DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND DEVELOPMENT PLANNING, WESTERN CAPE, SOUTH AFRICA

A CLIMATE CHANGE STRATEGY AND ACTION PLAN

FOR THE WESTERN CAPE, SOUTH AFRICA

RESPONDING TO THE CHALLENGE OF CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT IN THE WESTERN CAPE

SUMMARY
2008

Vision statement

The Western Cape's climate change response strategy and action plan aims to strengthen the province's resilience to climate change and its adaptive capacity, particularly in vulnerable economic sectors and communities. It further aims to maintain the Western Cape's status as a relatively low greenhouse gas emitter by reducing the provincial carbon footprint, even in the face of economic growth.

Structure of this report

This report provides a summary and overview of the main report:

A climate change strategy and action plan for the Western Cape.

The complete document can be found at:

http://www.capegateway.gov.za/eadp

This summary report is divided into two main sections, as follows:

- First section - "The need for a response to climate change in the Western Cape" - examines climate change and socio-economic factors in the Western Cape, and establishes the need for a climate change response in the region.
- Second section - "The response strategy and action plan" - outlines the broader aspects of the Western Cape's climate response strategy.

Foreword

For the immediate future, the focus must be on planning to adapt to climate change and its impacts using the best available knowledge.

It is clear that climate change will affect the Western Cape Province.

Climate Change is happening now and is one of the biggest challenges facing the international community. Even with the achievement of significant global greenhouse gas emission reduction targets, there will still be changes to the global climate and to our climate here in the Western Cape. These changes will affect everyone in our community - government, industry, community groups and individuals - and all sections of the community have a part to play in responding to climate change.

To achieve this vision, we need to act now using our existing knowledge. We then need to set out longer-term strategies to continue to improve our understanding of the impacts of climate change. We need to plan and adapt to the expected changes.

The Western Cape has relatively low levels of greenhouse gas emissions when compared to other parts of South Africa, but it is incumbent on us to look for local opportunities to maintain these low emission levels. We will also continue to participate in national policy development and strategies on greenhouse gas mitigation.

This Strategy builds on the work already done in the province and sets out our direction now and for the longer term. It sets out the Government's commitment to:

- Leading the response to climate change in partnership with other spheres of government, research institutions, industry and the community
- Planning and adapting now and into the future to minimise possible adverse impacts of climate change and to position the province to take advantage of emerging opportunities
- Focusing on water as our already scarce resource that is extremely vulnerable to climate change impacts
- Developing renewable energy and energy efficiency options and minimising our greenhouse gas emission levels
- Continuing to improve our knowledge of the impacts of climate change
- Informing and involving our industry sectors and the community to ensure they are better able to adapt and respond to the challenges associated with a changing climate.

The Strategy promotes a strategic outlook as well as practical actions, land use and development planning based on a risk management approach and a culture of innovation to capture opportunities. It aligns with the goals established through the Sustainable Development Strategy for the Western Cape and will provide a sound foundation for future climate change responses in the province.

The need for a response to climate change in the Western Cape

Climate change in the Western Cape

Climate change is one of the biggest challenges facing the international community. Although media coverage and talk is generally about the future impacts of climate change, our climate is in fact already changing and a further level of climate change is inevitable – whatever the global response to reducing greenhouse gas emissions.

Research has indicated that the south-western corners of the three continents south of the equator - Africa, Australia and South America - are likely to be the most affected by climate change. This has already been evidenced by the impact on Perth in Australia. Similarly, because of its location, the Western Cape is likely to be particularly vulnerable to climate change - and changes to the provincial climate will affect everyone in our community.

What we know about the future

- Much work is being conducted on a global scale to evaluate global warming and its impacts. Significant local variation may occur around these global generalisations. The regional response needs to be carefully evaluated.
- Based on the existing scientific understanding, it is increasingly clear that there will be continued changes in the regional climate. These changes will, in nearly all respects, impose additional stress with dominantly negative (and some positive) consequences for the province unless immediate steps are taken to optimise the opportunities which underlie these challenges.
- There is little doubt that the Western Cape will face some degree of climate change, which is expected to be evident by as early as 2030.
- This necessitates a strategic response on the part of the provincial and national government, predicated on the best scientific understanding of the regional expressions of climate change.

A number of stress factors have been identified, with likely results as in Table 1 (although the scale and exact manifestation of the change is less certain). The above statements should not be regarded as forecasts but rather as indications of possible directions and scale of change. The most useful approach is to use these projections as an experimental basis for assessing additional risk – that is, the potential exposure to hazards to life, biodiversity or economic interests that climatic changes on this scale could pose.

Global warming and greenhouse gas emissions

The so-called 'greenhouse gases' (GHGs), including carbon dioxide and methane, are gases that prevent long-wave radiation energy from leaving the Earth's atmosphere. The presence of this trapped radiation tends to warm the planet's surface.

Temperature	• An increase in the annual average temperature of at least 1 ºC by 2050. (The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report released in February 2007 shows an expected increase of between 3 and 5 ºC by 2100.)
Water	• Reduced rainfall in the western parts of the Western Cape Decreased water resources • Reduced soil moisture from an increase in temperature coupled with a decrease in average precipitation
Extreme weather events	• Possible increase in the frequency and intensity of extreme weather events (e.g. flooding)
Fire	• An increase in conditions conducive to wildfires (higher temperatures and increased wind velocity)
Agriculture	• Temperature impacts on crop activities – crop burn, drought, pests and microbes resulting in yield reductions, and loss of rural livelihoods.

• **Table 1: Climate change stress factors in the Western Cape**

Case study:

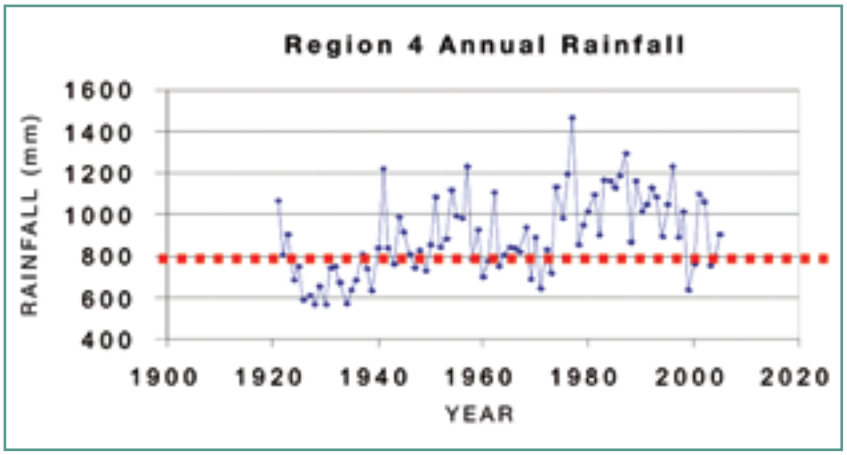
The Western Cape drought of the 1920's

Although droughts in themselves are not climate change, more frequent droughts may be part of a changing climate in a particular area. South Africa experiences periodic droughts. This includes several devastating droughts.

- A sustained drought started in 1919 and went on well into the 1920s in the Western Cape.
- The dry spell from July 1991 to June 1992 [with a mean rainfall of fifteen and a half inches (390mm)] is reckoned as the fifth driest on record since 1920 (Vogel and Drummond, 1993).
- The other major post-war dry spells in order of severity were: 1925/26; 1923/24; 1932/33; 1921/22 and 1982/83.
- The most recent severe drought in the Western Cape was in 2003. A key question for the province now is whether it could sustain an extended drought of similar magnitude.

During the 1920s drought, farming was the staple and farmers had little option but to adapt, as policy makers and regulators were late in coming to their support. Large-scale failure of agriculture was one of the main features. Population levels were approximately one-third of current levels and infrastructure and services did not draw on water supply at current levels.

Direct losses of the 1919 drought (Union of South Africa 1924) alone were estimated by the Census Department at 16 million British pounds at pre-1914 prices, or 308 billion rands - about a third of South Africa's GDP at 2005 prices. The Commission of Enquiry set up to investigate the issues associated with the periodic drought was also careful to point out that although the cost to sectors of the economy other than agriculture was not easily quantifiable, the drought indirectly affected every profession, business and trade.



