Biodiversity and Climate change: Policy Framework for Response and Vulnerability Assessment Report

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Introduction

- South Africa is home to a significant portion of global biodiversity (Cowling *et al.*, 1996; Myers *et al.*, 2000), and many of its natural ecosystems are relatively intact (Scholes & Biggs, 2005), despite the changes in land cover that have accompanied societal development.

- Anthropogenic climate changes are likely to cause increasingly adverse impacts on the country's ecosystems and biodiversity (Midgley & Thuiller, 2005).

- Impacts of climate change on species, and their adaptation interact strongly with human activities.

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Problem statement

Millennium Ecosystem Assessment (2005) – climate change and loss of natural habitat are two greatest threats to biodiversity. Loss of natural habitat through land-use changes, climate change and ecosystem degradation accounts for the loss of biodiversity around the globe.

South Africa's National Spatial Biodiversity Assessment (2004) found that 34% of terrestrial ecosystems, 82% of the main river ecosystems and 65% of marine ecosystems are threatened, with few of these threatened ecosystems currently afforded any formal protection.

National Biodiversity Assessment (2011) found that 40% of terrestrial, 57% of the river, 65% of the wetlands, 44% of estuaries, 41% of offshore and 59% of coastal and inshore ecosystems are threatened, with few of these threatened ecosystems currently afforded any formal protection.

What is Climate Change?

- According to the IPCC, Climate change is any long-term significant change in the “average weather” that a given region experiences. (average temperature, precipitation, rainfall and wind patterns),

- These changes can be caused by dynamic processes on Earth, external forces like variations in sunlight intensity, and more recently by human activities,

- The main human influence on global climate is emissions of the key greenhouse gases (GHG) - carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFC) and nitrous oxide (N_2O),

- Climate change affects biodiversity complex interaction, thereby disturbing and shaping natural ecosystems, human socio-economic needs and the environment.

What is Biodiversity?

- According to the UN CBD and NEMBA (Act 10 of 2004), Biodiversity is defined as *"the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems",*

- This refers to the totality of life on earth including the variability within a given species' population and the variety of ecosystems across a geographic area,

- South Africa is one of the world's top 3 mega-biodiverse nations, has 3 biodiversity "hotspots":- the Cape Floristic kingdom; the Succulent Karoo region; and the Maputoland-Pondoland region,

- Biodiversity is a national asset and a powerful contributor to economic development, natural resource management, ecological infrastructure and human wellbeing.

Policy Framework Rationale

- The science behind climate change and its potential impacts is now clear enough to justify the development of a policy framework that takes account not only of the potential impacts of climate change on ecosystems and their biodiversity, but also the role of ecosystems in climate change adaptation and mitigation, and related global climate change policy decisions on biodiversity, wild species and ecosystems.

- Ecosystem resilience enhance human capacity to respond to climate change, hence linking adaptation and sustainability

Why the response framework?

- South Africa is blessed with significant biological wealth, both in terms of numbers of species and ecosystems,
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- Biodiversity underpins the ecological processes that facilitate and sustain life on earth, such as provision of fresh air, clean water, nutrients and pollination of plants, while meeting human needs.

- South Africa's biodiversity is under stress from human-induced impacts such as land use change, abstraction of water and regulation of water flows, invasive alien species, over-harvesting of commercially valuable species and changes in fire regimes.

- As a result, the biodiversity sector is a priority for climate change adaptation. Natural ecosystems can play a key role in supporting human adaptation to climate change, healthy functioning ecosystems

Response principles and philosophy

- South Africa ratified the United Nations Framework Convention on Climate Change in August 1997, giving impetus to a variety of policymaking and legislative processes, as well as institutional arrangements.
- The Millennium Development Goals, to which the country is also committed.
- The National Environmental Management Act (NEMA 2008) is an enabling Act providing a framework for government to meet its environmental responsibilities, that is to improve environmental management while facilitating sustainable development, improving coordination and governance of environmental issues.
- The principles of the Ecosystem-based Approach as adopted by the Conference of the Parties to the Convention On Biological Diversity at its Fifth Meeting, Nairobi, 15-26 May 2000. Decision V/6, Annex 1. CBD COP-5 Decision 6 UNEP/CBD/COP/5/23,
- The framework should emphasis the point that management of ecosystems should be decentralized to the lowest level possible. Perhaps the third element which is partnership between various stakeholders to endure that South Africa plays a proactive role in halting biodiversity loss due to climate change.

