



CLIMATE CHANGE ADAPTATION SCENARIOS

Adaptation Scenarios Factsheet Series, Factsheet 7 of 7

THE LONG-TERM ADAPTATION SCENARIOS FLAGSHIP RESEARCH PROGRAMME (LTAS) FOR SOUTH AFRICA

The LTAS (April 2012 – June 2014) aims to respond to the South African National Climate Change Response White Paper (2011) by undertaking climate change adaptation research and scenario planning for South Africa and the Southern African sub-region.

The **Adaptation Scenarios Factsheet Series** has been developed to communicate key messages emerging from LTAS Phase 2 (June 2013 – June 2014) to policy- and decision-makers, researchers, practitioners and civil society. The Factsheet Series complements the LTAS Phase 2 technical reports. For further details on this factsheet, see the LTAS Phase 2 full technical report entitled *Long Term Adaptation Scenarios for South Africa: Together Developing Adaptation Responses for Future Climates*.

1. Introduction

The reality of South Africa's vulnerability to climate variability and change is increasingly apparent. Air temperatures in South Africa have increased at least 50% more than the global annual average of 0.65°C over the last five decades, raising the very real possibility that in a world of >2°C of temperature change, South Africa could experience changes of >3°C. Sustained warming and increasing rainfall variability over the short-term (next decade) will have increasingly adverse effects on many sectors of South Africa's economy in the absence of effective adaptation responses. Early impacts will largely be felt by the poor. Subsistence farmers and those dependent on rain-fed agriculture will be significantly impacted by increasing temperatures and drying trends. Similarly, the increasing frequency of extreme weather events is likely to have a disproportionate impact on the poorest in society (rural and urban), amplifying existing social inequalities.

An effective response to the risks created by climate variability and change would be usefully based on an understanding of the range of adaptation measures available for various adaptation scenarios, as well as the institutional vulnerability and capacity to address these risks. LTAS Phase 2 found that South Africa's future climate can be separated into three scenarios: warmer and wetter; warmer and drier; and hotter. Each scenario is characterised with its own climate impacts. All show greater variability in climate, the possibility of extreme events,

and fluctuations in rainfall conditions. This demonstrates that climate change is unpredictable and that uncertainty exists.

However, LTAS Phase 2 also concluded that across all the three scenarios explored, increasing individual and community resilience to climate change cannot be separated from basic developmental interventions. Furthermore, it emphasised that fulfilling the developmental objectives of providing basic life opportunities and improving the welfare of the general population should be a major building block of any response to climatic change. Other high level messages emanating from LTAS Phase 2 are listed in Box 1.

BOX 1: HIGH LEVEL MESSAGES FROM THE DEVELOPMENT OF ADAPTATION SCENARIOS

- There will be a significant change in the nature and scale of adaptation required if global mean temperature rises more than 2°C (roughly equivalent to a national temperature increase of 3°C).
- Balanced development enables effective adaptation i.e. a healthy, educated and financially secure population, living in a sustainable environment will be better able to withstand and cope with extreme climate events.
- Adaptation must focus on vulnerable communities, as they are most at risk from climate change.
- Adapting to an uncertain climate future with finite resources will result in trade-offs in the investment of resources.
- As the climate changes, systemic transformation and a paradigm shift in thinking will be needed in the medium- and long-term.
- Contingency planning for both wetter and drier climate futures is required in South Africa.
- Climate change has both positive and negative implications for national development pathways.
- Climate change will likely accentuate inequality, undermining social justice and cohesion if South Africa does not adopt effective adaptation responses.

The project is part of the International Climate Initiative (ICI), which is supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.



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On behalf of:



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- The benefits of adapting outweigh the costs in the long run.
- Effective approaches to disaster risk reduction, including early warning systems, yield early returns on investment across all sectors.
- Institutions are currently unprepared to appropriately manage infrastructure under a more extreme and variable climate.
- South Africa's adaptation options are dependent on its development pathway, which is linked to global mitigation efforts.

2. Approach

An adaptation scenario is a description of a suite of adaptation responses that may be implemented across a range of sectors, in response to the impacts of climate change. They are complex, and are informed by the meeting of two related scenarios – a set of climate scenarios and a set of development trajectories.