- **Figure 1: Region 4: Annual rainfall from 1930 to date (CSAG, 2007)**

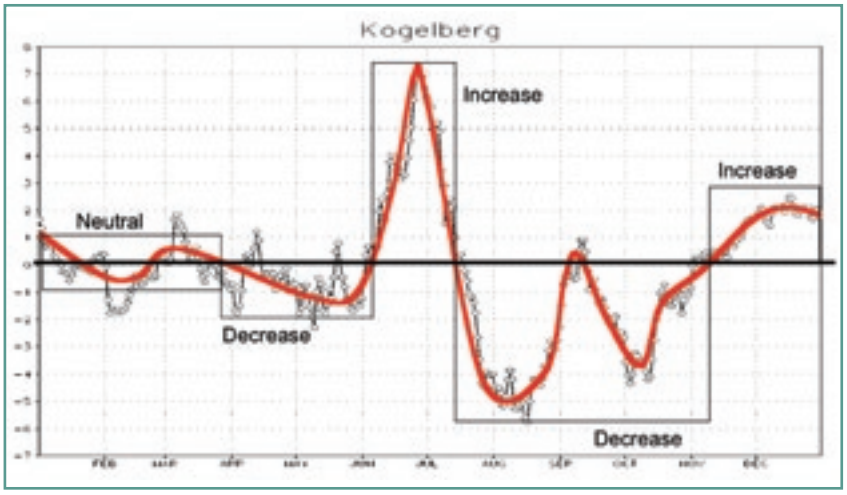
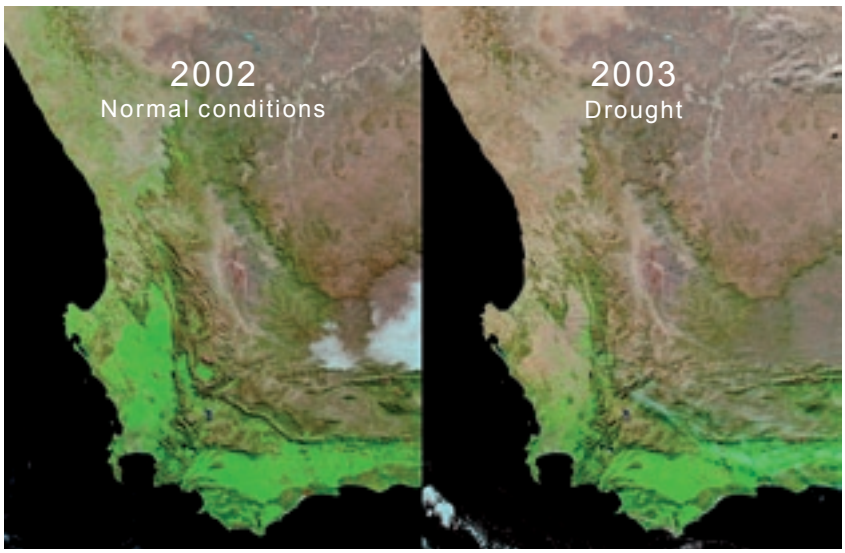


Figure 2: The sub-seasonal trends for precipitation for one location (Kogelberg). This diagram shows changes in rainfall (and dewfall, fog, etc.) patterns within the four seasons (CSAG 2007)



Satellite photographs showing the effect of the drought of 2003

Summary of temperature changes expected by 2030

- Planning should be for a minimum of 1 °C warming by the late 2030s compared to the second half of the 20th century, and warmer minimum temperatures.
- The warming trend increases from the south-west to the north-east.
- Warming is most pronounced in the spring and summer months.

Resultant threats to communities and livelihoods

An increase in minimum temperature increases crops' susceptibility to crop burning, as well as increasing the incidence of pests such as fruit fly.

Infrastructure shows sensitivities to increased temperatures, for example Telkom experienced infrastructure failure in the Clanwilliam area during the February 2007 heatwave.

Figure 3 shows (a) the daily maximum temperatures and (b) daily minimum temperatures for the last 50 years, smoothed, with a 365 day moving average, for a location in the Swartland. The strongest warming trend is apparent in the minimum temperatures.

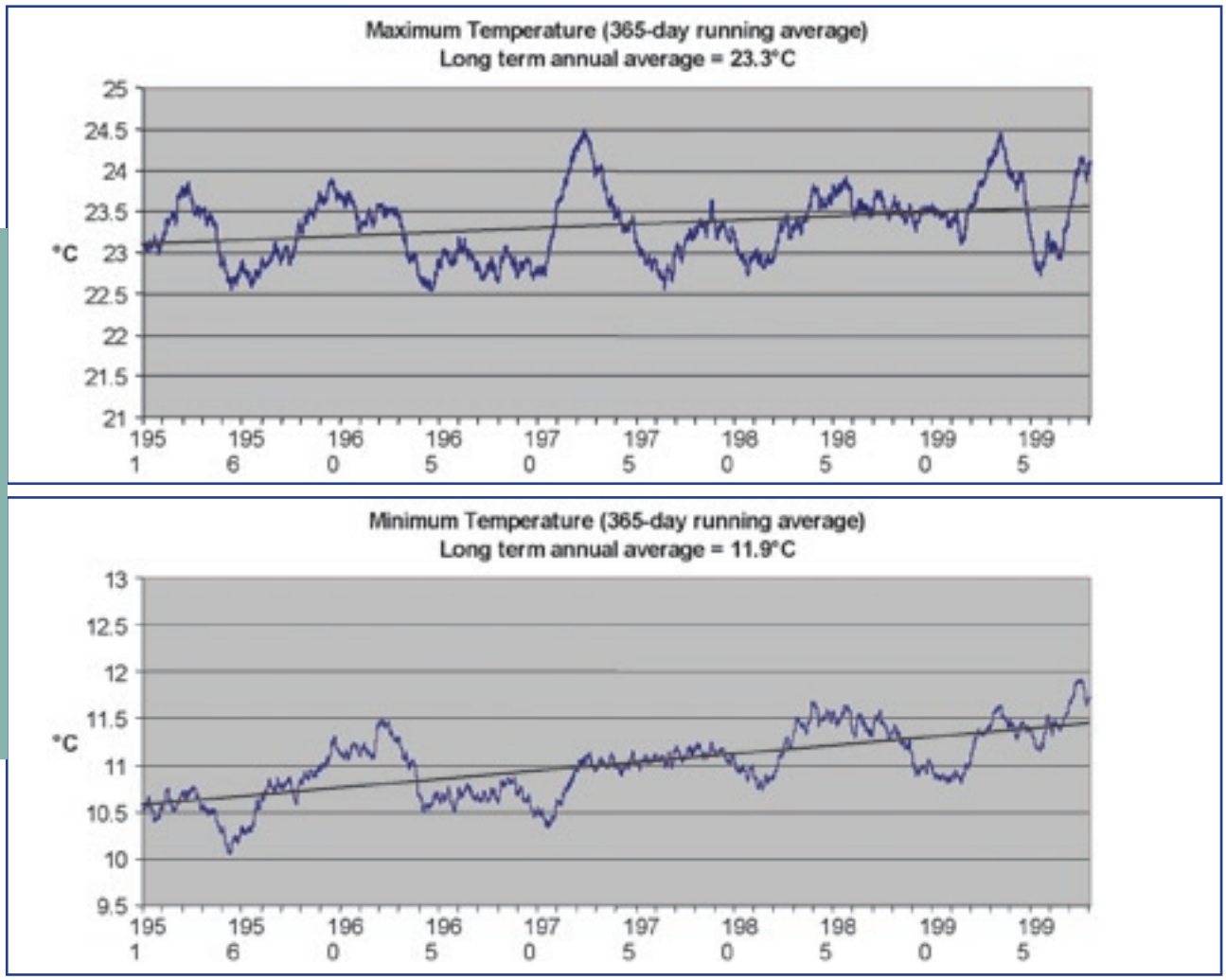


Figure 3: Historical warming trend in daily maximum and minimum temperatures for a location in the Swartland.

Change to climate variable	Examples of impacts
Higher mean temperatures	• Increased evaporation and decreased water balance. • Increased severity of droughts (see below). • Increased incidence of pests such as fruit fly
Higher maximum temperatures, more hot days and more heat waves	• Increased incidence of death and serious illness, particularly in older age groups. • Increased heat stress in livestock and wildlife. • Increased risk of damage to some crops. • Increased susceptibility to crop burning. • Increased wild fire danger (frequency and intensity). • Increased threat to infrastructure such as Telkom. • Increased electric cooling demand and reduced energy supply reliability.
Higher minimum temperatures, fewer cold days and frost days	• Decreased risk of damage to some crops and increased risk to others. • Extended range and activity of some pest and disease vectors. • Reduced heating energy demand. • Increased risk to crops such as deciduous fruits that rely on cooling period in autumn.
Decrease in precipitation	• Decreased average runoff, stream flow. • Decreased water quality. • Decreased water resources. • Decrease in shoulder seasons threatens the Western Cape fruit crops. • Increased fire danger (drying factor). • Impacts on rivers and wetland ecosystems.
Increased severity of drought	• Decreased crops yields and rangeland productivity. • Increased damage to foundations caused by ground shrinkage. • Increased fire danger. • Reduced economic activity including industry. • Decrease in positive investment environment in the Western Cape.
Decreased relative humidity	• Increased wildfire danger. • Increased comfort of living conditions at high temperatures.
Increased intensity of extreme events	• Increased risk to human lives and health. • Increased storm surge leading to coastal flooding, coastal erosion and damage to coastal infrastructure. • Increased damage to coastal ecosystems. • Increased soil erosion. • Increased pressure on disaster relief systems.
Increased mean sea level	• Salt water intrusion into ground water and coastal wetlands. • Increased coastal flooding (particularly when combined with storm surges).

