



The State of South Africa's Biodiversity
2012



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About SANBI:

The South African National Biodiversity Institute (SANBI) is a public entity that falls under the Department of Environmental Affairs. Established in 2004 in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004), SANBI leads and co-ordinates research, and monitors and reports on the state of South Africa's biodiversity. It makes information and knowledge available to a wide range of users, provides planning and policy advice, pilots best-practice management models in partnership with stakeholders, leads the human capital development strategy of the biodiversity sector, and manages a network of National Botanical Gardens as windows on South Africa's biodiversity for enjoyment and education. See www.sanbi.org.za for more information.

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LIFE

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2012



Land and sea: the diversity of life in South Africa's ecosystems is a kind of infrastructure which, just like roads and railway lines, is critical to the wellbeing of the economy, communities and individual people.

Terrestrial Biomes

- Albany Thicket
- Desert
- Forests
- Fynbos
- Grassland
- Indian Ocean Coastal Belt
- Nama-Karoo
- Savanna
- Succulent Karoo

Marine Ecoregions

- Southern Benguela
- Southeast Atlantic
- Agulhas
- Natal
- Southwest Indian
- Delagoa



Without roads, electricity pylons, storm water drains, sewers, rubbish collection trucks, power stations and the like, our society wouldn't run as smoothly as it does. This built infrastructure is all around us. It's expensive to build and maintain. But it's technologically advanced, it lubricates the economy, and it allows people to live better, healthier lives.

We often don't realise, though, that the natural environment is also a kind of 'infrastructure'. It's more intricate and sophisticated than the built environment that we value so highly, and it's even more critical to our survival.

This 'ecological infrastructure' comes in the form of wetlands, mountain catchments, rivers, coastal dunes, vegetation and the like. These give us a whole suite of services, sometimes called ecosystem services: fresh water, firewood and fertile soils for agriculture; they regulate water flows and help to protect us from extreme events associated with climate change, like floods, droughts and fires.

Ecosystem services, just like municipal services, play an essential role in supporting social development and economic prosperity.

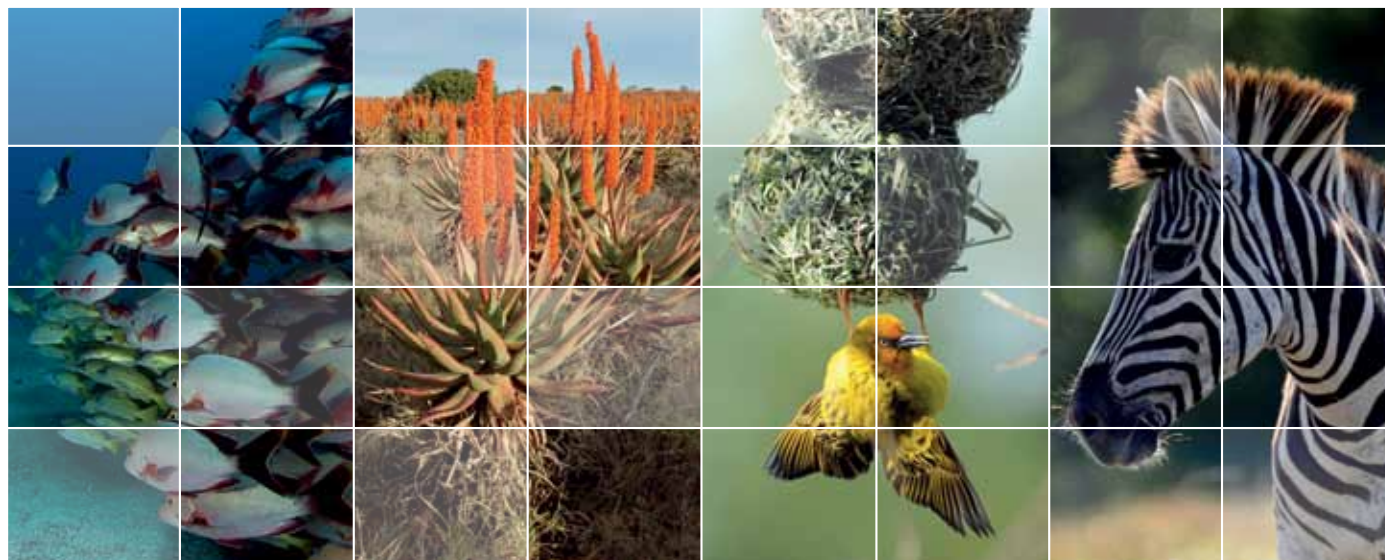
The message of this report on the state of South Africa's biodiversity is simple: the country's vast wealth of biodiversity – which includes all forms of life, from genes and species to the ecosystems they live in – offers us natural solutions that can support development and help us respond to the pressing problems of unemployment, poverty and climate change.

We need to care for this infrastructure because every South African – rural and urban, rich and poor – needs it in order to live a full, rich, abundant life.

Life: the State of South Africa's Biodiversity 2012 is a summary of the National Biodiversity Assessment 2011, which was led by the South African National Biodiversity Institute (SANBI) in partnership with the Department of Environmental Affairs, CSIR, South African National Parks and a range of other organisations. To read the full National Biodiversity Assessment 2011 Synthesis Report and associated technical reports, please visit <http://bgis.sanbi.org>.

Note that references have not been included in this report. Readers should consult the National Biodiversity Assessment 2011 Synthesis Report for references.

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FOREWORD

This publication captures the essence of an inheritance so worthy of celebration.

The diversity of life we find in South Africa's natural heritage is as rich and wondrous as our many languages, cultures and people. Our expansive landscapes, and the species that we find in them, share the same ancient historic roots as every South African.

This beautiful publication captures the essence of an inheritance so worthy of celebration. And it offers the information and inspiration we need in order to make better decisions about how we use, manage and invest in our biodiversity, across our land and waters, for the benefit of all South Africans.

The National Biodiversity Assessment, completed in 2011, was built on world-class science. *Life: the State of South Africa's Biodiversity* distils the key messages from that assessment and presents them here in fulfilment of our mandated role to advise the Minister of Environment on the state of our biodiversity. This publication is also written with a wider audience in mind, with the aim of igniting a passion for nature and the environment amongst South Africans citizens. We celebrate our abundant biodiversity as we explore the inherent value of this natural wealth, as well as the fundamental role it plays in supporting our development goals as a nation.

It is the role of the South African National Biodiversity Institute (SANBI), charged by national government through the Biodiversity Act of 2004, to monitor the state of our biodiversity, and provide policy advice based on good science. We can fulfil this role only in collaboration with many partners. We would like to recognise the skill, expertise, time and resources of the many exceptional organisations, institutions and people in the research community, non-governmental organisations and the private sector, who contributed to the important body of work that is captured between the covers of this report.



Dr Tanya Abrahamse

CHIEF EXECUTIVE OFFICER
South African National Biodiversity Institute

INTRODUCTION

**Nature, free as the air
we breathe, more precious
than gold.**

Each one of us is heir to a precious gift. It comes in the bubbling curve of the sea water along the tide line, the stirring of air around the wings of a sandveld copper butterfly, it's there in the laughing cough of a zebra or the stoic silhouette of the *halfmens* as it stares out over the desert.

These heirlooms don't just give us small moments of beauty to enjoy as our playground. Rather, they're part of a broader weave of life that gives us the water we drink, scrubs clean the air we breathe, gives us the soil where our maize and potatoes and apples grow, or the grassy hills and valleys where our nation's cattle and sheep graze. The rivers, wetlands, forests, grassy hills, river mouths, deserts, ocean currents which curl around our coastlines – these are all part of the intricate systems that make life possible for us in this country.

But because the natural environment and the services it provides are given to us free, we tend to forget their immeasurable value.

It's up to us, therefore, to look after these heirlooms. And the National Biodiversity Assessment (NBA) 2011, which is summarised in this report, is a tool to help us do just that.



The family **HEIRLOOM**

It may help to think of this heirloom as being handed the keys to the family car. There's a purring engine under the hood that needs to be cared for to make sure it keeps ticking over and doesn't overheat or seize up. If this carefully engineered piece of technology isn't serviced and maintained constantly, it could grind to a halt and be as useless as a pile of rusting metal melting under the corrosive effects of the highveld sun.

The NBA is an attempt to pop the bonnet on that car so our 'mechanics', the ecologists and other scientists and experts, can look at the inner workings of the engine room of South Africa's natural environment. They can map the whole engine, listen to the timing, calibrate how well the cooling system works, see whether the electronics are up to scratch, and test if the fuel pump is feeding the system.

In such a highly advanced society, we often live with the belief that if we break something, we can find a technological fix for it. But as in the case of the car engine, it's better to keep the original one well serviced, than to burn it out and then try to rebuild it by buying in spare parts.

In many respects, once nature has been 'burned out', it cannot be fixed. There may not be spare parts, or they may be too expensive or hard to come by. And they may not work as well as the original.

It's up to us to make sure it never comes to that.

OUR INVALUABLE ecological infrastructure

All life on Earth, from the genes in the cells of each individual plant or animal, to the species themselves and the ecosystems in which they live, make up a multiplicity of life that we call biodiversity.

South Africa has an extraordinary diversity of life and ecosystems which give us goods and services that we could not live without. Taking care of this inheritance calls for us to see its value, with careful planning, and time and money set aside specially for the task. Investing in

our natural capital and our ecological 'infrastructure' is for the public good. It is as important for our wellbeing as the roads, railways, ports, electricity grid and all the other examples of built infrastructure that we invest in and maintain so carefully.

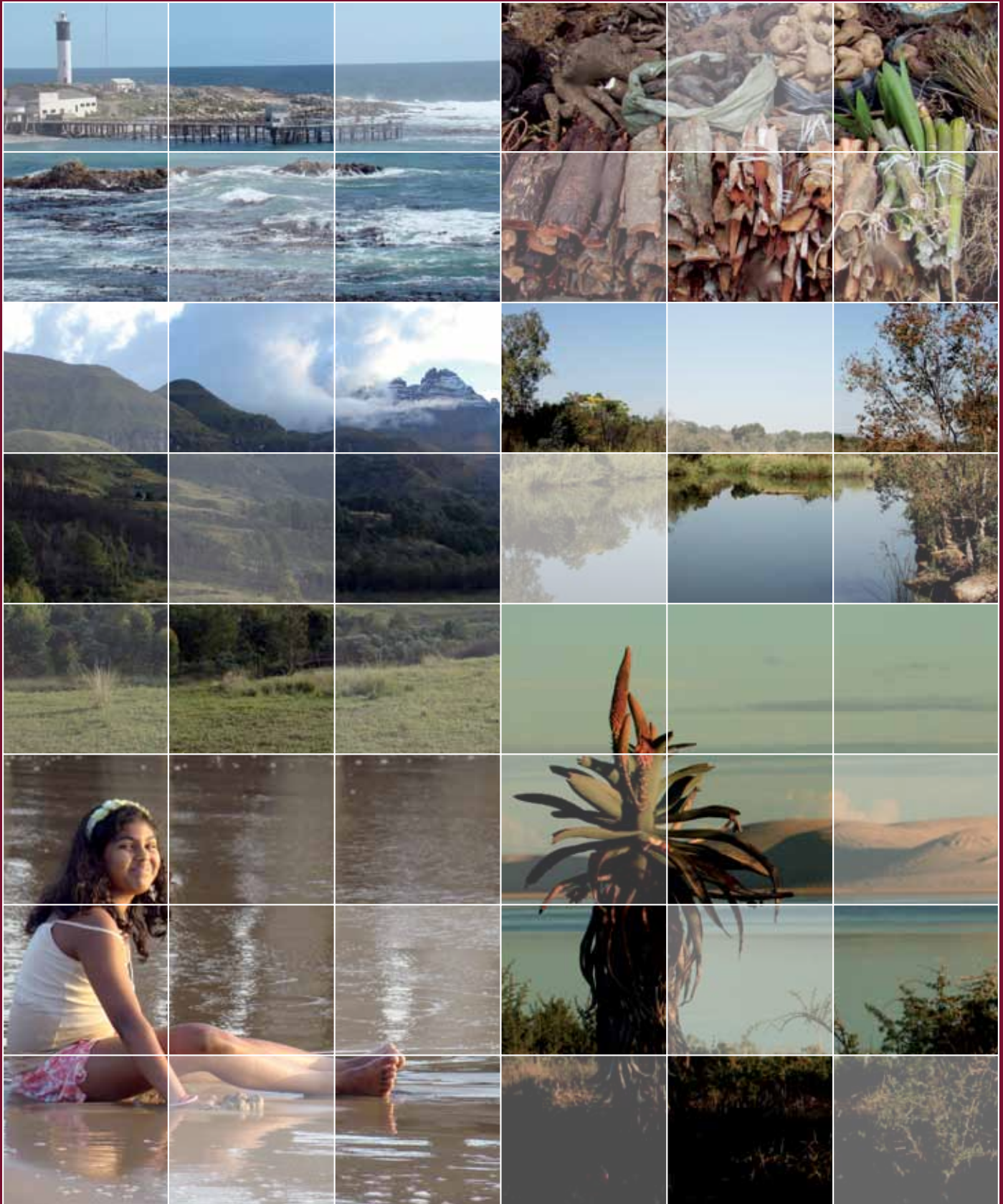
Luckily we are given this natural infrastructure free. We don't have to allocate chunks of the national budget to build wetlands or engineer grasslands. But we do have to look after it otherwise the cost to ourselves and our communities will be immeasurable.

BRINGING TOGETHER world class science and pioneering research to steer policy and action

The National Biodiversity Assessment 2011 brought together world class science with pioneering mapping methods to give policymakers, decision makers and managers a powerful tool as they care for the country's natural assets, be they land-based, riverine, wetland, estuarine, coastal or open ocean.

For the first time the NBA not only mapped these spaces, but zoomed in closely enough on each of these broad systems, in order to classify and compare smaller, more distinct ecosystem units within them. It provides a robust and consistent methodology to allow a comparison of the threat status and protection levels between these different systems. The status of a particular ocean habitat type, for instance, can be compared with that of a wetland, essentially allowing scientists to compare apples with oranges using robust science.

The intention of the NBA is to inform policy and prioritise action, and is central to the South African National Biodiversity Institute's (SANBI's) role of monitoring and reporting on the state of the country's biodiversity. In so doing, the NBA gives indicators for assessing ecosystem threat status and protection levels across all environments; it zooms in on ecosystems that build climate resilience; it highlights species of concern and takes stock of the spread of invasive alien species; and it maps priority biodiversity areas.



AT A GLANCE

1. Dynamite in a small package: wetlands, which make up only a little over 2% of the country's footprint, give us irreplaceable services, like purifying water and slowing down flood waters. But we have already lost many wetlands; of those which remain, nearly half are critically endangered.

2. Protect our water factories: areas with high natural run-off, such as the Drakensberg Mountains, the Soutpansberg and the Wolkberg in Limpopo Province, are critical for gathering and channelling the water which this semi-arid country depends on. Yet only about a fifth of these areas are formally protected.

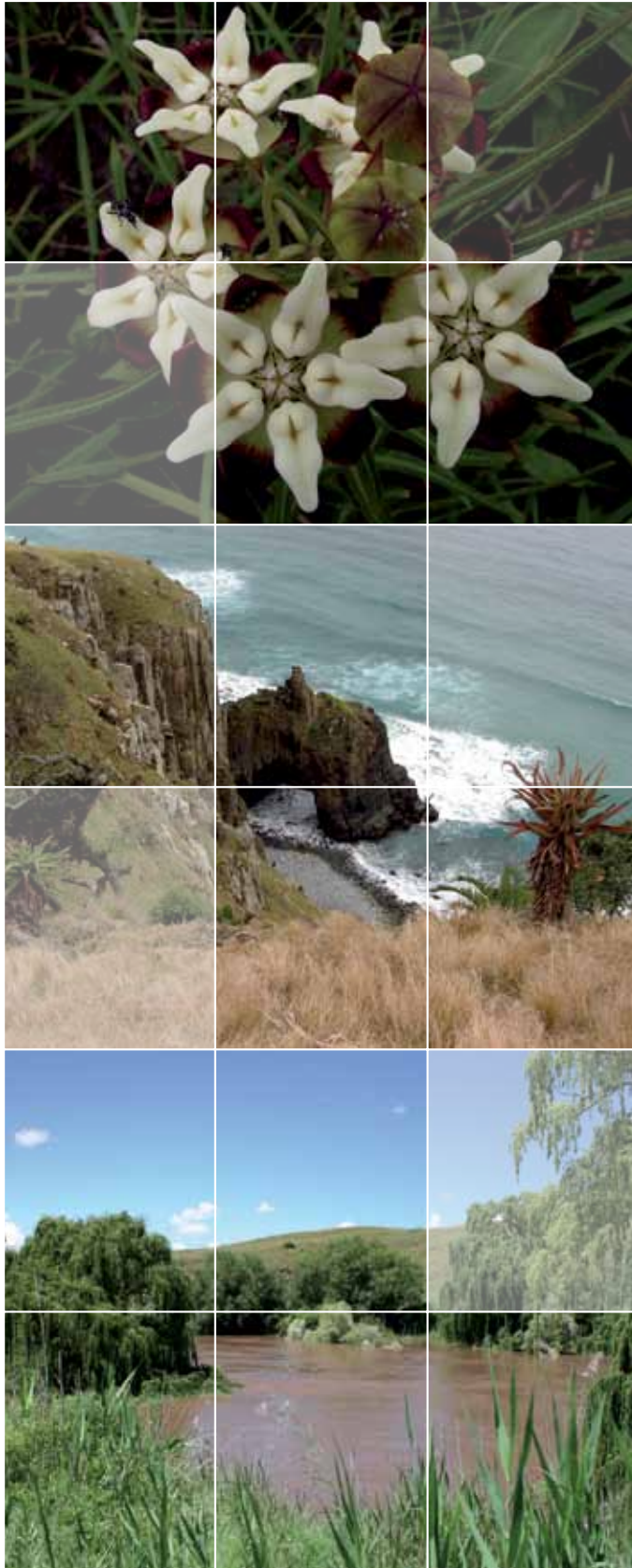
3. Treasure the small tributaries: all those smaller rivers which feed into the country's main, hard working arteries like the Orange and the Vaal Rivers, are key to keeping our water supplies in good health. Fortunately, our tributaries are generally in better shape than the main rivers they feed into, and we should keep them this way.

4. St Lucia – a phoenix rising: the Lake St Lucia system is our most important estuary and a key nursery for fish on the southeast African coast. For six decades St Lucia received too little fresh water, due to human interventions and drought, leaving this flagship estuary in poor condition and closed to the sea for much of the past ten years. Work has begun on restoring St Lucia back to health, a top priority for the iSimangaliso Wetland Park Authority, but it is challenging and will take time. Significantly, in July 2012 the lake received enough fresh water to open to the sea again.

5. Paving over our coast: nearly a fifth of our coastline has some form of development within 100m of the shoreline, which means nature's buffers against storm surges and rising seas may have been stripped away and paved over in parts. This puts people and property at risk in the face of climate change. Our coastal and inshore ecosystems are more threatened than offshore marine ecosystems.

6. Lost at sea: further out to sea, offshore ecosystems are the most poorly protected of all our ecosystems, yet these are the lifeblood for healthy and productive fisheries. Marine protected areas are key to keeping both the ecosystems and the fisheries safe.





7. Hand in hand – state meets the private sector:

biodiversity stewardship programmes, where private land owners enter into an agreement with state conservation bodies to protect a section of their land and biodiversity, are making headway in terms of our national protected area targets. This is more affordable than when the state buys land for conservation purposes. With modest increases in resources, this scheme could make an even larger contribution.

8. Warning signs:

some parts of the country have lost much more natural habitat than others. If Gauteng, KwaZulu-Natal and North West Province keep losing natural landscapes at the current rate, for example to cultivation, mining and urban expansion, these provinces will have almost no natural habitat left outside protected areas by 2050. Where natural vegetation is being converted to other land uses at a high rate, it's critical to use maps of biodiversity priority areas to guide decisions about where best to locate development.

9. Planning for an uncertain climate:

with the uncertain and extreme climate we will face in the future, it's critical that we keep natural habitats healthy so they can support functional, stable landscapes in the long term, which can then better support human activities. Scientists have drawn up a new national map which identifies areas that are important for climate change resilience, and which need to be kept intact.

10. Protecting our natural medicines:

South Africa has over 2 000 plant species that are used for medicinal purposes, about a third of which are traded commercially. But some are threatened. We need to manage these species better, and monitor how other heavily traded medicinal plant species are used, so that they don't become over-exploited too.

