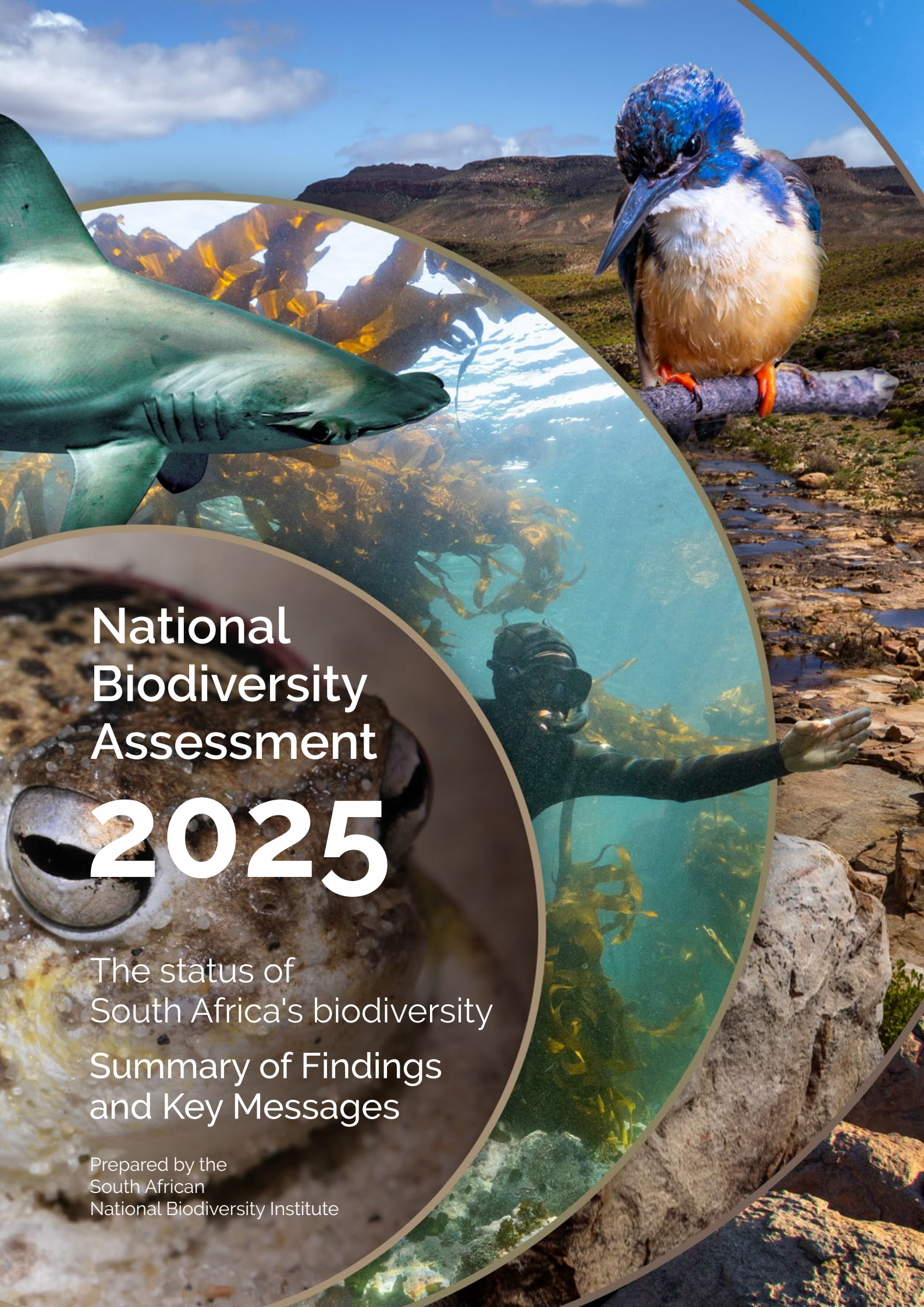

National Biodiversity Assessment 2025

The status of South Africa's biodiversity

Summary of Findings and Key Messages

Prepared by the
South African
National Biodiversity Institute

Front cover images, left to right:

- Sharks, rays and chimaeras are among South Africa's most threatened species groups, with declining trends for many species. Scalloped hammerhead sharks (*Sphyrna lewini*) are now listed as Critically Endangered globally on the IUCN Red List of Threatened Species™. © Ryan Daly.
- The desert rain frog (*Breviceps macrops*) has been uplisted from Near Threatened to Vulnerable since NBA 2018. The population is declining due to the impacts of mining and climate change. © Nicolas Telford.
- Kelp forests cover a small portion of South Africa's marine realm, yet play a vital role in climate regulation and buffering coastal communities from sea storms. They are also an important source of food, essential minerals and fertiliser. © Sacha Specker.
- South Africa's freshwater systems are crucial for many ecosystem services such as absorbing flood waters and cleaning pollutants. Their poor ecological condition is affecting these services. Over 60% of river and wetland types are threatened, while less than 10% are Well Protected. © Jeremy Shelton.
- The half-collared kingfisher (*Alcedo semitorquata*) is now listed as Vulnerable on BirdLife South Africa's Regional Red Data Book of Birds 2025. Previously listed as Near Threatened, it is now threatened due to reduction in habitat size and quality as this species is dependent on clear, vegetated streams, which are increasingly threatened. © Tim Kuiper.

National Biodiversity Assessment 2025

The status of South Africa's biodiversity

Summary of Findings and Key Messages

Prepared by the South African National Biodiversity Institute
under its mandate to assess and monitor the state of South Africa's biodiversity.

SANBI
Biodiversity for Life
South African National Biodiversity Institute

2025

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Note: Refer to the NBA 2025 website (http://nba.sanbi.org.za/) for contributors to individual modules of NBA 2025 work.

Reviewers: This publication was checked by Dr Colleen Seymour and Dr Emily Botts. The draft key messages were workshopped with a number of stakeholder groups.

Technical editor: Alicia Pretorius
Proofreader: Yolande Steenkamp
Design and layout: Elizma Fouché

Recommended citation for specific results or data

Use the recommended citation found on each webpage (refer to the inside back cover for more information).

Recommended citation for this *Summary of Findings and Key Messages* publication

South African National Biodiversity Institute (SANBI). 2025. *National Biodiversity Assessment 2025: The status of South Africa's biodiversity. Summary of Findings and Key Messages*. Skowno, A.L., Poole, C.J., Besseling, N.A., Currie, J.C., Da Silva, J.M., Dayaram, A., Harris, L.R., Job, N., Monyeki, M.S., Mtshali, H., Raimondo, D.C., Sink, K.J., Van der Bank, M.G., Van der Colff, D., Van Niekerk, L., Von Staden, L. South African National Biodiversity Institute (an entity of the Department of Forestry, Fisheries and the Environment), Pretoria. https://hdl.handle.net/20.500.12143/9467.

ISBN 978-1-928224-80-8

Obtainable from: SANBI Bookshop, 2 Cussonia Ave., Brummeria, Pretoria 0184, South Africa.
Available for free download: https://www.sanbi.org/gardens/pretoria/sanbi-bookshop/
Tel.: +27 12 002 5201/+27 12 002 5200
E-mail: sanbibookshop@sanbi.org.za
Website: www.sanbi.org
Printed by: Typo Print, 19 Beaufort St, c/r Albertina Sisulu Rd, Troyeville, Johannesburg, 2139 South Africa; tel.: +27 11 402 3468/9.

The South African National Biodiversity Institute is an entity of

forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Contents

About the National Biodiversity Assessment 2025

The National Biodiversity Assessment (NBA) is a collaborative effort to synthesise the best available science on South Africa's biodiversity to inform policy, support decision-making across multiple sectors, and contribute to national development priorities. It is produced by the South African National Biodiversity Institute (SANBI) as part of its mandate, in partnership with numerous institutions. The *National Biodiversity Assessment 2025* (NBA 2025) is the fourth iteration, building on the 2004, 2011 and 2018 releases.

The NBA 2025 is presented in two formats:

- This *Summary of Findings and Key Messages* publication (full title: *National Biodiversity Assessment 2025: The status of South Africa's biodiversity. Summary of Findings and Key Messages*; available in print and PDF).
- A dedicated website (http://nba.sanbi.org.za/) featuring around 100 webpages of scientifically referenced, citable content, with links to detailed technical documentation and academic publications.

The new online format transforms how the NBA content is delivered. Readers can access the level of detail they require, navigating from high-level statistics to detailed methods and datasets, and use smart searches to locate specific information. A website can be updated regularly, making the NBA a 'living' assessment that reflects the most current data available.

See the last page of this publication for an overview of the website contents and details of the technical documentation underpinning each webpage/module of the NBA. For further information about the origins, context, purpose, content, form and approach of the NBA, refer to *South Africa's National Biodiversity Assessment: Contextual and Operational Framework* (https://hdl.handle.net/20.500.12143/9058).

Editorial conventions in this summary

- **Species and taxa:** Both scientific and common names (where available) are provided when referring to species. English common names are used unless a non-English name is predominantly used in South Africa. It is recognised that more than one English common name and common names in other official South African languages may also exist. Some species have been split into subspecies and/or varieties and are assessed at these levels. Consequently, if a taxonomic group includes subspecies or varieties, the summary statistics use the term 'taxa' (singular: taxon). If a group contains only species then the term 'species' is used in the summary statistics.
- **Acronyms and abbreviations:** The use of these has been restricted to those that are in common usage or used frequently throughout the document.
- **Terminology:** This publication does not include a glossary. Readers are encouraged to refer to the Lexicon of Spatial Biodiversity Assessment, Prioritisation and Planning in South Africa (Second Edition, 2023, available at http://hdl.handle.net/20.500.12143/8261) for standard definitions of key concepts and frequently used terms.
- **References:** This publication does not include references. References can be found on the relevant NBA webpages where the technical content is explained in detail. Visit http://nba.sanbi.org.za/ and navigate to the specific module of the NBA to access the reference list.
- **References to this publication in the text:** This publication is referred to by either its full title (*National Biodiversity Assessment 2025: The status of South Africa's biodiversity. Summary of Findings and Key Messages*), or parts of the title (i.e., *National Biodiversity Assessment 2025* or NBA 2025 [these forms may also refer to the full assessment, available online]), or *Summary of Findings and Key Messages* (specifically this book).

Acknowledgements

The NBA is produced by the South African National Biodiversity Institute (SANBI) as part of its mandate to report regularly to the Minister of Forestry, Fisheries and the Environment on the status of the country's biodiversity. SANBI operates through the Network of Partners Model, recognising that such a technically demanding and wide-ranging scientific assessment cannot be achieved without substantial support from numerous partners. This model not only ensures the completion of the NBA, but it also fosters collective ownership of the assessment by the biodiversity community in South Africa. The co-production of knowledge for the NBA enables scientists, practitioners and decision-makers to work towards a common vision for priority actions and responses following the assessment.

The NBA 2025 would not have been possible without the substantial in-kind contributions of time, data and expertise from numerous individuals and institutions. From November 2019 to October 2025 more than 490 individuals from approximately 110 institutions contributed over 23 000 person-days of work. Their dedication and expertise are sincerely appreciated – the NBA truly is a multi-stakeholder endeavour.

SANBI is particularly grateful for the strategic and long-term partnerships that supported leadership of the Estuarine (Council for Scientific and Industrial Research) and Coastal (the Institute for Coastal and Marine Research at Nelson Mandela University) Components of the NBA. Their clear and experienced leadership of these complex components was invaluable.

Various governance structures guide the NBA, ensuring a broad range of experts and stakeholders contributed to the assessment. We extend our thanks to the members of the various ecosystem committees and species working groups for their technical inputs; the NBA 2025 Core Reference Group for leading the complex content; the internal SANBI Cross Functional Steering Committee for oversight and support; and the Strategic Advisory Committee (consisting of senior officials from various government departments and entities, non-governmental organisations and private sector associations) for cross-sectoral inputs and advice on communicating NBA findings. Appreciation also goes to the Department of Forestry, Fisheries and the Environment intergovernmental structures where the NBA key messages were tabled for inputs.

Finally, thanks to all the talented photographers who generously donated their images for use in NBA 2025, both in this publication and on the website. Their contributions greatly enrich the presentation and communication of the state of South Africa's biodiversity.

Foreword

South Africa is one of 17 megadiverse countries in the world, with extraordinary biodiversity defined by rich species variety, high levels of endemism and diverse ecosystems. We host three of the world's 36 biodiversity hotspots and rank third globally in marine species endemism. Our wealth extends beyond our rich tapestry of cultures, languages and biodiversity, all the way into our remarkable geological and climatic diversity, uniquely shaping the South African story. This natural heritage is a legacy that must be protected and used sustainably for the benefit of all South Africans, now and for generations to come.

Our biodiversity underpins both our economy and our society. It provides essential services and products that sustain human wellbeing. It is not only a national treasure, but also a driver of development. Biodiversity plays a central role in advancing the Government of National Unity's priorities: inclusive growth and job creation; reducing poverty and lowering the cost of living; and building a capable, ethical and developmental state. As we confront climate change and socio-economic pressures, we must recognise that investing in ecological infrastructure is as vital as investing in roads, energy and water systems.

Safeguarding biodiversity requires sound science and an understanding of the complex relationship between people and nature. The publication of the *National Biodiversity Assessment 2025*, during the year of South Africa's G20 Presidency, provides a unique opportunity to highlight the importance of biodiversity in achieving our developmental goals and meeting global environmental commitments. The *National Biodiversity Assessment 2025* gives a clear, evidence-based picture of the state of our biodiversity and guides policies, laws and actions across all spheres of government. It also supports South Africa's international obligations under multilateral environmental agreements.

I am proud to present the *National Biodiversity Assessment 2025*: a high calibre, multi-author and multi-stakeholder scientific effort that captures the state of our biodiversity today. This knowledge must guide collective action. The *National Biodiversity Assessment 2025* is not only a tool for the environment sector, but also a resource for government, business, communities and all South Africans. Protecting and managing our landscapes and seascapes is a shared responsibility, and through a whole-of-society effort we can secure this natural wealth for the future.

Mr Willem Aucamp, MP
Minister of Forestry, Fisheries and the Environment

Message

South Africa's rich biodiversity is foundational to the wellbeing of its people. Biodiversity gives our people food, clean water, medicine and materials; it supports agriculture and fisheries; it offers resilience against disasters; and it provides the basis of a vibrant tourism industry while offering natural spaces for recreational and cultural activities.

South Africa was one of the first countries to explore and realise the possibility of a national assessment of the state of its ecosystems and species, with the first iteration being in 2004. Now in its fourth iteration, the NBA continues to be a world-class scientific product that is influential in policy and planning. NBA 2025 endeavours to be more robust, transparent and repeatable. This provides us with a comprehensive picture of South Africa's biodiversity threat status and protection level across time. Each NBA builds on decades of research and innovation by South African scientists, and makes that science available in a suitable form to users both inside and outside of the biodiversity sector.

The NBA enables evidence-based decisions in areas such as expansion of protected and conserved areas, adaptation to climate change, land-use planning, the restoration and management of ecological infrastructure, and in pursuit of sustainable development. It is also a vital tool in fulfilling South Africa's international obligations under the Convention on Biological Diversity.

I commend the SANBI team and the many partners who contributed to the NBA 2025. This is more than a report – it is a national resource. Let us use it wisely to advance conservation, strengthen ecological resilience and support inclusive economic growth.

Dr Mmaphaka Tau
Chairperson of SANBI Board

The NBA contributes to the body of evidence that enables diverse stakeholders to co-develop, through participatory whole-of-society and whole-of-government approaches, the policy responses and implementation plans required for the conservation and management of South Africa's biodiversity for the benefit of people and nature. © Jeremy Shelton.

Preface

SANBI is proud to present the NBA 2025 – a landmark publication that reflects the best available science on the status and trends of South Africa's biodiversity. The NBA is a key deliverable in fulfilling SANBI's legislative mandate under the National Environmental Management: Biodiversity Act (Act 10 of 2004), which requires reporting to the Minister on both the status of the country's biodiversity, and the status of all listed threatened or protected species and ecosystems.

The NBA has seven objectives:

1. Inform policy and decision-making across multiple sectors.
2. Support prioritisation and planning for conservation action.
3. Highlight the benefits of biodiversity for people and the economy.
4. Present indicators for both national and international reporting.
5. Raise key issues for education and fundraising.
6. Provide a platform for collaboration and capacity development within the biodiversity sector.
7. Identify crucial data and knowledge gaps to stimulate future research and improvement.

While the NBA does not prescribe all actions or responses to the pressures on biodiversity, it offers a robust evidence base that stakeholders can use to co-produce solutions and shape a shared path forward. South Africa's future depends on recognising the inextricable link between biodiversity and human wellbeing – requiring integrated strategies and a whole-of-society approach. Collaborative efforts across government, industry and civil society are vital to sustaining the benefits that nature provides, with thriving ecosystems, species and genetic diversity forming the foundation of economic growth and wellbeing for all.

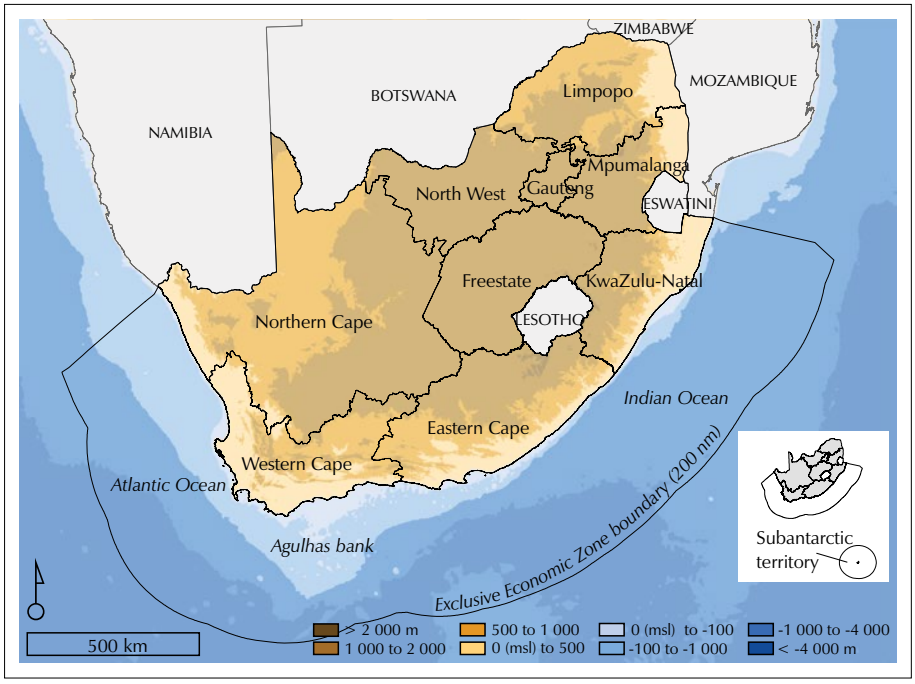
The scope of the NBA is extensive. It assesses all three components of biodiversity – ecosystems, species and genetic diversity – across South Africa's full geographic extent, including the subantarctic Prince Edward Islands. It encompasses all ecological realms: terrestrial, freshwater (rivers and wetlands), estuarine and marine (benthic and pelagic), as well as the coast, which serves as a vital cross-realm interface.

The NBA is a collaborative, science-based assessment that informs policy, guides planning, and supports national development priorities and commitments under the various multilateral environmental agreements, such as the Kunming-Montreal Global Biodiversity Framework. Its production brought together contributions from over 490 experts representing more than 110 institutions across government, academia, civil society and the private sector. This collective effort has produced a rigorous, inclusive and forward-looking assessment. SANBI extends special thanks to external contributors, without whom this work would not be possible, particularly the Council for Scientific and Industrial Research for leading the Estuarine Component, and the Institute for Coastal and Marine Research at Nelson Mandela University for leading the Coastal Component.

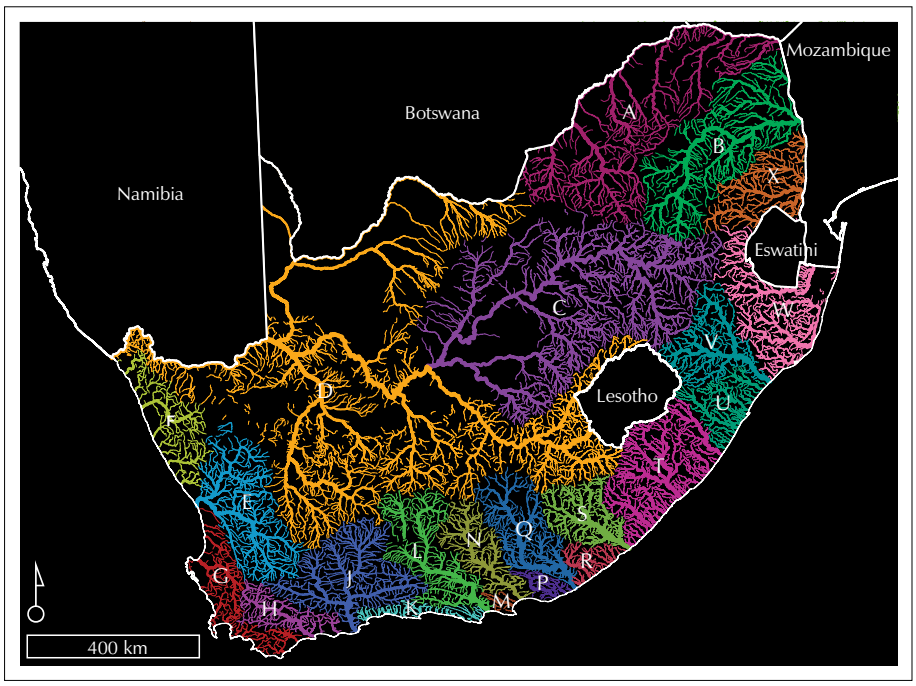
Notably, NBA 2025 leverages digital innovation. The full assessment is accessible online, offering a user-friendly structure, open access to datasets, transparent scripts used for analyses, and links to peer-reviewed literature and other key resources. This approach enhances trust, encourages broader use and empowers decision-makers at all levels. This *Summary of Findings and Key Messages* publication only captures a glimpse of the full NBA. I encourage you to explore the complete online platform to fully engage with the depth and breadth of the work.

Please join me in congratulating all those who contributed to this monumental achievement. Your dedication ensures that South Africa continues to lead with integrity, innovation and inclusiveness in biodiversity science.

Mr Shonisani Munzhedzi
Chief Executive Officer of SANBI



The geography of South Africa showing the elevation range of the mainland and bathymetric (depth) profile of the territorial waters and Exclusive Economic Zone. South Africa's subantarctic territory, namely Prince Edward and Marion islands, 1 700 km from the mainland, is shown in the inset.



Primary catchments of South Africa showing the major river networks. The largest catchment in the country is linked to the Orange River (D), which together with the Vaal (C), Limpopo (A) and Olifants (B) rivers, dominate the interior. Map inspired by the work of Sukhmani Mantel, Rhodes University.

South Africa's biodiversity profile

South Africa has exceptional biodiversity that is globally recognised, characterised by high species richness, high rates of endemism and a wide variety of ecosystem types. Although among the smaller of the world's 17 megadiverse countries, which together contain more than two-thirds of the world's biodiversity, South Africa ranks in the global top 10 of countries in terms of plant species richness and third for marine species endemism. The country holds three of the world's 36 recognised biodiversity hotspots, 31 Ramsar sites (wetlands of international importance, including the subantarctic Prince Edward Islands) and the Agulhas Bank that is an equivalently unique marine ecosystem (Figure 1). Applying the international standard, South Africa has identified 263 terrestrial Key Biodiversity Areas (KBAs), which are sites of global biodiversity significance. This network of KBAs is expected to expand over time as the marine realm is assessed.

Ecosystem facts

South Africa has a wide range of bioclimatic, oceanographic, geological and topographical settings. Together, these support high ecosystem diversity and endemism. Almost 1 000 distinct ecosystem types have been described and for the purposes of the NBA these are grouped into four realms: terrestrial, freshwater (rivers and inland wetlands), estuarine and marine. The cross-realm coastal zone is made up of selected terrestrial and marine ecosystems and all estuaries, and the Subantarctic is made up of the marine and terrestrial ecosystems of the Prince Edward Islands, 1 700 km south of mainland South Africa.

- **Terrestrial realm**: Nine biomes and 463 ecosystem types, approximately 80% of which are endemic.

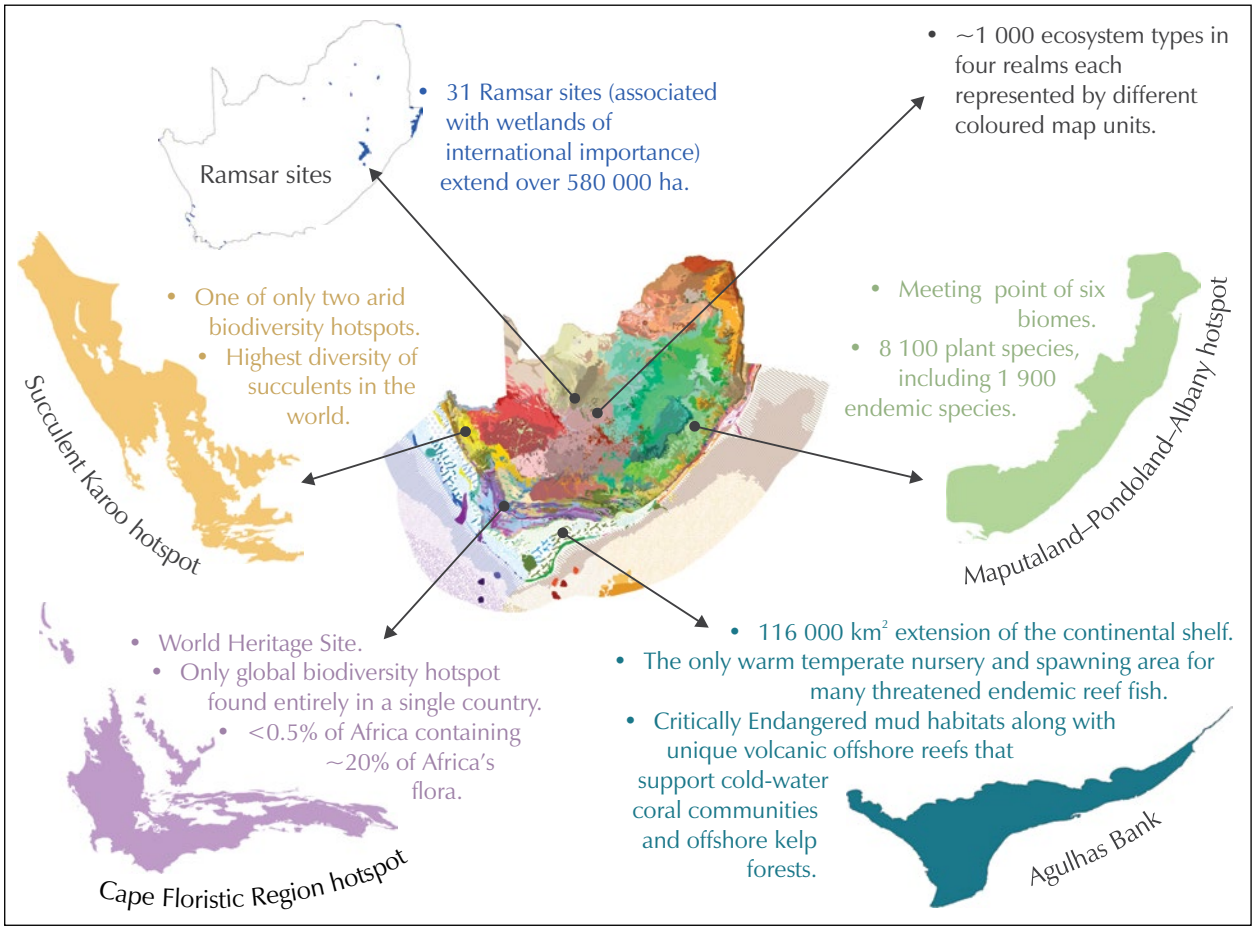


Figure 1. South Africa has exceptional biodiversity that is globally recognised – here ecosystem diversity is highlighted through several examples across the realms.