Response principles and philosophy (cont)

- Manage further loss and degradation of natural ecosystems in priority marine, coastal and terrestrial areas for climate change resilience,
- **Avoid** strategies that pose a **high risk to the integrity of ecosystems to adapt naturally,**
- Prioritise adaptation strategies which deliver multiple benefits across several sectors (for example, benefits for the safety of human settlements, benefits for agriculture, as well as benefits for natural ecosystems),
- Prioritise adaptation strategies that facilitate resilience both to increased climate variability and to long-term climatic shifts,
- Prioritise cost-effective adaptation measures where possible

Response principles and philosophy (cont)

- Address **adaptation to climate change at landscape, ecosystem, species and genetic levels,**
- Where possible, **integrate climate change adaptation and mitigation responses** into existing programmes and institutional arrangements rather than creating new programmes and institutional arrangements,
- Ensure **ongoing generation of scientific knowledge to support climate change adaptation and mitigation**, and **facilitate strong links between science, policy and implementation** to ensure that the best available science informs the biodiversity and climate change response strategy and action plan,
- Draw on indigenous and traditional knowledge to support climate change adaptation and mitigation through biodiversity and ecosystem strategies,
- Improve communication and public awareness efforts and encourage active public participation in biodiversity matters that relate to climate change.

Ecosystem-based adaptation

- Ecosystem-based adaptation to climate change will be a major focus of South Africa's biodiversity and climate change response strategy- significant value for societal adaptation, ability to provide additional benefits and the maintenance of diverse agricultural landscapes to support productivity under changing climate conditions.
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- Ecosystem-based adaptation, if designed, implemented and monitored appropriately, can:
  - Generate multiple social, economic and cultural co-benefits for local communities,
  - Contribute to the conservation and sustainable use of biodiversity,
  - Contribute to climate change mitigation, by conserving carbon stocks, reducing emissions caused by ecosystem degradation and loss, or enhancing carbon stocks.

Sector	Interdependency on biodiversity	Specific examples
Agriculture	Pollination, soil protection, soil fertility, food, fibre and fuel resources	Direct use of ecosystem services, for instance, by consuming bushmeat and other wild foods, cutting fodder for livestock, using wood products in home construction, or eating produce grown in a home garden. Where markets exist, goods harvested from ecosystems, such as fish, herbs, or fuelwood, can be sold for cash or exchanged for services like school tuition
Water	Water quality, rate of delivery, flood protection	The mountain catchments of South Africa deliver water of generally high quality. These underpin major economic activity in South Africa, and support a potentially disease free water supply. Local catchments also provide water for small scale farmers if wetlands are kept intact

Sector	Interdependency on biodiversity	Specific examples
Tourism	Habitat quality, key iconic species and ecosystems	Nature based tourism dependent on high quality habitat and high biodiversity, for example the Kruger National park and the flower displays of Namaqualand
Forestry	Soil protection, soil fertility, fire management	Wildfire protection to forests can be exacerbated or reduced by the management and characteristics of indigenous vegetation surrounding commercial forests
Human health and quality of life	Flood protection, heat stress protection, wind protection, disease protection	Extreme rainfall can produce flooding conditions that exacerbate health issues such as cholera in informal settlements. Enhancing catchment vegetation and biodiversity can reduce these risks considerably with other co-benefits.

Response principles and philosophy (cont)

- **Reducing existing threats to biodiversity to promote resilience of natural ecosystems and species**, especially in priority areas for climate change resilience identified in spatial biodiversity plans,

- **Enhancing understanding of and increasing the value and application of Ecosystem-Based Adaptation responses**. These integrate the sustainable use of biodiversity and ecosystem services into an overall adaptation strategy. It is cost-effective and generate social, economic and cultural co-benefits while also contributing to the conservation of biodiversity,
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- **Incorporating climate change information into management tools for biodiversity management**, including bioregional plans and biodiversity management plans,

- **Ongoing development and expansion of a comprehensive, adequate and representative protected areas network** which incorporates adaptation to the impacts of climate change,

Response principles and philosophy (cont)

- **Protected areas need to be expanded to incorporate altitudinal gradients and topographic range**, intact river corridors, coastal dune cordons, and a greater range of microhabitats, in order to conserve the climatic gradients required to give us some leeway for climate change. Taking a bioregional approach, i.e. working to conserve intact ecosystems in priority areas throughout the landscape not only in the protected area network,

- **Assisting the natural adaptation of species and ecosystems** through improved in-situ and ex-situ management of areas of high conservation value,

- **Increased monitoring and research into the impacts of climate change and adaptation** options for species and ecosystems threatened by climate change, and

- **Integrating biodiversity and adaptation strategies** into climate change mitigation programmes already under way.

