# My Custom Title

Subtitle or additional text

# National Biodiversity Assessment 2025

**The status of South Africa's ecosystems and biodiversity**

Andrew L. Skowno Carol J. Poole Domitilla C. Raimondo
Kerry J. Sink Lara van Niekerk Linda R. Harris
Krystal A. Tolley Tsungai A. Zengeya

2024-10-12

# Table of contents

# Preface

I am proud to present South Africa's National Biodiversity Assessment 2025, a product of high scientific calibre that summarises the state of our biodiversity by drawing on a broad foundation of information compiled by over a hundred authors. This body of knowledge should be used as a basis for policy, planning and decision making regarding the wise use and conservation of our country's biodiversity assets and the management and restoration of ecological infrastructure.

**Shonisani Munzhedzi**
**South African National Biodiversity Institute - Chief Executive Officer**

The NBA is a tool not only for the environment sector, but for all sectors of government that share the responsibility for the sustainable development of our landscapes and seascapes, and is prepared as part of the South African National Biodiversity Institute (SANBI) mandate under the National Environmental Management: Biodiversity Act (Act 10 of 2004). South Africa is a special country, with diverse cultures, remarkable geological wealth and exceptional biodiversity, much of which is unique to our nation. With this rich endowment comes the responsibility and challenge of ensuring our species and ecosystems are conserved and used sustainably to the benefit of all South Africans and future generations. This biodiversity wealth gives our people tangible benefits like food, clean water, medicine and materials; it supports agricultural and fisheries production, and helps protect us from natural hazards like floods and droughts; and it provides the basis of a vibrant tourism industry while offering natural spaces for recreational and cultural activities.

Biodiversity is central to South Africa's national objectives of addressing poverty, inequality and unemployment, and supports increased economic growth and improved service delivery for all its citizens. Examining biodiversity in the context of social and economic change shows us that investing in ecological infrastructure is as important as investing in built infrastructure, and safeguarding the delivery of services from ecosystems can support service delivery from all spheres of government.

# 1 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

```
1 + 1
```

```
[1] 2
```

Figure I: A beautiful image of a frog

In Figure I, you can see a frog.

Figure II: A beautiful image of a bird

In Figure II, you can see a bird

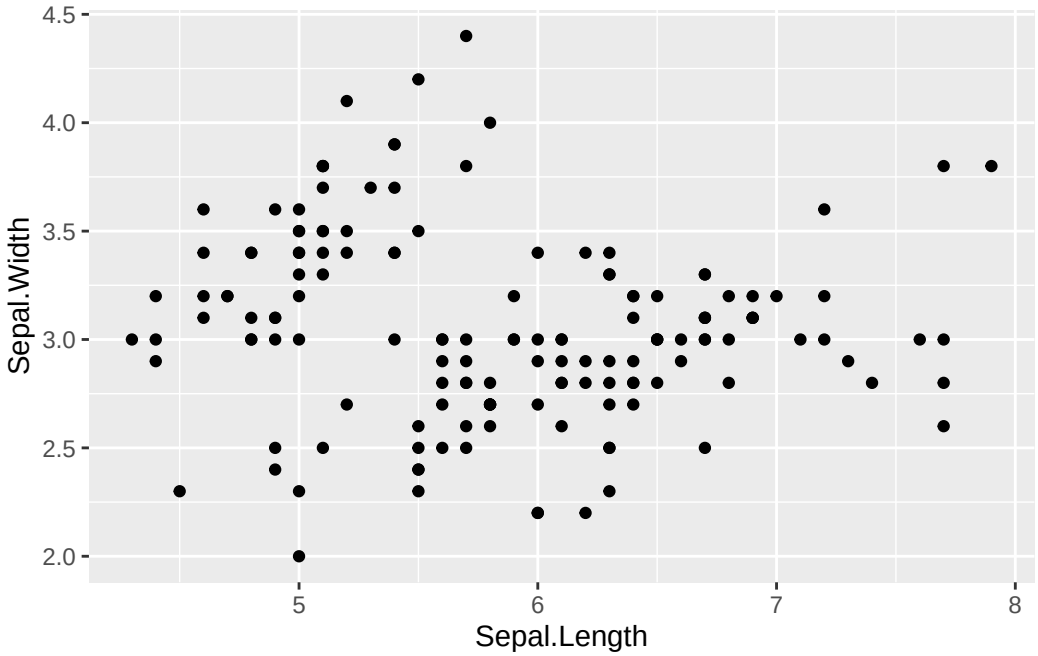


Figure III: A scatter plot

In Figure III you can see a scatter plot.