Tundra vegetation on Marion Island – part of South Africa's subantarctic territory; waterlogged mires, fern-dominated slopes and coastal salt spray habitats can be seen. © Stephni van der Merwe.

- **Freshwater realm**: Highly variable rainfall supports diverse freshwater ecosystems; **wetlands** are classified into 82 distinct types and **rivers** are classified into 222 distinct types.
- **Marine realm**: Exceptional marine biodiversity, represented by 163 distinct ecosystem types.
- **Estuarine realm**: South Africa's 290 estuaries and 42 micro-estuaries are classified into 22 estuarine ecosystem types and three micro-estuary types.
- **Cross-realm coastal zone**: An ecological definition of the coast is used for biodiversity assessments. It comprises 190 ecosystem types from the terrestrial (83 types), estuarine (22 types) and marine (85 types) ecosystem maps to form a cross-realm coastal zone.
- South Africa's **subantarctic territory** consists of Prince Edward Island, Marion Island and surrounding maritime domain. There are five terrestrial and 29 marine ecosystem types.

Species facts

South Africa is rich in species (Figure 2) and is home to an estimated 67 000 animal species, although many invertebrates remain undescribed or undiscovered. The 2025 South African National Plant Checklist records 23 514 taxa and 21 539 species, of which 20 204 are indigenous. Remarkably, 60.5% of these indigenous species are endemic to the country.

Current estimates indicate that South Africa harbours approximately 8% of the world's non-vascular and 6% vascular plant species; and 10% of the world's dung beetle, 7% of bird, 6% of bee, 5% of mammal, 3% of reptile, 2% of amphibian and 1% of freshwater fish species. In the marine realm, South Africa supports 15% of the world's shark, ray and chimaera species, 15% of nudibranch, 13% of marine (bony) fish and 5% of seaweed (including brown, green and red algae). Several terrestrial invertebrate groups have high richness relative to global statistics, with South Africa hosting nearly 5% of the world's butterfly, 4% of spider, and 3% of dragonfly and damselfly species.

Two-thirds of South Africa's plant species are endemic, and its cycads represent 10% of the global species count with 92% endemism. Around half of the South African species of amphibians, butterflies, bees, spiders and freshwater fishes are endemic, as are nearly 40% of dung beetle and reptile species. Approximately 30% of seaweed species and 40% of South Africa's estimated 10 000 marine animal species are endemic, the vast majority being invertebrates.

Microorganisms (e.g., bacteria, protozoa, fungi, viruses), an often-overlooked and largely unassessed group, are essential for healthy functioning of natural

and agricultural systems in both terrestrial and aquatic environments. Given the country's immense diversity of floral and faunal species, and that each species has its own array of microbial species associated with it, it is likely that these are also diverse. For example, it has been estimated that each unique vascular plant species in South Africa is associated with at least seven unique fungal species, implying more than 171 000 fungi species (an underestimate, as fungi associated with invertebrates are not included).

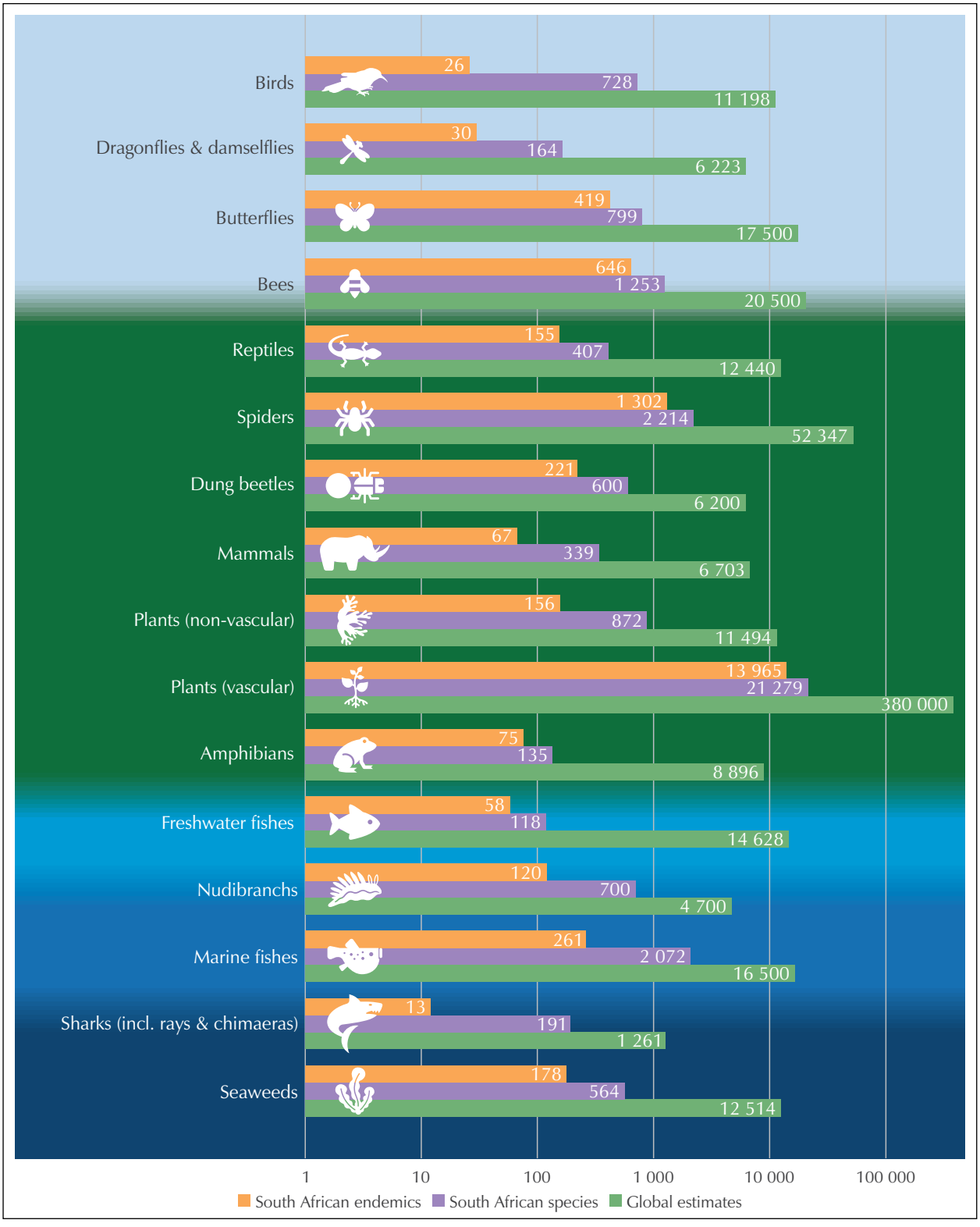


Figure 2. Species facts for South Africa (note the logarithmic scale).

The importance of South Africa's biodiversity

South Africa's extraordinary biodiversity provides multiple benefits to the economy, society and human wellbeing. These benefits depend on intact ecosystems, healthy species populations and genetic diversity. The accompanying infographic highlights important facts about nature's contributions to people in the South African context, with further statistics available on the NBA website.

A central tenet of South African national strategic frameworks is that biodiversity and development are inextricably linked – it is 'biodiversity *and* development', not 'biodiversity or development'. Biodiversity is a national asset and a powerful contributor to inclusive growth, socio-economic development and job creation. The primary goals of reducing poverty and inequality in South Africa through stimulating the economy, building an inclusive rural economy and ensuring affordable health care, all depend, to varying degrees, on healthy ecosystems and species, resilient ecological infrastructure and environmental sustainability.

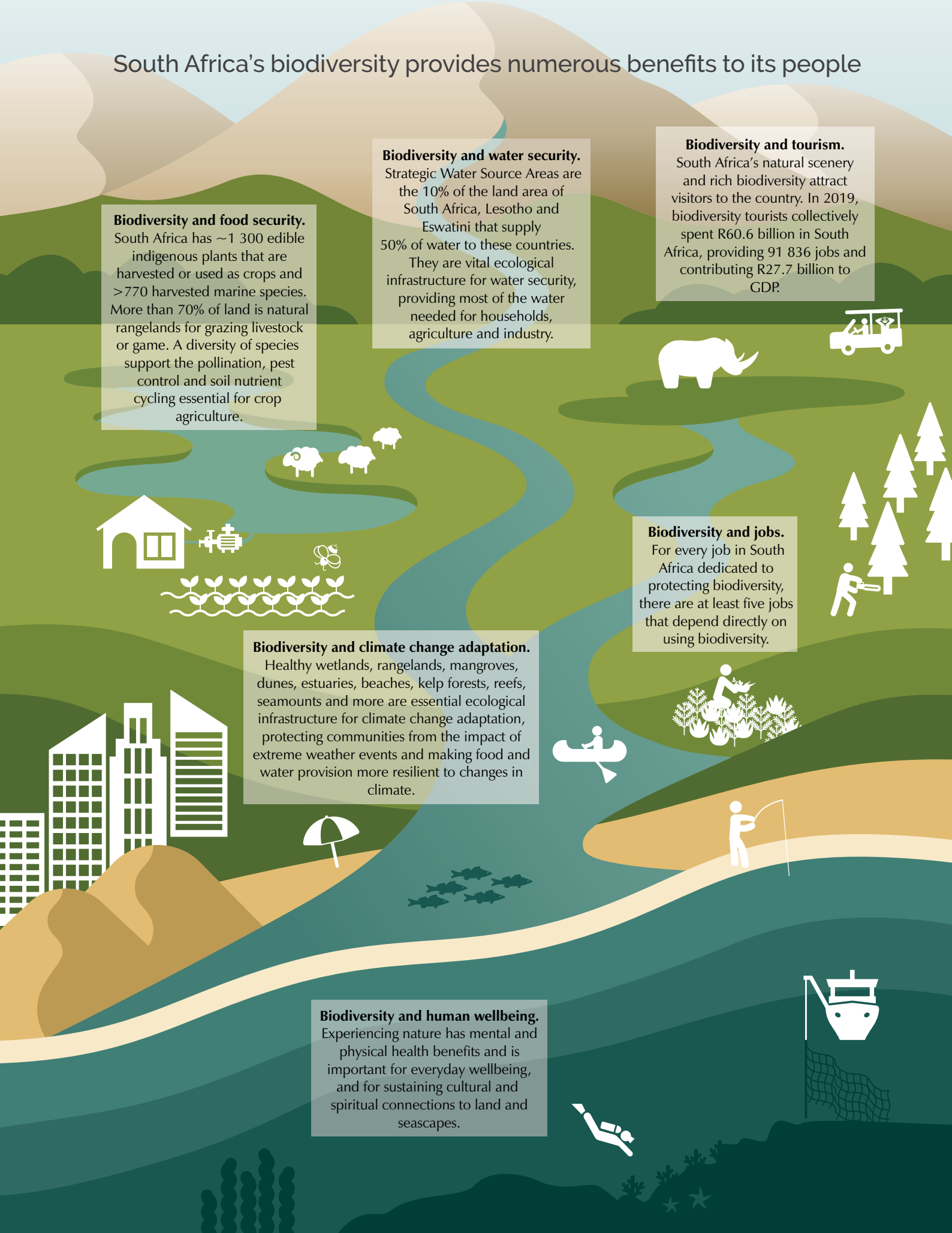
South Africa's exceptional biodiversity sustains livelihoods; supports water and food security; provides medicines; protects communities from natural disasters; enriches cultural, spiritual and recreational practices; enables adaptation to climate change; and drives innovation through bioprospecting and biomimicry. Biodiversity is woven into our languages, place names, art, religions and folklore; and is showcased across the world through tourism, storytelling and horticulture. Biodiversity is both a national priority and a treasured legacy for future generations.

Every decision taken, whether by government, the private sector or individuals, shapes the future of biodiversity. By investing in the restoration, conservation and management of biodiversity assets, and ecological infrastructure, South Africans simultaneously enhance social and economic development and contribute to human wellbeing.

South Africa's exceptional biodiversity provides many benefits to the economy, society and human wellbeing, and it is the basis for employment across a range of sectors, including A, fishing (© Ryan Daly); B, scientific research (© Jeremy Shelton) and; C, tourism (© John Power).

South Africa's natural places are host to many important activities, such as A, citizen science (© Greg Martindale); B, cultural and spiritual practices (© Peter Chadwick) and; C, extensive natural rangelands (© John Power).

South Africa's biodiversity provides numerous benefits to its people



Biodiversity and food security. South Africa has ~1 300 edible indigenous plants that are harvested or used as crops and >770 harvested marine species. More than 70% of land is natural rangelands for grazing livestock or game. A diversity of species support the pollination, pest control and soil nutrient cycling essential for crop agriculture.

Biodiversity and water security. Strategic Water Source Areas are the 10% of the land area of South Africa, Lesotho and Eswatini that supply 50% of water to these countries. They are vital ecological infrastructure for water security, providing most of the water needed for households, agriculture and industry.

Biodiversity and tourism. South Africa's natural scenery and rich biodiversity attract visitors to the country. In 2019, biodiversity tourists collectively spent R60.6 billion in South Africa, providing 91 836 jobs and contributing R27.7 billion to GDP.

Biodiversity and jobs. For every job in South Africa dedicated to protecting biodiversity, there are at least five jobs that depend directly on using biodiversity.

Biodiversity and climate change adaptation. Healthy wetlands, rangelands, mangroves, dunes, estuaries, beaches, kelp forests, reefs, seamounts and more are essential ecological infrastructure for climate change adaptation, protecting communities from the impact of extreme weather events and making food and water provision more resilient to changes in climate.

Biodiversity and human wellbeing. Experiencing nature has mental and physical health benefits and is important for everyday wellbeing, and for sustaining cultural and spiritual connections to land and seascapes.

NBA 2025 national headline indicators

The NBA has four headline indicators, providing information on the threat status and protection level of ecosystems and species (Figure 3).

The threat status indicators use established IUCN Red List of Ecosystems™ and IUCN Red List of Threatened Species™ assessment frameworks. The risk of collapse (ecosystems) or extinction (species) is evaluated across all realms and for taxonomic groups for which sufficient data exist. The protection level indicators reflect how well species and ecosystem types are represented in the protected area network.

- **Ecosystem Threat Status**: Almost half of the 986 ecosystem types assessed in the NBA 2025 are threatened. Estuaries, wetlands, rivers and the coast have the highest proportion of threatened ecosystem types.
- **Ecosystem Protection Level**: Over three-quarters of ecosystem types are represented in the current protected area network, leaving 24% in the Not Protected category. River, wetland and estuary types have the lowest levels of protection.
- **Species Threat Status**: Of 20 248 plant species assessed, 16% are threatened. Of 5 226 animal species assessed, 10% are threatened. The most threatened taxonomic groups are freshwater fishes and cartilaginous fishes (sharks, rays and chimaeras).
- **Species Protection Level**: A total of 70% of plant species are Well Protected (based on a random sample of 900 taxa). All mammal, reptile, bird, amphibian and freshwater fish species were assessed and overall 77% are Well Protected.

New international **indicators for genetic diversity** were used for the first time in NBA 2025 (see 'Integrated findings across realms'). Although these cannot yet be considered national headline indicators, further work is underway to increase the coverage of South African taxa, invest in genetic monitoring and pilot additional metrics. This will allow for a better understanding of the full extent of genetic loss within South Africa, and provide information to inform the management and restoration of species' populations.

South Africa's estuaries have a high proportion of threatened ecosystem types. The Swartkops estuary is in a Heavily Modified condition (and its type is classified as Vulnerable) due to poorly managed wastewater treatment works and storm water systems, overfishing and coastal development. © Riaan Weitz.

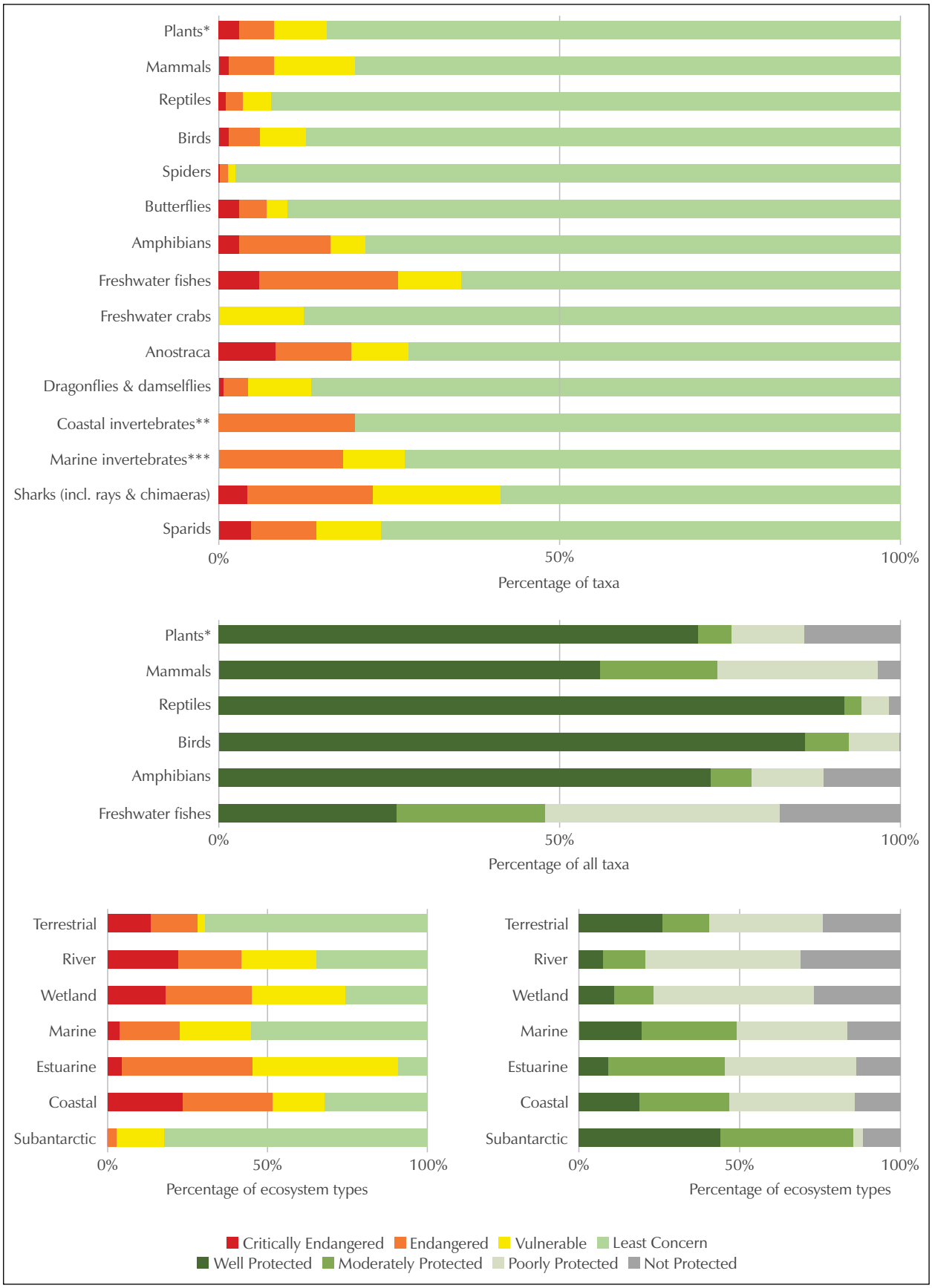


Figure 3. The NBA's four national headline indicators are threat status and protection level for ecosystems and species. Symbols in 'Percentage of taxa' graph: *sample of 900 plant taxa; **sample of sandy beach invertebrate species; ***sample of economically important marine invertebrate species.

Integrated findings across realms

Pressures on ecosystems and species

The IUCN proposes a threats classification scheme with a hierarchical structure for various pressures on biodiversity. The NBA 2025 adopted this approach with some minor language changes. Figure 4 is for the realms, coast and Subantarctic, and Figure 5 is for taxonomic groups.

In the estuarine and marine realms, and in coastal areas, **unsustainable use of biological resources** (in this case overfishing of key species, along with associated impacts on non-target species) is a significant pressure on biodiversity. There is increasing illegal harvesting and trade of numerous high value species in the terrestrial and aquatic realms, with population declines and near extinction of several species. Overuse of rangelands, which results in loss of shrub and herbaceous cover and leads to increased erosion, is a direct pressure to terrestrial species and ecosystems and an indirect pressure on freshwater ecosystems.

Modifications to natural systems such as changes in hydrological regime are major pressures on biodiversity in freshwater, estuarine, many coastal and selected terrestrial ecosystems. Over-abstraction of water and dam construction have direct negative impacts on species and ecosystems, and indirect impacts through disruption of important ecological processes such as sediment supply.

Changes to fire regimes linked to management imperatives, climate (drought events and high winds) and an increase in fuel loads from invasive alien plants are important natural system modifications in the terrestrial realm that have a detrimental impact on biodiversity. Species that have evolved special adaptations to survive fire, such as certain lycaenid

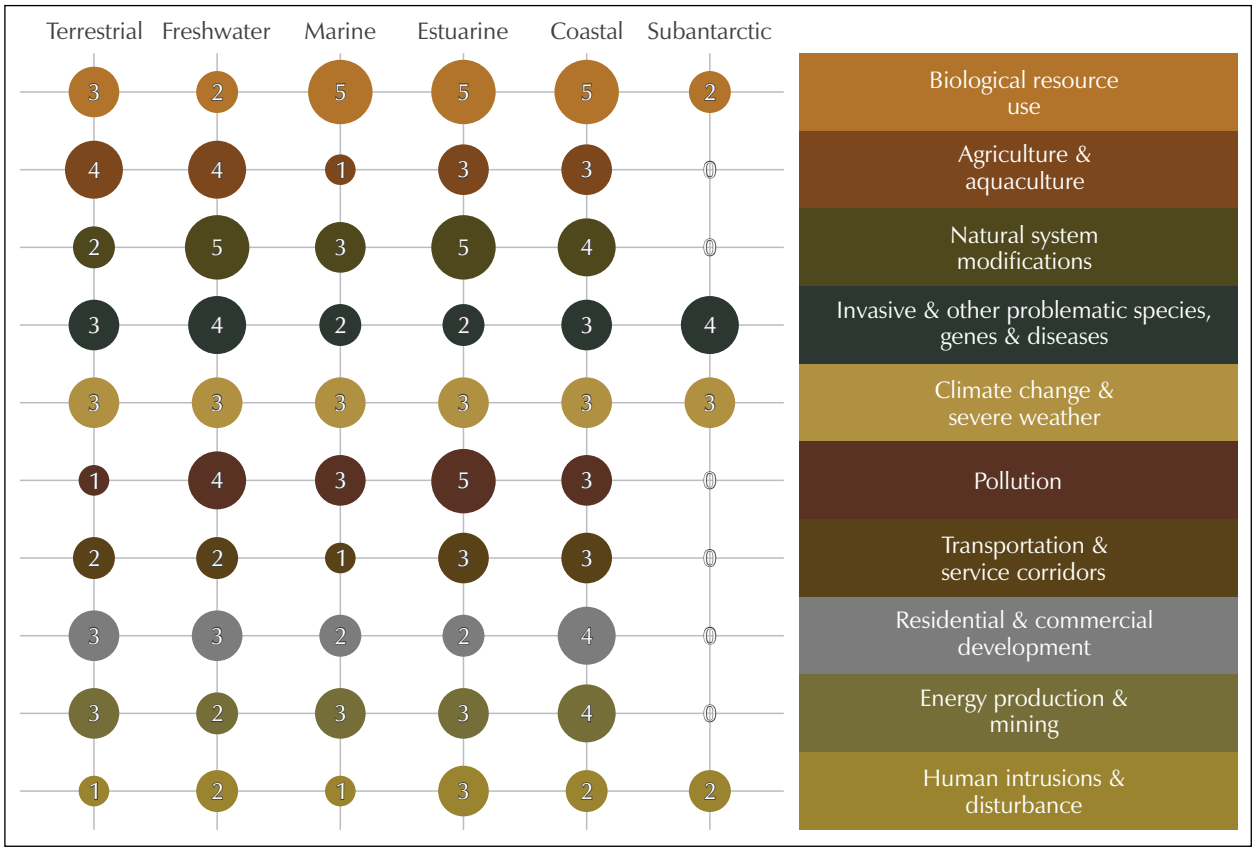


Figure 4. Key pressures on biodiversity in each realm, informed by the Red List of Threatened Species and the Red List of Ecosystems assessments. The size of the bubbles indicates the relative importance (on a scale of 0–5) of each pressure class.

butterflies and Fynbos plants, struggle to cope with fires that have increased intensity and occur more frequently than in the past. South Africa's iconic Brenton blue butterfly has likely gone extinct as a result of high invasive plant fuel loads in the Garden Route region of South Africa coupled with climate change linked intense wildfires.