Table 2: Climate impacts for the Western Cape

An integrated climate change response

There are two key ways to respond to a changing climate:

- One is through adaptation, which is the process of recognising the effects of climate change and adapting to these changed conditions.
- An equally important response is mitigation - the reduction of the intensity of climate change effects by reducing greenhouse gas emissions. This approach recognises that in the longer term, countries — and individuals — can stem the tide of climate change through activities that reduce the quantities of greenhouse gases we produce.

As part of a developing country, the focus of the Western Cape's climate response strategy is first and foremost on adaptation, so that development can be supported. However, mitigation also plays a central role in the strategy.

Adaptation

Adaptation implies behavioural change in response to the changed conditions, for example:

- the implementation of alternative farming practices (for example, growing alternative, more appropriate crops)
- appropriate measures in development planning (for example, implementing building restrictions in the 1:50 year flood plain)
- changes in demand-side management practices.

Demand-side management

Demand-side management is the practice of controlling the use of resources (such as water), and utilities (such as electricity) by controlling the demand for these resources. For example, making electricity more expensive at peak hours would result in decreased use during those times. This implies behaviour change by the consumer rather than the supplier.

Adaptive capacity

Some **adaptation** in response to the observed change in conditions takes place naturally. The ability of a system or resource to adapt naturally/ autonomously is referred to as a system or resource's **adaptive capacity**.

Case study:

The wine industry of the Western Cape

During the risk and vulnerability assessment of the agricultural sector undertaken for this study, it emerged that climate stresses are already being felt by the wine industry. Changing factors including rainfall patterns and temperatures are making some cultivars less viable in the Western Cape wine-growing regions.

Mitigation

This approach implies radical changes in the use of technology, and employing practices that **actively reduce carbon emissions** such as:

- innovative industrial processes
- the use of cleaner fuels
- the implementation of energy efficiency measures
- the enforcement of fuel-efficiency in vehicles.

The long 'lead-in time' of climate change means that a certain level of climate change is inevitable – meaning that we will have to adapt in order to maintain economic stability and enjoy a measure of continued growth. Adaptation, however, is not enough. It will see the Western Cape through effective risk management if integrated effectively in decision planning, stewardship and resource conservation decision- making and implementation processes, but it needs to be coupled with mitigation strategies that aim to reduce the provincial carbon footprint. The Western Cape is a relatively low emitter in terms of local direct emissions. However its contribution to national emissions is significant given the amount of electricity that is imported from Mpumalanga and consumed locally (over 90% of the province's electricity is imported).

Did You Know?

South Africa is a significant global emitter of GHGs (19th biggest GHG emitter in the world) with over 70% of emissions arising from electricity production (Climate Change Indicator Analysis Database, World Research Institute).

Why do we need a mitigation response?

Anthropogenic (human-made) greenhouse gas (GHG) emissions are loading the atmosphere with ~8.8 GtC (Gigatonnes of carbon) which equates to 32.3 $GtCO_2$ annually at present. The oceans and vegetation are absorbing about half of that. Carbon dioxide equivalent concentrations in the atmosphere have risen from 280 ppm before the industrial revolution to ~430 ppm now (these values include methane – CH_4 and nitrous oxide – NO_2). This increase has created a global average radiative forcing of about 2.3 $W.m^{-2}$, which has pushed up global temperatures. Observed effects of this are contracting polar ice sheets, glacial retreat everywhere, a sea level rise of about 1.5 mm/a, earlier spring in the northern hemisphere and observed rainfall changes in many locations around the world, amongst numerous other effects.

Because carbon dioxide has a long life in the atmosphere (~50 years on average), and there are insurmountable technological and financial barriers to switching immediately from fossil fuel dependence to alternative energy sources with lower GHG emission rates, atmospheric concentrations of CO_2 will continue rising for the foreseeable future. The world is committed to at least a doubling of CO_2 equivalent concentrations to 550 ppm or more by 2100, but possibly trebling under Business as Usual (BAU) emissions scenarios, in which dependence on carbon-based fossil fuels for transport and energy generation continues and grows.

Global average atmospheric temperatures will rise about 2-5 °C over the next 100 years, with a 50% chance of average temperatures exceeding 5 °C if the GHG concentration trebles. These projected temperature increases are unprecedented: the world has no experience of what this could do to global climate and all related human and ecosystem dependencies, or how to cope with such changes. At the upper end of projected temperature rises, the global climate impacts could be substantial or even disastrous.

South Africa is a signatory of the United Nations Framework Convention on Climate Change. Under the Kyoto Protocol, South Africa, as a developing nation, does not have to take active steps to mitigate this country's carbon emissions. While mitigation efforts are not going to be effective in the short term (10 - 30 years), we must make progress in developing technologies and approaches to reducing carbon emissions. International concern is already leading valuable markets in the European Union to impose carbon emission reduction targets on their suppliers. The Western Cape stands to lose market share on agricultural goods, for example, if no attempt is to be made to achieve at least carbon neutrality (no net emission of carbon for a produced good).

Vulnerable systems and sectors in the Western Cape

Prioritising response actions to climate change requires the following:

- Identification of vulnerable systems (both natural and human) and the estimation of costs if these systems fail
- Identification of the scope to reduce risks, strengthen adaptive capacity and capture potential benefits.

A response strategy that encompasses adaptation must identify sectors and systems that are vulnerable to change, coupled with an examination of the scope to increase their resilience. A further consideration is the identification of vulnerable systems or regions whose failure or reduced functioning is likely to carry the most significant consequences.

Vulnerable systems identified as priorities for this strategy are:

- Natural systems – water, biodiversity, and coastal and marine systems and resources
- Economic sectors – agriculture, tourism and fisheries
- Economic resources and infrastructure – energy, transport, health and air quality
- The built environment, livelihoods and disasters – social systems, extreme events (floods, fires).

Vulnerability

Vulnerability is a function of exposure to climate factors, sensitivity to change and capacity to adapt to that change. Vulnerable systems are those that are highly exposed, sensitive and less able to adapt.

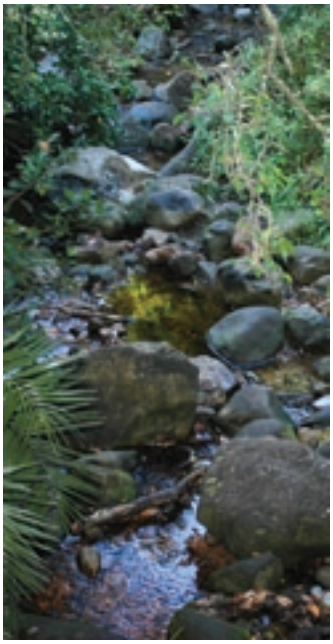
Natural systems and resources

The availability of **water** is essential for many industries, livelihoods and other natural resources. Many cities and regions in the Western Cape face water stress already. In most cases, climate change will increase this pressure through increased temperature, possible reductions in rainfall, drying, and related (possible) increase in extreme weather events. Reduced water supply and a drought as severe as the one experienced in the province in the 1920s can have catastrophic short- and medium-term effects in terms of human and economic losses.

Options for responding to water stresses (as already experienced) could include the systematic inclusion of climate risk on both the supply and demand side in all the province's major catchments.

Much work is already being done in the area but climate risk strengthens the need to carry out the following measures:

- Harness existing supply.
- Manage resources more efficiently (for example, fix leaks).
- Implement the ecological reserve (that is, establish the water requirement for sustainable functioning of river ecosystems).
- Develop more robust catchment models.
- Improve support tools for decision-making (for example strengthen climate and water resource information platforms that support municipalities in decision-making).
- Alternative water supply options such as desalination plants are under consideration, however, these plants are energy intensive



Invasive alien species

Invasive alien species are plant and animal species not indigenous to an area that may, in colonizing the area, affect local species negatively.

Eco-systems and biodiversity are likely to come under significant pressure from climate change, which is likely to proceed at a rate that will exceed the natural adaptive capacity of many organisms and systems.

In some cases, there may be scope to assist the adaptation of vulnerable systems and species so the threat of climate change should be specifically factored into related planning and actions.

- Managing Invasive Alien Species in an integrated manner based on prevention, early response and removal is critical to protecting the province's delicate and unique fynbos eco-system, for example, which in turn protects natural water supply.