# 2 Summary

In summary, this book has no content whatsoever.

```
1 + 1
```

```
[1] 2
```

# Part I

# About

# 3 About the National Biodiversity Assessment

## 3.1 Why do we do the NBA

Mandate etc

## 3.2 How do we do the NBA

Who, number of people

## 3.3 When is the NBA updated

Modules are updated at different times

## 3.4 What the NBA is not

Explanation of what NBA is not

## 3.5 How to cite the NBA

**Recommended citation**

Reference in scientific publications:

Reference in non-scientific publications:

## 3.6 Acknowledgements

# 4 How the NBA is used

## 4.1 Introduction

The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. It is prepared as part of the South African National Biodiversity Institute's (SANBI) mandate to monitor and report regularly on the status of South Africa's biodiversity, and is a collaborative effort from many institutions and individuals. The NBA focusses primarily on assessing biodiversity at the ecosystem and species level, with efforts being made to include genetic level assessments. Two headline indicators that are applied to both ecosystems and species are used in the NBA: threat status and protection level. The products of the NBA include seven technical reports, a technical synthesis report and several popular outputs.

The primary purpose of the NBA is to provide a highlevel summary of the state of South Africa's biodiversity at regular points in time, with a strong focus on spatial information. Each NBA builds on decades of research and innovation by South African scientists, and makes that science available in a useful form to users both inside and outside of the biodiversity sector. As a body of work the NBA is not prescriptive; it presents important information that can be adopted by government and civil society in various decision making processes to support socio-economic imperatives, human wellbeing, and the best management and conservation of South Africa's biodiversity.

## 4.2 How the NBA input datasets are used

### 4.2.1 Overview of how NBA input datasets are used

add text

#### 4.2.2 Detailing how NBA realm specific input datasets are used?

##### 4.2.2.1 Terrestrial realm

add text

##### 4.2.2.2 Freshwater (Inland aquatic) realm

add text

##### 4.2.2.3 Estuarine realm

add text

##### 4.2.2.4 Marine realm

add text

##### 4.2.2.5 Coast cross-cutting realm

add text

#### 4.2.3 How the NBA findings and key messages can be used

add text

### 4.3 Direct links between NBA indicators and MEAs indicators

#### 4.3.1 KBA analysis and indicators?

add text

#### 4.3.2 Indicators database to serve NBA and MEAs

add text

# 5 South Africa's biodiversity profile

## 5.1 Overview of South Africa's biodiversity profile

South Africa has exceptional biodiversity, characterised by high species richness, high levels of species endemism and a wide variety of ecosystems. South Africa's diversity and richness are not limited to biodiversity. Within its borders are also diverse cultures and languages, and exceptional geological and climatic diversity.

Identified as one of the world's 17 megadiverse nations, South Africa ranks as one of the top ten nations globally for plant species richness and third for marine species endemism. With a landmass of 1.2 million km2 and surrounding seas of 1.1 million km2, South Africa is among the smaller of the world's megadiverse countries – which together contain more than two-thirds of the world's biodiversity. South Africa also holds three of the world's 35 biodiversity hotspots (a measure of biological diversity combined with vulnerability to threats): the Cape Floristic Region, Succulent Karoo biome, and the Maputaland–Pondoland–Albany centre of endemism.

## 5.2 Biodiversity benefits

Add text

### 5.2.1 Benefits of biodiversity in this realm?

Benefits and how to link to the importance of SA's biodiversity

#### 5.2.1.1 Terrestrial realm

Add text

#### 5.2.1.2 Freshwater (inland aquatic) realm

Add text

#### 5.2.1.3 Estuarine realm

Add text

#### 5.2.1.4 Marine realm

Add text

#### 5.2.1.5 Coast cross-cutting realm

Add text

# Part II

# Key messages

# 6 South Africa's biodiversity provides benefits to people

---

#3 Biodiversity provides jobs

South Africa's biodiversity provides substantial employment in a range of sectors (established but incomplete). Continued investment in managing and conserving biodiversity is essential so that jobs that depend on biodiversity can continue to increase.

## 6.1 Healthy ecosystems are essential for water security

Rivers, wetlands and their catchment areas are crucial ecological infrastructure for water security, often complementing built infrastructure, but the benefits from some of these ecosystems are currently compromised by their poor ecological condition (well established). Water security can be improved through integrated management of natural resources in Strategic Water Source Areas as well as other key catchments, including protection and restoration in some cases.