Pollution of aquatic ecosystems from a combination of acid mine drainage, mining, industrial and urban wastewater, stormwater, as well as agricultural return flows, negatively impact water quality. When combined with flow regime changes, pollution represents a major additional pressure on freshwater, estuarine and coastal biodiversity. For example, freshwater bird species are becoming more threatened due to pollution.

Climate change is an accelerating threat across all realms, and amplifies other pressures such as invasive species, disease, habitat loss, flow reduction and habitat degradation. Climate change may also be associated with more severe or extended droughts. Multiple indigenous terrestrial species from the western arid regions of South Africa have experienced significant population declines as a result of a severe extended drought over the past decade. Though impacts of climate change on biodiversity are best understood in the terrestrial realm, coastal and estuarine ecosystems are particularly at risk from extreme weather events, especially where human settlements limit the natural resilience of these ecosystems by encroaching into dune systems and the Estuarine Functional Zone.

The primary pressure in the terrestrial realm is direct **habitat loss** as a result of land clearing for croplands, plantation forestry, human settlements and mining. Mining is one of the main drivers of increased risk of extinction for reptiles, mammals, amphibians and plants, and several coastal ecosystem types in Namaqualand. Intensive agriculture, in the form of croplands and pastures, significantly impacts most terrestrial and freshwater species groups assessed to date.

Biological invasions impact all realms, with predatory alien fishes substantially impacting indigenous fish species in rivers. A wide range of woody invasive plant species impact riverine areas, wetlands and mountain catchments in particular, and cause severe declines to South Africa's indigenous plants and amphibians.

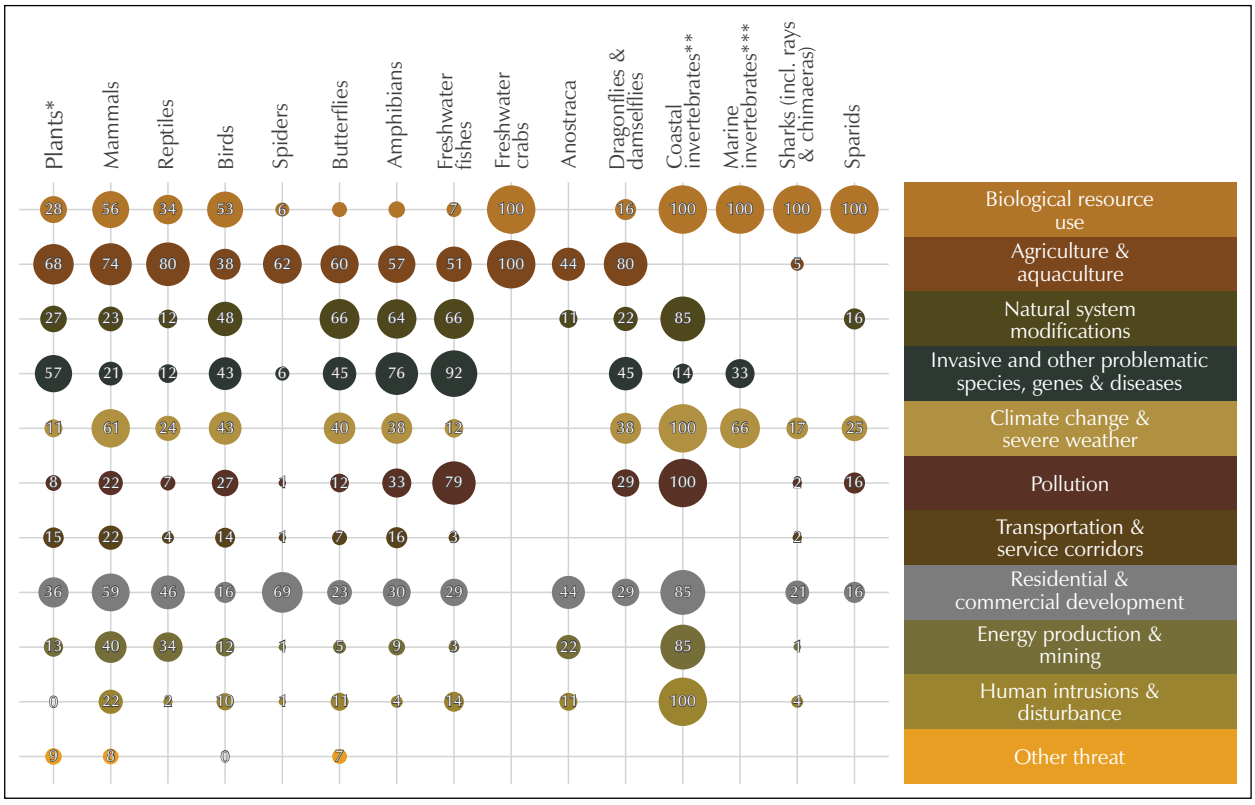


Figure 5. Key pressures on South Africa's species. This analysis presents the relative frequency of pressures affecting threatened species, categorised by taxonomic group, using the IUCN Threat Classification Scheme. The size of the bubbles indicates the percentage of taxa impacted by each pressure class. *sample of 900 plant taxa, **sample of sandy beach invertebrate species, ***sample of economically important marine invertebrate species.

Ecological condition across realms

Ecological condition is estimated using a range of different approaches across the realms, but is essentially the product of spatially representing the various pressures exerted on biodiversity. Ecological condition in the terrestrial realm relies primarily on land cover change, invasive species and overgrazing data; cumulative pressure mapping is used in the marine realm; and a multi-criteria ecological condition framework is used in the estuarine and freshwater realms. The different systems were aligned as far as possible in the NBA to allow for cross-realm comparisons of ecosystem condition and unified terminology (Figure 6).

The marine and terrestrial realms are similar in terms of their relatively high percentage of natural/near-natural ecosystem extent (~70%). In these extensive realms, ecosystem modification tends to be focussed in pressure hotspots, usually linked to local 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 beyond the shelf have yet to see extensive modification.

In stark contrast, freshwater wetlands and rivers, as well as estuaries, are predominantly heavily modified and in poor ecological condition. These realms are geographically constrained and pressures tend to concentrate. Only 18% of estuarine area, 49% of wetland area and 25% of river length are considered to be in natural/near-natural condition. Coastal biodiversity is also under particularly high pressure and approximately half of the ecologically determined coastal zone remains in a natural/near-natural condition.

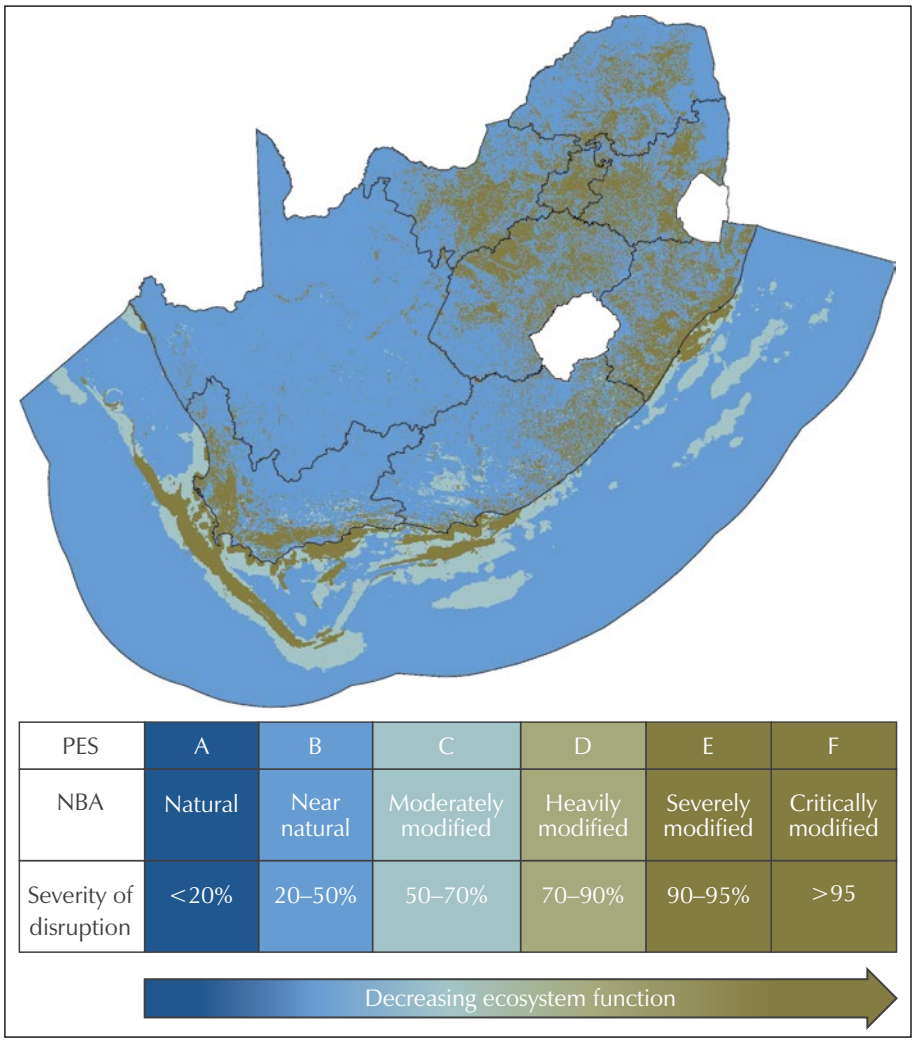


Figure 6. Ecological condition map (terrestrial and marine). The legend shows the categories used across the different realms: Present Ecological State (PES) for freshwater and estuarine; NBA ecological condition categories; and severity of disruption of ecosystem function (IUCN Red List of Ecosystems).

Threat status of ecosystems and species

Ecosystems

Ecosystem threat status is an indicator of the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function or composition. The IUCN Red List of Ecosystems (RLE) framework uses the concept of ecosystem collapse as the end point for ecosystem decline. For NBA 2025 the RLE framework was applied across all realms, where in previous NBAs the South African threat status framework (developed prior to the IUCN RLE) was applied for some realms. Ecosystem types are placed into one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Least Concern (LC); where CR, EN and VU together make up the threatened categories. The categories are based on assessments of quantitative and qualitative criteria (and thresholds) linked to ecosystem extent, ecological condition and threatening processes.

Wetland, river and estuarine ecosystems are threatened, with over half of the ecosystem types and ecosystem extent of rivers and wetlands listed as Critically Endangered, Endangered or Vulnerable; while for estuaries these figures are over 75% (Figure 7). This reflects the poor ecological condition of wetland, river and estuarine ecosystems that are overwhelmed by a variety of compounding pressures, particularly, increasing disruptions to the hydrological regime and deteriorating water quality, with fishing being an additional pressure in estuaries. Similarly, high levels of pressure are evident on the coast, with 71% of ecosystem types being threatened, comprising almost half of the coastal extent. In contrast, a relatively large proportion of marine and terrestrial ecosystem types are listed as Least Concern. This is in part due to the relatively low pressure on some ecosystem types (e.g., abyssal or remote mountain ecosystem types) and due to inadequate data on pressures in utilised ecosystem types (e.g., marine pelagic fishing and grazing pressures in rangelands). Ecosystem assessments are updated periodically, and new information and methods of measuring risk of ecosystem collapse will inform future assessments.

Generally, ecosystem types with a limited distribution tend to be more highly threatened than extensive types – this is evident when panels A and B of Figure 7 are compared. In the marine realm, the larger remote offshore ecosystem types are generally less threatened than the smaller inshore ecosystem types; in the terrestrial realm the large ecosystem types of the Nama-Karoo are less threatened than the many small types in the Fynbos Biome (Figure 8A, B). The Eastern Cape estuaries (specifically along the Wild Coast) are less threatened than those on the Cape West Coast and southern KwaZulu-Natal (Figure 8B), reflecting the condition of their catchments and minimal coastal development pressure. The rivers of northern KwaZulu-Natal, Lowveld and Succulent Karoo are generally less threatened than other regions of the country (Figure 8C). Wetlands of the interior Highveld, along the Escarpment and the south-western Cape are the most threatened (Figure 8D). In the marine realm, the Southern Benguela ecoregion has more threatened ecosystems than the Agulhas ecoregion, and most of the threatened ecosystem types in the Natal–Delagoa ecoregion are concentrated in the KwaZulu-Natal Bight (Figure 8A).

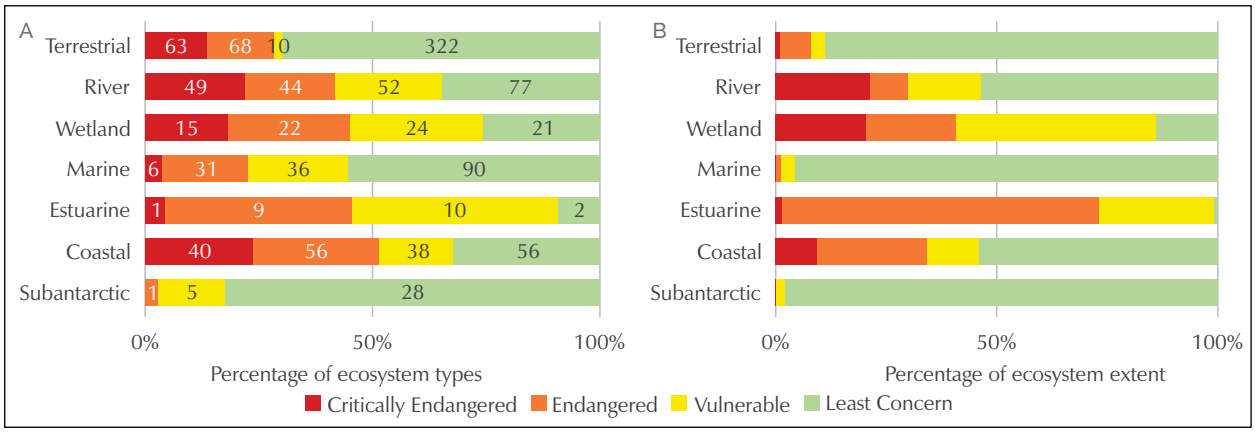


Figure 7. A, percentage of ecosystem types in each threat status category in each realm; B, the percentage extent of each ecosystem in each threat status category (note that length is used for rivers, while area is used for all other realms). In addition to the realms, the plot also shows results for the coastal zone, made up of estuaries and selected marine and terrestrial types, and the subantarctic territory of South Africa.

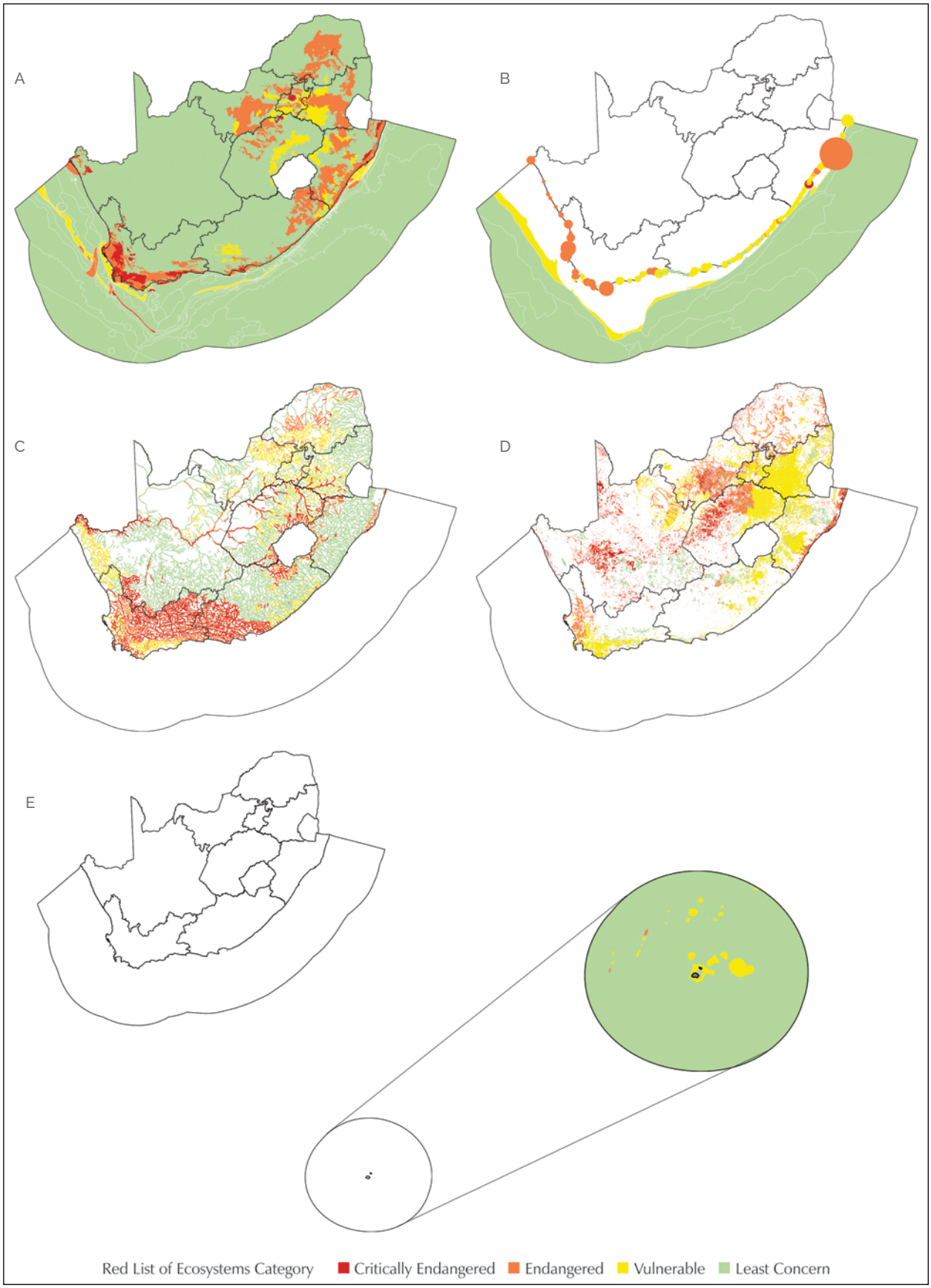


Figure 8. Spatial distribution of threatened ecosystems for each realm: A, terrestrial and marine benthic; B, estuarine and marine pelagic (note: estuaries, which are not visible at this map scale, are shown as circles, scaled to the size of the estuary); C, river; D, wetland; E, subantarctic territory including the Prince Edward Islands and surrounding seas.

Species

South Africa has assessed the threat status of 25 474 indigenous taxa from 15 taxonomic groups using the IUCN Red List of Threatened Species Categories and Criteria, which reflects a species' extinction risk. There are several extinct categories, three threatened categories (Critically Endangered [CR], Endangered [EN], Vulnerable [VU]), as well as categories for Near Threatened (NT), Data Deficient (DD) and Least Concern (LC). South Africa augments the IUCN system by adding a category for rarity (Rare), defined as range restricted endemic species that have a global extent of occurrence of less than 500 km^2 occurring where there are no anthropogenic pressures. Rare species are priorities for inclusion in national conservation interventions despite them qualifying as Least Concern under the IUCN system.

Of the assessed taxa, 0.5% are extinct or possibly extinct (122 taxa) and a further 3 659 taxa are threatened with extinction (14%). South Africa has high levels of species endemism – 75% of freshwater crab, 67% of plant, 57% of spider, 56% of amphibian, 52% of butterfly, 49% of freshwater fish, 44% of fairy shrimp (Anostraca), 38% of reptile and 36% of seabream taxa are endemic. For all of these groups, levels of threat to endemic taxa are higher than for all indigenous taxa (Figure 9). Overall, 20% of endemic taxa are threatened with extinction (3 213 taxa) and 0.8% are extinct or possibly extinct (120 taxa).

The most threatened taxonomic groups in South Africa are cartilaginous fishes (sharks, rays and chimaeras), as 42% are threatened. Most of these species are wide ranging and much of their declines can be attributed to poor fisheries management in other parts of the world, however six of the 13 species of endemic sharks, rays and chimaeras are threatened, indicating that the country has a responsibility to reverse declines of these charismatic predators. When only considering endemics, South Africa's freshwater fishes are

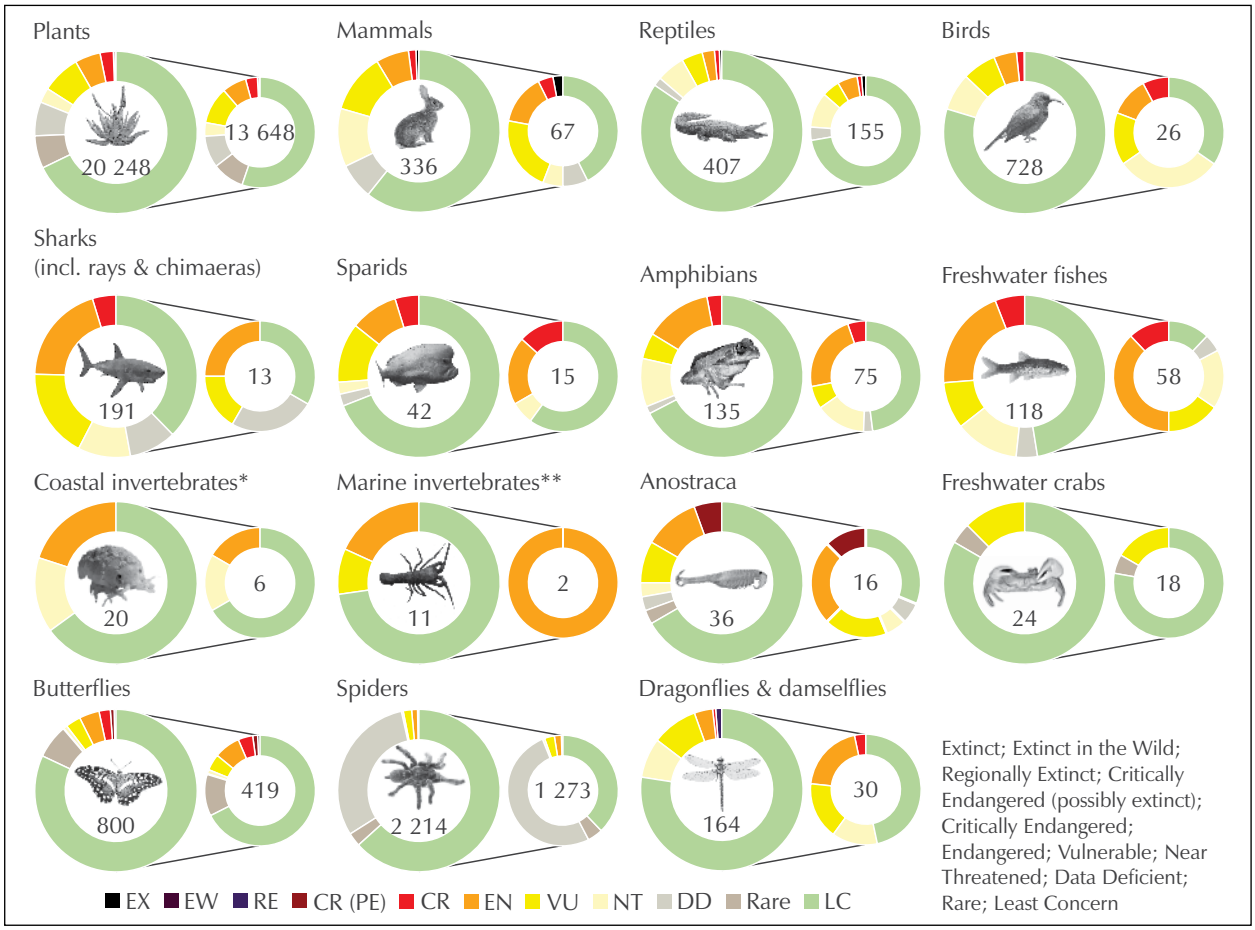


Figure 9. Threat status of the 15 assessed South African taxonomic groups; categories follow the IUCN 3.1 Red List Categories and Criteria with an additional national category of Rare added for range-restricted, localised endemics that are not declining. The portion of species in each category is shown in the larger circle, and the proportion of endemic species per category is shown in the smaller circle. The total number of taxa that have been assessed are shown in the inner circle. *sample of sandy beach invertebrate species, **sample of economically important marine invertebrate species.

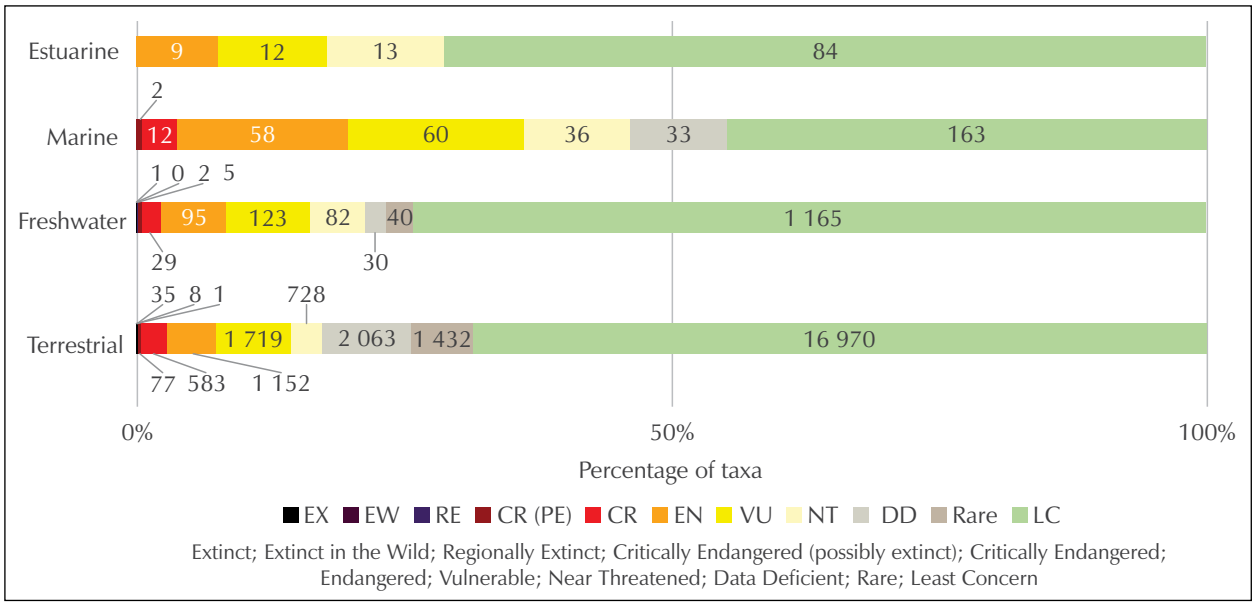


Figure 10. Species threat status across the realms with the bars representing percentage of taxa in each category.

the most threatened comprehensively assessed group, with 66% of species threatened due to competition with invasive alien fish and degradation of their freshwater systems through water abstraction, pollution and inappropriate sedimentation.

