2050 and 9.5% by 2080 (Kruger, A.C and Shongwe, S 2004). The frequency and intensity of climate extremes, *inter alia,* droughts, floods, storms and wild fires will increase (Davis, C.L 2011; Böckmann, M 2015). Climate change evidence indicates changes in frequency and intensity of flood and prolonged drought events at small scales (Meyiwa, T et al. 2014). Furthermore, the sea level will continue rising and ocean acidification will get worse (Böckmann, M 2015).

There are however uncertainties associated with climate projections because they are based on the potential rates of resource use in the future, and associated greenhouse gas emissions (Nicholson-Cole, S.A 2005).

To aid in assessing the potential climate change impacts, the country has been divided into six hydrological zones (Figure 1 below). These hydrological zones not only reflect water management areas but have been grouped according to common climatic and hydrological characteristics (Department of Environmental Affairs 2013a). Based on a range of data and projections, four possible climate scenarios have been identified for South Africa:

- Warmer/wetter (with greater frequency in extreme rainfall events),
- Warmer/drier (with an increase in frequency of drought and somewhat increased frequency of extreme rainfall events),
- Hotter/wetter (with substantially greater frequency of extreme rainfall events), and,
- Hotter/drier (with a substantial increase in the frequency of drought events and greater frequency of extreme rainfall events).

Projections on rainfall have also been developed for each of the hydrological zones (Department of Environmental Affairs 2013a). The following four climate change scenarios have been described for the Pongola Hydrological Zone (the dominant zone in KwaZulu-Natal) in the Department of Environmental Affairs' Long Term Adaptation Scenarios Reports. These are:

- Warmer wetter scenario - Increased rain in spring
- Hotter drier scenario - Decreased rain in spring & strongly decreased in summer & autumn
- Hotter wetter scenario - Strongly increased rain in spring
- Warmer drier scenario - Decreased rain in spring & strongly decreased in summer & autumn

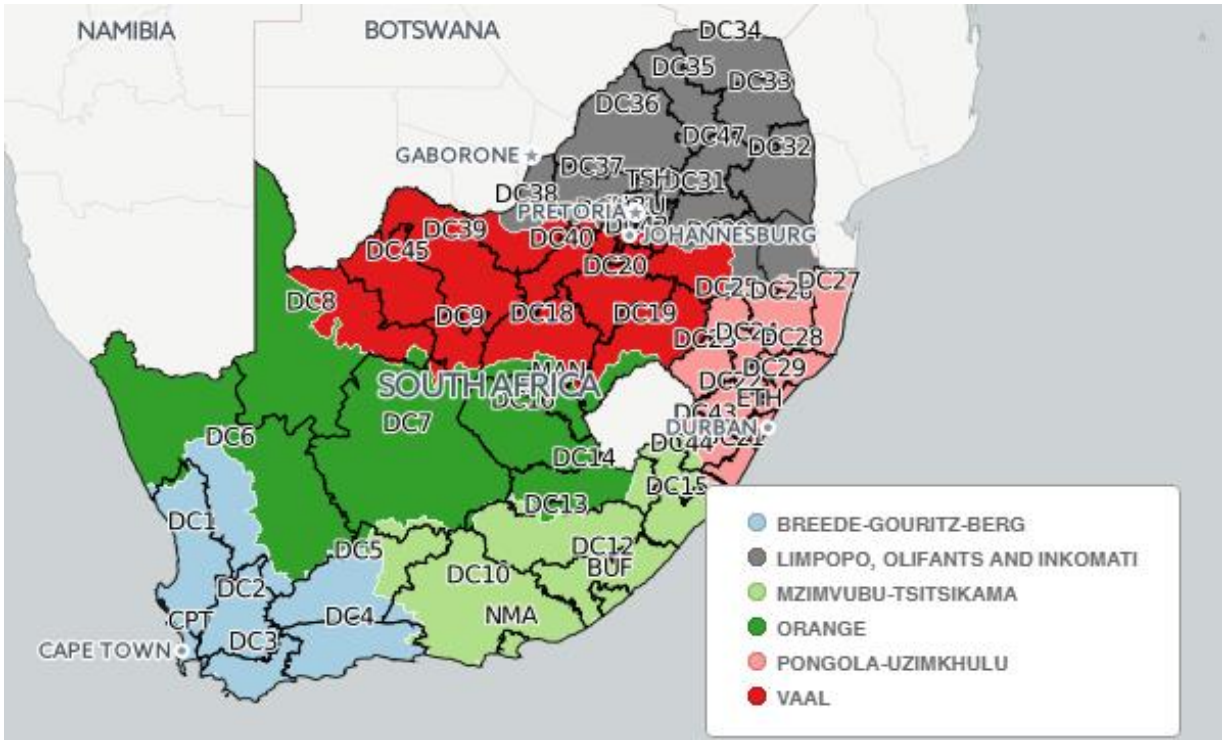

Figure 1: Hydrological Zones of South Africa

2.1.4 Provincial Climate Change Context

The KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) has developed the Draft Climate Change Action Plan (June 2014). The plan covers both mitigation and adaptation strategies, but provides limited detail on adaptation strategies. For example, the plan only mentions the development of sector specific climate change response plans. A Status Quo Vulnerability Study of the Impacts of Climate Change in the KZN Province, developed by Department Agriculture, Environmental Affairs & Rural Development (DAEARD) in 2009, provides a much more detailed assessment of climate risks.

The KZN Council for Climate Change was established in 2012 to coordinate climate change management activities in the province. However, the council has not been operational over the past two years. KwaZulu-Natal has managed to secure some climate change funding, particularly through United Nations Industrial Development Organization (UNIDO) for mitigation activities. eThekwini Municipality has also secured funding through the Green Fund for the Buffelsdraai Community Reforestation Project.

Climate change poses a significant threat to KwaZulu-Natal's water resources, food security, health, infrastructure, ecosystem services and biodiversity (Montmasson-Clair, G and Zwane, M 2016). High vulnerability in the province is attributed to low adaptive capacity (Shezi, N and Ngcoya, M 2016) and biophysical sensitivity (Department of Rural Development and Land Reform 2013).

The table below is a summary of the key climate change issues in the province as outlined in the Status Quo Vulnerability Study of the Impacts of Climate Change in KZN.

Table 2: Key climate change issues in KZN

Adaptation Category	Vulnerability Details
Natural systems	Natural systems highly susceptible to change Biggest risks are uncertainties to thresholds
Water resources	KZN already water stressed Potential increase in evaporation Increase in storm events and associated discharge events
Biodiversity resources	Climate change will increase already high rates of biodiversity degradation Potential for bio-climatic shifts to take place Species rich hotspots under threat
Fire regime	Bio-climatic shifts may change impacts of fire Need more research into fire regimes and climate change
Coastal zone	Observed changes in sea level Storm events already resulting in loss of property South Coast particularly vulnerable to coastal erosion
Agricultural sector	Net loss of cold to moderate climatic zones and a potential increase in warm sub-tropical and tropical areas Potential increase in new pests

3 Methodology

This climate change response plan was developed through a combination of desktop research and stakeholder engagement activities. Initially, desktop research was conducted on the climate change status quo for each of the key sectors in the district. This research was used for the basis of the stakeholder engagement activities.

The workshop methodologies were based on the active-based learning theory approach. Action learning is an approach used to train and to encourage stakeholders to solve real life problems. The workshop methodologies ensured there was a focus on knowledge exchange and capacity building at the workshops.

There were four stakeholder engagement occurrences. These were:

1. Provincial level workshop, where key stakeholders were introduced to the core concepts of climate change and the LGCCSP program. The exposure component of the vulnerability assessment was also undertaken by various stakeholders at this workshop, including government officials and other key community members. The workshop therefore involved presentations, participatory exercises and associated discussions.
2. A District Municipality Level workshop, where the focus was specifically on the identification and review of key climate change vulnerabilities for the area. A more detailed vulnerability assessment was undertaken by the participants. The process included the identification of context specific climate change indicators, assessing exposure, sensitivity and adaptive capacity.
3. A second District Municipality Level workshop, where key stakeholders were invited to review the vulnerability assessment process and develop priority climate change responses.
4. A final Provincial Level workshop, where key stakeholders were invited to present their municipal climate change plans.

These workshops aimed to provide the necessary tools, build capacity and provide support to stakeholders to develop and review existing Climate Change Vulnerability Assessments and response plans.

3.1 What is a Vulnerability Assessment?

According to the IPCC (Parry et al. 2007) "vulnerability to climate change is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change". A vulnerability assessment therefore is a multifaceted assessment of an area's vulnerability to climate change. Nelitz et al. further define a climate change vulnerability assessment as "a process for assessing, measuring, and/or characterizing the exposure, sensitivity, and adaptive capacity of a natural or human system to disturbance"(Nelitz, M, Boardley, S, and Smith, R 2013). The methodology used in assessing climate change vulnerability for the District used the three assessment criteria, namely: exposure, sensitivity and adaptive capacity.

- **Exposure** refers to the magnitude and extent, to which a municipal area is exposed to climate change impacts (Amos, E, Akpan, U, and Ogunjobi, K 2015) and is a function of one's location and environment.
- **Sensitivity** on the other hand refers to the extent to which a municipal area is affected by the climate change impacts
- The IPCC (Parry et al. 2007) formally defines **adaptive capacity** as: "The ability of a system to adjust to climate change to moderate potential damages, to take advantage of opportunities, or to cope with the consequences".

Exposure and sensitivity increases one's vulnerability to climate change, while adaptive capacity decreases vulnerability. The above-mentioned components allow for more detailed characterizations of climate change vulnerability.

3.2 Steps involved in a Vulnerability Assessment

Four steps were followed when conducting a vulnerability assessment, they are:

- Step 1: Identify indicators of potential impacts.
- Step 2: Assess whether the impact will take place (exposure).
- Step 3: Assess how important the risk is (sensitivity).
- Step 4: Assess if you can respond to the risk (adaptive capacity).

Figure 2 below illustrates how the components of a Climate Change Vulnerability Assessment link to each other.

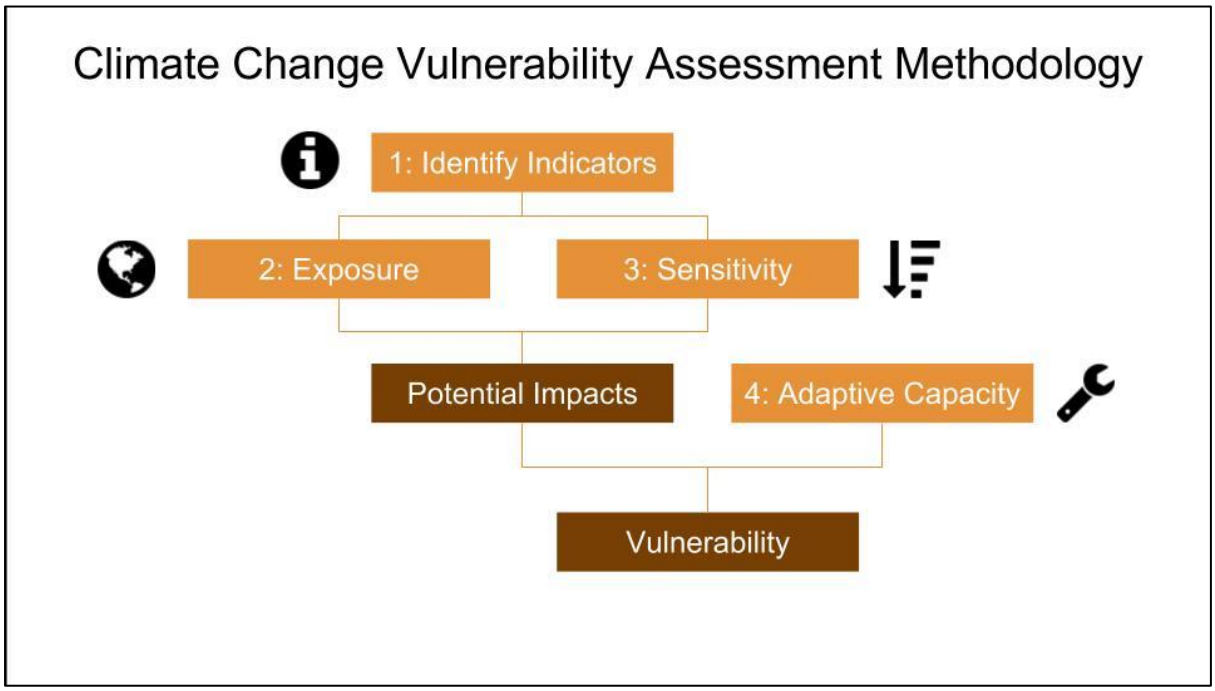

Figure 2: Vulnerability Assessment Methodology

3.3 Step 1: Develop Climate Change Indicators

As mentioned above, the first step in a Climate Change Vulnerability Assessment is the identification of context specific indicators. Essentially, indicators are potential climate change induced impacts in a specific area. The LGCCSP Vulnerability Assessment Toolkit developed a draft of several indicators using the Long Term Adaptation Scenario Reports (Department of Environmental Affairs 2013e). The indicators are grouped into six sectors (agriculture; biodiversity and environment; coastal and marine; human health; disaster management, infrastructure and human settlements; and water).

3.4 Step 2: Assessing Exposure

The assessment of exposure followed the identification of indicators. Exposure assessment aimed to ascertain whether the identified indicators are relevant in the District Municipality. If the District Municipality was exposed to a particular indicator, stakeholders scored that indicator a 'yes'.

3.5 Step 3: Assessing Sensitivity

The third step of the Climate Change Vulnerability Assessment 'asks' the question, "if you are exposed, how important is the potential impact?" This is termed "sensitivity" and is assessed using a graded scale (High, Medium, Low). If an indicator scored a "yes" in the exposure assessment, the sensitivity of the Municipality to that indicator was than analysed using the graded scale.

3.6 Step 4: Assessing Adaptive Capacity

Once exposure and sensitivity were determined, the next step was the assessment of adaptive capacity. The question directed at stakeholders during the workshop was "If there are going to be significant impacts due to climate change, do you have the necessary systems (policy, resources, social capital) in place to respond to the change?"

The indicators that scored "yes" for the exposure questions and "high" or "medium" for the sensitivity questions, were then assessed in terms of adaptive capacity. For the purpose of the LGCCS Vulnerability Assessment Toolkit, the guiding question was "Do you have high, medium or low adaptive capacity (policy, institutional, social and finance) to respond to the change?" The adaptive capacity answers were scored using a graded scale (high, medium or low).

Those that scored a "low" or "medium" were recorded as indicators with potential adaptive capacity constraints in Harry Gwala District Municipality.

3.7 Step 5: Develop Response Plans for Priority Indicators

Upon completion of the exposure, sensitivity and adaptive capacity assessments, priority indicators were identified using the criteria below:

- Exposure - Yes
- Sensitivity - High
- Adaptive Capacity - Low

Priority indicators are perceived to be the ones the district is most vulnerable to. A response plan was then developed to address climate change vulnerabilities and inform resource allocation for climate change adaptation. To facilitate the development of a response plan, stakeholders were given a LGCCS generic response plan template for each sector, which was used as a starting point to develop sector specific response plans for Harry Gwala District Municipality.

3.8 Desired Adaptation Outcomes

The Department of Environmental Affairs (DEA) has developed (ongoing process) a set of Desired Adaptation Outcomes (DAOs). The DAOs provide evidence of climate change impacts and of responses to climate change in South Africa. DAOs identify desired states that, individually and in combination, will contribute to climate resilience in the short to medium-term (i.e. over the next five to 20 years). They aim to provide clear insights into climate change adaptation in South Africa and help capture the country's unique circumstances to aid reporting on adaptation at national and international levels. They also provide a means of assessing the capacity of 'at risk' sectors and their stakeholders to adapt to climate change and whether the measures being taken are appropriate, efficient and effective.

The current set of DAOs are provided below:

- G1 - Robust/integrated plans, policies and actions for effective delivery of climate change adaptation, together with monitoring, evaluation and review over the short, medium and longer-term.

- G2 - Appropriate resources (including current and past financial investments), capacity and processes (human, legal and regulatory) and support mechanisms (institutional and governance structures) to facilitate climate change adaptation.
- G3 - Accurate climate information (e.g. historical trend data, seasonal predictions, future projections, and early warning of extreme weather and other climate-related events) provided by existing and new monitoring and forecasting facilities/networks (including their maintenance and enhancement) to inform adaptation planning and disaster risk reduction.
- G4 - Capacity development, education and awareness programmes (formal and informal) for climate change adaptation (e.g. informed by adaptation research and with tools to utilise data/outputs).
- G5 - New and adapted technologies/knowledge and other cost-effective measures (e.g. nature-based solutions) used in climate change adaptation.
- G6 - Climate change risks, impacts and vulnerabilities identified and addressed.
- G7 - Systems, infrastructure, communities and sectors less vulnerable to climate change impacts (e.g. through effectiveness of adaptation interventions/response measures).
- G8 - Non-climate pressures and threats to human and natural systems reduced (particularly where these compound climate change impacts).
- G9 - Secure food, water and energy supplies for all citizens (within the context of sustainable development).

The activities in the Sector Response Plans below have a column to allocate to the DAOs. This will assist the DEA to monitor and evaluate the implementation of climate change adaptation throughout the country.

4 District Snapshot Harry Gwala District Municipality

Harry Gwala District Municipality is one of ten district municipalities within the KwaZulu-Natal Province. The district is located south of the province and comprises of the following four local municipalities: Dr Nkosazana Dlamini Zuma, Greater Kokstad, Ubuhlebezwe, and uMzimkhulu local municipality. The district municipal area has a total population of 461 420 less than 10% of the province's total population (Statistics South Africa 2011). The district is mostly rural with small urban centres (Harry Gwala District Municipality 2016).

Climate change is deemed to be a threat in the district (Harry Gwala District Municipality 2014). Observed climate change impacts include unpredictable weather patterns, and more frequent extreme weather events (Harry Gwala District Municipality 2014).

Responding to climate change has been identified as a key issue for the Harry Gwala District Municipality (Harry Gwala District Municipality 2016). In response to identifying this need, the Harry Gwala District Municipality has in the past budgeted funding to draft a District-level Climate Change Response Strategy (Harry Gwala District Municipality 2016). According to the *Harry Gwala District Municipality 2016-2017 Integrated Development Plan* this funding was insufficient to appoint anybody in relation to drafting a District-level Climate Change Response Strategy (Harry Gwala District Municipality 2016)

4.1 Key District Indicators

The table below provides a summary of the key indicators for the District. The table lists the national indicators for comparison purposes. Many of these indicators are used in the climate change vulnerability assessment process below.