## 6.2 Water flowing into the sea provides multiple benefits to people

Freshwater flowing from rivers through estuaries into the sea is not wasted, and is essential for coastal and marine food production, livelihoods, tourism and future climate change resilience (established but incomplete). Through appropriate management, South Africa can maintain the vital freshwater flows that reach the coast.

## 6.3 Small high-value ecosystem types take up just 5% of South Africa's territory, but provide disproportionate benefits to people

Certain small ecosystem types function as crucial ecological infrastructure and, despite their small footprint, provide multiple benefits to society (established but incomplete). Managing, protecting and restoring these small, high-value.

## 6.4 Benefits from fishing are at risk, including food and job security

Estuarine and marine ecosystems provide South Africans with food and livelihoods by providing a basis for fishing – whether commercial, subsistence or recreational. Yet many fish stocks are overexploited and many fish species are threatened (well established). While a range of plans are in place to ensure that fisheries are sustainable, better practices to rebuild stocks of priority species are needed, as well as reliable data and sufficient capacity for undertaking regular stock assessments.

## 6.5 Climate change is impacting on people and ecosystems; in spite of this, healthy ecosystems can help us adapt to climate change

The impacts of climate change are evident across all realms and within most species groups. Biodiversity provides resilience against the worst effects of climate change (*established but incomplete*). Restoring ecosystems and maintaining them in a good ecological condition means they are better able to support natural adaptation and mitigation processes, offering increased protection to human communities and reducing the economic burden of future climate disasters.

# 7 South Africa's biodiversity is under pressure, but solutions are at hand

## 7.1 Estuaries and wetlands are the most threatened and least protected ecosystems in South Africa

Estuarine and inland wetland ecosystems face many pressures and are highly threatened (*established but incomplete*). The restoration and protection of estuaries and inland wetlands will secure essential benefits and deliver large return on investment.

## 7.2 Coastal biodiversity assets, including beaches, are at risk

Sixty per cent of coastal ecosystem types are threatened – a result of the many pressures concentrated on the coast (*well established*). Judicious coastal development that avoids sensitive areas can minimise further damage, maintain ecological infrastructure and reduce climate risks.

## 7.3 Protected areas: investment success in the ocean and on land

Protected areas have expanded in the ocean and on land, and are a source of pride for South Africans (*well established*). Continued expansion will help to ensure biodiversity conservation, ecological sustainability and even more social and economic benefits from biodiversity.

## 7.4 Protected areas: providing effective protection for many species

South Africa's protected areas are generally providing good protection for species, as shown by new protection level indicators for species (established but incomplete). The results provide important feedback for protected area expansion strategies and for protected area management.

## 7.5 Freshwater fishes are the most threatened species group in South Africa

Freshwater fishes are the most threatened of all species groups that have been fully assessed in South Africa, and half of South Africa's freshwater fish species are found nowhere else in the world (established but incomplete). Effective management and conservation strategies to halt the decline and promote recovery of threatened fish species are needed, focussed on the rivers and catchments where these fish occur.

## 7.6 Trends in threat status show rapid declines in some of South Africa's species, especially freshwater species and butterflies

Changes in species threat status over time were tracked for eight taxonomic groups using the IUCN Red List Index (RLI). Increased extinction risk is evident for most groups, but freshwater species and butterflies, in particular, show a steep decline (*established but incomplete*). For the RLI to be more comprehensive, repeat assessments are required for species in the marine and estuarine realms, and invertebrates in general.

## 7.7 Areas where pressures are concentrated should be priorities for spatial planning

The spatial distribution of pressures on biodiversity across the landscape and seascape is uneven. Pressure hotspots, where many different pressures converge, require strategic spatial planning and focussed management (*established but incomplete*).

## 7.8 Biological invasions threaten biodiversity and human wellbeing

Over 100 alien species have a severe impact on South Africa's biodiversity and, in some cases, on human wellbeing (*well established*). Although some successes in the management of biological invasions have been achieved, the adoption of a national strategy for managing biological invasions, improved project-level planning for prevention and management, and enhanced spatially explicit data will greatly increase effectiveness of current efforts.

## 7.9 Cooperative governance is essential for healthy landscapes and seascapes

Biodiversity patterns and ecological processes are connected in complex ways that cross realms as well as human-constructed boundaries. At the same time, human activities in a range of different sectors that have separate policies and legislation and are separately managed, can impact on the same biodiversity or ecological infrastructure (*established but incomplete*). To deal with this interconnectedness, cooperative governance and cross-sectoral planning and decision making are essential.