First time assessments for two groups of invertebrates show that spiders have very low levels of threat compared to other taxa (only 3% threatened), while fairy shrimps (Anostraca) are within the top three groups with the highest levels of threat (44% threatened). Degradation of South Africa's arid wetland ecosystems is threatening this unique group of species, as Anostraca are dependent on ephemeral wetlands. Freshwater crabs were first assessed in South Africa in 2007, and a repeat assessment for this NBA indicates that 13% of species are threatened.

Due to poor taxonomic knowledge and a paucity of occurrence records, most marine and coastal invertebrates cannot be assessed, however, a sample of utilised marine species shows that 18% are threatened. Of the 20 coastal invertebrates assessed (the first sandy beach invertebrates to be added to the IUCN Red List of Threatened Species globally), four (20%) are listed as Endangered and a further three (15%) are Near Threatened. The pressures on coastal invertebrates are mainly mining on the West Coast, coastal development and associated artificial light at night, and removal of washed-up kelp from the shore.

The proportion of threatened taxa varies across realms (Figure 10). Of the species that have been assessed, the marine realm currently has the highest proportion of threatened taxa (36%), followed by the estuarine realm

A, a sample of 20 sandy beach invertebrates have been assessed for the first time in NBA 2025 and the granulated calloused beach pillbug (*Tylos granulatus*) is one of four Endangered species, with much of its habitat along the West Coast being impacted or lost due to mining, coastal development and associated artificial light at night, and removal of washed-up kelp (© Linda Harris); B, the Critically Endangered Brenton blue butterfly (*Orachrysops niobe*), known only from Knysna, has been listed as possibly extinct, with the only known population lost during the 2017 Garden Route fires where the extensive spread of woody invasive alien plants were the main driver of the intensity and extent of the fires (© Justin Bode).

(18%). Both the marine and estuarine assessments have prioritised economically important and charismatic species over comprehensive taxonomic assessments for full taxonomic groups, and this may have inflated the proportion of threatened taxa. Species assessments in the marine realm are limited by gaps in taxonomic knowledge, and the lack of information on species distribution, life histories and long-term population trends has resulted in high levels of data deficiency. The terrestrial assessments also include many Data Deficient taxa since many genera of plants and invertebrates still require taxonomic work and are not yet sufficiently delineated for a threat status to be assigned. For the freshwater and terrestrial realms, complete taxonomic groups have been assessed, providing greater confidence in the results. Approximately 16% of freshwater and 14% of terrestrial taxa assessed to date are threatened. Despite lower threat percentages, the terrestrial realm has suffered the highest extinction toll (44 confirmed extinct species and a further 77 highly likely to be extinct).

Trends in species threat status

The trend in species status over time was measured using the globally recognised indicator, the IUCN Red List Index of species (RLI). The RLI is calculated for specific taxonomic groups based on genuine changes in Red List categories over time. The RLI value ranges from 0 to 1 and, the lower the value, the faster the taxonomic group is heading towards extinction; i.e., if the value is 1, all taxa are Least Concern and if the value is 0, all taxa are extinct.

The RLI is calculated only for comprehensively assessed taxonomic groups or groups where a representative sample has been selected. Changes in status over time have been tracked for 13 taxonomic groups (Figure 11). Increases in extinction risk are evident for most groups, but a marked increase in rate of extinction since the last assessment is evident from the change in slope of declines for reptiles, birds, mammals and plants. Increases in threat statuses for birds have largely been due to freshwater birds being impacted by increasing levels of pollution and other forms of habitat degradation, while the main drivers of declines for mammals, plants and reptiles have been climate change and loss of habitat for mining and renewable energy developments. Most plants that have been uplisted due to increasing levels of extinction risk are found in the Northern Cape (Figure 12). The province was severely impacted by the drought over the past decade and is experiencing ongoing pressure from mining, succulent poaching and renewable energy developments. The two groups at highest risk of extinction are freshwater fishes and cartilaginous fishes. Sharks, rays and chimaeras are included on South Africa's RLI for the first time, with the majority having wide ranges that extend outside South African territory. Many of these

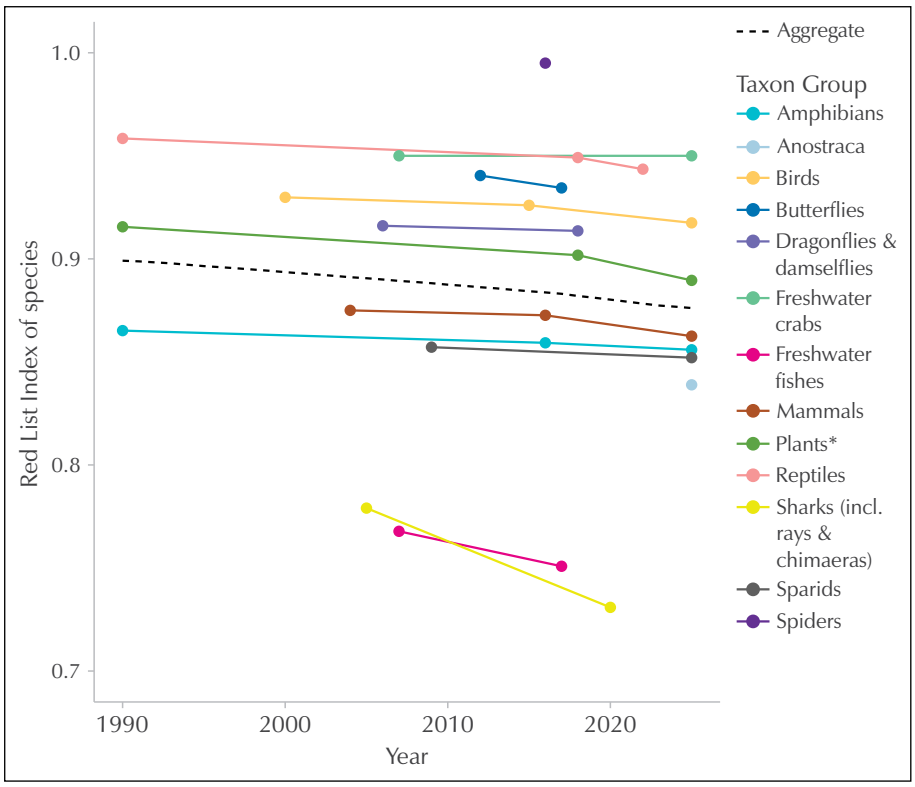


Figure 11. The Red List Index (RLI) for taxonomic groups assessed in South Africa. The slope of the line indicates the rate at which species within each taxonomic group are becoming more threatened over time, e.g., note the sharp decline in sharks, birds, mammals and plants. The lower the value, the faster the group of species is heading towards extinction (if the value is 0, all species are extinct). The newly assessed group Anostraca (fairy shrimps) are threatened by degradation of ephemeral wetlands. *Due to the extremely high number of plant species occurring in South Africa, the threat status is calculated for a statistically representative sample of 900 plant taxa.

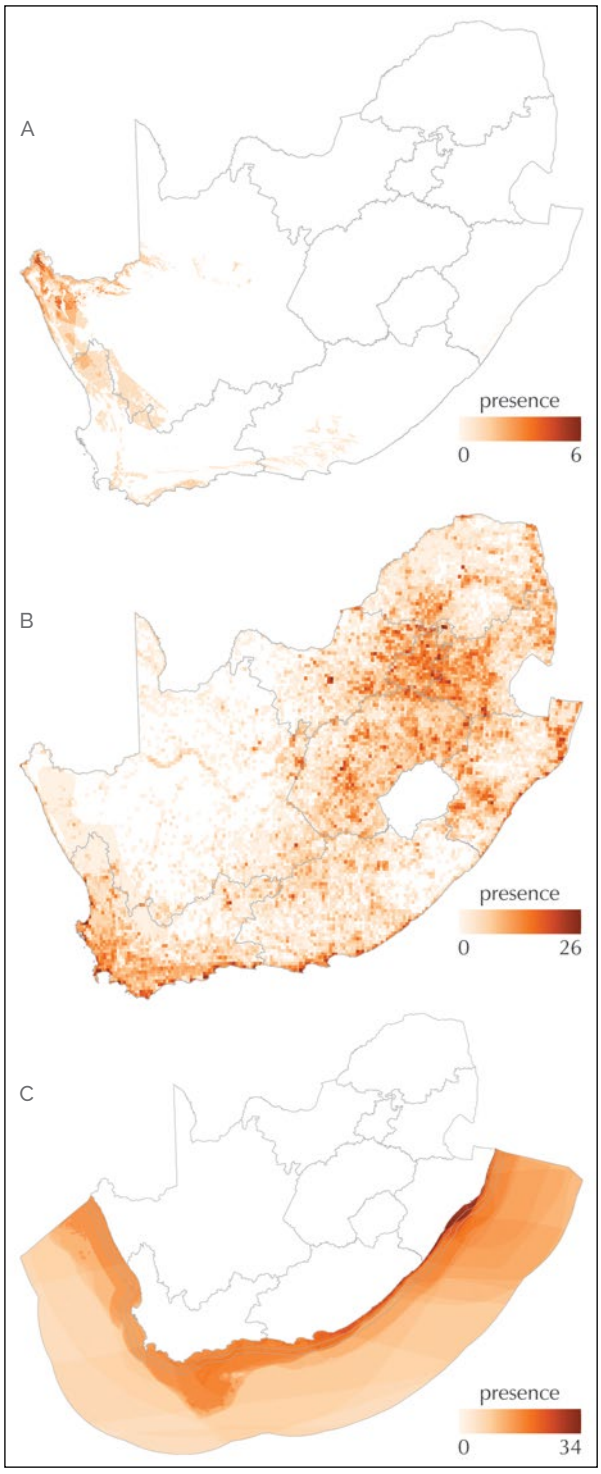


Figure 12. The distribution and density (per km²) of species that have increased in threat status since NBA 2018, for A, plants; B, terrestrial and freshwater animals; and C, marine animals (including sharks, sparids and marine birds only). Plants in the Northern Cape's Namaqualand region are under the most severe pressure from climate change related drought, mining and succulent poaching, while the impacts on terrestrial and freshwater animals are widespread but linked to areas with high habitat loss and degradation. In the marine realm, increased risk to species is attributed to multiple pressures with coastal mining, estuarine degradation, flow reduction, overfishing and lethal shark control measures contributing to worsening species threat status.

cartilaginous fishes are long-lived, have slow growth and low reproductive output, and many are declining across their ranges due to overfishing (including from recreational fisheries and as bycatch from industrial fisheries), lethal bather protection measures and habitat degradation. Half of South Africa's freshwater fishes are endemic, with many concentrated in Western Cape river systems. While only due for reassessment in 2026, the declining status of rivers and dwindling resources available for management actions where many of these species are concentrated likely means that they will continue on a declining trajectory.

Trends in ecosystem threat status in the terrestrial realm

South Africa is among the first countries globally to apply the Red List Index of ecosystems (RLIe) at a national scale for terrestrial ecosystems. While the Red List Index is well established for species, its application to ecosystems is relatively recent. As a headline indicator of the Kunming-Montreal Global Biodiversity Framework, the RLIe supports monitoring of progress towards the ecosystem-focussed Goals and Targets agreed by parties to the Convention on Biological Diversity. RLIe scores range from 0 (all ecosystems collapsed) to 1 (all ecosystems classified as Least Concern), providing a clear, comparable measure of ecosystem health across time.

All ecosystem types described for South Africa (across all realms) have been matched to the Global Ecosystem Typology (Level 3 – Ecosystem Functional Groups). This allows all the ecosystem assessments in the NBA to be reported using the EFGs when required, which is useful for global comparisons. For the NBA 2025, the RLIe was calculated for 463 terrestrial ecosystems at the South African biome level, across four RLE assessment periods: 2014, 2018, 2020 and 2024 (Figure 13). The emerging trends reveal a mixed picture of both resilience and vulnerability across South Africa's biomes. The Indian Ocean Coastal Belt has experienced the steepest decline in RLIe (from 0.50 in 2014 to 0.43 in 2024). This downward trend reflects growing pressures from land-use conversion, including the expansion of croplands, urban development and plantations. The Fynbos Biome also remains under substantial pressure. In contrast, the Nama-Karoo, Forests and the Succulent Karoo biomes have high RLIe scores, indicating lower risk of ecosystem collapse. South Africa's aggregate (overall) terrestrial RLIe declined slightly from 0.82 to 0.79 between 2014 and 2024, signalling a slow but steady increase in the risk of ecosystem collapse (Figure 13).

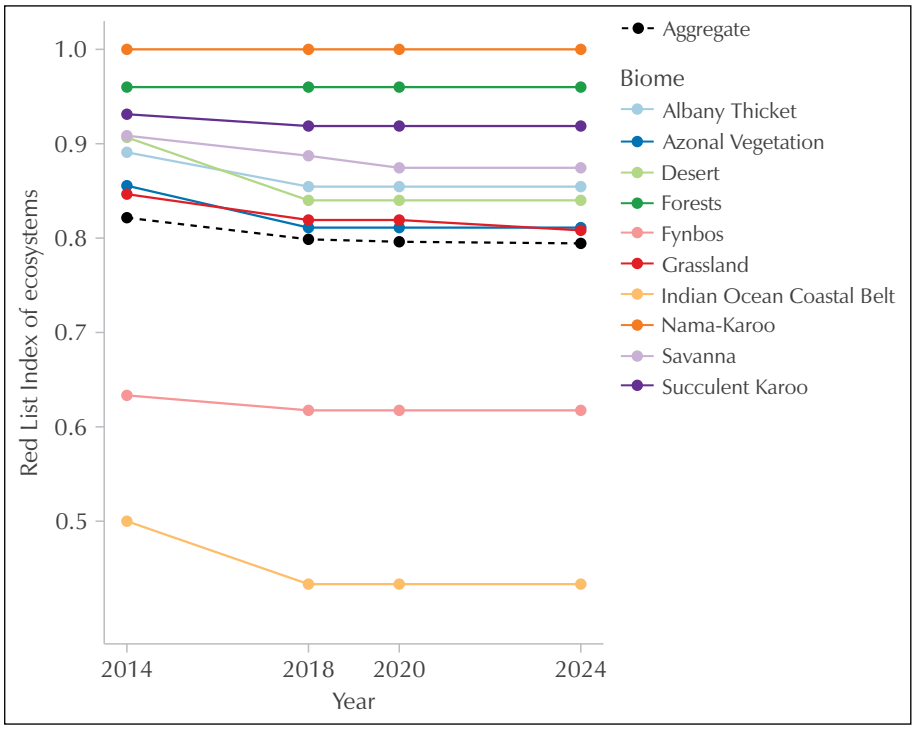


Figure 13. Red List Index of ecosystems (RLIe) for South Africa, disaggregated by South African vegetation biomes. The slope of the line indicates the rate at which ecosystem types within each biome are becoming more threatened over time.

Landscape level change in the arid Kuboes region of the Northern Cape between 1910 and 2023, documented by Professor Norbert Jurgens and colleagues. Perennial shrub cover (*Mesembryanthemum pseudoschlichtianum*) has been lost, leaving bare saline soils with occasional annual species. Decades of overgrazing by livestock in combination with intense drought between 2017 and 2019 have changed the topsoil structure and severely altered ecosystem function and composition. © University of Cape Town (~1910, Fred Cornell; 2003, Rick Rohde and Timm Hoffman; 2023, James Puttick and Timm Hoffman).

Protection level of ecosystems and species

Ecosystems

Ecosystem protection level measures the degree to which ecosystem types are represented in the protected area network. The indicator was developed in South Africa and has been used as a headline indicator in national reporting since 2005. Ecosystem types are assigned to one of four categories, based on a set of predefined targets ranging from 16 to 32% (linked to the extent and condition of types within protected areas). Well Protected (WP) ecosystem types are those where the extent target is met or exceeded within the protected area network, Moderately Protected (MP) types are those with between 50 and 99% of their target within the protected area network, Poorly Protected (PP) types have between 5 and 49% of their target within the network, and types with less than 5% of their target within the protected area network are categorised as Not Protected (NP).

Wetlands and rivers have the lowest overall protection levels of any realm, with over 80% of ecosystem types categorised as Poorly Protected or Not Protected (referred to as under-protected) (Figure 14A, B). This is driven, in part, by the poor ecosystem condition of many freshwater ecosystems (only intact or moderately modified ecosystem extent contributes fully to the ecosystem targets). A high proportion of estuarine ecosystem types have some level of protection, but very few are considered Well Protected. Protecting estuaries is challenging, given the range of pressures that can impact them directly and their upstream catchment areas. Marine protection improved dramatically in 2018/2019 with the declaration of 20 new Marine Protected Areas – this translates into higher levels of protection within the marine realm when compared to the terrestrial realm. The marine realm has a small number of large ecosystem types that are under-protected and this results in a difference between the percentage of types in each category (Figure 14A) and the extent of each category (Figure 14B).

The spatial patterns of protection level reflect the geography of the protected area network: terrestrial ecosystem types around large national parks (e.g., Kruger National Park in the northeast of the country) are Well Protected (Figure 15A). Under-protected regions on the mainland include the grasslands of the Free State and interior of the Eastern Cape, and the Nama-Karoo. Other gaps in the protected area network are evident in the offshore eastern portion of the marine realm, the southern Eastern Cape coast and the Northern Cape coast (Figure 15A, B). Most coastal ecosystem types are represented in protected areas, although only a quarter of the extent is Well or Moderately Protected. The Prince Edward Islands Marine Protected Area in South Africa's subantarctic territory provides protection to most ecosystem types, with almost half the types being Well Protected, however, these comprise a small portion of the territory.

The Ecosystem Protection Level indicator has recently been adapted into the Ecosystem Protection Level Index, following the principles of the IUCN Red List Index of species. The index will be used for national and international biodiversity reporting. More detail on the development of the index and the emerging trends can be found online.

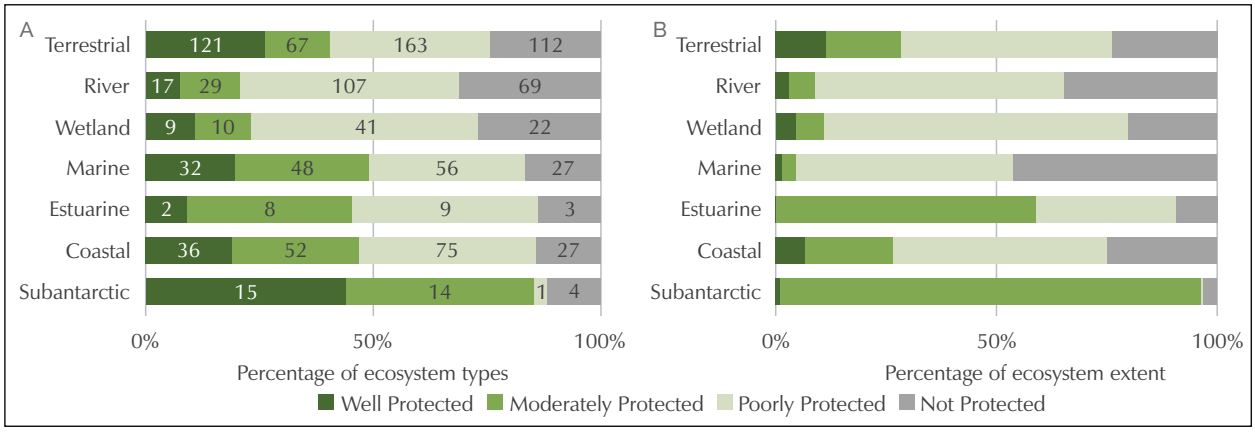


Figure 14. A, the percentage of ecosystem types in each protection level category in each realm; B, the percentage extent in each category in each realm (for rivers length is used as the unit of extent, for all other realms area is used). In addition to the realms, the plot also shows results for the coastal zone, made up of estuaries and selected marine and terrestrial types, and the subantarctic territory of South Africa.

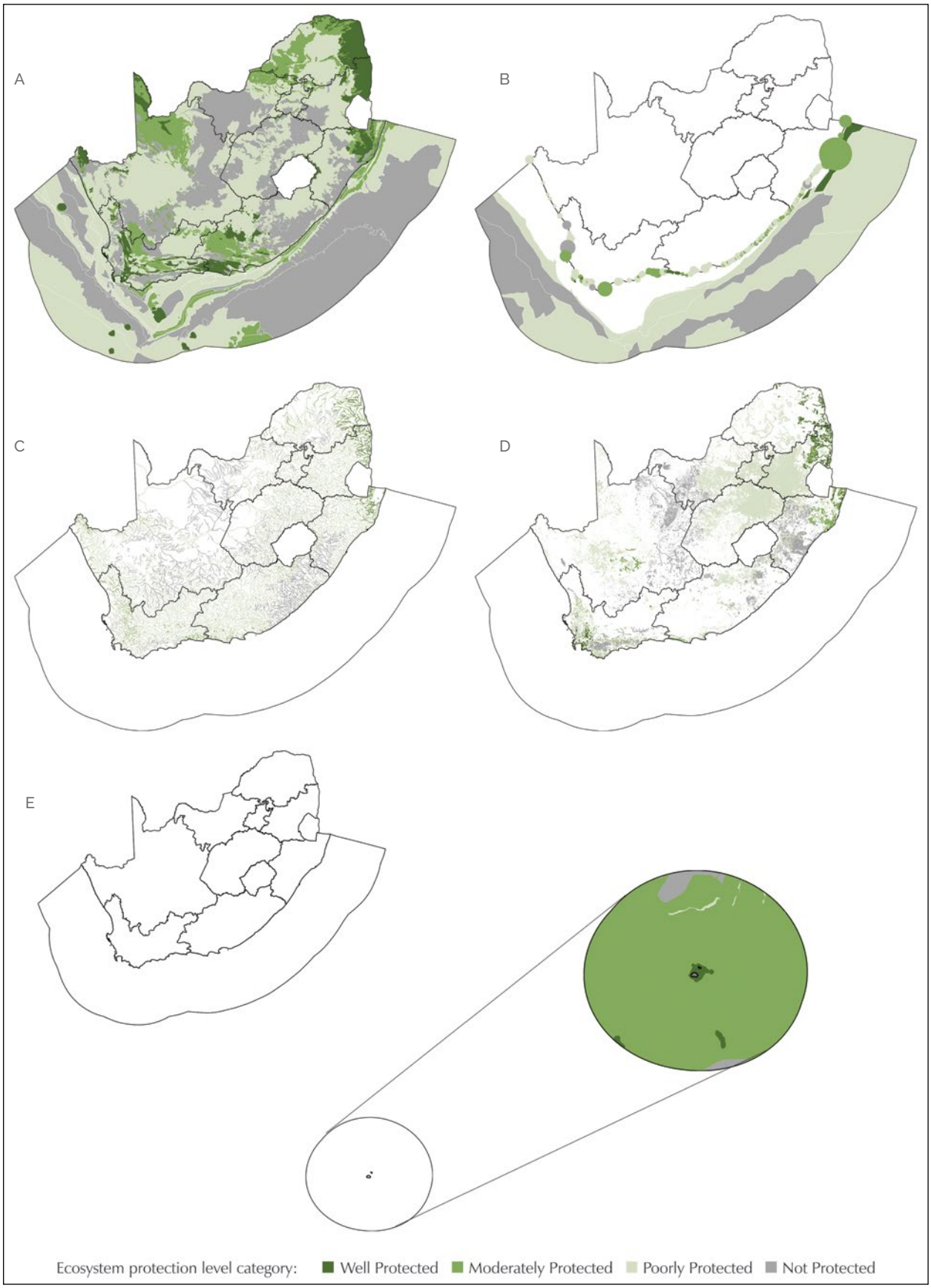


Figure 15. Spatial distribution of ecosystem protection level for each realm: A, terrestrial and marine benthic; B, estuarine and marine pelagic; C, river; D, wetland; E, subantarctic territory including the Prince Edward Islands and surrounding seas. Estuaries, which are not visible at this map scale, are shown as circles, scaled to the size of the estuary.

Species

Species protection level is used to determine how well the protected area network is conserving species. The indicator measures progress towards protecting a population persistence target for each species. As species persistence is dependent on the degree to which protected areas can mitigate threats that cause population decline, a protected area effectiveness factor is included in the calculation. The categories for protection level are: Well Protected where the species persistence target is met or exceeded by the protected area network; Moderately Protected where between 50 and 99% of the species persistence target is met; Poorly Protected where between 5 and 49% of the species persistence target is met; and Not Protected where less than 5% of the species persistence target is met.

This indicator has been used to assess terrestrial and freshwater species within six taxonomic groups (Figure 16). Plants were assessed using a representative sample of 900 taxa. Peripheral taxa, which have less than 5% of their distribution range occurring in South Africa, were excluded from the analysis. Protection level has been calculated for 2 449 taxa.

Except for freshwater fishes, South Africa's protected area network protects species relatively well, with most groups having over 50% of taxa qualifying as Well Protected (Figure 16A). The protection level of birds and reptiles is particularly good, with both groups having over 85% of their taxa qualifying as Well Protected.

Protection levels of endemic species are lower than for all species (Figure 16B). Freshwater fishes and amphibians have the highest proportion of endemic species that are Not Protected, 36% and 19% respectively. Endemic mammals are of some concern as 20 taxa (34%) are Poorly Protected and four taxa (7%) are Not Protected.

The effectiveness of protected areas in mitigating threats to species within their borders reveals some interesting case studies. While 38% of freshwater fishes are well represented within protected areas, many species are not being effectively protected due to the presence of invasive alien fish species within the protected areas' freshwater systems and limited management interventions in place to control these invasive species. Pollution and over-abstraction of water upstream of the protected area boundary further compromise protection effectiveness. Consequently, only 23% of South African freshwater fish species qualify as Well Protected once the impact of these pressures is taken into account.

For birds, 55 species (8.3%) experienced protection level category downgrades once effectiveness is included. The effectiveness adjustment reduces the protection level score particularly for wetland species (e.g., flamingos, cranes, pelicans) and raptors (e.g., vultures, harriers).

