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# Climate Support Programme (CSP) – Climate Change Adaptation Strategies

## Adaptation Strategies for North West Province



**environmental affairs**

Department:  
Environmental Affairs  
**REPUBLIC OF SOUTH AFRICA**

**giz** Deutsche Gesellschaft  
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## List of Acronyms

AFOLU – Agriculture, Forestry, and Land Use  
ARC - Agricultural Research Council  
AGWA – Alliance for Global Water Adaptation  
CCAFS - Climate Change, Agriculture, and Food Security  
CoGTA - Department of Co-operative Governance and Traditional Affairs  
CSA – Climate Smart Agriculture  
CSIR – Council for Scientific and Industrial Research  
DAFF – Department of Agriculture, Forestry, and Fisheries  
DEA – Department of Environmental Affairs  
DRDLR – Department of Rural Development and Land Reform  
DWS – Department of Water and Sanitation  
FANRPAN - Food, Agriculture and Natural Resources Policy Analysis Network  
FAO – Food and Agricultural Organisation of the United Nations  
FSC – Forest Stewardship Council  
GHG – Greenhouse Gas  
ICFR - Institute for Commercial Forestry Research  
IDP – Integrated Development Plan  
IFPRI – International Food Policy Research Institute  
IPCC – Intergovernmental Panel on Climate Change  
IUFRO International Union of Forest Research Organizations  
IUCN – International Union for the Conservation of Nature  
LTAS – Long Term Adaptation Scenarios  
MBSP – Mpumalanga Biodiversity Sector Plan  
NAFU - National African Farmers' Union  
SANBI – South African National Biodiversity Institute  
SARVA – South African Risk and Vulnerability Assessment  
SDG – Sustainable Development Goals  
UNEP – United Nations Environment Programme  
UNFCCC –United Nations Framework Convention on Climate Change  
WFP – World Food Programme  
WHO – World Health Organisation

## 1. Executive Summary

South Africa is already witnessing evidence of climate change,<sup>1</sup> and is located in one of the three regions of the African continent that is most likely to suffer significant adverse impacts from climate change.<sup>2</sup> Within South Africa, the North West province is no exception to observed and projected national trends. In fact, recent climate change science from within the country indicates that the region within which the North West province is located could face a potential increase in temperatures by as much as 2.5°C by 2035, by 1-3°C between 2040 and 2060 (or even 2-5°C in the high-end scenarios), and by 3-6.5°C between 2080 and 2100 (or as much as 5-8°C in the high-end scenarios).<sup>3</sup> Thus, the North West faces a warmer, and potentially hotter future. In terms of rainfall, available science is less definitive; while some models project decreased rainfall over the North West in the long term, these rainfall projections remain within the realm of present-day variability. However, at the same time other models suggest that there may be moderate future increases in rainfall in the region, attesting to the uncertainty in model projections for this region of Southern Africa within the existing body of knowledge.

However, what emerges out of such uncertainty is that the region is likely to experience greater variability in rainfall, and will almost certainly witness an increase in evaporation rates,<sup>4</sup> implying a drier future even in the presence of greater rainfall and heavy rainfall events.<sup>5</sup>

In a welcome development, the North West province has taken the commendable step of starting to be better prepared for such climate change impacts and uncertainty. The first step towards building climate change resilience is to identify areas of vulnerability and thereafter to identify high-level strategies that could reduce vulnerability by strengthening the ability to respond and cope well, i.e. by building adaptive capacity. The present report captures a set of initial adaptation strategies for each of the key sectors in the North West that exhibit high climate change vulnerability (based on the findings of a vulnerability assessment) or sectors that are critical to the province's economy. The identification of sectors and overall project approach and methodology were validated with stakeholders and experts in a workshop in North West province in March 2015, and the strategies were presented to and reformulated by stakeholders in a second such workshop in the province in June 2015. Thus, the strategies enumerated here were endorsed (and in many cases proposed) by stakeholders within the province.

The strategies (as well as the project approach and methodology) are described in greater detail in the body of the report. In summary, the strategies are as follows:

### Agriculture

- I. Allocate funding and resources to develop a climate change adaptation plan for the agriculture, forestry, and fisheries sector in the North West (starting with agriculture at a minimum)
- II. Develop and implement sub-plans for each of the sectors - agronomy, horticulture, monogastric animals (poultry and swine), and ruminants (cattle).

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<sup>1</sup> DEA, "South Africa's Second National Communication Under the United Nations Framework Convention on Climate Change," *UNFCCC*, 2011. <http://unfccc.int/resource/docs/natc/zafnc02.pdf>

<sup>2</sup> Alex Kirby, "Three African Regions at High Risk from Climate Change," *ClimateCentral*, May 11, 2014. <http://www.climatecentral.org/news/climate-hotspots-imperil-parts-of-africa-17417>

<sup>3</sup> Long Term Adaptation Scenarios, "Climate Trends and Scenarios," 2013. <http://www.sanbi.org/sites/default/files/documents/documents/ltasclimate-trends-and-scenarios-tech-report2013low-res.pdf>

<sup>4</sup> Department of Science and Technology, "South African Risk and Vulnerability Atlas," 2010 [http://www.rvatlas.org/download/sarva\\_atlas.pdf](http://www.rvatlas.org/download/sarva_atlas.pdf)

<sup>5</sup> Long Term Adaptation Scenarios, "Agriculture and Forestry," 2013 <http://www.sanbi.org/sites/default/files/documents/documents/ltasagriculture-and-forestry-tech-report2013high-res.pdf>



### **Rural Livelihoods and Settlements**

- I. Devote resources to identifying and providing training on alternate sources of livelihood for different regions and communities within the North West.
- II. Create and strengthen business development mechanisms for smallholder farmers.
- III. Redouble efforts to improve overall socio-economic security and wellbeing, especially in high vulnerability municipal wards.

### **Terrestrial Ecosystems**

- I. Develop communications and carry out a sustained training and awareness campaign regarding the province's ecosystems and vulnerabilities.
- II. Implement SPLUMA to internalize climate change issues into land use planning (after integrating climate change into provincial level SPLUMA implementation instruments through amendment).
- III. Develop a specialized climate change management programme to focus on identification and protection of the North West's main terrestrial ecosystems in the face of climate change.
- IV. Strengthen forums for cooperative governance and improve implementation of existing efforts.

### **Water Resources (Aquatic Ecosystems and Water Supply)**

- I. Establish a water resource conservation programme to recommend and implement evidence-based measures for resource protection.
- II. Enhance the use of Water Conservation and Demand Management measures.
- III. Improve Water Quality Management.
- IV. Strengthen inter-departmental coordination.

### **Extractives**

- I. Establish a long-term climate change and health programme for the mining sector in the province.
- II. Organize an annual conference or symposium in the province focused on the mining industry's response to climate change.
- III. Fund a province-specific assessment of water related climate change risk to the mining industry in the North West.

### **Disaster Management**

- I. Include climate change issues into institutions that are already dealing with disasters.
- II. Incorporate issues of climate change into municipal disaster management plans.
- III. Develop sector-specific disaster management plans, incorporating climate change.

It is recommended that these strategies be further developed into an implementation plan by the relevant sectors within the North West, so that they can be mainstreamed into provincial policy.

## **2. Introduction and Key Concepts in Climate Vulnerability**

### **2.1. Assessing Climate Change Vulnerability**

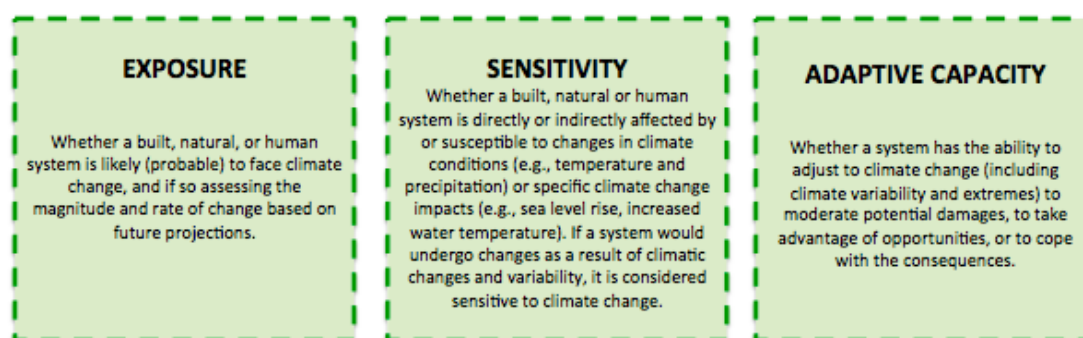
As the North West province deals increasingly with climate change impacts, it is necessary for decision makers in the province to gain a strong understanding of what makes a community, region, sector, or system vulnerable to climate change, the extent of such vulnerability, and then develop strategies and

action plans to reduce the level and extent of vulnerability by improving the ability to cope with expected changes. This objective is central to any climate change vulnerability assessment and adaptation strategy development process. The steps involved become easier to grasp when one comprehends what climate change vulnerability is, and what it is constituted by.

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

*“Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is **exposed**, its **sensitivity**, and its **adaptive capacity**.”*<sup>6</sup> (Emphasis added.)

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



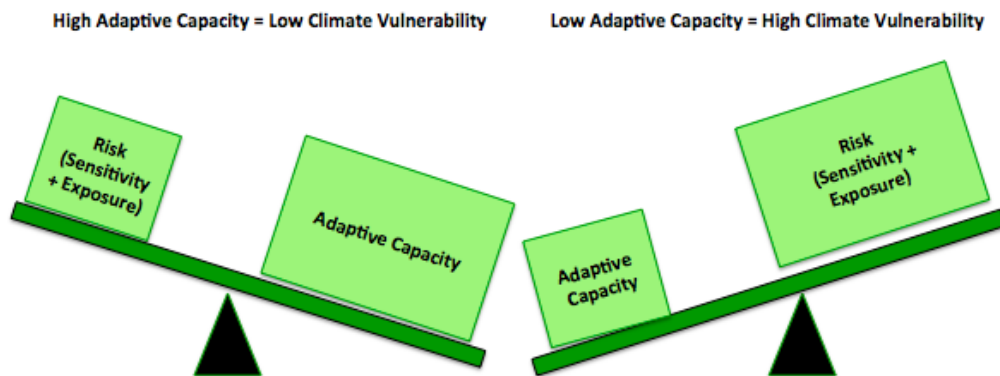
In simple terms, exposure is the extent to which a given system will be subject to or come into contact with a climate change impact – in this case, increased temperatures and changes in rainfall patterns. Sensitivity, then, is the extent to which a given system can be affected by a particular climate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

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

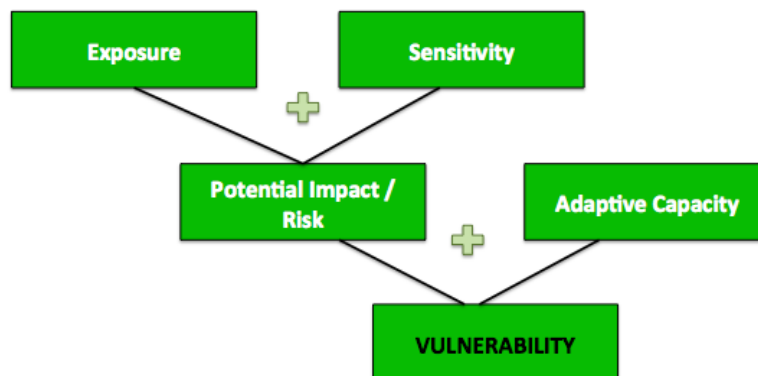
In the same vein, merely because a sector or sub-sector (or any entity or system) faces a risk of climate change impacts, this does not automatically make it vulnerable. Vulnerability in the face of climate risk is also a function the entity or system’s adaptive capacity. Put simply, adaptive capacity is the extent to which a system is able to exploit opportunities and resist or adjust to change. Adaptive capacity is often

<sup>6</sup> Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (2007), Report of Working Group II on Impacts, Adaptation, and Vulnerability, (Section 2.4) <http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=8>

estimated based on proven historical ability to cope with the changes in question, and for the future it is assessed through proxies such as levels of education and income or even effective programs or policies being put in place to help the sector cope with changes in a positive manner. As the figure below illustrates (in the form of adaptive capacity versus risk),<sup>7</sup> **the greater the adaptive capacity, the lower the vulnerability, and the lower the adaptive capacity, the greater the vulnerability.**



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

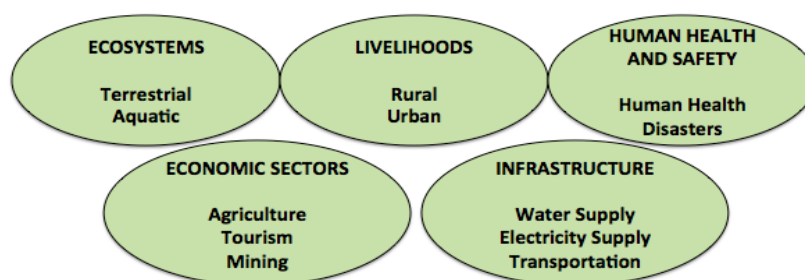


## 2.2. Project Overview

This report is the culmination of a five-month project aimed at developing climate change adaptation strategies for three of South Africa's nine provinces – Limpopo, Mpumalanga, and North West. The project was conducted in two phases; the first phase of three months entailed conducting climate change vulnerability assessments in each of the three provinces, focusing on several sectors and sub-sectors:

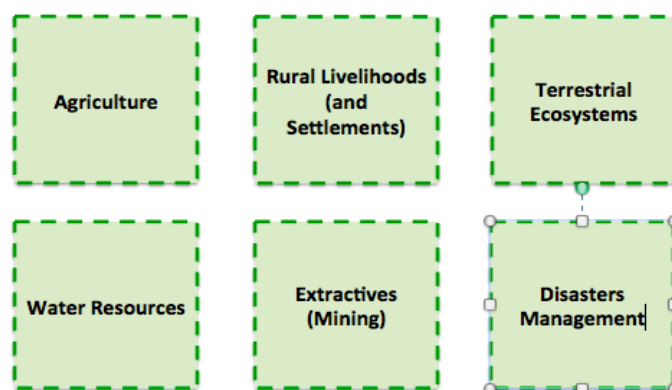
<sup>7</sup> Adapted from "Adapting Urban Water Systems to Climate Change – A Handbook for Decision-makers at the Local Level," SWITCH Training Kit, 2011. As seen at Adapting to Rising Tides <http://www.adaptingtorisingtides.org/vulnerability-and-risk/>



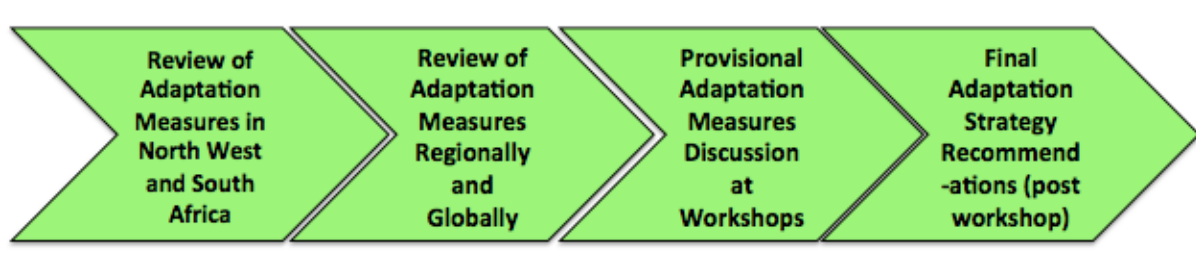


Phase one also involved seeking and integrating stakeholder input from experts and relevant sector officials in each of the three provinces, through provincial workshops in Limpopo, Mpumalanga, and North West.