# 8 The NBA stimulates work to address knowledge gaps

## 8.1 South Africa's new seamless map of ecosystem types paves the way for improved assessment, planning and monitoring

Substantial progress made in classifying and mapping ecosystem types seamlessly across all realms has unlocked comprehensive and systematic assessment and planning for all of South Africa's territory, providing improved information to inform policy and decision making.

## 8.2 New indicators developed during the NBA 2018 advance South Africa's ability to report on the status of biodiversity

The collaborative process of undertaking the NBA builds on innovations and advances in the biodiversity sector to produce new techniques and advances in knowledge. In the NBA 2018, several new indicators have been developed to provide a more comprehensive picture of the state of ecosystems and species.

## 8.3 Evaluation of genetic diversity brings new value to the NBA

Genetic diversity enables species to evolve and adapt within an ever-changing environment. The development of potential genetic diversity indicators for national-level assessments and monitoring has added value to the NBA and South Africa's international reporting commitments.

## 8.4 Investment in strategic and collaborative biodiversity monitoring programmes is crucial to inform management and decision making and for biodiversity assessments

Investment in existing and future strategic and cooperative biodiversity monitoring programmes is essential to strengthen our ability to detect and report on trends, plan accordingly and manage effectively.

# Part III

# Integrated findings

# 9 National Headline Indicators

## 9.1 Overview

This section brings together the findings from components of the NBA 2018 and presents them in an integrated fashion. The headline indicators are compared across realms and taxonomic groups, key pressures that affect all realms are highlighted, and genetic diversity – that applies to all realms and taxonomic groups – is addressed.

### 9.1.1 Red List Index of Ecosystems

Trends in ecosystem threat status

### 9.1.2 Protection Level

add text

## 9.2 Species indicators

add text

### 9.2.1 Red List Index of Species

Trends in species threat status

### 9.2.2 Species Protection Level

add text

## 9.3 Genetic diversity

### 9.3.1 Genetic diversity at population level

add text

### 9.3.2 Genetic diversity at landscape level

add text

# 10 Pressures

## 10.1 Synthesis

The International Union for the Conservation of Nature (IUCN) proposes a threats classification scheme with a hierarchical structure for various pressures on biodiversity. The NBA 2018 adopted this approach with some minor language adaptations and the resulting pressure plots are used throughout the NBA 2018 reports. The species plots were based on a meta-analysis of species Red List assessments (which document pressures on each species) and the cross-realm plot was informed by the species meta-analysis and expert inputs.

### 10.1.1 Climate change

add text

### 10.1.2 Land cover change

add text

### 10.1.3 Degradation

add text

### 10.1.4 Alien invasive species

add text

### 10.1.5 Pesticides

add

## 10.2 Ecological condition overview

Ecological condition is estimated using a range of different approaches across the realms, but essentially depends on the ability to spatially represent the various pressures exerted on biodiversity. Ecological condition in the terrestrial realm relies primarily on land cover change data; cumulative pressure mapping is used in the marine realm; and a multi-criteria ecological condition framework is used in the estuarine and inland aquatic realms. The different systems were aligned as far as possible in the NBA to allow for crossrealm comparisons and unified terminology.

The marine and terrestrial realms are similar in terms of their relatively high percentage of natural/near-natural ecosystem extent ($\pm$ 80%). In these extensive realms, ecosystem modification tends to be focussed in pressure hotspots, usually linked to regional characteristics such as high productivity, accessibility and valuable natural resources; while large areas remain relatively unmodified or intact. For example, the Cape lowlands have extensive winter field crops while the mountainous areas of the Cape see far less intensive agriculture; all bay ecosystem types, the shelf edge and the KwaZulu-Natal Bight are subject to multiple pressures while many deep sea ecosystems