11. A bridgehead against invasion:

invasive alien plants dramatically increased their footprint in South Africa in about a decade, and now we lose about R6.5 billion worth of ecosystem services to them each year. Programmes like Working for Water give us a chance to create jobs and reclaim nature's valuable services.

on the **SIDE**

NEW TOOLS in the biodiversity toolbox

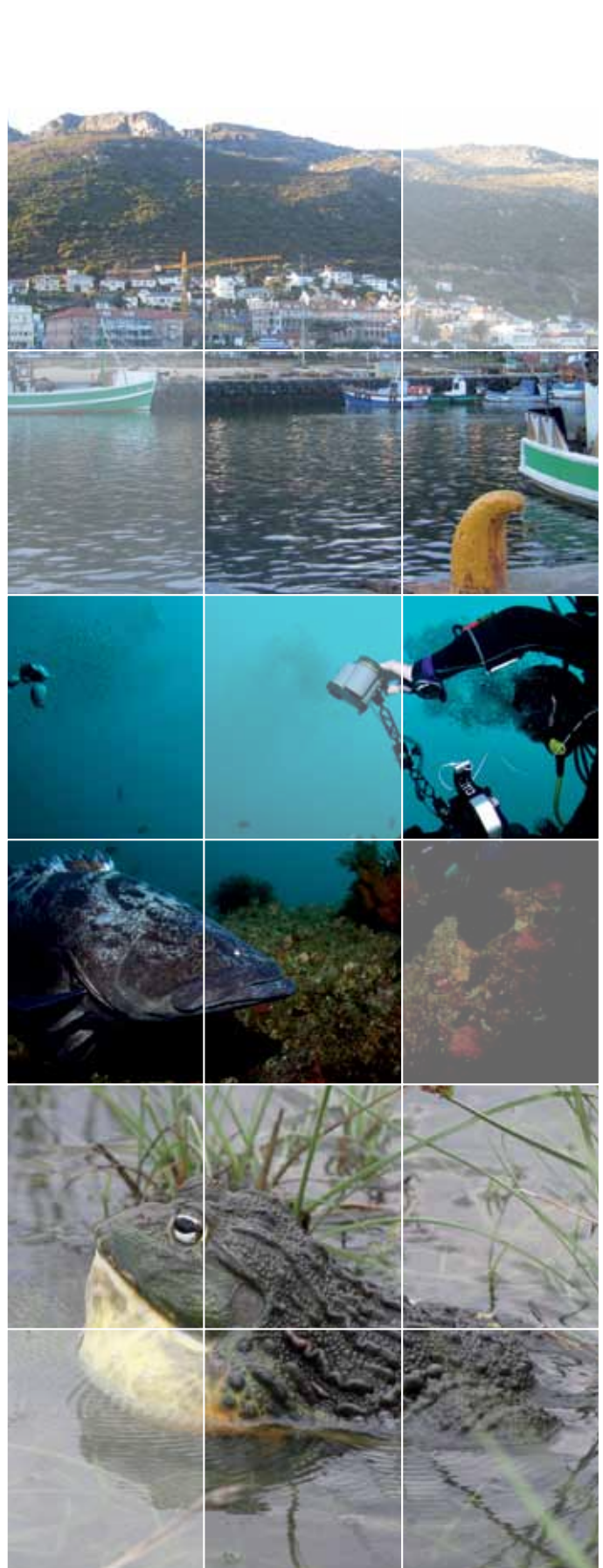
A ruler is a good way to measure the size of a page, and using degrees centigrade is a way to quantify temperature. But how do you measure and compare the health of ecosystems as different from one another as an apple is from an orange, such as comparing the state of a high-altitude Grassland with that of a deep-ocean bed? It's not easy.

But for the first time our scientists have devised a set of indicators that allow them to do just that. These have been used throughout this book to show how threatened and how protected our many different ecosystems and habitats are.

Ecosystem threat status: This tells us whether an ecosystem is still intact, or if it's losing vital aspects of its structure, function or composition, related to a series of thresholds. Ultimately, the functioning of threatened ecosystems is compromised as they reach certain measurable thresholds.

Ecosystem protection level: This tells us whether an ecosystem is well represented in protected areas, based on the proportion of the ecosystem that falls into an area that is formally protected under national legislation, namely the Protected Areas Act.

12. Having the right tools for the job: our scientists have made great strides in mapping and classifying South Africa's ecosystems. This gives the foundation for meaningful assessment, planning and monitoring our ecosystems. For example, now we have the first maps which identify our marine and coastal habitat types and wetland ecosystem types.



THIS LAND IS OUR LAND

‘It is our blood, it is our flesh,
it is everything.’

‘To the Gumbi people, land means being ourselves. Land is of great importance, more than anything else.’

This is how Lucky Gumbi, member of the original Gumbi Traditional Council in northern Zululand, explained what it means to his people to have 21 000 hectares of bushveld near the border with Mozambique returned to them after they were dispossessed of it under the apartheid state.

‘You can’t separate it from us. It is our blood, it is our flesh, it is everything,’ he told the Wildlands Conservation Trust during an interview in 2011.¹

The Gumbis had three priorities for this land, their leader Inkosi (chief) Zeblon Gumbi explained: first, they needed a place to settle and build their homesteads; then they needed land to farm and sustain themselves; and thirdly they decided to dedicate most of the land (16 000 hectares in all) to conservation. This meant they could generate an income for the community through ecotourism while being custodians of the environment.





This is the kind of win-win approach to conserving nature which underpins the philosophy of the National Biodiversity Assessment (NBA) and the mandate of the South African National Biodiversity Institute (SANBI): to emphasise how much a healthy natural environment gives us in terms of 'free' goods and services and development potential, and why we should continue to be good stewards.

Just as South Africans need human and manufactured capital to grow the economy, we are also dependent on the 'capital' in wild spaces and natural landscapes, and the species that live in them. And our land-based, or terrestrial, ecosystems are no exception.

Living in the **LANDSCAPES**

Where our food grows: agriculture, and by association the entire nation's food production, is dependent on a healthy natural environment. Good soils allow us to grow crops. The natural veld gives us grazing for livestock, something which was valued at over R8 000 for every square kilometre annually in 2008. Without the pollination of certain insects, birds and rodents, many crops would be impossible to grow. In the Western Cape alone, wild pollinators give a service to the deciduous fruit industry amounting to between US\$49 million (R400 million) and US\$311 million (R2 500 million) every year, according to a 2008 study. Creatures living in wild places also offer pest control for agriculture.

Healthy lands, healthy waters: healthy land-based environments also protect people from natural hazards, slow down floods and store water to help see us through times of drought. Our life-giving rivers can only be healthy if the surrounding Grassland, Fynbos or Savanna ecosystems are in a similar state of good repair.

Relax and renew: we use nature as a playground, something that gives immeasurable pleasure. Tourists, many of whom are drawn to our beaches, natural spaces and wild animals, brought an estimated R251 billion into the country's gross domestic product (GDP) in 2011, according to the Industrial Development Corporation. This means that tourism contributes nearly 9% to the GDP, more or less equivalent to the mining sector.

The wealthy countryside: many rural communities use Forest, Albany Thicket and Savanna systems for fire wood, wild fruits, and to make wooden utensils. Others gather traditional medicines from the natural environment.

A growing industry: game farming and hunting – similar to that which the Gumbis are now doing – bring in another R7.7 billion a year and give some 100 000 jobs to people, and are significantly more labour intensive than livestock farming. In some instances in the Eastern Cape, switching from farming to ecotourism has produced 4.5 times as many full-time jobs, according to a 2006 study.



Photo: Mike Cadman

¹ To read more about the Wildlands Conservation Trust, visit <http://www.wildlands.co.za/>. The original interview can be viewed on <http://www.youtube.com/watch?v=elpyxCTecr4>.



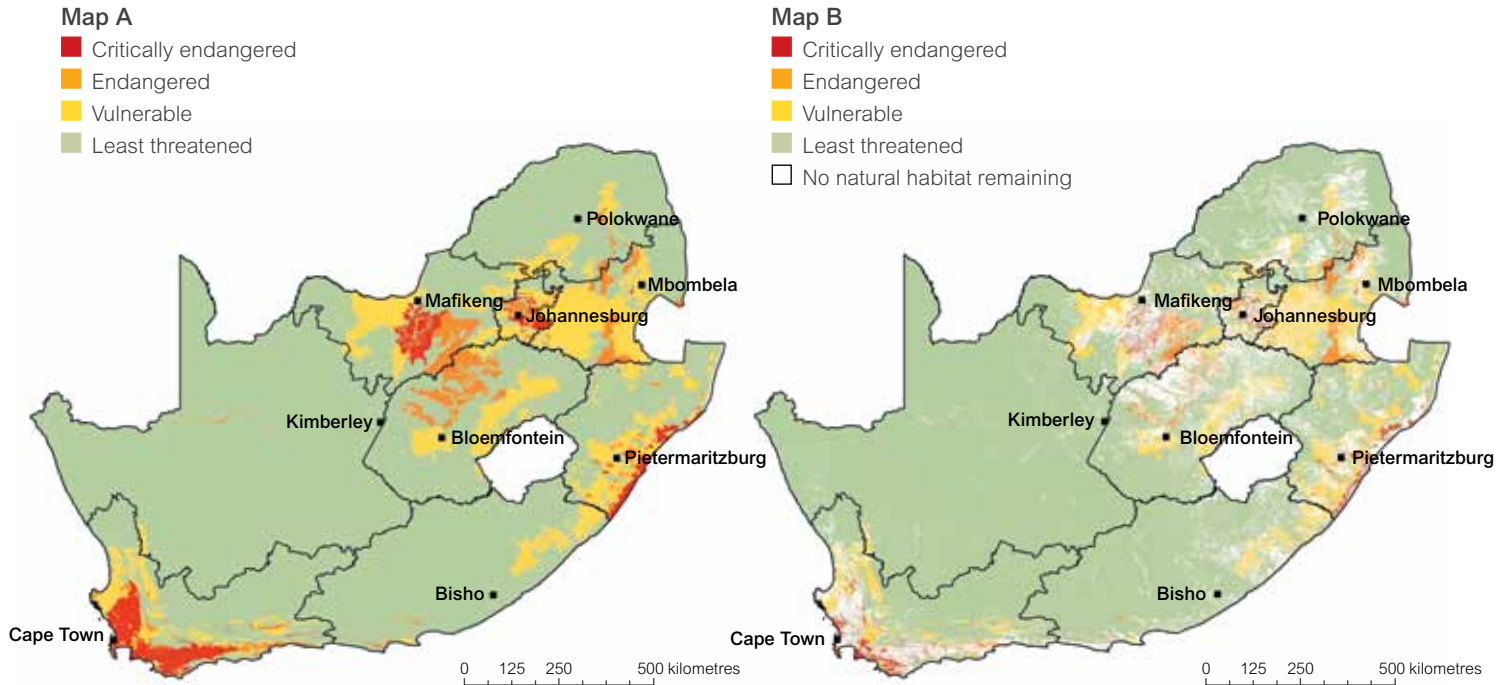
‘ We believe that we are born out of land and when we die we will go back to the land, said Lucky Gumbi. ’

After the land was returned to the Gumbi people in northern KwaZulu-Natal, and they were able to build their settlements and re-establish their farms, work began on establishing the protected area. Because it had such a high diversity of bushveld life, the provincial conservation body Ezemvelo KZN Wildlife and the Wildlands Conservation Trust assisted the community in formally proclaiming a portion of their land as a Nature Reserve through the province’s biodiversity stewardship programme. The establishment of the Somkhanda Game Reserve has seen black rhino introduced to the reserve, tourist lodges refurbished, game numbers supplemented, water has been secured and hunting is bringing in revenue. And the Gumbi people receive an income from these activities.

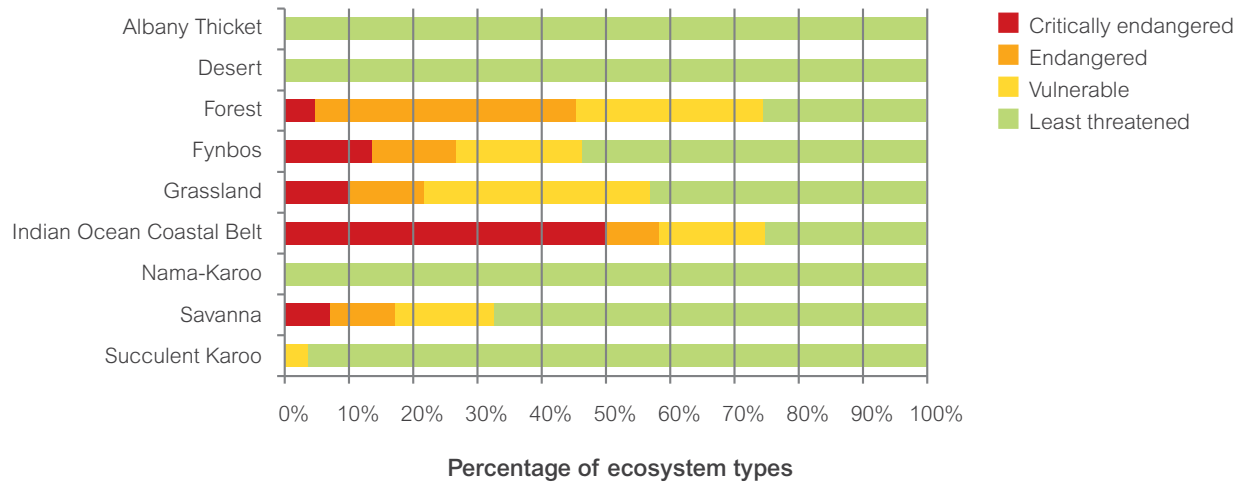
And yet even though this is an example of how land reform and land restitution can be coupled with conservation to the potential economic benefit of all, the value of this natural place is not something that can be reduced to mere rands and cents. The diversity of life found in this bushveld, and the cultural meaning to the people who have returned there, cannot be measured in monetary units.

‘We say that when you respect our ancestors, we say *abaphansi* meaning those that are underground. So when you walk on the land we’ve got to respect it,’ said Lucky Gumbi, the sky turning mauve above the Savanna of his forefathers.

This is why his chief, Inkosi Zeblon Gumbi, believes it’s so important that the land that was taken from the Gumbis has been returned to the community.



Our threatened land-based ecosystems: Most of our threatened ecosystems are found near big cities, productive croplands and coastal areas, where large amounts of natural habitat have been lost. Map A shows the original footprint of terrestrial ecosystems. Map B shows what remains of those ecosystems today, with the white areas showing where natural habitat has been irreversibly lost.



Counting the cost: This graph shows ecosystem threat status by biome.

Most threatened biomes: Grassland, Fynbos and Indian Ocean Coastal Belt.

The great unknown: Scientists are able to map areas where natural vegetation has been irreversibly lost, but it's less easy to map areas that have been degraded to varying degrees, so this threat status is probably an underestimate.

PUTTING ON THE PRESSURE: the many demands on a changing landscape

Because we need nature's infrastructure, and since we tend to damage these resources in the course of our economic activities, we face the challenge of making sure that we use the natural environment in a way that allows our ecosystems to stay healthy in the long term.

In many ways we have failed to do this until now.

Gone for good: change in land cover is the greatest driver of habitat loss across South Africa. Nearly a fifth of the land surface has been lost, mostly due to natural vegetation being ploughed up for crop farming (like maize, wheat and sugar cane), and to a lesser extent to mining, forestry and urban sprawl. The greatest losses are around hubs of economic activity.

Down but not out: even if an ecosystem isn't completely destroyed, we can still undermine how well it functions. These are some of the ways an ecosystem can be tampered with: if it gets carved up into too many smaller, fragmented parts; if the natural fire regime is changed, for instance if fires burn too often or not often enough; if the vegetation is over-grazed; if the soil becomes degraded; if invasive species move in.

Pollution from mining, agriculture, manufacturing and cities into the water, soil or air can also disrupt ecosystems, how well they function, or the species living in them.

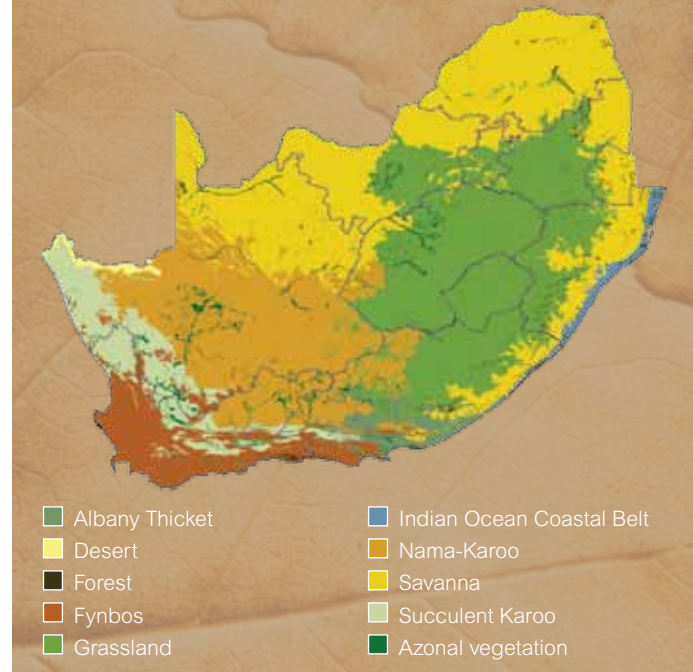
Sometimes degraded ecosystems can be repaired, but not always. Dry ecosystems, in areas where there is less rainfall, generally take longer to recover than wetter ones.

The ripple effect: when land-based ecosystems like Grassland or Thicket are damaged, the effects usually spill over into wetlands and rivers and may trickle all the way down to distant estuaries. Protecting terrestrial landscapes is also about protecting our water resources.

The road to 2050: KwaZulu-Natal, Gauteng and the North West are amongst the provinces that have had the greatest loss of natural habitat. And if the remaining

on the SIDE

A biome is a distinct community of plants, animals and other organisms, that is shaped by prevailing physical conditions such as climate and soil types, and which becomes the dominant form in an area. Each biome is made up of many vegetation types.



natural areas continue to be transformed into crops and forestry or turned over to mining or urban sprawl at the current rate, there will be little to no natural vegetation left in these provinces by 2050, outside of protected areas. That's less than four decades from now.

Cost to the soul: it's easy to keep measuring the loss of habitats and the services they give us purely in scientific or economic terms. But how does one measure the social and psychological consequences of losing these wild iconic spaces?

Gauteng might be the engine room of the economy, and account for a third of the country's GDP, but as with all decisions around how we manage our natural spaces in future, development here should go together with looking after the province's ecological infrastructure.

Maps of biodiversity priority areas are an invaluable tool to help guide decision makers to ensure that development is situated in appropriate places.

Protecting OUR ASSETS

Nearly a quarter of land-based ecosystems are well protected, but 35% have no protection at all.

Fynbos, Forest, and Desert: the best protected biomes.

Grassland, Thicket, and Nama-Karoo: the least protected biomes. Grassland is also one of South Africa’s largest and most threatened biomes.

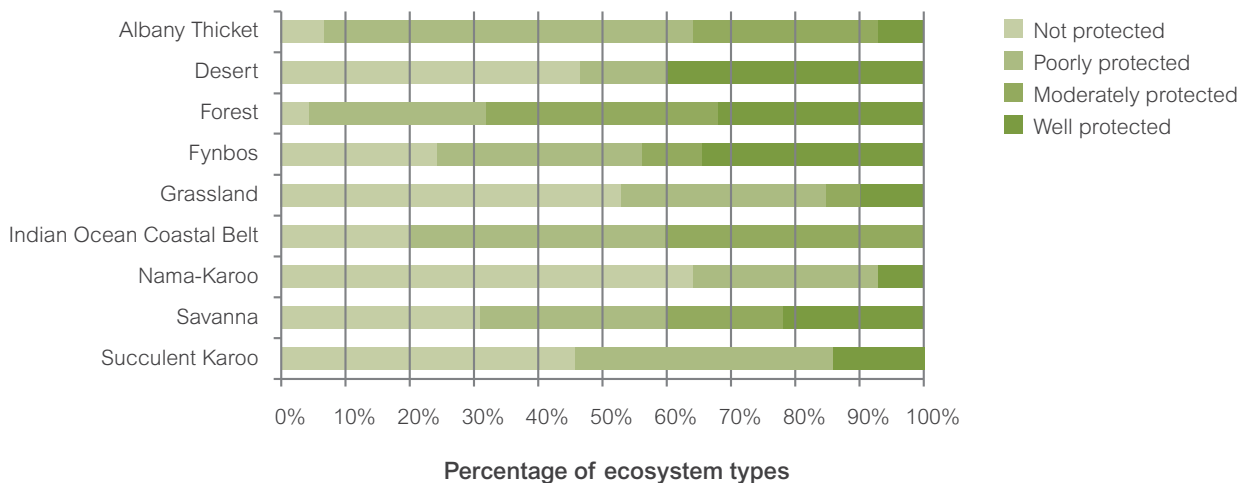
Smaller parts of the whole: some ecosystems types within broader biomes are better protected than others, though. Mountain Fynbos is well protected, but lowland Fynbos isn’t; lowveld Savanna is well represented in the Kruger National Park, for instance, but central bushveld Savanna isn’t found in many protected areas.