Amphibians and plants are also significantly impacted by threats occurring within protected area boundaries. As a result, 7% of amphibian species and plant taxa drop down a category of protection. While amphibians are impacted by high levels of invasive alien species within protected areas, the main reason for plants not being effectively protected is due to high levels of plant poaching in the protected areas of Namaqualand.

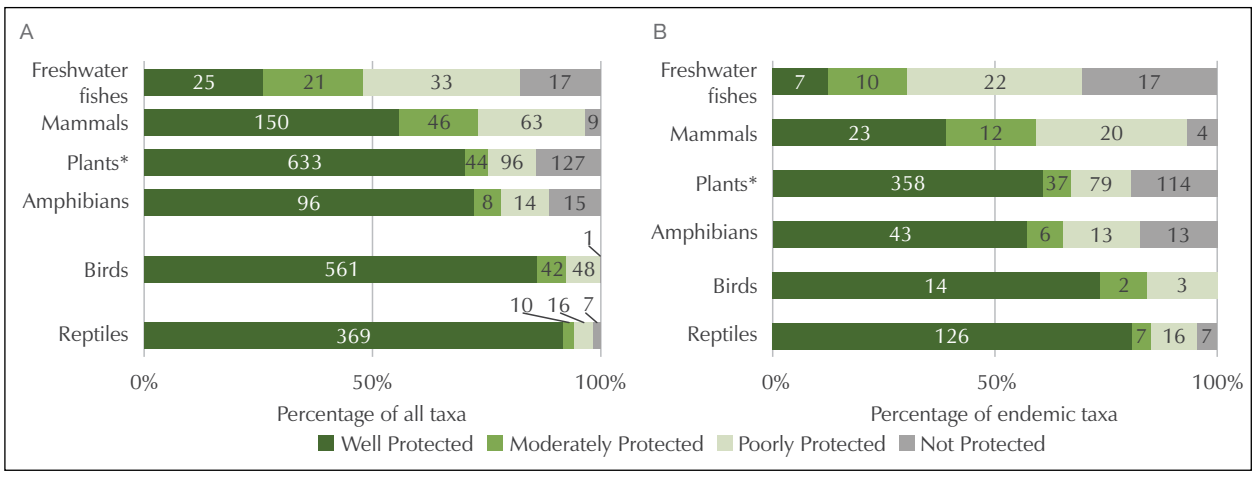


Figure 16. Protection level for six of South Africa's indigenous terrestrial and freshwater taxonomic groups. Analysis excluded peripheral taxa (those with less than 5% of distribution range occurring in South Africa): A, protection level for all taxa; B protection level for South African endemics. *Due to the extremely high number of plant species occurring in South Africa, the protection level is calculated for a statistically representative sample of 900 plant taxa.

Daubenya namaquensis, a rare and restricted range species from Namaqualand, experienced a genuine improvement in protection level status as a result of the declaration of new protected areas between 2018 and 2025. © Nick Helme.

Eighteen mammal taxa (7%) drop a category of protection due to protected areas not effectively mitigating against pressures; poaching and bushmeat hunting within reserves is a particular problem for mammals.

Many species have improved in their protection level since the last assessment in 2018. A total of 5% of plant species assessed have improved in protection level with the newly proclaimed Mountain Zebra-Camdeboo Protected Environment, Gamsberg Nature Reserve, and Orange River Mouth Nature Reserve contributing most to improving protection levels. Nine bird species (1%), four amphibian species (3%), nine freshwater fish species (9%), eight (3%) mammal taxa and seven (2%) reptile species have shown improvements in protection level. The improved protection level for reptiles is specifically due to the newly proclaimed De Hoop Dam and Mphaphuli Protected Environments and the Thengwe Nature Reserve, all in Limpopo.

The Species Protection Level indicator has recently been adapted into the Species Protection Level Index, following the principles of the IUCN Red List Index of species. The index will be used for national and international biodiversity reporting. More details on the development of the index and the emerging trends can be found online.

A, the Critically Endangered Cape Flats frog (*Microbatrachella capensis*) (© Kurt van Wyk) and B, the Endangered Cape platanna (*Xenopus gilli*) (© Alexander Rebelo) both improved in protection level due to rehabilitation of wetland habitats within the Table Mountain National Park.

Intersecting threat status and protection level

The headline indicators of the NBA provide information on the pressures faced by species and ecosystems and on the progress made in protecting them. Combining the indicators provides an additional perspective on the status of South Africa's biodiversity.

Ecosystems

The outputs of spatially explicit ecosystem assessments, as conducted in the NBA, can provide an initial indication of priority ecosystem types by intersecting the results of ecosystem threat status and protection level. Ecosystem types that are highly threatened (Critically Endangered or Endangered) but under-protected (Not Protected or Poorly Protected) can be considered to be in urgent need of conservation action (Figure 17). Priority ecosystem types could need additional protection, focussed management intervention or could be restoration priorities.

- In the marine realm, 17% (27/163) of ecosystem types are both highly threatened and under-protected, prevalent on the West Coast, the western Agulhas Bank shelf edge and parts of the Kwazulu-Natal Bight.
- A quarter of terrestrial ecosystem types (115/463) are highly threatened and under-protected. The Fynbos Biome and Namaqualand contain many Critically Endangered and under-protected ecosystem types, while the grasslands of the interior and the Indian Ocean Coastal Belt have many Endangered and under-protected types.
- Over a third of river ecosystem types (82/222) and a third of wetland types (29/82) are highly threatened and under-protected. Lowland river ecosystem types and depression wetlands have the highest proportion of types in this combined threat and protection category.
- A third of estuarine ecosystem types (7/22) are highly threatened and under-protected. Each of the four biogeographical regions have ecosystem types that are highly threatened and under-protected.
- For the coast, over a third of ecosystem types (68/190) are highly threatened and under-protected.

Species

While overall protection of species has improved, threatened species (CR, EN, VU) remain inadequately protected. Less than 30% of threatened amphibian, mammal and plant species, and only 5% of threatened freshwater fishes are Well Protected. On a

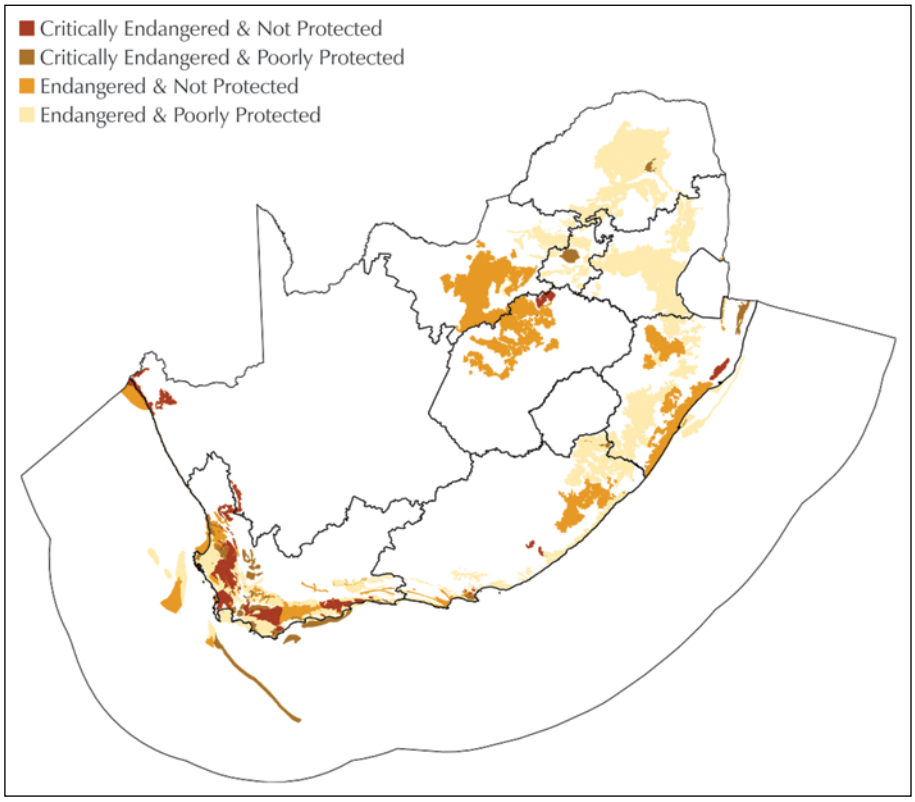


Figure 17. Highly threatened and under-protected ecosystems of the marine and terrestrial realms (other realms not visible at this scale).

The unique lowland renosterveld vegetation of the Overberg is highly threatened and under-protected, and home to dozens of endemic plant and animal species. Recent biodiversity stewardship efforts by the Overberg Renosterveld Trust and WWF South Africa in partnership with CapeNature have resulted in the declaration of a new 500 ha nature reserve in the region, with further expansion planned in the near future. © Odette Curtis-Scott.

positive note, nearly 60% of threatened bird and reptile species are Well Protected.

Some species have benefited from the expansion of protected areas and targeted management interventions, however, these successes are limited and most threatened species remain under-protected. For example, the Endangered freshwater fish species, the Verlorenvlei redfin (*Pseudobarbus verloreni*), has shifted from Not Protected to Poorly Protected following the declaration of a new protected area that now covers one of its populations. Unfortunately the broader pattern for freshwater fishes is that protected areas do little to shield species from ongoing pressures of invasive species, over-abstraction of water and pollution.

Species threat status and protection level assessments provide a useful basis for guiding prioritisation processes. Highly threatened (Critically Endangered and Endangered) and under-protected (Not Protected and Poorly Protected) species represent the most urgent need for conservation action, particularly when they are endemic to South Africa. Across all taxon groups 5% of taxa (127/2 449) fall into this category, and the majority of these are South African endemics (80%, 104/127 taxa). Freshwater fishes and amphibians have the highest proportion of species in this category, 27% (26/96 assessed fishes) and 13% (17/133 assessed amphibians) respectively. Both groups make use of freshwater habitats, which are also typically threatened ecosystems. Five per cent of plant species and close to 10% of all assessed mammal species are both highly threatened and under-protected. Bird and reptile taxon groups have fewer species (less than 2%) within this category, and these species include habitat specialists and range-restricted species that require specific targeted protected area expansion.

A, the white-winged flufftail (*Sarothrura ayresi*) is Critically Endangered due to the high rate of loss and degradation of its preferred habitat, seasonal marshland, however, its protection level has improved from Not Protected to Poorly Protected through concerted expansion of protected areas in Mpumalanga and southern KwaZulu-Natal (© Kyle Lloyd); B, the Clanwilliam sandfish (*Labeo seeberi*) is Endangered and Poorly Protected, as only one of its seven subpopulations receives protection in the Oorlogskloof Nature Reserve (© Jeremy Shelton); C, the Table Mountain ghost frog (*Heleophryne rosei*) occurs only on Table Mountain and has a declining population trend due to over-abstraction of water from the few streams where it occurs (© Jeremy Shelton); D, the Pondo dwarf chameleon (*Bradypodion caffrum*) is Endangered and Not Protected, as it occurs in small forest fragments in the Eastern Cape and has less than 5% of its population protected (© Chad Keates).

Genetic diversity indicators

Genetic diversity underpins all biological diversity, playing a key role in individual fitness (an organism's ability to survive and reproduce), species' ability to adapt to changing environments, and overall ecosystem resilience. The genetic diversity of many wild species has declined in recent decades and greater declines are projected through ongoing habitat loss and population size reductions. Local extinctions, reduced population sizes and disruption of genetic connectivity mean that many of the populations that exist today have insufficient genetic diversity to persist in the long term.

As technology advances and the cost of molecular processing decreases, it will become easier to monitor the genetic health of species and their populations through time. In the absence of complete genetic data being available now, proxy indicators – like population size and numbers – can inform conservation. They address two key conservation genetic principles: 1, the need to protect all genetically distinct populations, and 2, the importance of ensuring populations are large enough for species to persist. Additionally, identifying species based on their evolutionary uniqueness and risk of extinction supports long-term adaptive potential.

South Africa has adopted genetic indicators from the Kunming-Montreal Global Biodiversity Framework for national biodiversity monitoring:

- **Proportion of populations with an effective population size greater than 500 (Ne 500 indicator):** Effective population size (Ne) represents the number of individuals in a population contributing to the gene pool. At any given time or reproductive cycle not all adults reproduce, consequently Ne is a subset of the number of individuals in a population (typically 10 to 30% of the census size). Studies have identified a threshold of Ne greater than 500 signifying a genetically stable and healthy population into the long term; while below 500, the risk of extinction increases. The Ne 500 indicator ranges from 0 to 1, with 0 indicating no populations of a species have Ne above 500 and 1 indicating all populations exceed the 500 threshold.
- **Proportion of populations maintained within species (PM indicator):** This indicator is based on the principle that genetic differences increase as populations are farther apart in geographic and/or environmental distance. By maintaining distinct populations, species are more able to adapt and evolve. The PM indicator ranges from 0 to 1, with 0 indicating all populations have been lost (species is extinct) and 1 indicating that all populations are still present.
- **Changing status of evolutionarily distinct and globally endangered species (EDGE index):** This index is grounded in the understanding that genetically distinctive and threatened species would represent a significant loss to the tree of life if they are lost, making their preservation crucial. It is a tool for monitoring the changes in the conservation status of South Africa's evolutionary heritage. For each taxonomic group that has a phylogeny, a value of 0 indicates that none of the genetically distinctive species are threatened and a value of 1 indicates that all genetically distinctive species are threatened with extinction.
- **Expected loss of phylogenetic diversity (PD):** This complementary indicator is estimated as the total phylogenetic diversity in a phylogeny weighted by the probability of extinction for each species. This can be expressed as a percentage of the total phylogenetic diversity for the clade, where 100% would indicate that all species have the highest possible probability of extinction and all PD is expected to be lost, while 0% suggests that all species are safe from extinction and no PD is expected to be lost. The larger number of threatened species that contribute to high phylogenetic diversity, the more diversity is expected to be lost into the future. A case study on herpetofauna has been conducted for this indicator, which reveals that South Africa is expecting to lose around 6% of amphibian PD and around 5% of reptile PD.

South Africa's Ne 500 and PM indicator scores for selected taxonomic groups

As part of a global study testing the PM and Ne 500 indicators, South Africa was found to have a **PM value of 0.95 and Ne 500 value of 0.42.** This indicates that, while South Africa has maintained the majority of its species' populations (for the 126 species assessed), they are smaller than what is needed to ensure their long-term persistence and the overall adaptive potential of the species. While this first assessment incorporated a relatively small number of species, the species included were from a wide variety of taxonomic groups, ecosystems, distributions and conservation statuses. Importantly, even Least Concern and Near Threatened

The population of the Near Threatened southern white rhinoceros (*Ceratotherium simum simum*) numbers over 14 000 individuals, yet genetic studies reveal its effective population size (Ne) is under 100 – well below the Ne 500 threshold, reflecting serious genetic erosion from the historically small recovery population. Poaching still impacts this species (see key message A6). © Greg Martindale.

taxa received poor indicator values, indicating a loss of diversity that has gone undetected using other measures of extinction risk. To better understand the genetic health of South African biodiversity, efforts are underway to expand this work across complete taxonomic groups.

A, the geometric tortoise (*Psammobates geometricus*, CR) (© Andre Botha) and; B, the giant girdled or sungazer lizard (*Smaug giganteus*, VU) (© Johan Marais) are the top scoring EDGE (evolutionarily distinct and globally endangered) species for South African reptiles. The EDGE index is an indicator under Goal A of the Kunming-Montreal Global Biodiversity Framework and South Africa has ongoing work to enable reporting against this indicator.

NBA 2025 key messages

The key messages distil some of the most important findings of NBA 2025 in a way that is accessible to various audiences. Each key message includes a summary paragraph with a confidence statement. The messages draw on evidence from an NBA analysis (e.g., Red List status, ecological condition); describe why this is important (e.g., what are the consequences for people); and give some practical actions, responses and interventions that can be done.

The NBA provides a summary of the state of biodiversity at a point in time, and cannot provide details of *all* actions, responses and interventions that could or should occur. The NBA is a strategic tool from which important discussions amongst all relevant stakeholders should flow. The key messages should be considered with their underlying data and analyses to inform sector-specific strategies and action plans, cross-sectoral planning and interventions, research strategies, scenario planning and other action plans or response strategies that may be co-produced subsequent to the NBA.

The NBA 2025 key messages are grouped into three clusters (see summary table and Figure 18).

NBA 2025 key messages summary	
CLUSTER A: Cross-realm pressures on South Africa's biodiversity are impacting people	A1. Accelerated climate change has widespread impacts on biodiversity and people.
	A2. Unsustainable land use and sea use changes erode natural capital and undermine ecosystem services.
	A3. Pollution reduces water quality, impacting aquatic ecosystems and their dependent economic activities.
	A4. The prevention and management of biological invasions remain a priority.
	A5. Building on past successes, opportunities exist for more sustainable and equitable fisheries.
	A6. Innovation is needed to address escalating illegal wildlife harvesting and trade.
	A7. Freshwater flows from land to sea are essential for coastal ecosystems, species and communities.
CLUSTER B: Improving the status of South Africa's biodiversity is key to a sustainable and equitable future for all	B1. Recovery efforts are required to curb rising extinction risk and a growing number of threatened species.
	B2. Estuaries, rivers and wetlands are the most threatened and least protected ecosystems in South Africa.
	B3. Genetic diversity of South African indigenous species' populations is declining.
	B4. Enhancing effectiveness of protected and conserved areas for mitigating pressures on biodiversity will build on progress in representing ecosystems and species.
	B5. Scientific and well-documented programmes are needed for ecosystem restoration and species recovery.
CLUSTER C: Inclusive actions across the whole-of-government and whole-of-society are needed to secure nature's contributions to people	C1. Safeguarding South Africa's biodiversity calls for a whole-of-government and whole-of-society approach.
	C2. Investment in biodiversity monitoring is crucial for management, decision-making, research and reporting.
	C3. Innovative finance solutions are needed to address funding and capacity constraints in the biodiversity sector.

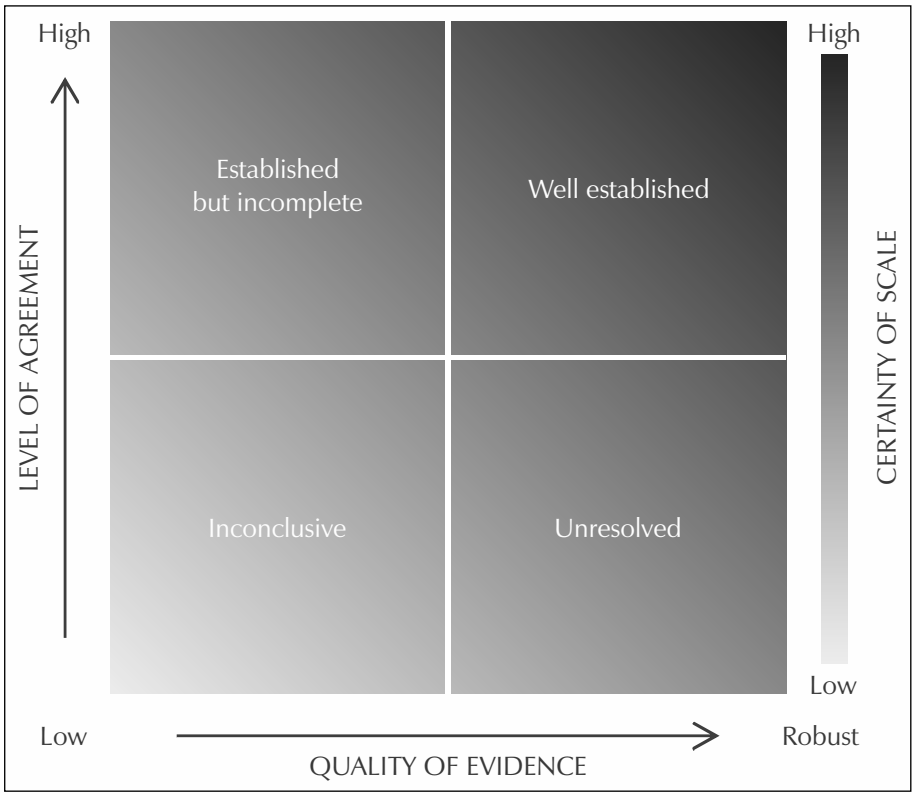


Figure 18. Each message in clusters A and B is accompanied by a qualitative statement of the degree of confidence in the finding. NBA 2025 uses the model adopted by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) that plots findings on two axes: quality and quantity of evidence on the x-axis and level of agreement on the y-axis.

Biodiversity underpins the South African economy and society. Well-managed mixed land uses contribute to biodiversity targets and a sustainable and equitable future for all. © Linda Harris.

CLUSTER A:

Cross-realm pressures on South Africa's biodiversity are impacting people

This cluster highlights the key pressures on South Africa's biodiversity across realms and how these pressures have impact on the numerous benefits people derive from biodiversity.

A1. Accelerated climate change has widespread impacts on biodiversity and people

> *Accelerated climate change has caused widespread adverse impacts on biodiversity and people, with increasing irreversible losses and disturbances (well established). Intact and well-managed biodiversity helps people to build resilience against the impacts of climate change. Integrated solutions involving biodiversity, society and climate action are key to adapting to climate change.*

Climate change has caused irreversible losses of species and range shifts, as well as changes in ecosystem structure and disturbance regimes in all realms. More than 200 South African species have experienced severe population declines and increased extinction risk due to climate change, such as the iconic halfmens (*Pachypodium namaquanum*) and Namaqua dune mole rat (*Bathyergus janetta*). In the South African ocean, climate-driven shifts in prey species' ranges contribute to a decline in seabird numbers and the worst coral bleaching in history is currently underway. Estuarine fish species (e.g., spotted grunter, *Pomadasys commersonnii*) have extended their ranges by hundreds of kilometres, changing estuarine food webs. Climate change also amplifies other pressures on biodiversity such as biological invasions, habitat loss, pollution and changes to freshwater flow.

Globally, climate thresholds have now been reached. The year 2024 was the first on record with a mean temperature more than 1.5 °C above the 1850–1900 mean. South Africa will likely become drier in the west and have intensified rainfall events in the east, with the interior warming faster than the global terrestrial mean. Biomes will likely change (e.g., Fynbos and Succulent Karoo drier and Savanna more woody) and species extinction risk is likely to increase. Environmental cycles and ecosystem processes that humans depend

Scaling up renewable energy is part of South Africa's Just Energy Transition, and must be accomplished in a way that considers biodiversity. For example, this blade patterning experiment is ongoing at the Umoya wind farm in Hopefield, where painted blades show reduced bird fatalities. © Robert Simmons.

Disruptive flooding is now a seasonal reality in several provinces due to climate change. In 2022, KwaZulu-Natal experienced extensive flood damage like the Umdloti beachfront in this image. The Palmiet area was less affected, thanks to the Palmiet Rehabilitation Project. The project had recruited EnviroChamps from the community to clear alien vegetation along the river and monitor for blockages of sewers and stormwater drains in the two years prior to the 2022 floods. © Ryan Daly.

on are changing. Rising sea levels cause coastal erosion and infrastructure damage; shifting fire regimes impact property and air quality; warmer temperatures threaten water quality through increased eutrophication; and extreme weather events like droughts, heavy rainfalls and strong winds undermine safety and livelihoods.

Greenhouse gas reductions and biodiversity-friendly renewable energy remain important for mitigating climate change. Recognising the connection between climate, biodiversity and society helps to identify additional integrated solutions. Ecosystem-based adaptation is the use of biodiversity to help people adapt to and build resilience to the impacts of climate change. Ecological infrastructure, such as wetlands, rivers, estuaries, coastal dunes and kelp forests, helps to protect people and built infrastructure from the impacts of extreme weather events. Well-managed ecological infrastructure can support resilient agricultural production and maintain a steady supply of water. Programmes that maintain and restore ecological infrastructure and ensure connectivity across landscapes and seascapes are cost-effective ways to preserve nature's adaptive capacity. Investment in inclusive climate action that reduces risk and prioritises equity and justice is essential.

A2. Unsustainable land use and sea use changes erode natural capital and undermine ecosystem services

Uncoordinated land- and sea-use changes cause biodiversity loss, degrade ecosystems and undermine the ecosystem services they provide (established). Biodiversity provides essential ecosystem services to support people and the economy. Strengthening collaborative, biodiversity-inclusive planning is essential to safeguard South Africa's natural capital while enabling development.

Across the country's landscapes and seascapes, habitat loss, fragmentation and declining ecological function are reducing the capacity of natural systems to deliver crucial services. On land, habitat loss is primarily driven by expanding human settlements and the establishment of new croplands, with over 100 000 ha lost annually between 1990 and 2022. Encouragingly, the rate of loss shows signs of slowing since 2014. In the freshwater and estuarine realms, direct habitat loss from, for example, mining, croplands and housing developments, is a major pressure on aquatic biodiversity, alongside flow reduction and pollution. Direct habitat loss from mining and energy generation is relatively limited compared to other forms of land use (< 1% of land in South Africa), but intense, persistent and cumulative impacts often extend beyond the direct footprint, especially in aquatic realms where effects cannot be easily contained. In the marine realm, there are substantial direct impacts on biodiversity from coastal and offshore mining, and oil and gas extraction.

Development on land and in the sea is crucial for economic growth to address the country's social challenges of poverty, inequality and unemployment. When these developments are positioned appropriately and managed sustainably, biodiversity loss and ecosystem degradation can be prevented. Healthy ecosystems are the foundation for South Africa's social, economic and environmental wellbeing. They provide essential services to sustain life and livelihoods such as clean water, food security, climate regulation and disaster risk reduction.

South Africa has a strong foundation for systematic biodiversity planning and supportive legislation, but implementation gaps remain. Action is urgently needed to better integrate biodiversity into spatial planning and decision-making at all levels of government and across all sectors. Development decisions should be informed by the best available science and local knowledge, ensuring that future land and sea uses align with ecological sustainability. Strategic Environmental Assessments, updated environmental guidelines (such as the *Mining and Biodiversity*

Sand mining is an escalating pressure on the South African coast and in estuaries, impacting coastal biodiversity and ecosystem services. Mining can be seen on the beach in the foreground and on the adjacent dunes. © Jacque Smit.

Mixed land use, ensuring corridors for biodiversity, is possible in South Africa's production .landscapes, such as this plantation forestry landscape. © Endangered Wildlife Trust.