Findings from phase one (captured in three province-specific reports that serve as background feeder documents into the present report) highlighted specific sub-sectors that display relatively high vulnerability to climate change, relative to other sub-sectors. As agreed upon at the project inception stage, phase two of the project hones in on these priority sub-sectors, so as to allow more focused work on the development of adaptation strategies for the province. In response to stakeholder interest, the list of target-sectors was expanded from solely those that were identified through the vulnerability assessment process to include a few additional sectors deemed important to the province (even if their relative vulnerability was lower than the sectors originally evaluated as having High vulnerability in the assessment stage). Also, based on stakeholder feedback, the sector covered in the vulnerability assessment as “water supply” was reconfigured for the adaptation strategies as “water resources.” Similarly, it was decided at the workshop that “disaster management” would be pulled out from the sector examined in the Vulnerability Assessment as “Human Health and Safety,” and would have specific strategies for itself. For the North West, the final sectors that were chosen for Adaptation Strategies are:



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



In identifying approaches to climate change adaptation, it is typical for jurisdictions (countries, states and provinces, or municipalities) to first embark on the development of strategies, i.e. strategic directions and guidelines identifying certain areas where attention is required. Strategies answer the question of “what do we do?” Once strategies have been framed and approved (i.e. the objective of this present project), the appropriate government entities or responsible institutions then set about the task of answering, “how do we do it?” In other words, the strategy is typically followed by local or domain experts drawing up a detailed adaptation plan, which includes specific actions, responsibilities, clear timelines, budgetary allocations, and accountability mechanisms. It is expected that such an implementation plan will follow in the North West province after the conclusion of the current project, informed by the present report.

### 3. Priority Sectors for Adaptation Strategies in North West Province

The Long Term Adaptation Scenarios (LTAS) project suggests that the region within which North West province is located is could face a potential increase in temperatures by as much as 2.5°C by 2035, by 1-3°C between 2040 and 2060 (or even 2-5°C in the high-end scenarios), and by 3-6.5°C between 2080 and 2100 (or as much as 5-8°C in the high-end scenarios). LTAS projects decreased rainfall over the North West in the long term, but rainfall projections in the LTAS project remain within the realm of present-day variability (i.e. they do not show a statistically significant departure from current patterns).<sup>8</sup> Other studies suggest that there may be moderate future increases in rainfall in the region, attesting to the uncertainty in model projections for this region of Southern Africa within the existing body of knowledge. However, what emerges out of such uncertainty is that the region is likely to experience greater variability in rainfall, and will almost certainly witness an increase in evaporation rates,<sup>9</sup> implying a drier future even in the presence of greater rainfall and heavy rainfall events.<sup>10</sup>

An investigation into climate change vulnerability in North West province has highlighted specific sectors that are particularly vulnerable. Adaptation measures are suggested for each of these sectors.

A recent study noted with concern that even though in South Africa there is a growing body of work focusing on understanding medium to long term changes and corresponding adaptation required, “most adaptation responses still focus on reducing vulnerability to present-day climate exposure...There is little practical experience of implementing adaptation programs related to longer-term climate change.”<sup>11</sup> Even though the timeframe identified and the scope of this project is through the year 2035, and the recommendations have been framed with a view to their being fully acted on and implemented within the decade (2015 to 2025), an effort has been made to identify adaptation measures (to be effected through adaptation strategies) that would still have relevance even in the mid-century timeframe.

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<sup>8</sup> Long Term Adaptation Scenarios, “Climate Trends and Scenarios,” 2013.

<http://www.sanbi.org/sites/default/files/documents/documents/Ltasclimate-trends-and-scenarios-tech-report2013low-res.pdf>

<sup>9</sup> Department of Science and Technology, “South African Risk and Vulnerability Atlas,” 2010

[http://www.rvatlas.org/download/sarva\\_atlas.pdf](http://www.rvatlas.org/download/sarva_atlas.pdf)

<sup>10</sup> Long Term Adaptation Scenarios, “Agriculture and Forestry,” 2013

<http://www.sanbi.org/sites/default/files/documents/documents/Ltasagriculture-and-forestry-tech-report2013high-res.pdf>

<sup>11</sup> Gina Ziervogel et al., “Climate Change Impacts and Adaptation in South Africa,” WIRE’s Climate Change (2014) 5:605-620.

<http://www.egs.uct.ac.za/downloads/Ziervogel%20et%20al%20Climate%20change%20impacts%20and%20adaptation%20in%20SA%20WIRES%20Sept%202014.pdf>

## 3.1. Agriculture

### 3.1.1. Agriculture in the North West

In 2010, the agriculture sector contributed an estimated 2.6% to the province's Gross Domestic Product (GDP), and just 0.1% to GDP growth.<sup>12</sup> Estimates of employment in the agriculture sector in the North West vary from 5%<sup>13</sup> to as much as 19%.<sup>14</sup> North West produces 18% of South Africa's total Maize, a crop whose yields have been shown to be highly sensitive to rainfall changes.<sup>15</sup> In particular, small-scale farmers in North West are likely to experience revenue losses if rainfall decreases markedly.<sup>16</sup> Game farming is also an important activity in the province. Given the province's major role in maize production<sup>17</sup> (as well as sunflower seed) and cattle ranching and game farming, impacts of climate change in the agriculture sector in North West have national implications.

### 3.1.2. Vulnerability to Climate Change

Across South Africa, climate change is expected to exacerbate already-rising irrigation demand in the agriculture sector, create spatial shifts in the growing areas for some crops, result in changes in yield for certain crops (on the balance, a fall in yields, especially in a significantly hotter future), and a shift as well as expansion in the range of several agricultural pests and parasites. Additionally, warmer temperatures are expected to increase heat stress amongst cattle, which has been linked to reduced milk yield and fertility in dairy cattle.<sup>18</sup> Although the impact of climate change cattle and game farming is similar, game tends to be more resilient to climate change.

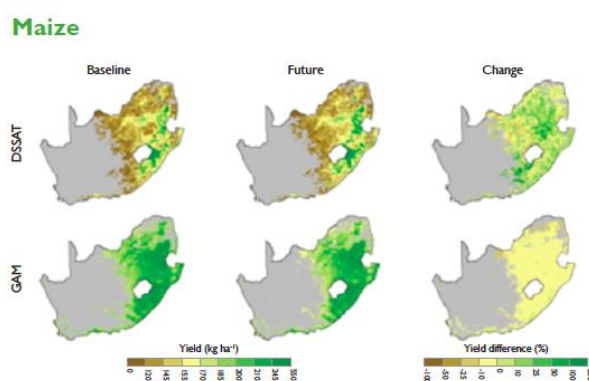
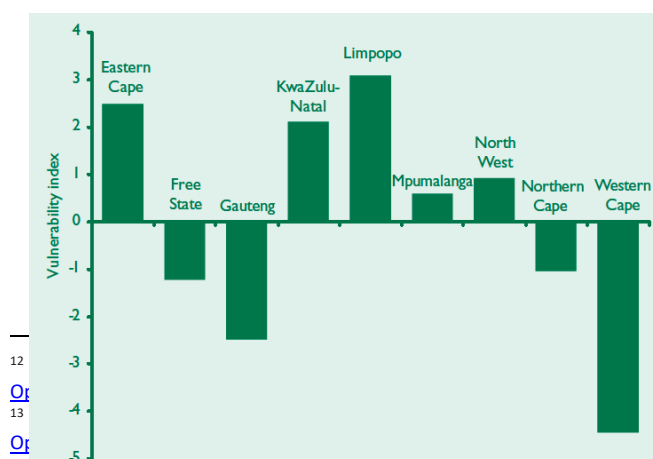


Figure 1: Median Change in Crop Yield for Rain-fed Maize



The above figure is one illustration (based on two distinct models) of how yields of Maize (one of the North West's main crops) may be affected by climate change, with a potential range of a 25% decrease (yield loss) or even a

<sup>12</sup> Department of International Relations and Cooperation, North West Province, <http://www.dirco.gov.za/sweden/northwest.pdf>

<sup>13</sup> James Blignaut, Lisa Uekermann, and James Aronson, "Agriculture Production's Sensitivity to Changes in Climate in South Africa," *South African Journal of Science*, 109(1), 2013, <http://www.dbsa.org/EN/DBSA-ice.pdf>

<sup>14</sup> James K.A. Benhin, "Climate Change and South African Agriculture – Impacts and Adaptation Options," Center for Environmental Economics and Policy in Africa, University of Pretoria, 2006. <https://static.weadapt.org/knowledge-base/files/1426/5370f181a5657504721bd5c21csouth-african-agriculture.pdf>

<sup>15</sup> Dr. GA Krier, "South African Country Study on Climate Change – Synthesis Report for the Vulnerability and Adaptation Assessment Section," [https://unfccc.int/files/meetings/seminar/application/pdf/sem\\_sup5\\_south\\_africa.pdf](https://unfccc.int/files/meetings/seminar/application/pdf/sem_sup5_south_africa.pdf)

<sup>16</sup> Long Term Adaptation Scenarios, "Agriculture and Forestry," 2013 <http://www.sanbi.org/sites/default/files/documents/documents/Itasagriculture-and-forestry-tech-report2013high-res.pdf>

10% increase (yield gain).<sup>19</sup> The Western Highveld, where most of South Africa's maize is grown (including regions in the North West) has been identified as one of several global climate hotspots due to its vulnerability to temperature rise.<sup>20</sup> Decreasing rainfall over the last few decades in the North West is already an issue of concern for the province, given the Maize crop's sensitivity to changes in water availability.<sup>21</sup>

The change in terrestrial ecosystems due to climate change (reduction in area covered by grassland) will impact on grazing area for cattle and game, and thus impact on cattle and game farming.

An assessment by the International Food Policy Research Institute (IFPRI) identified the North West as one of South Africa's five most sensitive provinces in terms of the susceptibility of the agriculture sector to climate change. As indicated in the figure above, along with agriculture in Limpopo, the Eastern Cape, and KwaZulu-Natal, this sector in the North West is expected to suffer negative impacts of climate change and variability, whereas some other South African provinces may even potentially see net benefits to agriculture from climate change.<sup>22</sup>

### 3.1.3. Agricultural Adaptation in the North West Province and South Africa

The North West province is already taking noteworthy actions on climate change adaptation, and has relatively strong adaptive capacity emerging, in comparison to some other provinces. For instance, farmers in some parts of the province have already begun switching their maize cultivar of choice so as to use seeds that require shorter growing seasons, or have switched to growing sunflowers instead in a few areas (as well as supplementing existing maize crop with sunflower crops).<sup>23</sup> While a potential adaptation measure is for farmers to switch to growing sorghum or millet, there is reluctance to grow these as they are not staple crops. Another form of farmer adaptation already being seen in parts of South Africa is the use of marginal lands for purposes other than cultivation – for example, the lands are used increasingly for grazing.<sup>24</sup>

The North West's Animal Science and Pasture Science Division has begun adopting adapted livestock and pasture management practices. This entails re-matching stocking rates and timing with pasture production, new varieties and species of forage and livestock, updated fertilizer applications, and using supplementary feeds and concentrates. They are emphasizing the use of indigenous breeds like Afrikaner, Nguni, Boergoat, and locally bred hybrids like Bonsmara and SA Mutton Merino. The province has also been promoting the use of fodder banks, to reduce the stress on farmers during periods of variable harvest or yield. Another initiative in the North West involves promoting biodiversity conservation to preserve the underlying ecosystem assets that support agriculture. The North West Soil Science Division conducts soil surveys that have been helpful in identifying soil conservation needs, and enabling the division to accordingly advise farmers on soil tillage best practices. The province's Crop

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<sup>19</sup> Long Term Adaptation Scenarios, "Agriculture and Forestry," 2013 *ibid*.

<sup>20</sup> Union of Concerned Scientists, "Climate Hot Map – Western Highveld, South Africa," <http://www.climatehotmap.org/global-warming-locations/western-highveld-south-africa.html>

<sup>21</sup> James Blignaut, Lisa Uekermann, and James Aronson, "Agriculture Production's Sensitivity to Changes in Climate in South Africa," *South African Journal of Science*, January-February 2009, at 105. <http://www.sajs.co.za/sites/default/files/publications/pdf/4-28-1-PB.pdf>

<sup>22</sup> Glwadys Aymone Gbetibouo and Claudia Ringler, "Mapping the South African Farming Sector's Vulnerability to Climate Change and Variability – a Sub National Assessment," IFPRI Research Brief 15-3 (2009). [http://www.ifpri.org/sites/default/files/publications/rb15\\_03.pdf](http://www.ifpri.org/sites/default/files/publications/rb15_03.pdf)

<sup>23</sup> Province vulnerability assessment workshop, March 2015.

<sup>24</sup> CEEPA, Climate Change and Crop Water Use in South Africa, 2006. <http://www.ceepa.co.za/uploads/files/POLICY%20NOTE%2028.pdf>

Science Division has researched Amaranthus as an alternative crop. There have also been some initial training and awareness building programs on conservation agriculture through the LandCare initiative.<sup>25</sup>

Additionally, stakeholders shared information on a number of adaptation measures that are already underway in the North West.<sup>26</sup> The government is helping farmers adapt to changing climatic conditions through the provision of small grants; Extension officers from the national level Department of Agriculture, Forestry and Fisheries (DAFF) are helping provide farmers education on climate change and improved agricultural practices; DAFF has set up a Climate Change and Disaster Management Directorate, with a focus on prevention, avoidance, and preparedness; DAFF has initiated a project to help farmers switch to alternate crops (but this has faced some resistance); DAFF is promoting the breeding of indigenous cattle, which may be more adaptable to changing local climatic conditions; and DAFF is also piloting early warning systems that could be helpful to farmers and ranchers.

DAFF has already gazetted (in 2013) a national level Climate Change Sector Plan for Agriculture, Forestry, and Fisheries, which calls for the scaling up of Climate Smart Agriculture, the funding of more research on climate change impacts and adaptation practices in the agriculture sector, education and capacity building etc.<sup>27</sup>

At the national level, the LTAS project recommends a host of adaptation practices for the agriculture sector in South Africa: (i) conservation agriculture, climate-smart agriculture, ecosystem-based adaptation, community-based adaptation, and agro-ecology; (ii) sustainable water use and management; (iii) sustainable farming systems; (iv) early warning systems, risk management and decision support tools; (v) integrated and simplified policy and effective governance systems; and (vi) awareness, knowledge, and communications. (Detailed descriptions of each may be referred to in the LTAS Agriculture report,<sup>28</sup> to obviate duplication of the list in this present report, whose aim is rather to identify a strategy for the province going forward.)

Further at the national scale, the Department of Agriculture, Forestry, and Fisheries (DAFF) released a Climate Change Sector Plan for Agriculture (in 2010), which identified four key performance areas (institutional arrangements; vulnerability assessments; mitigation and adaptation; response and recovery), and three critical enablers (Information management and communication; education, training, public awareness, research; and funding arrangements). Many aspects of this plan still need to be rolled out and implemented at the provincial level.<sup>29</sup> Similarly, the National Climate Change Response Policy also acknowledges Climate Smart Agriculture when discussing Agriculture, Forestry, and Other Land Use (AFOLU), noting the need to, “invest in and improve research into water, nutrient and soil conservation technologies and techniques, climate-resistant crops and livestock as well as agricultural productivity in line with the National Development Plan and post 2015 Sustainable Development Goals, ownership and financing to promote the development of Climate Smart Agriculture that lowers agricultural emissions, that transitions to a low carbon sector, that is more resilient to climate change, and that boosts

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<sup>25</sup> Pearson Mnkeni and Charlen Mutengwa, Food, Agriculture Natural Resources Policy Analysis Network, “A Comprehensive Scoping Assessment Study of Climate Smart Agriculture Policies in South Africa,” April 2013.