Biodiversity stewardship programmes: throwing a protective net around wild and natural landscapes can be an expensive exercise. That’s why the state wants to get the private sector involved in conservation. Biodiversity stewardship arrangements are now operating in six provinces, allowing private and communal land owners to dedicate part or all of their property to conservation.

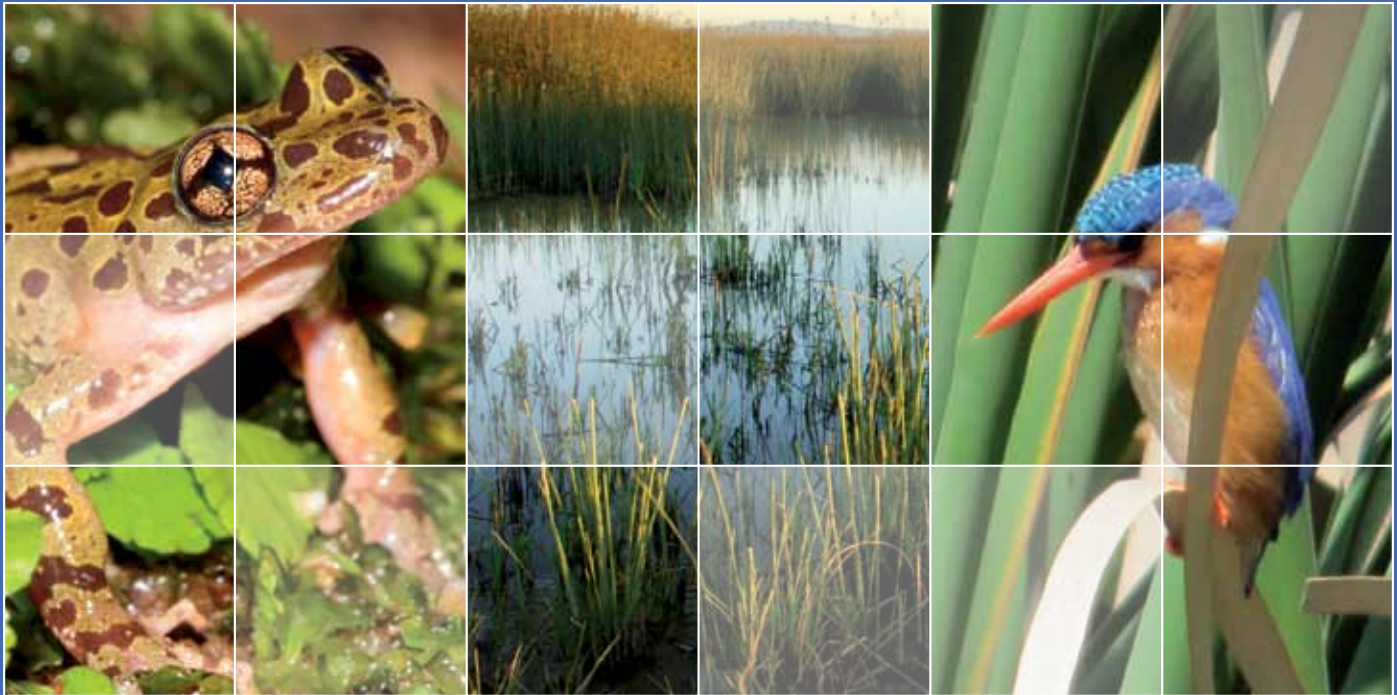
on the SIDE

If you were to take a drive from Port Nolloth on the west coast to, say, Port Shepstone on the east coast, you’d see vegetation changing around you subtly but constantly. What drives this change? The soils, rock formations, how much water flows through the system, the temperature, the climate: all of these make up the weave of a fabric that forms our different ecosystems and determines which plants and animals are able to thrive there or not.

Mapping the country’s vegetation – something our scientists have done extremely well – is one of the best ways of visualising the footprint of these ecosystems and knowing which plants, animals, birds, insects and other organisms live there. South Africa has nine distinct biomes: Fynbos; Grassland; Savanna; Albany Thicket; Forest; Succulent Karoo; Nama-Karoo; Desert; Indian Ocean Coastal Belt. Each biome is made up of many different vegetation types. Scientists now have the ability to compare these sub-types with one another, across different biomes, in order to understand the levels of threat. This is groundbreaking.



Caring for the land: This graph shows the levels of protection for our land-based ecosystem types, by biome.



OUR precious WETLANDS

... energy is diffused, water slows and settles, the damage it could cause as it hurtles through water courses is dampened ...

Try this at home: take a damp sponge, place it on a kitchen countertop, and pour half a cup of water onto it. Now, pour the same amount of water directly onto the counter. See what happens? Bit messy, but it makes the point.

Now imagine that cup of water is a summer thunderstorm, the countertop is a paved road or patch of hard, dry ground, and the sponge is the gentle reed beds along the tributaries which feed into the river system that gives fresh water to Gauteng's important industrial complex. People here depend on that water arriving in a clean and regulated way; infrastructure and communities are vulnerable, should the river burst its banks and flood.

When fast moving water from a rain storm or flood hits the reeds and other plants in a wetland or vlei, energy is diffused, water slows and settles, the damage it could cause as it hurtles through water courses is dampened. Wetlands catch and hold onto that water, either in the soil or on the surface, and later trickle-feed it downstream, keeping our rivers flowing and feeding myriad dams and water pumps and taps along the way. This is why wetlands are compared to sponges: they catch water in the landscape, clean it for us, and bank it away in their soggy soils to be released slowly during the dry season.

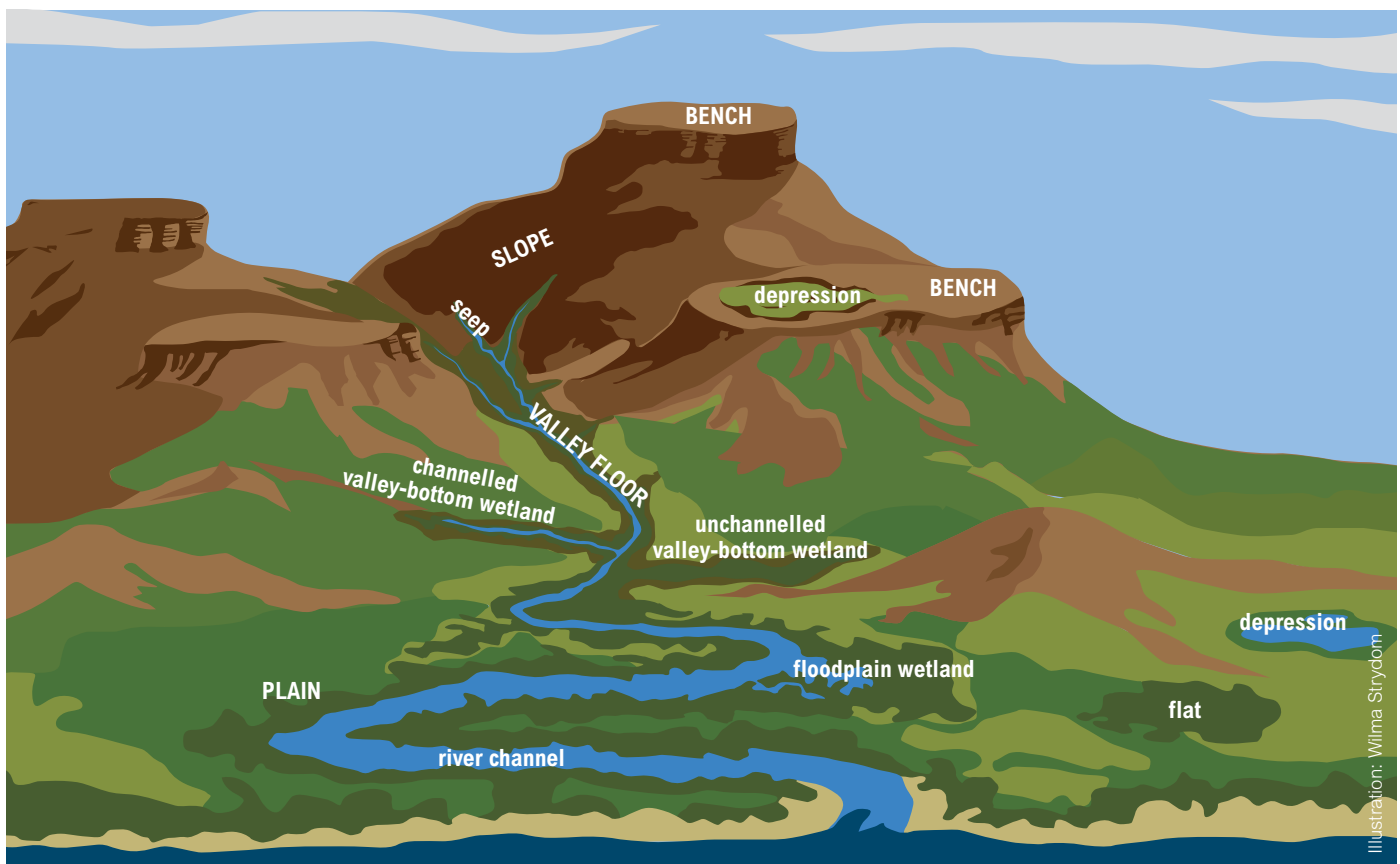
Wetlands are **IRREPLACEABLE**

Wetlands support agriculture, filter pollution from water, trickle-feed water into rivers even during the dry season, slow flooding, combat desertification and help us absorb the environmental shocks that come with droughts. Wetlands are also warehouses of a diverse range of life. Some of these wetland species are used for food, craft manufacture, medicines, grazing, building material and fuel, for both subsistence and commercial use.

We can't rely solely on complex and expensive engineering solutions to provide drinking water and to clean waste water. Our natural water infrastructure, in the form of wetlands, streams, rivers, lakes, aquifers and estuaries, complements and protects our dams, pipelines and water treatment plants. The extreme bouts of flooding and drought we expect to come with climate change mean our wetlands will become even more critical for water management.



All this from only 2.4% of our country's surface area. So when wetlands are damaged, the consequences ripple out across a system that reaches far beyond that little marsh or vlei.



No one is an island: Wetlands relate to the landscape around them in different ways. Some are linked directly to the course of a river, while others are found across a broader catchment.

IN PRAISE of the vlei

Depending on which definition you choose, the term 'wetland' can cover anything from a reed-covered seep to an entire lake. Wetlands are places in the landscape where the water table is at or near the surface, or the land is covered with shallow water for all or part of the year. These conditions create distinctive soils and support plants adapted to life in saturated soils.

Typically, wetlands are found in a range of settings across the landscape, including on hill slopes, in valley bottoms, on floodplains, in depressions and on flats. Some are connected to river networks while others may be isolated from rivers and groundwater.

Filtering our water clean: the wetlands around the Klip River in southern Johannesburg have been cleaning the water released by gold mines there for the past 100 years, along with more recent industrial and urban pollution. If wetlands in industrial hubs like this are degraded, not only do they stop purifying water that gets dumped into them, but they also release all the trapped pollutants.



Supporting the farmer and local livelihoods: wetland habitats give people highly productive agricultural land, grazing, fish, fibre and medicines. They underpin the health and wellbeing of many rural communities. It's the poor and vulnerable who benefit from healthy wetlands most directly, and who suffer most if wetlands are damaged. This is just one reason there's a direct link between the return on environmental investment, and the welfare and survival of the poor.



A community **MADE RICHER**

In Bushbuckridge, Mpumalanga, the Manalana wetland in the Sand River catchment is the only source of food and income for about a quarter of the surrounding community. It also acts as a safety net that buffers other households from slipping further into poverty during times of shock or stress.

The wetland was badly eroded, something which threatened to destroy these benefits. However, since Working for Wetlands began rehabilitation in 2006, people living in the area can again use it for food, grazing and construction materials. The value of these services, given free by nature, amounts to about R3 500 per year for about 70% of local households, in an area where half of households survive on an income of less than R5 700 per year.

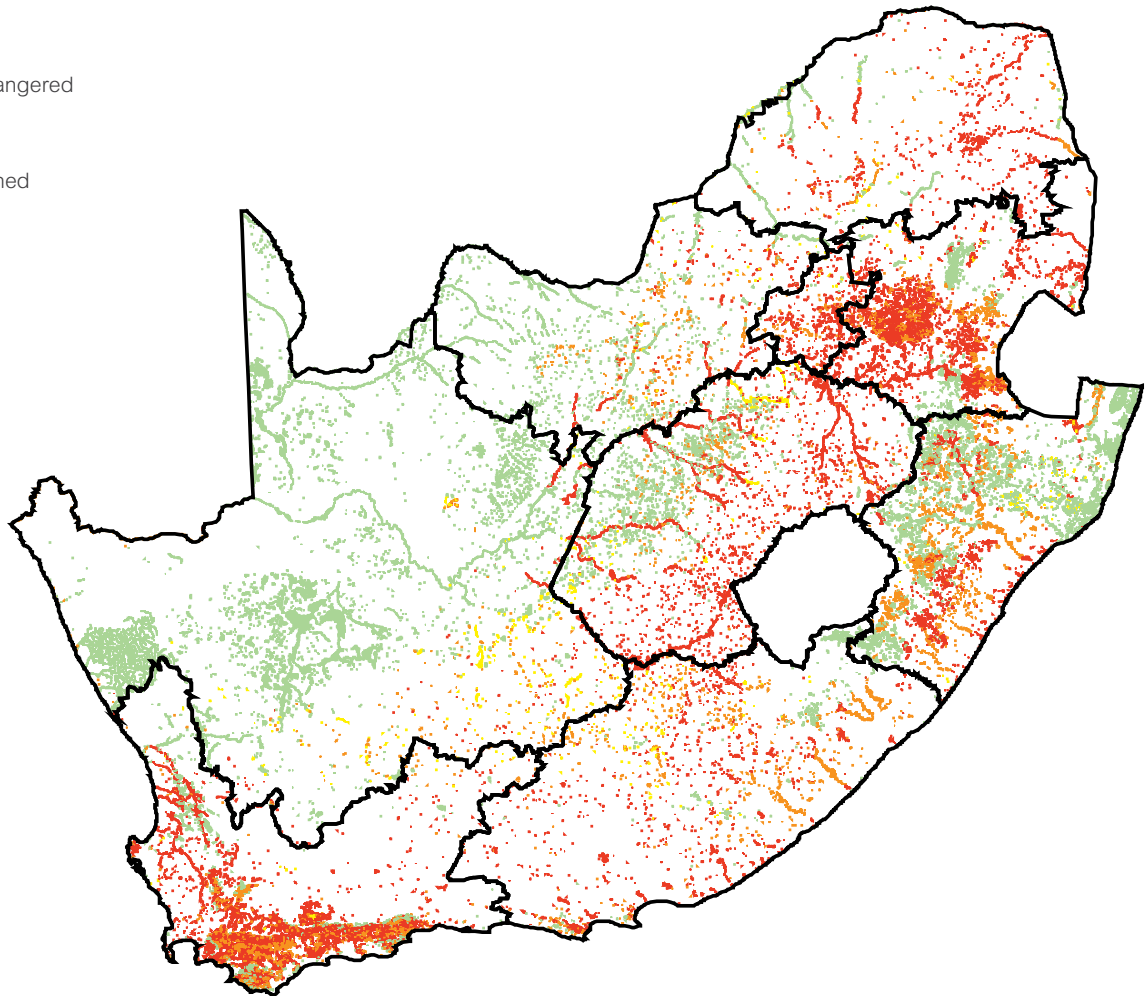
Putting on the squeeze: Wetlands are our **MOST THREATENED ECOSYSTEMS**

It's almost impossible to know precisely how many of our wetlands have been lost for good, especially where cities, dams and mines have paved over or swallowed up wetlands, but we know it's considerable.

Of the wetlands that remain today, many of them have been heavily modified because we have dammed, drained, mined or bulldozed them.

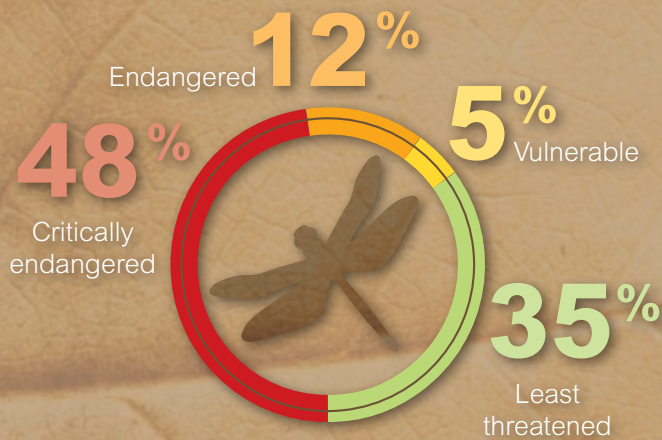
The most threatened wetland types are floodplain wetlands, because they are often found in highly productive land where people drain or bulldoze them to make way for agriculture.

- Critically endangered
- Endangered
- Vulnerable
- Least threatened



Point of impact: This map shows the threat status of wetland ecosystems. The greatest pressures on our wetlands are in places where cities, cultivated farmlands and mining are most widespread.

Percentage of wetland ECOSYSTEM types



Caution, caution! Nearly half of all our wetland ecosystem types are critically endangered, making wetlands the most threatened of all ecosystems in South Africa.

The JUGGLING ACT

It can be difficult deciding how nature should be used: should a wetland be kept in a pristine state because of the benefits we gain from having our water stored and purified by it, or should we turn it over to agriculture and try to get food from it? What about jobs and income from mining? Or a settlement for people to live in?



Digging in the dirt: This is a typical open cast coal mine in the Delmas-Ogies area in Mpumalanga. It highlights the tension between extracting resources, since wetlands often occur just above shallow coal deposits, or leaving them in the ground in order to preserve the services provided by the wetland that would otherwise be lost once mining starts.

So far, we've often put other economic pursuits first, without thinking of the benefits of keeping wetlands intact. But we're already seeing how this kind of decision-making can be to our own detriment, leaving us battling with problems of water quality and flood damage, for example. Every choice we make now, regarding our threatened wetlands, is a choice we will have to live with for generations.

In the wetland: wetlands are lost or degraded because of cultivation (for instance, for sugar cane or orchards), for urban development, for mining, to build dams, or because of poor grazing management which causes erosion.

Around the wetland: what happens in the catchment area around a wetland can also cause the wetland itself to become degraded. Disrupting the timing and the way water flows into the wetland through activities like building a dam or over-extracting water upstream of the wetland or extracting too much groundwater can cause damage. Pollution in rivers feeding into a wetland can cause harm. Similarly overgrazing or poor crop management can lead to soil being flushed away and deposited in wetlands.

How much is PROTECTED?

Our wetlands are severely under-protected. Very few wetland ecosystem types (just over 10% in all) are adequately represented within South Africa's formally protected areas, such as National Parks and Nature Reserves; meanwhile 70% are unprotected.

The most well protected: because of the Kruger National Park and iSimangaliso Wetland Park, wetland ecosystems in the lowveld region and in northern KwaZulu-Natal are relatively well protected.

The least protected: floodplain wetlands have the lowest levels of protection, and have the highest proportion of critically endangered types within them.

The priority now should be the conservation of a representative spread of different wetland ecosystem types, through protecting wetlands themselves. But we must also take care of upstream systems and surrounding

catchment areas so that the quality, quantity and timing of water which wetlands depend on, is secured.

The National Water Act, complemented by other laws such as the Conservation of Agricultural Resources Act and the National Environmental Management Act, calls for precisely this sort of integrated approach to resource management: protecting the ecological reserve (the amount of water that needs to stay in the natural environment in order for it to be healthy), classifying water resources and maintaining our water quality.

But the challenges remain. This is partly because of the shortage of capacity to implement and enforce these legal requirements, and the need for further work to make sure the right science is available so that the most prudent choices can be made about the sometimes inevitable trade-offs between development and loss of ecological infrastructure.



Bouncing back: Wetlands tend to be more resilient than many other ecosystems, meaning that even if they are in poor condition, sometimes they can be rehabilitated. For example, this wetland has been cultivated, but its functioning could be restored, albeit at considerable effort and expense. However, once wetlands are paved over with concrete, or drowned under dams, they are irrevocably lost.

on the **SIDE**

OUR INTERNATIONAL COMMITMENTS

South Africa is a signatory to the Ramsar Convention on Wetlands, which means we have to identify important wetlands which are then added to Ramsar's List of Wetlands of International Importance. Our obligation under Ramsar is to promote the wise use of all wetlands, create protected areas for wetlands, and cooperate with other member states when it comes to managing wetlands which straddle national borders.

We have 20 Ramsar-listed wetland sites. Eighteen of these are protected under South African law, in most cases as Nature Reserves. The remaining two, Orange River Mouth in the Northern Cape and Verlorenvlei in the Western Cape, are not formally protected.