Table 3: Key District Municipal Indicators for Harry Gwala DM compared to the National Average

General Information	Harry Gwala District Municipality	South Africa
Code	DC43	
Province	KwaZulu-Natal	
Seat	Ixopo	
Area (km²)	11127	1219740
Census Statistics		
Criteria	**Harry Gwala District Municipality**	**South Africa**
Population	**461420**	**51770553**
Age Structure		
Population under 15	37.90%	29.17%
Population 15 to 39	40.07%	44.30%
Population 40 to 64	17.10%	21.19%
Population over 65	4.93%	5.34%
Dependency Ratio		
People in age group 0-14 & 65+, supported by age group 15-64	74.9%	52.7%

Employment (between 15 and 64)		
Employed	23.46%	38.87%
Not economically active	54.53%	39.21%
Unemployed	13.18%	16.50%
Discouraged work-seeker	8.82%	5.41%
Education (aged 20 +)		
Post School Qualification	5.00%	9.94%
Grade 12/Matric	19.10%	27.83%
High School	33.48%	32.16%
Less than High School	30.31%	16.43%
Other	12.12%	13.64%
Vulnerability Indicators		
Criteria	**Harry Gwala District Municipality**	**South Africa**
Household Dynamics		
Households	112281	14450151
Average household size	4.11	3.58
Percentage households involved in agricultural activities	48.46%	20.56%
Dwelling Type		
Percentage Households that are Informal Dwelling	3.75%	13.58%
Percentage Households that are Traditional Dwelling	54.18%	7.89%
Combined Percentage Households that are Traditional and Informal Dwelling	57.92%	21.47%
Sources of Water		
Percentage of Population that sources water from Boreholes	3.52%	1.76%
Percentage of Population that do not source water from piped water schemes	65.44%	21.82%
Percentage of Population that source water from Service Providers (e.g. Municipalities)	34.56%	78.18%
Percentage of Population that sources water from Water Tanks	3.93%	2.67%
Electricity Usage		
Percentage of households that use alternatives to electricity for cooking	62.87%	26.12%
Percentage of households that use alternatives to electricity for cooking, heating or lighting	36.95%	17.77%
Sanitation		
Percentage Population with flush toilets	15.76%	56.51%

Percentage Population using pit latrines	69.36%	30.73%
Percentage of Population with no toilet facilities	2.79%	5.34%
Percentage of Population with other toilet facilities	12.09%	7.42%
Refuse		
Percentage of Households with no rubbish disposal	8.77%	5.97%
Percentage of households with refuse removed by local authority/private company	17.38%	59.40%
Health		
Percentage of young (<5yrs) and elderly (>64yrs)	18.69%	16.32%
Percentage workforce employed in the informal Sector	17.23%	12.20%
Vulnerability Tool Indicators		

Criteria	Harry Gwala District Municipality	South Africa
Percentage households involved in agricultural activities	48.46%	20.56%
Percentage Population with flush toilets	15.76%	56.51%
Percentage of young (<5yrs) and elderly (>64yrs)	18.69%	16.32%
Percentage Households that are Traditional and Informal Dwelling	57.92%	21.47%
Percentage of Households with no rubbish disposal	8.77%	5.97%

4.2 Harry Gwala DM Agriculture Sector Summary

The Harry Gwala District Municipal Area is largely rural and agriculture based (Harry Gwala District Municipality 2016, 2014). The agriculture sector in the District Municipal Area consists of commercial agriculture, subsistence agriculture and commercial plantations (Harry Gwala District Municipality 2016, 2014). Subsistence agriculture mainly occurs in the Traditional Authority managed areas, which occur largely in the east and north of the District Municipal Area (Harry Gwala District Municipality 2016, 2014). Meanwhile, commercial agriculture occurs throughout the District Municipal Area, while commercial forestry occurs in parts of the east, north and south of the District Municipal Area (Harry Gwala District Municipality 2016; De Lange 2013).

The main commercial agricultural activities in the Harry Gwala District Municipal Area is the production of cattle for dairy (Harry Gwala District Municipality 2016). The Harry Gwala District Municipal Area actually produces 10 % of all the milk consumed in South Africa (Harry Gwala District Municipality 2016). Other agriculture products that are produced in the District Municipal Area include sugar cane, maize, potatoes, cabbages, citrus, carrots, soybeans, tomatoes, wheat and sorghum and cattle for beef (Harry Gwala District Municipality 2016, 2015a).

With so much agricultural production, the agriculture sector is regarded as one of the more important sectors for employment in the Harry Gwala District Municipal Area (Harry Gwala District Municipality 2016). However, employment in the agriculture and forestry sectors has declined sharply from 21,229 jobs in 2003 to 6,976 jobs in 2013 (Harry Gwala District Municipality 2016). In 2013, these jobs accounted for approximately 9 % of the total number of people employed within the District Municipal Area (Harry Gwala District Municipality 2016).

Furthermore, the South African National Census of 2011 estimated that 48.46 % of households in the Harry Gwala District Municipal Area (Figure 3) are involved in agricultural activities (Statistics South Africa 2011). This is higher than the national average of 20.56 % (Statistics South Africa 2011). The Harry Gwala District Municipality has however noted that rural households that are highly dependent on subsistence agriculture, are under pressure from declining natural resources (Harry Gwala District Municipality 2016). In the map (Figure 3) the darker areas indicate higher percentages of households involved in the agriculture sector (Statistics South Africa 2011).

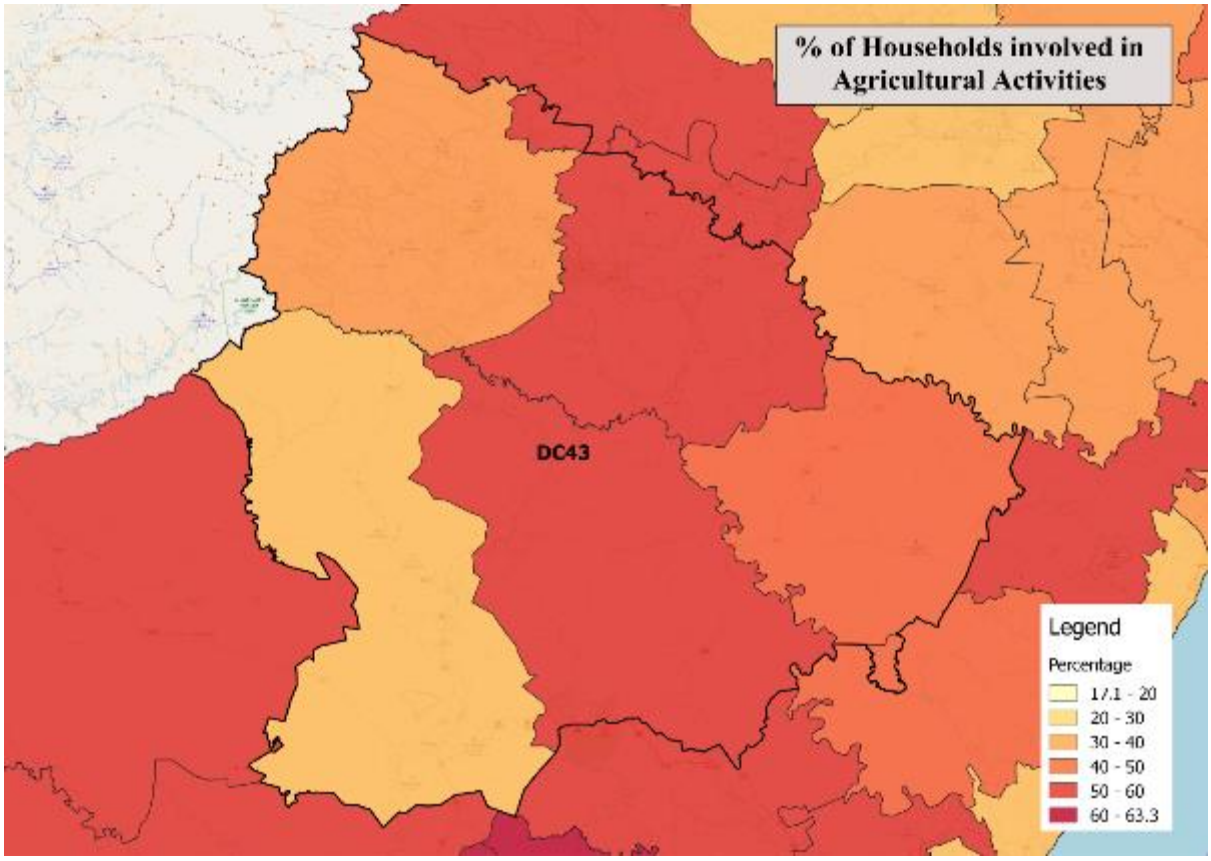

Figure 3: Percentage of households involved in agricultural activities across the District Municipal Area (Statistics South Africa 2011)

Similar to the decrease in employment is the change in the agriculture sector's contribution to the Harry Gwala District Municipal Area's economy in terms of Gross Value Added. The Gross Value Added refers to the economic performance of a sector, industry or area in terms of the value of the products and services produced (Statistics South Africa 2005). It includes subsidies and excludes taxes paid on products (Statistics South Africa 2005).

The Gross Value Added by agriculture and forestry in the Harry Gwala District Municipal Area declined from approximately 19 % of the total Gross Value Added for the District Municipal Area in 2003 to 11 % in 2013, even though (in 2005 constant prices) the Gross Value Added by the agriculture and forestry increased from roughly R 730 million in 2003 to roughly R 780 million in 2013 (Harry Gwala District Municipality 2016). The reason why this is possible is because the contributions from other sectors in the District Municipal Area such as the "Finance, Insurance, Business" and "Manufacturing" sectors grew at a much faster rate over the same period than the agriculture and forestry sectors did (Harry Gwala District Municipality 2016).

The agriculture and forestry sectors remains important sectors in the Harry Gwala District Municipal Area in terms of food security and contribution to Gross Value Added, despite the decreases in jobs and contribution to Gross Value Added (Harry Gwala District Municipality 2016). There is also some potential to grow certain crops or expand the yields of crops that are already being grown in the District Municipal Area.

The potential for maize yields in the Harry Gwala District Municipal Area, ranges from 2 to 7 tons per hectare (t/ha) (Schulze and Walker 2007b). It can be gown across most of the District Municipal Area (Figure 4), with the highest yields occurring in the central parts of the District Municipal Area (Schulze and Walker 2007b). The map (in Figure 4) is divided into 'mesozones'. Mesozones are areas (spatial zones) of approximately the same size that are split by geographic as well as social boundaries such as rivers and areas of varying human activity (stepSA 2016). Each mesozone is roughly 50 square kilometres in size and allows for more accurate representations of activities or features (stepSA 2016).

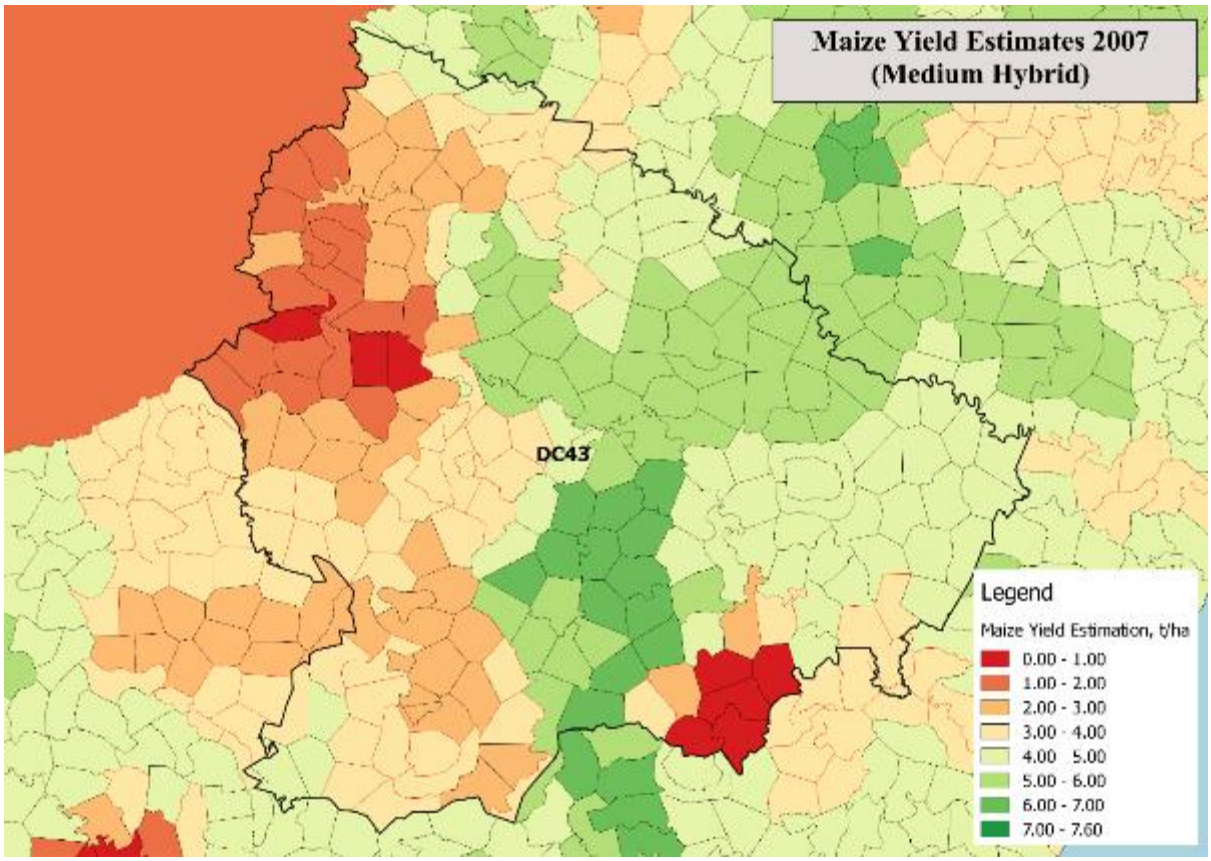

Figure 4: Maize (medium hybrid) yield estimates per mesozone across the District Municipal Area (Schulze and Walker 2007b)

In addition to maize, there is potential for sorghum and soybean production in the Harry Gwala District Municipal Area. Potential for sorghum is spread across the eastern half of the District Municipal Area (Figure 5) with possible yields in some areas as high as 6 to 8 t/ha (Schulze and Walker 2007c). Soybean production (Figure 6) has less potential (ranging from 0 to 3 t/ha) but could be grown across most of the District Municipal Area (Schulze and Walker 2007d).

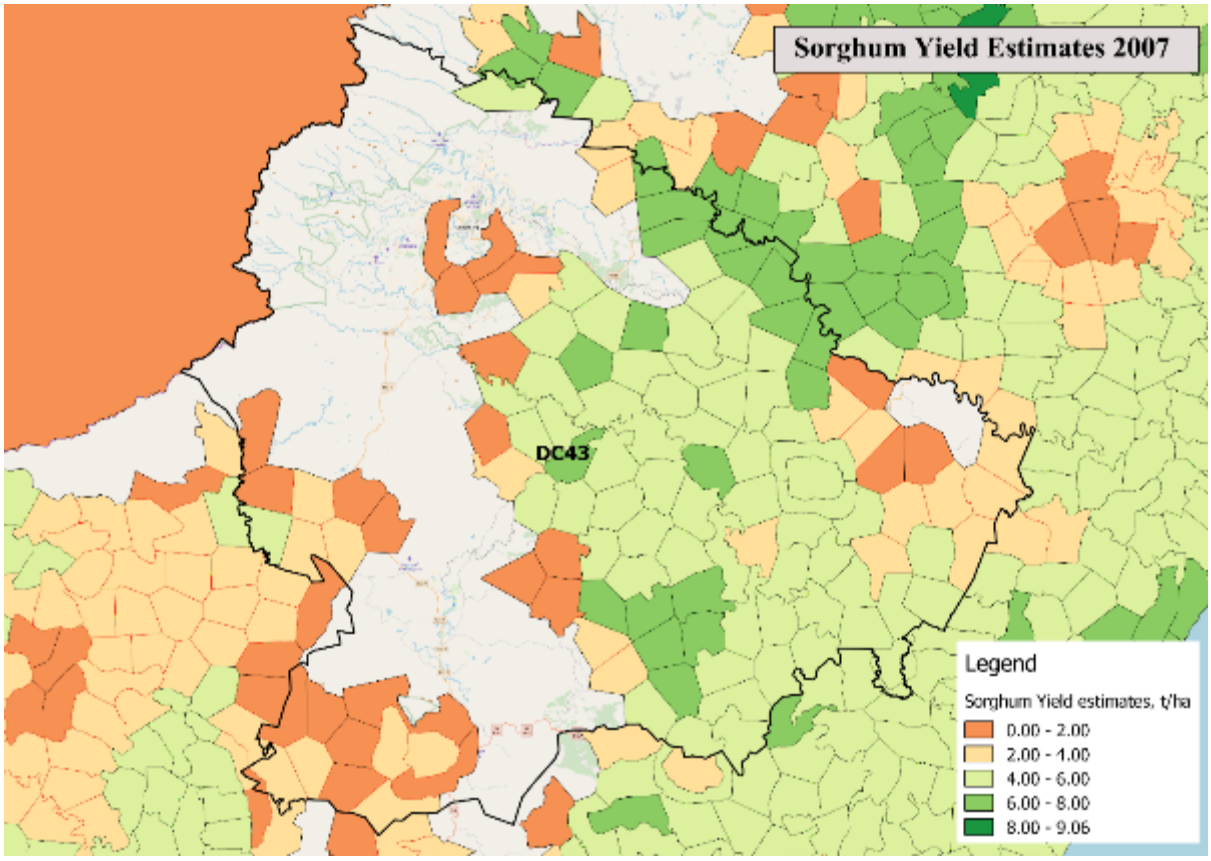

Figure 5: Sorghum yield estimates per mesozone across the District Municipal Area (Schulze and Walker 2007c)

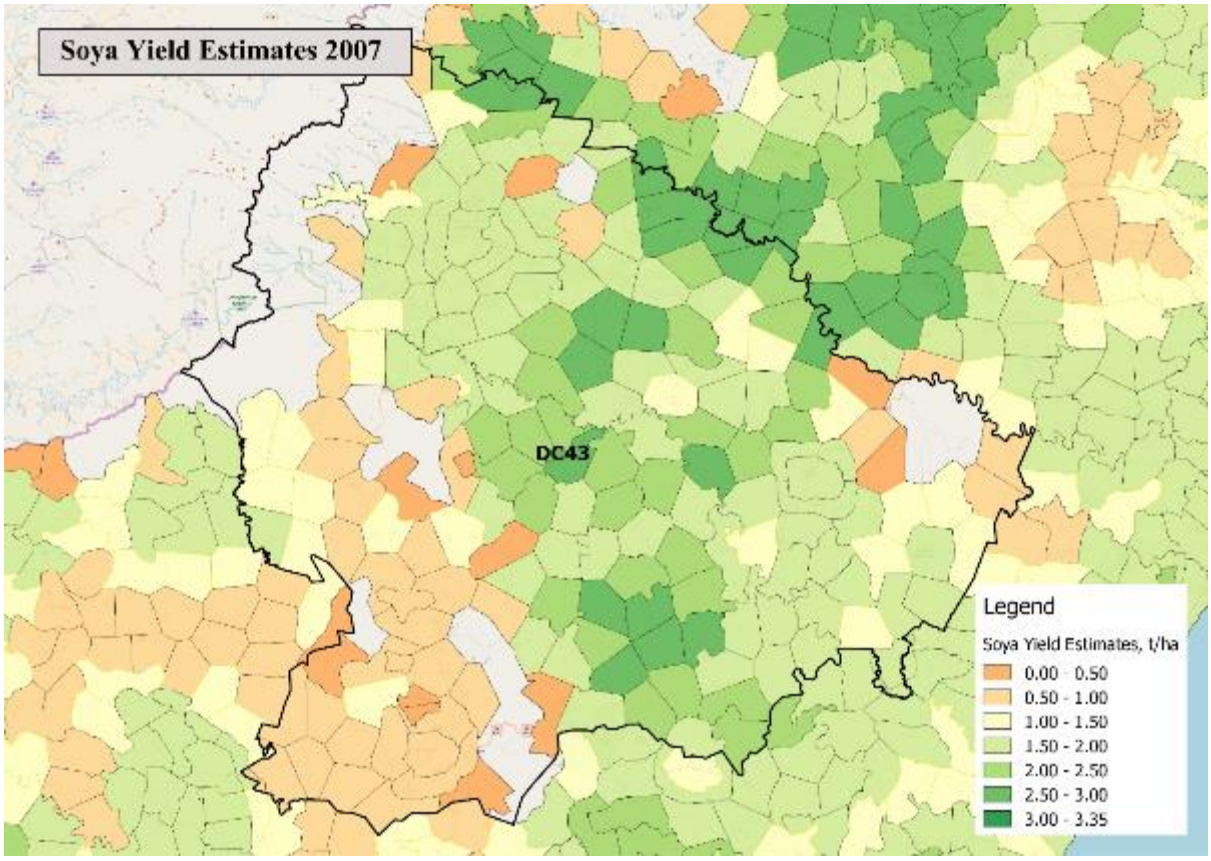

Figure 6: Soybean yield estimates per mesozone across the District Municipal Area (Schulze and Walker 2007d)

There is also potential for dryland (non-irrigated) sugar cane production throughout the entire Harry Gwala District Municipal Area (Figure 7), with potential yields in some central areas as high as 70 to 80 t/ha (Schulze and Walker 2007e).