Monitoring and Evaluation

- In order to maintain and improve South Africa's biological diversity and monitor the impacts of climate change, South Africa will –

  – Ensure that research and observation bodies initiate and/or maintain nation-wide biodiversity and climate change research, especially in rainfall and ecosystem services, land use change and degradation, temperature and soil moisture, and extreme weather events such as floods and droughts

  – Ensure that appropriate research and observation bodies initiate and/or maintain nation-wide biodiversity and climate change impact monitoring systems, especially in ecosystem functioning, dynamics and services including zone changes, vegetation changes, river and stream-flow changes, alien plant invasions and crop failures,

  – Implement and comply with the monitoring, reporting and verification (MRV) system for developing countries that is finally negotiated internationally.

Biodiversity Vulnerability Assessment

- Biodiversity is facing the greatest environmental challenge known as climate change. Climate change has emerged as a major threat to biodiversity and continues to affect the survival of plants, animals, and ecosystem services and functioning,

- Climate change has the potential to undermine sustainable development, increase poverty, and delay or prevent the realization of the Millennium Development Goals

- To ensure the long-term well-being of the biodiversity, ecosystems and people of Southern Africa, it is essential to understand the specific vulnerabilities of the region, biomes and ecosystems to climate change and define the urgent priority actions needed to ensure that people and biodiversity can adapt to these changes,

- The vulnerability assessment component aims to assess the potential vulnerability of biomes and their biodiversity to projected climate change over the medium and long term (i.e. from 2020 to 2050), that is to identifying which biomes, species or ecosystems are likely to be most strongly affected by projected changes and to understanding why they are likely to be vulnerable.

International Context

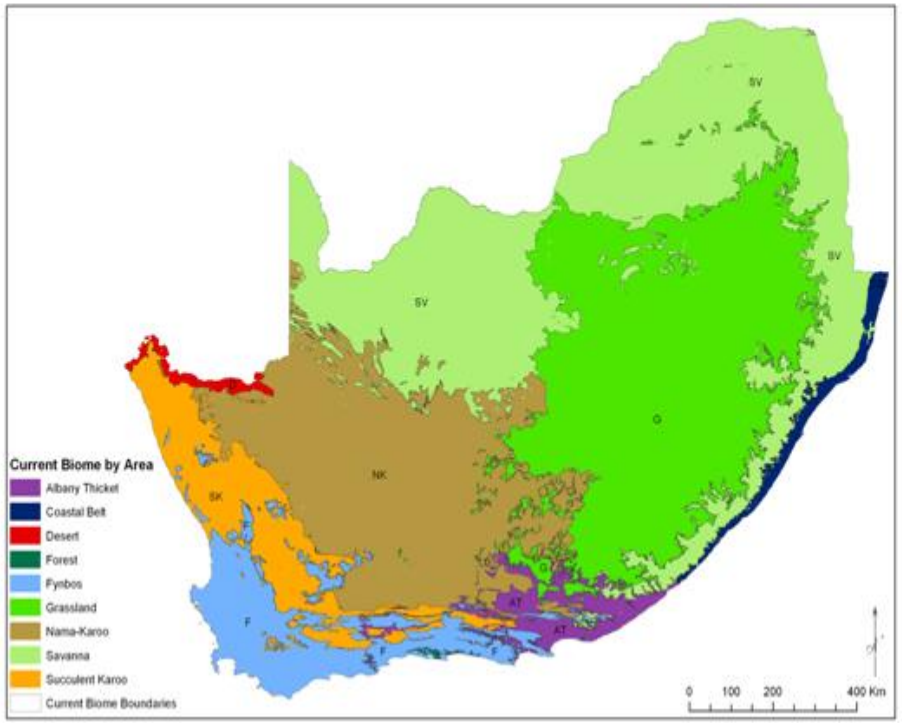
- UNFCCC **explicitly recognizes relationship** btw **ecosystem resilience & vulnerability, & resilience** of human communities to climate change,