Photo: Kate Snaddon

Water ... keeps the economy ticking over, it is the lifeblood for our agriculture and forestry, it helps power the electricity grid, and drives industry.

Liquid GOLD

It's called the Goldilocks Zone, after the porridge in the classic fairy tale: not too hot, not too cold, just right. And it's why Earth is the only planet we know that has life on it.

Earth travels in a course around the sun that's just the right distance to keep an atmosphere in place that supports liquid water. Any closer to the sun, and our atmosphere would have cooked away, along with the planet's water. Any further away, and the water would be frozen solid.

Without water, life on the planet wouldn't have happened. It's as simple as that.

Earth's water isn't spread out evenly like a neatly buttered slice of bread. South Africa, for instance, doesn't have much fresh water – we are a semi-arid country – meaning water is our most scarce natural resource. Yet we lean so heavily on it: it keeps the economy ticking over, it is the lifeblood for our agriculture and forestry, it helps power the electricity grid, and drives industry. Each of us needs clean water in our homes so we can live a healthy life.



The nature of water is to run, meaning it carves out paths as it goes, creating rivers that become the arteries feeding this life-giving liquid through land-based habitats. Rivers store and move our water about. Together with manmade dams and water transfer schemes, they deliver it to where we need it in cities and farmlands, allowing us to irrigate crops, get rid of waste and giving us playgrounds.

But we're putting huge pressure on our rivers – taking more and more water out of them, and dumping greater amounts of pollution into them. Climate change is already shifting rainfall and evaporation patterns, putting further stress on these hard working ecosystems.

So we need to reduce how much water we use, and take good care of what we have. One of the best ways to promote water security is to manage and conserve ecosystems that maintain our water supply and keep it healthy. That means keeping river ecosystems in a good state of repair.

RIVERS: an invaluable infrastructure

We need to remember that if we want to be able to turn on the taps in our homes, factories, businesses and on our farms, we need to make sure that our rivers are healthy right from the very top of the system, the mountain catchments, down to the estuary where the river meets the ocean.

Healthy rivers also support a wide diversity of life, which helps to process pollutants and clean our water, and supports the people living in and around them.

Because rivers are long, linear systems which carve through the landscape, anything that happens in their catchments, or along their banks, or in the habitats that feed into them, inevitably impacts on the rivers themselves. And problems which occur along the length of the river tend to accumulate and reinforce each other as they travel down the system.



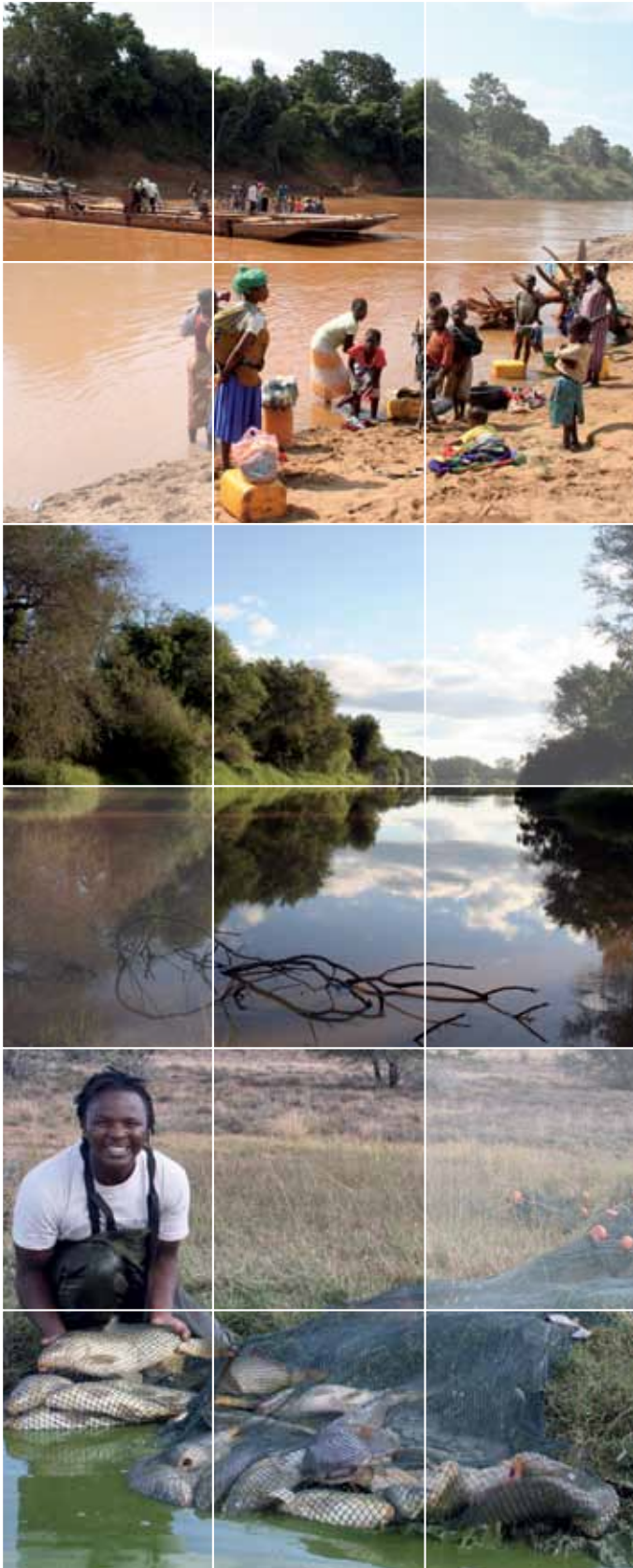
Mountain stream

Upper foothill

Lower foothill

Lowland river

The trickle-down effect: One immutable quality of water is that it travels downhill. This means that the river system often bears the brunt of environmental problems unfolding along the length of the river. So by the time the river reaches lower-lying ground, often where the most economic activity happens, the river is already carrying with it the burden of the accumulated pressures from over-extraction of water, disruption of the environment around the river, invasive alien species, pollution, erosion and damage to river banks that may have happened tens or even hundreds of kilometres higher upstream.



on the **SIDE**

WHAT IS 'THE RESERVE'?

The water needed by a river in order for the whole system to stay healthy is called the 'ecological reserve' and is protected under the National Water Act. This means that rivers and their surrounding environs must be managed in such a way that the amount and quality of water, and the rate at which it flows through a system, isn't disrupted to a point that degrades the sustainability of a river.

The 'human needs reserve' is also protected under the Act. This refers to the amount of water needed for a person to drink, prepare food and keep themselves and their homes clean. Many people who live off the municipal grid are still directly dependent on rivers in order to meet these daily water needs.

Together, the ecological reserve and the human needs reserve are called 'The Reserve'.

Nothing in nature **IS WASTED**

Fresh water pouring out from rivers into the ocean is not wasted. Rather, it plays a vital part in keeping estuaries and nearby ocean ecosystems healthy. Some fish species, for instance, spawn their young near estuaries, so that they can 'sniff' out the fresh water flushing out of the river and into the ocean. This important navigational cue leads the young fish towards the safety of the estuary which then serves as a nursery until the fish are big enough to venture out into the more dangerous waters of the open ocean. Many of these fish species are important for commercial or subsistence fisheries.

It's important, then, that we don't siphon off all the water from our rivers, leaving nothing to spill out at the mouth. The knock on effects of this not only harm ecosystems and the species living there, but impact on the people who depend on them, and ultimately our communities and economy.

Our rivers **UNDER PRESSURE**

Changing the flow: anything that alters the way water flows through a river system can have a serious impact on the health of riverine life. Dams 'impound' water, changing water quality and quantity downstream; irrigation extracts water; dumping waste water into a river increases the flow; and pumping water from one catchment to another (inter-basin transfers) changes both the receiving and the delivering rivers. Large rivers are often the most heavily used.

Pollution: pollutants can come from failing sewerage treatment plants, industrial waste water with harmful chemicals poured directly into wetlands and rivers, and agricultural pesticides and fertilisers running off farmlands. Taking water out of a polluted system leads to even higher concentrations of pollutants.

Destruction of river banks: bulldozing banks or planting crops along river edges can cause permanent damage to a river system and the ecological services it provides.

Natural vegetation along river banks filters water running into the system from nearby lands, protecting the river from pollution. Intact river banks also help to prevent erosion.

Invasive alien plants: thirsty invaders drink up an estimated 7% our total annual runoff, which then deprives rivers, dams and people.

Invasive alien fish: fish introduced for recreational fishing and aquaculture, like bass and trout, can wipe out indigenous fish species and other life.

Climate change: rising temperatures and changing rainfall patterns will impact on how much water makes it into river systems.

Land management throughout catchments: water resources must be managed together with land-based activities that surround them because what happens on the land throughout catchments impacts on river health.



HOW THREATENED are our rivers?

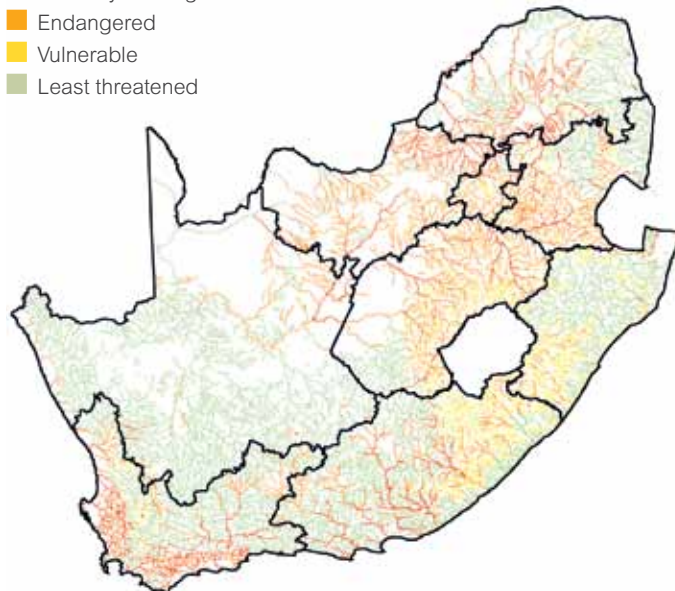
The big few: larger rivers such as the Vaal and Olifants are hard working because they tend to have more dams built on them, more water pumped from them, and more pollution dumped into them.

One in three: only a third of our main rivers are in good ecological condition. This is measured according to criteria such as flow, altering inundation (we often channel rivers to redirect their flow or build barriers to make them more predictable), water quality, stream bed condition, and bank condition. Smaller tributaries that flow into main rivers tend to be in better ecological condition.

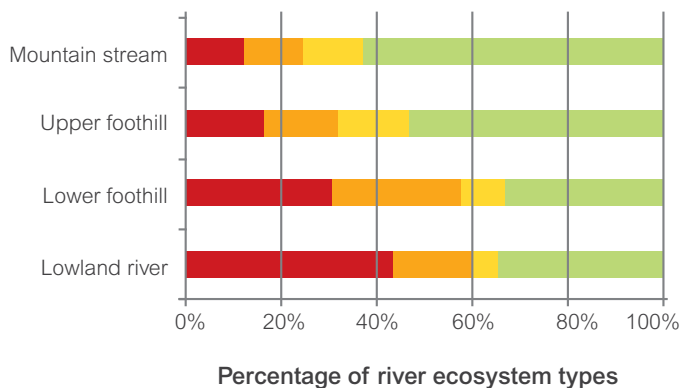
Uneven spread: some river systems, like the Berg and Breede, have extremely high levels of threat and need deliberate restoration efforts. Meanwhile others, such as the Mvoti and the Umzimkulu on the east coast, have low levels of threat and should be kept this way.

Investing in gold: keeping our rivers healthy, and rehabilitating damaged rivers, is an excellent investment in future water security and river services.

- Critically endangered
- Endangered
- Vulnerable
- Least threatened

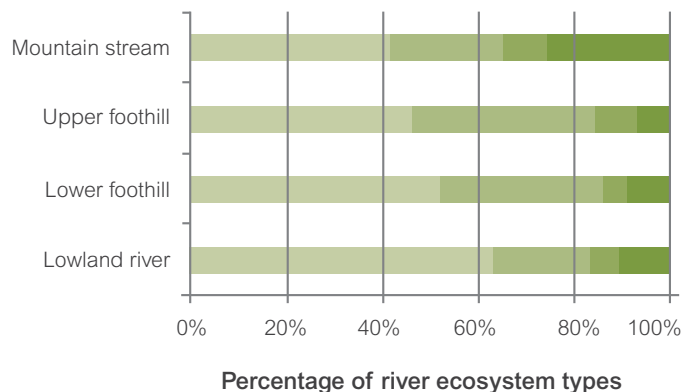


Our threatened rivers: Critically endangered and endangered river ecosystems are found mostly around major cities, in cultivated or mined landscapes, and in places with a lot of economic activity. This is where water demands are greatest and catchments have lost much of their natural habitat. If a river ecosystem is assessed as 'threatened', that doesn't necessarily mean it's unsafe for people to use.



- Critically endangered
- Endangered
- Vulnerable
- Least threatened

Picking up speed: This graph shows the threat status of rivers. The further you travel down the length of a river, the greater the cumulative impacts. Lowland rivers have the largest proportion of critically endangered ecosystems because of the impact of intensive agriculture, mining and urban pollutants.



- Not protected
- Poorly protected
- Moderately protected
- Well protected

Protecting the lifeblood: This graph shows how protected our river ecosystems are. While higher altitude river systems are best protected, lowland rivers have lower levels of protection.

‘ ... rivers downstream of protected areas tend to be in better shape ... ’

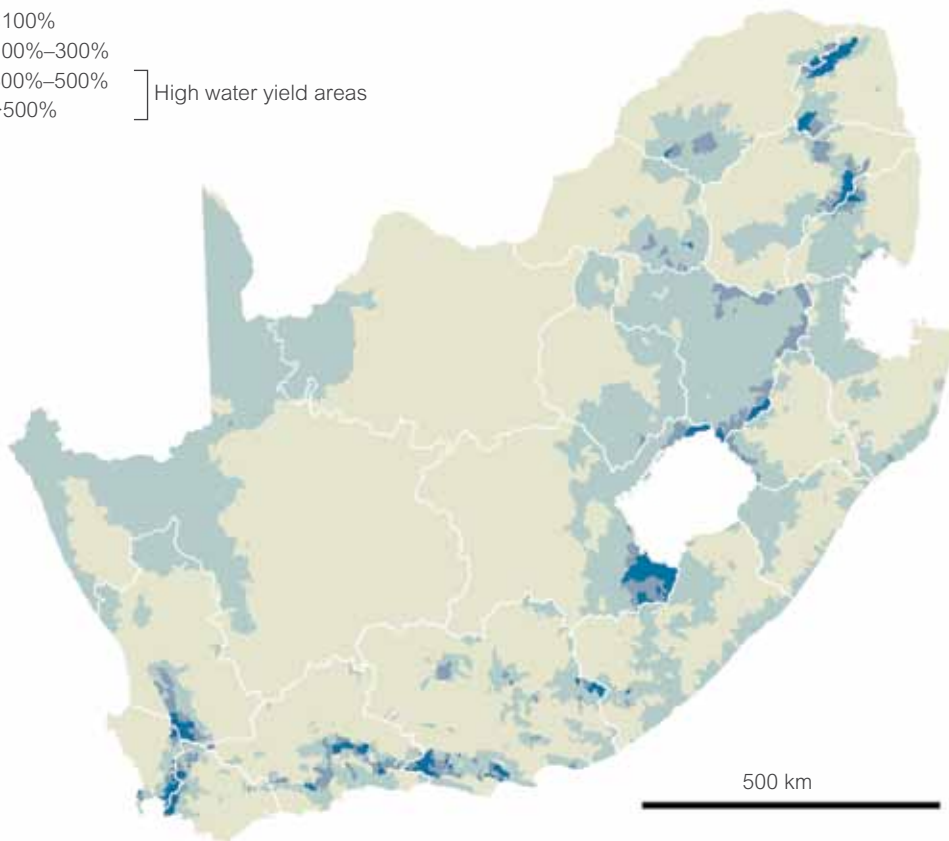
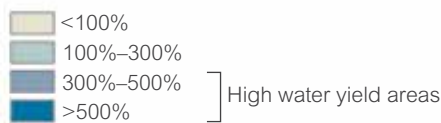
Making **PROTECTED AREAS** work better for rivers

Most protected areas were not designed with river protection in mind. However, these guidelines can help to ensure that protected areas do a better job of taking care of river ecosystems:

- Don't make rivers the boundaries of National Parks or Nature Reserves, make them part of the protected area.
- Extend protected areas along greater lengths of rivers that are only partly protected.
- Include river catchment areas into protected areas.
- Don't place developments, like chalets or lodges, on or near priority freshwater ecosystems inside protected areas.
- Push for the last remaining rivers that are undisturbed from source to sea, so-called 'free flowing' rivers, to be incorporated into protected areas.

How much **IS PROTECTED**?

Because rivers are long and linear, it's not often that an entire river system will fall inside a protected area such as a National Park, and even then, a river may carry its upstream impacts down into the protected area. Rivers are often used as convenient boundary lines for protected areas which begs the question: are such rivers protected or not? Nevertheless, rivers downstream of protected areas tend to be in better shape than when they entered the protected area. Of the country's river ecosystem types, only 14% are well protected, one third are poorly protected, and half have no protection at all.



The water factories: Catchments with high natural runoff provide several times more runoff than the average for their river basin. These priority catchments are critical to our water security, but aren't well protected.



Where **THE RIVER** meets the **SEA**

**... our flagship estuary,
St Lucia, demonstrates why
science-based management
is so important.**

Until the 1950s, the mouths of the St Lucia Lake and the mighty uMfolozi River came together in an impressive junction at the beach on the northern KwaZulu-Natal coast, and would spill their fresh water out into the ocean. From time to time, during droughts, the combined estuary would close, allowing fresh water to flood into the lake, until normal rainfall patterns returned and the mouth would re-open.

This was how nature designed the system, and it worked well. But in the 1950s, in an effort to support agricultural irrigation upriver and stop sediment building up in the lake, the two mouths were separated by dumping piles of sand and mud between them, creating artificial mounds which split the two bodies of water.

Since then, investments in research have led to a better understanding of how this particular estuary works, and how certain previous management practices had been damaging to the health of the system, and to species living and breeding in it. Based on this new scientific knowledge, 60 years of accepted wisdom has recently been overturned. In July 2012, the mouths were reunited once more, leading to a new era of science-based management of this flagship estuary.

South Africa's coastline is about 3 100km long. That's roughly the distance of driving from Cape Town to Johannesburg and back again. Dotted along that coastline is a series of estuaries, ecosystems formed where fresh water from a river meets the sea. If you were to add up the area covered by each of these estuaries, the total footprint would amount to about the same size as the Kruger National Park, 90 000 ha.

The Lake St Lucia system makes up more than half of that estuarine footprint.

Certain fish species spawn out at sea, but their young then move into estuaries to complete their life cycles. St Lucia supports many of the fish species of the offshore Thukela Bank and Richards Bay area, making it the most important nursery for young fish on the southeast African coastline. Scientists are now showing a link between the

recent extended closure of the Lake St Lucia system and population decreases in some fish stocks – another reason that the re-opening of the estuary is a significant achievement.