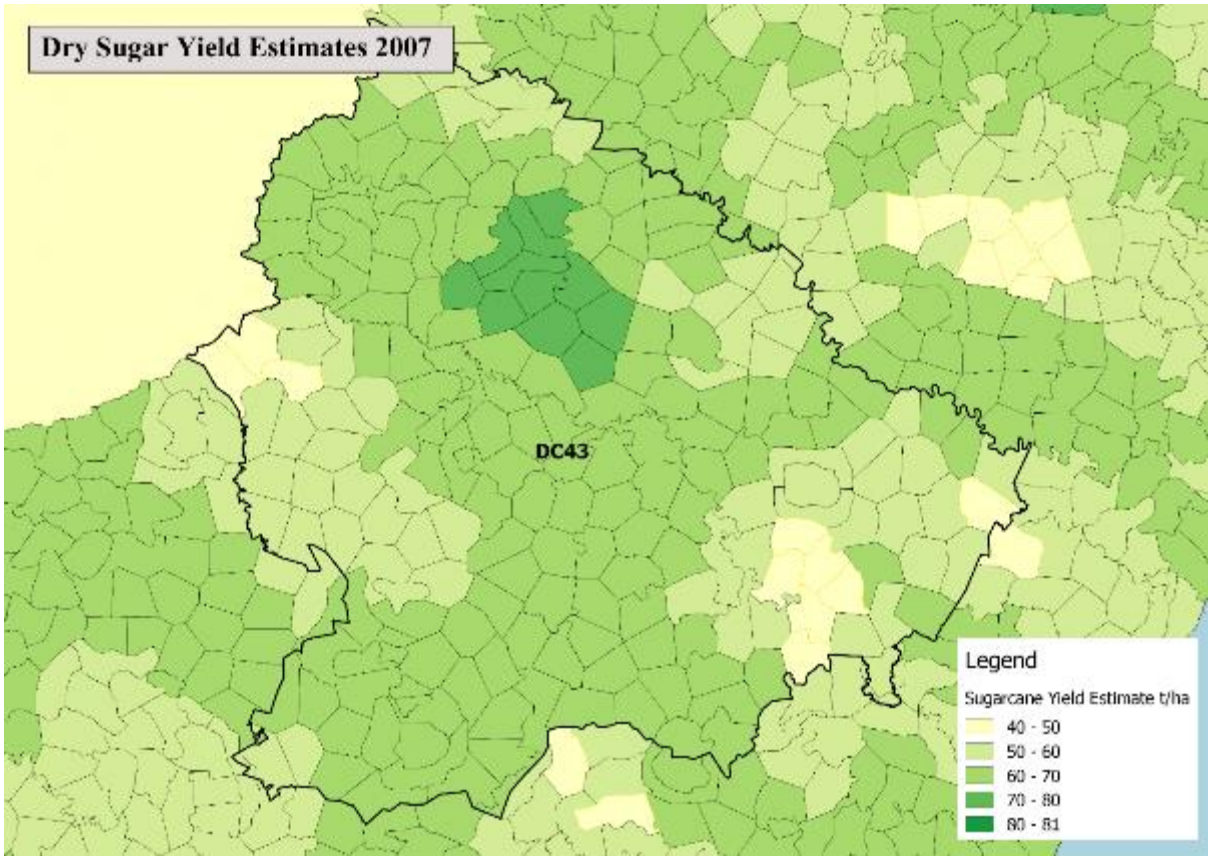

Figure 7: Dryland sugar yield estimates per mesozone across the District Municipal Area (Schulze and Walker 2007e)

Furthermore, there is some potential to grow groundnuts in east of the Harry Gwala District Municipal Area, with potential yields in the southeast areas as high as 3 to 4 t/ha (Figure 8) (Schulze and Walker 2007a).

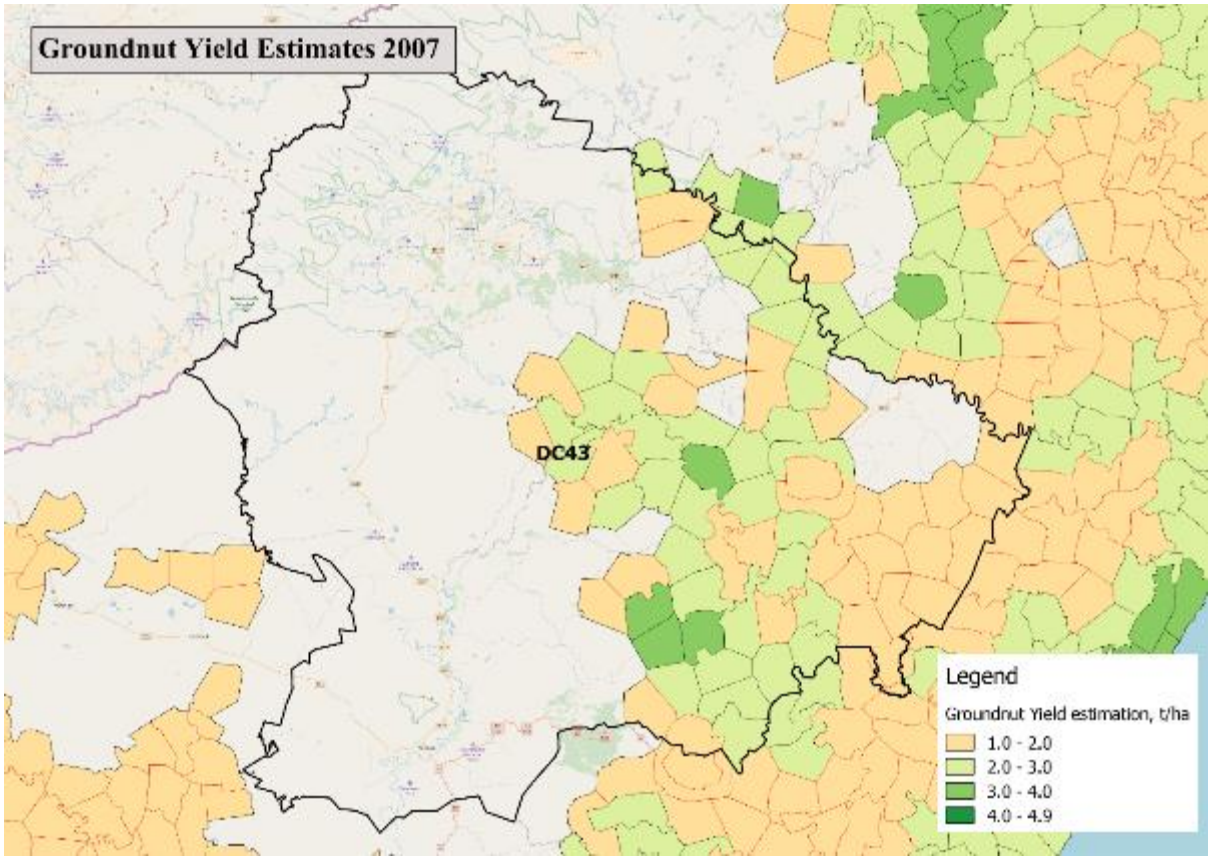

Figure 8: Groundnuts yield estimates per mesozone across the District Municipal Area (Schulze and Walker 2007a)

Commercial forests (consisting of *Pinus*, *Eucalyptus* and *Acacia* species) are scattered throughout the east, north and south of the District Municipal Area (Figure 9) (De Lange 2013). According to the Harry Gwala District Municipality's 2016/2017 *Integrated Development Plan*, there is little ability to expand the area under commercial forestry in the District Municipal Area for reasons such as existing water scarcity and the potential for serious ecological damage (Harry Gwala District Municipality 2016). Several of the main risks for commercial forestry in the District Municipal Area include: the increases in fire-related losses, possible increases in the frequency and severity of fires due to climate change, and the land restitution process (Harry Gwala District Municipality 2016).

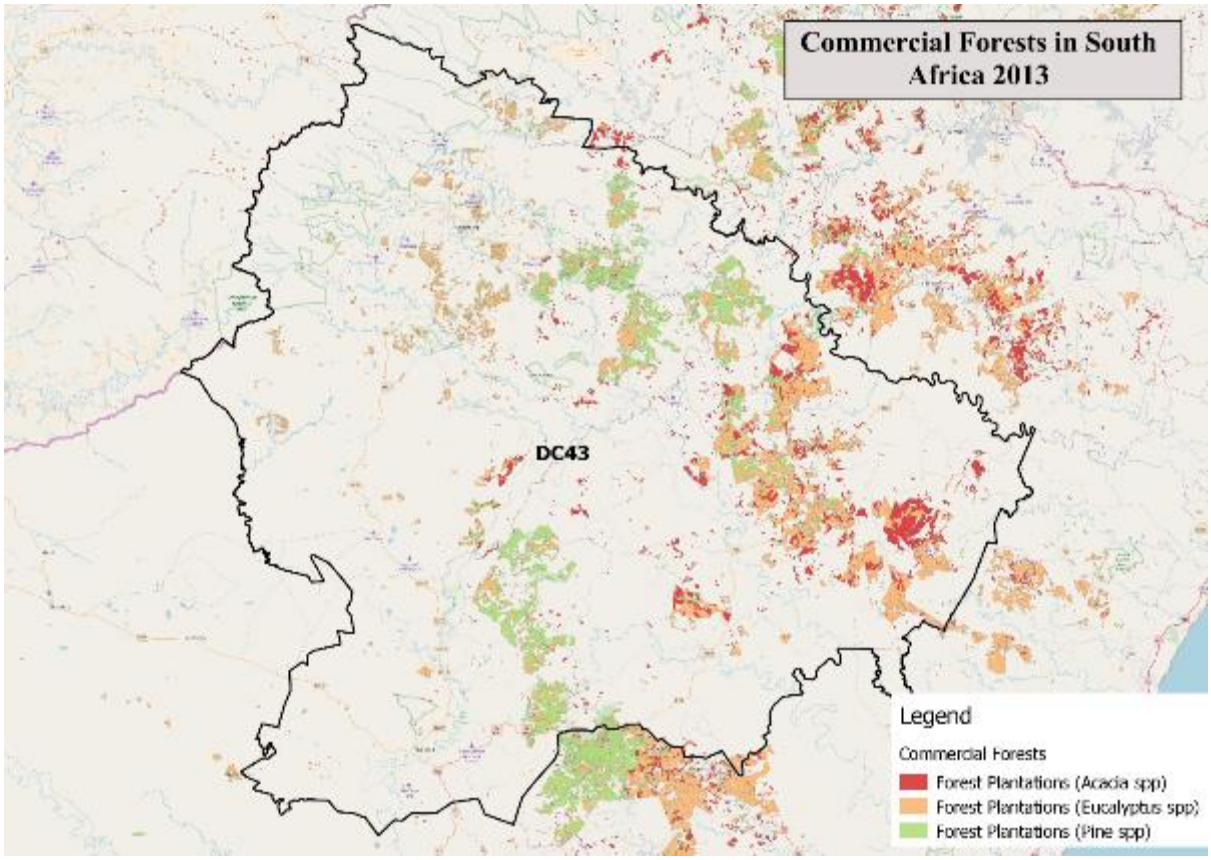

Figure 9: Commercial Forestry distribution across the District Municipal Area (De Lange 2013)

Despite the potential for expanding agricultural production in the Harry Gwala District Municipal Area, it is predicted that climate change will affect the agriculture sector both positively and negatively. The Long Term Adaptation Scenarios Flagship Research Programme (LTAS) forecasts that in the future, parts of eastern South Africa will become more suitable for grain production (Department of Environmental Affairs 2013c). The LTAS has also forecast that the production of sugarcane and fruit (such as apples and pears) will be increasingly vulnerable to damage from a predicted expansion of the areas affected by agricultural pests (Department of Environmental Affairs 2013c).

Furthermore, it is predicted in LTAS that climate change is forecast to increase the total average rainfall in the east of South Africa (Department of Environmental Affairs 2013c). This could increase the agricultural output of maize, soybean and sugar cane as well as that of commercial forestry plantations (Department of Environmental Affairs 2013c). However, climate change is also predicted to increase temperatures and rainfall variability as well as decrease water security, which will negatively affect the quantity of agricultural production in the District Municipal Area (Department of Environmental Affairs 2013c). These effects are expected to raise the frequency and severity of floods, droughts and fires in South Africa, resulting not only in agricultural losses but also in impacts to most other sectors of the local economy as well (Department of Environmental Affairs 2013c). By decreasing agricultural yields, climate change could impact commercial agriculture by reducing profitability and job opportunities in the sector (Department of Environmental Affairs 2013c).

There is also concern that subsistence farmers and their dependents are vulnerable to land degradation, overcrowding and the predicted effects of climate change such as the effect of increased rainfall variability on food production and food security (Harry Gwala District Municipality 2016). This is especially important given the high level of subsistence agriculture in the Harry Gwala

District Municipal Area (Harry Gwala District Municipality 2016). Subsistence farmers struggle to adapt to the predicted impacts of climate change because they tend to lack access to information and the necessary resources to adapt.

Moreover, these predicted changes are not only future-related considerations. The Harry Gwala District Municipality has noted an increase in the number of extreme weather events occurring in the District Municipal Area (Harry Gwala District Municipality 2016). In this regard, the Harry Gwala District Municipality has developed a map showing the disaster prone areas in the District Municipal Area (Harry Gwala District Municipality 2016).

4.3 Harry Gwala DM Biodiversity Sector Summary

The Harry Gwala District Municipality is predominantly covered by the Grassland Biome (Figure 10). Additionally, the Savanna Biome occurs in the east of the Harry Gwala District Municipality Area, while a small patch of the Indian Ocean Coast Belt Biome occurs in the south-east of the Harry Gwala District Municipality Area. The Grassland Biome is characterised by a single layer of grass with varying degrees of land-cover depending on rainfall and grazing practices. The Grassland Biome is essential for agriculture in South Africa and has the second highest level of biodiversity after the Fynbos Biome (Mucina and Rutherford 2006). The Savanna Biome is the largest biome in South Africa and is characterised by shrubveld and bushveld (and where wet enough woodland) vegetation (Mucina and Rutherford 2006). The Indian Ocean Coast Belt Biome contains a mix of subtropical forests and grasslands and at most reaches about 35 kilometres inland from the Indian Ocean (Mucina and Rutherford 2006).

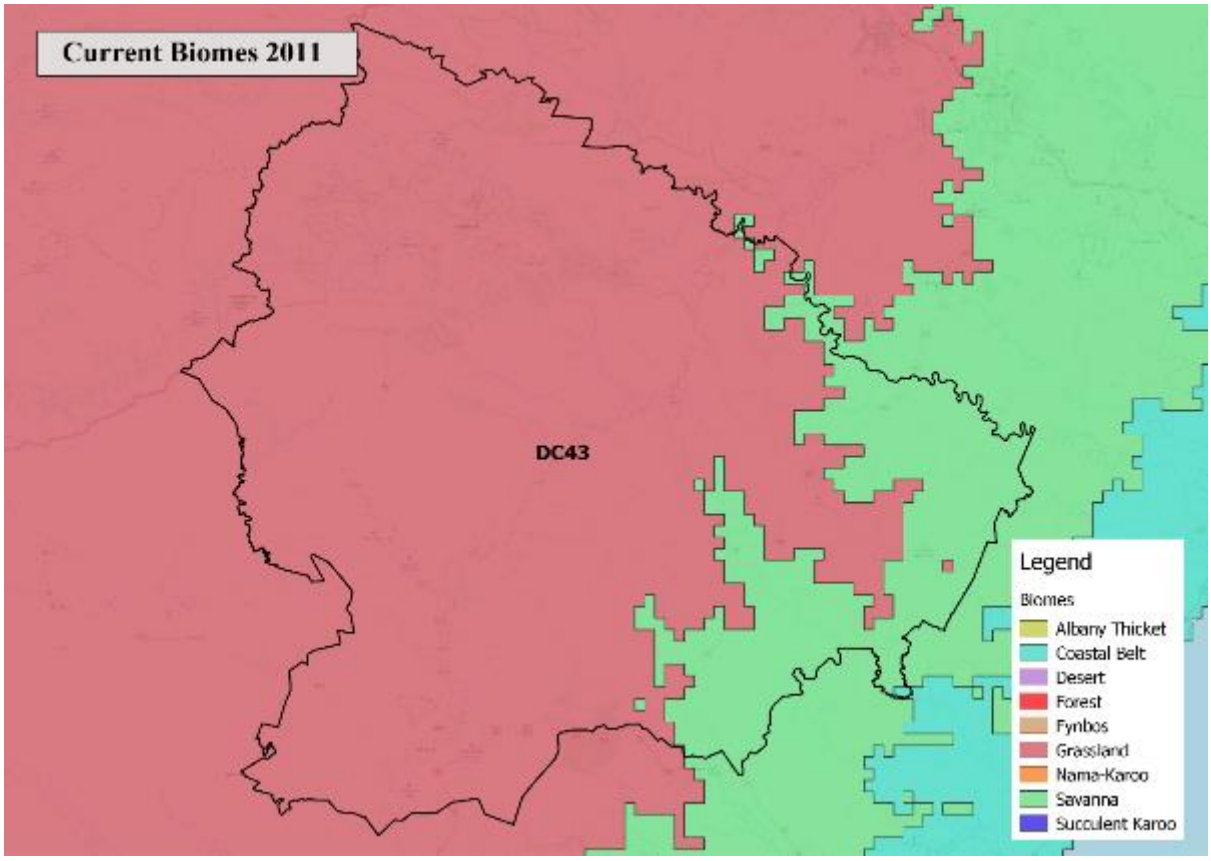

Figure 10: Current biome delineation in the District Municipal Area (South African National Parks 2011a)

Climate change is predicted to shift the biomes in South Africa, resulting in a change to the ecosystems and vegetation found in the Harry Gwala District Municipal Area. The Long Term Adaptation Scenarios Report on biodiversity highlights the following biomes as the most vulnerable and "in need of strong protection, restoration and/or research" (Department of Environmental Affairs 2013b).

- Highest priority for action: Grassland and Indian Ocean Coastal Belt.
- High priority for action: Fynbos and Forest.
- Medium priority for action: Nama Karoo and Succulent Karoo.

The maps below (Figure 11 and Figure 12) show the shift in biomes in the Harry Gwala District Municipal Area given different climate scenarios modelled by the South African National Biodiversity

Institute (SANBI) in 2011. It is forecast that under a medium risk climate scenario, the Savanna Biome will expand westwards, roughly doubling its current range at the expense of the Grassland Biome. Also, the small patch of Indian Ocean Coast Belt Biome will disappear. Under a high risk climate scenario, it is forecast that the Savanna Biome will expand westwards to cover roughly half of the Harry Gwala District Municipality Area. Additionally, the coverage of the Grassland Biome will diminish, and the Indian Ocean Coast Belt Biome will disappear.