[http://www.fanrpan.org/documents/d01761/South%20Africa\\_Comprehensive\\_Scoping\\_Assessment\\_of\\_CSA\\_Policies.pdf](http://www.fanrpan.org/documents/d01761/South%20Africa_Comprehensive_Scoping_Assessment_of_CSA_Policies.pdf)

<sup>26</sup> Province vulnerability assessment workshop, March 2015.

<sup>27</sup> Department of Agriculture, Forestry, and Fisheries, “Draft Climate Change Sector Plan for Agriculture, Forestry, and Fisheries,” January 2013. [http://www.gov.za/sites/www.gov.za/files/36063\\_gen7.pdf](http://www.gov.za/sites/www.gov.za/files/36063_gen7.pdf)

<sup>28</sup> Long Term Adaptation Scenarios, “Agriculture and Forestry,” 2013

<http://www.sanbi.org/sites/default/files/documents/documents/Ltasagriculture-and-forestry-tech-report2013high-res.pdf>

<sup>29</sup> Department of Agriculture, Forestry, and Fisheries, “Climate Change Sector Plan for Agriculture,” March 2010.

[http://www.sasscal.org/downloads/RSSC\\_workshop\\_SA\\_final\\_presentations\\_programme\\_participants\\_\(LQ\)\\_part\\_2.pdf](http://www.sasscal.org/downloads/RSSC_workshop_SA_final_presentations_programme_participants_(LQ)_part_2.pdf)



agricultural production.” The response policy also lays out five guiding principles for the AFOLU sector, including integration with rural development, food security, and job creation; developing short term and long term land use adaptation scenarios; investing in research; investing in awareness and education programmes; and the development and use of early warning systems.<sup>30</sup>

A nationwide survey of farmers in South Africa indicates that several farmers have already, to varying degrees, considered and even adopted adaptation measures in response to increased climate variability. These include adjustments in farming operations (changing planting dates; adopting shorter planting periods; delaying the start of the planting period; increased use of modern machinery; collection of rainwater; increased use of irrigation; using more water-efficient crop varieties; using early-maturing varieties; and mixed farming with more livestock), increased application of chemical fertilizers and pesticides, improved water management practices, and increasing the use of shade and shelter.<sup>31</sup>

A survey of farmers in the North West revealed that 75% of respondents already have a perception that climate is changing, with temperatures rising and rainfall volumes decreasing. Farmers from the Northwest indicated that in their experience, winters have gotten longer, but summers have gotten hotter.<sup>32</sup> In another survey of farmers in all the provinces covered by the Limpopo river-basin (including North West), nearly 90% of farmers in the North West stated that they perceive temperatures to have increased over time, 62% noted that they thought rainfall volumes have decreased over time, and 15% stated that rainfall had both decreased and there has been a change in the timing of rainfall.<sup>33</sup> When queried about whether they had started adopting any adaptation measures in response to changes in temperature, 3.9% of farmers in the North West said they had tried new crop varieties, 1.9% said they were irrigating more, 5.8% said they were using feed supplements, 3.9% were switching to different crops. But an overwhelming 78% said they had not adopted any form of adaptation whatsoever. Similarly, regarding adaptation to changes in rainfall, 1.9% of farmers in the North West said they had invested in a water harvesting scheme, 13.9% said they were irrigating more, 3.8% were buying feed supplements, 2.9% were trying different crops, 3.8% were trying different planting dates, but a majority of 68% said they had not tried any adaptation technique at all.<sup>34</sup> When asked to identify the main impediments that prevented them from adapting to climate change, farmers in the North West called out several factors: 10% pointed to a lack of information on climate change, 3% noted a lack of access to water and another 3% spoke of insecure property rights, and only 1% identified the lack of transport or lack of access to markets. But 55% identified the lack of credit or savings as the single biggest barrier to climate change adaptation.<sup>35</sup>

### 3.1.4. Agricultural Adaptation Lessons and Best Practices from Elsewhere

Globally as well as across Africa, there is growing momentum behind “Climate Smart Agriculture.”<sup>36</sup> Climate Smart Agriculture is defined as involving production systems that sustainably increase

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<sup>30</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

<sup>31</sup> James K.A. Benhin, “Climate Change and South African Agriculture: Impacts and Adaptation Options,” University of Pretoria. <http://www.elsenburg.com/trd/globalwarm/downloads/agriculture.pdf>

<sup>32</sup> James K.A. Benhin, “Climate Change and South African Agriculture: Impacts and Adaptation Options,” University of Pretoria. <http://www.elsenburg.com/trd/globalwarm/downloads/agriculture.pdf>

<sup>33</sup> Glwadys Aymone Gbetibouo, “Understanding Farmers’ Perceptions and Adaptations to Climate Change and Variability,” IFPRI Discussion Paper 00849, February 2009. <http://www.ifpri.org/sites/default/files/publications/ifpridp00849.pdf>

<sup>34</sup> Glwadys Aymone Gbetibouo, “Understanding Farmers’ Perceptions and Adaptations to Climate Change and Variability,” IFPRI Research Brief 15-8, 2008. <http://www.ifpri.org/sites/default/files/publications/ifpridp00849.pdf>

<sup>35</sup> Glwadys Aymone Gbetibouo, “Understanding Farmers’ Perceptions and Adaptations to Climate Change and Variability,” IFPRI

<sup>36</sup> The Climate Smart Agriculture Partnership, <http://www.fao.org/climate-smart-agriculture/en/>

productivity, resilience (adaptation), reduces or removes GHGs (mitigation), and enhances the achievement of national food security and development goals.<sup>37</sup> The Food and Agriculture Organisation (FAO) has helped spur rapid uptake of Climate Smart Agriculture in different regions by providing knowledge resources and tools such as a sourcebook for implementation.<sup>38</sup>

In February 2014, in Tanzania, delegates from over 20 African nations attended a regional workshop on “African Agriculture in a Changing Climate – Enhancing the Uptake of Climate Smart Agriculture.” They agreed that research is now increasingly pointing towards climate smart agriculture as the solution to enhancing capabilities of agricultural and food systems to cope with current climate variability in order to improve productivity and resilience.<sup>39</sup> Thereafter, 26 African countries have collectively launched the voluntary Climate Smart Agriculture Alliance for Africa, which aims to trigger policy changes and increase investments that strengthen African agriculture in the face of changing climate.<sup>40</sup> This new alliance aims to empower six million smallholder farmers across Africa by the year 2021, and is launching its first stage of efforts in Zambia, Ethiopia, and Niger.<sup>41</sup>

There are emerging success stories and best practices for Climate Smart Agriculture from various parts of Africa. For instance, potato farmers in Tanzania are expecting a harvest with ten times the average yield.<sup>42</sup> Traditional “Kihamba” agro-forestry techniques in Tanzania are helping raise incomes by an estimated 25%. Smallholder farmers in Kenya and Tanzania are adopting water and soil conservation practices. Zambia and Malawi are strengthening their institutional and policy capacity to support climate smart agriculture. Farmers in Rwanda have increased income through agricultural diversification and mixed farming.<sup>43</sup>

Climate Smart Agriculture is being adopted in industrialized nations as well, as evidenced from the North American Climate Smart Agriculture Alliance, and the commitment of the G7 countries to this approach.

Climate Smart Agriculture has already been well received in South Africa’s national level climate change adaptation strategies and plans, and in an informal way several Climate Smart Agriculture practices are being applied even in the North West province. However, adopting more of the tenets and practices of Climate Smart Agriculture, as locally applicable and adaptable, and increasing awareness and utilization of the same may be of relevance in the North West.

### **3.1.5. Climate Adaptation Measures for Agriculture in North West - Recommendations**

At the national level, such as in DAFF’s Climate Change Sector Plan for Agriculture, Forestry, and Fisheries, there is already recognition of Climate Smart Agriculture as a promising adaptation approach. In addition, the plan also acknowledged the need for more research, and called for more funding to be directed to research about the impacts of climate change on the agriculture sector and appropriate response measures. This research gap certainly exists within the provincial level; even though a lot of

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<sup>37</sup> Climate Smart Agriculture, “About Climate Smart Agriculture,” <http://www.fao.org/climate-smart-agriculture/72610/en/>

<sup>38</sup> Food and Agricultural Organisation (FAO), “Climate Smart Agriculture for Development,” <http://www.fao.org/climatechange/climatesmart/en/>

<sup>39</sup> CGIAR Research Program on Climate Change, Agriculture, and Food Security, “Building Climate Resilience in the African Agricultural Sector,” February 26, 2014. <http://ccafs.cgiar.org/blog/building-climate-resilience-african-agriculture-sector#.VUMxFEsWs1>

<sup>40</sup> CGIAR Research Program on Climate Change, Agriculture, and Food Security, “A Climate-Smart Agriculture Alliance for Africa,” June 15, 2014. <http://ccafs.cgiar.org/blog/climate-smart-agriculture-alliance-africa#.VUMtrUsaWs0>

<sup>41</sup> Africa CSA <http://africacsa.org/#founding-members>

<sup>42</sup> CGIAR Research Program on Climate Change, Agriculture, and Food Security, “In Pictures: Ten-Fold Potato Yield in Lushoto, Tanzania,” April 13, 2015. <http://ccafs.cgiar.org/blog/pictures-tenfold-potato-yield-lushoto-tanzania#.VUMy3EsaWs0>

<sup>43</sup> FAO, “Success Stories on Climate Smart Agriculture,” 2014. <http://www.fao.org/3/a-i3817e.pdf>

valuable work is already being done, there is a need for more province-specific scientific studies and for the development of knowledge and data on locally relevant climate change adaptation practices.

The following recommendations are thus based on the need to scale up existing efforts and target areas of particular relevance for the North West province. Stakeholders at the provincial workshop in June 2015 affirmed these recommendations, where they evaluated the original recommendations and reformulated them as follows:

- I. **Allocate funding and resources to develop a climate change adaptation plan for the agriculture, forestry, and fisheries sector in the North West province:** the province should identify and secure resources and funding to develop its own climate change adaptation plan for the agriculture, forestry, and fisheries sector. Such a sector-specific plan, developed by sector experts within the province, would be a significant step towards aligning adaptation approaches in the North West with the guidelines and principles enshrined in the national level sector plan and with LTAS, but even more importantly will be an opportunity to develop robust and locally-relevant adaptation measures that address the province's needs. (If such a programme needs to start with one focus area, agriculture could be the immediate starting point, over fisheries and forestry).

*Responsibility for the implementation of this strategy would rest with READ at the province, but it would be implemented in coordination with DEA, DAFF, and DWS at the national level, SANBI, the Red Meat Producers Association, North West University, and a range of others. This provincial level strategy, aligned with national level policies and plans, could be developed in a one-year timeframe. Funding sources include the national treasury as well as the Land Bank.*

- II. **Develop and implement sub-plans for each of the sectors - agronomy, horticulture, monogastric animals (poultry and swine), and ruminants (cattle)**
  - a. **Agronomy:** Initiate a dedicated climate change adaptation programme for crop cultivation in the province, to investigate the impact of climate change on yields, growing periods, growing ranges, water use etc. Given the importance of crop (and particularly maize) production in the province, funding should be allocated to a focused, multi-year campaign targeting crop growers in the North West. Such a program would include educational outreach about the impacts of climate change on crops (tailored to North West province), would engage farmers on various practices that can strengthen climate resilience of crops, attempt to lower resistance to changing from maize to other crops or to practice multi-cropping, and train farmers on best practices to enhance their ability to reap successful results from adaptation measures. The programme could be designed and funded in collaboration with development partners, but should also have sustainability through domestic funding sources.
  - b. **Horticulture:** While horticulture is relatively less prevalent in North West province, it is nevertheless critical to understand the impacts in the province from the effects of climate change on fruits and vegetables and other garden plants. This would include green leafy vegetables, Amarathus, Red milkwood, Num-num, Bambara groundnuts, and cowpea, all of which are common in North West province.<sup>44</sup>
  - c. **Monogastric animals:** the animal husbandry and farming sector in the North West province includes farmers who raise monogastric animals such as swine and chicken (poultry). Climate

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<sup>44</sup> DAFF, "Most Common Indigenous Food Crops of South Africa," <http://www.nda.agric.za/docs/Brochures/Indigfoodcrps.pdf>

change impacts such as increased temperatures and dry spells can have a detrimental impact on these animals as well, affecting factors like growth rates. Additionally, climate change impacts the availability of feed for these animals, making them particularly susceptible during periods of drought or crop failure. Thus, a dedicated sub-plan tailored to these animals is key to ensure farmers understand the likely impacts and are better prepared to cope with them. As above, this would not merely be a research programme but an applied programme to help train farmers in best practices and provide them with additional resources.

- d. **Ruminants:** Initiate a dedicated climate change adaptation sub-programme for livestock rearing in the province. Similar to the campaign described above, a multi-year, province-specific programme should be launched to help livestock farmers, cattle ranchers and game farmers adapt to changing climatic conditions. Given the predominance of cattle farming in the province, this is a key area for intervention. Such a campaign would include the production of greater research conducted within the province, with results relevant to the local industry, but also include applied research on adaptation measures. It would involve education and training sessions, funding for on-farm adaptation measures, and ongoing assistance to ensure that farmers are maximizing the benefits of the adaptation responses utilized. As noted above, the programme could be funded in part by development partners, but the government must allocate the necessary funds to support the campaign at least in its initial years.

*READ would be the lead implementing entity, but would apply this strategy in collaboration with DAFF, DWS, NWU, the Red Meat Producers Association, and other relevant entities. These sub-plans should be developed in a year's timeframe and thereafter implementation should be ongoing. Funding could come from the treasury as well as the land bank programme.*

## 3.2. Rural Livelihoods and Settlements

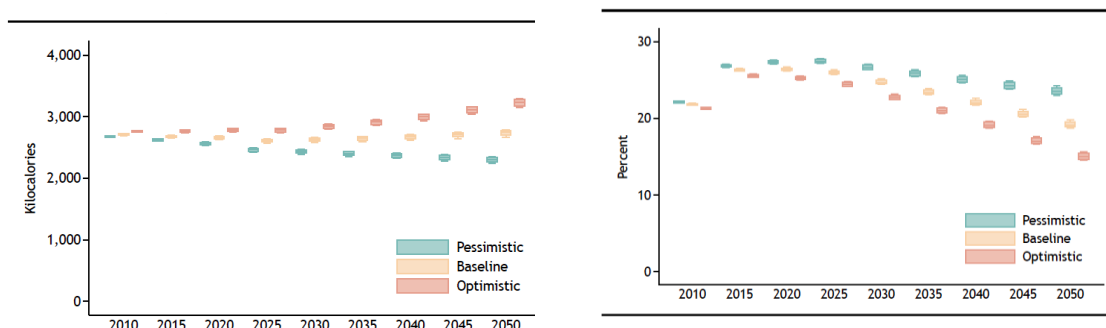
### 3.2.1. Rural Livelihoods and Settlements in the North West province

A nationwide climate change vulnerability assessment by the Department of Rural Development and Land Reform created a composite vulnerability map by assessing indicators of sensitivity for rural human settlements (physical water scarcity by major river basin, irrigated agricultural land, terrain slope index, growing period, net primary production (rain-fed and irrigated), major perennial rivers, ground water availability, land degradation index, crop diversification index and ecological resilience). The assessment identified a large number of municipal wards in North West province as being highly sensitive.<sup>45</sup>

The relatively high vulnerability of rural livelihoods – predominantly based on agriculture and livestock – is a matter of significance for North West province, where a large percentage of people reside in rural areas and rely mostly on natural resources for sustenance. 45% of all households live in tribal or traditional areas.<sup>46</sup> According to the 2011 census, over 20% of people in North West were illiterate, and the province had the third lowest annual average household income of all provinces in the country<sup>47</sup> – both factors that contribute to low adaptive capacity in the face of climate change.