### 10.2.1 Ecological condition per realm

add text

#### 10.2.1.1 Terrestrial realm

add text

#### 10.2.1.2 Freshwater (inland aquatic) realm

add text

#### 10.2.1.3 Estuarine realm

add text

#### 10.2.1.4 Marine realm

add text

#### 10.2.1.5 Coast cross-realm

add text

# Part IV

# Findings by realm

# 11 Terrestrial realm

**Recommended citation:**

---

## 11.1 Overview

add text

## 11.2 Input data and method for the terrestrial realm

add text

### 11.2.1 Ecosystem assessments

add text

### 11.2.2 Species assessments

add text

## 11.3 Key drivers and pressures impacting terrestrial ecosystems

add text

### 11.3.1 Habitat loss

add text

### 11.3.2 Land degradation

add text

### 11.3.3 Biological invasions

add text

### 11.3.4 Climate change

add text

### 11.3.5 Biological resource use

add text

## 11.4 Terrestrial ecosystems

### 11.4.1 Map of ecosystem types

add text

### 11.4.2 Overview of South African biomes

add text

#### 11.4.2.1 Albany Thicket

add text

#### 11.4.2.2 Azonal Vegetation

add text

#### 11.4.2.3 Desert

add text

#### 11.4.2.4 Forests

add text

#### 11.4.2.5 Fynbos

add text

#### 11.4.2.6 Grassland

add text

#### 11.4.2.7 Indian Ocean Coastal Belt

add text

#### 11.4.2.8 Nama-Karoo

add text

#### 11.4.2.9 Savanna

add text

#### 11.4.2.10 Succulent Karoo

add text

## 11.5 Ecological condition

## 11.6 Overview

add text

### 11.6.1 Ecological condition per realm

add text

#### 11.6.1.1 Albany Thicket

add text

#### 11.6.1.2 Azonal Vegetation

add text

#### 11.6.1.3 Desert

add text

#### 11.6.1.4 Forests

add text

#### 11.6.1.5 Fynbos

add text

#### 11.6.1.6 Grassland

add text

#### 11.6.1.7 Indian Ocean Coastal Belt

add text

#### 11.6.1.8 Nama-Karoo

add text

#### 11.6.1.9 Savanna

add text

#### 11.6.1.10 Succulent Karoo

add text

## 11.7 Red List of Ecosystems

add text

### 11.7.1 Red List of Ecosystems per biome

add text

#### 11.7.1.1 Albany Thicket

add text

#### 11.7.1.2 Azonal Vegetation

add text

#### 11.7.1.3 Desert

add text

#### 11.7.1.4 Forests

add text

#### 11.7.1.5 Fynbos

add text

#### 11.7.1.6 Grassland

add text

#### 11.7.1.7 Indian Ocean Coastal Belt

add text

#### 11.7.1.8 Nama-Karoo

add text

#### 11.7.1.9 Savanna

add text

#### 11.7.1.10 Succulent Karoo

add text

### 11.7.2 Red List of Ecosystems - Prince Edward Island

add text

## 11.8 Protection Level

add text

### 11.8.1 Protection level per biome

add text

#### 11.8.1.1 Albany Thicket

add text

#### 11.8.1.2 Azonal Vegetation

add text

#### 11.8.1.3 Desert

add text

#### 11.8.1.4 Forests

add text

#### 11.8.1.5 Fynbos

add text

#### 11.8.1.6 Grassland

add text

#### 11.8.1.7 Indian Ocean Coastal Belt

add text

#### 11.8.1.8 Nama-Karoo

add text

#### 11.8.1.9 Savanna

add text

#### 11.8.1.10 Succulent Karoo

add text

## 11.9 Terrestrial species

### 11.9.1 Utilized terrestrial species resource assessments

add text

# 12 Freshwater realm

**Recommended citation**:

---

## 12.1 Overview

add text

### 12.1.1 Rivers

Ecological condition of rivers

### 12.1.2 Wetlands

Ecological condition of wetlands

## 12.2 Ecosystems

add text

### 12.2.1 Rivers

Map ecosystem types - rivers

### 12.2.2 Wetlands

Map of ecosystem types - wetlands

### 12.2.3 Riparian

Map of ecosystem types - riparian

## 12.3 Ecological condition

add text

### 12.3.1 Rivers

Ecological condition of rivers

### 12.3.2 Wetlands

Ecological condition of wetlands

## 12.4 Red List of Ecosystems

add text

### 12.4.1 Red List of Ecosystems - rivers

add text

### 12.4.2 Red List of Ecosystems - wetlands

add text

## 12.5 Protection level

add text

### 12.5.1 Protection level of rivers

add text

### 12.5.2 Protection level of wetlands

add text

## 12.6 Species

add

# 13 Estuarine realm

**Recommended citation:**

---

## 13.1 Overview

add text

## 13.2 Ecological condition

add text

### 13.2.1 Condition

add text

### 13.2.2 Pressures

Estuary pressure information and condition dataset

Estuarine Invasive Alien Aquatic Plants