Guideline), and enhanced cross-sector coordination are required to manage cumulative impacts to safeguard species and ecosystems. By strengthening participatory, integrated, biodiversity-inclusive planning, and embedding biodiversity considerations into all development processes, South Africa can balance economic growth with the protection of its natural capital, securing the ecosystem services that are needed to support current and future generations.

A3. Pollution reduces water quality, impacting aquatic ecosystems and their dependent economic activities

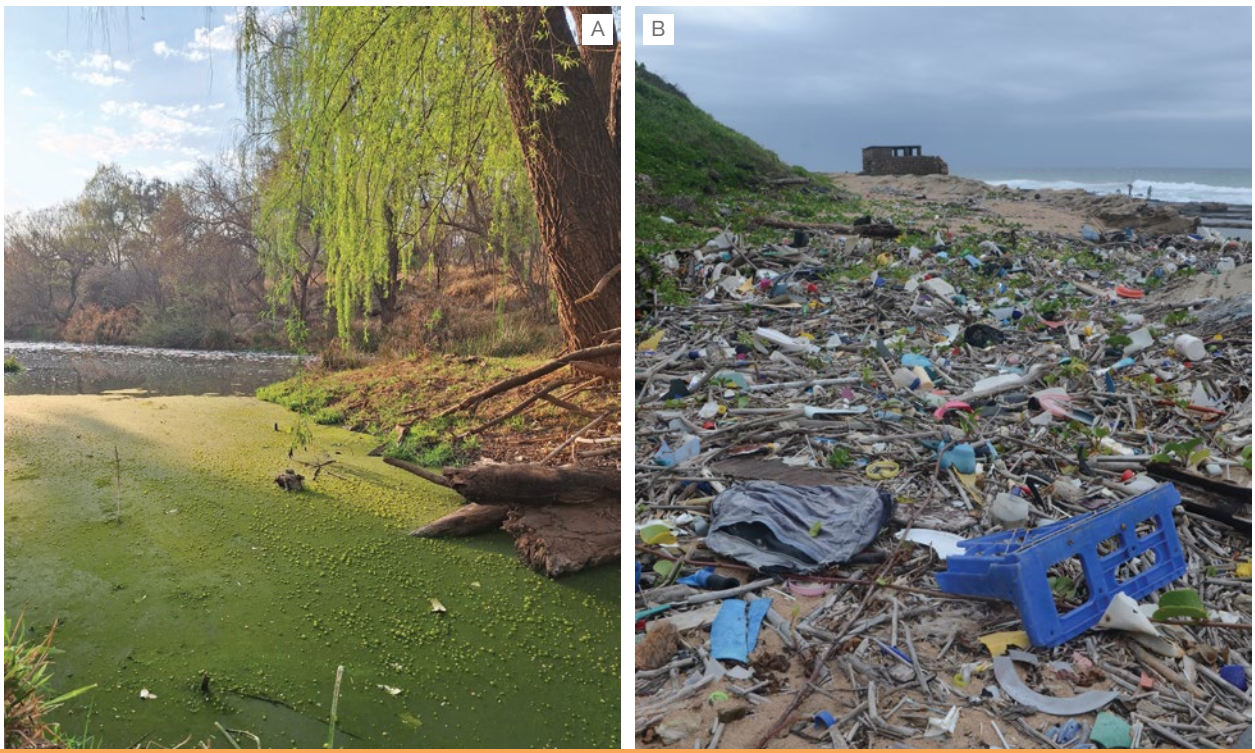
The negative impacts of pollution continue to increase in South Africa's aquatic ecosystems, exceeding sustainable limits and affecting biodiversity, human wellbeing and economic development (established). South Africa has advanced water policy, however, there is a need to strengthen compliance monitoring and enforcement for aquatic ecosystems.

South Africa's rivers, wetlands, groundwater, estuaries and marine ecosystems are vital for water and food security, yet are compromised by pollution that contributes to a third of aquatic ecosystem extent being in poor condition. Half of South Africa's estuaries have moderate to very high levels of pollution. The pollution originates from point and non-point sources, including agricultural return flow, discharge from wastewater treatment works, sanitation distribution networks, unmanaged urban stormwater, and other production and industrial processes. Poor solid waste management, particularly from rural and peri-urban areas upstream or near to water resources, also impacts water quality. Pollution disrupts the functioning of terrestrial, freshwater and coastal ecosystems, compromising ecosystem services, causing eutrophication and oxygen depletion and local die-off of aquatic species, and often supporting uncontrolled spread of invasive aquatic plants. Emerging pollutants such as microplastics, persistent organic pollutants (e.g., PFAS[1]) and pharmaceuticals threaten water safety and aquatic biodiversity. Recent studies have detected DDT[2] and other organochlorine pesticides in Lake Sibaya, coral reefs and offshore marine ecosystems.

South Africa's aquatic ecosystems have limited pollution assimilation capacity, which is being exceeded. Contaminated water has public health implications and reduces the availability of clean drinking water, and water of suitable quality for food production

[1]Polyfluoroalkyl substances (PFAS) represent a large class of synthetic chemicals used throughout society, sometimes called 'forever chemicals' due to their persistence in the environment and human body.
[2]Dichlorodiphenyltrichloroethane (DDT) usage was discontinued for agricultural use in South Africa in 1983, but is used for malaria control. In addition to posing health risks to people, DDT is persistent and bioaccumulates in ecosystems.

South Africa's aquatic systems face multiple forms of pollution, including from plastics, pesticides, untreated wastewater, urban runoff and more. Their capacity to assimilate pollutants is being exceeded with consequences for biodiversity, health and economic development. A, eutrophication from sewage spillage into a river (© Hlengiwe Mtshali); B, plastic pollution usually ends up in rivers, the ocean and on beaches (© George Branch).



and other economic activities. Toxins from pollution accumulate in food chains, affecting both aquatic life and the human communities that depend on ecosystems for food security and livelihoods. These impacts disproportionately affect the most vulnerable communities who are directly reliant on natural water sources.

South Africa needs to improve management of pollutants, particularly for wastewater, agricultural runoff, urban stormwater and emerging contaminants. With increased demand on water resources and considering the water-food-energy nexus, there is a need for alignment in policy, law and governance for integrated water quality management. Recent achievements include the publishing of the *National Water Resource Strategy III* in 2023, the *South African Water Quality Guidelines for Coastal Marine Waters* in 2022, and the Marine Pollution (Prevention of Pollution from Ships) Amendment Bill in 2025. These recent advances in water policy now require well-resourced action. It is vital to amplify current investment in modernising wastewater treatment works to ensure they meet current and future demands. Innovative urban drainage solutions should be instituted to improve stormwater management. Pollution levels in aquatic ecosystems should be effectively monitored. Water pollution is a complex developmental, economic, social and environmental issue. Addressing it effectively requires an integrated, participatory approach and collaborative partnerships across all levels of society, including government, the private sector and civil society.

A4. The prevention and management of biological invasions remain a priority

South Africa has over 3 500 alien species present outside of captivity or cultivation, at least a third of which are invasive (established but incomplete). New alien species arrive every year and those present in the country continue to spread and cause negative impacts. Better planning and monitoring are required to ensure effectiveness of interventions aimed at managing biological invasions for the benefit of biodiversity, people and the economy.

Since 2018, South Africa has detected around three new alien species per year. Invasive species continue to spread and are found throughout the country. The national survey of invasive plants showed that coverage of selected invasive species increased by 10.6% between 2008 and 2023. Recent estimates indicate that 17% of terrestrial ecosystem types show greater than 10% cover by invasive alien plants. Biological invasions contribute to the listing of 31% of threatened terrestrial ecosystems and 36% of all threatened species.

Invasive alien species are having increasing impacts on nature, water security, people and the economy.

South Africa's third national report *The status of biological invasions and their management in South Africa (2022)* provides important information and recommended actions. © SANBI.

Invasive species, such as the black wattle (*Acacia mearnsii*) pictured here, are found across the country, impacting many Strategic Water Source Areas. Efforts to improve water security by clearing invasive alien plants in catchments are ongoing at various scales, for example, efforts of the Greater Cape Town Water Fund has resulted in the clearing of more than 46 000 ha of invasive trees in five years (2018–2023), with an estimated recovery of over 15.2 billion litres of water per year. © Tsamaelo Malebu

Studies show that biological invasions use 3–5% of South Africa's precious surface water runoff each year, which is a direct threat to water security in a water-scarce country. They also reduce the value of livestock production from natural rangelands by R340 million per year, impacting both food security and livelihoods.

Knowledge of the distributions of alien plants has increased through the national survey, as well as through citizen science and the digitisation of historical records. Biological invasions have also been successfully managed in some cases, including through biological control, with positive returns on investment. Successful eradication includes the estuarine cordgrass (*Sporobolus alterniflorus*) from the Great Brak Estuary and the smallmouth bass (*Micropterus dolomieu*) from the Rondegat River. Prevention is crucial, through management of introduction pathways, particularly in marine systems where eradication is often unfeasible.

Finalisation of the Ballast Water Management Bill is essential to preventing marine introductions. The establishment of the Border Management Authority aims to improve the prevention of illegal and accidental introductions. Management plans, with clear goals and consistent monitoring, will improve the effectiveness of invasive species control. Several global and national initiatives provide a framework for managing invasive species. These include the Kunming-Montreal Global Biodiversity Framework (Target 6) and the Invasive Alien Species Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. At a national level, South Africa is guided by the White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity and the draft National Invasive Species Strategy and Action Plan. With judicious investment and integrated governance, the impact of biological invasions on South African society can be reduced and any potential benefits researched and optimised.

A5. Building on past successes, opportunities exist for more sustainable and equitable fisheries

Multiple fishing pressures impact many aquatic ecosystems and species (established). There are opportunities to improve fisheries' sustainability at the ecosystem, species and genetic level, while supporting more fair fisheries. Fisheries management plans that apply an ecosystem approach to fisheries can allow fisheries resources to recover for the benefit of food security and livelihoods.

Fishing is one of the most enduring marine activities that supports food and job security. However, fishing exerts the greatest pressure on estuarine and marine biodiversity, with impacts on ecosystems, species and genetic diversity. Concentrated fishing pressure by multiple actors, including recreational fisheries, is the cause of ecosystem degradation in some areas, and increases extinction risk of target and bycatch species. The many coastal species threatened by fishing include some endemic seabreams, several kob species and some invertebrates. Formerly common species like South African abalone (*Haliotis midae*), West Coast rock lobster (*Jasus lalandii*) and white mussels (*Donax serra*) are now Endangered due to overexploitation. Fishing has led to genetic consequences for seventy-four seabream (*Polysteganus undulosus*) and kob species (Sciaenidae). It also affects many seabirds, including the threatened African penguin (*Spheniscus demersus*), Cape gannet (*Morus capensis*) and Cape cormorant (*Phalacrocorax capensis*), and many sharks and rays. Fisheries management efforts have resulted in the partial recovery of some seabream species, including slinger (*Chrysoblephus puniceus*), carpenter (*Argyrozona argyrozona*) and Cape bream (*Pachymetopon blochii*).

Overfishing has consequences for food security and livelihoods, affecting small-scale, recreational and commercial fisheries. The marine recreational fishery includes at least 700 000 anglers and has substantial, yet unquantified, impacts on marine biodiversity and other fishery sectors. Recreational fishers compete with small-scale and commercial fisheries, but remain largely unmonitored and ineffectively regulated.

To ensure fair and sustainable fisheries that support ocean life and human livelihoods, effective management plans based on scientific evidence should be implemented for all sectors, to manage the impacts on ecosystems, species, genes and people. Fortunately, the number of assessed stocks has grown due to new methods in stock assessment, and South Africa has made progress with ecological risk assessments. The country can expand on this foundation to implement an ecosystem approach to fisheries. Better inclusion of recreational fisheries in policy and planning could reduce sectoral conflict and ensure equitable resource distribution. Key strategies include rebuilding overfished stocks, enhancing monitoring, and ensuring sufficient capacity for Red List and stock assessments. Specific actions should focus on reducing harmful practices, reducing bycatch, regulating (especially online) sales/imports, reducing gill net use, increasing compliance, improving spatial management, preserving genetic diversity, and promoting responsible resource use. Diversifying shark control measures can help reduce fishing pressure on threatened shark, ray, mammal and turtle species. Ensuring policy coherence and aligning monitoring efforts will be essential to manage growing demand on limited marine resources sustainably.

Effective fisheries management has supported the partial recovery of species such as A, Cape bream (*Pachymetopon blochii*) (© Joris van Alphen) and; B, slinger (*Chrysoblephus puniceus*) (© Geoff Spiby).

Industrial fisheries are one of the most wide-spread pressures in the marine realm. © Peter Chadwick.

There are many recreational fishers in South Africa and improved management of this sector can support more fair fisheries. © Kerry Sink.

A6. Innovation is needed to address escalating illegal wildlife harvesting and trade

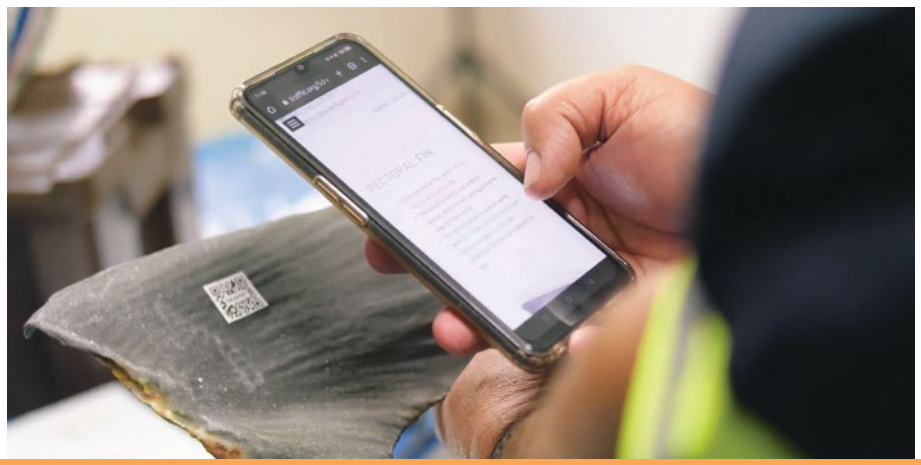
Illegal harvesting and trade of South Africa's species is increasing, with conventional law enforcement and legislative approaches failing to prevent population decline and near extinction of several species (established). Interventions that increase revenue within the conservation sector and contribute meaningfully to local livelihoods are required.

South Africa's rich biodiversity, combined with socio-economic challenges, has led to increasing illegal trade of numerous high value species in all realms. Around 9 500 southern white rhinoceroses (*Ceratotherium simum simum*; Near Threatened) were poached between 2010 and 2023. Tens of thousands of plants of South Africa's 37 cycad species (*Encephalartos* spp.), 71% of which are threatened, have been illegally harvested from wild populations in the last three decades – even from protected areas. A lack of effective guardianship of Endangered South African abalone (*Haliotis midae*) has seen an estimated 90% reduction in abundance over the past 35 years. The West Coast rock lobster (*Jasus lalandii*) has changed from Least Concern to Endangered, largely because of illegal fishing. Official seizures and analyses of online trade show that reptiles, medicinal plants, seahorses, pipefish, sea cucumbers, marine gastropods (cowries, cone-shells, etc.), fish maw (swim bladders) and live ornamental aquarium species (including sharks, rays and corals), are being targeted. Some illegal harvesting methods (e.g., the use of gill nets for illegal fishing) are indiscriminate, affecting non-target species as well. Since 2020, illegal harvesting of ornamental succulent and geophytic plants, in high demand in Europe and Asia, has seen a dramatic escalation in the Succulent Karoo Biome where range-restricted endemic plant species are easily accessible and local people have limited livelihood opportunities. Over 1.1 million harvested plants have been confiscated, 632 species populations are in decline, and the populations of 12 endemic species have been reduced to functional extinction[1].

Addressing illegal wildlife trade through conventional law enforcement, focussed on stringent legislative measures such as trade prohibitions, is failing. For example, despite substantial enforcement, policy and management efforts directed towards curbing the poaching of rhinos, many have been killed within state-owned protected areas, leaving the private sector with the responsibility of protecting just over half the national herd. Similarly, 96 million South African abalone have been poached in 10 years, despite a severely reduced catch limit for the legal fishery. Many of the comprehensive response strategies and management plans, particularly for cycads and succulents, are severely under-resourced and poorly implemented, while conservation agencies lack resources for effective compliance measures.

Contributing to a sustainable biodiversity economy through legal trade offers a new frontier for addressing wildlife crime by supplying persistent demand, whilst directly tackling socio-economic challenges and generating funds for conservation. Molecular techniques, such as DNA and stable isotope forensics, as well as the use of artificial intelligence, 3D printing and other accessible digital technologies that improve monitoring, training and databasing, provide innovative technological solutions for ensuring that trade is well-regulated and does not threaten wild populations.

[1]Functional extinction means that there are too few individuals left in the wild for the population to be viable and recover from the impacts of illegal collection.



The use of innovative technologies can contribute to a sustainable biodiversity economy through legal wildlife trade. Shown here are 3D-printed examples of shark fins provided by TRAFFIC to help customs officials at border points, with a QR code link providing additional support for identification. © TRAFFIC.

SANBI
Biodiversity for Life
South African National Biodiversity Institute

Conscientious consumers support
ethical, responsible and sustainable use of succulent plants

Purchasing plants that have been collected from the wild can be a major threat to natural plant populations if they are collected in significant numbers. By reducing plant population numbers in nature, species cannot persist, and this impacts ecosystems and the life-supporting services they provide to us. Species that are found only in very specific locations or those that are already rare in nature are particularly at risk of going extinct if too many plants are removed from the wild.

Consumers of these plants must take accountability by making more informed and responsible choices to ensure that wild populations can be seen by future generations. Supporting an ethical, responsible and sustainable trade in succulent plants can also benefit local economies within countries where the species grow, thereby helping these countries to protect and conserve the planet's important natural resources.

How to become a more conscientious consumer of succulent plants:

- Learn about the relevant domestic and international laws that have been put in place to protect wild plant species/populations. Many species are protected by domestic laws within their country of origin, and some are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- Be aware of the permits needed to harvest, buy, possess, trade, etc. succulent plant species.
- Find out if/why a species is at risk of extinction and/or protected by law before making a purchase (visit https://www.iucnredlist.org/ and https://speciesplus.net/species for more).
- Avoid buying large plants or species that are rare, at risk of extinction, and/or not widely available on the retail market.
- Choose to buy plants that have been grown artificially in a nursery or garden and try growing plants from seed, cuttings or seedlings and smaller plants.
- Be wary when purchasing plants online, especially from traders active only on social media platforms.
- Take note of the plant's appearance before finalising your purchase to make sure you are not buying a wild-collected plant. Ask for pictures beforehand if purchasing from online traders.
- Before purchasing a plant, ask questions if you are unsure of anything and speak with other ethical succulent plant enthusiasts.

Cultivated plant	Wild-collected plant
A plant that is grown from seeds, cuttings, divisions or other plant tissues, under controlled conditions (i.e., non-natural conditions influenced and managed by humans) for the purposes of plant production.	A plant that comes from its natural environment where it was living, growing and (possibly) multiplying without human assistance under natural (uncontrolled) conditions.

For more information please visit the SANBI website (https://www.sanbi.org/) or contact Ms Emily Kudze (E.kudze@sanbi.org.za).

More than 1.1 million succulent plants have been confiscated from poachers between 2020 and 2025, representing only an estimated 15% of the total poaching underway. This flyer promotes how conscientious consumers can differentiate between cultivated and wild-collected plants. © SANBI.

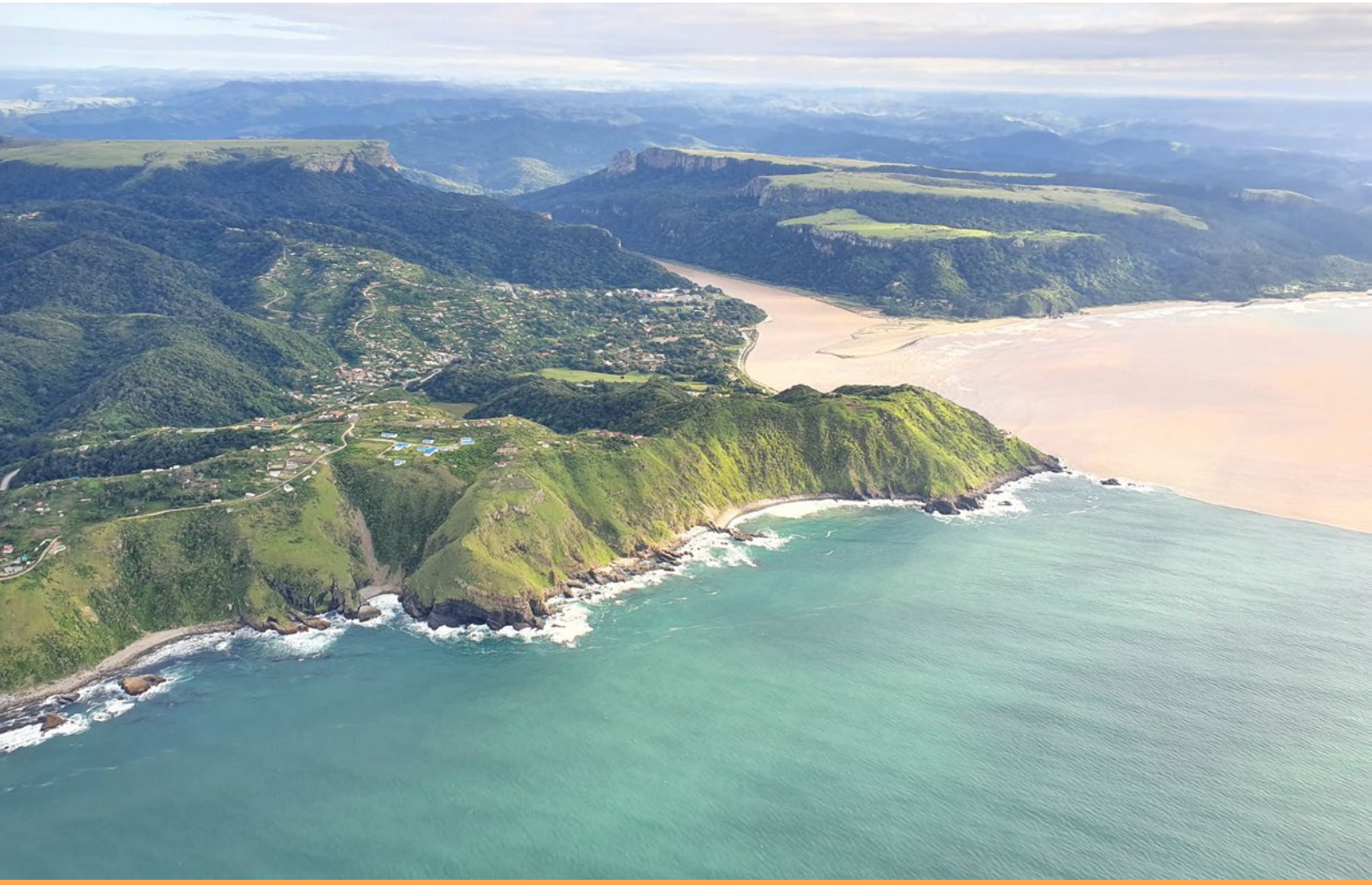
A7. Freshwater flows from land to sea are essential for coastal ecosystems, species and communities

Sufficient flow of clean water from land to sea is important for the functioning of coastal, estuarine and marine ecosystems, with implications for water quality, marine fisheries and coastal resilience to disasters (established). Sustaining the vital flow of freshwater to the sea requires an integrated approach that combines the management of flow, water quality and ecological and built infrastructure with coordinated efforts across all components.

Freshwater flows into the ocean are essential for functioning coastal and marine ecosystems and the species that live in them. Estuaries demonstrate this interconnectivity between land and sea, and more than 20% suffer severely reduced freshwater flow and 32% are under severe pollution pressure. Flow reduction and poor water quality cause poor coastal ecosystem condition and increased species threat in the estuarine and marine realms. South Africa has very few (only 62) remaining free-flowing rivers that reach the coast without substantial barriers limiting flows and species movement. The water from many of the country's catchments is already fully allocated for human uses inland, leaving ever decreasing volumes to flow into the ocean.

Sufficient freshwater flow into the ocean maintains water quality, salinity regimes and estuarine connectivity that supports fish nursery functions vital for marine fisheries. Freshwater flow enables the movement of sand and sediments, maintaining beaches and dunes, which are tourism and coastal resilience assets that help protect people from sea storms. Fisheries associated with muddy ecosystem types (e.g., prawns, sole) require mud delivery through freshwater flows to the sea. Species that move between marine and freshwater environments during their life cycle (e.g., eels [*Anguilla* spp.] and the commercially important dusky kob [*Argyrosomus japonicus*]) are

Freshwater reaching the sea is not wasted. Sediment-rich clean water, flowing from catchments through estuaries into the ocean, is essential and provides multiple benefits such as nutrients for fish and sand for beaches and dunes. Actions have been identified to track progress in securing freshwater flow to the estuarine and marine realms. © Darren Hanner.



particularly vulnerable when estuarine connectivity and functioning are altered.

Ecological infrastructure, such as catchments, rivers and wetlands, together with built infrastructure, facilitates and regulates freshwater flows into the sea. A lead agency is needed to coordinate the development of an officially accepted standard protocol for the determination and implementation of flow requirements for fluvial-dependent marine ecosystems and resources. Then, alignment of strategies amongst stakeholders, such as the *National Water Resources Strategy and Water Resource Classification*, can ensure that flow requirements are implemented. Coordinated monitoring, data management and sharing will further support this effort. Investing in water resource monitoring and reporting is crucial to understand trends in streamflow quality and quantity, including associated declining estuary and coastal ecosystem conditions. Natural capital accounting, including the subnational water resource accounts and Strategic Water Source Areas accounts, provides insights into how water moves across the landscape. Catchment Management Agencies play a key role by encouraging partnerships across sectors for collaborative water governance. Finally, coastal and estuary management plans must detail freshwater allocation, fish resource use, water quality management and appropriate land-use activities.

CLUSTER B:

Improving the status of South Africa's biodiversity is key to a sustainable and equitable future for all

This cluster relates to the status of South Africa's biodiversity, using national and international headline indicators. These messages encourage intensive effort towards ensuring a society living in harmony with nature, where biodiversity conservation and sustainable use ensure healthy ecosystems, with improved benefits that are fairly and equitably shared for present and future generations.