Other options for managing biodiversity in the face of climate risks include extending protected areas, managing wetlands consistently and effectively and increasing the provincial fire risk ratings.

Coastal and marine systems and resources are exposed to extreme events - that is, extreme weather events such as flooding and storms. The frequency and intensity of such extreme events is likely to increase under climate change.

- Increased intensity of flooding and coastal storms lead to increased salt-water intrusion, raised groundwater tables and increased coastal erosion.
- The province's coastline is sensitive to sea level rises, which will impact on coastal ecology – particularly where developments are too close to high-water lines.
- The impacts of climate change are also economic: the Western Cape's 50 estuaries are particularly vulnerable to climate change and these are important feeding and nursery grounds for many shellfish, fish and bird species. Estuaries are economically important as fisheries.

Possible options for mitigating climate risk include:

- integrating climate risk considerations into coastal development planning
- strengthening existing coastal assets and infrastructure
- refining the understanding of socio-economic impacts of reduced fisheries – particularly on the West Coast, the hub of the South African fishing industry.

Economic sectors

Agriculture systems have an inherent level of **adaptive capacity** to climate variability and change. This is evidenced through changes in land management practices, crop and cultivar choices. However, many aspects of agricultural life in the province are already found to be at (or close to) their thresholds.

The agri-business units at highest risk will be:

- Those that are already under stress economically and/or biophysically as a result of land degradation, salination and loss of biodiversity
- Those at (or close to) the threshold of their climate tolerance
- Emerging farmers who may have limited capacity, resources and skills to adapt to and withstand economic pressures
- Rural livelihoods that depend on agri-business-based economic activity for jobs
- Commercial farmers who have made significant long term investments, for example in irrigation systems, processing facilities and some cultivars
- Agri-business activity that is dependent on the export market, which is itself adapting to climate change.

Options and strategies to increase resilience and reduce the vulnerability of agriculture should include integrated land care management, research on pests and microbes that are particularly sensitive to climate change, research on cultivars that are capable of handling temperature increases and drought and more efficient irrigation for water conservation.

Fisheries are sensitive to climate change and risks (as discussed in the coastal and marine section). Communities that depend on the resource, as well as commercial industry, are at risk. The last eight to ten years have seen significant financial investment in the sector and that investment is potentially at risk due to climate impacts.

Options for adaptation for fisheries include researching the socio-economic impacts, understanding the adaptive capacity of fishing stock (for example, migration eastwards) and factoring climate risks into calculating allocation allowances.

The tourism sector in the Western Cape is largely dependent on international tourists, mostly from Europe, who may respond to international adaptation and mitigation responses to climate change.

- The introduction of a **carbon tax** on air travel may, for example, encourage long-haul tourists to seek destinations closer to home, thus making travel easier on the pocket.
- Tourism places stress on scarce resources such as water.
- Increased temperatures in the province may lead to an increased energy demand, for example, in greater demand for air conditioning.
- Increased air pollution may impact negatively on tourism, and threats that climate change poses to the province's coastal infrastructure and beaches are also of concern.

A carbon tax is a tax on activities that consume fossil fuels (for example burning wood, using petrol, etc.).

Since long-distance flights use large quantities of fuel, this would make flights to the Western Cape very expensive.

Mitigation and adaptation responses for the tourism sector could include:

- factoring climate risks into development planning and approval processes in the industry
- researching the socio-economic impacts of climate change on tourism and monitoring climate impacts, responses and tourism demand closely in the province
- development of alternate sustainable energy sources that includes applications for the tourism industry (such as use of solar water heaters).

Economic resources and infrastructure

- Demand for energy is temperature sensitive – increasingly so with the penetration of commercial and domestic air conditioning. Peak demand changes from winter to summer and peaks are getting steeper.
- Electricity supply is sensitive to both extreme weather-related events and in some cases temperature itself, as it degrades transmission capacity.
- Infrastructure (electricity distribution) is also susceptible to the impacts of increased bush fires.
- The Western Cape's energy infrastructure has demonstrated its reduced capacity to sustain cumulative impacts. The failure in supply of high quality energy that the province relies on has high social and economic costs.
- The electricity sector is subject to regulation and it is not clear that the regulators are as yet sensitive to the pressures that may be further placed on infrastructure by climate change.
- Climate risks must be factored into the Western Cape's energy planning. Mitigation and adaptation responses include strengthening the province's energy security through diversifying its supply base using available resources – natural gas, wind and solar. Energy efficiency can be managed through demand side management programmes. Opportunities in the established solar water heating industry should be maximized.

The transport sector

is already under stress and development planning has impacted negatively on the sector in that communities are being established further and further away from economic nodes. The sector is a significant contributor to provincial greenhouse gas emissions and growth in demand will exacerbate this problem. In addition, local air quality is impacted on by transport.

Options for mitigation in the sector include introducing cleaner fuel programmes in the provincial fuel mix and commercialising innovation in the province such as the development of South Africa's first 'home-grown' electric car, being developed in Cape Town.

Air quality

can be sensitive to increased temperatures, increased greenhouse gas emissions as well as to an increased demand for local fuels such as paraffin and wood. Local and indoor air quality impacts on **health** and could, as mentioned, affect economic activities such as tourism. Climate change and failure to mitigate may contribute to increased severe air pollution episodes, and early warning systems can help mitigate this.

Options include increasing the number of monitoring stations in the province, disseminating air quality data effectively and introducing cleaner fuel programmes in peri-urban and rural areas.

Other health impacts (apart from those related to air quality) include those that arise from increased penetration of Invasive Alien Species (IAS) as a result of climate impacts such as increased temperatures combined with drying. Some species contaminate water, increasing the risk of disease. Poor air quality (pollution) contributes to increases in respiratory diseases. Other vector-borne diseases may also arise as a result of climate impacts.

Introducing a cohesive programme for managing IAS in the province that has a clear vision and budget is an important adaptation option.

The built environment, livelihoods and extreme events

The built environment and urban areas can be seen as machines to manage and control climate impacts. Some provincial infrastructure and various communities are already threatened by their situation on unsuitable sites, for example housing developments on sites vulnerable to flooding or coastal infrastructure below the high water mark. Climate change is set to alter these limits.

Damage, injury and death as a result of increased extreme events hold particularly strong consequences for livelihoods, settlements, and emergency services that are already beyond their thresholds of coping capacity. In many of the provincial urban and rural centres, increases in severe weather events linked with climate change (such as fires, heavy rainfall, high winds and increased heat waves) could cause significant damage. This is worsened in areas that have increased population density, such as Cape Town and George.

Options to adapt include integrating climate risks into development planning and approval processes; enhancing the emergency services and integrating climate risk into disaster management processes and systems; and maintaining livelihoods (such as rural livelihoods) as far as possible so as to minimize population stress in urban centres.

Dealing with risk and vulnerability in the Western Cape

Climate change can influence and react with a range of macro-variables, for example:

- **increased demands on the province's already-threatened energy security and water supply systems**
- **internal migration if rural livelihoods decline**
- **requisite changes to production processes and socio-economic factors**

Climate response stakeholder consultations revealed the desire for government to lead by example and follow through on strategies and policies adopted. This requires strong provincial government leadership on climate change response, which can manifest through:

- Demonstrated integration of climate risks in decision-making and planning across the different tiers of government
- Leadership by example at a most senior level of government
- Improved understanding and knowledge of climate science, related risks and impacts and the establishment of clear government – science dialogue
- Co-ordinated monitoring, review and revisiting of strategies for identifying and managing risk in vulnerable systems and sectors
- Provision of decision-support tools and climate change related information that could assist local government, developers, the private sectors and households to integrate climate risk into key decisions and resource management. For example, the map in Figure 4 of the Western Cape Catchment Management Areas (CMAs) provides an important tool for management of water resources.
- Dissemination of information about climate change, weather and air quality
- Communications, education and awareness around climate change.