## 13.3 Ecosystems

### 13.3.1 Habitats and vegetation

add text

#### 13.3.1.1 Functional zone

Estuary Functional Zone update

KZN Estuary Functional Zone

#### 13.3.1.2 Classification updates

DWS Great Fish to Tsitsikamma Classification

## 13.4 Red List of Ecosystems

add text

## 13.5 Protection Level

add text

## 13.6 Species

add text

# 14 Marine realm

**Recommended citation:**

---

## 14.1 Overview

add text

## 14.2 Input data and method for the marine realm

add text

### 14.2.1 Ecosystem assessments

add text

### 14.2.2 Species assessments

add text

## 14.3 Key drivers and pressures impacting marine ecosystems

add text

### 14.3.1 Habitat loss

add text

### 14.3.2 Degradation

add text

### 14.3.3 Biological invasions

add text

### 14.3.4 Climate change

add text

### 14.3.5 Biological resource use

add text

## 14.4 Ecosystems

add text

### 14.4.1 Ecosystems in the marine realm

add text

### 14.4.2 Ecosystems around Prince Edward Island

add text

## 14.5 Ecological condition

add text

### 14.5.1 Marine pressure datasets

add text

## 14.6 Red List of Ecosystems

add text

## 14.7 Protection level

add text

## 14.8 Species

add text

# 15 Coast cross-cutting realm

**Recommended citation:**

---

## 15.1 Overview

add text

## 15.2 Ecosystems

add text

### 15.2.1 Map of ecosytem types

add text

## 15.3 Ecological condition

add text

## 15.4 Red List of Ecosystems

add text

## 15.5 Protection level

add text

## 15.6 Species

add text

# Part V

# Species

# 16 Species

**Recommended citation:**

---

## 16.1 Amphibians

Taxonomic group summary

## 16.2 Birds

add text

### 16.2.1 Terrestrial

Taxonomic group summary

### 16.2.2 Estuarine

Estuary birds

## 16.3 Fish

add text

### 16.3.1 Inland aquatic

Taxonomic group summary - Freshwater fish

### 16.3.2 Estuarine

Estuary fish

## 16.4 Invertebrates

### 16.4.1 Overview of invetebrate groups assessed to date

### 16.4.2 Bees

Taxonomic group summary page

### 16.4.3 Branchiopoda

Taxonomic group summary - Large Branchiopoda

### 16.4.4 Butterflies

Taxonomic group summary

### 16.4.5 Crabs

Taxonomic group summary

### 16.4.6 Dragonflies

Taxonomic group summary

### 16.4.7 Mollusca

#### 16.4.7.1 Terrestrial

Taxonomic group summary

#### 16.4.7.2 Inland aquatic

### 16.4.8 Spiders

Taxonomic group summary

### 16.4.9 Estuary invertebrates

Taxonomic group summary

## 16.5 Mammals

### 16.5.1 Terrestrial

Taxonomic group summary

### 16.5.2 Inland aquatic

add text

### 16.5.3 Marine

add text

## 16.6 Plants

Taxonomic group summary

## 16.7 Reptiles

Taxonomic group summary

# Part VI

# Priority actions and responses

# 17 Priority actions for improving future NBAs

## 17.1 Overview

add text

## 17.2 Knowledge Gaps and Research Priorities for Strengthening the NBA

### 17.2.1 Review of NBA 2018 Research, Monitoring and Data Management Priorities

add text

### 17.2.2 NBA 2025 Research, Monitoring and Data Management Priorities

add text

#### 17.2.2.1 Terrestrial realm

add text

#### 17.2.2.2 Freshwater (inland aquatic) realm

add text

#### 17.2.2.3 Estuarine realm

add text

#### 17.2.2.4 Marine realm

add text

#### 17.2.2.5 Coast cross-realm

add text

## 17.3 Review of tools used to measure genetic diversity

add text

### 17.3.1 State of DNA barcoding

Genetic resources and tools

### 17.3.2 Use of eDNA in South Africa

add text

### 17.3.3 State of SA's Biobanks

add text

# 18 South Africa's responses for managing and conserving biodiversity

## 18.1 Overview

add text

## 18.2 Avoid loss

add text

## 18.3 Protect

### 18.3.1 Protection over time indices?

Protected area layer, consolidated annual time steps for PL and Accounts

## 18.4 Restore

Response initiatives map

Recording where and what restoration is happening in the country

## 18.5 Resources for biodiversity conservation

add text

## 18.6 The need for evidence on the effectiveness and impact of responses

add text

# References

Knuth, Donald E. 1984. "Literate Programming." *Comput. J.* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.