To construct adaptation scenarios, a number of key inputs from both LTAS Phase 1 (including the climate scenarios and a detailed policy alignment review) and Phase 2 (including stakeholder feedback and the findings of the technical reports) were drawn on. Phase 1 provided a set of four robust climate scenarios based on climate modelling. This was complemented by a number of cross-sectoral stakeholder engagements that considered South Africa's future development trajectories and defined two fundamental scenarios – a collaborative decarbonising world scenario, and a carbonising scenario. This provided a sound basis on which to construct adaptation scenarios through further consultation with stakeholders to obtain feedback and finalise the findings. This process was supported in its later stages by results from detailed econometric modelling that was undertaken in Phase 2 to explore the impacts of climate shifts on water, infrastructure and agriculture.

3. Adaptation scenarios and responses

The three adaptation scenarios are not designed to be an exhaustive description of all the possible impacts of climate change on the socio-economic landscape of South Africa. Instead, they provide a snapshot of the sectors that will be most directly impacted and the thematic issues that arise as a result. Each scenario also provides a description of the systemic adaptation responses that will be needed to respond to the theoretical climate futures.

Scenario 1

A warmer and but drier climate in South Africa (temperature increase of <3°C and reduced rainfall)



This scenario is characterised by an increase in the frequency of drought events. The limited availability of water and the implications for water pricing become a key determinant of economic and demographic activity driving transition across South Africa. The affordability of water drives a transformation in approaches to rural economic growth, water efficient urban design and the development of new models for managing food security. Demand for water in urban areas is driven by population increase, while demand for water in agriculture increases dramatically with irrigation needs increasing by 15 – 30% in dry areas. With water increasingly expensive, agricultural production has no choice but to shift to high-value export goods which creates food security issues for the majority of South Africa. Rural towns experience de-population as agricultural jobs are lost in the shift to more mechanised and efficient export crop production. This in turn accelerates rural to urban migration as well as exacerbates existing social tensions.

BOX 2: SYSTEMATIC ADAPTATION RESPONSES FOR A WARMER/DRIER SCENARIO

- Introducing effective early warning systems for drought to help communities and farmers manage the risks, and support government to mobilise emergency resources.
- Reconceiving rural economic growth through a paradigm shift in the thinking behind rural agricultural areas, including the development of agro-enterprise clusters and value chains, and addressing market constraints.
- A radical re-thinking of urban design based on water preservation and efficiency, necessitating the use of new technological innovations and indigenous methods.
- Shifting behavioural change and patterns of resource production and consumption, focused on water conservation and foot printing.
- Building food and energy buffers.
- Restoring, protecting and maintaining biodiversity and ecological infrastructure through upscaling existing and introducing novel approaches.



Scenario 2



A warmer but wetter climate in South Africa (temperature increase of $<3^{\circ}\text{C}$ and increased rainfall)

This scenario is characterised by a greater frequency of extreme rainfall events. Rural and urban infrastructure and property are threatened, and already vulnerable informal settlements in rural, peri-urban and coastal settlements are particularly affected as flooding increases in frequency and severity. These phenomena adversely affect human health – standing water in a wetter and warming environment amplifies the potential for the spread of water-borne diseases such as cholera or dengue fever; and increased erosion and siltation from extreme rainfall events has a negative effect on the quality and quantity of drinking water. The increasing variability of rainfall also creates a shifting pattern of agricultural production. Rural livelihoods dependent on a stable climate become increasingly vulnerable. Flood resilience and socially sensitive settlements are prioritised as infrastructure design is re-thought. Simultaneously, approaches to conservation of natural resources evolve further, as do innovative approaches to incentivising effective ecosystem management.

BOX 3: SYSTEMATIC ADAPTATION RESPONSES FOR A WARMER/WETTER SCENARIO

- Introducing early warning systems to promote proactive adaptive measures in the housing, agriculture, health and transport sectors, from government to community to individual household levels.
- Constructing robust infrastructure (roads, bridges, railways and building) that is able to withstand extreme events, and is supported where possible by intact ecological infrastructure.
- Developing flood resilient and socially sensitive design of informal and rural settlements, as well as urban areas, with a focus on defences against the failure of drinking water, sanitation and transport systems.
- Prioritising conservation management practices that incentivise sustainable land management to support the building or maintaining of ecological infrastructure.
- Developing an adaptive and innovative agricultural sector as regions suitable for agriculture may shift, providing constraints and opportunities for crop and livestock farming.