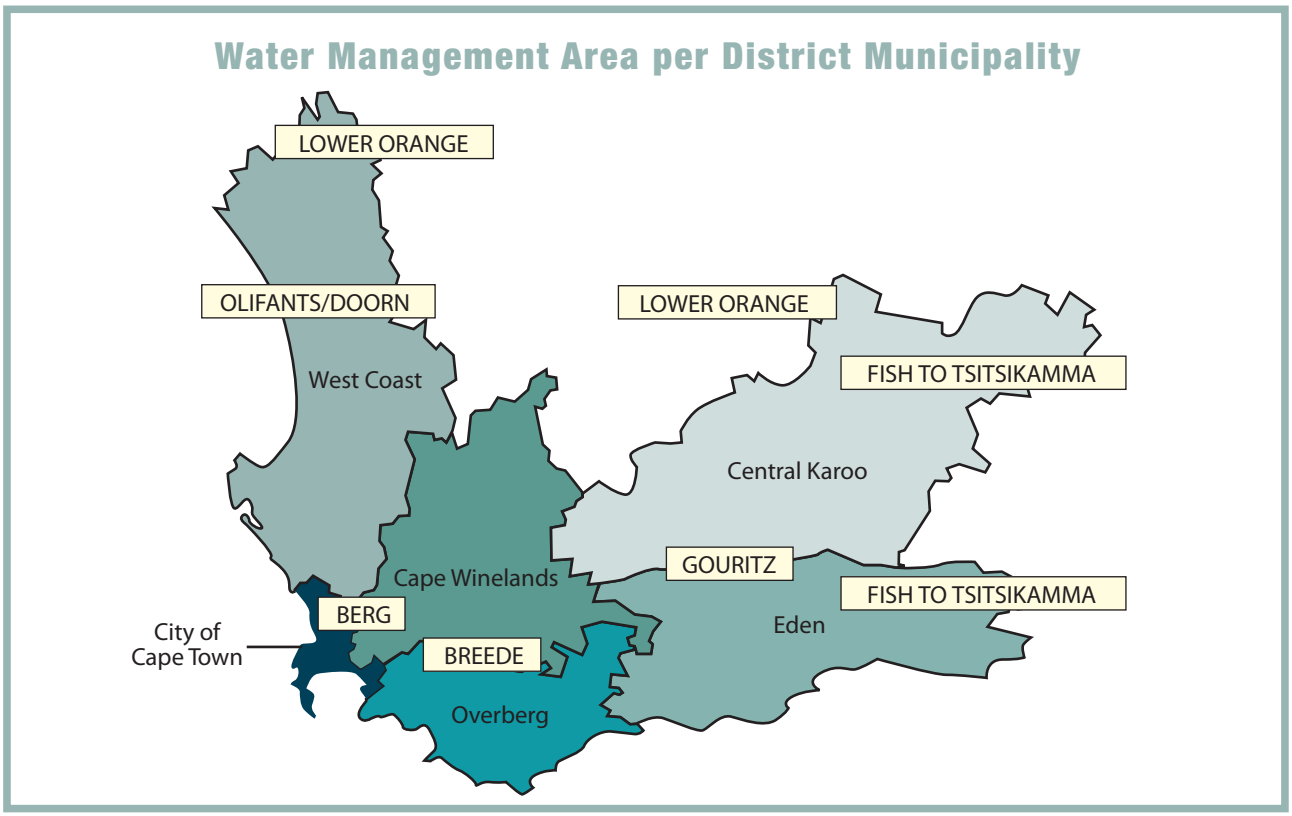


Figure 4: The Western Cape, showing district municipalities and water Catchment Management Areas (CMAs)

Figure 5 below shows various aspects of how informed decision making can be enabled.

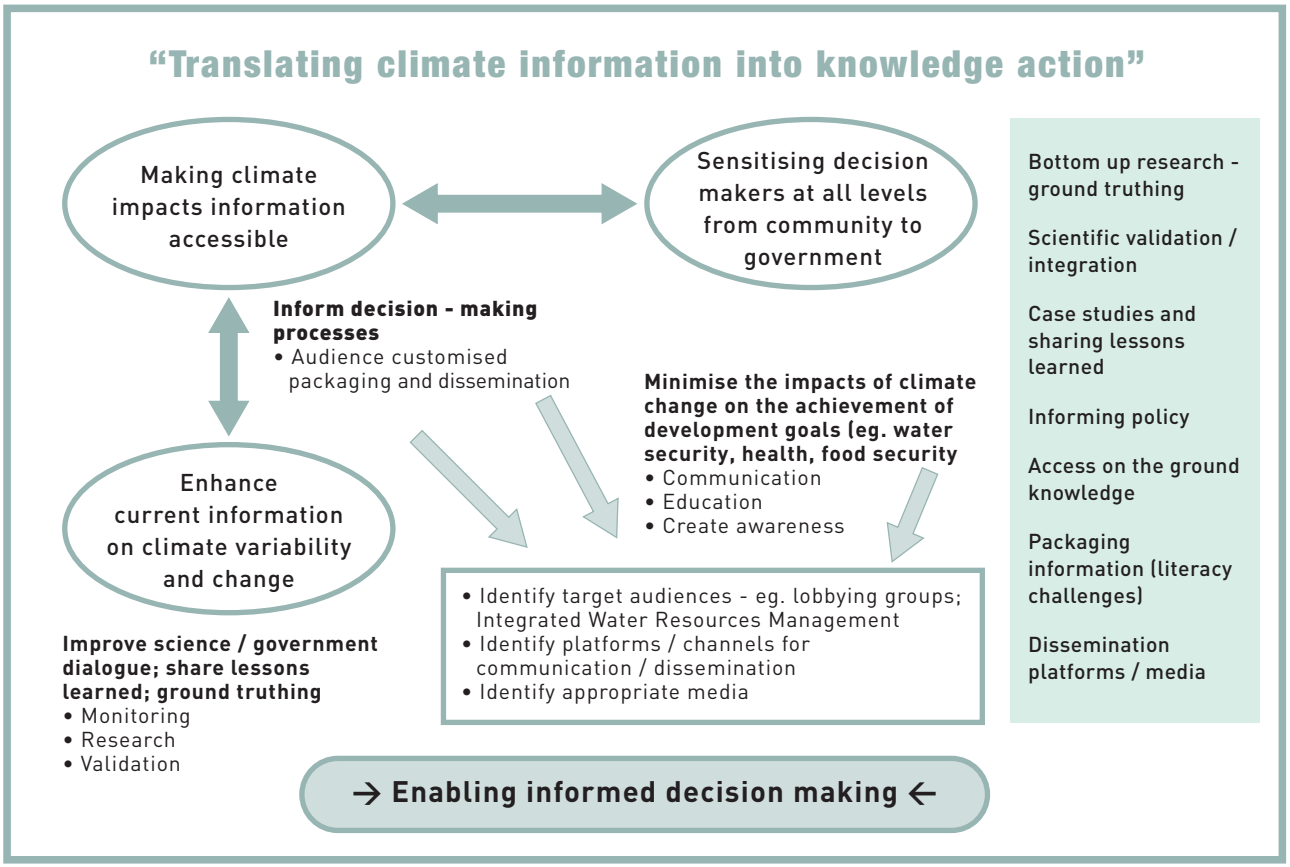


Figure 5: Enabling informed decision making

Developing a provincial response strategy

Stakeholder consultation, international best practice, a comprehensive literature review and expert opinion have informed the development of the strategy. A review of other relevant strategic planning processes and initiatives further underpinned the strategy development.

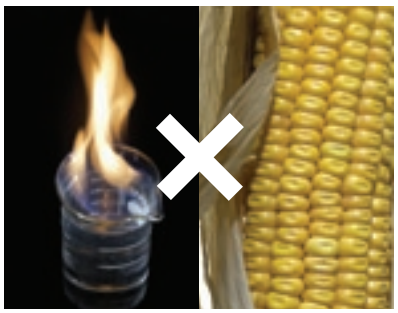
Climate science analysis provided the basis for assessing impacts and developing the adaptation and mitigation strategy. Sensitivity thresholds of the prioritised vulnerable natural and human systems were the tested. Climate science modeling information provided a set of robust statements about expected climate change in the Western Cape and some climate scenarios (i.e. outlines of future climate development for the province). This climate change information was then assessed alongside socioeconomic models so that environmental change was linked with socioeconomic changes.

Stakeholder engagement and discussions with government officials, civil society, community-based organisations, development agencies and private sector industry players were used to provide a rapid assessment of the key stakeholder issues and priorities. This also provided a platform for the communication strategy and awareness campaigns.

Prioritising and evaluating options for climate response actions

Over 280 possible adaptation and mitigation response actions were reviewed through the stakeholder and expert analysis process. These options were reviewed in the light of:

- Cost-effective analysis – assessing the cost of taking action versus the cost of a 'business as usual' approach
- Ease of implementation – who will be the option custodian and can the option be implemented on a practical level?
- Social impact – will the implementation of the action have a positive or negative social impact and will it compromise the goals of sustainable development within the province?
- Environmental effectiveness – will the measure or action have a neutral or positive environmental impact when considered holistically in the context of the environment in which it will take effect?



Case study: Biofuels - an option that didn't make the grade

One of the options that did not meet the criteria in this filter process was the local supply of biofuels in a cleaner fuel programme for the Western Cape. Biofuel production using known feedstock is water intensive and can also be energy intensive. Furthermore, creating a viable local supply of biofuels requires consistent and high agricultural yields but the trend of planting crops on marginal lands at the expense of emerging farmers does not facilitate the achievement of this objective, and also indicates a likely negative social impact and increase in poverty.