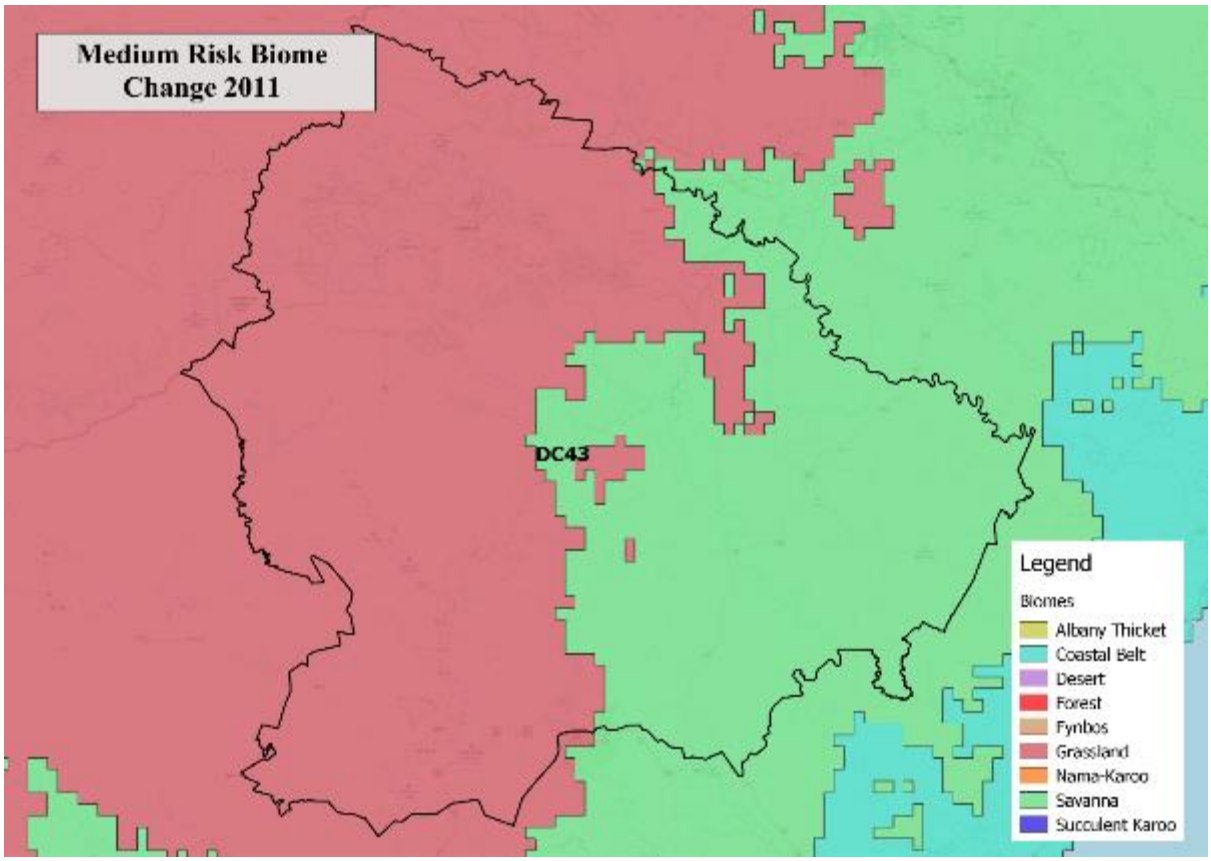

Figure 11: Predicted shift in biomes in the District Municipal Area using a medium risk scenario (South African National Parks 2011c)

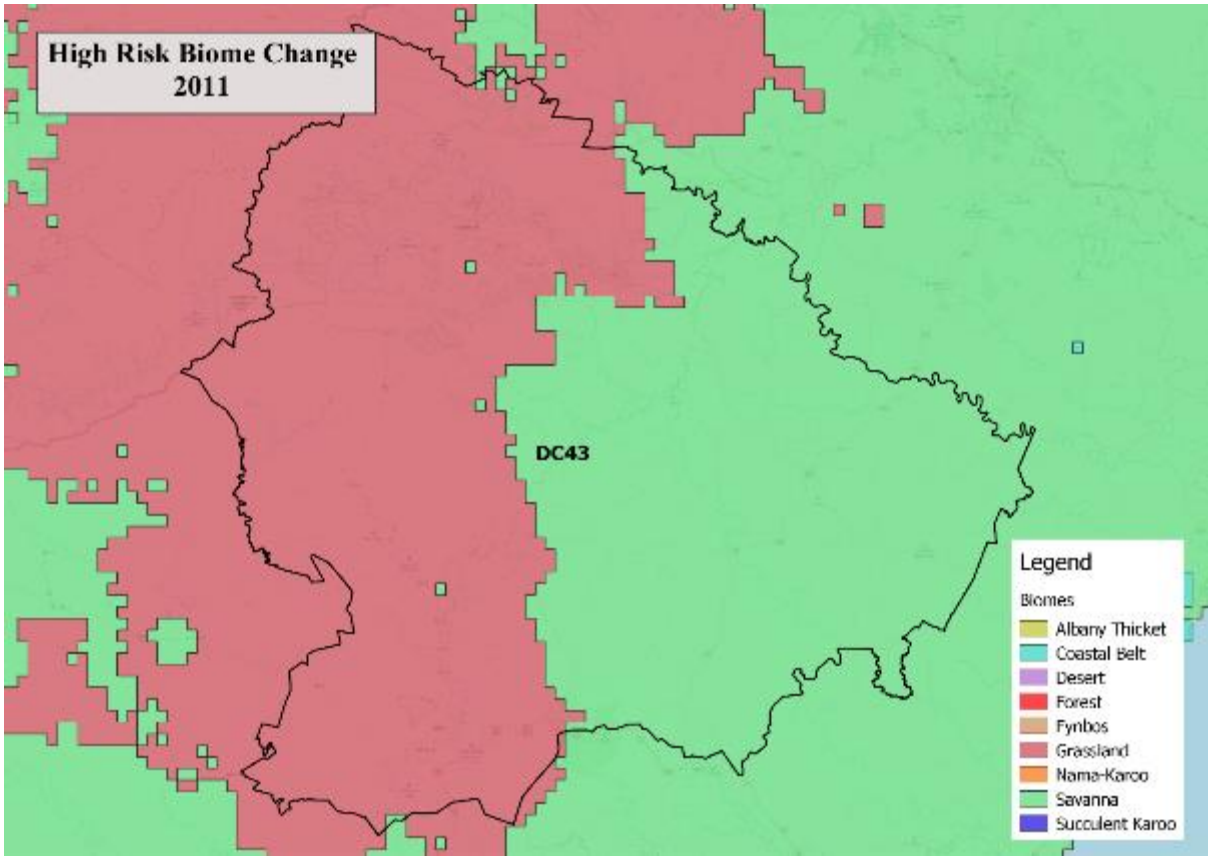

Figure 12: Predicted shift in biomes in the District Municipal Area using a high risk scenario (South African National Parks 2011b)

Within the Biomes found in the Harry Gwala District Municipal Area, there are many threatened ecosystems types (Figure 13). The 'Highover Nature Reserve and Roselands Farm Surrounds' is listed as a critically endangered ecosystem type, while the 'KwaZulu-Natal Sandstone Sourveld', 'Sihleza' and 'Hlabeni State Forest' are all listed as endangered ecosystem types (South African National Biodiversity Institute 2011). There are also many vulnerable ecosystem types found within the Harry Gwala District Municipal Area (South African National Biodiversity Institute 2011).

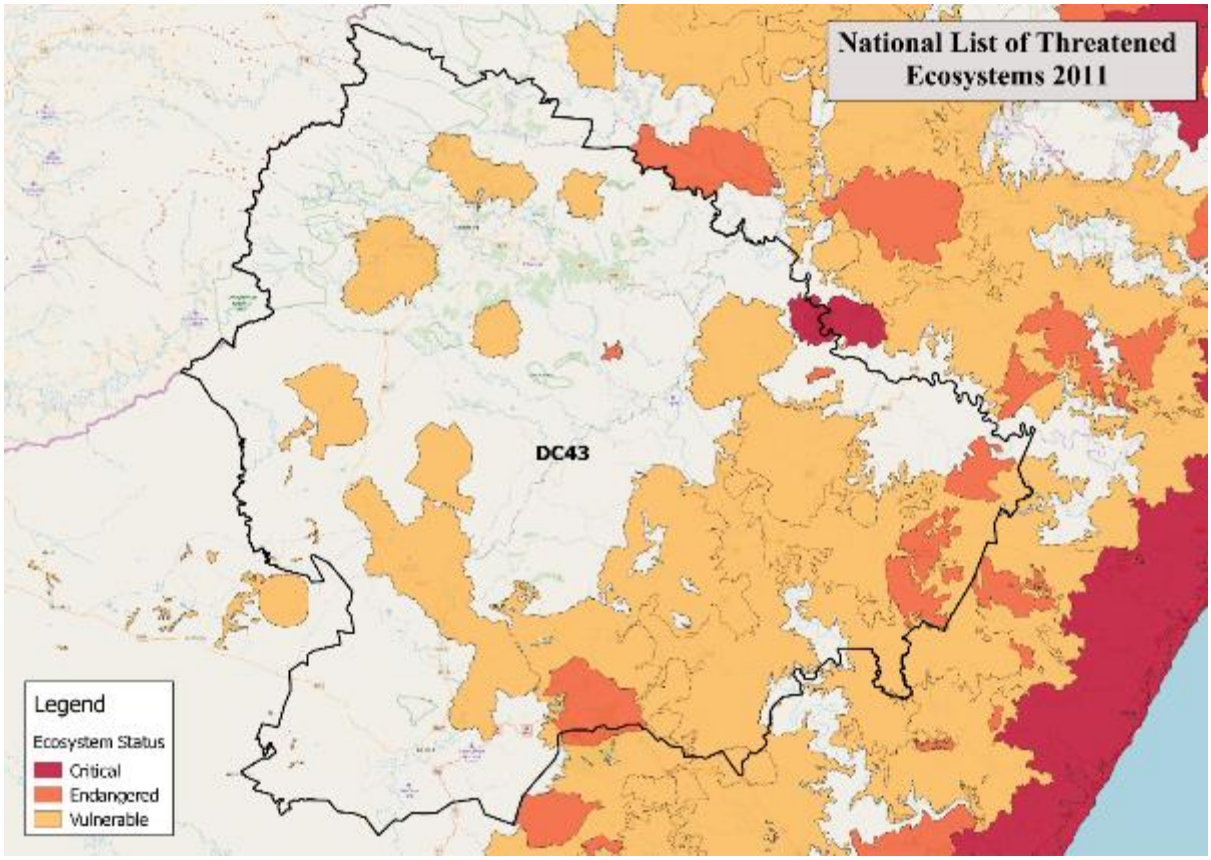

Figure 13: Threatened ecosystem types in the District Municipal Area (South African National Biodiversity Institute 2011)

In South Africa, a 'protected area' is defined as areas of land (e.g. a national park) or ocean (e.g. a marine protected area) that is legally protected and managed for the conservation of biodiversity, as per the National Environmental Management: Protected Areas Act (No. 57 of 2003) (Department of Environmental Affairs 2009). Internationally, the International Union for Conservation of Nature's (IUCN) definition of protected area includes areas that are not legally protected, which the Department of Environmental Affairs refers to as 'conservation areas' (Department of Environmental Affairs 2009). Within the Harry Gwala District Municipal Area there are 17 protected areas (Figure 14). Notably, the uKhahlamba-Drakensberg Park, a World Heritage Site, falls partially within the Harry Gwala District Municipal Area. Additionally, according to the *Harry Gwala District Municipality 2016-2017 Integrated Development Plan* there are several species of flora and fauna occur in the Harry Gwala District Municipal Area that are on the International Union for Conservation of Nature's (IUCNs) Red List of Threatened Species (Harry Gwala District Municipality 2016).

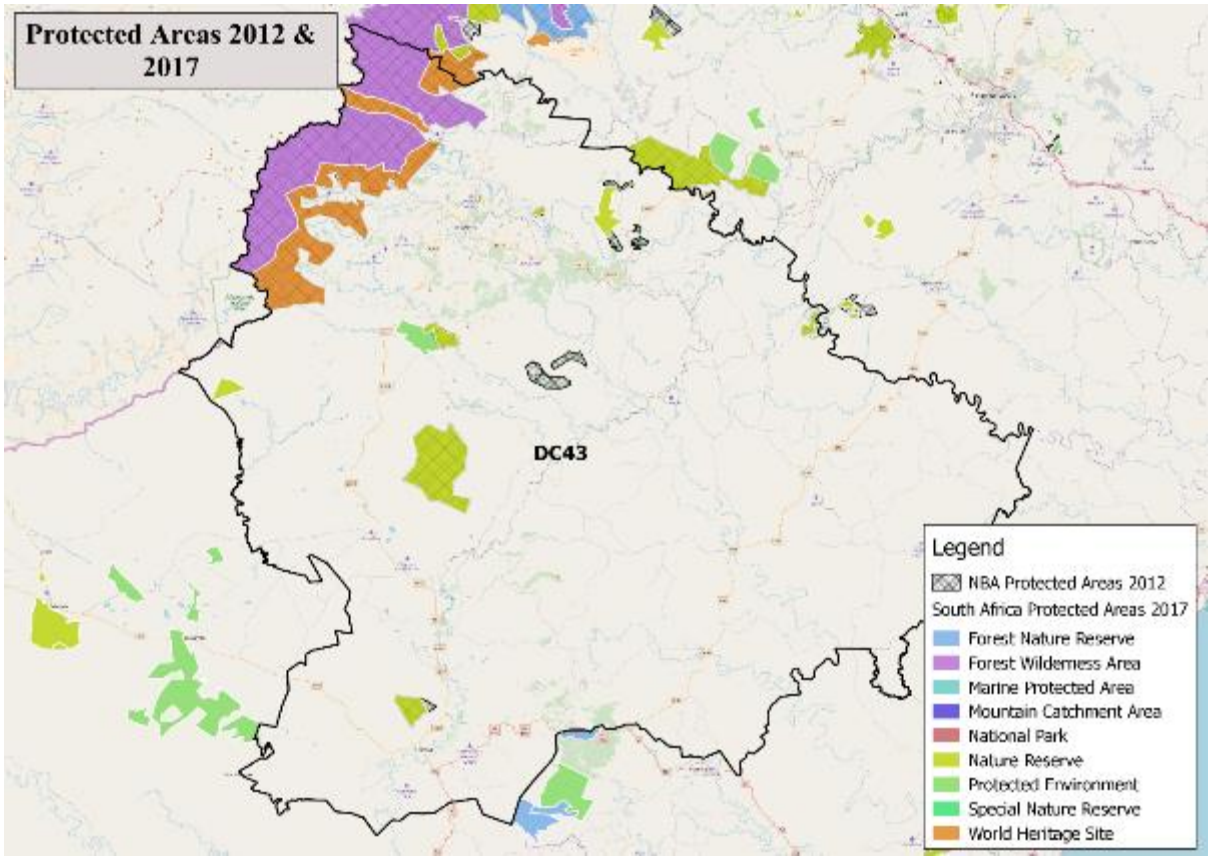

Figure 14: Protected areas in the District Municipal Area (South African National Parks / South African National Biodiversity Institute 2011; Department of Environmental Affairs 2017)

In South Africa, 65% of wetlands are threatened, of which 48% are critically endangered, 12% are endangered and 5% are vulnerable (Driver, A. et al. 2012). Wetland degradation is caused by inter alia: poor land management practises, spatial developments near urban areas, the spread of invasive alien plants; agricultural practises, pollution and the building of dams (Driver, A. et al. 2012).

In the Harry Gwala District Municipal Area (Figure 15), most wetlands are classified as 'moderately modified' (between 25% and 75% of the wetland land cover is natural) or 'mostly natural or good' (more than 75% of the wetland land cover is natural) (Council for Scientific and Industrial Research 2011). There are some wetlands that are classified as 'heavily to critically modified' (less than 25% of the wetland land cover is natural). These wetlands often occur in or around dams or urban areas.

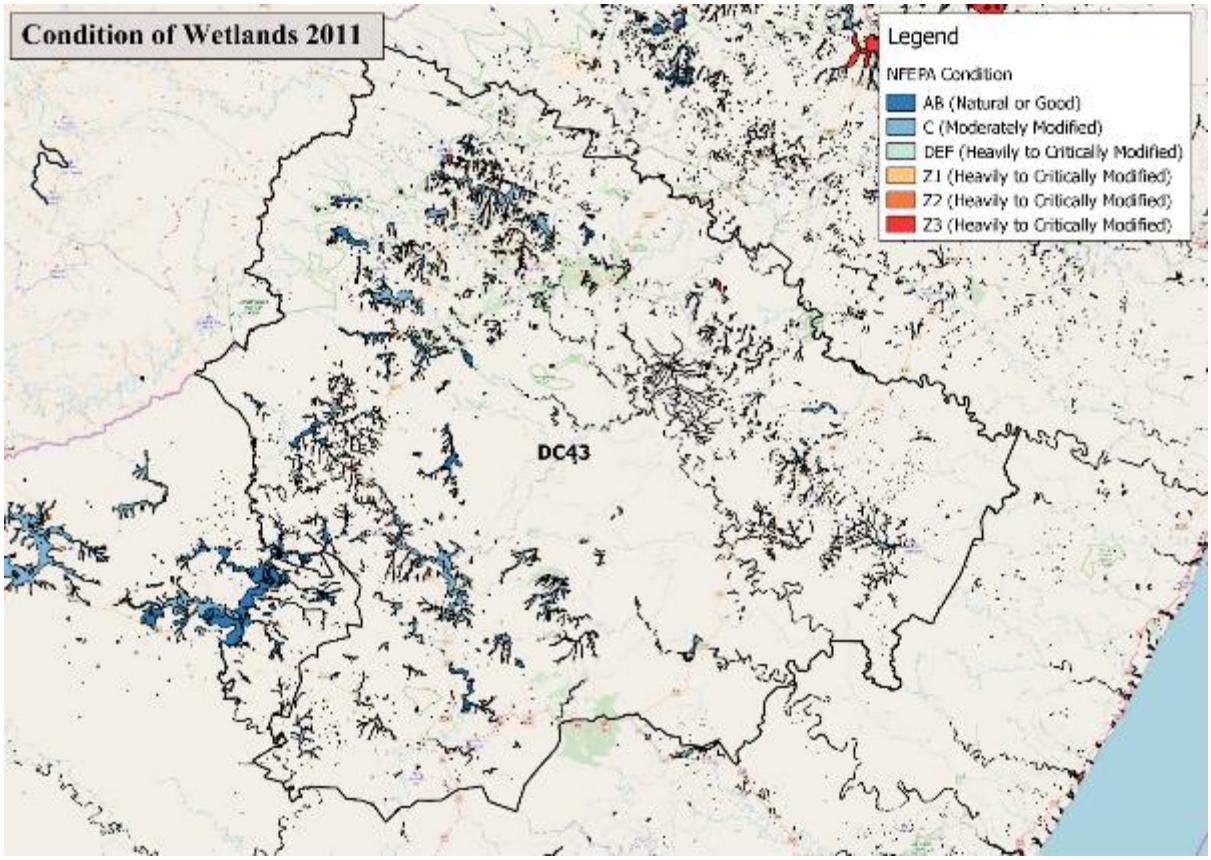

Figure 15: Condition of wetlands in the District Municipal Area (Council for Scientific and Industrial Research 2011)

Land use in the Harry Gwala District Municipal Area is varied. The more sizeable land-use activities include agriculture, forestry (plantations), Traditional Authority land (rural settlements and subsistence agriculture), protected areas and urban areas (Harry Gwala District Municipality 2016). These land uses have had varying effects on the biodiversity of the Harry Gwala District Municipal Area.

Biodiversity in the Harry Gwala District Municipal Area has been positively influenced by the conservation areas. It has been negatively influenced by: land degradation (mainly due to overgrazing and poor land management practises), unsustainable harvesting of natural resources, soil erosion, the spread of invasive alien species, increased pollution, poor waste management, population growth, spatial development (such as the expansion of agricultural and urban areas), an extended drought that has affected most of KwaZulu-Natal since 2015, and climate change (Harry Gwala District Municipality 2016).

According to the Millennium Ecosystem Assessment (2005) ecosystem services are “the benefits that people obtain from ecosystems”, which can be divided into four categories: provisioning (e.g. timber), supporting (e.g. nutrient recycling), regulating (e.g. water purification), cultural (e.g. recreational activities) (Millennium Ecosystem Assessment 2005). The existing challenges that negatively affect the biodiversity in the Harry Gwala District Municipal Area (discussed above) have also reduced ecosystem services (particularly provisioning services and regulating services) in the Harry Gwala District Municipal Area and will continue to do so, if these impacts are not reduced.

If the biodiversity and related ecosystem services in the Harry Gwala District Municipal Area are badly reduced, it could have direct negative consequences for the economy and social structures in the Harry Gwala District Municipality. These consequences could have a detrimental effect on efforts

to reduce poverty, inequity and unemployment in the Harry Gwala District Municipal Area. Furthermore, it is predicted that climate change will exacerbate these challenges and their effects on the biodiversity and related ecosystem in South Africa.

4.4 Harry Gwala DM Health Sector Summary

A great proportion (82.4 %) of South Africa's population are dependent on the public health sector for health related services of which there are 3,880 public facilities (Health Systems Trust 2012). These public facilities are divided into two main groups: 3,487 primary health care facilities (consisting of 3,074 clinics; 238 community health centres; 125 satellite clinics; 44 community day centres; four specialised clinics and two health posts) and 391 hospitals (of which six are central hospitals; 10 tertiary; 55 regional; 254 district and 66 specialised hospitals) (Health Systems Trust 2012). Of the above, 39 clinics, one community health centre, four district hospitals, and three other hospitals fall within the Harry Gwala District Municipal Area (Massyn et al. 2016).

According to a health care facilities audit by the Health Systems Trust, the Harry Gwala District Municipal Area received a score of 56 % on vital measures in the six ministerial priority areas for health care facilities and 71 % for the infrastructure of health facilities (Health Systems Trust 2012). The score on vital measures in the six ministerial priority areas relates to patient-centred care, specifically focusing on: positive and caring attitudes; waiting times; cleanliness; patient safety; infection prevention and control; and availability of medicines and supplies (Health Systems Trust 2012). The infrastructure score meanwhile is based on the assessment of mainly: building and site infrastructure, facility infrastructure management and standards around the availability of space (Health Systems Trust 2012).