### 3.2.2. Vulnerability to Climate Change

South Africa-wide projections suggest that in a pessimistic (high-emissions) scenario, climate change will have an impact on the number of kilocalories available for consumption per capita, causing 20% slight decline by mid-century, primarily due to a decrease in agricultural yield. This is also expected to spark an initial increase (through 2025) in the number and percentage of malnourished children under five years.<sup>48</sup>



**Figures 3 a and b:** (a) Kilocalories per capita in South Africa in multiple income and climate scenarios (2010-2050); and (b) Share of malnourished children under five years of age in South Africa in multiple income and climate scenarios (2010-2050). (Source: IFPRI).

Impacts from climate variability, such a drought, are already a problem for livelihoods in the North West and are likely to become more pronounced with climate change. Conditions like drought take a heavy toll on subsistence farmers. For instance, during the 2013 drought, the province's Disaster Risk Management Centre received 700 applications for relief from commercial farmers but over 6000 applications from

<sup>45</sup> Department of Rural Development and Land Reform, "Climate Change Risk and Vulnerability Assessment for Human Settlements," 2013. [http://www.ruraldevelopment.gov.za/phocadownload/spatial\\_Planning\\_Information/Climate\\_Change/Latest\\_Risk\\_and\\_Vulnerability\\_july\\_2013\\_09072013.pdf](http://www.ruraldevelopment.gov.za/phocadownload/spatial_Planning_Information/Climate_Change/Latest_Risk_and_Vulnerability_july_2013_09072013.pdf)

<sup>46</sup> Department of Rural Development and Land Reform, "Climate Change Risk and Vulnerability Assessment for Human Settlements," 2013. [http://www.ruraldevelopment.gov.za/phocadownload/spatial\\_Planning\\_Information/Climate\\_Change/Latest\\_Risk\\_and\\_Vulnerability\\_july\\_2013\\_09072013.pdf](http://www.ruraldevelopment.gov.za/phocadownload/spatial_Planning_Information/Climate_Change/Latest_Risk_and_Vulnerability_july_2013_09072013.pdf)

<sup>47</sup> South Africa Statistics, "Census 2011," published 2012. <http://www.statssa.gov.za/publications/P03014/P030142011.pdf>

<sup>48</sup> Peter Johnston et al., IFPRI, "South Africa – Chapter 7," in Southern African Agriculture and Climate Change, 2013. <http://www.ifpri.org/publication/southern-african-agriculture-and-climate-change>

subsistence farmers.<sup>49</sup> A (somewhat dated) study about rural livelihoods in North West province identified environmental risks (variability and its effect on crop yields and prices) as one of the single biggest sources of vulnerability for rural livelihoods in North West province.<sup>50</sup>

In general, resource-poor settings such as North West are at a greater disadvantage in coping with the effects of climate change and adapting to changing conditions. The province's climate vulnerability in terms of livelihoods is as much a function of expected climate impacts as it is a function of high levels of poverty and unemployment, dependence on agriculture for food security and employment, and inadequate access to sanitation, water supply, and healthcare.<sup>51</sup>

Within such settings, it is often the extremely young and the extremely old (i.e. children and the elderly, who are not part of the formal working population) who face the biggest challenges coping with climatic changes and the resultant impact on household livelihoods. Children in North West province already face higher than average levels of hunger and malnutrition, and deleterious impacts of climate change on agricultural yields could lower food production and spur shortages that would make access to food even worse for these children.<sup>52</sup>

The median age in North West province has increased over time, as has the aggregate number of elderly persons residing in the province.<sup>53</sup> These trends are also likely to continue, implying an increase in the number and share of the North West's population that is more vulnerable to climate change impacts, particularly livelihoods (since they are often a dependent population not generating their own livelihoods).

### **3.2.3. Rural Livelihoods Adaptation in North West and South Africa**

Given the important role of agriculture as a source of subsistence and food security in North West, adaptation to the impacts of a changing climate on rural livelihoods is, to a significant degree, agricultural adaptation. (Note: rural livelihoods in North West are also closely linked to the mining sector, which will be addressed in a subsequent section).

Literature indicates that some farmers in North West province have been experimenting with climate adaptation measures such as modifying their planting dates, increasing their irrigation potential, and changing the amount of land used for cultivation, although most farmers have yet to undertake any adaptation measures.<sup>54</sup>

Some are responding to changing agricultural conditions by moving away from farming, or diversifying their income streams. For instance, in Mantsie village of the Lehurutshe district, some households have coped with recurrent drought and unpredictable rains by adopting the practice of petty trading, while others have started investing in poultry or livestock trading.<sup>55</sup>

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<sup>49</sup> Lenyaro Sello, "Drought Cripples North West Farmers," eNCA, April 18, 2013. <http://www.enca.com/south-africa/drought-cripples-north-west-farmers>

<sup>50</sup> Dr. Elizabeth Francis, "Rural Livelihoods, Institutions, and Vulnerability in South Africa," Development Studies Institute Working Paper Series no. 02-03, 2002. <http://www.lse.ac.uk/internationalDevelopment/pdf/WP/WP30.pdf>

<sup>51</sup> UNICEF, "Exploring the Impact of Climate Change on Children in South Africa," 2011. [http://www.unicef.org/southafrica/SAF\\_resources\\_climatechange.pdf](http://www.unicef.org/southafrica/SAF_resources_climatechange.pdf)

<sup>52</sup> UNICEF, "Exploring the Impact of Climate Change on Children in South Africa," 2011. [http://www.unicef.org/southafrica/SAF\\_resources\\_climatechange.pdf](http://www.unicef.org/southafrica/SAF_resources_climatechange.pdf)

<sup>53</sup> Statistics South Africa, "Profile of Older Persons in South Africa," 2011. <http://www.statssa.gov.za/publications/Report-03-01-60/Report-03-01-602011.pdf>

<sup>54</sup> Glwadys Aymone Gbetibouo, "Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability," IFPRI Discussion Paper 00849, February 2009. <http://www.ifpri.org/sites/default/files/publications/ifpridp00849.pdf>

<sup>55</sup> UNICEF, "Exploring the Impact of Climate Change on Children in South Africa," 2011. [http://www.unicef.org/southafrica/SAF\\_resources\\_climatechange.pdf](http://www.unicef.org/southafrica/SAF_resources_climatechange.pdf)



Food insecurity is a key factor that contributes to social exclusion and inequality. In the North West province, “Fetsa Tlala” is an integrated government framework that seeks to promote food and nutrition security and to address structural causes of food insecurity. The initiative is aimed at maximizing cultivation of food by putting one million hectares of land under production by the 2018-19 production season. It is expected that this programme primarily help provide security of livelihoods to the indigent and most vulnerable members of the community.<sup>56</sup> From the private sector, SAB Miller is working with farmers in the Taung area of the North West province to help them produce barley through sustainable farming methods, which also become a more secure source of livelihoods by conserving water usage and natural resources, and thus make the farmers more resilient to changing climatic conditions.<sup>57</sup>

At the national level, the National Climate Change Response Strategy White Paper suggests the following adaptation responses for rural human settlements: supporting small-scale farmers including on-farm demonstration and experimentation related to conservation agriculture; empowering local communities – especially women – to design and implement adaptation strategies; designing and implementing economic diversification; prioritizing adaptation technologies such as low water-use irrigation, water harvesting, and drought-resistant seed varieties; and enhancing disaster-management architecture in rural areas.<sup>58</sup> It also makes note of the need to overcome apartheid-era spatial planning challenges through approaches such as land redistribution without compromising on food security and agricultural production.

### 3.2.4. Rural Livelihoods Adaptation Lessons and Best Practices from Elsewhere

The UK-funded Western Odisha Rural Livelihoods Project in India offers some valuable insights, given the many demographic and development parallels between the province (state) of Odisha in India and North West province in South Africa. The project focused on building overall resilience amongst rural communities by: “(i) building structures and processes that develop community skills and confidence, enabling them to articulate their needs and demand improved services; (ii) enabling the poor and marginalized to become actively and effectively involved in planning and development; (iii) promoting equity between socio-cultural groups and empowering rural women; (iv) promoting farm and non-farm enterprises that improve income, employment and nutritional security, relieve the debt burden, and encourage savings; (v) improving management of common property and the fair distribution of its benefits; (vi) promoting local technology that responds to specific needs, including the particular needs of women; (vii) helping communities and local service providers – government or non-government - to use modern participatory methods for planning, implementation, monitoring and evaluation; and (viii) helping to create an environment that promotes pro-poor policy change.”<sup>59</sup> Even though the core focus of this program was not on climate change adaptation per se, the results indicate that the communities involved in the project are now better able to respond to climate variability, in terms of both droughts and heavy rainfall. The success also led to uptake of this approach by the state government.<sup>60</sup>

Other best practices and viable case studies to draw lessons from include the World Food Program’s

<sup>56</sup> Department of Agriculture, Forestry, and Fisheries, “Fetsa Tlala Production Plan 2014-2015.”

<sup>57</sup> SAB Miller, SAB Stories, “Better Barley, Better Beer: Promoting Sustainable Agriculture in South Africa,” September 3, 2014.

<http://www.sabstories.co.za/entrepreneurship/better-barley-better-beer-promoting-sustainable-agriculture-in-south-africa/>

<sup>58</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

<sup>59</sup> DDIInternational, “Western Odisha Rural Livelihoods Project,” <http://ddinternational.org.uk/viewProject?project=4>

<sup>60</sup> Virinder Sharma et al., “Sustainable Rural Livelihoods Approach for Climate Change Adaptation in Western Odisha, Eastern India,” *Development in Practice* Volume 24, Issue 4 (2014).

<http://www.tandfonline.com/doi/abs/10.1080/09614524.2014.911817?journalCode=cdip20>

(WFP) Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods (MERET) project, which has worked with over 500 communities in Ethiopia to enhance livelihood resilience to weather-related shocks, and improving food security, by rehabilitating land and water resources;<sup>61</sup> the Food and Agriculture Organization's (FAO) demonstrations of 15 viable agricultural adaptation practices in Bangladesh, geared towards drought mitigation, climate resilience, economic robustness, increased production, sustainability and social acceptability, where communities self-selected the use of mini-ponds, homestead gardens, dry seedbeds for rice cultivation, and cultivating hardy species of trees as their preferred adaptation options amongst the over 225 activities demonstrated and tested;<sup>62</sup> and Malawi's Climate Adaptation for Rural Livelihoods and Agriculture (CARLA) project,<sup>63</sup> which is partially underway but has begun offering key implementation lessons about capacity building and training.<sup>64</sup>

### 3.2.5. Climate Adaptation Measures for Rural Livelihoods in North West - Recommendations

Since livelihoods in North West province are very closely tied to agriculture, the recommended adaptation measures for that sector (earlier in this paper) would also be beneficial for livelihoods. Similarly, the adaptation strategies for the mining sector may also be relevant, given the sector's role in providing gainful employment and income within the province (see subsequent section in the paper).

In addition, however, a few other key interventions are recommended, particularly with a view to economic diversification. The North West must actively explore how to provide alternative means of livelihoods to its people, divorced from agriculture or mining, since they are both highly vulnerable to climate change. With this in mind, stakeholders at the provincial workshop in June evaluated the original adaptation strategies and reformulated them as follows:

- I. **Devote resources to identifying and providing training on alternate sources of livelihood for different regions and communities within the North West.** The provincial government should establish an applied research programme that makes a rigorous analysis of viable alternative means of livelihood for different communities in different parts of the North West, based on locally available resources, existing and potentially transferable skill-sets, and the needs and aspirations of the communities concerned. Once some viable alternatives have been determined (in the 1-2 year timeframe), the program should transition into a 2-3 year technical training and skills-building program involving demonstration projects to help the communities' uptake of the alternative livelihood sources. This program could be done in collaboration with universities, research institutes, development partners, but most importantly it should be grounded within the communities and be co-designed and co-implemented by the communities in collaboration with external and government experts.

*READ should take the lead in implementation, and FEED, DAFF and the Department of Social Development should also be involved in designing and implementing the programme.*

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<sup>61</sup> Inter Agency Standing Committee (IASC), "Addressing the Humanitarian Challenges of Climate Change – Regional and National Perspectives: Case Studies on Climate Change Adaptation," 2009.

<sup>62</sup> Inter Agency Standing Committee (IASC), "Addressing the Humanitarian Challenges of Climate Change – Regional and National Perspectives: Case Studies on Climate Change Adaptation," 2009.

<sup>63</sup> AfDB, "CARLA Project Appraisal Report," October 2011. [http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Malawi\\_-\\_AR\\_-\\_Climate\\_Adaptation\\_for\\_Rural\\_Livelihood\\_and\\_Agriculture\\_CARLA\\_-\\_LOTB\\_-\\_Approved\\_.pdf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Malawi_-_AR_-_Climate_Adaptation_for_Rural_Livelihood_and_Agriculture_CARLA_-_LOTB_-_Approved_.pdf)

<sup>64</sup> UNDP, National Adaptation Plan Global Support Programme, "Reporting, Monitoring and Review: Experiences and Lessons Learnt from National Climate Change Programme and NAPA Implementation in Malawi," April 2014. [http://www.undp-alm.org/sites/default/files/malawi\\_nap-gsp\\_africa\\_regional\\_training\\_workshop\\_element\\_d\\_malawi.pdf](http://www.undp-alm.org/sites/default/files/malawi_nap-gsp_africa_regional_training_workshop_element_d_malawi.pdf)

*The initial programme structuring and design should be completed within a period of 1 year so that skills building on viable alternatives can begin within a 2-3 year timeframe, after which implementation should be continuous.*

- II. **Create and strengthen business development mechanisms for smallholder farmers.** In light of the fact that farmers in the province identified low credit and savings as the primary obstacle in adapting to climate change, the North West province in partnership with the national government (Department of Rural Development and Land Reform, as well as the Department of Agriculture, Forestry, and Fisheries), along with development institutions, donors and the private sector, should enhance opportunities for rural communities in North West (especially farmers) to develop sustainable livelihoods. This entails raising credit availability through loans, grants, and microfinance; increasing access to and participation in markets; and institutional resources in the form of sustainable rural livelihoods board or committee that can offer guidance and feedback to rural communities in order to help them identify and develop new opportunities in the agricultural value chain.