The Western Cape Climate Response Strategy and Action Plan

The response strategy and action plan aims to strengthen the province's resilience to climate change and its adaptive capacity, particularly in vulnerable economic sectors and communities. It further aims to maintain the Western Cape's status as a relatively low greenhouse gas emitter by reducing the provincial carbon footprint even in the face of economic growth.

The action plan and strategy identifies **water as a significant risk factor** when considering climate change impacts, risk and vulnerability. Establishing a cohesive water supply and infrastructure management programme that integrates climate risks is a cornerstone of the response strategy and action plan.

The response strategy and action plan is built on the following prioritised programmes:

- An integrated water supply and infrastructure management programme that integrates climate impacts and risks – researching the cost benefit of irrigation, increasing water efficiency including through pricing strategies, establishing uninterrupted water conservancy targets, systems maintenance and repairs and establishing the ecological reserve
- Establishing clear links between land stewardship, livelihoods and the economy – effective land use and land care; protection, maintenance and enhancement of natural resources; strengthening vulnerable communities and protecting livelihoods through targeted research; maintaining diversity in the economy; integrating climate risks into development planning.
- Establishing a focused climate change research and weather information programme
- Reducing the province's carbon footprint – energy efficiency, development of renewable and alternate sustainable energy resources, effective waste management strategies and cleaner fuel programmes for households and transport.

Communications, awareness and education strategy

To be effective, the strategy and actions implemented need an integrated communications strategy that will create awareness and understanding, drive prioritised change and support government policy decisions. Education and training for specific government departments as well as awareness programmes for youth and various sectors are central to the communications strategy.

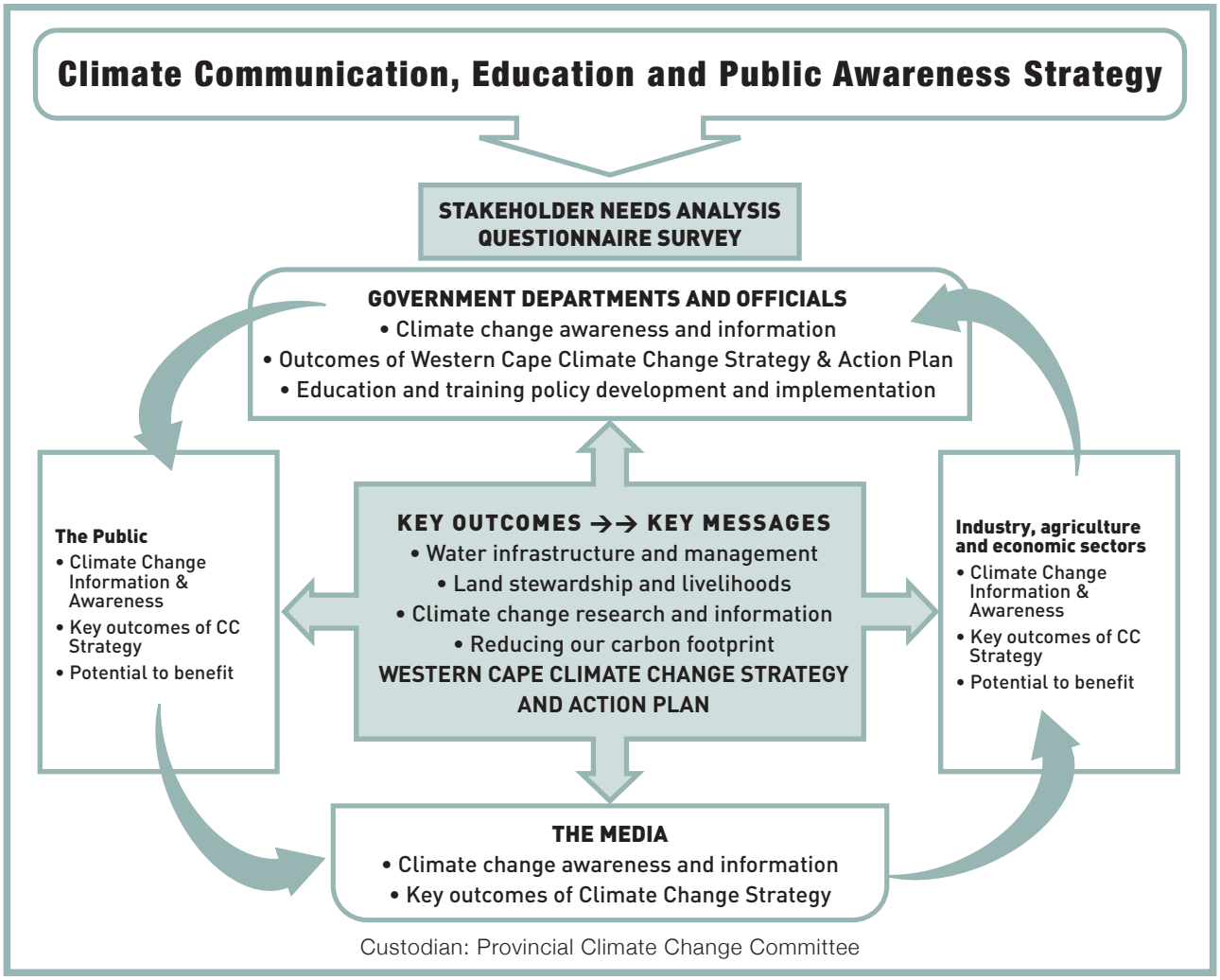


Figure 6: Climate communications, education and public awareness strategy

Funding mitigation and adaptation

The international community supports a range of actions aimed at reduction of greenhouse gas emissions in developing countries such as South Africa, such as the Clean Development Mechanism (CDM). Other options support adaptation-based strategies and responses, such as research and implementation programmes through the United Nations Framework Convention for Climate Change (UNFCCC) Adaptation Fund.

However the risk resides at home. Important to note are the following:

- Local leadership and financed response is critical to strengthen resilience and enhance adaptive capacity.
- Government owns significant amounts of the provincial infrastructure, some vulnerable.
- Treasury has a key role to play in ensuring that budget allocations are appropriate.
- Applications for UNFCCC funding can only be successful where supporting research and accurate information underpin the application.

Insuring crop losses - a national government response?

Improved disaster risk reduction processes, strengthening of emergency response systems and institutional responses such as crop insurance are critical. Trevor Manuel, South Africa's Finance Minister, has recently alluded to potential government policy that will insure farmers' crop losses experienced due to climate (Business Day, 5 November 2007).

The Action Plan

The Western Cape's Climate Change Action Plan is based on a set of integrated cross-sectoral planning and implementation programmes. These programmes include both mitigation and adaptation responses, and are outcomes based:

Adaptation response strategy and programmes

1 Integrated Water Management Programme

2 Climate change, weather research and information programme

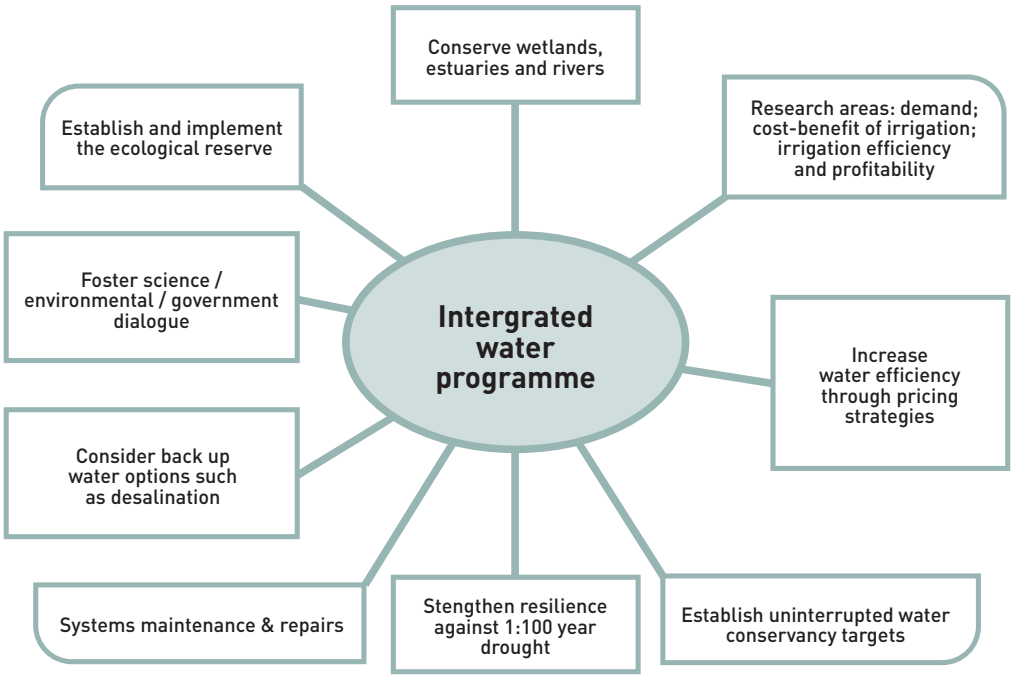
3 Land stewardship and Livelihoods Programme