The total population of the Harry Gwala District Municipal Area was approximately 461,420 people in 2011 (Statistics South Africa 2011). The District Municipal Area is youthful, with children under the age of 15 making up 37.90 % of the total population, while those aged between 15 and 39 account for a further 40.07 % (Statistics South Africa 2011). Furthermore, the 40 to 64 age group makes up 17.10 % of the population and the elderly (>64yrs age group) make up the remaining 4.93 % of the population (Statistics South Africa 2011). The young (<5yrs) and elderly (>64yrs) constitute 18.69 % of the total population (Figure 16) (Statistics South Africa 2011). These two groups are said to be the most vulnerable to climate change impacts. The darker areas on the map (Figure 16) indicate higher percentages of young and elderly people.

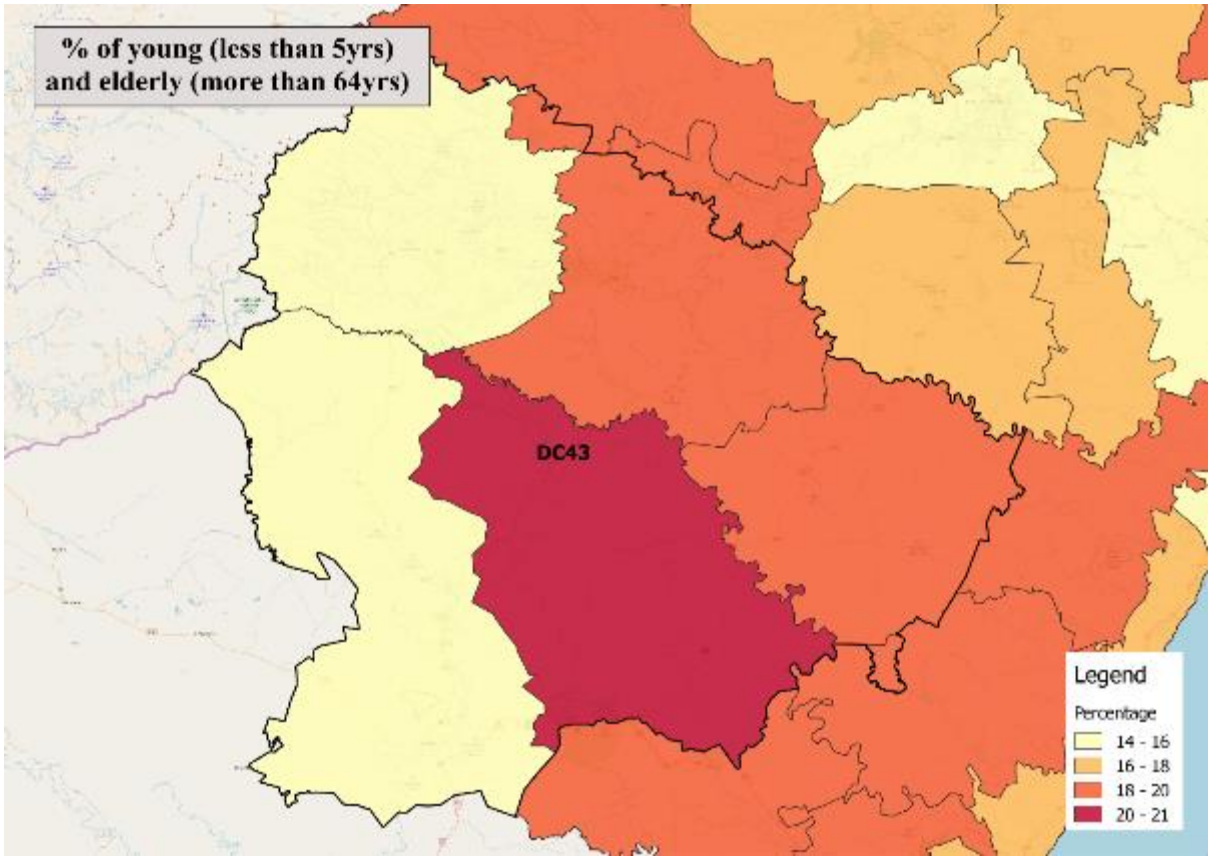

Figure 16: Percentage of young (<5yrs age group) and elderly (>64yrs age group) across the District Municipal Area (Statistics South Africa 2011)

In 2015, the total number of deaths in South Africa was 460,236, of which 5,521 occurred in the Harry Gwala District Municipal Area (Statistics South Africa 2015). The distribution of deaths by age for South Africa revealed that, in 2015, 7 % of the deaths occurred in children under the age of five, while individuals over the age of 64 accounted for 34.4 % of the deaths (Statistics South Africa 2015).

In 2015, the top ten underlying natural causes of death within the Harry Gwala District Municipal Area were: tuberculosis; HIV; diabetes mellitus; cerebrovascular diseases; other forms of heart diseases; influenza and pneumonia; hypertensive diseases; other viral diseases; certain disorders involving the immune mechanism; and intestinal infectious diseases (Statistics South Africa 2015).

Specifically, the leading causes of death for children under five years of age, for the 2009 to 2014 period in the Harry Gwala District Municipal Area were a group of communicable (infectious) diseases together with perinatal, maternal and nutritional conditions (Massyn et al. 2016). Diarrhoeal diseases (23.5 %) were the leading cause of children's (<5yrs age group) deaths, followed by lower respiratory infections, which accounted for 17.6 % of deaths (Massyn et al. 2016).

Additionally, the leading causes of death for the elderly (>64yrs age group) in the Harry Gwala District Municipal Area were a group of non-communicable diseases (which cannot be transferred from one person to the next) that accounted for 56.3 % of the deaths between 2009 and 2014 (Massyn et al. 2016). Of these non-communicable diseases, cerebrovascular disease was the leading cause (20.4 %) of deaths, followed by hypertensive heart disease (12.0 %) (Massyn et al. 2016).

Concerning waterborne and communicable diseases, approximately 65.44 % of the Harry Gwala District Municipal Area's households do not source water from piped water schemes (Statistics South Africa 2011) and are therefore vulnerable to waterborne diseases. For the "children under five

years diarrhoea case fatality" (that is children under five years who died in hospital from diarrhoeal disease) the District Municipal Area ranked 33rd (where 1st represents the best performance and 52nd represents the worst performance in South Africa) with a diarrhoea case fatality rate of 2.5 % during the 2015/16 period (Massyn et al. 2016). The national average for "children under five years diarrhoea case fatality" was 2.2 % over the same time period (Massyn et al. 2016).

Furthermore, for the "Child under 5 years severe acute malnutrition case fatality rate" (that is children under five years who died from acute malnutrition) the Harry Gwala District Municipal Area ranks 25th (where 1st represents the best performance and 52nd represents the worst performance in South Africa) with a rate of 8.2 % during the 2015/16 period (Massyn et al. 2016). This is below the national average of 8.9 % over the same time period (Massyn et al. 2016).

In terms of risks posed by working conditions, about 23.46 % of the Harry Gwala District Municipal Area's economically active population are employed, of which roughly 17.2 % are employed within the informal sector (Statistics South Africa 2011). Many of the people employed in the informal sector work outdoors in poor conditions, with limited infrastructure and services such as shade, and limited access to amenities such as water and sanitation (Statistics South Africa 2011).

Additionally, 48.46 % of the Harry Gwala District Municipal Area's households are involved in agricultural activities (Statistics South Africa 2011). People who work outdoors, like those involved in agricultural activities, are especially vulnerable to the impacts of extreme weather conditions. Moreover, climate change is forecast to exacerbate the frequency and severity of extreme weather events (Department of Environmental Affairs 2013c). Consequently, predicted impacts for households involved in agriculture include reduced agricultural yields and water security as well as increased food insecurity.

The Harry Gwala District Municipal Area is prone to disasters (Harry Gwala District Municipality 2016). The main disaster risks that are likely to affect human health in the Harry Gwala District Municipal Area are floods, droughts, fires, thunderstorms and lightning (Harry Gwala District Municipality 2016). Furthermore, climate change has been identified as threat in the District Municipal Area that is predicted to exacerbated these disasters (Harry Gwala District Municipality 2014).

From the information above, the predicted impacts of climate change on human health and health services are mostly negative. Hence, there is a need for climate change adaptation (and mitigation) to limit the negative impacts and encourage any positive effects of climate change on human health in the Harry Gwala District Municipal Area.

4.5 Harry Gwala DM Human Settlements Sector Summary

Harry Gwala District Municipality's population is approximately 467,292 (Statistics South Africa 2011). The District has a relatively young population (Harry Gwala District Municipality 2015b) with the highest proportion (40.07%) of the population are between 15 and 39 years old, while children under 15 years old make up 37.90% of the total population (Statistics South Africa 2011). People between the ages of 40 and 64 constitute a total share of 17.10%, while people over 64 years old constitute the smallest part (4.93%) of the total population (Statistics South Africa 2011).

The District is characterised by low literacy levels (Harry Gwala District Municipality 2016). Only 19.10% of the population have attained a matric and 5.00% of the population have earned a post-school qualification, while 33.48% of the population have some secondary schooling, and 30.31% have some or completed primary schooling (Statistics South Africa 2011). The remaining 12.12% have been classified as "other" in terms of their level of education (Statistics South Africa 2011).

The non-economically active population constitutes 54.53% of the District's working-age population (those aged 15 to 64) (Statistics South Africa 2011). In 2010, the District had one of the lowest economically active populations in the Province of KwaZulu-Natal, along with the uMkhanyakude and uMzinyathi District Municipalities (Harry Gwala District Municipality 2015b). Employment levels in the District are low (Harry Gwala District Municipality 2015b). Of the working-age population, 23.46% are employed (Figure 17) and the majority of all employed people (68%) are employed in the formal sector (Statistics South Africa 2011), which includes wholesale, retail, catering and tourism related employment (Harry Gwala District Municipality 2016). Additionally, 13.18% of the working-age population are unemployed, while the remaining 8.8% are discouraged work-seekers (Statistics South Africa 2011). Failure to provide educational facilities and job opportunities in the District has led to the migration of the youth to Durban and Pietermaritzburg (Harry Gwala District Municipality 2015b).

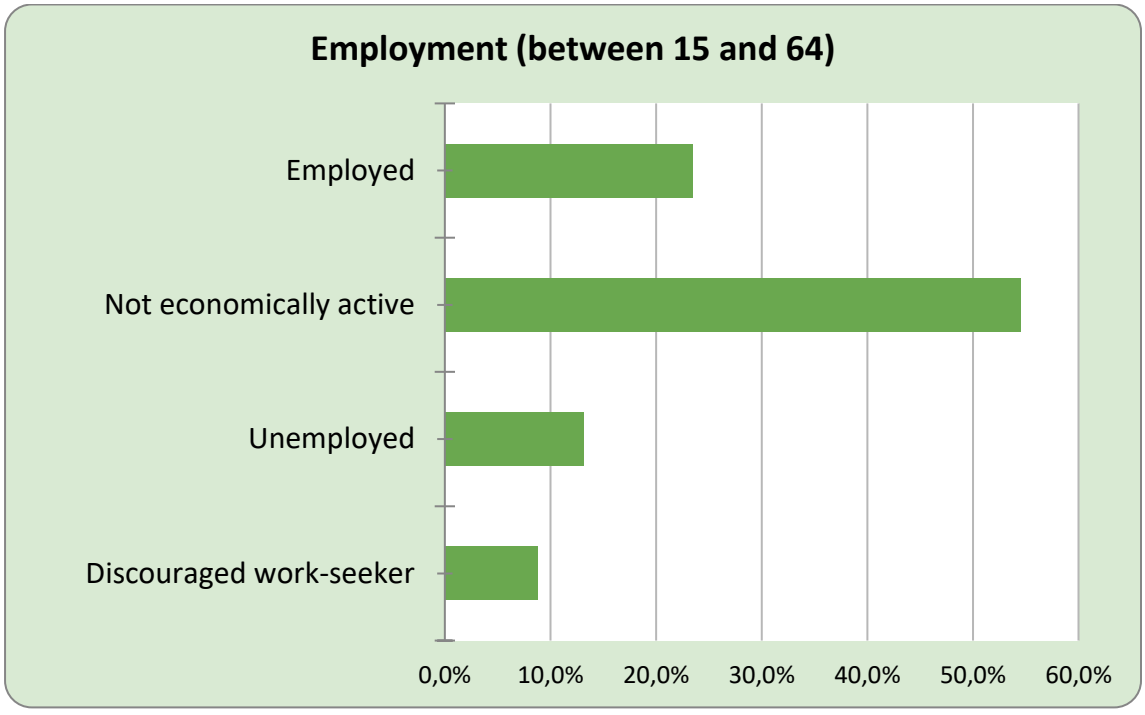

Figure 17: Employment status in the District Municipal Area (Statistics South Africa 2011)

The District is largely rural in nature, with small urban centres (Harry Gwala District Municipality 2016). Settlements in rural areas are dispersed and sparsely populated (Harry Gwala District Municipality 2014; uBuhlebezwe Local Municipality 2016), while larger towns (such as Kokstad, Ixopo, Underberg and Creighton) have higher settlement densities (uBuhlebezwe local municipality 2016). There are 120,940 households within the District and average household size is four individuals (Statistics South Africa 2011; Auditor-General of South Africa 2014; Harry Gwala District Municipality 2014). The majority (55%) of the District's households are traditional1, 41% are formal2 and 4% are informal dwellings (Figure 18) (Auditor-General of South Africa 2014; Harry Gwala District Municipality 2014).

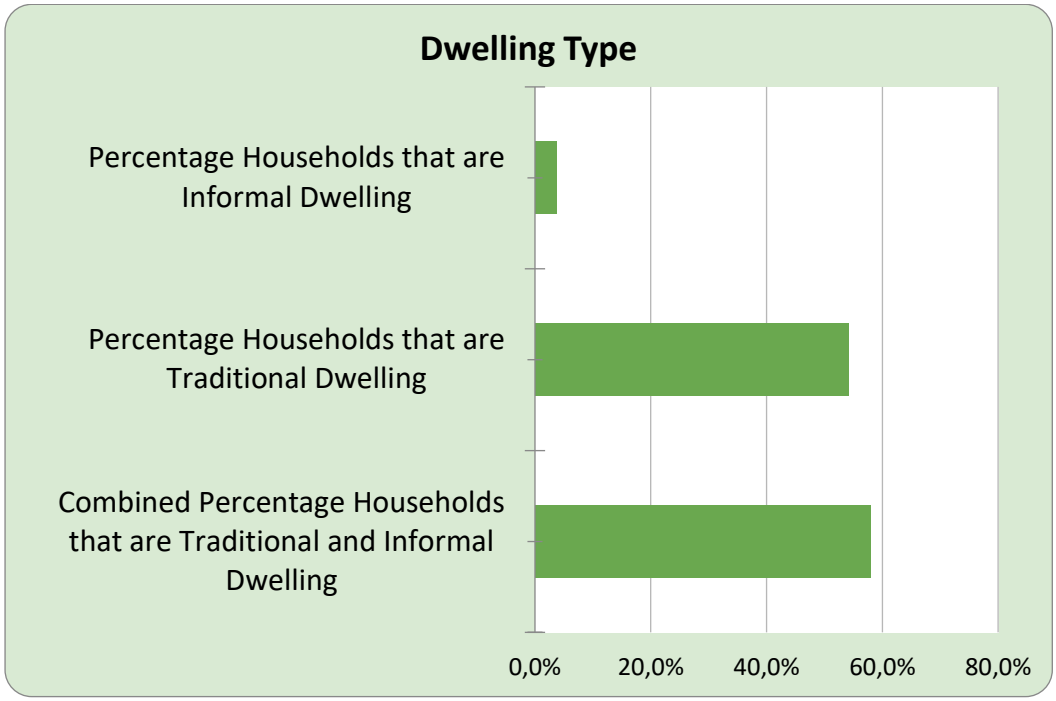

Figure 18: Households by type of dwelling in the District Municipal Area (Statistics South Africa, 2011)

In the District, 63% of the population has access to electricity (Auditor-General of South Africa 2014). Yet, 62.87% of the households use alternatives to electricity for cooking, while 36.95% use alternatives to electricity for cooking, heating or lighting (Statistics South Africa 2011).

About 34% of the District's population source water from service providers, while 43% source water from natural water sources (rivers and springs), 3.5% from boreholes and 13% access water through other means (Figure 19) (Statistics South Africa 2011).

There is a huge backlog in the provision of sanitation services (Harry Gwala District Municipality 2015a). Regarding sanitation services (Figure 20), 15.76% of the population has access to flush toilets, 69.36% rely on pit latrines, 12.09% have access to other toilet facilities and 2.79% of the population have no toilet facilities (Statistics South Africa 2011).

[1] "Traditional Structure" includes dwelling/hut/structure made of traditional materials
[2] "Formal House" includes cluster houses, flat or apartment, house/flat/room in backyards, house or brick/concrete block structure on a separate stand or yard or on a farm, room/flatlet on a property or larger dwelling/servant's quarters/granny flat and semi-detached houses

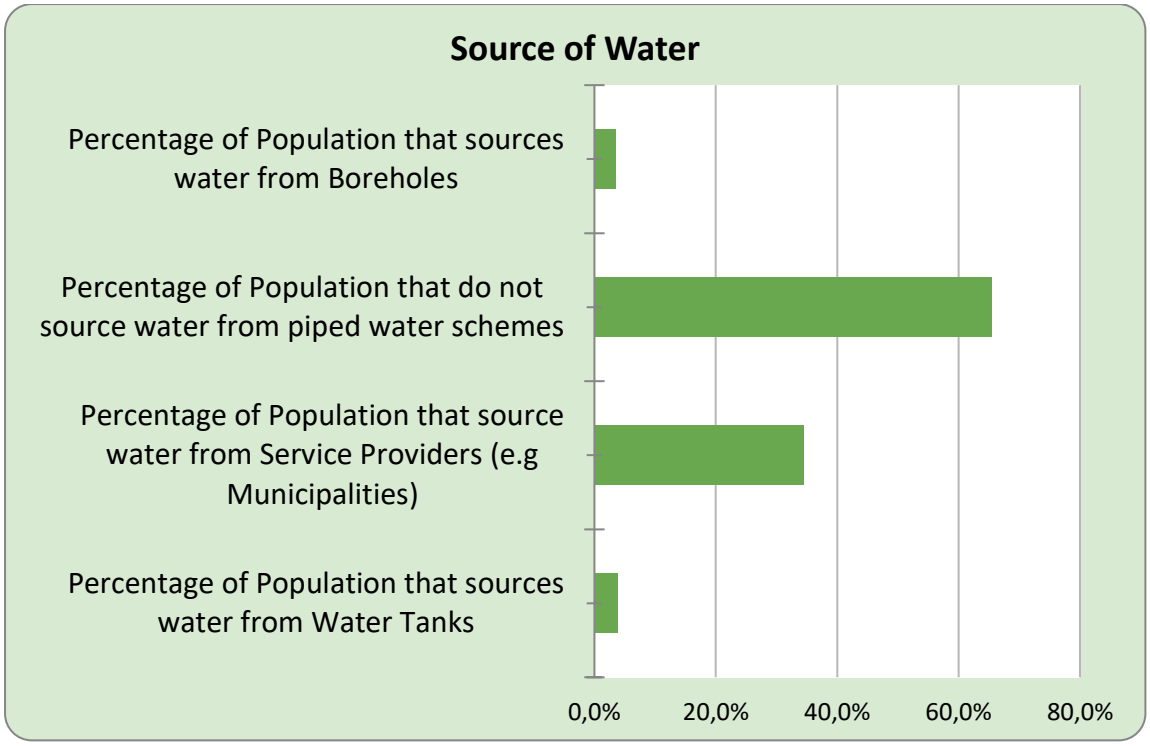

Figure 19: Household water sources in the District Municipal Area (Statistics South Africa 2011)

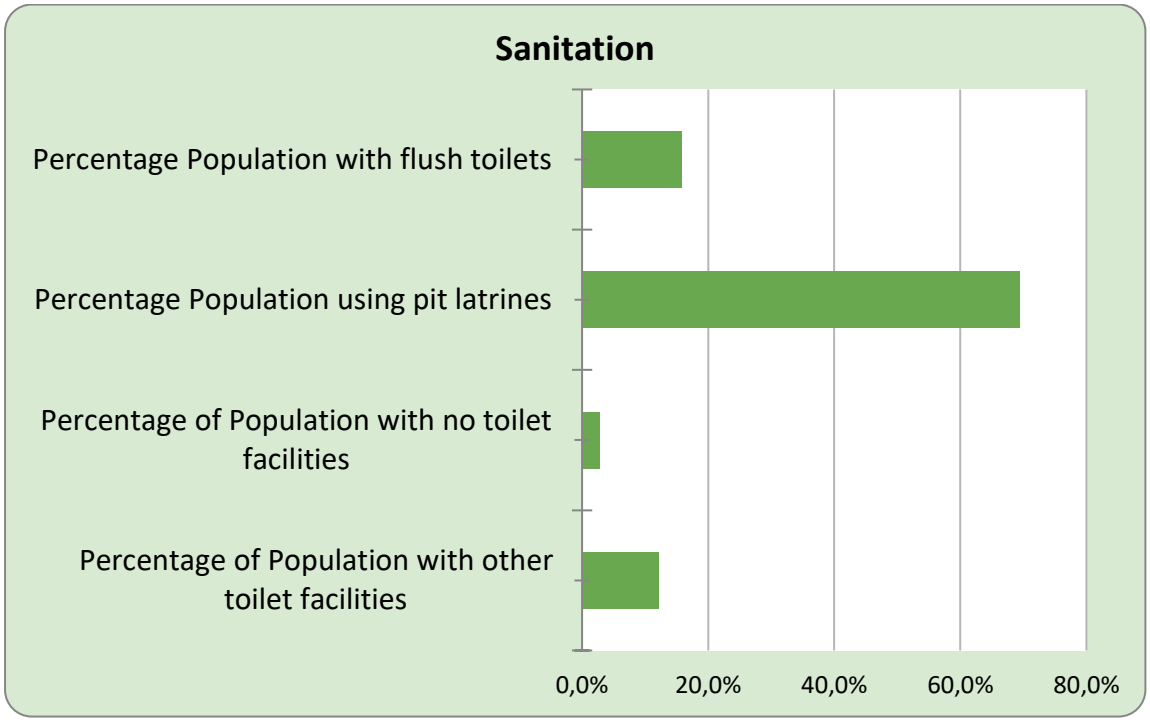

Figure 20: Sanitation facilities in the District Municipal Area (Statistics South Africa 2011)

In terms of road infrastructure, the District Municipality does not have direct access to any national roads (Harry Gwala District Municipality 2014). Key roads within the district are the R56, R617 and R612 (Harry Gwala District Municipality 2014). Furthermore, an underutilised and degraded rail network exists within the District (Harry Gwala District Municipality 2014).