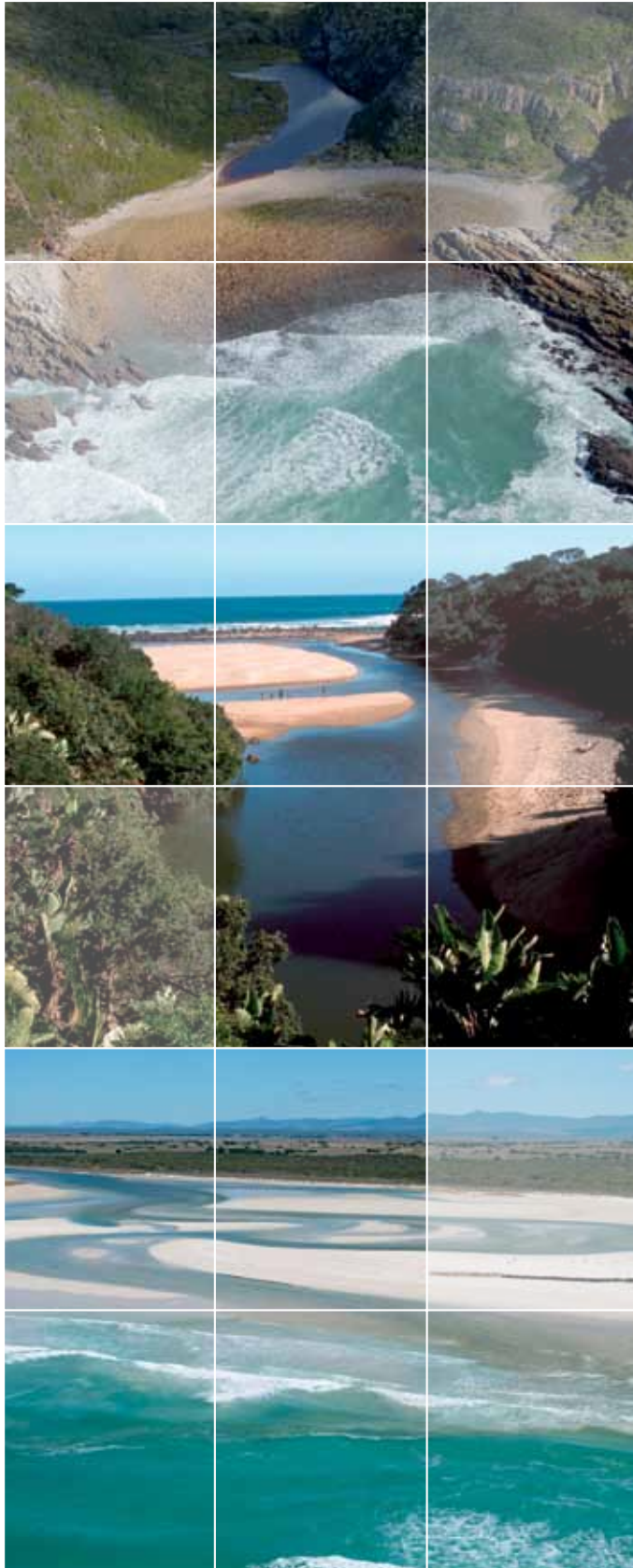
As the country's flagship estuary, St Lucia demonstrates why carefully considered, science-based management of the lake and mouth is so important.

‘ ... St Lucia, the most important nursery for young fish on the southeast African coastline ... ’



Photo: Andrew Brown

Romping along the south coast: The Knysna estuary is a tourist hotspot – it's estimated that over 840 000 people visit it every year. More than half of these visitors stay overnight, meaning they bring good tourist spend with them. On aesthetic value alone, the Knysna estuary adds an additional R150 to R200 million to property prices here annually.



MORE THAN JUST a 'play school' for fish

A useful harvest: as a form of natural infrastructure, estuaries are more than just 'kindergartens' for young fish. People use many different kinds of raw materials in estuaries: reeds and sedges for craft work; saltmarshes for grazing; firewood, timber and poles from mangrove forests. The rural poor are particularly reliant on this sort of 'free' service in order to make ends meet. A 2009 study showed that vegetation collected from the Lake St Lucia system was valued at nearly R5 million every year.

Buffers against the elements: just as the vegetation in wetlands helps diffuse the energy of floodwaters, so estuarine vegetation like mangroves, coupled with natural barriers such as sand berms, buffer against flooding and storm surges. Estuaries also play a role in treating waste, particularly near urban centres where municipalities often discharge waste water into them.

Places to play: people use estuaries because they are often safer than beaches or the open ocean for swimming and other water sports. Because of their natural beauty, we build coastal settlements on or near estuaries and use them extensively for our leisure.

THE SHAPE of an estuary

South Africa's estuaries range from cool (or 'temperate') on the west coast, to moderately warm on the south coast, to ones in the hotter climes of the sub-tropical east coast. Some estuaries are sparsely vegetated, particularly along the cooler stretches of coastline. Many have salt marshes. Others, like those along the KwaZulu-Natal north coast, might have mangroves forests.

The estuary is far more than just the mouth where fresh water from the river spills out into the sea. It also consists of the body of water where fresh and sea water mix, which is influenced by the tides, creating a unique habitat for life in the estuary. And the estuary includes the surrounding floodplain that can either be wide and flat, or small if the landscape rises steeply on either side.

on the **SIDE**

An estuary, by any other name: Within our 291 estuaries, 46 distinct estuary ecosystem types have been grouped according to four main factors.

- The size of the estuary.
- Whether the mouth stays open to the sea permanently, or whether it closes from time to time (three quarters of South Africa's estuaries have temporarily closed mouths).
- How fresh or salty the water is, which depends on the balance between fresh water and sea water in the estuary.
- The type of fresh water the estuary receives from its catchment (for example clear water, muddy water or black water).



THREAT ALERT at the estuary

Estuaries are hard working systems. They're often close to built up economic hubs, and a focal point for all the environmental stresses happening upstream of the mouth.

Size matters – the St Lucia effect: based on the pure numbers of estuaries, just over a third of South Africa's estuary types are critically endangered. But this gives a falsely reassuring picture. Bigger estuaries tend to be in poorer shape, and the Lake St Lucia system, which accounts for half the total estuary area, has been heavily impacted. Looking at the total combined footprint of estuaries, rather than the number of individual estuaries, nearly 80% of our estuarine footprint is critically endangered.

Happy south and south east: relative to the heavily impacted estuaries of the warm east and cool west coasts, many of the south and south east coast estuaries are healthy.

Estuaries on the global radar: six South African estuaries are Ramsar-declared wetlands (see p19), and yet only two of these are healthy, Wilderness and Kosi. The remainder – St Lucia, Heuningnes, Orange, and Verlorenvlei – are not in good condition.

Open on the Orange: the mighty Orange River traces a course some 2 200km from its birthplace in the mountains of Lesotho, down to where it eventually spills out into the Atlantic Ocean on South Africa's west coast. At the end of this economically important river, the Orange River mouth is heavily impacted by mining and access roads.

But it's the damming and extraction of water upriver for irrigation, combined with increased flows in winter as a result of hydro-electric power schemes, that has disrupted this mouth's natural opening and closing action. The mouth hasn't closed in two decades, causing the surrounding soil to become too salty and the vegetation to die off.

‘ The estuary is the body of water where fresh and sea water mix, which is influenced by the tides, creating a unique habitat for life in the estuary ... ’

It all **FLUSHES DOWN** through the mouth

Estuaries are a focal point for environmental pressures: every disruption higher up in the river system, be it in the wider catchment, or in wetlands, or damage to the rivers and streams themselves, will eventually find its way down to the estuary. These cumulative pressures make the management of estuaries a priority, but also a challenge.

Changing the catchment: land use change in catchments feeds into rivers and ultimately impacts on estuarine health.

Turning off the tap: anything upriver that changes the fresh water flowing into an estuary adds to the pressure our estuaries face. Dams, irrigation, thirsty invasive plants, and forestry upstream take fresh water away from a system which needs it for supporting fish nurseries, coastal habitats, marine productivity, and food webs.

Changing the tides: any inappropriate development or land use near the estuary – be it mining, land reclamation, building harbours and marinas, channelising or artificially breaching the mouth – changes the habitat, tidal flow and flooding behaviour of the estuary.

Becoming a sand trap: sand and silt get deposited in estuaries when overgrazing or ploughing farmlands upstream causes erosion. This is nothing less than a form of pollution for estuarine life.

Throwing in the line: over-fishing and bait extraction (of prawns, for instance) can damage nurseries, and reduce or collapse fish stocks.

Pollution: this comes from fertilisers, herbicides and pesticides flushed from farmlands by irrigation runoff; waste water treatment works discharged into rivers and estuaries; heavy metals and oils from industrial effluent, and stormwater runoff; too many nutrients flushing out of mariculture operations, or even genetic contamination. These can all damage estuarine life.



Photo: Peter Chadwick

Places in need: The Orange River mouth (above), along with Verlorenvlei (below), are both high priority estuaries needing legally robust protection.



Photo: CapeNature

PROTECTING the estuaries

At first glance, South Africa's estuaries seem relatively well protected – nearly two thirds of the total estuarine area of about 90 000ha has some form of protection. But several estuaries, even though they are formally protected, are actually in poor condition. The Lake St Lucia system is a case in point – it's legally protected, making up the majority of our protected estuarine footprint, but it has been heavily impacted. As South Africa's flagship estuary, intense research has led to new and better management practices at St Lucia. Lessons from this experience, showing the power of science for informing management, could benefit other estuaries.

For an estuary to be fully protected, we need to: protect it from inappropriate development, both on the land side and the sea side; manage the flow and quality of the water that reaches the estuary; and make the estuary 'no-take' (not allowing fishing or other forms of harvesting).

‘ ... estuaries are often quite resilient systems and many need only partial protection to stay in good health. ’

Luckily, estuaries are often quite resilient systems and many need only partial protection to stay in good health. This can include, for example, having some fishing restrictions (such as no-take zones, closed seasons, and bag limits or restrictions on fishing gear), managing for improved fresh water flow, and keeping natural vegetation intact along the estuary perimeter.

The NBA 2011 identified 120 priority estuaries for South Africa. Fifty-eight of these need full protection, and 62 of them require partial protection.



Photo: iSimangaliso Wetland Park Authority

Where to from here? National priority estuaries that are already in protected areas, but are nevertheless degraded, include the Lake St Lucia system, uMngeni, uMhlanga, Seekoei, Heuningnes, Sand, Witvoëlvlei, and Diep.

If a concerted effort is made to restore these estuaries to a healthier state, it would go a long way towards helping the country realise our goal of protecting a representative spread of estuaries. We are already on our way towards achieving this goal, since enormous efforts are being put into the restoration and recovery of the Lake St Lucia system. But this shouldn't allow us to become complacent about other degraded estuaries.

ON the BEACH and OUT to SEA

... many of us feel a profound
connection with the ocean's
haunting beauty...

The ocean is a mysterious place. For most of us, the best we can hope to see of this vast, blue watery expanse is the view we'll get when we dive under the waves for a swim. Even with our most high tech inventions, so much of the ocean remains hidden and unexplored. And yet many of us feel a profound connection with the ocean's haunting beauty, and take immeasurable pleasure from its bounty.

Out of sight shouldn't mean out of mind, however. South Africa's oceans hold a marvel of wealth: from subtropical corals, to kelp beds, to seamounts, to deep cold-water corals. From the cold, rich Atlantic to the subtropical Indian Ocean to the icy Southern Ocean, the waters off our coast are vastly diverse.

While we haven't been able to inhabit the ocean the way we have the land, we have still found ways to transform the seascape dramatically, with the extremely efficient and sometimes destructive ways we've developed to extract resources from the sea.



Unseen wealth in our **OCEAN DEPTHS**

Because we can see how hard working our land-based systems are – in terms of giving us agriculture, minerals, sewage disposal, fuel for fires, or timber for building – it would be easy to believe that this natural infrastructure has the greatest value to our economy. But this is not necessarily so.

The value of services from ocean ecosystems across the globe was a staggering US\$21 trillion in 1994, according to the journal *Nature*, almost double the value provided by land-based ecosystems at the time.

In South Africa, the value of our coastal resources is equivalent to nearly 4% of the country's gross domestic product (GDP), some R85 billion in 2011, including from fishing, coastal tourism, and ports and harbours, according to a recent study.



Safe house for spawning fish: The Garden Route's marine protected area provides a breeding ground for fish which are valued at around R33 million per year.



Photo: Peter Chadwick

Making a haul: The shoals of fish that tack back and forth in our coastal waters are immensely valuable. Each year, we haul R6 billion worth of fish out of the water – a fresh, healthy source of wild food. The fishing industry gives 27 000 jobs to people in the commercial sector, and another 28 000 households are involved in subsistence fishing.



Photo: John Yeld

Beachfront playground: More and more tourists are flocking to our beaches every year. The money they spend drives local economic growth. The beaches around Cape Town have a recreational value of between R70 and R86 million per year, according to a 2009 report by the city. Meanwhile the beaches along the Garden Route attract some R950 million worth of tourist spend annually.

A buffer against a **LESS FORGIVING CLIMATE**

One fifth of South Africa's coastline has some form of development within 100m of the shoreline. Without the buffering effects of dunes, mangroves and marshes, people and property close to the coast are directly at risk. The more coastal ecosystems are built up and paved over, the less they are able to help us cope with the sometimes unpredictable nature of the sea, like strong storms which can damage coastal property.

The carbon **SPONGE**

Mangroves, salt marshes, sea grass beds and other such habitats suck carbon out of the atmosphere and bank it away in their soggy roots and stems. They're so efficient at it, that intact coastal habitats lock away as much carbon as Japan's total greenhouse gas emissions each year (120 to 329 million tonnes).

Mapping **THE INVISIBLE**

So much of what happens out at sea is invisible to us, it's three dimensional, and it's in a perpetual state of motion. Defining the system, and tracking what goes on in it, is complicated.

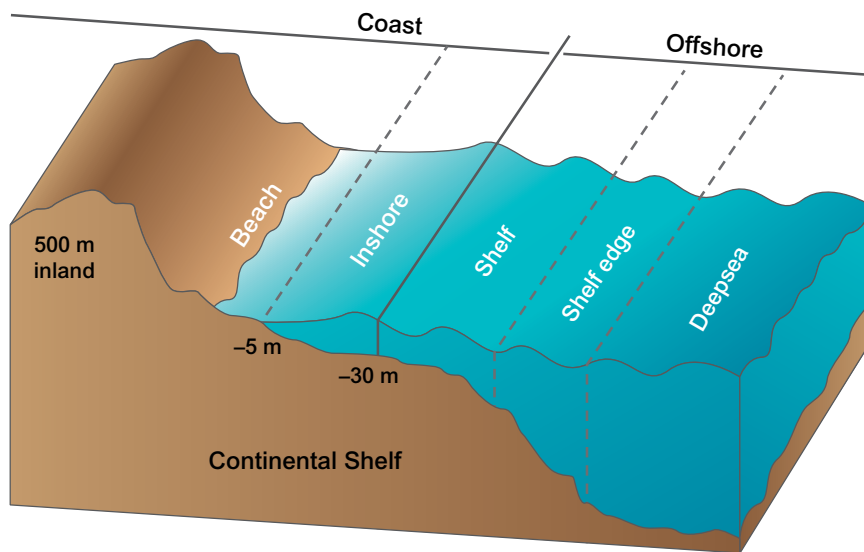
But our scientists have narrowed down South Africa's marine ecoregions to six distinct ones, found 500m inland of the tide line to 200 nautical miles out to sea. Within that, they've identified 136 different habitat types, falling within 14 distinct ecosystem groups.

Coastal and inshore

- *Coastal* habitats, from 500m inland, to a water depth of 5m where the wave action no longer has an impact.
- *Inshore* habitats from a depth of 5m to a depth of 30m.
- Key features are the substrate (rocky, sandy or muddy, for instance), and whether it's sheltered from wave action or not.

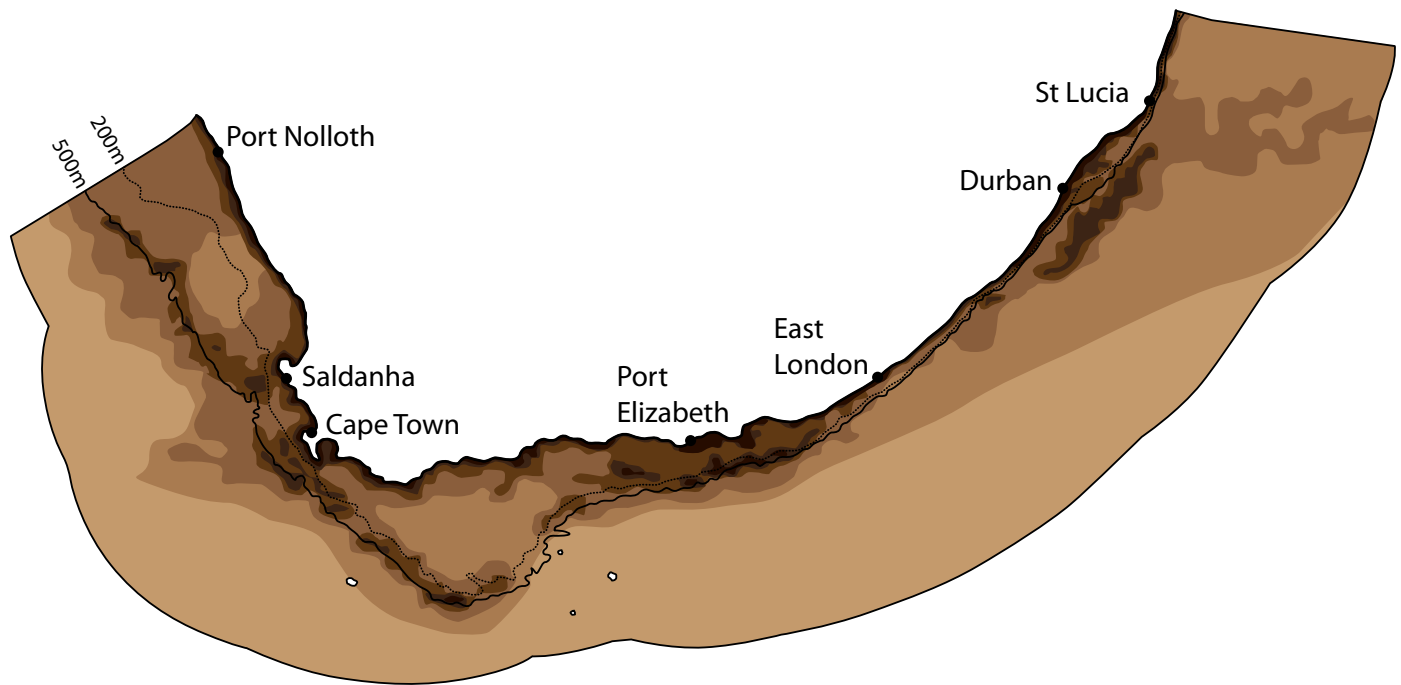
Offshore

- The sea floor, or *benthic* environment, from a depth of 30m to 200 nautical miles out to sea; key features include depth and slope of the sea floor, whether it's hard or soft, and its geology (for instance sand, mud, reef or canyon).
- The water column between the sea surface and the sea bed is the *pelagic* zone; key features are the temperature of the water at the surface, the depth of the water column, how clear or murky the water is, its productivity and so on.



From coast to sea: This diagram illustrates how the marine and coastal habitats are defined.

‘ ... we can continue to benefit enormously from the many ecosystem services that are given to us freely by our marine and coastal ecosystems ... ’



Layer upon layer: This map shows the cumulative pressures in the ocean, which are greatest along the coast and the shelf edge. These are highly productive and key fishing areas.

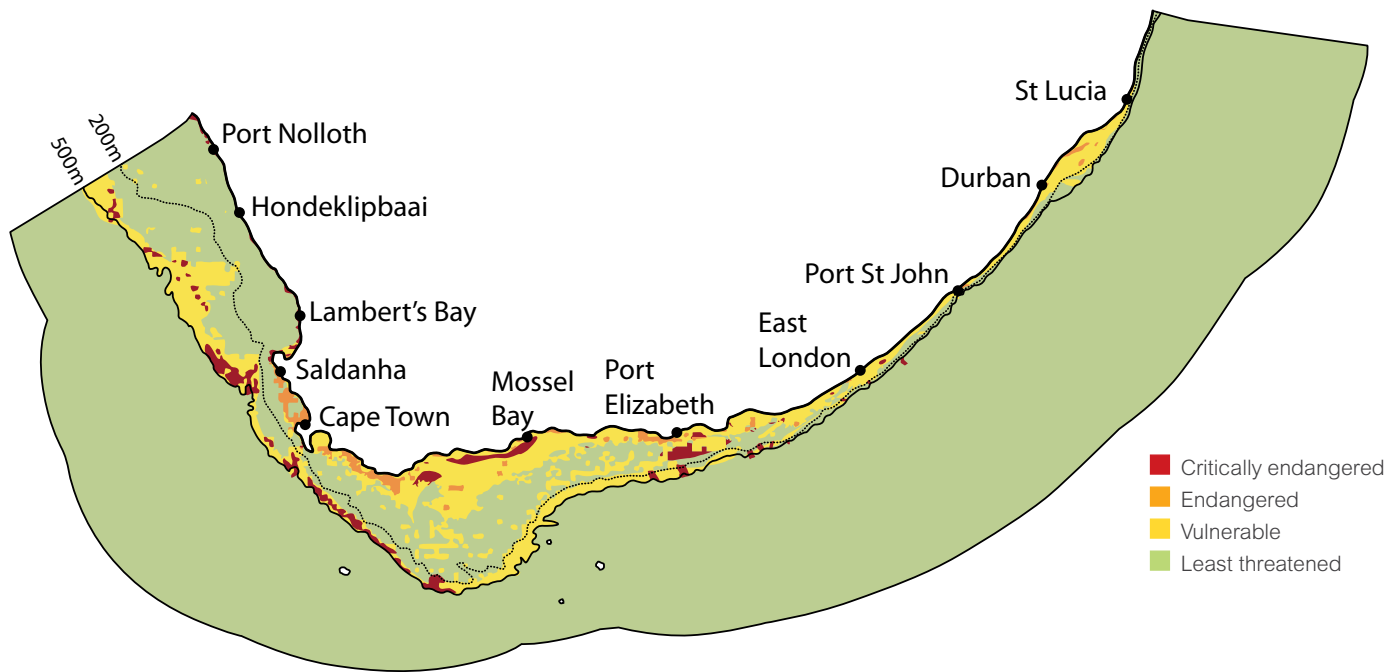
Putting on **THE PRESSURE**

On land we tend to only have to deal with one land use change happening in an area at a time, such as agriculture or mining or urban expansion. How we use our oceans is different, in that many ocean uses can be concentrated in the same place. There could be many overlapping pressures, such as several types of fishing, shipping, and mining, all in one area.