Mitigation response strategy and programmes

4 Energy, transport, waste and air quality management programme

Key outcome # 1

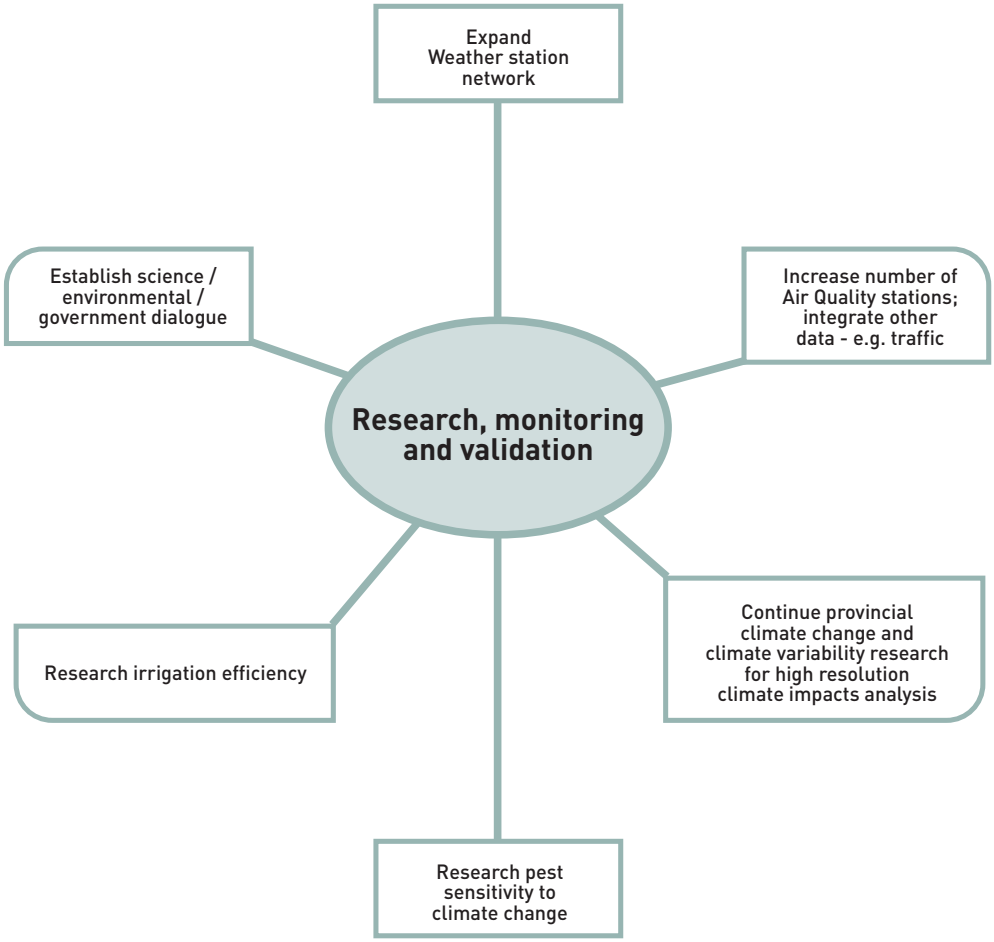
Establish a cohesive Water Supply and Infrastructure Management Programme that integrates climate impacts and risks



Programme custodian: DWAF

Key outcome # 2

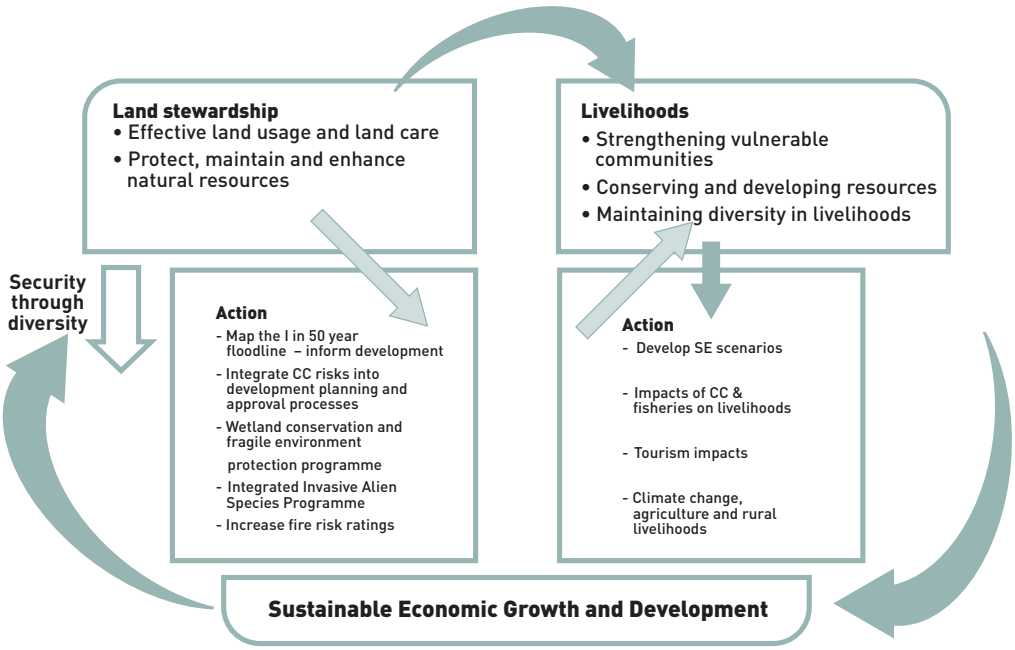
Establish a focused climate change research and weather information programme



Programme custodian: PCCC / DEA&DP

Key outcome # 3

Establish clear linkages between land stewardship, livelihoods and the economy

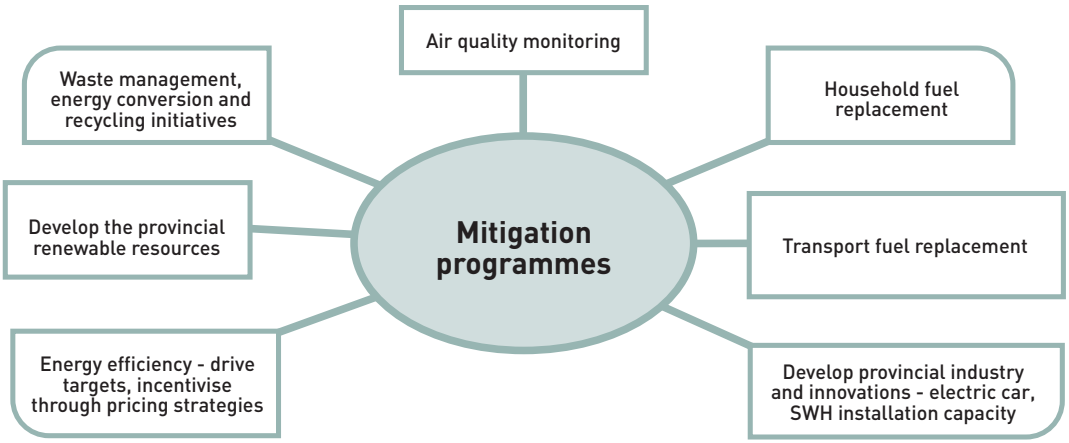


Minimising impact of climate change on Sustainable Development Goals

SOURCE: ONEWORLD SUSTAINABLE INVESTMENTS

Key outcome # 4

Reduce our carbon footprint



Programme custodians: Department of Environmental Affairs & Development Planning; Department of Minerals & Energy; CTC; Department of Transport; Housing

Challenges, conclusions and key recommendations

There is a clear need for a response strategy that mitigates risk, reduces vulnerability, and strengthens the province's capacity to adapt to climate change while simultaneously reducing the provincial carbon footprint.

Challenges

- Appropriate and facilitative institutional arrangements are required for effective implementation. Current linear government functions do not address this need.

Case study:

Institutional requirements for an integrated water programme

A cohesive water programme requires provincial ownership, Department of Water Affairs and Forestry (DWAF) ownership and participation and then significant involvement by other departments such as agriculture. DWAF does not, however, have a provincial function and although there are structures in place such as the Provincial Water Liaison Committee, accountability is not altogether clearly established.

Conclusions and recommendations

A number of the conclusions are inherent in the response strategy and action plan. However, the province and South Africa will need to give careful consideration as to how the institutional arrangements are best structured to allow for the realization of sustainable development goals while dealing with the negative and positive impacts of climate change on achieving these.