The District is prone to disasters (Harry Gwala District Municipality 2015a). Major climatic risks in the District Municipal Area include: floods, severe weather (such as thunderstorms and lightning) and veld fires (Harry Gwala District Municipality 2016). Regarding veld fires specifically, nearly the entire District Municipal Area has an extreme fire risk (Figure 21) (Department of Agriculture, Forestry and Fisheries 2010). Responding to veld fires in the District has become more challenging due to a drought, that has forced Municipal officials to impose water restrictions in many parts of the District (Harry Gwala District Municipality 2016).

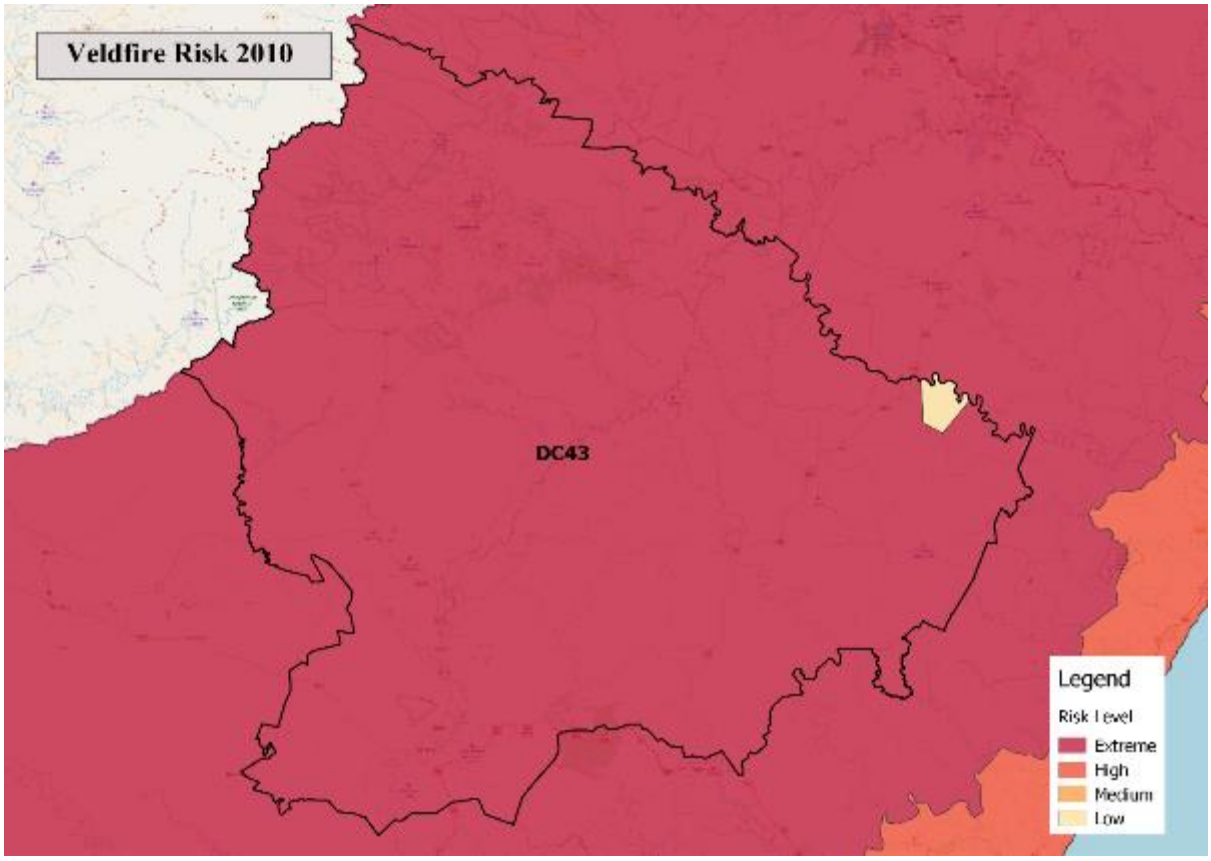

Figure 21: Veld fire risk for District Municipality Area (Department of Agriculture, Forestry and Fisheries 2010)

Climate change has been identified as a major threat in the District that will likely exacerbate common hazards (Harry Gwala District Municipality 2014). Observed climate change impacts within the District include unpredictable weather patterns, more frequent extreme weather events and increased rainfall variability (Harry Gwala District Municipality 2014).

Eco-tourism in the district has large economic returns and provides job opportunities, for example between 2000 and 2010 employment increased by 20% and this increase has been largely attributed to the tourism sector (Harry Gwala District Municipality 2016). However, the tourism sector and the associated jobs are vulnerable to the predicted impacts of climate change (Harry Gwala District Municipality 2014). The rate of urbanisation is expected to be exacerbated by climate change impacts, which will result in a higher proportion of young and elderly people in the District.

4.6 Harry Gwala DM Water Sector Summary

The Harry Gwala District Municipality falls mainly under the Pongola-uMzimkhulu hydrological zone (Figure 22) with a small part in the south falling within the Mzimvubu-Tsitsikama hydrological zone (Department of Environmental Affairs 2013d). As outlined above (in Figure 1), in the warmer wetter future scenario, the Pongola-uMzimkhulu hydrological zone is predicted to experience an increase in rainfall in spring (Department of Environmental Affairs 2013d). While in the hotter and drier scenario, the region will experience a decrease in rainfall in spring and a strong decrease in rainfall in summer and autumn (Department of Environmental Affairs 2013d).

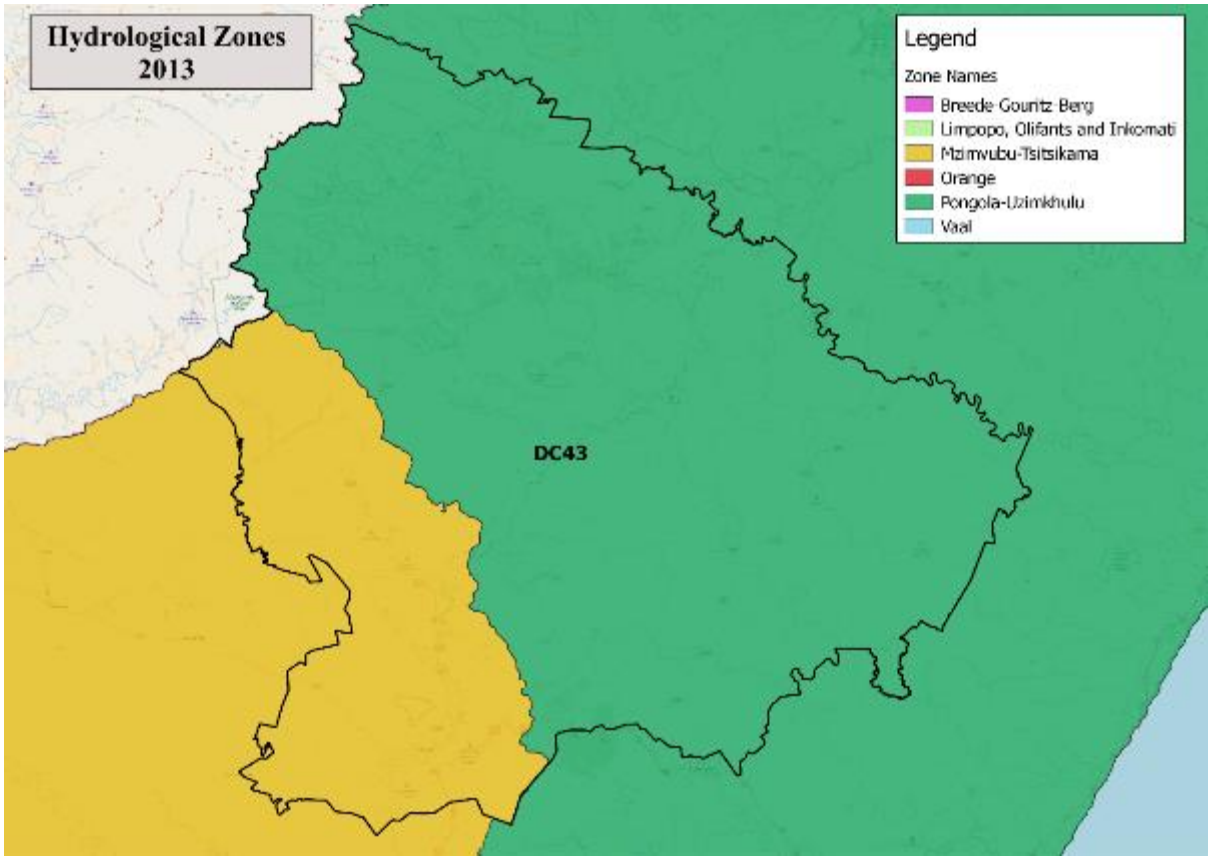

Figure 22: Hydrological Zone for the District Municipal Area (Department of Environmental Affairs 2013d)

Most of the Harry Gwala District Municipality falls under the Pongola-uMzimkhulu Water Management Area (Figure 23), while a small part falls within the Mzimvubu-Tsitsikama water management area (Department of Environmental Affairs 2013d). The Harry Gwala District Municipal Area overlaps with the Ngwagwane catchment (Department of Water and Sanitation 2016b). Within the Harry Gwala District Municipal Area there is one main water resource, the Singisi Dam, which is located in the southern central region of Harry Gwala District Municipal Area (Figure 24) (Department of Water and Sanitation 2016b).

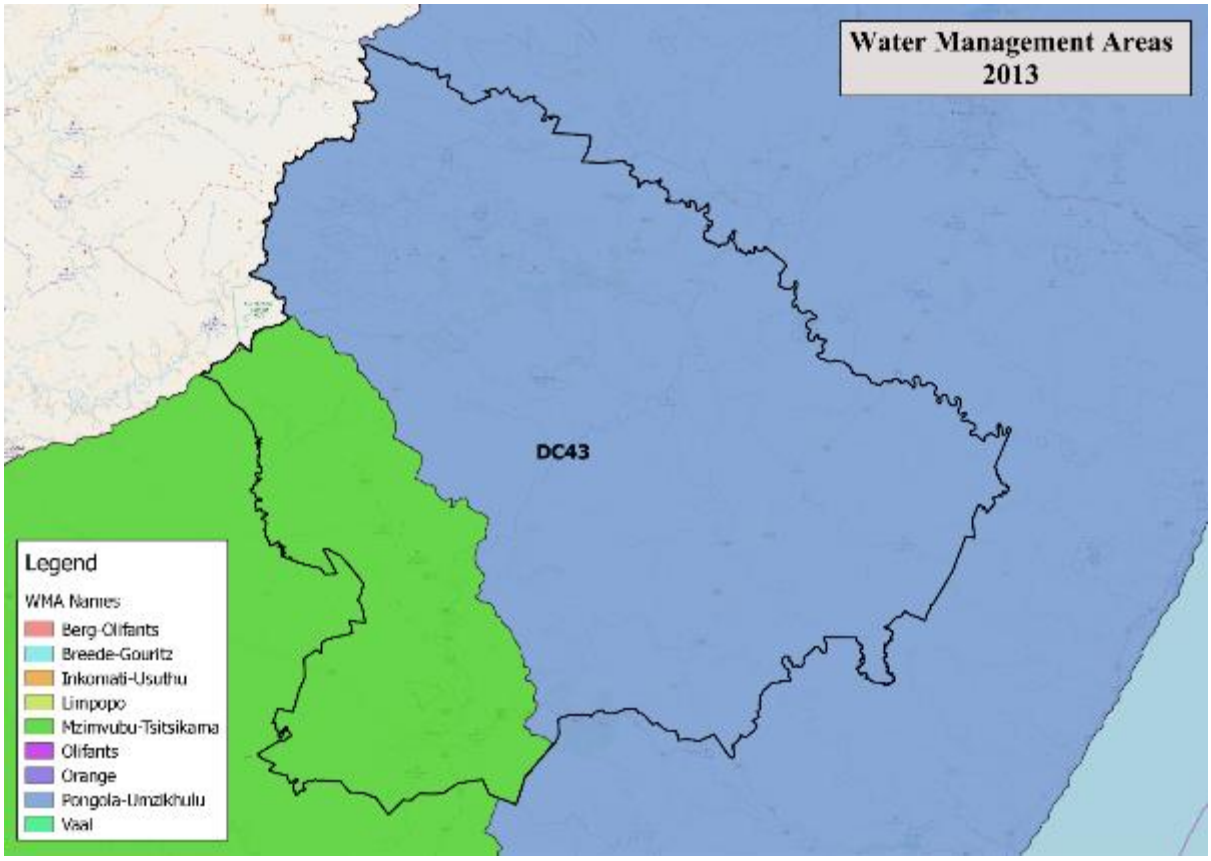

Figure 23: Water Management Area for the District Municipal Area (Department of Water Affairs 2013)

Figure 24: Water resources within the District Municipal Area (Department of Water and Sanitation 2016b)

The river quality within the Harry Gwala District Municipal Area is highly variable, which means that many rivers are unable to contribute towards river ecosystem biodiversity targets (SANBI 2011). The health of a river system is graded into one of several categories (SANBI 2011). These categories are listed in Text Box 1.

Text Box 1: Freshwater Ecosystem Priority Areas (FEPAs) classification for river ecosystem conditions

River conditions in South Africa have been classified according to the Freshwater Ecosystem Priority Areas (FEPAs) for river ecosystems (SANBI 2011). The different grades are provided below:

A = Unmodified, Natural
B = Largely Natural with Few Modifications
Ab = A or B Above
C = Moderately Modified
D = Largely Modified
E = Seriously Modified
F = Critically/Extremely Modified
Ef = E or F Above
Z = Tributary Condition Modelled as Not Intact, According to Natural Land Cover

Rivers that are unmodified or in their natural state are able to contribute towards river ecosystems biodiversity targets (SANBI 2011). In contrast, rivers that are categorised as 'largely modified' or worse are unable to contribute towards river ecosystems as they are not in a good state.

The condition of rivers in the Harry Gwala District Municipal Area is varied (Figure 25). Some of the rivers in the Harry Gwala District Municipal Area (Figure 25) such as the uMzimkhulu and Umkhomazi Rivers are classified as 'Unmodified, Natural' (SANBI 2011). Furthermore, sections of the Ngwagwane River as well as smaller rivers such as the Gungununu and Bisi Rivers are classified as 'moderately modified' (SANBI 2011; Harry Gwala District Municipality 2016). Other small rivers such as the Mbumba, Lufafa and Luhane Rivers are classified as 'largely modified' (SANBI 2011).

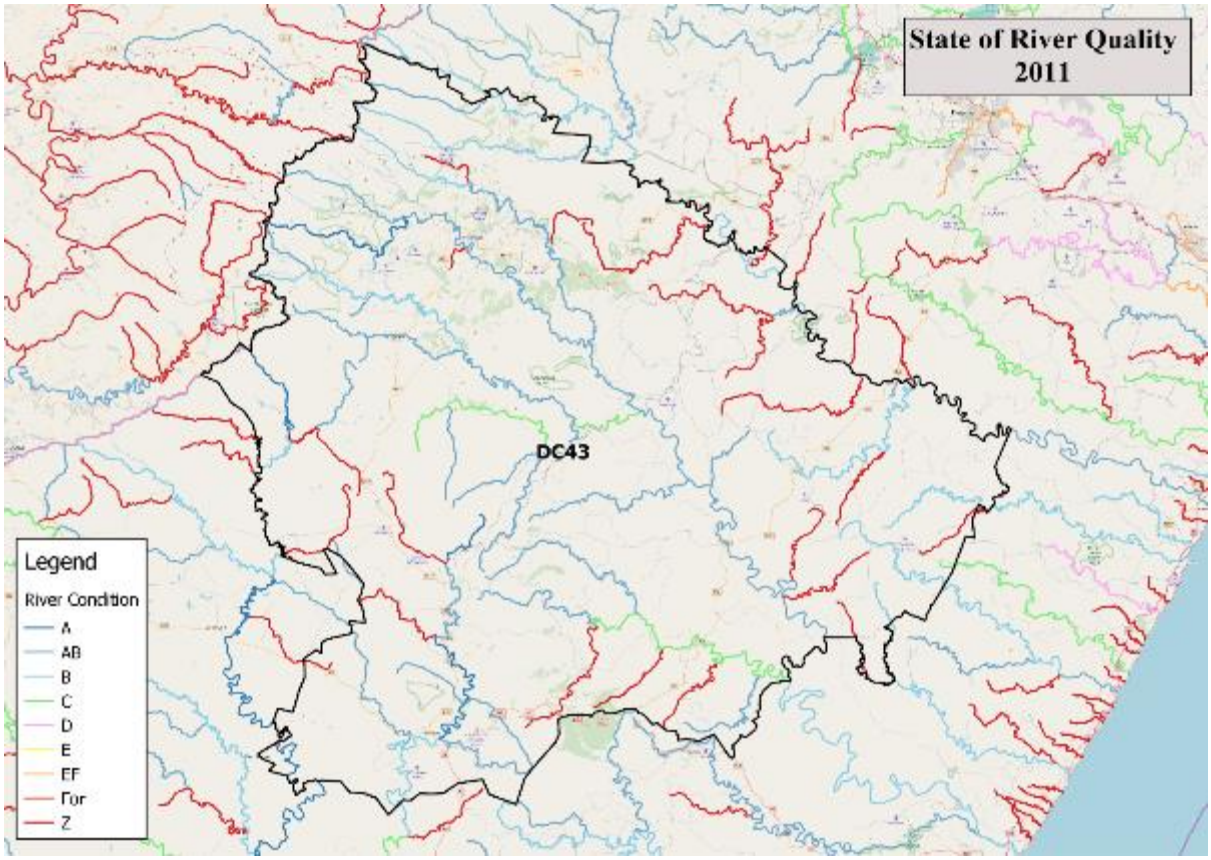

Figure 25: State of water quality in rivers in the District Municipal Area (SANBI 2011)

Water resources in any catchment are largely depended on rainfall. The Historical Climate Monthly Averages include long-term historical monthly average rainfall totals and monthly averaged minimum and maximum temperatures for a particular spot (Climate System Analysis Group 2017b). Due to the unavailability of weather data stations, the Historical Climate Monthly Averages for the Harry Gwala District Municipal Area have been calculated using the nearest weather data station to the Municipality, which is the measuring station at Cedara near Pietermaritzburg (Figure 26). The graph (in Figure 26) shows that average temperatures peak in the same months as highest rainfall, indicating that the Harry Gwala District Municipal Area is in a summer rainfall area (Climate System Analysis Group 2017b). Resultantly, there is less rainfall during winter seasons with the lowest average monthly rainfall historically occurring in June, which averages less than 15 mm (Climate System Analysis Group 2017b).