Toeing the line: fishing is the greatest stress on our marine ecosystems. This comes mainly from over-harvesting of fishing stocks; catching non-target species, or 'bycatch', such as birds, turtles, sharks and other fish species; and damage to the habitat through the fishing process (trawling of some parts of the seabed, for instance, is about as damaging and irreversible as ploughing up a grassland). Poaching is another threat to the diversity of marine life, the sustainability of resources and the livelihoods of legitimate fishers.

Paving over our coastlines: coastal development is the greatest pressure on our coastal systems. Healthy coastal systems protect us from large waves which roll ashore during extreme storms; their dunes are a key sand reserve to maintain our beaches; these habitats filter water and recycle nutrients; and they have huge tourism and recreational value. Putting up hard surfaces and buildings along coastlines undermines a system's ability to provide these services.

Other key pressures: other serious pressures come from invasive alien species like the Mediterranean mussel; mining off the coast for diamonds, oil or gas, or dune mining for heavy metals and phosphate; shipping, which can introduce invasive alien species or oil pollution; agricultural, industrial or municipal pollution from rivers washing out to sea; and over abstraction from rivers pinches off fresh water flowing out to sea, with associated changes in nutrient and sediment deposits.



Threats to our beaches and seas: This map of ecosystem threat status for coastal, inshore and offshore benthic habitat types illustrates how coastal and inshore habitats tend to be more impacted than offshore areas because they're easier for us to reach. Since these key threatened habitats are concentrated in small areas, it means that 70% of our total marine and coastal area is not as severely threatened.

Making the good **EVEN BETTER**

Good news! While these pressures are serious, we can continue to benefit enormously from the many ecosystem services that are given to us freely by our marine and coastal ecosystems. There's plenty of opportunity to manage, protect and restore most marine and coastal habitat types.

Large areas of the marine and coastal environment are in good shape, according to the threat status analysis. Since the coast and inshore areas are more accessible to us, they're usually more impacted than offshore areas. Similarly the cumulative impacts of up-stream activities concentrate themselves in these habitats.

The most threatened coastal and inshore habitats tend to be rocky zones, like reefs and rocky shores, because of fishing, invasive species and climate change. KwaZulu-Natal and the Western Cape tend to have the most coastal development; while the Namaqualand and south-western Cape have many threatened habitats.

‘ ... the coast and inshore areas are usually more impacted than offshore areas ... ’

Further out to sea, the most threatened habitats are in the Southern Benguela and Agulhas ecoregions (especially the shelf edge, which is highly productive for fishing), and hard grounds such as reefs and canyons.

An integrated approach to managing the coastal environment is critical to keeping these spaces healthy:

- The boundaries of coastal protection zones and coastal public property need to be refined to account for ecological factors.
- Priority coastal ecosystems that should be kept natural need to be identified, in order to guide decisions about where best to locate future coastal development.

HOW MUCH is protected?

The marine protected area (MPA) is the legal mechanism that best protects ocean and coastal ecosystems and is key to keeping both the ecosystems and the fisheries safe.

'No fishing, please!': providing for 'no-take zones' in MPAs allows for a greater level of protection for some areas. Without this, MPAs can actually become a focal point for recreational, subsistence or even commercial fishing.

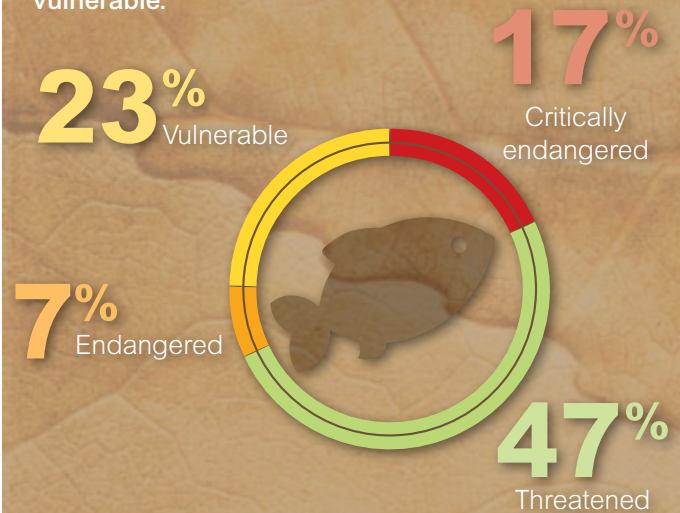
Along the coast: so far, nearly a quarter of South Africa's 3 100km of coastline (23% in all) falls in a MPA, but only 9% gets 'no-take' protection. The Namaqua coast is currently completely unprotected.

Two new safe spaces: Still Bay and the Amatole Marine Protected Areas, both in the Agulhas bioregion, are two new stretches of coastline to get special protection in recent years.

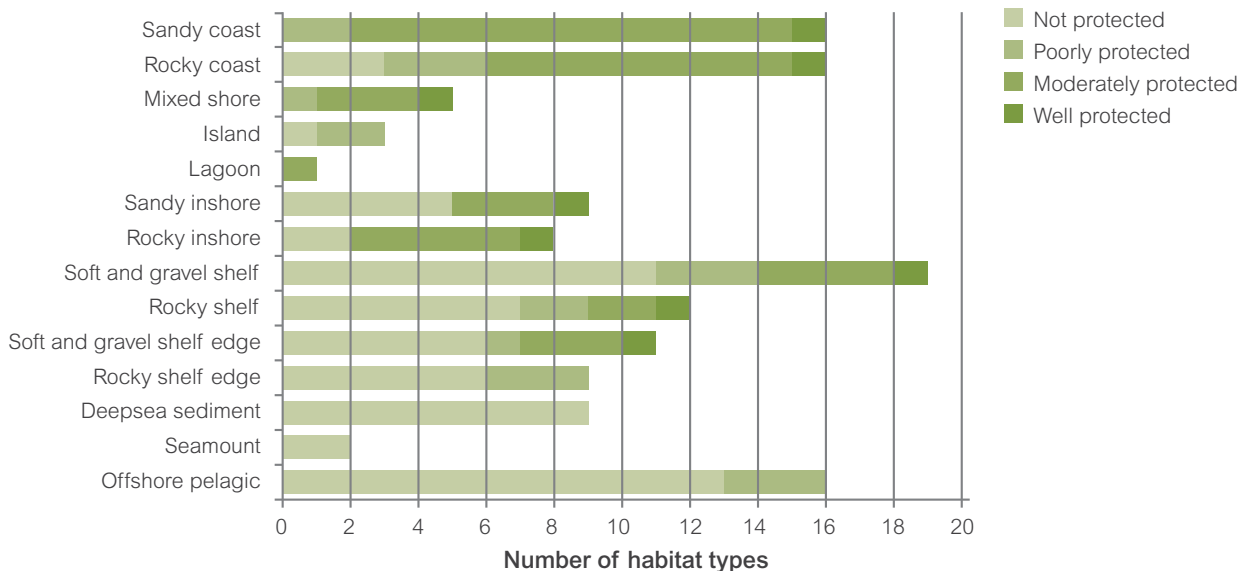
Lost at sea: ecosystems further out to sea – offshore – are the most poorly protected of all our ecosystems yet these are the lifeblood of healthy and productive fisheries. So far, only a negligible 1% of the offshore environment is protected, showing the urgent need for MPAs that extend further out to sea. The state is the only entity controlling access to our oceans, for fishing or mining rights.

on the **SIDE**

Of South Africa's 136 marine and coastal habitat types, 17% are critically endangered, 47% are threatened, 7% are endangered and 23% are vulnerable.



Zooming in on the greatest need: scientists can now pinpoint habitat types that need greater protection. They have identified ten specific focus areas for offshore protection that will protect a representative spread of marine habitats and contribute to sustainable fisheries.



Protecting our beaches and seas: This graph shows how protected our marine and coastal ecosystems are. Of all the marine and coastal ecosystem types, two groups in the offshore environment are completely unprotected, namely deep sea sediments and seamounts. And no habitat types beyond the shelf edge are well protected.



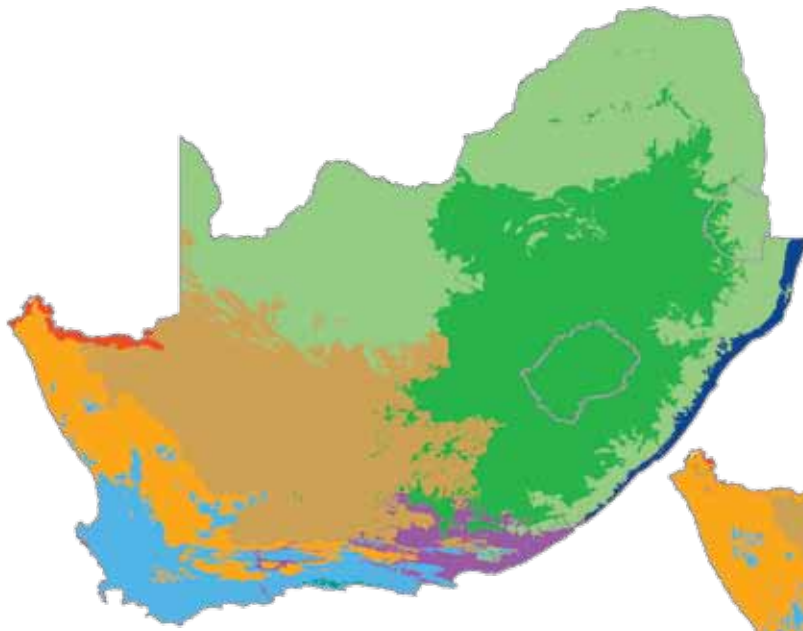
THE CLIMATE COMPLEX

Ecosystems that are healthy can buffer against environmental shocks ...

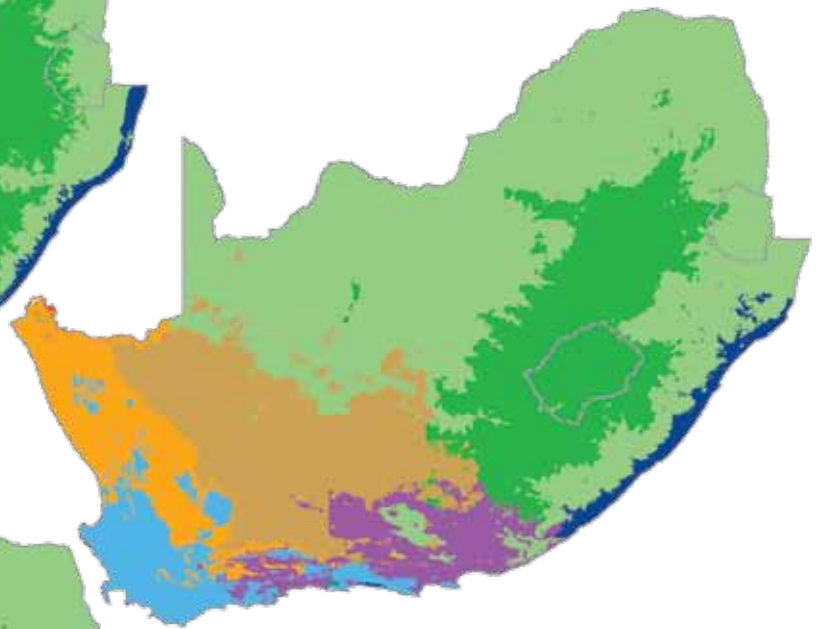
Leaving healthy ecosystems to do what they do naturally might be one of the easiest and most cost effective ways to help South Africa cope with climate change.

Ecosystems that are healthy and intact can help buffer against the kinds of environmental shocks that we'll have to live with in a warmer world: larger and more frequent floods, heat waves, droughts, storms, and veld fires. Healthy vegetation in and around wetlands, for instance, helps slow and disperse flood waters, reduce soil erosion and improve water quality. Coastal dunes, kelp beds and salt water marshes diffuse the impact of strong seas and storm surges, protecting coastal buildings and infrastructure.

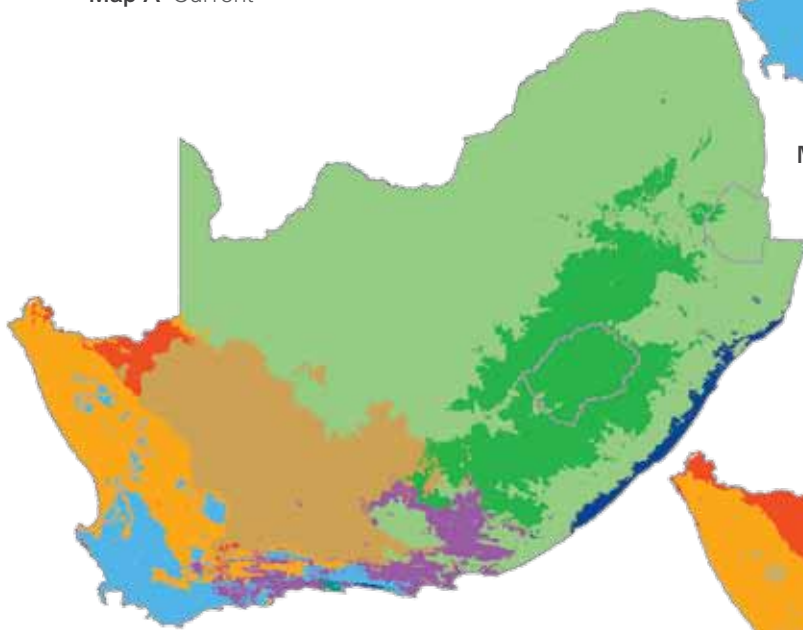
An ecosystem-based approach to preparing for climate change can pay huge dividends for society and the economy as a whole.



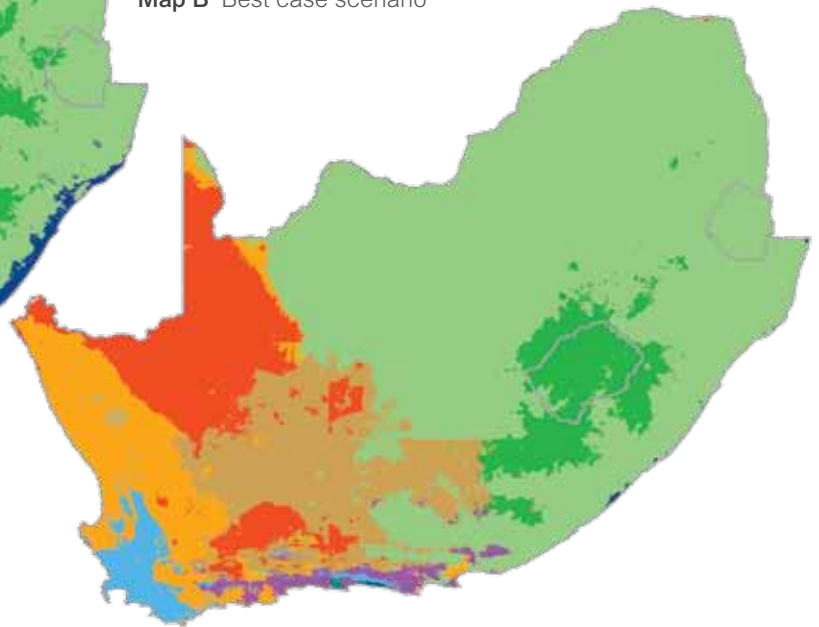
Map A Current



Map B Best case scenario



Map C Intermediate scenario



Map D Worst case scenario

Today: Map A illustrates the footprint of our biomes now. **Beyond tomorrow:** Climate change will redraw the map of South Africa: the worst case scenario (Map D) is that by 2050 the climate 'envelopes' which shape our existing biomes will have moved or changed substantially. This is according to scientists who have worked out computer models which try to paint possible scenarios of the future of our country in a warming climate. It's difficult to predict how ecosystems and species will respond and what kinds of communities of plants and animals we'll find in their place 50 or 100 years from now.

Our CHANGING LANDS

The clusters of vegetation and habitat which form our country's biomes are moulded into shape by each region's unique 'climate envelope': the range and pattern of temperatures, the amount of rain and how it falls, for instance.

By 2050, South Africa will probably warm by around 1°C to 2°C along the coast, and by around 2°C to 3°C in the interior of the country. By 2100, this warming could be as much as an average 3°C to 4°C along the coast, and 6°C to 7°C in the interior.

The west of the country will become hotter and drier; the east, hotter and wetter.

Rising temperatures will push the country's long-term weather trends into a less predictable and more variable state, the region will experience more severe and more frequent extreme weather events such as droughts, floods, heat waves and storms. Sea-level rise will negatively impact on the coast and coastal infrastructure.

The climate envelopes which shape our biomes will change, but change will happen too fast for most species to adapt in time. This will amplify the stress caused by other pressures on the natural environment, such as invasive alien species, loss or fragmentation of natural habitat, resource extraction and pollution. Working together, all of these pressures will have a serious impact on the healthy functioning of our ecosystems and the species living in them.

We cannot say for sure how rising temperatures and changing rainfall patterns will alter our existing biomes, but using climate models, our scientists can show some best or worst case scenarios of what we might expect in the coming decades:

Grassland: seems most at risk; models say its climate envelope might shrink significantly; as things get hotter, the climate conditions for this biome will remain only at higher altitudes.

Nama-Karoo: if temperatures rise only moderately, then large areas might begin to look like what we know today as arid Savanna; in the worst case scenario, it might become outright Desert.

Indian Ocean Coastal Belt: best case scenario sees the warm moist conditions for this biome expanding inland and south along the coast; but as things tip towards the worst case scenario, and conditions dry, the climate here will be more suited to Savanna.

Succulent Karoo: possibly the most stable biome in the medium term; but significant impacts might be seen towards the end of the century.

Fynbos: the core south-western Fynbos is most stable, while the climate in the eastern and northern reaches of Fynbos may resemble that of the Succulent Karoo or Albany Thicket.

Albany Thicket: remains fairly stable; in the worst-case scenario climate conditions may begin to resemble those of the Nama-Karoo and Savanna.

Desert: likely to expand, particularly into the Nama-Karoo envelope.

Forest: hard to say; but water shortages and fires could threaten pockets of Forest.

Savanna: the climate envelope will expand to the benefit of specific species, but the overall habitat and groups of species may still suffer.

COPING WITH CHANGE, building our resilience

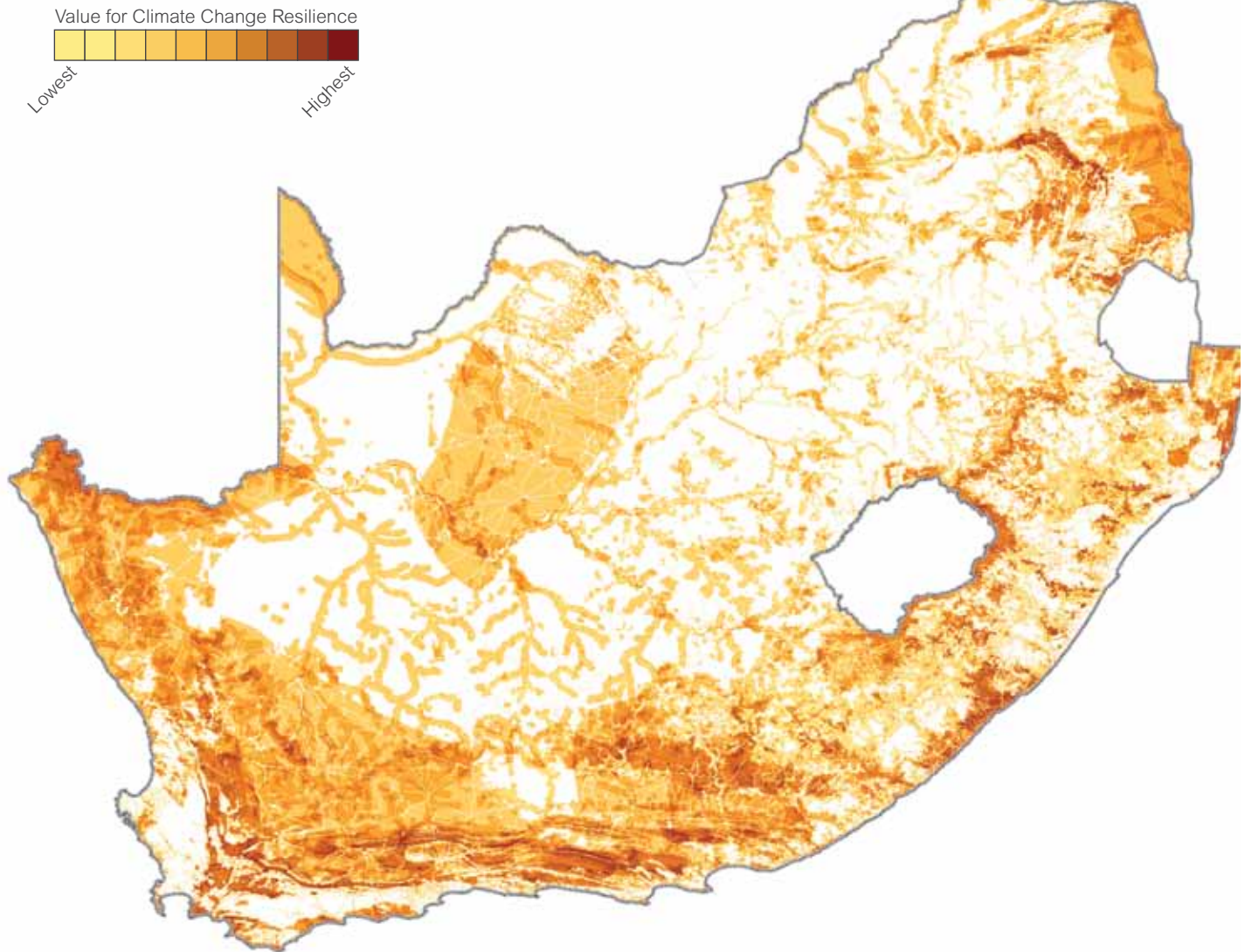
A 'resilient' biome, landscape or ecosystem is one that can absorb change and re-organise itself in a way that means it won't lose character, or how it functions as an ecological unit.