Climate change and sustainable development

Both climate change and sustainable development – which are intertwined – give rise to contemplation of the problems of inequality and poverty. When considering these against the environmental challenge inherent in the climate change scenario it may appear that the latter is not important – but to quote Amartya Sen, Nobel economics laureate and philosopher who visited South Africa in April 2007 to deliver a lecture on poverty, war and peace, "It seems (to me) that the main challenge for a human being is how to take note of each of these major issues without putting them in a horse race with each other" (Sunday Independent, 29 April, 2007).

Glossary of terms

Adaptation: Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to climate stimuli and is instituted to moderate the effects of climate change. Adaptation response depends on land use.

Anthropogenic: Human made. Usually used in the context of emissions that are produced as the result of human activities.

AOGCMs (or GCMs): Atmosphere/Ocean General Circulation Model or Atmosphere/ Ocean Global Climate Model. Fully coupled atmosphere ocean Global Climate Model of the three dimensional global climate (see GCM).

Biodiversity: The variety of organisms found within a specified geographic region.

Biofuel: Liquid fuel produced from plant material (biomass) e.g. agricultural waste, waste from municipal landfills, wood, etc. and ethanol mixed together to form an equivalent to petrol for motor vehicles.

Carbon cycle: The term used to describe the flow of carbon (in various forms such as carbon dioxide) through the atmosphere, ocean, terrestrial biosphere and lithosphere.

Carbon Dioxide (CO2): CO2 is a colourless, odourless, non-poisonous gas that is a normal part of the ambient air. Of the six greenhouse gases normally targeted, CO2 contributes the most to human induced global warming. Human activities such as fossil fuel combustion and deforestation have increased atmospheric concentrations of CO2 by approximately 30 percent since the industrial revolution. CO2 is the standard used to determine the "global warming potentials" (GWPs) of other gases. CO2 has been assigned a 100 year GWP of 1 (i.e., the warming effects over a 100 year time frame relative to other greenhouse gases).

Carbon footprint: A measure of a person's or business's carbon dioxide impact, calculated by adding the various components that create carbon dioxide, for example use of fossil fuels in traveling, heating, etc.

Carbon sink: An area that acts as carbon reservoir where carbon is stored for the longer term (for example a forest), which absorbs more carbon dioxide than it gives out.

Catchment: The area of land from which rainfall and precipitation drain into a particular watercourse such as a river.

Clean Development Mechanism (CDM): One of the three market mechanisms established by the Kyoto Protocol. The CDM is designed to promote sustainable development in developing countries and assist Annex I Parties in meeting their greenhouse gas emissions reduction commitments. It enables industrialized countries to invest in emission reduction projects in developing countries and to receive credits for reductions achieved.

Climate: The average course or condition of the weather over a period of years, as exhibited by temperature, humidity, wind velocity, and precipitation.

Climate change: A change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural variability observed over comparable time periods.

Desertification: Land degradation in arid, semi arid and dry sub-humid areas resulting from various factors, including climate variations and human activities.

Ecosystem: The complex of plant, animal, fungal and micro-organism communities and their associated non-living environment interacting as an ecological unit. Ecosystems have no fixed boundaries; instead their parameters are set according to the scientific, management, or policy question being examined. Depending on the purpose of analysis, a single lake, a watershed, or an entire region may be considered an ecosystem.

Emission taxes: Taxes levied on air or water emissions, usually on a per ton basis. Emission taxes provide incentives for firms and households to reduce their emissions and therefore are a means by which pollution can be controlled. The greater the level of the emissions tax, the greater the incentive to reduce emissions.

Emissions: Anthropogenic (human caused) releases of greenhouse gases to the atmosphere (e.g., the release of carbon dioxide during fuel combustion).

Endemic species: A species native to a specific location or region, occurring naturally in a specific region characterised by certain bio-geophysical features.

Estuaries: A somewhat restricted body of water where the flow of freshwater mixes with saltier water transported, by tide, from the ocean. Estuaries are the most productive water bodies in the world.

Extreme events: "An extreme weather event is an event that is rare within its statistical reference distribution at a particular place. Definitions of "rare" vary, but an extreme weather event would normally be as rare or rare than the 10th or 90th percentile." (IPCC 2001) Examples include extreme flooding, droughts etc

Fossil fuel: A naturally occurring organic fuel formed in the Earth's crust, such as petroleum, coal, or natural gas. Fossil fuels result from organic matter being laid down and compacted over very long periods of time (hence 'fossil'). This means that stocks of these fuels are finite (compare to renewable energy).

GCM: Global Climate Model / General Circulation Model. A computer driven numerical representation of the climate system based on the physical, chemical and biological components, their interactions and feedback processes. GCMs are applied as a research tool to study and simulate the climate, but also for operational purposes, including monthly, seasonal and interannual climate predictions.

GIS Global Information System

Greenhouse gases/ radiatively active gases: Those gases (such as water vapour, carbon dioxide, tropospheric ozone, nitrous oxide, and methane) that are transparent to solar radiation but opaque to long-wave radiation, thus preventing long-wave radiation energy from leaving the atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface. The major greenhouse gases covered by the UNFCCC and Kyoto Protocol are carbon dioxide, methane, nitrous oxide and three trace gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride). Ozone falls under the Montreal Protocol. 'Greenhouse gas forcing' is the relative effectiveness of greenhouse gases in restricting long-wave radiation from escaping back into space and the effects of changing concentrations of these gases on global climate.

Intense rainfall: A subjective term, typically referring to rainfall that is in the upper tail of the distribution of historical rainfall. A useful threshold for Cape Town is of the order of 20mm in 12 hours. This significant quantity of rain over a short period of time and has two impacts: stress on storm water drainage, causing flooding of streets, and high input into streams, causing flooding of rivers.

Intergovernmental Panel on Climate Change (IPCC): A panel established jointly in 1988 by the World Meteorological Organization and the United Nations Environment Programme to assess the scientific information relating to climate change and to formulate realistic response strategies.

IPCC Assessment Reports: Reports by the Intergovernmental Panel on Climate Change. Since the IPCC's inception, it has produced a series of assessment reports (1990, 1995, 2001, 2005 and the latest in 2007).

Mitigation: An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.

Precipitation: Water that falls from the sky in various forms, e.g. rain, snow, hail, mist.

RCM: (Regional Climate Model) and Empirical downscaling are two complementary methods used to producing projections on a horizontal resolution from point scale to about 50 km.

RCM (Regional Climate Model) and Empirical downscaling: Two complementary methods used to producing projections on a horizontal resolution from point scale to about 50 km.

Renewable energy (RE): Energy obtained from sources that are essentially inexhaustible (unlike, for example, fossil fuels - of which there is a finite supply). Renewable sources of energy include wood, waste, geothermal, wind, photovoltaic, small hydro and solar thermal energy.

Scenario: A plausible and often simplified description of how the future may develop based on assumptions of key driving forces. Each climate change scenario depends on future governmental decisions made about greenhouse gas emissions. A range of climate change scenarios leads to climate change predictions, dependant upon the scenario followed.

Seasonality: Periodic fluctuations in the climate related to seasons of the year e.g. wet winters, drier summers.

Sustainable development: A broad concept referring to a country's need to balance the satisfaction of near-term interests with the protection of the interests of future generations.

Tipping point: A point at which sudden and extensive climate change becomes inevitable.

Trend: Evidence of change from observations over a period.

Vulnerability: Defines the extent to which climate change may damage or harm a system. It depends not only on the sensitivity of a system but also on its ability to adapt to new climatic conditions.

Abbreviations and acronyms

Abbreviation	Definition
CC	Climate Change
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CO2	Carbon Dioxide
DA	Department of Agriculture
DEA&DP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DOL&H	Department of Local Government and Housing
DOT	Department of Transport
DST	Department of Science and Technology
DWAF	Department of Water Affairs and Forestry
EE	Energy Efficiency
EU	European Union
GCM	General Circulation Models (of the atmosphere)
GDP	Gross Domestic Product
GHG	Green House Gas
GIS	Geographic Information System
IDP	Integrated Development Plan
IPCC	Inter-Governmental Panel on Climate Change
MW	Megawatt
NGO	Non Governmental Organisation
PCCC	Provincial Climate Change Committee
PDC	Provincial Development Council
RE	Renewable Energy
SA	South Africa
SWH	Solar water heater
UNFCCC	United Nations Framework Convention for Climate Change
US	United States
WC	Western Cape
WMA	Water Management Area

References

For complete references, please refer to the full report: A climate change strategy and action plan for the Western Cape at http://www.capegateway.gov.za/eadp .

This report was prepared for the Department of Environmental Affairs and Development Planning, Western Cape, South Africa, by OneWorld Sustainable Investments

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