- Decisions taken within CBD context **- highlighted threat** of **climate change** on **biodiversity and ecosystems,**

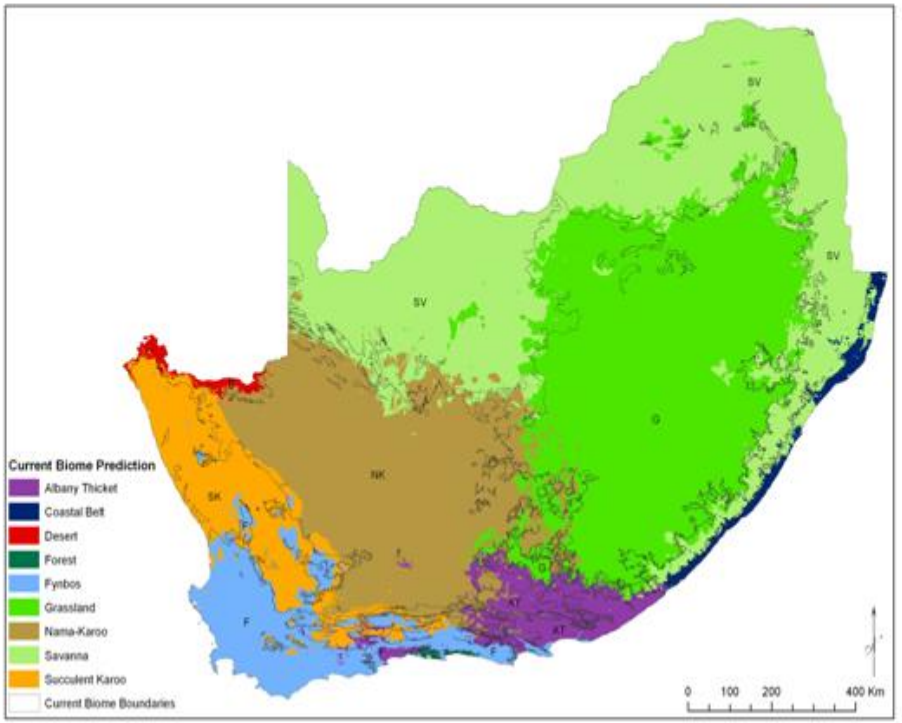
- S.A. seen as both **contributor to, and potential victim of, global climate change** (has **energy-intensive**, fossil-fuel powered economy & also **highly vulnerable** to impacts of **climate variability and change**)

Credible, coherent climate projections are limited: A2 emission scenario, 15+ GCMs using statistical downscaling; CSIR projections using mechanistic downscaling; new impacts projections contrast with previous projections.