*Stakeholders present at the June provincial workshop noted that such initiatives have been tried before, but have not shown great success, primarily because the markets are predominantly in Gauteng while production is in the North West. Nevertheless, improved programs to enhance production and increase production volumes could be helpful, and be just as viable as market access in terms of improved access to capital and revenue streams.*

*The Department of Economic Development at the national level and READ at the provincial level should take the lead, and DTI, FEED, and DAFF should be involved. The programme should be developed within a one-year timeframe and thereafter implemented on a continuous, ongoing basis. Some funding for such a programme could come from DAFF and some could also come from the Department of Small Business Development.*

- III. **Redouble efforts to improve overall socio-economic security and wellbeing, especially in high vulnerability municipal wards.** Climate change resilience is in part a function of existing human vulnerability and adaptive capacity, which are influenced by several overarching socio-economic factors. One of the key determinants is the type of settlement or security of shelter that communities enjoy. Thus, reducing vulnerability in the municipal wards identified by the national human settlements vulnerability assessment would be a key approach to strengthening livelihoods in the province overall.<sup>65</sup>

In North West province, adaptive capacity in rural livelihoods will automatically be strengthened with broad-based development and inclusive economic growth. As a corollary, no amount of sector-specific climate adaptation strategies and plans will bring about long-lived resilience unless they are built on a foundation of economic and social security. Thus, even from a climate change adaptation point of view, the North West province must redouble and accelerate its efforts to extend the coverage of safe drinking water supply, adequate sanitation, adequate and reliable electricity supply, formal housing, education, and access to healthcare services. In doing so, it must integrate climate change into its existing plans and policies, so as to ensure climate mainstreaming within broader development programmes and initiatives. It could also align its

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<sup>65</sup> Department of Rural Development and Land Reform, "Climate Change Risk and Vulnerability Assessment for Human Settlements," 2013. [http://www.ruraldevelopment.gov.za/phocadownload/spatial\\_Planning\\_Information/Climate\\_Change/Latest\\_Risk\\_and\\_Vulnerability\\_july\\_2013\\_09072013.pdf](http://www.ruraldevelopment.gov.za/phocadownload/spatial_Planning_Information/Climate_Change/Latest_Risk_and_Vulnerability_july_2013_09072013.pdf)

own targets more closely with the post 2015 Sustainable Development Goals, and thereby leverage available international support for the achievement of SDGs.

*To implement this broad-based strategy, the Department of Human Settlements should take the lead, and should coordinate with DHS, FEED, Social Development, Department of Health and SALGA to enhance the effectiveness of a vast range of existing social welfare initiatives. This should also be an ongoing effort.*

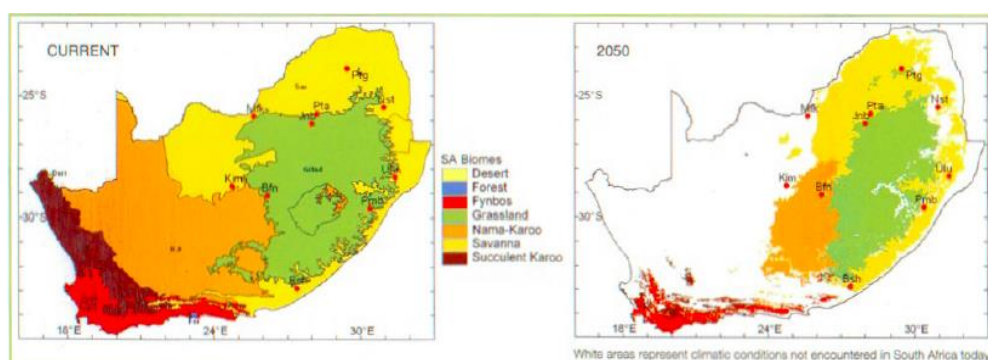
### 3.3. Terrestrial Ecosystems

#### 3.3.1. Terrestrial Ecosystems in North West Province

North West's terrestrial ecosystems are highly vulnerable to climate change. The province already has one critically endangered ecosystem (the western sandy Highveld grassland), one endangered ecosystem (the Vaal-Vet sandy grassland), and eight vulnerable ecosystems.<sup>66</sup> North West has approximately 2,221 plant species, 120 mammals, 480 birds, 34 amphibians and 123 reptiles. Several species are endemic to the province.

#### 3.3.2. Vulnerability to Climate Change

The predominant terrestrial ecosystems in the North West are Savanna and Grassland. The Savanna ecosystem has a fairly high resilience to climate variability and change. Thus it is considered less vulnerable than many other ecosystems, but with climate change it is nevertheless likely to see changes in range and in the level of ecosystem services being provided.<sup>67</sup> Grasslands on the other hand are at far greater risk from climate change, with an increased likelihood that warmer temperatures and higher carbon dioxide levels in the atmosphere will support the growth of wooded plants and trees, edging out grasses. The savanna biome is likely to shift into areas currently covered by grasslands, with species currently present at higher elevations replaced by species from lower elevations, which move up with warmer temperatures.<sup>68</sup>



**Figure 4:** Biomes of South Africa as Mapped in 2000 and Projected in 2050 (Source: SANBI, The Heat is On)

However, there is also growing evidence to suggest that the Savanna biome itself may face negative impacts from climate change, as a result of encroachment by bush and woody tree vegetation.<sup>69</sup> This type of forest encroachment (or forest colonization), is more likely in a wetter climate scenario, with more rain; for the North West, most projections suggest a trend of rising temperatures and evaporation that will likely to lead to an overall drier climate in the region, leaving it unclear whether the North West's

<sup>66</sup> South African National Biodiversity Institute, "Summary of Listed Ecosystems by Province," [http://bgis.sanbi.org/ecosystems/Summary %20listed\\_ecosystems\\_province.pdf](http://bgis.sanbi.org/ecosystems/Summary%20listed_ecosystems_province.pdf)

<sup>67</sup> CSIR, Risk and Vulnerability Atlas, "Information Portal K2C," <http://www.rvatlas.org/k2c/information/conservation.php>

<sup>68</sup> South African National Biodiversity Institute, "The Heat is On," 2008 <http://www.sanbi.org/sites/default/files/documents/documents/theheatison.pdf>

<sup>69</sup> Vhalinavo P. Khavagali and William J. Bond, "Increase of Woody Plants in Savannah Ecosystems," Grassroots – Newsletter of the Grassland Society of South Africa, Vol. 8, No. 2 (May 2008). <http://grassland.org.za/resources/grassroots/2006-to-2010/2008/May%202008/5%20Khavagali%20May%202008.pdf>

savannas may be encroached on by forest ecosystems.<sup>70</sup> A better understanding is required of the impact of changing climatic conditions (carbon dioxide levels, temperature, rainfall, evaporation) in conjunction with non-climate factors (fire, grazing, changes in local megafauna etc.) on different types of savanna ecosystems in South Africa (for instance, the varied response between mesic and semi-arid savanna).<sup>71</sup>

### 3.3.3. Ecosystem Adaptation in North West Province and South Africa

The North West province has a range of environmental plans in place that highlight the importance of biodiversity. The province is also actively developing other plans. For instance, the North West Environment Outlook 2013 has recently been published, and underscores the threat that climate change poses to ecosystems in the province.

The 2014 North West Biodiversity Sector Plan (BSP) is slated for completion by the end of 2015, and it is anticipated that it will include climate change considerations explicitly when identifying new or updating existing Critical Biodiversity Areas (CBAs). These will inform the expansion of protected areas in the North West in the future.

The North West Biodiversity Conservation Assessment (2009) is a systematic conservation plan that provides guidance for conservation in North West province, and forms the basis for the BSP currently in development. The 2014 BSP will also be used to inform Spatial Development Frameworks (SDF), Environmental Management Frameworks (EMF), and Environmental Impact Assessments (EIAs) in the province.<sup>72</sup>

A helpful tool that is available to North West is the SANBI-developed Biodiversity GIS Land Use Decision Support (LUDS) tool, which provides municipality-level biodiversity information and summaries, enabling planners to better understand the impacts of land use decisions on underlying ecosystems.<sup>73</sup> However, this does not explicitly integrate information about projected climate change impacts to ecosystems and recommended adaptation measures.

The National Climate Change Response Strategy White Paper notes, in relation to biodiversity and ecosystem adaptation to climate change, that responses to climate change should include the following: (i) strengthening biodiversity management and research institutions for better monitoring and assessment; (ii) conservation, rehabilitation, and restoration of natural ecosystems that improve resilience; (iii) prioritizing impact assessment and adaptation planning; (iv) prioritizing research into climate change ecosystem threats in marine and terrestrial ecosystems, including effective monitoring; (v) expanding the protected area network with a perspective on climate resilience; (vi) encouraging partnerships for areas that are not under formal protected status; and (vii) expanding gene banks.<sup>74</sup>

### 3.3.4. Ecosystem Adaptation Lessons and Best Practices from Elsewhere

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<sup>70</sup> Robert J. Scholes, "Impacts and Adaptations to Climate Change in the Biodiversity Sector in Southern Africa," AIACC Project Number AF04, Final Report (2006). [http://www.start.org/Projects/AIACC\\_Project/Final%20Reports/Final%20Reports/FinalRept\\_AIACC\\_AF04.pdf](http://www.start.org/Projects/AIACC_Project/Final%20Reports/Final%20Reports/FinalRept_AIACC_AF04.pdf)

<sup>71</sup> R. Buitenwerf et al., "Increased Tree Densities in South African Savannas: >50 Years of Data Suggests CO<sub>2</sub> as Driver," *Global Change Biology* (2011). [http://researchspace.csir.co.za/dspace/bitstream/10204/6127/1/Stevens\\_2012.pdf](http://researchspace.csir.co.za/dspace/bitstream/10204/6127/1/Stevens_2012.pdf)

<sup>72</sup> SANBI, "North West Province Biodiversity Conservation Assessment," <http://bgis.sanbi.org/northwest/project.asp>

<sup>73</sup> SANBI, Biodiversity GIS, "Municipal LUDS," <http://bgis.sanbi.org/municipalities/choose-muni.asp?prov=NW>

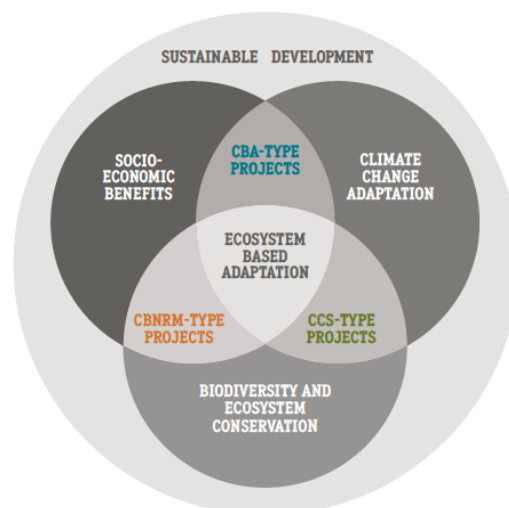
<sup>74</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, "National Climate Change Response White Paper," (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>



In recent years there has been growing interest in and uptake of Ecosystem Based Adaptation (EBA), which brings together traditional biodiversity conservation, socio-economic development, and climate change adaptation. The key elements of EBA are Community-Based Natural Resource Management (CBNRM), Community Based Adaptation (CBA), and Climate Change-Integrated Conservation Strategies.<sup>75</sup>

There are several examples of positive results from EBA in the field. These include IUCN's efforts in Zambia, Tanzania, and Mozambique (emphasizing the role of forests and water resources in community livelihoods), community-based fire management in Northern Australia (West Arnhem),<sup>76</sup> the government of Colombia's efforts to work with local communities to build climate resilience through the protection of thousands of hectares of tropical ecosystems rich in medicinal plants,<sup>77</sup> debt-for-nature swaps funded by France that involve local communities in Madagascar and Cameroon,<sup>78</sup> grassland protection and restoration in China by the Gansu and Xinjiang Pastoral Development Project,<sup>79</sup> and sustainable pasture management in Mongolia to protect grasslands as well as livelihoods of local herders.<sup>80</sup> One of the richest sources of information in the realm of freshwater ecosystem adaptation is the World Bank's 'Flowing Forward' report, which takes a biodiversity lens to water resources management in a changing climate.<sup>81</sup>

There is also a great deal of literature globally (including case studies) about ecosystem conservation (particularly aquatic ecosystems) through the removal and management of Alien Invasive Species.<sup>82</sup>



**Figure 5: Ecosystem Based Adaptation**

### 3.3.5. Climate Adaptation Measures for Ecosystems in the North West - Recommendations

Across South Africa and North West, a significant amount of attention and resources are already devoted to conservation and ecosystem preservation. However, there appears to be a need for more focused programmes and initiatives that specifically take a climate change perspective when examining ecosystems. Stakeholders at the workshop, including the Department of Environmental Affairs, proposed the following ideas as climate change adaptation strategies for the North West province's ecosystems:

<sup>75</sup> SANBI, "Biodiversity, Climate Change, and Sustainable Development," [http://www.sanbi.org/sites/default/files/documents/documents/biodiversity-climate-change-and-sustainable-development\\_0.pdf](http://www.sanbi.org/sites/default/files/documents/documents/biodiversity-climate-change-and-sustainable-development_0.pdf)

<sup>76</sup> IUCN, "Ecosystem Based Adaptation – A Natural Response to Climate Change," 2009.

[https://cmsdata.iucn.org/downloads/iucn\\_eba\\_brochure.pdf](https://cmsdata.iucn.org/downloads/iucn_eba_brochure.pdf)

<sup>77</sup> UNFCCC, "Ecosystem Based Adaptation," 2012 Calendar. [https://unfccc.int/files/adaptation/application/pdf/nwp\\_cal\\_2012.pdf](https://unfccc.int/files/adaptation/application/pdf/nwp_cal_2012.pdf)

<sup>78</sup> Tahia Devisscher, "Ecosystem Based Adaptation in Africa," Stockholm Environmental Institute 2010.

[http://www.unep.org/climatechange/adaptation/Portals/133/documents/AdaptCost/10%20EBA\\_AdaptCost\\_Final.pdf](http://www.unep.org/climatechange/adaptation/Portals/133/documents/AdaptCost/10%20EBA_AdaptCost_Final.pdf)

<sup>79</sup> The World Bank, "Convenient Solutions to an Inconvenient Truth: Ecosystem Based Approaches to Climate Change," June 2009.

[http://siteresources.worldbank.org/ENVIRONMENT/Resources/ESW\\_EcosystemBasedApp.pdf](http://siteresources.worldbank.org/ENVIRONMENT/Resources/ESW_EcosystemBasedApp.pdf)

<sup>80</sup> Asian Development Bank, "Making Grasslands Sustainable in Mongolia: Adapting to Climate and Environmental Change," February 2014.

<http://www.adb.org/publications/making-grasslands-sustainable-mongolia-adapting-climate-and-environmental-change>

<sup>81</sup> Tom Le Quesne et al., "Freshwater Ecosystem Adaptation to Climate Change in Water Resources Management and Biodiversity Conservation," November 2010. [www.flowingforward.org/index.html](http://www.flowingforward.org/index.html)

<sup>82</sup> Jenny Davis et al., National Climate Change Adaptation Research Facility, Australia, "Climate Change Adaptation Guidelines for Arid Zone Aquatic Ecosystems and Freshwater Biodiversity," February 2013.

[http://www.nccarf.edu.au/sites/default/files/attached\\_files\\_publications/Davis\\_2013\\_Climate\\_change\\_adaptation\\_guidelines\\_for\\_arid\\_zone.pdf](http://www.nccarf.edu.au/sites/default/files/attached_files_publications/Davis_2013_Climate_change_adaptation_guidelines_for_arid_zone.pdf)

- I. **Develop communications and carry out a sustained training and awareness campaign regarding the province's ecosystems and vulnerabilities:** The relevant departments (such as DEA and READ as well as DAFF) should develop communication and awareness materials regarding ecosystems and climate change, and should observe and participate on the various environment-themed days including Earth Day, Arbor Day, World Environment Day, National Arbor Week etc. These communications should be aimed at raising public awareness and education.