B1. Recovery efforts are required to curb rising extinction risk and a growing number of threatened species

South Africa has recorded a marked rise in extinction risk for species over the past decade, with the international headline indicator, the Red List Index of species, showing accelerating declines (established). A whole-of-society approach is required for recovery efforts to meet national and international responsibilities.

South Africa's most threatened taxonomic groups are freshwater fishes, cartilaginous fishes (sharks, rays and chimaeras) and succulent plants. Up to 66% of freshwater fish taxa are threatened, due to invasive alien fish and habitat modification. Other plants, reptiles, birds and mammals are also showing increased rates of decline over the past decade. More than 100 species have moved from Least Concern to threatened categories on the IUCN Red List of Threatened Species since 2018. The main cause has been population reductions linked to climate change (see key message A1) in the western parts of the country impacted by severe drought. The worst impacted region is northern Namaqualand, where endemic plants, beach macrofauna and reptiles have also experienced declines as a result of expanding mining activities. The increase in illegal trade has caused severe declines to species in use (see key message A6), including endemic plants, some marine invertebrates and cartilaginous fishes. Estuarine degradation, fishing and lethal shark control measures contribute to the threat status of cartilaginous fishes. Their decline is a global trend, yet with several endemic species, South Africa has a responsibility to protect them.

Both largetooth sawfish (*Pristis pristis*) and green sawfish (*P. zijsron*) were once common along the KwaZulu-Natal coast and in estuaries, but are now considered Critically Endangered within our waters. Building on progress, South Africa can further diversify and modernise shark management measures to improve marine species status without unduly increasing risks to bathers. © Dennis King.

At least 55 plant species endemic to the Richtersveld region have been uplisted to highly threatened categories since NBA 2018 due to the combined impacts of climate change and rapidly expanding mining activities. All three species of tree aloes found in the Richtersveld, including this quivertree (*Aloidendron dichotomum*, Vulnerable), were listed on the IUCN Red List of Threatened Species in 2022 as threatened as a result of population declines due to climate change. © Wendy Foden.

The threatened status of several nearshore marine species is of concern for food and livelihood security (see key message A5), as is the status of other species harvested for food and medicine. Species support crop agriculture, the wildlife economy, tourism and many other jobs. South Africa is a megadiverse nation and has committed to global efforts to address the species extinction crisis. Target 4 of the Kunming-Montreal Global Biodiversity Framework calls for a concerted effort to halt human-induced extinction of threatened species, and for the recovery and conservation of species.

South Africa has many conservation tools available for species recovery. Sufficient resourcing is required to ensure Red List assessments are conducted and updated for all taxonomic groups at least every 10 years. Additional species information needs to be included in the National Environmental Screening Tool, particularly for the marine realm, and in Spatial Development Frameworks and Integrated Development Plans. In cases where species have experienced extreme losses and recovery is required, multiple partners need to work together. South Africa's Centre for Species Survival and the IUCN National Species Specialist Group have developed and costed recovery plans that estimate a 10-fold increase in spending on species recovery is required for South Africa to meet its obligations under the Kunming-Montreal Global Biodiversity Framework. Expanding protected and conserved areas, and improving their effectiveness for under-protected and threatened species, remains crucial to safeguard South Africa's rich species diversity (see key message B4).

B2. Estuaries, rivers and wetlands are the most threatened and least protected ecosystems in South Africa

South Africa's estuaries, rivers and wetlands remain highly threatened and under protected (established), despite providing many services that are vital to people. Achieving biodiversity conservation and socio-economic benefits will depend on innovative, integrated management of these ecosystems that combines regulatory enforcement with empowered community stewardship.

Estuaries, rivers and wetlands in South Africa are more threatened than ecosystems in other realms. Over 90% of estuarine ecosystem types are threatened and less than 10% are Well Protected. Over 60% of river and wetland types are threatened, while less than 10% are Well Protected. These ecosystems face multiple pressures from altered water flows, pollution, land-use changes, poor land management and biological invasions. Barrier structures, such as roads, and commercial forestry further alter stream flow, groundwater recharge and hydrology of rivers and wetlands. In estuaries, the availability of cheap gill nets from online retailers has led to an increase in illegal fishing, especially in KwaZulu-Natal. This indiscriminate fishing method impacts many biota, such as sharks, rays, invertebrates, birds, turtles, terrapins and crocodiles, beyond just the targeted fish species. Freshwater ecosystems and estuaries are complex and do not respond linearly to pressures.

Estuaries, rivers and wetlands are essential ecological infrastructure for water security, food security, tourism, recreation, spiritual and cultural services, as well as disaster risk reduction and carbon sequestration. They are important havens for many threatened and endemic species. Improving their condition will increase the diversity of benefits delivered, as well as the number of people who benefit from aquatic ecosystem services.

The dire status of South Africa's aquatic ecosystems has been documented since the National Spatial Biodiversity Assessment 2004. In response, ecological infrastructure, including rivers and wetlands, has received attention in various policy instruments, such as the National Infrastructure Plan and the pending National Wetland Policy. There have also been efforts to secure ecological infrastructure, and to protect and rehabilitate rivers and wetlands. Estuary Management Plans have been or are being developed for more than 20% of systems. Most freshwater resources have been classified into levels of resource utilisation, although environmental allocations sometimes fall short of biodiversity requirements. However, these responses have yet to improve the threat status or protection level of aquatic ecosystems.

Innovative approaches are needed that integrate social, economic and ecological considerations, and place people at the centre of environmental stewardship. Citizen science monitoring of aquatic systems is a powerful tool that assists communities to understand and appreciate these ecosystems and the services they derive from them. In addition, the implementation of regulatory mechanisms such as environmental authorisations, water use licences and biodiversity offsets must include the requisite resources and capacity for compliance monitoring and enforcement. The recovery of fish and invertebrate resources in estuaries calls for a reduction in fishing pressure, prioritising ecological water reserves for estuaries, and increasing citizen awareness.

Rivers, wetlands and estuaries are essential ecological infrastructure for water security, food security, tourism, recreation, disaster risk reduction and carbon sequestration. Careful management and restoration of Strategic Water Source Areas, river floodplains and estuaries are essential for these benefits to continue. A, there is no buffer alongside this river channel, leading to extensive encroachment of human land uses into the floodplain, heightening risk to agriculture and downstream areas during flooding (© Jeremy Shelton); B, the Heuningnes Estuary in the De Mond Nature Reserve is one of South Africa's 12 estuarine lakes (© Peter Chadwick).

B3. Genetic diversity of South African indigenous species' populations is declining

> *The first assessment of genetic health based on two international indicators suggests declines in the genetic diversity of South Africa's species (established but incomplete). More South African taxa need to be assessed to better understand the full extent of genetic loss within South Africa, and genetic richness analyses need to be incorporated into protected area expansion strategies.*

The Kunming-Montreal Global Biodiversity Framework (Target 4) uses the proportion of populations with an effective population size (Ne) above 500 (Ne 500 indicator) to assess genetic health. Ne represents the number of breeding individuals in a population. When Ne is above 500, populations are large enough to sustain genetic diversity. Populations below this threshold lose genetic diversity, increasing their risk of extinction. An initial assessment of 126 species from various taxonomic groups in South Africa, across different ecosystems and threat levels, found an Ne 500 score of 0.42, meaning that 58% of assessed populations are below the threshold, suggesting substantial genetic erosion. These populations are smaller than is necessary to ensure their long-term persistence and the overall adaptive potential of the species. Alarmingly, even Least Concern and Near Threatened species showed poor genetic indicators, suggesting undetected genetic decline not captured by extinction risk assessments. Similar trends have been seen globally. A complementary indicator tracks the proportion of species' populations still present (PM indicator). South Africa scored 0.95, suggesting that most populations of the assessed species have not yet disappeared. This offers hope that with effective management, the genetic health of South Africa's species can still be recovered.

Genetic diversity underpins a species ability to adapt to environmental changes. Low genetic diversity increases extinction risk, especially under pressures such as climate change, habitat fragmentation, inbreeding, hybridisation, unsustainable use and poorly managed translocations. Safeguarding evolutionarily distinctive species will enable adaptive potential to be maintained within an ever-changing environment.

To better understand the full extent of genetic loss within South Africa, efforts are underway to assess complete taxonomic groups. Increased investment is needed in genetic monitoring (i.e., comparing genetic metrics at multiple time points) to acquire more precise estimates of genetic indicators. Additional indicators based on phylogenetic diversity (e.g., the EDGE index – evolutionarily distinct, globally endangered; and the Expected Loss of Phylogenetic Diversity indicator) are being piloted and are important for ensuring that evolutionarily distinctive species are protected. Importantly, environmental impact assessments and spatial planning should integrate landscape-level genetic richness, particularly for threatened species, by using genetic data or their proxies in the identification of Key Biodiversity Areas, in systematic biodiversity planning and for strengthening the National Protected Areas Expansion Strategy.

A, the grey rhebok (*Pelea capreolus*) (© Tim Kuiper) and; B, the brown hyena (*Parahyaena brunnea*) (© Endangered Wildlife Trust) are both categorised as Near Threatened on the IUCN Red List of Threatened Species, yet their genetic population size (Ne) may already fall below the threshold for long-term survival. Falling below the threshold of Ne > 500 raises concerns about species' abilities to maintain genetic health and adapt to environmental change.

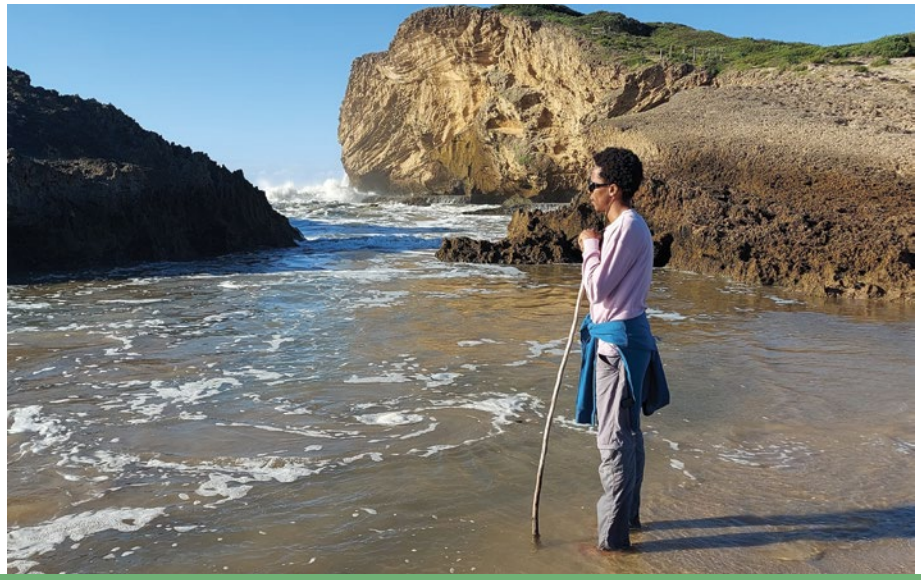
B4. Enhancing effectiveness of protected and conserved areas for mitigating pressures on biodiversity will build on progress in representing ecosystems and species

South Africa has made progress towards expanding protected areas to be more ecologically representative of ecosystems and species (well established). Spatial biodiversity planning tools continue to guide strategic expansion efforts. By enabling better participation in conservation and restoration, addressing gaps in sustainable finance and enhancing effectiveness of protected and conserved areas, pressures on ecosystems and species can be further mitigated.

Expanding the ecological representation of ecosystems and species in protected and conserved areas strengthens their effectiveness in reducing pressures on biodiversity. South Africa has made progress in expanding protected and conserved areas, with spatial planning guiding the inclusion of diverse terrestrial, freshwater, estuarine and marine ecosystems and their species. For example, the marine protected area network is spatially efficient and represents 83% of marine ecosystem types across 5.4% of South Africa's ocean. Despite these advances, gaps remain in achieving fully representative coverage, particularly for estuarine and freshwater ecosystem types. Restoration initiatives, including controlling invasive species, could also increase effectiveness of these areas in protecting ecosystems and species. However, resources and capacity for management have not increased alongside the expansion of protected and conserved areas.

Protected and conserved areas provide multiple benefits, including supporting sustainable jobs in tourism and the biodiversity economy, enhancing cultural and recreational experiences, and contributing to climate resilience and human wellbeing. Effective management of existing protected and conserved areas will ensure that progress made in expansion of these areas continues to deliver these benefits. Target 3 of the Global Biodiversity Framework calls for the conservation of 30% of land, waters and seas by 2030 at the global level, with attention to effectiveness, ecological representativity and equitable governance systems. South Africa, with innovative resourcing strategies (see key message C3), is committed to all elements of the target.

Protected and conserved areas work well with community involvement. Diversified protection models and other effective area-based conservation measures (OECMs), can provide new opportunities for community-led conservation, livelihood diversification and cultural heritage protection. Initiatives that provide opportunities for communities living in and around protected and conserved areas to become active participants should be enhanced and encouraged. Combining aspects of both natural and cultural heritage in protected area expansion can foster the involvement of indigenous and local communities. Inclusive and participatory stakeholder processes are needed for more effective protected areas that support thriving people and nature. The biodiversity sector must strengthen capacity for social processes across institutions to create innovative partnerships with community and industry. Securing sustainable finance, enhancing institutional capacity, and fostering innovative partnerships with communities and industry are essential to ensuring that protected and conserved areas continue to deliver long-term ecological, social and economic benefits.



South Africa has committed to expanding protected and conserved areas to meet national and global goals. Realising this ambition will require strengthened community participation in establishing and managing these areas. Areas such as Gompo's Rock (near East London, Eastern Cape), which hold both cultural and biodiversity significance, could be explored for conservation and recognition as other effective area-based conservation measures (OECMs) in partnership with value holders. © Kerry Sink

B5. Scientific and well-documented programmes are needed for ecosystem restoration and species recovery

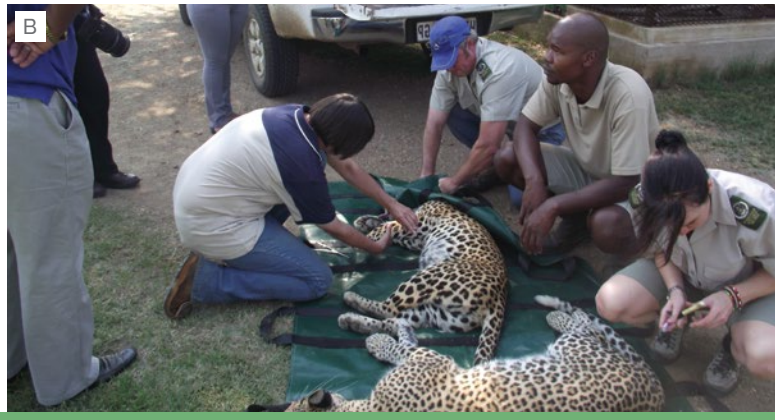
> *Nature's contributions to people are at risk due to poor ecological condition of ecosystems and pressures on important species (established). Restoration and recovery programmes, that are guided by science, implemented collaboratively and properly monitored, are essential to ensure lasting benefits for both people and nature.*

More than half of South African ecosystems are in poor ecological condition. A particularly high proportion of wetland (51%), river (75%), estuarine (82%) and coastal (> 48%) ecosystem extent is Moderately to Critically Modified. Species also suffer from multiple pressures, including unsustainable use, poaching or other impacts from human activities (e.g., pollution).

Often, the ecosystems and species that are most useful to people are those whose condition deteriorates the most. Wetland and river ecosystems provide people with essential water, and estuarine and coastal ecosystems are widely used for recreation, fishing and settlements. These ecosystems begin to lose their ability to provide these vital services as their condition deteriorates. In the same way, species that are used for harvesting or trade are susceptible to unsustainable use that threatens the resource. The Kunming-Montreal Global Biodiversity Framework (Target 2) calls for 30% of degraded ecosystems to be under effective restoration by 2030 to enhance ecological integrity and recover the benefits people receive from ecosystems. Target 4 calls for the recovery and conservation of species, in particular threatened species. The United Nations Convention to Combat Desertification also sets targets to avoid and slow degradation, and restore degraded lands to a natural, productive state (also part of the Sustainable Development Goals).

Preventing species decline or ecosystem degradation should always be the primary focus. However, species recovery and ecosystem restoration programmes can be effective interventions when done in a responsible and scientifically sound manner. Prioritising where such initiatives should occur can ensure cost-effectiveness and lasting positive impacts for both people and biodiversity. Several recent initiatives focus on using spatial biodiversity data to scientifically plan restoration initiatives. For example, the National Coastal and Marine Spatial Biodiversity Plan has been used to identify strategic priorities for restoration in coastal and marine ecosystems, and South Africa's Essential Life Support Action Areas map identified areas that should be prioritised for restoration on land. These efforts reiterate the value of spatial biodiversity information, such as the NBA threat status and protection level analyses, in supporting national priorities and actions. Species recovery initiatives should be equally well planned, as it is estimated that investments exceeding R1 billion are needed over the next five years to recover species under severe threat in South Africa (see key message B1). Monitoring and evaluating (see key message C2) ecosystem restoration and species recovery interventions are crucial, yet often neglected. Counterfactual impact evaluation and a national information system for restoration and recovery programmes are both essential for adaptive management, improving future projects and reporting meaningfully. Restoration and recovery should always be a collaborative effort, involving indigenous knowledge and a whole-of-society approach to future-proof programmes with diverse stakeholder expertise.

It is vital that ecosystem restoration and species recovery programmes are designed scientifically, and then evaluated for their effectiveness, so that future programmes are cost effective and have the best possible results for people and biodiversity. A, vegetation rehabilitation is key to restoring sand dunes, which are an important buffer to the human settlements nearby (© George Branch); B, species recovery projects may involve costly translocation efforts – here some leopards (*Panthera pardus*) are checked before their relocation (© North West Department of Economic Development, Environment, Conservation & Tourism).



CLUSTER C:

Inclusive actions across the whole-of-government and whole-of-society are needed to secure nature's contributions to people

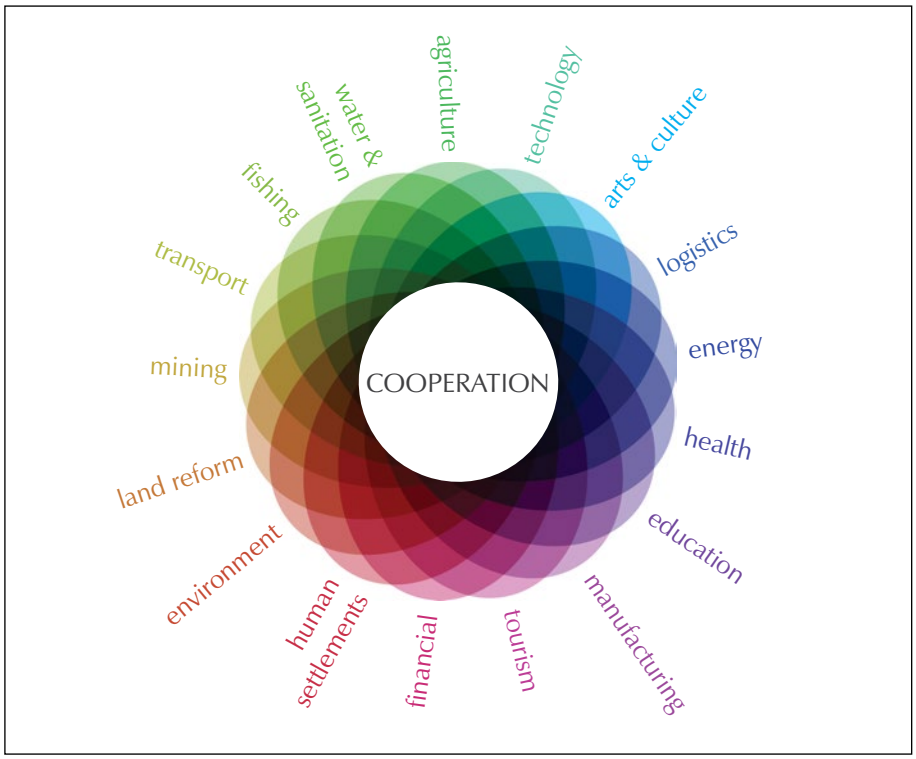
This cluster speaks to three all-inclusive and overarching actions that are needed to accelerate the calls to action expressed in each message in clusters A and B.

C1. Safeguarding South Africa's biodiversity calls for a whole-of-government and whole-of-society approach

> *Biodiversity patterns and ecological processes are connected in complex ways that cross realms and human-constructed boundaries. Human activities in different sectors, each with separate policies and practices, can impact on the same biodiversity and ecological infrastructure in different ways. Coordinated and collaborative planning and decision-making are essential to account for this interconnectedness.*

Biodiversity provides benefits and essential services to people, like food, clean water and medicines, and enriches our cultural, spiritual and recreational practices. These services are dependent on intact ecosystems, healthy species populations and genetic diversity. The interconnectedness of biodiversity and human wellbeing is highlighted globally through the three objectives of the Convention on Biological Diversity: conservation of biodiversity, sustainable use of the components of biodiversity, and the fair and equitable sharing of the benefits arising out of the utilisation. In South Africa, this interconnectivity is featured in the White Paper on the Conservation and Sustainable Use of Biodiversity, which provides a vision for an inclusive, transformed society where biodiversity conservation and sustainable use ensure healthy ecosystems and equitable benefit-sharing for present and future generations.

Biodiversity is fundamental to achieving South Africa's national objectives of inclusive economic growth,



Biodiversity is fundamental to achieving South Africa's national objectives, and safeguarding biodiversity calls for a whole-of-government and whole-of-society approach.

job creation, and improved service delivery and well-being for all citizens. The National Development Plan calls for collective responsibility towards the biodiversity that underpins these national goals. The National Biodiversity Strategy and Action Plan (NBSAP) can provide an opportunity for all actors in the whole-of-government and whole-of-society approach to work together and contribute to these national goals by strengthening the conservation of biodiversity, promoting and expanding the benefits derived from biodiversity, embedding biodiversity considerations across all sectors and levels of government and society, and strengthening financial and technical support for effective implementation.

South Africa's policy and legislative framework includes several tools to facilitate cross-sectoral planning and decision-making. Tools like Spatial Development Frameworks (developed at local, provincial and national level) and Marine Spatial Planning require multi-sectoral approaches to balance competing needs. Implementation of these frameworks, while sometimes challenging, can be improved by developing partnerships and working collaboratively. Some institutional arrangements already support this approach, for example, the Inland Water Ecosystem Liaison Committee, convened by the Department of Water and Sanitation, brings together all organs of state with shared mandates for managing and conserving rivers and wetlands. At the subnational level, catchment partnerships are an example of bringing together stakeholders from across government, civil society, research and the private sector to address natural resource challenges in a way that supports social and economic development. Collaborative action across government, all sectors and society towards a more nature-positive and inclusive pathway will enable interconnectedness, resulting in thriving ecosystems, species and genetic diversity, driving economic growth and wellbeing for all.

C2. Investment in biodiversity monitoring is crucial for management, decision-making, research and reporting

Investment in biodiversity monitoring is essential to inform effective biodiversity management, decision-making, research and reporting. Without monitoring, there is no way to know if efforts are making a difference or if targets are being met. Yet, data collection and monitoring are under-resourced and uncoordinated. Investment in strategic and collaborative biodiversity monitoring will provide the evidence needed to guide adaptive management and ensure resources are used effectively.

South Africa has several successful citizen science programmes, like the Custodians of Rare and Endangered Wildflowers, the Southern African Bird Atlas Project, programmes for water resource monitoring, and others, that generate invaluable biodiversity data and foster public engagement. However, gaps remain in the monitoring and detection of changes in species populations, ecological condition and community composition across realms.

Monitoring allows for a comprehensive understanding of a system or process by tracking trends across time

Ms Sisipho Njokweni, an intern with SAEON, takes part in a long-term marine invertebrate monitoring programme. Occurrence data from this programme was served through the SeaMap Project, and are contributing to a more data-driven marine ecosystem map and spatial biodiversity planning. © Safiyya Sedick.

Citizen science empowers individuals, schools and communities to contribute to biodiversity monitoring. Here a budding citizen scientist is taking a soil sample in a wetland area. © Tsamaelo Malebu.

and space. It directly supports decision-makers to identify emerging issues of concern and adjust management actions to address these. The collation of data from various field-based monitoring efforts supports reporting on the status of biodiversity at the provincial, national and international scales. Strengthening monitoring mechanisms and coordination will be crucial for driving accountability, transparency and learning through the revised National Biodiversity Strategy and Action Plan (NBSAP). A robust national biodiversity monitoring framework can play a pivotal role and its success will depend on:

- The extent to which national indicators comprehensively reflect the goals and targets of both the NBSAP and the Kunming-Montreal Global Biodiversity Framework.
- The degree to which the three spheres of government, non-state actors and other stakeholders actively adopt and apply the national monitoring system in planning and reporting.
- The accessibility and openness of biodiversity data and metadata ensuring that information is shared widely, used meaningfully, and contributes to the conservation and sustainable use of South Africa's biodiversity.

Biodiversity monitoring can be advanced by investment in innovative technology and data science. Remote sensing technologies, such as satellites and drones, are particularly useful for unobtrusively monitoring vast, inaccessible areas. Artificial intelligence can process and analyse large volumes of data to identify subtle changes in real-time, allowing for more proactive responses to emerging pressures. Biodiversity monitoring should also align with global best practices and build on existing international monitoring initiatives. Partnering with international institutions and initiatives will enable enhanced technical support, harmonised data collection standards, access to advanced technologies and invaluable insights into the creation of data processing workflows. Monitoring should continue to harness the value of citizen science, which reduces data collection costs while increasing the scale of data collection. Citizen science has the added benefit of empowering individuals to contribute to conservation efforts and strengthening community involvement in addressing global challenges like climate change. Citizen science programmes require constant fundraising and awareness building, and coordinated campaigns to secure these efforts are essential.

The Custodians of Rare and Endangered Wildflowers (CREW) programme has a dedicated network of citizen scientists who upload observations to iNaturalist. Five new species of Iridaceae were discovered and described in the past few years. *Ixia ebrahimii*, Critically Endangered, is named after the CREW Cape Floristic Region Node Manager, Ismail Ebrahim, for his years of dedication to flora conservation. © Ismail Ebrahim.