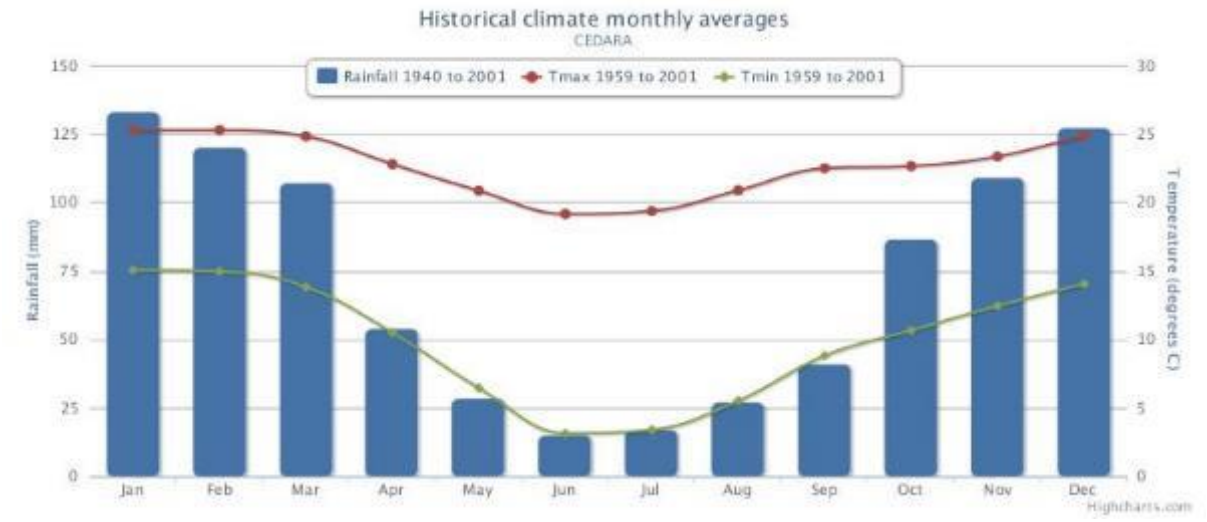

Figure 26: Historical Climate Monthly Averages for Cedara near Pietermaritzburg (Climate System Analysis Group 2017b)

Linked to the rainfall and rivers in the Harry Gwala District Municipal Area are the water and sanitation services. Specifically, a total of 65.44 % of households in the Harry Gwala District Municipal Area do not receive their water from piped water schemes, which is much higher than the national average of 21.82 % (Statistics South Africa 2011). Furthermore, the percentage of the population with flush toilets in the Harry Gwala District Municipal Area is 15.76 % while the national average is 56.51 % (Statistics South Africa 2011). This indicates a dire lack of sanitation facilities within Harry Gwala District Municipality. The Harry Gwala District Municipality's 2016/2017 *Integrated Development Plan* has identified these water and sanitation issues as key development challenges that need to be addressed (Harry Gwala District Municipality 2016).

Furthermore, the water backlog for the Harry Gwala District Municipality was given in the Harry Gwala District Municipality's 2016/2017 *Integrated Development Plan* as 40.83 % (Harry Gwala District Municipality 2016). This backlog is not spread equally among the five local municipalities that make up the Harry Gwala District Municipal Area. For example, the Ingwe Local Municipality had a backlog of 59.53 %, while the KwaSani Local Municipality has a backlog of 0.89 % (Harry Gwala District Municipality 2016).

Directly linked to water and sanitation services in the Harry Gwala District Municipal Area are the Blue and Green Drop scores. Blue Drop scores rate the quality of drinking water, while Green drop scores rate the quality of wastewater. Blue Drop scores rate the quality of drinking water supplied by water service providers. The Blue Drop score can be understood using the following scale: 90 – 100 % = 'Excellent situation'; 75 - <90 % = 'Good status'; 50 - <75 % = 'Average performance'; 33 - <50 % = 'Very poor performance'; and, 0 - <33 % = 'Critical status' (Department of Water Affairs 2011). The 2014 Blue Drop score for the Harry Gwala District Municipality was 63.00 %, indicating an 'average performance' (Department of Water and Sanitation 2014).

The Green Drop score rates the quality of wastewater management in municipalities. The Green Drop score can be understood using the following scale: 90 – 100 % = 'Excellent situation'; 80 - <90 % = 'Good status'; 50 - <80 % = 'Average performance'; 30 - <50 % = 'Very poor performance'; and, 0 - <30 % = 'Critical state' (Department of Water and Sanitation 2016a). The 2013 Green Drop score for Harry Gwala District Municipality was 67.11 % (Department of Water and Sanitation 2013). The Green Drop score indicates that the wastewater services in the Harry Gwala District Municipality are

'average' according to the expectations of the Department of Water and Sanitation as assessed by the Green Drop score.

In addition to an 'average' Green Drop score, just 17.38 % of households have their refuse removed by local authority/private company in the Harry Gwala District Municipal Area (Statistics South Africa 2011). As the national average for household refuse removal is 59.40 %, this indicates a lack of resources in the Harry Gwala District Municipality (Statistics South Africa 2011). Uncollected waste often ends up in water and sanitation infrastructure, blocking stormwater drains and polluting rivers. It is predicted that climate change will affect these water and sanitation challenges.

Climate change is predicted to have an impact on rainfall patterns in South Africa. Future rainfall projections for the Harry Gwala District Municipality (using the measuring station at Cedara near Pietermaritzburg) for the period 2020 to 2040 (Figure 27) are made using the Representative Concentration Pathways (RCP) 4.5 greenhouse gas concentration trajectories (Climate System Analysis Group 2017a).

The bar charts (Figure 27) show the potential change in rainfall, with the blue bars indicating a potential increase in average rainfall and the red bars indicate a potential decrease in average rainfall (Climate System Analysis Group 2017a). The grey lines represent the various models used for this projection. It is therefore projected across most of the models that Harry Gwala District Municipality could experience an increase in rainfall in the months of, February, March, April, July, September and December, and a decrease in rainfall during the months of January, May, June, August, October and November (Climate System Analysis Group 2017a).

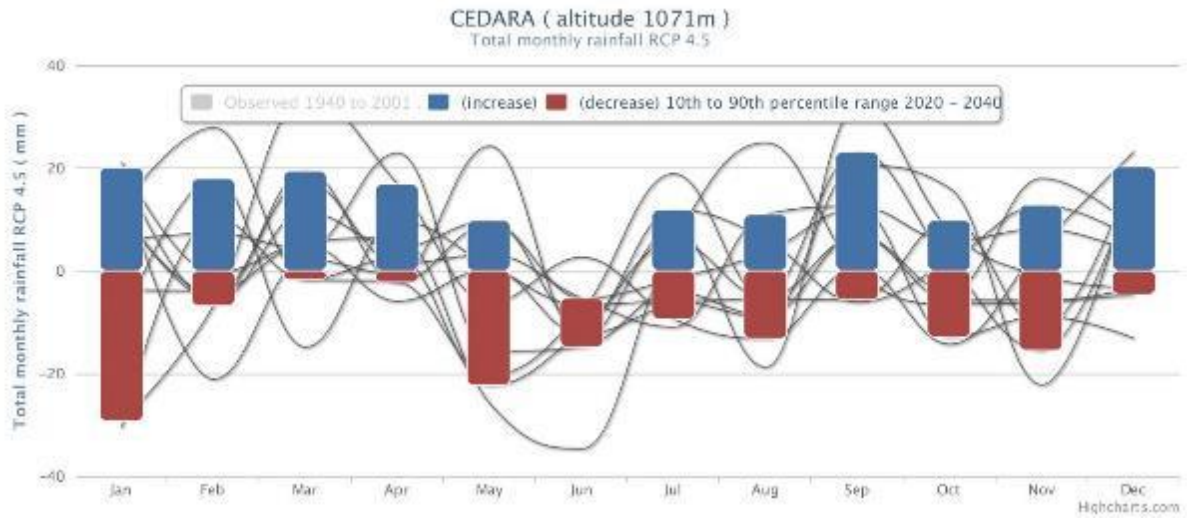

Figure 27. Rainfall Projections for Cedara near Pietermaritzburg (Climate System Analysis Group 2017a)

5 Vulnerability Assessment Results

The following section provides a summary of the Vulnerability Assessment conducted for Harry Gwala District Municipality.

5.1 Agriculture

Table 4: Agriculture Vulnerability Indicator Table Harry Gwala District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
1	Change in grain (maize, wheat & barley) production	Areas towards the west of RSA are likely to become less suitable for grain production.	Do you grow or have potential to grow grains in your area?	Yes	Throughout the District. The climate is suitable for grain production. Maize is used as animal feed.	How important is grain to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	Maize (animal feed), soya, pineapple, oranges. Research to be conducted on alternative animal feed	Medium	Commercial and subsistence farmers. KZNDARD KZN EDTEA
2	Change in Sorghum production	Sorghum yields are projected to increase in parts of western KZN, inland areas of the Eastern Cape and the eastern Free State, with some areas in the north registering losses compared with present climatic conditions.	Do you grow or have potential to grow Sorghum in your area?	Yes	Ubuhlebezwe, Umzimkhulu and Greater Kokstad Municipality. Climate is suitable for production.	How important is sorghum to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	Low	Not a priority crop		Subsistence farmers DARD Productivity SA Renewable Energy Producers of biomass

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
3	Change in Soya Bean Production	Areas in the east of RSA lost to potential production, with an expansion of suitable areas inland towards the central/west or RSA.	Do you grow or have potential to grow Soya Bean in your area?	Yes	Dr Nkosazana Dlamini Zuma Local Municipality and GKM The climate is suitable for production	How important is soya bean to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	Medium	Soya bean has potential. Alternative source to maize.	Low	DARD and DAFF
4	Change in Sugarcane Production	Increase in <10% in many parts of the present cane growing areas, but by up to 30% in new growth areas further inland.	Do you grow or have potential to grow Sugarcane in your area?	Yes	Climate is suitable	How important is sugarcane to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	Important for local economy	High	DARD Sugarcane growers Industry experts Market and Private companies have high capacity

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
5	Change in viticulture (grapes) production	Areas suitable for viticulture could be substantially reduced or shift to higher altitudes and currently cooler, more southerly locations.	Do you grow or have potential to grow grapes in your area?	No	Climate is not suitable for grape production	How important is viticulture (grapes) to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low /No Priority Crop = Low				
6	Change in fruit production	Projected reduction of the area suitable for fruit production (e.g. 28% reduction in apple and pears) by as early as 2020.	Do you grow or have potential to grow fruit in your area?	Yes	Ubuhlebezwe and NDZ, oranges and peaches	How important is fruit to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	At the household level Contribution to the economy	Medium	DARD and HGDA Commercial sector has capacity
7	Change in other crop production areas (e.g. vegetables, nuts, etc.)	Crop production may vary depending on a warmer wetter or warmer drier climate.	Do you grow or have potential to grow other crops in your area?	Yes	All local municipalities in the District. Subsistence farmers are already struggling, and climate change will exacerbate the situation.	How important are other crops to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	Cabbage, potatoes, spinach Contribution to the economy at the household level	Low	DARD Commercial and subsistence farmers HGDA

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
8	Increased areas for commercial plantations	The total area suitable for commercial forestry plantations would increase along the eastern seaboard and adjacent areas.	Do you have or have potential for commercial forestry plantations in your area?	Yes	Throughout the District	Is there capacity for commercial plantation expansion (water use licence, land availability, demand for plantation products)? High Potential for Expansion = High; Medium Potential for Expansion = Medium; Low/No Potential for Expansion = Low	High	A Lot of applications for forestry especially in uMzimkhulu	High	DAFF, Private stakeholders, Hans Merensky, SAPPI, Mondi, PG Bison Community growers, renewable energy (Biomass)

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
9	Increased exposure to pests such as eldana, chilo and codling moth	Exposure to eldana would increase in areas suitable for sugarcane by ~10% to > 30%. The area subject to damage by chilo would increase substantially (sugarcane). The area subject to damage by codling moth would increase substantially (apples, pears, walnuts and quince).	Are you or will you be exposed to agricultural pests in your area?	No	Controllable	How important are crops that are vulnerable to pests to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low				DARD and agricultural research facility in GKM
10	Increased risks to livestock	Projected decreases in rainfall and hence herbage yields would result in negative health impacts for livestock.	Do you or will you have livestock in your area?	Yes	Drought related, theft and veld fires. Dairy production in Harry Gwala is very substantial.	How important is livestock farming to the local economy and livelihoods? High Priority = High; Medium Priority = Medium; Low/No Priority = Low	High	Important at the household level. Mainly for dairy and meat production. Contributes to the economy.	Low	DARD HGDA Commercial sector has capacity

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
11	Reduced food security	Reduced food security, particularly of subsistence farmers, and resultant increase in malnutrition.	Do you or will you have food insecurity in your area?	Yes	Drought related	Percentage households involved in agricultural activities More than 20% = High; Between 20% & 10% = Medium; Less than 10% = Low	High	48.46% Weather patterns have changed	Medium	DARD, EDTEA, DOE (School nutrition) DOH and subsistence farmers SASSA

5.2 Biodiversity and Environment

Table 5: Biodiversity Vulnerability Indicator Table Harry Gwala District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
12	Loss of High Priority Biomes	High Priority Biomes (including Grasslands, Nama-Karoo, Indian Ocean Coastal Belt, Fynbos, Forest) to be replaced by other biomes such as savanna and desert.	Do you currently have high priority biomes in your area?	Yes	Grassland has been converted to savanna.	How much of this High Priority Biome will be lost due to climate change? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	Loss of open grasslands. Increased run-away fires. Reduced grazing land. Causes high erosion. Loss of species and habitats.	Low	EKZN Wildlife, DEA, EDTEA, DWAFF (Working for Water), SDF, EMF, LandCare.

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
13	Increased impacts on threatened ecosystems	Loss of threatened ecosystems due to changes in climate.	Do you currently have threatened ecosystems in your area? (Classified as critically endangered, endangered or vulnerable)	Yes	Wetlands, Indigenous forests, Critically endangered birds (Drakensberg escarpment).	How much of your Municipality is covered by threatened ecosystems? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	Critical and endangered ecosystems, several of which only occur in the District or immediate region.	Medium	EKZN Wildlife DEA EDTEA DWAFF (Working for Water) Lesotho Government as there is a bilateral relationship with South Africa Green project underway: -Working for water/wetlands/fire -EPWP -SEEP -Alien invasive clearing

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
14	Increased impacts on environment due to land-use change	Loss of biodiversity and degradation of natural habitat due to significant land use change (such as alien invasion, soil erosion and urbanisation) which impacts on ability to respond to climate change	Are you currently experiencing land use change?	Yes	Agricultural land for settlements and environmentally sensitive areas such as river banks invaded by human settlements. Invasion of alien plants.	Have you experienced significant loss of habitat since 1990? Above 10% = High; Between 5-10% = Medium; Under 5%= Low	High	Change of land use from grazing land to settlements	Medium	EKZN Wildlife, DEA, EDTEA, DWAFF (Working for Water). Lesotho Government as there is a bilateral relationship with South Africa EMF (underway), SDF, URP (Urban Regeneration Plan), RUP, SEMP, Draft Rural Development Plan, Working for river/wetland. Harry Gwala Biodiversity Sector Plan. NRMs.

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
15	Loss of Priority Wetlands and River ecosystems	Changes in rainfall patterns and temperature are likely to impact on wetlands and the ecosystem services they provide.	Do you have priority wetlands and river ecosystems in your area?	Yes	Loss of wetlands due to human activities and settlements. Wind-blown litter and dumping of litter. Invasion by alien plants.	How important are wetlands and river ecosystems in providing ecosystem services in your Municipality? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	uMzimkhulu River, Umkomaas River and Mzumbe River. Wetlands found throughout the District - including Franklin Vlei and Ntsikeni Vlei. Ramsar-Ntsikeni and Drakensberg.	Low	EKZN Wildlife DEA EDTEA DWAFF (Working for Water) DWS

5.3 Human Health

Table 6: Health Vulnerability Indicator Table Harry Gwala District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
21	Health impacts from increased storm events	Increased storms will result increased risk of drowning, injuries and population displacement impacts.	Are you or will you experience increased storm events in your area?	Yes	Climate change effect in all the local municipal areas	How populated are areas vulnerable to storms events (e.g. flood zones)? Densely populated = High; Partially populated = Medium; Sparsely or not populated = Low	High	uMzimkhulu town and surrounding areas are classified as floodplains	Medium	DOH, Municipal health Infrastructure, health and nutrition (availability impact) Disaster Management Plan Infrastructure maintenance and construction Average institutional support
22	Increased heat stress	Increases in average temperatures and extreme events (such as heat waves) are projected to induce heat stress, increase morbidity, and result in respiratory and cardiovascular diseases.	Are you or will you experience increased heat waves in your area?	Yes	Climate change effects experienced throughout the district	Is there a high percentage of young and elderly in the area? More than 20% = high; Between 15% & 20% = Medium; Less than 15% = low	High	The older and younger generation are mostly affected due to weak immune systems	High	DOH, Municipal health NGOs assist in building capacity The District has 4 district hospitals and 2 specialised hospitals.

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
23	Increased vector borne diseases from spread of mosquitoes, ticks, sandflies, and blackflies	Vector borne diseases such as malaria is projected to spread within regions bordering current malaria areas, which are presently too cold for transmission.	Are vector borne diseases present or likely in your area?	No		Are you in or neighbouring an area with vector borne diseases (e.g. malaria)? Already in a vector borne disease area = High; Neighbouring a vector borne disease area = Medium; Not near a vector borne disease area = Low				
24	Increased water borne and communicable diseases (e.g. typhoid fever, cholera and hepatitis)	Favourable conditions for the incubation and transmission of waterborne diseases may be created by increasing air and water temperatures.	Are waterborne and communicable diseases present or likely in your area?	Yes	Climate change effects are experienced throughout the district Diarrhoea Hepatitis	Have you had an incidence of waterborne and communicable diseases (e.g. typhoid fever, cholera and hepatitis) in the past 3 years Yes = High: No = Low	High	Quarterly basis, approximately 4 cases have been received	High	DOH/ Municipal Health Improve community capacity building Increase response system/time

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
25	Increased malnutrition and hunger as a result of food insecurity	Climate Change will affect food systems, compromising food availability, access and utilisation, leading to food insecurity (particularly of subsistence farmers).	Do you or will you have food insecurity in your area?	Yes	High unemployment rate in the district and high dependency on government grants.	Child under 5 years severe acute malnutrition case fatality rate More than 10% = high; Between 5% & 10% = Medium; Less than 5% = low	High	The rate is sitting at 15.5.	Low	DARD and DOH Provision of food Create more job opportunities Encourage the practise of one home, one garden
26	Increased air pollution	Health impacts in resulting from exposure to air pollutants include eye irritation, acute respiratory infection, chronic respiratory diseases and TB, and sometimes death.	Do you or will you have air pollution in your area?	Yes	Rock mining, Asphalt factories and dumpsites	Would you consider your area a high priority in terms of air pollution (e.g. SAAQIS Priority Areas)? Yes = High; Somewhat = Medium; No = Low	Medium	uBuhlebezwe has a rock mine	Low	No policies in place No bylaws There may be capacity, but the lack of legislation is a barrier
27	Increased Occupational health problems	Temperature is a common climatic factor that affects occupational health (for example, agricultural labourer's productivity) by causing heat stress and dehydration.	Do people work outside or are in conditions that cannot be cooled in your area?	Yes	Climate change effects municipal workers farm labourers.	Do a significant percentage of people work outside or are in conditions that cannot be cooled? Significant = High; Some = Medium; Low/No = Low	High	There are a lot of farms in the district.	Medium	OHS Capacity is available Hospitals Surgeries

5.4 Disaster Management, Infrastructure and Human Settlements

Table 7: Disaster Management, Infrastructure and Human Settlements Vulnerability Indicator Table Harry Gwala District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
28	Loss of industrial and labour productivity	Direct impacts of weather on construction, electricity generation and other industries, resulting in loss of productivity.	Do you have industrial activities in your area?	Yes	Change in rainfall patterns.	How significant is the Mining/Industrial/Manufacturing sector for the local economy? Significant = High; Somewhat = Medium; Low/No = Low	Medium	There is some manufacturing taking place in the District. There are a lot of plantations.	Medium	Early warning systems improvement.
29	Increased impacts on strategic infrastructure	Increased disruptions to key strategic infrastructure (e.g. WWTW, storm water, roads, rail, bridges) as a result of extreme weather events.	Do you have strategic infrastructure in your area?	Yes	Heavy rains, strong winds, snow and wildfires.	How important is this strategic infrastructure to the functioning of your municipality? Significant amount = High; Moderate amount = Medium; Minimal or no = Low	High	The district economy is affected.	Medium	Disaster Management Plan in place Capacity in place Response mechanisms to be improved.
30	Increased impacts on traditional and informal dwellings	Increased risk of extreme weather events to already vulnerable traditional and informal dwellings, that are often unplanned, and	Do you have traditional and informal dwellings in your area?	Yes	Fire risk. Informal settlements and rural areas. Illegal occupation on river banks.	What percentage of households are in traditional and informal dwellings in your area? More than 15% = high; Between 15% & 10% = Medium; Less than 10% = low	High	The district is largely rural and sparsely populated.	Medium	Informal and traditional dwellings not built according to building standards.