Scientists have identified areas where biomes are most at risk due to climate change, and areas where biomes are more likely to be able to hold out against the pressures of climate change and thus remain relatively stable.

Scientists have also identified features in the landscape that are likely to help build resilience for biodiversity in an area, which in turn helps to maintain stable landscapes for people living there:

- river corridors and buffers of natural vegetation along rivers,

- corridors of natural vegetation along the coast,
- areas that incorporate temperature, rainfall and altitude gradients,
- areas with a high proportion of plant species that are unique to that place,
- south-facing slopes and kloofs that can give refuge for species needing to move away from hotter, more exposed aspects of the surrounding landscapes,
- habitats that haven't been carved up and fragmented into small islands in a sea of urban sprawl or cultivated lands.



Places of resilience: Decision makers now have a single map which draws together information on nature's resilience-building scaffolding, which can then be prioritised for management and conservation purposes. These areas need to be considered in land-use planning, environmental impact assessments, protected area expansion, and working with industry sectors to minimise their spatial footprint and other impacts.

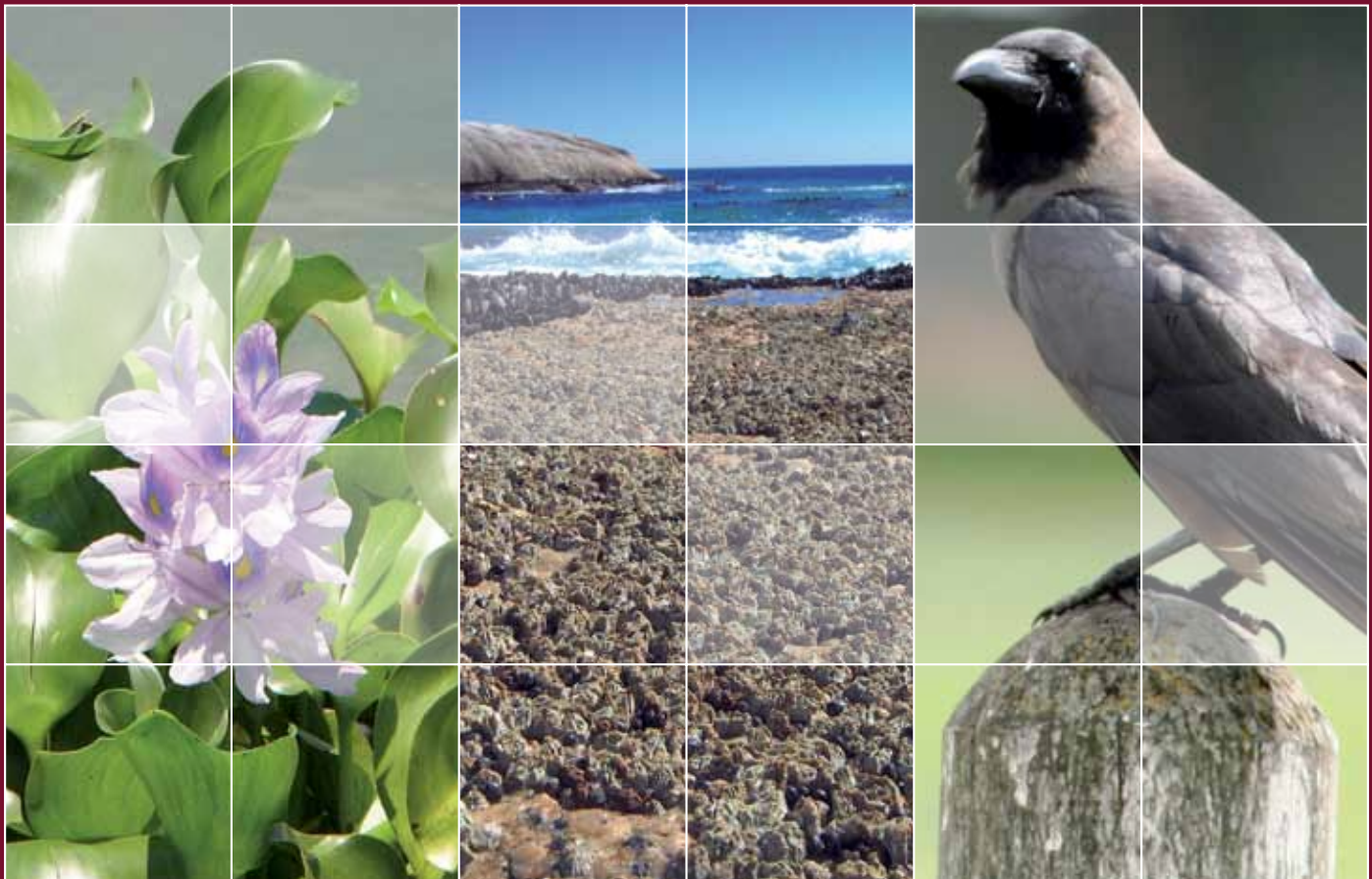
IN the **FACE** of **INVASION**

**... what makes this unique
problem so dangerous is
that it self-replicates.**

South Africa has a form of environmental decay that drains away an estimated R6.5 billion worth of services that the ecosystem should provide to the country's economy each year. And what makes this unique problem so dangerous is that it self-replicates. It breeds, and grows, and spreads.

We're talking about invasive alien species.

Over the past 350 years, many different kinds of plants, animals, and disease organisms have found their way into South Africa from abroad. Some were introduced intentionally, to beautify gardens, as pets, or for recreation (trout fishing, for instance). Some were brought in to modernise agriculture or for aqua- or mariculture. Some were brought in to bind sand dunes or for timber or biofuels. Others have slipped into the country unbeknownst to us at first, stowing away in the ballast water in ships, or clinging to ship hulls, or hidden away in agricultural products or freight.



Some of these species have found conditions in South Africa so comfortable that they have spread out of control, threatening the natural habitats they move into, and the species living there. The social and economic impacts are clear and measurable: they threaten our water security, reduce productivity of rangelands, increase fire risk, and can impact on crop agriculture. The more modern transportation allows us to travel around the globe – by air, road, or ship – the more potential pathways we open up for new invasive species to find their way to our shores.

DEFINING the problem

An invasive alien species is a species that:

- has been introduced into an area outside of its natural range, by intentional or unintentional human action, and
- once established in the new habitat, has spread in such a way that it threatens ecosystems, habitats or species with environmental or economic harm.



on the SIDE

At least 660 invasive alien plant species have been counted in South Africa, six types of mammal, and ten birds. At very least, there are six invasive reptile species, 22 freshwater fish, 26 molluscs, seven crustaceans, and more than 70 invertebrate species.

660

plant
species

6

mammals

10

birds

6

reptiles

22

fresh water fish

26

molluscs

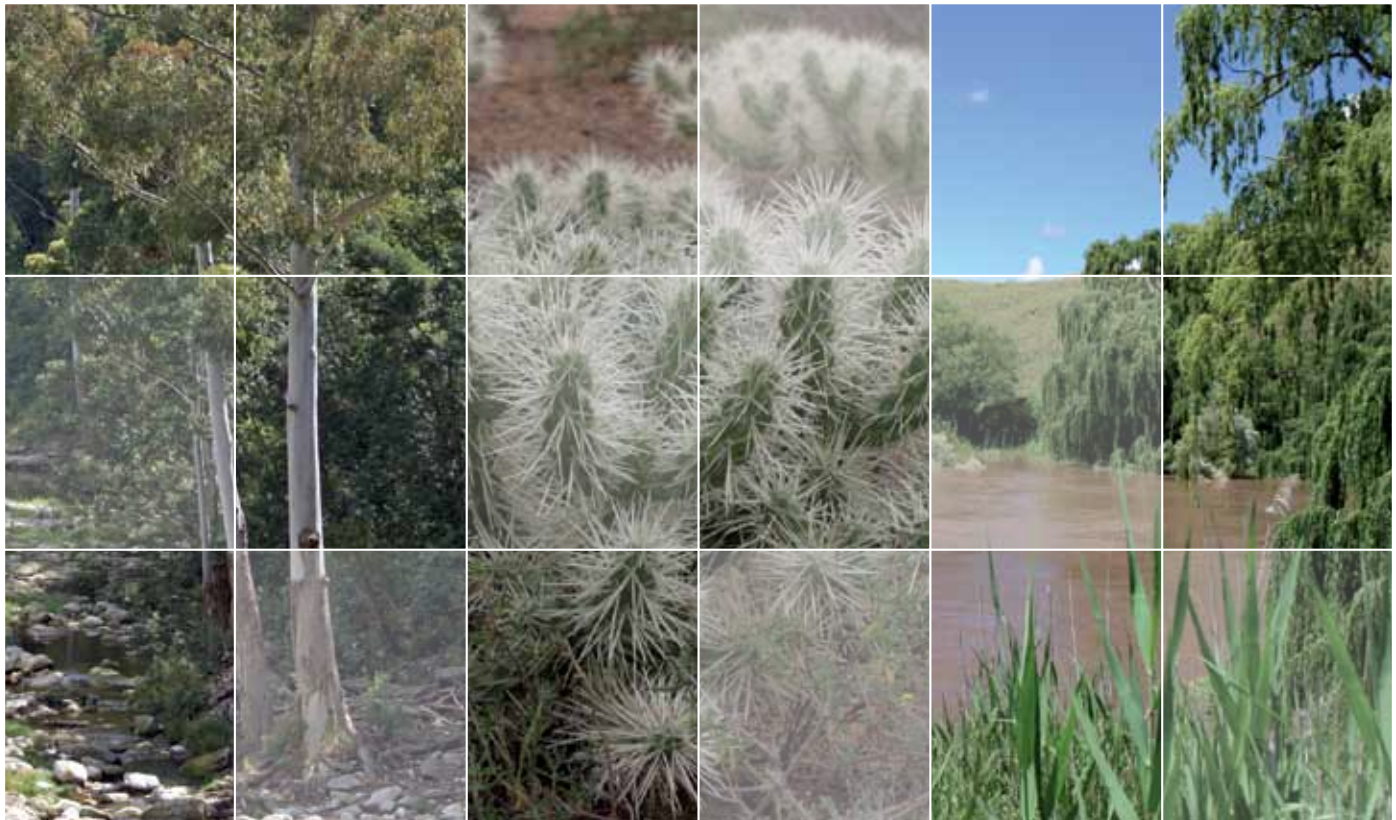
7

crustaceans

more than

70

invertebrate
species



THE WORST offenders

The most widely studied group of alien invaders are woody plants, partly because of the threat they pose to our water supplies which makes them a priority concern.

By 2010, these plants had spread over 16% of South Africa's land area – some 20 million hectares – which is dramatically greater than the estimated footprint from 15 years earlier.

The big guns of the invaders are the Australian wattles, gums, prickly pears, pines, poplars, weeping willows and mesquite.

COUNTING THE COST of invasions

The unquenchable thirst: some of the main invaders threaten our water security. By sucking up large amounts of water, they reduce how much water reaches the rivers, the impact of which ripples through the entire fresh water system. South Africa loses about 7% of its runoff every year (over 3 billion cubic meters, equivalent to 18 large

dams) in this way. Left unchecked, we would eventually lose nearly 60% of our runoff annually to invaders. The Grasslands would be hardest hit, which are home to the country's economic engine room.

A bitter taste in the mouth: some invaders out-compete fodder plants, which reduces farm grazing. Some species may even kill or poison livestock. If allowed to spread, these invaders could reduce the carrying capacity for large grazing animals by more than two thirds.

Blazing away: invasive trees and grasses increase the amount of fuel for fires, making them burn hotter and faster than fires in indigenous vegetation. This damages soil, leading to erosion. The increased risk to life and property can push up insurance premiums.

The pest problem: many agricultural pests are invasive species. Controlling them with pesticides increases the cost of agricultural production. Attempts by other countries to quarantine invaders can limit export opportunities for South African farmers.

The 'bush of evil': before it was cleared in 2005, a council-owned site in Delft, Cape Town, became a notorious haven for criminals because of dense invasion of Port Jackson trees where many rapes and murders took place.

MAKING THE BEST of a bad situation



In the mid-1990s, a groundbreaking concept was born: tackle the country's rampant and water-greedy invasive alien plant problem, at the same time as tackling unemployment. Since then, the success of the Working for Water programme has become globally recognised.

It uses labour-intensive methods to clear invasive woody plants, which means it provides many jobs – over 130 000 person-years of employment since the programme began – and alleviating poverty while making inroads into reclaiming the scarce water resources these species have plundered. Productive land and biodiversity have been restored in places where these plants have been cleared.

If we hadn't put measures in place to stop the spread of these species, the cost to the economy would have been about six times higher than the current R6.5 billion drain every year on the economy's ecosystem services.

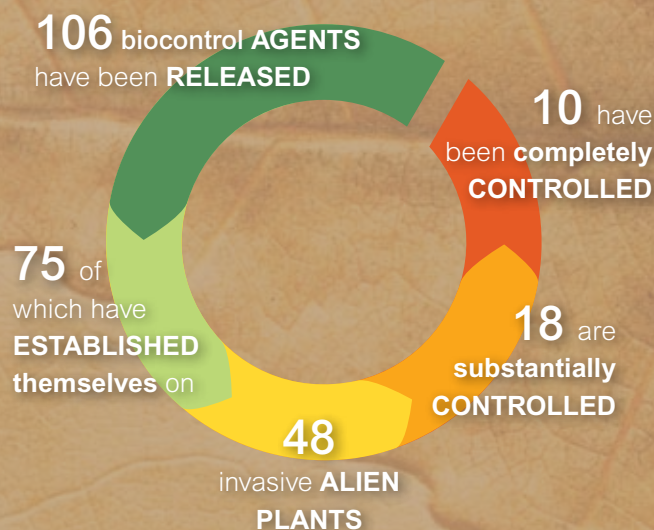
At the moment, about R700 million is spent every year by Working for Water, but this investment in reclaiming our lost ecosystem services needs a great deal more money – an average of R1.4 billion a year, for the next 25 years. That amounts to R36 billion in total.

SETTING A THIEF to catch a thief

One way to thwart the spread of invader plants is to find a natural enemy in the species' home environment that is host-specific (meaning it's unlikely to move onto other species and cause damage), and set it loose amongst the invading colony here in South Africa. For instance, a plant-feeding insect or a fungus can be used to reduce an invading community's seed production or vitality.

on the **SIDE**

Since the first 'biocontrol' agent was introduced in South Africa (the cochineal insect was used against prickly pears), a total of:



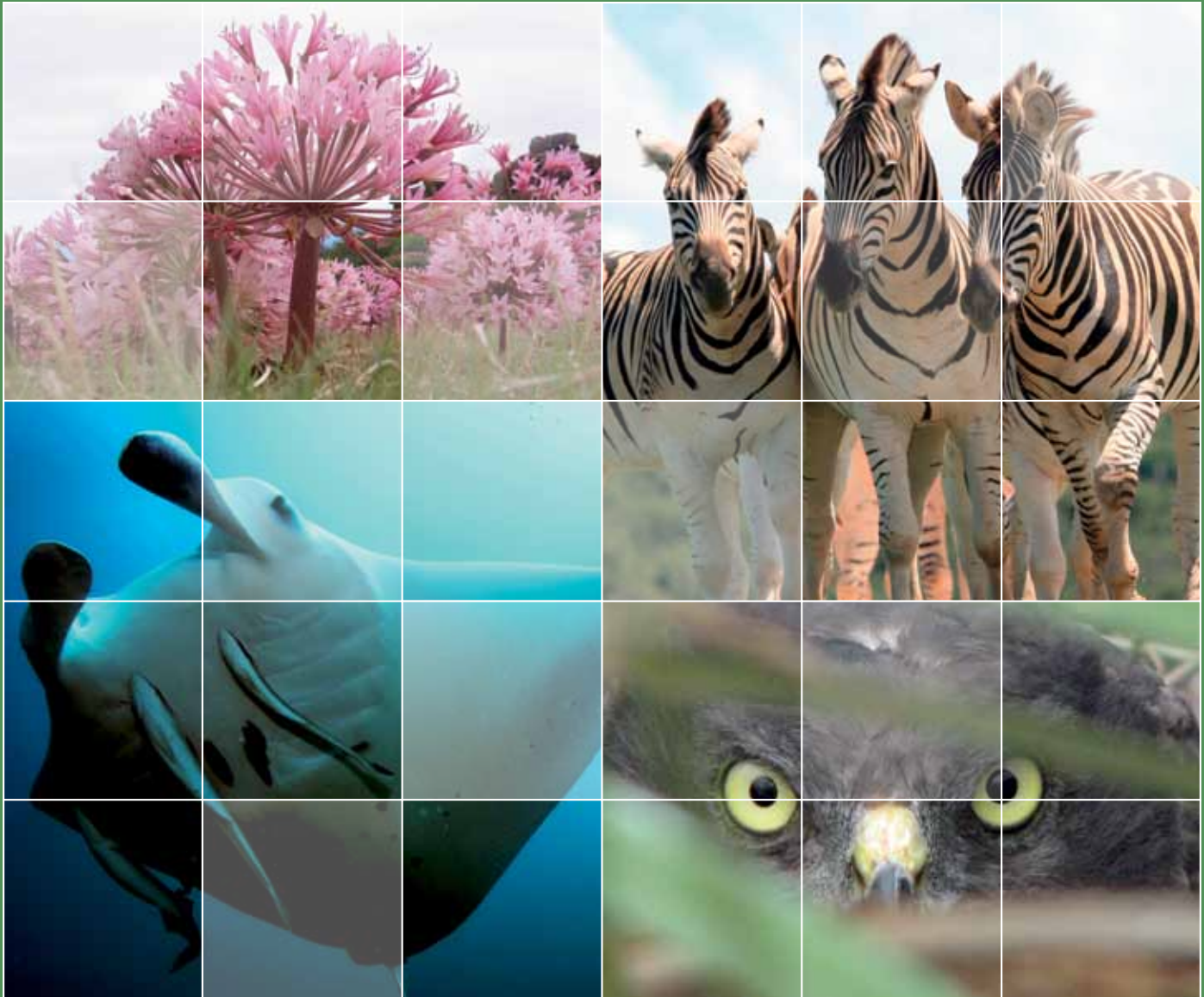
Scientists here have a solid track record in the use of such biological control methods on invasive alien plants, an approach which can be more cost effective than mechanical clearing.

PREVENTION is better than cure

The aim of Working for Water's Early Detection and Rapid Response programme is to identify potentially invasive plants that are beginning to establish themselves here, and get rid of them quickly before they become widely established.

A globally-recognised best practice approach is:

- first, prevent new species arriving in the country,
- second, if they're here, eradicate early on,
- third, if they're beyond eradication, at least contain their spread,
- fourth, if they're widespread, then try to manage, restore and protect highly valued ecological assets in the area of the invasion.



NATURE'S GEMS

...more are being discovered
all the time.

We started this book by thinking of the natural environment as if it were the engine of a car which we must keep serviced and well maintained. But keeping the metaphorical engine ticking over means making sure that its constituent parts are in good working order.