C3. Innovative finance solutions are needed to address funding and capacity constraints in the biodiversity sector

> *A sufficiently resourced biodiversity sector is crucial to managing biodiversity for all. Resource constraints compromise the ability to understand, track and address the impacts of biodiversity loss and degradation on people and nature. To protect the country's natural heritage for future generations, South Africa must move beyond business-as-usual and mobilise private sector investment and innovative finance solutions to fund biodiversity.*

Despite gradual increases in nominal public sector spending, South Africa's Biodiversity Expenditure Review highlights a concerning trend that real expenditure (adjusted for inflation) is declining, eroding the purchasing power of existing resources. This fiscal pressure, compounded by South Africa's constrained macroeconomic environment, poses serious challenges to achieving the country's biodiversity targets under the National Biodiversity Strategy and Action Plan (NBSAP).

To address this, the Biodiversity Expenditure Review strongly advocates for diversifying finance flows, including expanding private sector engagement, unlocking green finance instruments such as biodiversity bonds, and fostering public-private partnerships. Private sector partners, particularly financial institutions, have a key role to play in mobilising resources and innovative finance solutions to support more positive outcomes for biodiversity. Funding mechanisms such as the Green Climate Fund offer opportunities to scale up efforts for biodiversity and climate, and complement traditional funding mechanisms such as the Global Environment Facility and others.

The move towards a more collaborative, whole-of-government and whole-of-society approach is key to building an effective resource base for the biodiversity sector and to support positive biodiversity outcomes. This is underpinned by building strong partnerships, exploring new opportunities, strengthening institutions, and building capacity and skills. The Biodiversity Finance Plan for the third NBSAP will provide a clear, evidence-based roadmap to mobilise and align financial resources. Importantly, the country needs to standardise biodiversity tagging across all sectors to improve the tracking and reporting of biodiversity-related expenditures. This is the foundation of a sustainable biodiversity finance framework for South Africa, one that safeguards the country's exceptional natural heritage, supports socio-economic development and ensures long-term investment.

Managing South Africa's biodiversity is a collective effort that requires collaboration and resources, and moving beyond business-as-usual to diversified and innovative finance solutions. © Jeremy Shelton.

Priority actions, responses and interventions for South Africa's biodiversity

The NBA reports on the state of South Africa's biodiversity, accounting for the various pressures affecting ecosystems, species and genetic diversity. This approach reveals potential avenues through which pressures on biodiversity can be reduced and biodiversity conservation outcomes and sustainable resource management may be improved. Each key message in the NBA makes a 'call to action' that addresses the particular finding and identifies specific interventions that could be considered. Through this process, the NBA contributes to the body of knowledge that enables the multitude of stakeholders to co-develop, through participatory whole-of-society and whole-of-government approaches, the various policy responses and detailed action and implementation plans required for the benefit of both biodiversity and people.

Seven broad themes for action

The fifteen key messages of NBA 2025 highlight a range of actions that can be summarised into seven broad themes:

1. **Biodiversity inclusive spatial planning (key messages A1, A2, A3, B1, B2, B3, B4)**: Biodiversity and ecological infrastructure are powerful socio-economic engines contributing to South Africa's development. The negative impacts on biodiversity, both direct (e.g., land clearing, built infrastructure) and indirect (e.g., pollution, changes to natural processes), from land and sea use change can be avoided or minimised through effective biodiversity inclusive spatial planning. South Africa has well-established provincial spatial biodiversity planning and prioritisation processes, plus screening tools for biodiversity sensitivity in development sites (Figure 19). Ongoing investment is needed to keep these plans and tools current with the latest biodiversity data, and ensure they inform decision-making at national, provincial and local levels. Marine Spatial Planning processes offer robust opportunities for biodiversity plans to influence use in the marine realm and along the coast. Biodiversity inclusive spatial plans can also guide ecosystem restoration and expansion of protected and conserved areas.

2. **Policy development or refinement (key messages A3, A4, A7, B2, B4, C1)**: National, provincial and local policies and regulations unlock biodiversity and ecological infrastructure's benefits to people. NBA 2025 identifies key sectors needing effective policies (providing required frameworks, incentives and governance structures) to address pressures on biodiversity. For example, policy gaps around pollution, freshwater flow requirements to marine environments and management of invasive species introduction pathways can be addressed through cross-sectoral approaches that strengthen interconnectivity between people and biodiversity. Closing these gaps requires strengthening collaboration between all levels of governments, particularly to local government where targeted capacity building and technical support are needed to help municipalities integrate biodiversity conservation and sustainable use responsibilities into their policies and operations.

3. **Enforcement and compliance (key messages A3, A7, B2, B5, C1, C3)**: Although South Africa has strong environmental policies, effective enforcement and compliance mechanisms are required to achieve biodiversity conservation outcomes. Compliance and enforcement reporting should be strengthened as this provides both impetus for implementation and means of monitoring progress towards targets. Limited capacity and budgets for compliance and enforcement are major challenges, and effective cooperation and innovative solutions are needed to transform the relationship between people and nature, address the underlying causes of non-compliance and enable adaptive management.

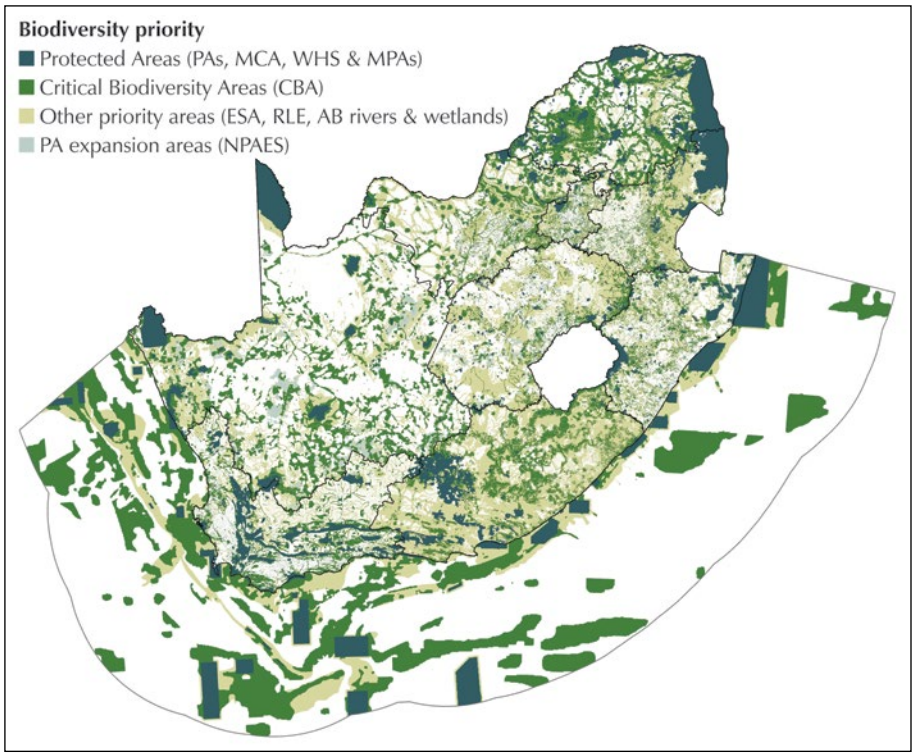


Figure 19. South Africa's spatial biodiversity priority areas.

4. **Management plans and programme/project implementation (key messages A1, A5, A7, B1, B2, B4, B5, C2, C3)**: Co-produced local management plans and projects/programmes are key tools for ensuring sustainable use of biodiversity, protecting livelihoods and restoring nature's contributions to people. Scientifically sound project/programme design and robust project management are essential for cost-effective, successful implementation with lasting positive impact.

5. **Innovation, access to and transfer of technology (key messages A4, A6, C2, C3)**: Innovation is required to address pressures on biodiversity and persistent compliance and implementation challenges. For example, new approaches for legal wildlife trade may deliver better results than decades of enforcement efforts that have had limited success. Crucial investments include artificial intelligence and new technologies for remote sensing, data science and forensics, alongside fostering innovations in citizen science and stewardship of biodiversity. Building partnerships that facilitate exchange of skills, knowledge and best practice is key.

6. **Data collection and monitoring (key messages A1, A3, A4, A5, B3, B5, C2)**: Effective biodiversity monitoring depends on continuous long-term data collection and analysis. Without this foundation, biodiversity inclusive spatial planning and biodiversity assessments are compromised. Interventions to mitigate pressures on biodiversity must be planned using the best possible data to ensure return on investment. Measuring impact through targeted data collection and monitoring enables adaptive management of current projects, informs future project improvements, supports meaningful reporting and contributes to national datasets.

7. **Innovative financing and resource mobilisation (all key messages, see C3)**: Current financial flows are insufficient for South Africa's ambitious biodiversity targets. It is essential to ensure that the baseline funding for biodiversity is not eroded while exploring new sources. There is urgent need for coordinated action to scale up innovative public and private financing mechanisms. Blended finance models, biodiversity offsets, green bonds and other nature-positive finance solutions can help bridge this funding gap, while partnerships with the private sector and development finance institutions can unlock considerable additional capital. Strategic resource allocation and measurable outcomes depend on investment in robust financial tracking systems, natural capital accounting and transparent reporting.

Reflecting on twenty years since the first NBA

These seven themes have remained consistent across all iterations of the NBA, although each has been substantially refined and expanded over the years. Global and national approaches to biodiversity conservation and management have seen important, nuanced changes. For example, the *National Spatial Biodiversity Assessment 2004* called for expanding the formal (i.e., state-owned) protected area network, but today's approach recognises that very effective conservation also happens outside formal reserves through private landowner initiatives (e.g., biodiversity stewardship programmes) and community-led other effective area-based conservation measures (OECMs). The often repeated calls for better regulations and enforcement for certain pressures are now augmented by innovative technologies (e.g., satellite monitoring, AI-powered wildlife tracking) and the move towards a whole-of-society custodianship approach to nature. Similarly, the perennial challenge of inadequate funding has led to numerous diverse and innovative finance mechanisms for biodiversity, and greater focus on economic systems to benefit both nature and people. The NBA has grown in content and participation, and its messaging reflects how conservation thinking and practice has developed.

It has been 20 years since the release of the first NBA and the calls for action in NSBA 2004, NBA 2011 and NBA 2018 are all still relevant. The various intervention plans that are co-produced or updated after NBA 2025's release, in participatory whole-of-society and whole-of-government approaches, could reflect the past calls to action, while using the modern nuances of biodiversity conservation and nature's contributions to people.

The framing of action, response and intervention plans

The NBA 2025 presents a suite of findings that can inform diverse international, national and local biodiversity initiatives, providing context, indicators and avenues for intervention.

At the global level, the Kunming-Montreal Global Biodiversity Framework sets 23 urgent targets for 2030 and four outcome-oriented goals for 2050. The United Nations Decade on Ecosystem Restoration focuses on interventions to reverse biodiversity loss. The various assessments by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) guide global thinking on biodiversity trends and solutions (e.g., the IPBES Transformative Change Assessment emphasises that transformative change requires a redefined relationship between people and nature). The NBA provides national context and important trends in biodiversity for these processes, and contributes many indicators specifically needed to report on South Africa's international commitments.

National initiatives include South Africa's National Development Plan's 2030 and SANParks' 'Vision 2040', which reimagines the role of conservation as a catalyst of redress, economic advancement and job creation through the Mega Living Landscapes. Furthermore, South Africa's National Biodiversity Strategy and Action Plan (NBSAP) is being updated around four strategic dimensions:

- Conservation (including formal protection, stewardship, OECMs, and targeted species efforts).
- Enhancing nature's contributions to people (including inclusivity in the biodiversity economy).
- Mainstreaming biodiversity (across all sectors and levels of government and society).

A wetland located in the headwaters of the Riet River in the Groot Winterhoek Strategic Water Source Area – the source area for the Doring River, the Western Cape's last free-flowing river and habitat to the Endangered Clanwillian sandfish (*Labeo seeberi*). To ensure species recovery, the Freshwater Research Centre and partners launched the 'Saving Sandfish' project in 2020, which is showing good results. © Jeremy Shelton.

- Resource mobilisation (innovative, sustainable and diversified strategies).

There are also many local, district and provincial-level initiatives under which actions, responses and interventions can be framed. South Africa has limited resources to implement these plans and must capitalise on past successes, existing initiatives and strategic innovation to meet national targets for both biodiversity and development. The NBA can guide these initiatives and provide a wealth of data products to support decision-making.

Knowledge gaps and research priorities for strengthening the next NBA

Progress since NBA 2018

NBA 2018 attempted a comprehensive summary of knowledge gaps causing limitations to the NBA, which resulted in a long list of research, monitoring and data management priorities for all components of the NBA. This table summarises the progress that has been made, highlighting the gaps that still remain:

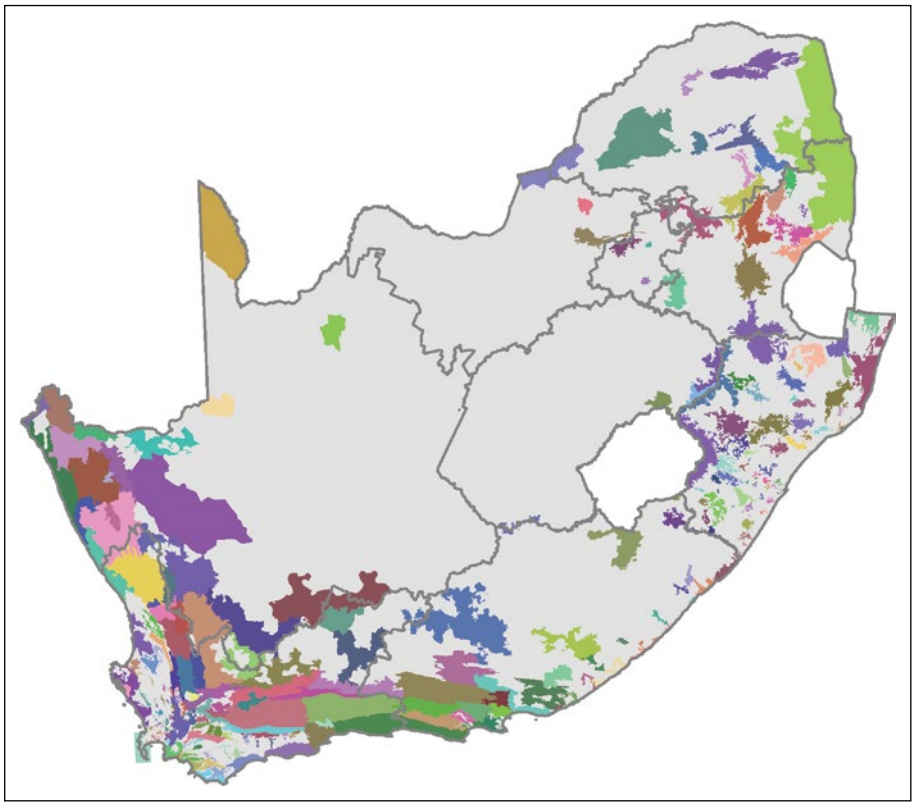
Priority from NBA 2018	Summary of progress since NBA 2018
Biotic and abiotic monitoring	Long-term, focused, site-based monitoring of biodiversity and pressures on biodiversity, as well as the monitoring of specific species at larger scales (e.g., harvested species, invasive alien species, etc.) remain insufficient. While there are some long-term, site-based and species monitoring programmes, many suffer from a lack of resources. Abiotic information (e.g., water turbidity, sediments, temperature, pesticide load, microplastics, etc.) is crucial for mapping ecosystems and their condition, and much of this information is not collected and/or poorly understood in terms of their impacts on ecological condition. Further investment in strategic monitoring and data systems is needed. See also key message C2.
Incorporating genetic diversity measures	There is ongoing progress on emerging genetic diversity indicators (see the genetic diversity indicators section), however the species and taxonomic groups included in these indicators are a small sample and coverage needs to be expanded.
Taxonomic coverage and taxonomists	Although progress has been made for vertebrate groups, particularly amphibians and freshwater fishes, many invertebrate groups lack essential information. Initiatives such as the SeaMap and REFRESH projects have helped fill some gaps in marine and freshwater invertebrate data, yet limited taxonomic capacity, few full-time taxonomist positions and declining collections expertise remain major constraints. While ongoing efforts of the Natural Science Collections Facility are helping to strengthen capacity, connect expertise and coordinate new collaborative approaches, revitalising taxonomic efforts and building capacity across all taxonomic groups remain urgent priorities.
Improved classification of ecosystem types and an integrated ecosystem classification system	Each realm continues to make steady progress in ecosystem classification and mapping, with regular cycles of updates and version releases. The first edition of the *South African National Ecosystem Classification System Handbook* was published by SANBI in 2021 and is available at: http://hdl.handle.net/20.500.12143/7150. The mapping and classification of South Africa's aquatic systems, especially riparian areas, wetlands and the deep sea, remain a challenge due to limited foundational data and ground-truthing.

Priority from NBA 2018	Summary of progress since NBA 2018
Measuring and mapping ecological condition and pressures data	Ecological condition data underpins our ability to assess the risk of collapse of ecosystems. Since the NBA 2018, new data on invasive alien plant species density and distribution have enhanced our RLE assessments on land, and focussed research on rangeland condition is starting to bear fruit – though comprehensive data sets will only be finalised in 2026–2027. Climate change models have improved and inform species assessments, and will be used in future ecosystem assessments. Marine pressure data are outdated and limits reliable condition assessment in the marine realm. Recently, extensive ecological modelling work has resulted in comprehensive wetland health data. The automated WET-Health 2.0 links seamlessly to the widely used field assessment methodology and allows broad assumptions to be drawn on which driving component (hydrology, water quality, vegetation or geomorphology) is most impacted per wetland, each wetland buffer and the wetland's receiving catchment. More work is required on microplastics, pesticides and other pollutants for such data to be useful in ecosystem and species assessments.
Mapping and assessing ecological infrastructure	Mapping has advanced for water-related ecological infrastructure (Strategic Water Source Areas, wetlands and rivers) within two large demonstration catchments. Advances have also been made in the terrestrial and marine realms, though much work remains.
Indicators linking biodiversity and human wellbeing	NBA 2018 showcased several facts and statistics via the 'Compendium of Benefits of Biodiversity' (http://hdl.handle.net/20.500.12143/8052). Unfortunately, few of these have been updated. The Multidimensional Biodiversity Index (MBI) Project (2022–2024) piloted a composite indicator for South Africa. It consists of two subindices, the Biodiversity Index (BI) that focuses on the state of biodiversity, and the Biodiversity Contributions to People Index (BCPI) that assesses how biodiversity supports human wellbeing through regulation, material provision and non-material benefits. Funding is needed for future steps for the MBI, including further development of BCPI indicators.
Monitoring effectiveness of interventions and responses	There are good examples of indicators being developed to monitor the effectiveness of actions and responses to pressures on biodiversity (e.g., *The status of biological invasions and their management in South Africa* is a regular report using various important indicators; and case studies have evaluated the effectiveness of maps of Critical Biodiversity Areas and threatened ecosystem regulations in certain biomes/provinces). More work is needed, ideally using counterfactual impact evaluation methods, to monitor the impact of interventions, especially restoration/recovery interventions. See also key message B5.
Data management and sharing	SANBI has made some progress on the 'national biodiversity information system' (https://biodiversityadvisor.sanbi.org/), which aims to enhance South Africa's open access approach to biodiversity information, through allowing users to search seamlessly across multiple sources of information. SANBI has also undertaken substantial capacity development for the skills needed to streamline and automate indicator calculation and produce dashboards. The upcoming National Biodiversity Monitoring System aims to provide dashboards of key biodiversity indicators, underpinned by transparent workflows and databases. The move to an online NBA enables more regular updating of certain NBA indicators.

Additional knowledge gaps and research priorities

Collaboration from multiple institutions and individuals is a key tenet of the NBA. Government departments and entities, academic institutions, non-profit organisations and civil society are encouraged to become involved in any of the priorities mentioned above or in this list of additional knowledge gaps and research priorities:

- Improving South Africa's Key Biodiversity Areas (KBA) network, especially in aquatic and coastal environments, and the strategic utilisation of the KBA data for reporting, prioritisation, fundraising and more.
- Enhancing efforts for tools that assist in mapping and assessing biodiversity, such as upscaling DNA barcoding, expanding South Africa's biobanks, and advancing the use of environmental DNA (eDNA).
- Improving the capacity to do more assessments at more regular time intervals – including the data science capabilities that are required for database design and workflow management.
- Improving the integration of social and natural sciences, particularly for the expansion and updating of facts and statistics about the benefits of biodiversity, and for further incorporation of indigenous and local knowledge into biodiversity mapping, assessments, prioritisation and planning processes.



South Africa's 263 terrestrial Key Biodiversity Areas were approved on the World Database of KBAs in June 2024. Work is ongoing to identify additional KBAs, particularly in marine and inland aquatic environments.

New in NBA 2025

The focus of NBA 2025 was on creating transparent and repeatable workflows hosted on accessible repositories, and ensuring that the entirety of the results expected in the NBA are online via a searchable website. In addition, there was also substantial new work that was accomplished between the release of NBA 2018 and the release of NBA 2025. The following a selection of what is new in NBA 2025:

- Excellent progress has been made regarding **automated condition assessments** to support the NBA 2025 **inland wetlands** threat status; NBA 2025 provides interim regional wetland types while a rigorous update of the typology is underway to provide more detailed characterisations; and work towards a revised National Wetland Map remains ongoing using a multi-partner, mixed approach that integrates GIS-based wetland predictive modelling, remote sensing and specialist mapping and validation (both field and desktop).
- The **Marine Ecosystem Map Version 2023** is used in this NBA and represents a minor update to the 2018 map, with the reintroduction of a pelagic layer in deeper waters beyond the shelf. In the meantime, a data-driven framework for updating the map has been in development and will represent a more substantial update in time for the next NBA. Condition data was not updated, however assessment methods have been improved.
- The NBA shows **trends in terrestrial ecosystem threat status** with one of the world's first applications of the Red List Index for ecosystems (RLIe), showing trends in ecosystem risk. The index can be disaggregated using national biomes or the IUCN Global Ecosystems Typology Level 3 – the latter is useful for international comparisons.
- **Three new taxonomic groups** have been included in NBA 2025: freshwater crabs, Anostraca (fairy shrimps) and spiders.
- Building on the efforts begun for NBA 2018, the genetic component of the NBA now pilots **international indicators of genetic diversity**.
- Thanks to Statistics South Africa's 2024 publication, *Experimental Biodiversity-based Tourism Estimates for South Africa*, the **updated Biodiversity Tourism** statistics are used in the infographic on page 5.

The NBA 2025 website: finding and citing detailed content

As this *Summary of Findings and Key Messages* publication only touches on the depth and breadth of the NBA findings, please explore the detailed website: http://nba.sanbi.org.za/.

Each of the > 90 modules of work for NBA 2025 (e.g., mammal threat status, estuarine protection level, genetic diversity at population level, wetland ecosystem map, etc.) has a webpage on the NBA website. The website is structured in several sections, including an overview about the NBA and South Africa's biodiversity, key messages, integrated findings showing the results of the national headline indicators, findings by realm for ecosystems and species, findings by taxonomic group, and a section on priority actions, responses and interventions.

The NBA 2025 website allows users to delve as deep as they choose. For example, users who want to only read the key messages can study this publication and the key messages section of the website. Users who are developing response strategies and action plans for a particular realm, taxonomic group or pressure can study those webpages in detail and explore the additional resources and references provided. Users, such as scientists or biodiversity planners, who need the underlying datasets to use for other purposes or the scripts to rerun analyses, can access the datasets and R scripts referred to from the relevant webpage.

Please use the recommended citation that is found on each webpage when citing a particular result or data from NBA 2025. The NBA has numerous modules, and each webpage lists a specific citation that recognises the module leads and contributors for that module. The recommended citation will also contain a clear explanation of the version (of data, analysis, etc.). Within an NBA cycle (i.e., between releases of a publication like this *Summary of Findings and Key Messages*), not all datasets or results will be versioned at the same time point. For example, the NBA 2025 summary may use a 2023 marine ecosystem map, 2024 terrestrial threat status and the spider Red List assessment from 2019. Due to the online form of the NBA, it will be possible to update certain data and indicators between when a summary publication is released at a particular point in time (usually before a report to the Convention on Biological Diversity is due). It is therefore extremely important to *use the recommended citation as stated on each webpage*.

Back cover images, left to right:

- The Cape calloused beach pillbug (*Tylos capensis*) is an endemic south coast sandy beach isopod that has been assessed as Endangered, primarily because of foredune habitat loss and degradation due to coastal development and night-time lights. © Linda Harris.
- All three species of tree aloes found in the Richtersveld, including this quivertree (*Aloidendron dichotomum*, Vulnerable), were listed on the IUCN Red List of Threatened Species in 2022 as threatened as a result of population declines due to climate change. © Geoff Spiby.
- The Custodians of Rare and Endangered Wild Flowers (CREW) Programme has a dedicated network of citizen scientists who upload observations to iNaturalist. Five new species of Iridaceae were discovered and described in the past few years. *Ixia ebrahimii*, Critically Endangered, is named after the CREW Cape Floristic Region Node Manager, Ismail Ebrahim, for his years of dedication to flora conservation. © Ismail Ebrahim.

The National Biodiversity Assessment (NBA) is a collaborative effort to synthesise the best available science on South Africa's biodiversity to inform policy, support decision-making across multiple sectors, and contribute to national development priorities.

The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa, and is produced by the South African National Biodiversity Institute as part of its mandate under the National Environmental Management: Biodiversity Act (Act 10 of 2004), in partnership with numerous institutions and individuals. The Council for Scientific and Industrial Research and the Institute for Coastal and Marine Research at Nelson Mandela University led the Estuarine and Coastal Components of NBA 2025 respectively.

The NBA 2025 is the fourth iteration, building on the 2004, 2011 and 2018 versions of the assessment. NBA 2025 contains all the work that is now expected of the NBA as its scope has expanded over the past 20 years – including threat status and protection level in each realm, the coast and South Africa's sub-antarctic territory; threat status and protection level for several taxonomic groups; ecological condition analyses in each realm; and trends over time where possible. International indicators of genetic diversity being piloted in South Africa are also featured in NBA 2025.

NBA 2025 consists of this *Summary of Findings and Key Messages* publication and a comprehensive website (http://nba.sanbi.org.za/) with scientifically referenced, citable content, and with links to detailed technical documentation and academic publications.

Prepared by:

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an entity of

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REPUBLIC OF SOUTH AFRICA

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ISBN 978-1-928224-80-8