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
		without extensive service or infrastructure.								
31	Increased isolation of rural communities	Physical isolation of rural communities as a result poor rural roads and increased flooding and erosion.	Do you have isolated rural communities in your area?	Yes	Occurrence of heavy rain.	Is your area predominantly Rural? Mostly Rural = High Equally Urban and Rural = Medium Mostly Urban = Low	High	Access roads and watercourse ways are not sufficient.	Medium	Improvement of access roads and watercourse ways is required.
32	Increased migration to urban and peri-urban areas	Increased migration from rural settlements to urban and peri-urban settlements.	Do you have rural urban migration in your area?	Yes	Growth of informal settlements	Is there a strong rural economy? Low opportunities in rural areas = High; Some opportunities in rural areas = Medium; Strong rural economy = Low	High	Most people migrate to urban areas seeking employment opportunities resulting in the eruption of informal settlements.	Low	The District needs to assist Traditional leaders with skills development and creation of employment opportunities.
33	Increased risk of wildfires	Increased risk of wildfires linked to higher ambient temperatures, dry spells and more frequent lightning storms.	Is this or will this take place in your area?	Yes	Forestry Wide open land, dry spells	What is the Veld Fire Risk Status of the area? Extreme or High = High; Medium; Low	High	Area is open and there are forests.	Low	Traditional leaders to assist with organising izimbizo for awareness programmes.
34	Decreased income from	Reduced income from tourism as	Do you have tourism assets	Yes	Tourism based on	How significant is tourism to the local economy?	High	The district has natural	Medium	Tourism industry - tourist

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
	tourism	a result of reduced recreational opportunities and increased impact on tourism-supporting infrastructure, such as conservation area access roads.	that can be impacted by climate change in your area?		natural resources Extinction of species	Significant contributor = High; Some contribution = Medium; Low/No contribution = Low		resources.		accommodation high in the area.

5.5 Water

Table 8: Water Vulnerability Indicator Table Harry Gwala District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer		Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
35	Decreased quality of drinking water	Deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates.	Is this or will this take place in your area?	Yes	Siltation. Restoration of dams. Contamination	What is the Blue Drop Score for the area (2012 Report)? Less than 50% = high; Between 50% & 90% = Medium; More than 90% = low	Medium	Average, rudimental water schemes and the blue drop score is 69.35%.	Low	Water authorities Lack of funding
36	Decreased water quality in ecosystem due to floods and droughts	More frequent floods result in increased effluent overflow into rivers. Increased drought means less water is available to dilute wastewater discharges and irrigation return flows to rivers.	Is this or will this take place in your area?	Yes	Contamination Salt concentration	What is the Green Drop Score for the area? Less than 50% = high; Between 50% & 90% = Medium; More than 90% = low	High	Green drop score is 45.40% because of rudimental water schemes.	Medium	Water authority Water and sanitation Implementation is slow.

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer		Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
37	Less water available for irrigation and drinking	Increased periods of drought mean less water is available.	Is this or will this take place in your area?	Yes		Drought	Years of drought over the past 20 years More than 7 incidence = High; Between 7 & 2 incidence = Medium; Less than 2 incidence = Low;	High	Revenue collection is low, and management of water schemes is poor.	Low	Water authority Water and sanitation Water reserve schemes are not in place
38	Increased impacts of flooding from litter blocking storm water and sewer systems	Human health and ecosystem impacts, associated with increased rainfall intensities, flash floods and regional flooding resulting in litter and washed-off debris blocking water and sanitation systems.	Is this or will this take place in your area?	Yes		Blockage of stormwater drains Non-effective collection of waste Rubble and Garden waste not collected.	Percentage of Households using no rubbish disposal More than 10% = High; Between 10% & 5% = Medium; Less than 5% = Low	High	Poor maintenance of storm water drainage due to the lack of funds.	Low	IWMP

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer		Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
39	Increased fish mortality	Increased freshwater fish mortality due to reduced oxygen concentrations in aquatic environments and mortality of temperature-sensitive fish species.	Do you have fresh water fish in your area?	Yes		Water contamination	How significant is fresh water fish to livelihoods? Significant to livelihoods = High; Some dependence = Medium; Low/No dependence = Low	Low	Only in Underberg small town Lack of capacity	Low	Forestry and fisheries

5.6 Vulnerability Assessment Summary

The tables below list the high and medium priority climate change indicators for the municipality.

5.6.1 High Priority Climate Change Indicators

Based on the above vulnerability assessment the following indicators were identified as high priority climate change vulnerabilities for the municipality. These were shortlisted by answering "yes" to exposure, "high" to sensitivity and "low" to adaptive capacity.

Table 9: High Priority Indicators Harry Gwala District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
7	Agriculture	Change in other crop production areas (e.g. vegetables, nuts, etc.)	Yes	High	Low
10	Agriculture	Increased risks to livestock	Yes	High	Low
12	Biodiversity and Environment	Loss of High Priority Biomes	Yes	High	Low
15	Biodiversity and Environment	Loss of Priority Wetlands and River ecosystems	Yes	High	Low
25	Human Health	Increased malnutrition and hunger as a result of food insecurity	Yes	High	Low
32	Human Settlements, Infrastructure and Disaster Management	Increased migration to urban and peri-urban areas	Yes	High	Low
33	Human Settlements, Infrastructure and Disaster Management	Increased risk of wildfires	Yes	High	Low
37	Water	Less water available for irrigation and drinking	Yes	High	Low
38	Water	Increased impacts of flooding from litter blocking storm water and sewer systems	Yes	High	Low

5.6.2 Medium Priority Climate Change Indicators

Based on the above vulnerability assessment the following indicators were identified as medium priority climate change vulnerabilities for the municipality. These were shortlisted by answering “yes” to exposure, “medium” or “high” to sensitivity and “low” or “medium” to adaptive capacity.

Table 10: Medium Priority Indicators Harry Gwala District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
1	Agriculture	Change in grain (maize, wheat & barley) production	Yes	High	Medium
3	Agriculture	Change in Soya Bean Production	Yes	Medium	Low
4	Agriculture	Change in Sugarcane Production	Yes	High	High
6	Agriculture	Change in fruit production	Yes	High	Medium
8	Agriculture	Increased areas for commercial plantations	Yes	High	High
11	Agriculture	Reduced food security	Yes	High	Medium
13	Biodiversity and Environment	Increased impacts on threatened ecosystems	Yes	High	Medium
14	Biodiversity and Environment	Increased impacts on environment due to land-use change	Yes	High	Medium
21	Human Health	Health impacts from increased storm events	Yes	High	Medium
22	Human Health	Increased heat stress	Yes	High	High
24	Human Health	Increased water borne and communicable diseases (e.g. typhoid fever, cholera and hepatitis)	Yes	High	High
26	Human Health	Increased air pollution	Yes	Medium	Low
27	Human Health	Increased Occupational health problems	Yes	High	Medium
28	Human Settlements, Infrastructure and Disaster Management	Loss of industrial and labour productivity	Yes	Medium	Medium
29	Human Settlements, Infrastructure and Disaster Management	Increased impacts on strategic infrastructure	Yes	High	Medium
30	Human Settlements, Infrastructure and Disaster Management	Increased impacts on traditional and informal dwellings	Yes	High	Medium

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
31	Human Settlements, Infrastructure and Disaster Management	Increased isolation of rural communities	Yes	High	Medium
34	Human Settlements, Infrastructure and Disaster Management	Decreased income from tourism	Yes	High	Medium
35	Water	Decreased quality of drinking water	Yes	Medium	Low
36	Water	Decreased water quality in ecosystem due to floods and droughts	Yes	High	Medium
39	Water	Increased fish mortality	Yes	Low	Low

6 Sector Response Plans

The section below summarises responses that have been identified to address the key vulnerabilities identified above.

6.1 Agriculture

6.1.1 Introduction

	Programme Name
	Agriculture Sector Adaptation to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	The South African agricultural sector is highly diverse in terms of its activities and socio-economic context. This sector can be described as two-tiered (commercial vs. small-holder and subsistence farmers), with activities across a wide variety of climatic conditions (especially of rainfall). Roughly 90% of the country is sub-arid, semi-arid, or sub-humid, and about 10% is considered hyper-arid. Only 14% of the country is potentially arable, with one fifth of this land having high agricultural potential. Climate is important in determining potential agricultural activities and suitability across the country, especially in smallholding and homestead settings. Irrigation and conservation tillage practices can overcome rainfall constraints, especially in the high-value commercial agricultural sector. Irrigation currently consumes roughly 60% of the country's surface water resources, with important implications for agricultural exports, and food and water security in the context of climate change.
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the agriculture sector in the District Municipality
7	Manage the change in other crop production
10	Manage increasing risks to livestock

6.1.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
7	**Manage the change in other crop production**	Department of Agriculture to improve the extension programme for subsistence farming support.				25%	50%	75%	100%	TBC
		Department of Agriculture to improve farming techniques for water saving, production capacity and organic farming.	Priority			25%	50%	75%	100%	TBC
10	**Manage increasing risks to livestock**	Private farmers to construct dams on their properties for the collection of water.				25%	50%	75%	100%	TBC
		Harry Gwala District Municipality together with farmers to improve firebreaks and create awareness around the importance of maintaining firebreaks.	Priority			25%	50%	75%	100%	TBC

6.2 Biodiversity and Environment

6.2.1 Introduction

	Programme Name
	Biodiversity and Environment Sector Adaptation to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	Biodiversity is crucial to ecosystem health, and healthy ecosystems are central to human well-being. Healthy ecosystems interlinked with working landscapes and other open spaces form the ecological infrastructure of the country and are the foundation for clean air and water, fertile soil and food. All South Africans depend on healthy ecosystems for economic and livelihood activities, including agriculture, tourism and a number of income generating and subsistence level activities. These natural ecosystems are under pressure from land use change and related processes causing degradation, as well as invasive alien species. Accelerated climate change (resulting in increasing temperature, rising atmospheric CO_2 and changing rainfall patterns) is exacerbating these existing pressures. Well-functioning ecosystems provide natural solutions that build resilience and help society adapt to the adverse impacts of climate change. This includes, for example, buffering communities from extreme weather events such as floods and droughts, reducing erosion and trapping sediment, increasing natural resources for diversifying local livelihoods, providing food and fibre, and providing habitats for animals and plants which provide safety nets for communities during times of hardship. Sustainably managed and/or restored ecosystems help in adapting to climate change at local or landscape level.
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the biodiversity sector in the District Municipality
12	Manage Loss of High Priority Biomes
15	Manage Loss of Priority Wetlands and River ecosystems

6.2.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
12	**Manage Loss of High Priority Biomes**	Planning Unit in each of the Local Municipalities to link the conservation of biomes with spatial planning e.g. define urban edge through LUMS and SDF.				25%	50%	75%	100%	TBC
		Establish a Natural Resource Management Committee for the District Municipality which will be coordinated by the delegated individuals in the Local and District Municipalities.	Priority			25%	50%	75%	100%	TBC
		The environmental and social development departments to establish an alien plant removal programme in each Local Municipality by 2022. The Programme should focus on the identification of priority areas and securing funding from NRM.	Priority			25%	50%	75%	100%	TBC
		Ubuhlebezwe Local Municipality and DEA to eradicate alien plants in wards 3, 5, 11, and 12.				25%	50%	75%	100%	TBC
		Map the area and identify landowners and target species within a period of 3 months.				25%	50%	75%	100%	TBC
		Implement a business plan in order to manage the loss of priority biomes over a period of four years.				25%	50%	75%	100%	TBC
15	**Manage Loss of Priority Wetlands and River ecosystems**	The environmental and social development departments to establish an alien plant removal programme in each Local Municipality by 2022. The Programme should focus on the identification of priority areas and securing funding from NRM.				25%	50%	75%	100%	TBC
		Ubuhlebezwe Local Municipality and DEA to eradicate alien plants in wards 3, 5, 11, and 12.				25%	50%	75%	100%	TBC
		Map the area and identify landowners and target species within a period of 3 months.				25%	50%	75%	100%	TBC
		Conduct education and awareness pilot projects in the Fairview area in Ixopo.				25%	50%	75%	100%	TBC

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
		Environmental department in uBuhlebezwe to produce a report on littering and waste management.				25%	50%	75%	100%	TBC
		Ubuhlebezwe Local Municipality and DEA to implement a working for rivers and wetlands project in the Ncalu Catchment over a period of 4 years.				25%	50%	75%	100%	TBC

6.3 Human Health

6.3.1 Introduction

	Programme Name
	Human Health Sector Adaptation to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	South Africa faces complex and pressing public health challenges exacerbated by adverse socio-economic conditions including dense informal settlements which constrain effective service delivery. These health challenges include a disease complex with the highest global prevalence of Human Immunodeficiency Virus (HIV) and tuberculosis (TB), complicated by water-borne and chronic respiratory disease. Under-nutrition and socio-economic stress are important contributors to poor human resilience and contribute to conditions that facilitate the emergence and propagation of disease. Malnutrition and disease interact strongly, and there is a key relationship between environmental quality, food security, and the disease burden of communities. Adaptation to the potential effects of climate change on human health is viewed in this context. However, significant knowledge and information gaps are preventing well supported quantitative projections of human health impacts in South Africa.
	Objectives
25	The following objective has been identified through the LGCCSP as a priority area for the health sector in the District Municipality Manage increased malnutrition and hunger as a result of food insecurity.

6.3.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
25	**Manage increased malnutrition and hunger as a result of food insecurity.**	LED to develop a project proposal to source funding for the one home one garden initiative in four wards in the District by June 2019.				25%	50%	75%	100%	TBC
		Environmental Health Practitioners to conduct awareness campaigns on food insecurity in rural areas and informal settlements in the District by June 2019.	Priority			25%	50%	75%	100%	TBC
		LED to initiate a project that supports the development of SMMEs in order to reduce the unemployment rate by June 2020 in the District Municipality.	Priority			25%	50%	75%	100%	TBC

6.4 Disaster Management, Infrastructure and Human Settlements

6.4.1 Introduction

	Programme Name
	Human Settlements, Infrastructure and Disaster Management Sector Adaptation to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	South Africa is a diverse country, not just in terms of populations and biodiversity, but also in terms of its human settlements. These settlements face severe challenges, even before climate change is taken into account. The implications of the compounding impacts of climate change will be profound, and human settlements therefore represent a crucial part of national adaptation strategies. The overarching strategic framework for the development of human settlements is described in the National Development Plan (NDP) and, more specifically in relation to the implications for climate change, in the National Climate Change Response White Paper (NCCRWP). However, to develop appropriate adaptation responses a more nuanced understanding of the challenges and options for human settlements is required, building on the insights of the NCCRWP. This understanding needs to take into account the unusually diverse urban forms of human settlement in the South African context, and the importance of ecological infrastructure in supporting service delivery and building resilient communities.
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the human settlements sector in the District Municipality
32	Manage potential increase migration to urban and peri-urban areas.
33	Manage potential increased risk of wildfires

6.4.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
32	**Manage potential increase migration to urban and peri-urban areas.**	The Department of Water Affairs and the Harry Gwala District Municipality to investigate the possibility of assisting small scale and subsistence farmers in rural areas by providing infrastructure such as boreholes, water harvesting initiatives, JoJo tanks, water trucks/tankers in order to contribute towards sustainable subsistence farming and food production by 2025.	Priority			25%	50%	75%	100%	TBC
		The Department of Agriculture, Department of Environmental Affairs and Local Municipalities to increase awareness campaigns on properly managing environmentally sensitive land that is used for cattle grazing in order to prevent land degradation and improve sustainability by 2030.				25%	50%	75%	100%	TBC
		The Department of Rural Development and Land Reform to accelerate issues of Land Tenure and empower rural communities on how to access any assistance required for funding and training opportunities in order to contribute to Local Economic Development by 2035.				25%	50%	75%	100%	TBC
33	**Manage potential increased risk of wildfires**	Municipalities to increase public awareness on fire preventions by investing in the procurement of equipment to be distributed through traditional leaders before each winter season.	Priority			25%	50%	75%	100%	TBC

6.5 Water

6.5.1 Introduction

	Programme Name
	Water Sector Adaptation to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	South Africa's climate is generally arid to semi-arid, with less than 9% of annual rainfall ending up in rivers, and only about 5% recharges groundwater in aquifers. In addition, rainfall and river flow are unpredictable in time and unevenly distributed in space, with only 12% of the land area generating 50% of stream flows. Decadal rainfall variability also results in extended dry and wet periods across the country. The main users of surface water resources are agricultural irrigation, domestic, industrial, mining and power generation, while plantation forestry intercepts and reduces runoff before it reaches the rivers and groundwater. Surface water resources were already over-allocated by the year 2000 in five of nineteen water management areas historically used for water planning and management purposes. The potential demand for water is expected to increase with economic growth, increased urbanisation, higher standards of living, and population growth. Because of the critical importance of water in the South African economy the country has a sophisticated water resources planning capacity, founded on a good understanding of the country's variable rainfall. This planning capacity will be a key capability for adaptation planning under ongoing and future climate change.
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the water sector in the District Municipality
37	Manage the quantity of water available for irrigation and drinking.
38	Manage the increased impacts of floods due to litter blocking the sewer system.

6.5.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
37	**Manage the quantity of water available for irrigation and drinking.**	Implement building regulations that will promote water conservation in the area.				25%	50%	75%	100%	TBC
		Conduct awareness campaigns that promote water saving.	Priority			25%	50%	75%	100%	TBC
		The municipality to develop bylaws that will contribute towards water saving.				25%	50%	75%	100%	TBC
		Conduct an investigation into understanding how the District Municipality allocates water to its communities, noting that water within the District has been requested for usage by other municipalities in the province.				25%	50%	75%	100%	TBC
38	**Manage the increased impacts of floods due to litter blocking the sewer system.**	The waste and gardens department to establish a rubble and garden waste site over a period of three years.				25%	50%	75%	100%	TBC
		The waste and garden department to develop a stream cleaning and waste management system.				25%	50%	75%	100%	TBC
		Enhance the capacity of the municipality to collect waste.				25%	50%	75%	100%	TBC
		The Department of Environmental Affairs to assist the District with developing an Integrated Waste Management Plan.	Priority			25%	50%	75%	100%	TBC

6.6 Cross-Cutting

6.6.1 Introduction

	Programme Name
	Cross Cutting Adaptations to Climate Change
	Programme Custodian/Driver
	Overview of Key Issues
	The projected impacts of climate change for Harry Gwala District could ultimately negatively impact the economy of district. Since the Agricultural sector is an important contributor to the district economy and the projected impacts of climate change on agriculture could negatively impact on the district economy as a whole. It should also be noted that the project impacts of climate change could also negatively impact on the finances of the municipality. For instance, water shortages will require the implementation of demand management measures by the district resulting in lower water sales. Climate change is a relatively new field in South Africa and research on economic impact of climate change is required for the field to get the attention that is needed.
	Objectives
63	Generate knowledge and disseminate information on climate change

6.6.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget	Cross Cutting
63	**Generate knowledge and disseminate information on climate change**	Commission a research report into the potential impacts of climate change on the district economy and municipal finances.				25%	50%	75%	100%	TBC	Cross Cutting

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