Scenario 3



A hotter climate in South Africa (temperature increase of $>3^{\circ}\text{C}$)

This scenario is characterised by a dramatic rise in temperatures, increasing by as much as $5-8^{\circ}\text{C}$ in the interior of South Africa. Smaller but still significant rises occur at and around the coast. There is a significant shift in the frequency of extreme weather events, variability in precipitation and more significant impacts from wildland fires and sea-level rise. To cope with this radically new and variable climate, the predictive power of early warning systems is prioritised as the weather become increasingly volatile. Urban spaces are re-configured to preserve water and shield South Africans from the intense heat. Approaches to organising labour and conservation are fundamentally re-thought as traditional models are not effective in a significantly hotter climate. In the face of sea-level rise, managed retreat from less populated coastal areas is considered as a policy response. The intense heat and the increasing incidence of extreme weather events means people, flora and fauna in South Africa are increasingly unable to cope.

BOX 4: SYSTEMATIC ADAPTATION RESPONSES FOR A HOTTER SCENARIO

- Introducing appropriate early warning and response systems for wildland fires, heat waves and storm surges.
- Radically shifting conservation mind-sets from a focus on maintaining the existing mosaic of flora and fauna and managing transition and prioritising resources.
- Heat proofing urban design in the face of accelerated urbanization and increased heat island affect.
- Changing environmental effects for South African labour, necessitating new labour practices supported by appropriate legislation and labour protections as temperatures rise and working conditions change.
- Introducing a strategic and comprehensive coastal management strategy as sea levels rise and storm surges become more frequent and severe.
- Regionally integrating through constructive diplomatic negotiations across SADC to realise flexible regional power, water and food systems.

- Prioritising resource-centric national development planning, centred around moving development focus to the areas of natural resource (water, soil, biodiversity) availability and the current thinking of moving resources to the areas of economic development.

4. Policy and research recommendations

There is still a high degree of uncertainty as to whether South Africa faces a wetter or drier future overall, and how rainfall change will be distributed across the country. Projected changes in seasonal rainfall patterns also remain highly uncertain. Flexibility is therefore necessary to adapt to the uncertainty of the rainfall projections, both in the direction and rate of change, especially in current institutions and organisations. No- and low regret adaptation measures can be usefully implemented immediately. These will have benefits regardless of the direction of climate change projections. Closing the 'development gap' and investing in ecological infrastructure are examples of such short-term, low regret options.

Strategic policy recommendations:

- Integrate and consider (in South Africa's mitigation and adaptation negotiations) the way outcomes of the negotiations could impact the national and global economy.
- Implement robust and integrated monitoring systems to reduce uncertainty regarding climate change.
- Introduce advanced early warning systems to mitigate the projected increase of extreme events and support effective disaster risk reduction.
- Improve understanding of the trade-offs in water allocation to promote sustainable, and more economically effective, water use.
- Expand initiatives such as maintenance of ecological infrastructure to help to maintain, support and sustain livelihoods and ecosystem

services.

- Mainstream climate resilience into urban, coastal and rural settlement design.
- Understand trade-offs to ensure food security in South Africa.
- Build robust infrastructure with an understanding of the long-term versus short-term costs and benefits.
- Improve understanding of labour and capital flexibility in the economy.
- Increase education and capacity building as they are cornerstone adaptation responses necessary at all levels and in all sectors.
- Coordinate all levels of government vertically and horizontally in the context of climate change.
- Explore innovative financing models to support deliver of appropriate adaptation responses.
- Support integration of climate change considerations within national planning initiatives such as the National Development Plan.

Research recommendations:

- Develop more robust and consistent tools for assessing climate change impacts and integrated economic cost/benefit of adaptation in key sectors of the economy.
- Build on the existing set of econometric tools for assessing cross-sectorally integrated economic impacts of climate change to investigate alternative adaptation and development scenarios at national and sub-national levels.
- Invest in additional drought and flood modelling.
- Enhance approaches to modelling economically autonomous adaptation responses that are based on flexibility of labour and capital investment.
- Improve the systematic production of climate projections and comparisons between different methodological approaches.
- Develop approaches for resource-centric national development planning.

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