At last count, South Africa had about 95 000 individual species, each of which contributes to the healthy working of the whole engine of life in this country. And more are being discovered all the time. Some of these species are especially important for ecological, economic or cultural reasons, which is why they're highlighted here.

The MEDICINE CHEST

Wild ginger or 'Natal' ginger (*Siphonochilus aethiopicus*) is a violet flowered plant which, just like the everyday ginger we use in the kitchen for cooking, grows from a rhizome root. Unlike its close cousin, though, we don't farm this ginger but collect it from the wild. Because of the plant's popularity as a natural remedy for everything from menstrual cramps or asthma, to preventing horse sickness in horses, it has been collected so extensively that it is extinct in KwaZulu-Natal, and is on the brink in Mpumalanga. Today it is listed as Critically Endangered according to the Red List of South African Plants. This is just one of the 2 000-odd different plant species which South Africans use for medicinal reasons, most of which come from our Grasslands, Forests and Savannas.



A bit of spice: The pepper-bark tree (*Warburgia salutaris*) is available in tablet form in many health shops, and is used to treat chest infections, and other yeast, fungal and bacterial infections. The treatment is made from the tree's bark. This species is classified as Endangered on the Red List of South African Plants.

In 2007, some R2.9 billion changed hands through the harvesting, trade and manufacture of these natural remedies, as well as through associated industries (such as consultation with traditional healers). And just like with wild ginger, the heavy demand for medicinal plants means some of these species are edging perilously close to extinction.

Nearly 10% of all the plant species that are bought and sold for medicinal purposes are threatened, some 56 species in all. Without urgent action to protect them, our children will not inherit these precious heirlooms from us. Ecologists recommend urgent action to prevent the further loss of these valuable threatened species, as well as research and monitoring of all medicinal plants, including non-threatened species, so that we can ensure they are harvested sustainably and don't also find themselves on the threatened list.

From the SEA

There's a message of hope from the deep water hake fisheries, where fish stocks seem to be recovering slowly after careful management decisions were made to monitor fish numbers, reduce quotas and limit the quantity of fish being pulled up from the deep sea.

We need to strengthen our long tradition of managing the country's fishing stocks using good science to support appropriate policy if we're to continue benefiting from the 630 ocean species which our commercial, subsistence and recreational fisheries depend on. Of the 40 species whose stock status has been assessed, 25 are over-exploited, collapsed or threatened.

To arrest this decline, we need to:

Fish within limits: ensure that fishing quotas are drawn up using accurate scientific information which reflects the real parameters of our fish stocks.

Create safe spaces: protect important spawning, nursery and foraging areas.

Hone in on the targets: the wasteful catching of non-target species, by-catch, needs to be reduced.

Consider the whole food chain: management of fisheries needs to allow for the needs of competing species and predators.

Go for the green label: eco-certification is a way to get the whole food value chain to push for responsible fishing practices.

On the RED LIST

The terrible escalation in the rate of poaching of the country's rhinos in recent years puts a spotlight on those individual species that are edging perilously close to extinction because of the pressure brought to bear on them for various reasons.



Rapid decline: A sudden rush for rhino horn in Southeast Asia since 2008 has sparked an increase in poaching which threatens to reverse the gains made in conservation efforts of this flagship species in recent decades. Since southern white rhino numbers were at an all-time low at the end of the 1800s, with just 20 to 50 animals left, its numbers grew to nearly 19 000 in 2010. However, in 2012 alone, over 650 rhinos were killed for their horns.

the RED LIST

South Africa is a world leader in the Red Listing process which is an internationally recognised method for assessing the threat status of individual species, based on their likelihood of extinction. As a result of pressures such as natural habitat loss and invasive alien species, the Red Listing process shows that:



ONE in **five** of our **inland MAMMAL** species is **THREATENED**

ONE in **five** **freshwater FISH** species is **THREATENED**



ONE in **seven** **FROG** species is **THREATENED**

ONE in **seven** **BIRD** species is **THREATENED**



ONE in **eight** **PLANT** species is **THREATENED**

ONE in **twelve** **REPTILES** is **THREATENED**



ONE in **twelve** **butterfly** species is **THREATENED**

on the **SIDE**

Red alert: The Red List system of the International Union for Conservation of Nature, the IUCN, is a way of measuring the likelihood of a species becoming extinct in the wild, meaning that there are no more living examples of that species in their natural wild spaces. South Africa's scientific community uses this listing system.

Threatened species are those facing a high risk of extinction in the near future, and are categorised as:

- Critically endangered
- Endangered
- Vulnerable

Other species of concern are categorised as:

- Extinct
- Extinct in the wild
- Near threatened
- Data deficient (meaning there is not enough information to make an assessment)
- Rare or Critically rare (these are South Africa-specific categories)

Read more about this at www.sanbi.org.za (look for 'threatened species programme') or on www.iucnredlist.org.



Primeval beauty: This is the last known wild specimen of the Vanda cycad. Cycads have been around since the dinosaurs, but their unusual dawn-of-time beauty and their rarity has created a collectors' industry that often leads to poaching of these slow-growing plants. South Africa has an unusually high number of cycad species, 38 of the world's 308 species. But two thirds of these are threatened with extinction, while a third are critically endangered, according to the Red List.

EYES AND EARS on the ground

Citizen scientists play a huge role in helping us track the status of our many species. Nature enthusiasts like bird watchers and butterfly collectors gather information on different species which help build atlases of species distribution and virtual museums.

As a country, we need to put money and effort into keeping species assessments up to date, making the Red Lists available online, and drawing up a national Red List Index to follow trends in the conservation status of species over time. Volunteers and amateurs on the ground can continue to be an important part of this process.



Swimming our rivers: A staggering one in five freshwater fish in South Africa is threatened with extinction, making this our most threatened group of animals. Predatory invasive alien fish like trout and bass are one of the main reasons species like this Barrydale redbfin is critically endangered.

See <http://redlist.sanbi.org> for more information.

Knowing which habitats are most threatened, or least protected, can help channel efforts and resources so we get the biggest bang for our conservation buck, and can help us make optimal decisions about how to use land and natural resources. An important tool to help with this sort of high-level thinking is spatial biodiversity planning, which brings together the best available science to produce maps of priority areas that relate directly to policy and legislative tools.

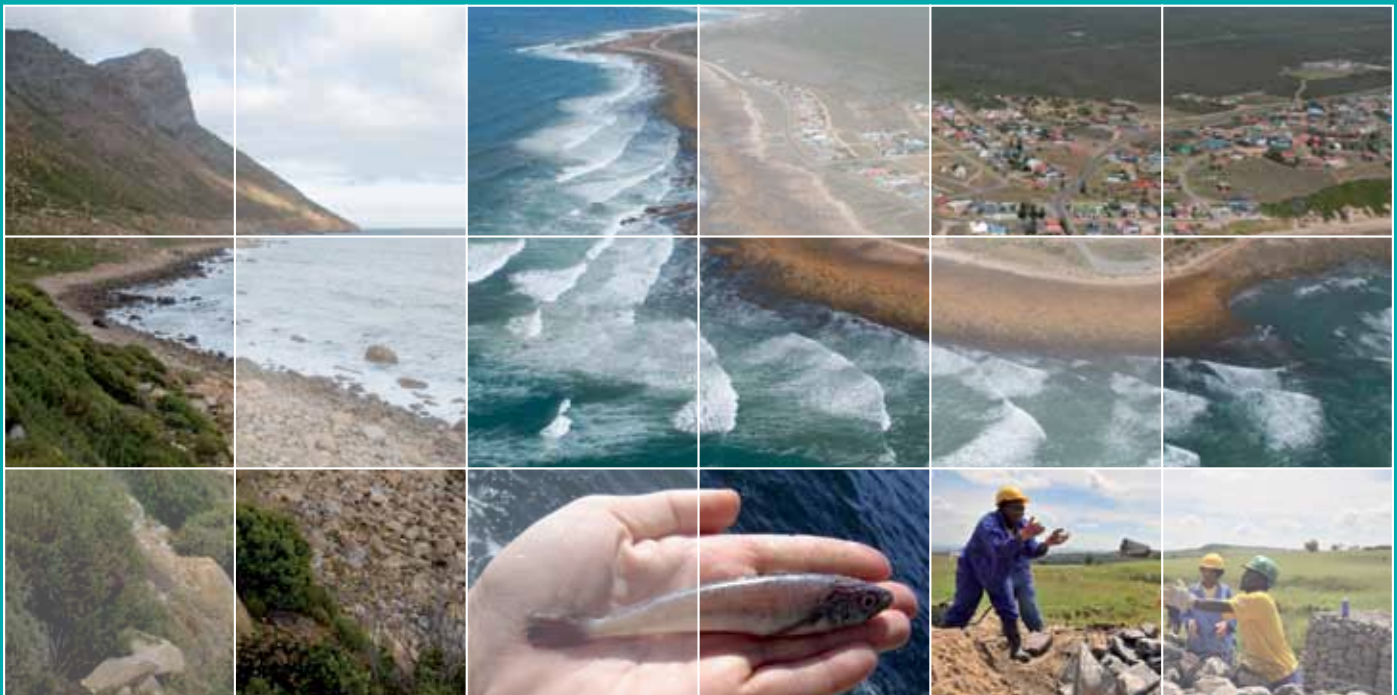
SMART MAPS

“An important tool to help with this sort of high-level thinking is spatial biodiversity planning...”

Spatial biodiversity planning helps planners identify the most important areas for conserving a representative spread of ecosystems and species, for maintaining ecological processes, and for providing ecosystem services.

These priority areas have been clearly mapped and categorised. For example, critically endangered and endangered ecosystems, critical biodiversity areas, ecological support areas, freshwater ecosystem priority areas, and high water run-off areas.

Coastal and marine ecosystem priority areas are the missing piece of the puzzle, though, and still need to be identified. Development of a national coastal biodiversity plan is an urgent priority.



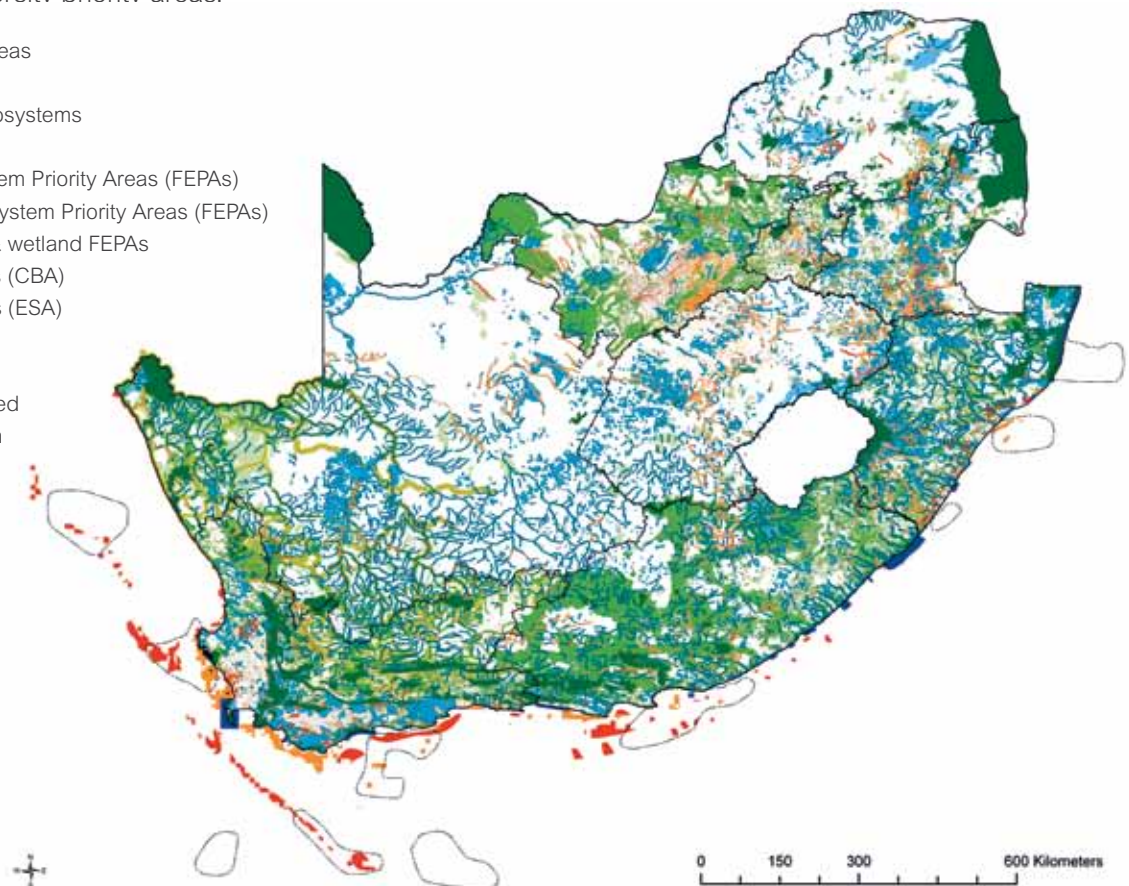
A CALL to action, in three parts

This three-way action plan, used together with maps of biodiversity priority areas, will help prioritise the often limited resources available for managing and conserving our precious terrestrial and aquatic environments.

Stem the loss: actions must focus on preventing loss and degradation of natural habitat in biodiversity priority areas that are still healthy, working well and in good ecological condition.

Throw the protective net wider: actions must focus on consolidating and expanding the protected area network. Existing protected areas must become more effective. A two-pronged approach can achieve this: expanding state-owned protected areas; and partnerships between the state and private or communal landowners whose land falls within biodiversity priority areas.

- Land-based protected areas
- Marine protected areas
- Critically endangered ecosystems
- Endangered ecosystems
- River Freshwater Ecosystem Priority Areas (FEPAs)
- Wetland Freshwater Ecosystem Priority Areas (FEPAs)
- 1km Buffer around river & wetland FEPAs
- Critical Biodiversity Areas (CBA)
- Ecological Support Areas (ESA)
- Priority estuaries
- High water yield areas
- Focus areas for land-based protected area expansion
- Focus areas for offshore protection

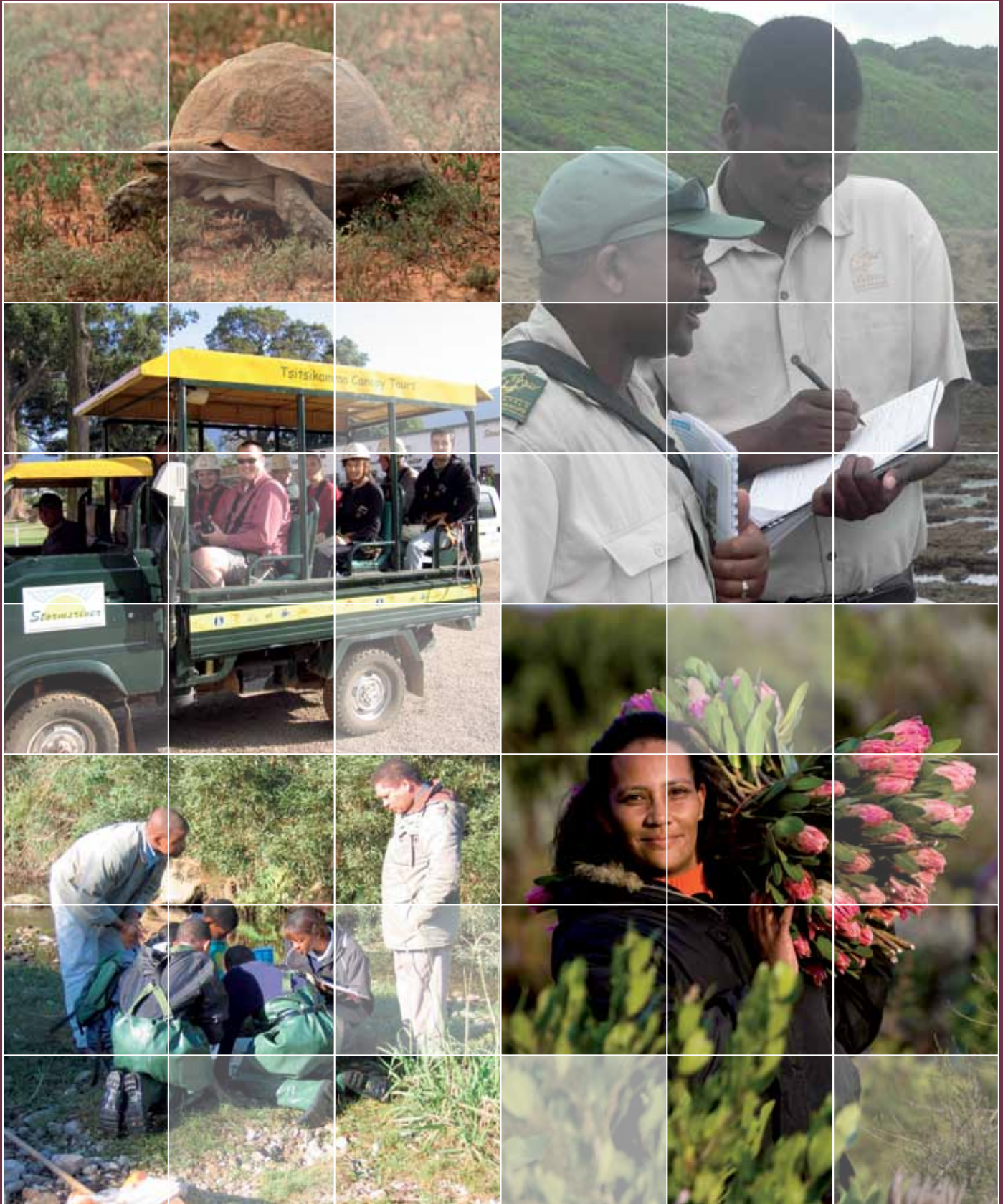


Smart planning: Biodiversity priority areas are grouped into different categories. These aren't mutually exclusive and in many cases overlap. Where categories overlap, it emphasises the significance of an area in terms of its biodiversity and the need to keep that area in good ecological condition.

on the SIDE

Most of the maps, spatial data and reports for these biodiversity priority areas are freely available to the public, and can be found on SANBI's Biodiversity GIS website (<http://bgis.sanbi.org>). These are an excellent biodiversity information resource to assist with development planning and decision-making.

Restore the damaged infrastructure: actions must focus on active interventions required to restore those biodiversity priority areas that are currently not in good ecological condition, in order to enhance ecological infrastructure and support delivery of ecosystem services.



Filling the GAPS

ZOOMING IN on the individual

What's the difference between a blue wildebeest and a black wildebeest? Both are from the same family as, say, the domestic cow, namely the cloven-hoofed, ruminating 'bovid'. And the two wildebeest are so closely related that they look almost identical. The blue is more common, has an almost brindled pattern on its neck and shoulders, a black tail and light 'beard'. The black is extremely rare, doesn't have any shoulder markings, has a white tail and a black 'beard'.

The discipline of identifying and classifying species – be they big mammals, little butterflies or succulent plants in the Karoo – is known as 'taxonomy' and we have a huge shortage of scientists who are trained in this area, and many gaps in knowledge still to be filled.

‘ We need many more scientists who are trained in a number of different disciplines in the natural sciences, so that the country can continue to produce world-class biodiversity science ... ’

STEPPING BACK to get the big picture

The discipline of mapping and classifying ecosystems is essential for monitoring, assessing and managing biodiversity, and yet this field is even less well-developed than the arena of taxonomy.

Having skills like this within different spheres of society – in government, in non-governmental organisations (NGOs), and in the academic community – is imperative to us



being able to draw up the kind of national assessment of biodiversity, and its various recommendations, that are presented in this book.

STAYING AHEAD of the pack

South Africa is a world leader in terms of ecosystem mapping and classification. Our emerging national ecosystem classification system needs to be formalised and strengthened.

We need many more scientists who are trained in a number of different disciplines in the natural sciences, so that the country can continue to produce world-class biodiversity science, the kind which can inform the wise management and sustained use of our natural world.



For example, we need people to who are equipped to continue the work of updating the countrywide data on the condition of our ecosystems, and who can do further research on the links between biodiversity and human wellbeing. With these skills in place, we can manage ecosystems appropriately and plan future developments in a way that allows us to meet the country's development needs without undermining the critical natural infrastructure that we all depend on.

Jobs for the people: to make the most of our biodiversity assets, we need *people*. People with skills and experience. The biodiversity sector's Human Capital Development Strategy is a way to bridge critical skills shortages and highlights the tremendous potential that biodiversity management and conservation offer in terms of contributing to national job creation and development objectives.

Career opportunities: where better to follow a natural science career than right here in South Africa, a global powerhouse of biodiversity? Career options range from scouring the oceans floors for clues to life in the deep, to game ranging in the Savanna; from managing teams of people, to developing multi-media communication tools; from undertaking university-based research to pursuing biodiversity-based business opportunities. And that's just for starters.

There's work to be done, careers to be built, and a host of passionate people to do it with.





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Biodiversity for Life



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