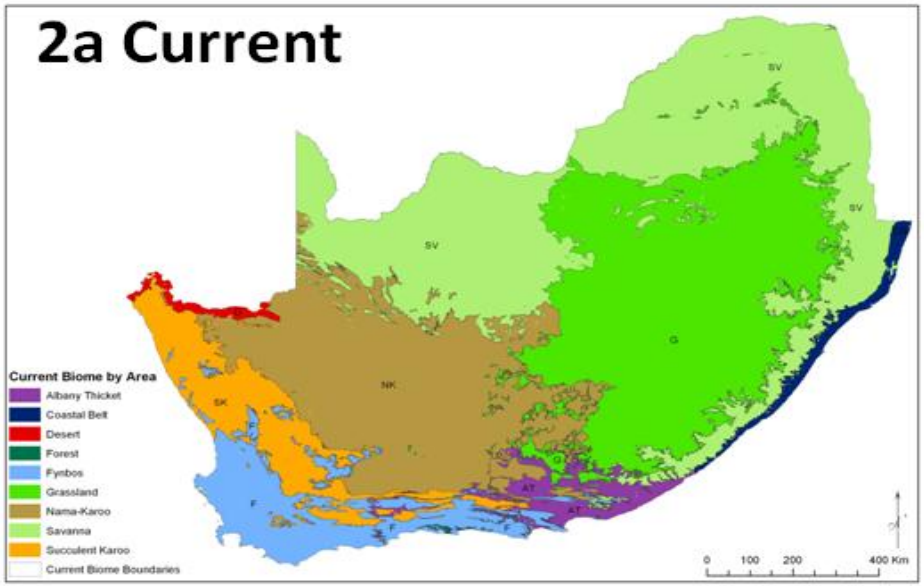
1a Actual Current

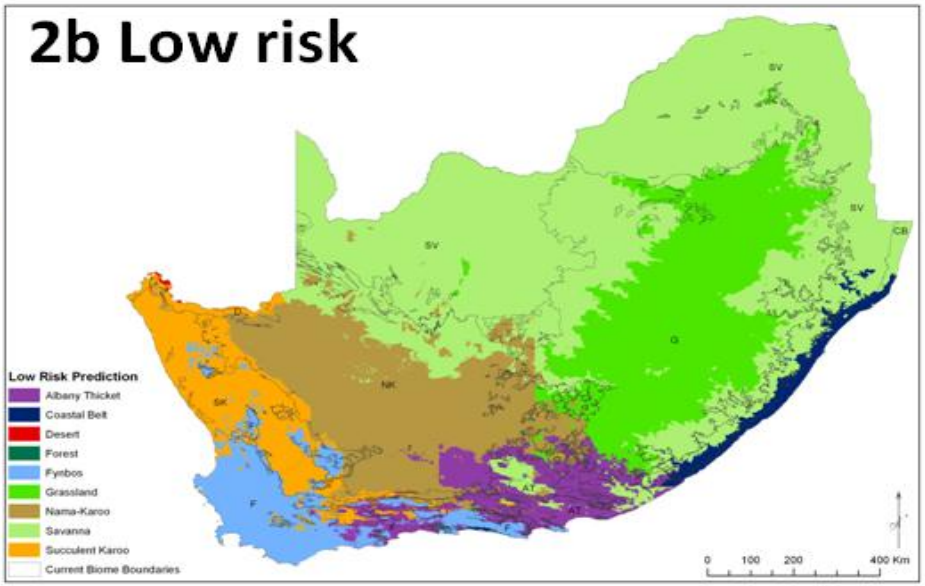


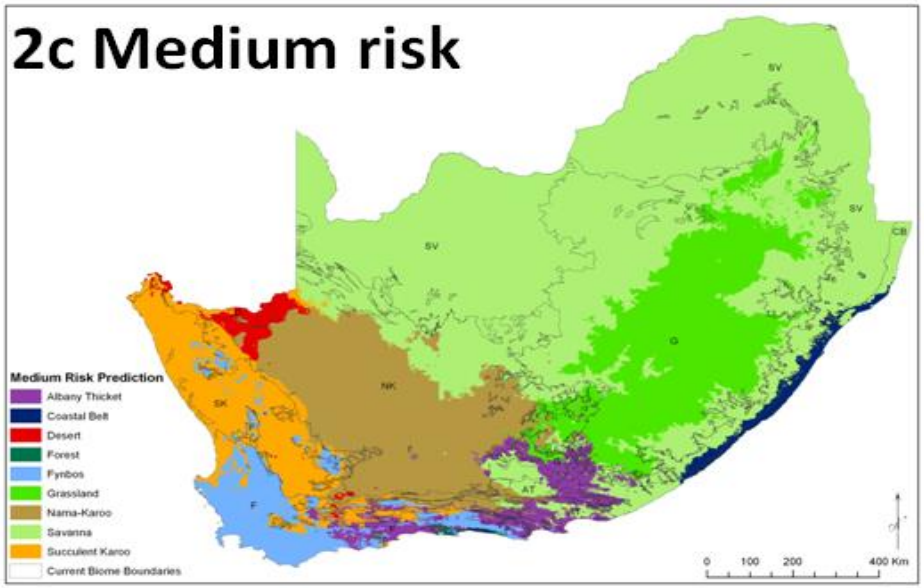
1b Modelled current

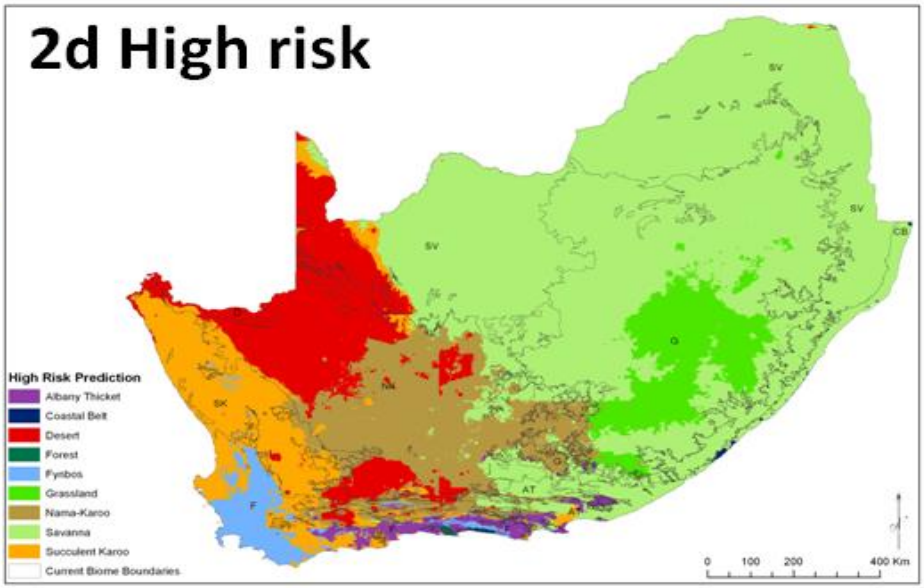


2050 – a2 emissions scenario









Observed Impacts- SNC & NBA

- Some evidence of impacts on wild species is reported for the north-western Cape, where the iconic desert tree aloe (the kokerboom) shows adverse population impacts at warmer sites (greater mortality of adult plants), and positive impacts at cooler sites (increased establishment of young plants).

- An increase in the frequency of large fires in the western and southern Cape.
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- Sea birds showing adverse impacts due probably both to climate change and commercial fishing. Falling population trends are noted - African Black Penguin and some other seabird species) and even on Marion Island in the sub-Antarctic region (Rockhopper Penguin).

- Climate of Marion Island has changed appreciably in the past 30 years, with significant increases in temperature and falling rainfall,

- Coral reefs off the South African coast (e.g. Sodwana bay) are experiencing increasing rates of coral bleaching.

Summary of Biomes

- The **Grassland biome** appears to be at most risk of significant change. Areas with a climate envelope suitable for Grassland are predicted to be greatly reduced under all scenarios, and in the worst case scenario to occur only in the highest altitude areas.
- The climate envelope found in large areas which are currently **Nama-Karoo** is likely to resemble an arid Savanna under the best case and intermediate scenarios, and a Desert climate envelope under the worst case scenario.
- The area with a climate envelope suitable for **Indian Ocean Coastal Belt** increases under the best case scenario with the warm moist conditions which favour this biome expanding southwest along the coast and extending inland. However, as soon as water becomes less available under the intermediate and worst case scenarios, the area with a climate suitable for Indian Ocean Coastal Belt shifts to a Savanna climate envelope.