*The Department of Education, SANBI and Department of Health should also be involved in this. This strategy can be implemented in the timeframe of one year, and then be an ongoing effort.*

- II. **Implement SPLUMA to internalize climate change issues into land use planning** (after integrating climate change into provincial level SPLUMA implementation instruments through amendment): The Spatial Planning and Land Use Management Act (SPLUMA) was signed into law and published in a gazette in August 2013. SPLUMA is a framework for all spatial planning and land use management legislation in South Africa, and is set to aid efficient and effective planning and land use management. SPLUMA is meant to address collaborative planning in areas, taking into account biodiversity protection, heritage, tourism and transportation. It does not mention climate change, but many of the objectives that SPLUMA seeks to address will automatically create better climate adaptation if land use planning is done in a way that also incorporates future climate change projections for the areas being planned or developed. Collaboration should come through regional plans and joint tribunals, thus allowing for consistency in decision-making. Municipalities will be solely responsible for processing and dealing with land use applications and the appeals relating thereto. SPLUMA should be thus be implemented in the North West province, taking the impact on the environment and climate change aspects into account in all future land use decisions (if need be, the SPLUMA implementation instrument in the province can be amended to explicitly indicate that it should take climate change into account).

*The main responsibility for implementation would be local municipalities. This strategy can be implemented in the timeframe of one year, and then remain an ongoing effort.*

- III. **Develop a specialized climate change management programme to focus on identification and protection of the North West's main terrestrial ecosystems in the face of climate change:** There is a credible evidence-base to indicate that climate change is likely to have deleterious impacts on the grassland ecosystems in the North West, and potentially also on the savanna ecosystem. However, in addition to better understanding the climate and non-climatic dynamics that result in changes like bush encroachment, it is also essential to develop more robust studies about the biodiversity, natural capital, and human livelihoods impacts of these changes, as well as what can be done to reduce or better manage the change. Thus North West could consider establishing, in partnership with other South African provinces that share grassland and savanna ecosystems, and the South African National Biodiversity Institute, a dedicated programme that strengthens the understanding of climatic changes to the two ecosystems, and simultaneously increases the knowledge-base regarding the socio-economic implications of such changes. This applied research programme could then, in conjunction with development partners, fund and implement conservation programs to arrest or manage the impacts of climate change in certain regions covered by the two ecosystems (such as in sub-sections of already protected areas). It could also create a push to create new parks or protected areas focused on grasslands or savannah.

*The main responsibility for implementation would be with DEA and the provincial counterparts at READ, working in collaboration with DAFF and SANBI as well as other provinces. This strategy can be implemented in the timeframe of one year, and then remain an ongoing effort. Funding would be sourced from DEA or be included in provincial budgetary outlay on an annual basis.*

- IV. **Strengthen forums for cooperative governance and improve implementation of existing efforts:** In order to deal with the impacts of climate change on the terrestrial ecosystems, it is necessary for all land-use sectors to work together, including economic development, mining, agriculture, water, energy and human settlements. Thus, forums for cooperative governance where decisions are made regarding land-use should be established and strengthened. Together, a coordinated approach would help improve the implementation of not only new strategies but also existing programmes and projects that serve the province's ecosystems. One of the key steps that would build resilience of ecosystems in North West to the impacts of climate change is to effectively implement existing plans and programmes. For instance, climate change is already being integrated into the Biodiversity Sector Plan, and thus if adequate resources are devoted to the implementation of the plan, it would go a long way towards strengthening the protection of ecosystems in the province in the face of climate change and to creating overall ecosystem resilience.

*The implementation of this strategy would be a collective responsibility and would be ongoing.*

## 3.4. Water Resources

### 3.4.1. Aquatic Ecosystems and Water Resources in North West Province

In terms of riverine and aquatic ecosystems in the North West province, these are primarily constituted by the Vaal river (which underpins 60% of the province's economy), as well as portions of the Crocodile and Limpopo river basins, plus the province's wetlands (numbering over 5000, plus another 6600 water pans).

In the North West, ground and surface water are integrated as inter-dependant; groundwater flowing to the surface as dolomitic eyes or springs is the source of several major rivers (Groot Marico, Mooi, Schoon Spruit and Molopo).

The most prominent wetland in the North West is Baberspan, a recognized Ramsar protected site. The Upper Groot Marico River in the province is currently the only free-flowing river in all of northwestern South Africa.<sup>83</sup>

According to the 2011 census, nearly 70 percent of North West's population had access to piped water supply within their own dwelling or yard, 22 percent had access to piped water outside their own yard, and approximately eight percent of the province's people had no access whatsoever to piped water.<sup>84</sup>

All but one of North West's Municipal Water Services Authorities (WSAs) were deemed as highly vulnerable, according to the Department of Water Affairs in 2013 (on a general, non-climate basis).<sup>85</sup>

### 3.4.2. Vulnerability to Climate Change

According to the Provincial Development Plan (PDP) 2030, the province is currently a water scarce province and water shortages are likely to occur by 2020 (based on current growth in consumption and demand), particularly in the western and north western parts if interventions are not put in place. Water resources are drying quickly due to higher temperature and less rainfall. This reduction of rainfall in an already water-stressed province like the North West is compounded by huge water losses that many water schemes suffer due to lack of technical capacity, decaying infrastructure and lack of proper operation and maintenance capacities. Water infrastructure is ageing and proper management and maintenance remains a challenge.

For the Northeastern region of South Africa (including much of the North West province), climate change is likely to pose the following risks to the water sector:<sup>86</sup>

- Decreased availability of water in rivers as a result of the net effect of increased temperatures and increased evaporation, combined with shifts in the timing and amount of rainfall;
- Changes in the timing of high and low flows due to changes in rainfall patterns;
- A higher incidence of floods as heavy rainfall events increase;
- Increased risk of water pollution and decreased water quality, arising from erosion and high rainfall events (which elevate the amount of nutrient runoff, sediments, and dissolved organic carbon) and increased temperatures (which promote algal blooms).

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<sup>83</sup> CSIR, "South Africa Freshwater Ecosystem Atlas," [http://www.csir.co.za/impact/docs/Final\\_Freshwater\\_Atlas\\_Article.pdf](http://www.csir.co.za/impact/docs/Final_Freshwater_Atlas_Article.pdf)

<sup>84</sup> South Africa Statistics, "Census 2011," published 2012. <http://www.statssa.gov.za/publications/P03014/P030142011.pdf>

<sup>85</sup> Department of Water Affairs, "Strategic Overview of the Water Sector in South Africa, 2013," <http://nepadwatercoe.org/wp-content/uploads/Strategic-Overview-of-the-Water-Sector-in-South-Africa-2013.pdf>

<sup>86</sup> Claire Davis, CSIR, "Climate Change Handbook for Northeastern South Africa," 2010. [http://www.rvatlas.org/k2c/download/handbook\\_climate\\_change.pdf](http://www.rvatlas.org/k2c/download/handbook_climate_change.pdf)

Greater rainfall intensity in this region is expected to increase scouring in rivers and sedimentation in dams, which has implications for water treatment and supply infrastructure.<sup>87</sup>

Projections suggest that even without the exacerbating influence of climate change, South Africa will “exceed the limits of economically viable land-based water resources by 2050,” making this sector highly vulnerable to climate stressors.<sup>88</sup>

### **3.4.3. Aquatic Ecosystem and Water Resources Adaptation in North West Province and South Africa**

In the context of aquatic ecosystems, the Department of Environmental Affairs (DEA), under the Working for Water programme, is working on a process to remove invasive alien plant species. The programme is also active in parts of the North West province, and helps maintain natural biodiversity, while at the same time improving water security and creating jobs.<sup>89</sup>

At the national level, the South Africa Risk and Vulnerability Atlas points to Integrated Water Resource Management (IWRM) as a framework for improving socio-economic welfare of people dependent on water resources without compromising the sustainability of ecosystems. It also emphasizes that water adaptation in South Africa requires more investment in information, stronger institutions, and man-made water adaptation infrastructure.<sup>90</sup>

The National Climate Change Response Strategy White Paper recommends a host of adaptation approaches for the water sector: (i) integrating climate change in planning processes across various relevant sectors; (ii) sustaining state of the art research on water and climate change; (iii) transboundary water management with a regional perspective; (iv) investing in water conservation and demand management, and the best catchment management; (v) exploring new or un-used sources of water such as groundwater, desalination, and treated re-usable effluents; (vi) increasing community water resilience; (vii) providing human, legal, regulatory, institutional, governance, and financial resources to cope with climate change in the water sector; and (viii) undertaking focused monitoring and research.<sup>91</sup>

The LTAS water sector report outlines adaptation responses across several areas, ranging from institutional approaches to hard infrastructure and service delivery, i.e. water resources management, water resources infrastructure, and water services. In particular, it underscores the need to integrate adaptation into water resources planning frameworks in South Africa, and incorporate climate change adaptation into reconciliation studies. It also reaffirms measures highlighted in the water sector climate change adaptation strategy, including water governance; infrastructure development, operation, and maintenance; and water management (which incorporates resource management and protection; gathering and storing of better reported water data; water planning; water allocation and authorization;

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<sup>87</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

<sup>88</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

<sup>89</sup> SANBI, Long Term Adaptation Scenarios, “Water Sector,” 2013. <http://www.sanbi.org/sites/default/files/documents/documents/ltaswater-tech-report2013high-res.pdf>

<sup>90</sup> Department of Science and Technology, “South African Risk and Vulnerability Atlas,” 2010 [www.researchspace.csir.co.za/dspace/bitstream/10204/4974/1/Archer2\\_2020.pdf](http://www.researchspace.csir.co.za/dspace/bitstream/10204/4974/1/Archer2_2020.pdf)

<sup>91</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

optimization of dam and groundwater management and operation; water conservation and demand management; and disaster management).<sup>92</sup>

### **3.4.4. Water Resources Adaptation – Lessons and Best Practices from Elsewhere**

There is a wealth of information on water sector adaptation measures and best practices from various corners of the globe. What is less clear, given the complexity of water resources and water supply systems, is the extent to which the range of measures adopted have been successful and to what degree. Nevertheless, there are lessons to draw from the activities taking place in this sector the world over.

Canada's Adaptation to Climate Team (ACT)'s policy roadmap for decision makers on climate change adaptation is instructive for water governance.<sup>93</sup> Burkina Faso's experience with the United Nations' national adaptation planning process is a demonstration of how well established institutional arrangements can foster early strategic thinking about medium and long term adaptation strategies.<sup>94</sup> The United Nations' Environment Programme (UNEP) has resources on eleven key water technologies that aid adaptation, with illustrative information on where they've been used successfully to build adaptive capacity, including developing countries like India (the technologies include boreholes and tube-wells; desalination; household drinking water treatment and storage; protected wells; leakage management and detection systems for piped water; post-construction support for community-managed water supplies; rainwater collection; rainwater harvesting; water reclamation and re-use; and water safety plans).<sup>95</sup>

The Alliance for Global Water Adaptation (AGWA) is a helpful network and resource on the integration of climate change adaptation approaches into water infrastructure development, with projects around the world to draw insights from.<sup>96</sup>

### **3.4.5. Climate Adaptation Measures for Aquatic Ecosystems and Water Resources in the North West – Recommendations**

Preliminary recommendations for climate adaptation strategies related to water resources (both aquatic ecosystems and water supply) were discussed in the provincial workshop in June. Stakeholders reformulated the recommendations, increased the emphasis on dolomitic aquifers and water quality, and provided the following four final adaptation strategies for the North West province, below.

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<sup>92</sup> South African National Biodiversity Institute (SANBI), Long Term Adaptation Scenarios, "Water," 2013.

<http://www.sanbi.org/sites/default/files/documents/documents/ltaswater-tech-report2013high-res.pdf>

<sup>93</sup> Bon Sandford et al., "Briefing Paper for Decision Makers: Climate Change Adaptation and Water Governance," 2011.

[http://www.gwp.org/Global/ToolBox/References/Climate%20change%20adaptation%20and%20water%20governance%20\(ACT-SFU,%202011\).pdf](http://www.gwp.org/Global/ToolBox/References/Climate%20change%20adaptation%20and%20water%20governance%20(ACT-SFU,%202011).pdf)

<sup>94</sup> UNFCCC, LDC Expert Group, "Best Practices and Lessons Learnt in Addressing Adaptation in the Least Developed Countries Through the National Adaptation Program of Action Process." 2011.

[http://www.gwp.org/Global/ToolBox/References/Best%20practices%20and%20lessons%20learned%20in%20addressing%20adaptation%20in%20the%20least%20developed%20countries%20\(UNFCCC,%202011\).pdf](http://www.gwp.org/Global/ToolBox/References/Best%20practices%20and%20lessons%20learned%20in%20addressing%20adaptation%20in%20the%20least%20developed%20countries%20(UNFCCC,%202011).pdf)

<sup>95</sup> Mark Elliott et al., UNEP, "Technologies for Climate Change Adaptation – The Water Sector," April 2011.

[http://www.gwp.org/Global/ToolBox/References/Technologies%20and%20Practices%20for%20Climate%20Change%20Adaptation%20in%20the%20Water%20Sector%20\(UNEP,%202011\).pdf](http://www.gwp.org/Global/ToolBox/References/Technologies%20and%20Practices%20for%20Climate%20Change%20Adaptation%20in%20the%20Water%20Sector%20(UNEP,%202011).pdf)

<sup>96</sup> Alliance for Global Water Adaptation, <http://alliance4water.org>



The national Department of Water Sanitation (DWS) has already adopted a climate change strategy, and the measures suggested hereunder are in line with this strategy.

- I. **Establish a water resource conservation programme to recommend and implement evidence-based measures for resource protection:** The province's water resources must be protected from overutilization, especially dolomitic aquifers, wetlands, and pans. Publicly available literature does not demonstrate that a lot of attention has been given to studying the impacts of climate change on dolomitic aquifers, wetlands, and water pans in the North West province, and the resulting impacts on water availability and quality. Dolomitic aquifers, wetlands, and pans are key locales for biodiversity and play a critical role in ecosystem functioning as well as the provision of ecosystem services. Thus, to better understand the implications for the North West and to build resilience, a dedicated programme should be launched to closely study the impacts of climate change in the province on these resources, and to implement evidence-based measures to conserve these resources.
- II. **Enhance the use of Water Conservation and Demand Management measures:** Existing efforts on water conservation and demand side management for water should be increased and prioritized more. Households, industries, and various sectors should investigate whether they can substitute ground water use with surface water, and adopt more efficient practices such as rainwater harvesting. There should also be improved water infrastructure maintenance (a "war on leaks") and more measures and incentives to re-use grey water. This is a particularly critical action for North West, as infrastructure is severely aging in several area, including Lichtenburg.
- III. **Improve Water Quality Management:** The government should make water quality management a priority, and improve policy and enforcement to reduce effluents and contaminants flowing into the water stream (such as nitrites, discharges from toilets etc.).
- IV. **Strengthen inter-departmental coordination:** There is room for improvement in the ways that different departments, offices, and agencies work together on the issue of water. It is such an inter-disciplinary and cross-cutting issue that effective management of water resources and climate change adaptation in this sector requires the involvement of decision makers and key players from agriculture, industry, human settlements, environment affairs, mineral resources, health, and several other departments – besides water and sanitation. The same is true at the provincial level. Thus, an inter-office coordination forum on water management and conservation should be established, and it should integrate climate change.

*For all four of the strategies identified by local stakeholders, the stakeholders indicated that the entity that should take the lead on implementation is the DWS. It was recommended that DWS work closely with Catchment Management Authorities, local municipalities, SALGA, water user associations, and all relevant national departments (such as DEA, DAFF, DMR etc.). The implementation of these strategies would be initiated over the course of one year and then remain a continually implemented / ongoing effort. Funding for such climate mainstreaming in water management and conservation could come from both DWS and DEA, and existing funding for programs like Working for Water and Working for Wetlands could be scaled up.*



## 3.5. Extractives (Mining)

### 3.5.1. Mining in the North West Province

The extractives sector (mining and minerals) contributes nearly a fourth of North West's total economy, and the province produces a quarter of South Africa's gold and 94% of the country's platinum (and 50% of the world's platinum). The North West province alone makes up more than a fifth of South Africa's total mining industry.<sup>97</sup> The sector accounts for 15% of the province's total employment.<sup>98</sup> It is a critical pillar of the province's economy.

While the sector is not directly impacted by changes in temperature and rainfall in the way that ecosystems and agriculture are, the sector's water dependency and the effect of heat on working conditions makes this sector susceptible to climate change as well.

### 3.5.2. Vulnerability to Climate Change

The Vaal river system meets the water resource needs of roughly 60% of the South African economy and serves an estimated 20 million people (45% of the country's population).<sup>99</sup> Understanding future water availability in the basin is challenging because climate models do not currently provide clarity on whether the region will experience a rise in rainfall volumes or a reduction in rainfall. Even with a moderate increase in rainfall, however, higher temperatures and evapotranspiration suggest that the region will face a drier future (for example, two other river systems in the region – the Orange and Limpopo rivers – may potentially face as much as a 20% decrease in mean annual precipitation, under some of the higher end climate scenario projections).<sup>100</sup>

Water stress and scarcity is a risk and a source of vulnerability to the mining sector in South Africa and the North West, given the mining industry's heavy consumption of water for commercial activity (water is required for several industrial processes within mines and for treating ores etc.). Across South Africa, the mining sector uses three percent of all water withdrawn in the country (more than all other industries and commercial users put together).<sup>101</sup> In an average platinum plant, for instance, 36% of the water footprint lies in evaporation from the mineral processing unit, and 19% from the tailings storage facility.<sup>102</sup> By 2030, South Africa is likely to face a 17% gap between available water and projected demand.<sup>103</sup> In the North West province, mining activities are already largely concentrated in the relatively more water scarce sections of the province.

Not only is water scarcity a risk for the mining industry because of potentially lower water availability for its own operations, it is also a risk because in conditions of water stress or scarcity, this may result in regulatory risks or restrictions on certain aspects of its operations. For instance, many mines "dewater" dolomite aquifers in order to safely conduct mining below a certain depth; in a situation of growing water

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<sup>97</sup> SouthAfrica.Info, "North West Province, South Africa," <http://www.southafrica.info/about/geography/north-west.htm#.VXCTXEsaWs1>

<sup>98</sup> Development Bank of South Africa, "North West Profile Summary Report," <http://www.dbsa.org/EN/DBSA-Operations/Proj/Documents/Summary%20of%20North%20West%20Province.pdf>

<sup>99</sup> Department of Water Affairs, "Position Statement on Vaal River System and Acid Mine Drainage," November 2010. <https://www.dwa.gov.za/Projects/AMDFSLTS/Documents/Vaal%20River%20System%20&%20AMD%20Version%203.pdf>

<sup>100</sup> Thomas M. Hanlon, "The Impacts of Mining Legacy in Water-Scarce South Africa: An Environmental Security Perspective," United States Air Force Academy, June 2010. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.466.3616&rep=rep1&type=pdf>

<sup>101</sup> EL Haggard, CM Sheridan, and KG Harding, "Quantification of Water Usage at a South African Platinum Plant," 2015. <http://www.wrc.org.za/Lists/Knowledge%20Hub%20Items/Attachments/11180/SE410214%20abstract.pdf>

<sup>102</sup> N. Ranchod et al., "Assessing the Blue Water Footprint of an Opencast Platinum Mine in South Africa," *Water South Africa* Vol. 41, No. 2 (2015) <http://www.ajol.info/index.php/wsa/article/view/115261>

<sup>103</sup> Linda Dailey Paulson, "South African Coal Industry Examines Water Footprint," RWL Later, February 2, 2015. <http://www.rwlwater.com/south-african-coal-industry-examines-water-footprint/>

scarcity, such practices may be limited in the public interest. In the same vein, water scarcity from climate change could result in further environmental standards for the mining industry, to ensure that it does not negatively impact the water quality of limited freshwater through its discharge of mining wastes like overburden, waste rock, slime and other effluents.

A situation where the region experiences an increase in rainfall comes with risks of its own. More rainfall, especially heavy rainfall events and increased surface runoff, would likely exacerbate the problem of Acid Rock Drainage (ARD) or Acid Mine Drainage (AMD). Flash floods and heavy water runoff can also cause scour in mining areas, an additional risk to the industry's operations.<sup>104</sup> At least one study of the Vaal river basin suggests that climate change could, in fact, lead to higher future stream-flows as a result of increased precipitation in the area (but even that study offer the caveat that if for any reason the water availability from the Lesotho Highlands Water Project reduces, there will be significantly reduced stream-flow in the Vaal).<sup>105</sup>

The mining industry is also vulnerable to climate change impacts in terms of working conditions of mine labour. Rising temperatures may pose health hazards and reduce labour productivity, and worsen air quality conditions within mines.<sup>106</sup>

### 3.5.3. Extractives Sector Adaptation in the North West Province and South Africa

The mining industry in South Africa has already been taking several initiatives to improve its environmental performance, including water conservation and treatment. The South African mining industry has started looking at mine water re-use as a serious and viable option.<sup>107</sup>

On the policy side, the government developed an Integrated Water Quality Management Strategy for the Vaal river system (alongside a comprehensive reconciliation study). A study on the Potential Savings Through Water Conservation and Water Demand Management in the Upper and Middle Vaal Water Management Areas was also conducted.<sup>108</sup> At a national level, the second National Water Resources Strategy of 2013 placed a strong emphasis on treatment (including desalination) of mine water and on reducing the problem of AMD (including by modifying the conditions on mining licenses).<sup>109</sup>

The Department of Energy and CSIR's Sustainable Development Through Mining programme tackles a host of environmental issues, including wastewater treatment and mitigation of AMD.<sup>110</sup>

### 3.5.4. Extractives Sector Adaptation Lessons and Best Practices from Elsewhere

Within the mining industry globally, there is growing awareness and understanding of the risks that climate change poses. BSR (a global corporate social responsibility consulting firm) surveyed risks and opportunities to leading mining companies worldwide and identified adaptation practices that fell into

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<sup>104</sup> Climate Change Business Journal, "Climate Change and the Mining Industry," Environmental Business International, 2013.

[http://www.climatechangebusiness.com/Mining\\_Industry\\_and\\_the\\_Climate\\_Change](http://www.climatechangebusiness.com/Mining_Industry_and_the_Climate_Change)

<sup>105</sup> Huzeefa T. Haji, "Impact of Climate Change on Surface Water Availability in the Upper Vaal Basin," January 2011.

[http://www.weap21.org/downloads/Haji\\_MTech.pdf](http://www.weap21.org/downloads/Haji_MTech.pdf)

<sup>106</sup> T. Kjellstrom et al., "Climate Change and Occupational Health: A South African Perspective," *South African Medical Journal* (August 2014) [http://www.scielo.org.za/scielo.php?pid=S0256-95742014000800033&script=sci\\_arttext](http://www.scielo.org.za/scielo.php?pid=S0256-95742014000800033&script=sci_arttext)

<sup>107</sup> James Fotouhi, "Unearthing Mining Water Technology Innovation," *WaterWorld* Vol. 29, Issues 6

<http://www.waterworld.com/articles/wwi/print/volume-29/issue-6/technology-case-studies/unearthing-mining-water-technology-innovation.html>

<sup>108</sup> Department of Water Affairs, "Position Statement on Vaal River System and Acid Mine Drainage," November 2010.

<https://www.dwa.gov.za/Projects/AMDFSLTS/Documents/Vaal%20River%20System%20&%20AMD%20Version%203.pdf>

<sup>109</sup> Desalination and Water Re-use Business News, "South Africa to Focus on Desalination and Water Re-use," July 2013.

[http://www.desalination.biz/news/news\\_story.asp?id=7152](http://www.desalination.biz/news/news_story.asp?id=7152)

<sup>110</sup> Sustainable Development Through Mining <http://www.sdmining.co.za>

two categories: value protection (ensuring resilience of physical assets and planning responses to maintain business and usual operations) and value creation (devising solutions that contribute to the ability to pursue new revenue-generating opportunities and help suppliers, stakeholders, and customers adapt to climate change).<sup>111</sup>

According to BSR, under the value protection category, companies like Vale and Gold Fields have already established internal management systems and strategies to address climate change; Anglo-American, Exxaro, Vale, and Newmont have engaged in on-site scientific assessments and modelling to estimate physical risk to their assets; HudBay Minerals and Norsk Hydro have formally modified their existing risk identification and management protocols to include climate change; Anglo-American, Exxaro, and Gold Fields have integrated climate change related risk and mitigation into decision making processes during the entire project cycle; Kumba Iron Ore, Alumina, Kinross, and Norsk Hydro have strengthened or made more robust some of their site, project, and facility designs to be more structurally resilient to climate change; Teck, Cameco, Goldfields, Harmony Gold and Vale have developed emergency procedures and contingency plans that incorporate climate change; Norsk Hydro, Anglo-American, Newcrest, Exxaro, and Iluka Resources have significantly improved their water management systems.<sup>112</sup>

In terms of value creation, BSR reports that Gold Fields has responded to potential changes in future market conditions (resulting from climate change and environmental stresses) by expanding the portfolio of commodities; Gold Fields and Anglo-American are both developing and testing technology to help operations continue in potentially harsher climatic conditions; Barrick, Rio Tinto, Exxaro, Sesa Goa, Gold Fields, and Vale are investing in renewable energy and alternative fuels; and Gold Fields has pioneered waste recycling programs that could also bring in revenue from carbon credits.<sup>113</sup>

Best practices are also detailed in the International Council of Mines and Minerals' (ICMM's) publication, "Adapting to a Changing Climate: Implications for the Mining and Metals Industry."<sup>114</sup> The report recommends an adaptation framework within which the mining industry could develop and implement a large range of measures (many of which are detailed in the publication). The framework comprises: awareness, engagement and objective-setting; risk and opportunity assessment; monitoring, evaluation, and reporting; adaptation planning; adaptation actions; and partnership and collaboration. The range of adaptation measures described include those pertaining to protecting physical assets and facilities, changing management and strategic processes internally, engaging with climate change processes at the international and national level to be a part of decision-making; conducting risk assessments; diversifying business models and a number of other options.<sup>115</sup>

### 3.5.5. Climate Adaptation Measures for Extractives in North West - Recommendations

There is a need for more in-depth and province-specific studies in the North West regarding the implications of a changing climate for its mining industry. The following strategies could provide a strong foundation for further work by the industry and the provincial government, including in collaboration:

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<sup>111</sup> Julia Nelson and Ryan Schuchard, BSR, "Adapting to Climate Change: A Guide for the Mining Industry," [http://www.bsr.org/reports/BSR\\_Climate\\_Adaptation\\_Issue\\_Brief\\_Mining.pdf](http://www.bsr.org/reports/BSR_Climate_Adaptation_Issue_Brief_Mining.pdf)

<sup>112</sup> Julia Nelson and Ryan Schuchard, BSR, "Adapting to Climate Change: A Guide for the Mining Industry," [http://www.bsr.org/reports/BSR\\_Climate\\_Adaptation\\_Issue\\_Brief\\_Mining.pdf](http://www.bsr.org/reports/BSR_Climate_Adaptation_Issue_Brief_Mining.pdf)

<sup>113</sup> Julia Nelson and Ryan Schuchard, BSR, "Adapting to Climate Change: A Guide for the Mining Industry," [http://www.bsr.org/reports/BSR\\_Climate\\_Adaptation\\_Issue\\_Brief\\_Mining.pdf](http://www.bsr.org/reports/BSR_Climate_Adaptation_Issue_Brief_Mining.pdf)

<sup>114</sup> ICMM, "Adapting to a Changing Climate: Implications for the Mining and Metals Industry," <http://www.icmm.com/page/92086/adapting-to-a-changing-climate-implications-for-the-mining-and-metals-industry>

<sup>115</sup> ICMM, "Adapting to a Changing Climate: Implications for the Mining and Metals Industry," March 2013, <http://www.icmm.com/document/5173>

- I. **Establish a long-term climate change and health programme for the mining sector in the province:** the government should work with the industry and mining unions to better assess and prepare for increasing heat stress and temperature-related health threats that those working in the mining industry will be exposed to, as well as other health concerns such as potentially higher dust levels from dryer conditions. Such a long-term program would involve better monitoring and reporting of worker health, and also promote adaptation measures at the individual and business level (including better hydration, improved ventilation, heat stress early warning protocols etc.). It should be noted that it may be likely that best practices are already being implemented because these are international issues.

*The Department of Mineral Resources (DMR) should be the lead implementing entity for this strategy, and operationalize this in coordination with the Department of Labor (DoL), Department of Health (DoH), mining companies, the Chamber of Mines, and mine worker unions. Final implementation of such a programme would rest with the individual mines themselves. This strategy can be operationalized within a year, and thereafter there should be continuous implementation as this should be an ongoing programme. Funding for the strategy can be sought from DMR as well as mining companies' Corporate Social Responsibility budgets.*

- II. **Organize an annual conference or symposium in the province focused on the mining industry's response to climate change:** the industry, in collaboration with the government, should convene annually or biannually to focus attention and resources on the impacts of climate change and approaches to adaptation and risk-reduction. Bringing in experts from other regions would help with knowledge-transfer and expose the industry to best practices that have been successful elsewhere in building resilience to climate change.

*The Department of Mineral Resources (DMR) should be the lead implementing entity for this strategy, and operationalize this in coordination with the Department of Environmental Affairs (DEA), mining companies, and the Chamber of Mines. The conference need not be restricted to one province, it could be a national level conference with participation by all provinces and local governments. However, if conducted at a Provincial level the lead entity should be the North West Climate Change Office. This strategy can be operationalized within a year, and thereafter there should be continuous implementation as this should be an annual event. Funding for the event can be sought from DMR as well as mining companies' Corporate Social Responsibility budgets.*

- III. **Fund a province-specific assessment of water related climate change risk to the mining industry in the North West:** given the central role of the mining sector in the provincial economy, the government should allocate resources for a comprehensive climate change risk assessment focused on water, in relation to the mining industry in the province. Improved knowledge of risks will enable the industry and policymakers to evolve more tailored adaptation actions in the future.