- Areas with a climate envelope characteristic of **Succulent Karoo** largely persist under all the scenarios. This contrasts with previous predictions from the mid-1990s as newer climate models indicate far smaller impacts on winter rainfall than early models predicted.

Summary of Biomes

- The eastern and northern sections of **Fynbos** are likely to be under climate stress with the climate envelopes in these areas becoming more like Succulent Karoo or Albany Thicket. The core south-western portions of the Fynbos (especially the mountainous areas) remain within the current biome envelope, but probably with significant up-slope movement of suitable climate envelopes for particular species and habit types.
- Areas with an **Albany Thicket** climate envelope persist reasonably well under the best case and intermediate climate scenarios, but get replaced by Nama-Karoo and Savanna conditions under the worst case scenario.
- Areas with a climate similar to the current **Desert biome** are likely to expand in the future into areas which are now Nama-Karoo.
- It is extremely difficult to predict exact distributions of the climate envelope for the small Forest biome, but it is likely that many **Forest areas**, which are generally dependent of consistently available moisture and protection from fire, are likely to be under increasing pressure in the future.
- Although the climate envelope suitable for **Savanna** is likely to expand significantly in the future, and specific Savanna species are likely to benefit, this does not necessarily benefit existing habitats and species assemblages.

Way forward

- Biodiversity and Climate change Policy Framework,

- Biome modelling (mechanistic and correlative) using ecosystem function inputs (soil water, fire frequency and NPP). Species modelling using ecosystem function inputs (soil water, fire frequency and NPP),

- Response measures- determine effective and sustainable response measures to biodiversity, lining that with ecosystem services, ecosystem-based adaptation, working for programmes and community based natural resource management.

- Provincial and Bioregion inputs- **BIOME-BASED ADAPTATION FRAMEWORK**


Thank you