*The Department of Water and Sanitation would be an appropriate lead entity for this strategy, in close collaboration with DMR as well as DEA, and the mining companies. At the provincial level, READ and other relevant local entities would drive the strategy implementation. The assessment could be kicked off within a year, aiming for results within another year's timeframe. Funding for this initiative could come from DWS or from READ.*



## 3.6. Disaster Management

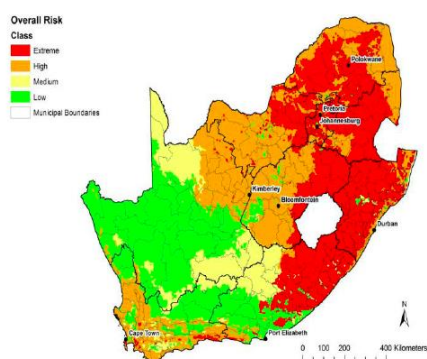
### 3.6.1. Disasters in the North West Province

The North West province in South Africa is prone to floods, drought, heat waves, wildfire or veldfire (and several other disasters without a climate linkage such as earthquakes). In 2015, the province is suffering one of the worst droughts in its history (the country's third worst drought since records began in 1918, and the worst drought in over 22 years, since 1992), which has taken its toll on Maize production in the North West (and other Maize growing provinces).<sup>116</sup> In recent years, the North West province has suffered from major floods in the summer of 2009-2010, and even more catastrophic floods in the summer of 2010-2011.<sup>117</sup>

### 3.6.2. Vulnerability to Climate Change

A range of climate change reports for South Africa, including the South African Risk and Vulnerability Atlas (SARVA) and the Climate Change Handbook for Northeastern South Africa, all suggest that certain categories of natural disasters are expected to worsen with climate change across the country, including the region where the North West province is located (north-central South Africa).

A study by the national department of Cooperative Governance and Traditional Affairs mapped out areas of existing risk to veldfires. It is evident that while all of North West province is at risk, the eastern half of the province is particularly at high risk (see figure below).<sup>118</sup> With climate change, as temperatures and evaporation rates increase across the province (as is expected), the hot and dry conditions are likely to worsen the risk of veld fire.



**Figure 6:** Veldfire risk classification of the country (CoGTA, 2012)

According to findings of the LTAS project, the North West is the second-most at-risk province for flood-related damage to bridges and dams, in the face of increased floods resulting from climate change.<sup>119</sup>

<sup>116</sup> BizNews.com, "SA's Worst Maize Drought Since 1992 a Timeous Reminder for Politicos," March 30, 2015. <http://www.biznews.com/sa-investing/2015/03/30/sas-worst-maize-drought-since-1992-timeous-reminder-for-politicos/>

<sup>117</sup> IFRCRC, "DREF Operation: South Africa – Floods," February 2011. <http://www.ifrc.org/docs/appeals/11/MDRZA005.pdf>

<sup>118</sup> SALGA, Sabelo Gwala, "Disaster Risk Reduction: A Multi Stakeholder Approach to Targeted Intervention in Selected Municipalities," March 2013. [http://www.salga.org.za/app/webroot/assets/files/Research\\_Results/Disaster%20Risk%20Reduction%20-%20March%202013%20-%20Publication.pdf](http://www.salga.org.za/app/webroot/assets/files/Research_Results/Disaster%20Risk%20Reduction%20-%20March%202013%20-%20Publication.pdf)

<sup>119</sup> SANBI, "Climate Change Adaptation: Perspectives for Disaster Risk Reduction and Management in South Africa," 2013. [https://www.environment.gov.za/sites/default/files/reports/ltasphase2\\_perspectivesfordisastermanagementinSA.pdf](https://www.environment.gov.za/sites/default/files/reports/ltasphase2_perspectivesfordisastermanagementinSA.pdf)

### 3.6.3. Disaster Management Adaptation in the North West Province and South Africa

In terms of existing disaster management frameworks and structure, the North West province appears to have significant capacity. The Department of Local Government and Human Settlements is responsible for Disaster Management and for implementing the National Disaster Management Framework at the provincial level. According to an assessment by the South African Local Government Association (SALGA), the following Disaster Management related bodies in the North West province are all in place and functioning effectively: the disaster risk management centre, the disaster risk management advisory forum, an inter-departmental disaster risk management committee, a volunteer disaster management unit, and a disaster risk management plan is also in place as part of the province's development plan. However, a case study of Mahikeng Municipality by SALGA revealed that even with all the right institutional structures in place, actual capacity to respond to disasters suffered from challenges of lack of equipment, old or non-functioning equipment, old vehicles, and inadequate capacity to deal with the high season of veldfires (May-July).<sup>120</sup>

Based on a literature review and engagement with stakeholders at two provincial workshops, there isn't enough evidence to suggest that existing disaster management structures and policy frameworks and regulations at the provincial level have actively and explicitly integrated climate change. The department and officials are well aware of the additional risks posed by climate change and thus are implicitly prepared for the increase in climate related disasters. However, this needs to be made explicit and climate change needs to be mainstreamed in provincial disaster management efforts so that an increase in resources and skills training can be assured in the face of growing threats.

The national level LTAS project produced a number of recommendations for climate change adaptation in the disaster risk management sector. These include: continuous monitoring; establishment and increased deployment of flood and drought early warning systems; improved land care, catchment management, and water-sensitive urban design; enforcement of existing zoning practices to reduce the number of vulnerable people in flood-risk areas; maintenance and correct operation of existing infrastructure; integrated design and planning to take into account climate risk and change uncertainty; and improved safety-nets and income diversification for particularly vulnerable populations.<sup>121</sup>

South Africa's National Climate Change Response Strategy also laid out several recommendations for adaptation to climate change, in relation to the disaster management sector. It urges that South Africa: continue to develop and improve early warning systems for weather and climate (especially severe weather) events and pest infestation events and to ensure that these warnings reach potentially affected populations timeously; seek to collaborate with neighbouring states to share early warning systems with regional applications and benefits; continue to promote the development of risk and vulnerability service centers at universities, which will in turn support resource-constrained municipalities; facilitate increased use of seasonal climate forecasts amongst

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<sup>120</sup> SALGA, Sabelo Gwala, "Disaster Risk Reduction: A Multi Stakeholder Approach to Targeted Intervention in Selected Municipalities," March 2013. [http://www.salga.org.za/app/webroot/assets/files/Research\\_Results/Disaster%20Risk%20Reduction%20-%20March%202013%20-%20Publication.pdf](http://www.salga.org.za/app/webroot/assets/files/Research_Results/Disaster%20Risk%20Reduction%20-%20March%202013%20-%20Publication.pdf)

<sup>121</sup> SANBI, "Climate Change Adaptation: Perspectives for Disaster Risk Reduction and Management in South Africa," 2013. [https://www.environment.gov.za/sites/default/files/reports/ltasphase2\\_perspectivesfordisastermanagementinSA.pdf](https://www.environment.gov.za/sites/default/files/reports/ltasphase2_perspectivesfordisastermanagementinSA.pdf)

key stakeholders, such as in the water and agriculture sectors; maintain, update, and enhance the SARVA as a tool that provinces and municipalities may use to inform climate change adaptation planning; cooperate with social networks such as community organisations, non governmental organisations (NGOs), women and farmers organisations, and the Adaptation Network to help raise awareness, transfer technology, and build capacity; and develop mechanisms for the poor to recover after disasters, including micro-insurance.<sup>122</sup>

### 3.6.4. Disaster Management Adaptation Lessons and Best Practices from Elsewhere

Internationally, a great deal of work is underway to integrate and mainstream climate change into disaster risk reduction and disaster management instruments and institutions. At the broadest level, the Hyogo Framework for Action calls on all nation states to “promote the integration of risk reduction associated with existing climate variability and future climate change,” and makes multiple references to climate change as an exacerbating factor for disaster risk in the coming years.<sup>123</sup> The International Federation of Red Cross and Red Crescent Societies have established the Red Cross Red Crescent Climate Center, to help humanitarian communities in responding to climate change related disasters and to facilitate better preparation for such disasters as they increase in frequency or intensity. They have published several useful guides to help the disaster management community build capacity to respond to climate change risks,<sup>124</sup> including a “Guide to Mainstreaming Disaster Risk Reduction and Climate Change Adaptation,”<sup>125</sup> which provides guidance for mainstreaming in several sectors such as healthcare, water sanitation and hygiene, migration, human settlements, livelihoods and food security, and natural resource management. The Intergovernmental Panel on Climate Change (IPCC) specifically addressed, in the Special Report in Extreme Weather (SREX), the need for disaster management to adapt to a changing climate. Amongst other things, it noted that management strategies that focus on reduction of everyday (or chronic) risk (as opposed to solely extreme events) help reduce both disaster risk and improve the ability to respond to extreme events; greatly improved and strengthened disaster risk management and adaptation will be needed as part of the development process; and community participation in planning, decentralized decision making, and the use of local community knowledge and capacity will be critical.<sup>126</sup>

For practitioners of disaster management and for policymakers engaged in disaster management planning and regulation, there are a host of resources providing exposure to best practices. These include the Global Facility for Disaster Reduction and Recovery’s “Understanding Risk: Best Practices in Disaster Risk Assessment,”<sup>127</sup> which (inter alia) describes the use of open data and crowdsourcing the help disaster risk reduction and response, the implementation of community-based risk assessments, and the use of satellite earth observations to support disaster management. The Australian National Climate Change Adaptation Research Facility recommends the introduction of

<sup>122</sup> South African National Biodiversity Institute (SANBI) and Department of Environmental Affairs, “National Climate Change Response White Paper,” (2011). <http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf>

<sup>123</sup> United Nations International Strategy for Disaster Reduction, “Hyogo Framework for Action,” 2007. [http://www.unisdr.org/files/1037\\_hyogoframeworkforactionenglish.pdf](http://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf)

<sup>124</sup> IFRC, “Aggravating Factors: Climate Change,” <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/aggravating-factors/climate-change/>

<sup>125</sup> IFRC, “A Guide to Mainstreaming Disaster Risk Reduction and Climate Change Adaptation,” 2013. [http://www.ifrc.org/PageFiles/40786/DRR%20and%20CCA%20Mainstreaming%20Guide\\_final\\_26%20Mar\\_low%20res.pdf](http://www.ifrc.org/PageFiles/40786/DRR%20and%20CCA%20Mainstreaming%20Guide_final_26%20Mar_low%20res.pdf)

<sup>126</sup> IPCC, SREX, Allan Lavell and Michael Oppenheimer, “Climate Change: New Dimensions in Disaster Risk, Exposure, Vulnerability, and Resilience,” 2012. [http://www.ipcc.ch/pdf/special-reports/srex/SREX-Chap1\\_FINAL.pdf](http://www.ipcc.ch/pdf/special-reports/srex/SREX-Chap1_FINAL.pdf)

<sup>127</sup> The World Bank, “Understanding Risk: Best Practices in Disaster Risk Assessment – Proceedings from the 2012 UR Forum,” 2012. [http://www.gfdrr.org/sites/gfdrr/files/publication/UR\\_Proceedings\\_120912\\_reduced.pdf](http://www.gfdrr.org/sites/gfdrr/files/publication/UR_Proceedings_120912_reduced.pdf)

collaborative funding (across national, provincial, local, and community levels) for groups to work together to tackle disaster risk in various areas; the use of local community resilience grants; and embedding researchers with disaster response and management teams so as to produce better studies and observations of areas for intervention.<sup>128</sup> The Catalyst Project's "Best Practices Notebook for Disaster Risk Reduction and Climate Change Adaptation" provides insights into institutional and organizational change to help mainstream climate change into disaster risk reduction policymaking; ecosystem-based disaster risk reduction; and management of climate change disaster risks in urban areas.<sup>129</sup> The World Bank has also published a guide for disaster management practitioners trying to integrate climate change, titled "Understanding Risk in an Evolving World: Emerging Best Practices in Natural Disaster Risk Assessment," which (amongst other things) highlights the use of open data for building resilience; the use of Geographic Information Systems (GIS); Government-to-Government risk assessment capacity building; a framework for modelling future urban disaster risk; and global probabilistic risk assessment modelling.<sup>130</sup>

### 3.6.5. Climate Adaptation Measures for Disaster Management in North West – Recommendations

Preliminary recommendations for climate adaptation strategies in the disaster management field were discussed in the provincial workshop in June. Stakeholders reformulated the recommendations, increased the emphasis on climate change mainstreaming, and provided the following three final adaptation strategies for the North West province in this context:

- I. **Include climate change issues into institutions that are already dealing with disasters:** The province has already established a Disaster Management Advisory Forum at the province-level. This Advisory Forum should integrate climate change issues into its work, and make climate change a standing agenda item in its proceedings.
- II. **Incorporate issues of climate change into municipal disaster management plans:** Municipalities must incorporate climate change into their own individual disaster management plans (this should be done in alignment with the national level Disaster Management Act, which should also integrate consideration of climate change during its ongoing review period). This process has already begun for many municipalities, but should be accomplished comprehensively.
- III. **Develop sector-specific disaster management plans, incorporating climate change:** Each key sector within the province needs to develop its own disaster management plan. These plans should also integrate climate change considerations.

*In terms of responsibilities, all departments are responsible themselves for including issues of climate change into their own plans. Departments should seek increases in their budgets to allow for better disaster management and planning, with the inclusion of climate change as a criterion.*

<sup>128</sup> Michael Howes et al., NCCARF, "Rethinking Disaster Management and Climate Change Adaptation," 2013.

[http://www.climateaccess.org/sites/default/files/Howes%20et%20al\\_Rethinking%20disaster%20risk%20management.pdf](http://www.climateaccess.org/sites/default/files/Howes%20et%20al_Rethinking%20disaster%20risk%20management.pdf)

<sup>129</sup> Matt Hare et al., "A Best Practices Notebook for Disaster Risk Reduction and Climate Change Adaptation: Guidance and Insights for Policy and Practice from the Catalyst Project," 2013. [http://www.catalyst-project.eu/doc/CATALYST\\_D65\\_Best\\_Practices\\_Policy\\_Notebook.pdf](http://www.catalyst-project.eu/doc/CATALYST_D65_Best_Practices_Policy_Notebook.pdf)

<sup>130</sup> The World Bank, Global Facility for Disaster Reduction and Recovery, "Understanding Risk in an Evolving World: Emerging Best Practices in Natural Disaster Risk Assessment," 2014. [http://www.worldbank.org/content/dam/Worldbank/Feature%20Story/japan/pdf/101414\\_event/Understanding\\_Risk-Web\\_Version-rev\\_1.8.0.pdf](http://www.worldbank.org/content/dam/Worldbank/Feature%20Story/japan/pdf/101414_event/Understanding_Risk-Web_Version-rev_1.8.0.pdf)

*If department budgets are exhausted, additional funding could be sought from the Disaster Management Center. Implementation of these strategies should take place within a year.*

## 4. Conclusion

It is critical that the recommended adaptation strategies in this report not become relegated to archival documentation but that they be translated into implementable and actionable adaptation plans.

For the strategies to be converted into ground reality, it is imperative that the relevant departments for each sector within the province take cognizance of the recommended strategies, and integrate the strategies into their annual planning and budgetary processes. Departments are best placed to assess the yearly and long-term expenditure required for the application of such strategies, and have a detailed understanding of their funding streams. Thus, sector-experts within the departments should be given the responsibility of preparing detailed implementation plans for the relevant strategies, identifying timelines, coordination mechanisms, monitoring and evaluation mechanisms, metrics to gauge the implementation and progress of the strategy, and the required financial and human resources.

In addition, the national Department of Environmental Affairs (DEA), the Department of Agriculture, Forestry and Fisheries (DAFF), the Department of Human Settlements (DHS), the Department of Water and Sanitation (DWS), the Department of Mineral Resources (DMR), the Department of Rural Development and Land Reform (DRDLR), and the Department of Tourism are urged to take note of the sector-by-sector strategies recommended for the province. National Departments can investigate potential ways of supporting the development of implementation plans in the corresponding sector at the provincial level, and work with the National Treasury to assist the allocation of funds for the implementation of the corresponding sector strategies.

Similarly, Local Municipalities within the province are also urged to take cognizance of the recommended strategies and identify ways to integrate the strategies into their next Integrated Development Plans (potentially with assistance and guidance from SALGA).

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