South African National Spatial Biodiversity Assessment 2004
Summary Report

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This report forms part of a set of five reports on the South African National Spatial Biodiversity Assessment 2004. The full set is as follows:

**Summary Report**


**Technical Reports**

**Volume 1: Terrestrial Component**


**Volume 2: River Component**


**Volume 3: Estuary Component**


**Volume 4: Marine Component**


**Comments and feedback**

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Final versions of the reports will be available at [www.nbi.ac.za](http://www.nbi.ac.za)

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1. Introduction

This report summarises the results and recommendations of South Africa’s first National Spatial Biodiversity Assessment (NSBA), led by the South African National Biodiversity Institute (SANBI). A detailed discussion of the methodology and results is presented in the four-volume NSBA Technical Report. In this summary report we have purposefully kept technical detail and references to a minimum.

The NSBA represents South Africa’s first national assessment of spatial priorities for conservation action, integrating terrestrial, river, estuarine and marine ecosystems, using available spatial data, biodiversity planning software and a series of expert and stakeholder workshops.

The NSBA is part of the National Biodiversity Strategy and Action Plan (NBSAP), led by the Department of Environment Affairs and Tourism (DEAT). The development of the NBSAP is part of South Africa’s obligations as a signatory to the Convention on Biological Diversity (CBD). It will provide an overarching framework for the conservation and sustainable use of South Africa’s biodiversity, and equitable sharing of benefits from use of genetic resources.1 As far as we know, South Africa is the first country to include a comprehensive spatial assessment of biodiversity as part of its NBSAP.

This report is intended to feed into the NBSAP and the National Biodiversity Framework.2 However, it is also a stand-alone document that can inform the policies, plans and day-to-day activities of a wide range of sectors, both public and private. We hope that the spatial products presented in this report will be widely used and built upon. A list of their possible applications is included in the appendix. As will be seen from the sections that follow, our focus is on mainstreaming biodiversity priorities throughout the economy, and making links between biodiversity and socio-economic development. In a country like South Africa, with our extraordinary biodiversity resources (see the box below), there is no need to see addressing socio-economic development challenges and conserving biodiversity as opposing goals. Rather, they can reinforce each other, so that conserving biodiversity strengthens our economy and contributes to social development.

Almost every corner of South Africa is packed with valuable biodiversity resources, but because of limited human and financial resources it makes sense to prioritise conservation action on areas of greatest opportunity for linking biodiversity and socio-economic development, and areas where biodiversity is

1 For more on the NBSAP, see DEAT’s website (www.deat.gov.za).
2 The development of a National Biodiversity Framework is required in terms of the Biodiversity Act (10 of 2004) – see Section 5.
under greatest pressure. This report highlights such areas. Our intention is not to undervalue or dismiss biodiversity in other parts of the country, but simply to provide a systematic way of prioritising short- to medium-term action.

We would like to stress that the NSBA is not in itself a strategy and action plan. It highlights geographic priority areas, which have been fed into the broader NBSAP process. The NBSAP has used these geographic priorities as one way of focusing the development of strategies and action plans.

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**What is biodiversity and why should we be concerned about it?**

The term biodiversity refers to genes, species (plants and animals), ecosystems, and landscapes, and the ecological and evolutionary processes that allow these elements of biodiversity to persist over time. South Africa’s biodiversity provides an important basis for economic growth and development, in obvious ways such as providing a basis for our fishing industry, rangelands that support commercial and subsistence farming, horticultural and agricultural industry based on indigenous species, our tourism industry, aspects of our film industry, and commercial and non-commercial medicinal applications of indigenous resources. Keeping our biodiversity intact is also vital for ensuring ongoing provision of ecosystem services such as production of clean water through good catchment management, prevention of erosion, carbon storage (to counteract global warming), and clean air. Loss of biodiversity puts aspects of our economy and quality of life at risk, and reduces socio-economic options for future generations.

People are ultimately fully dependent on living, functioning ecosystems and the services they provide. Loss of biodiversity leads to ecosystem degradation and subsequent loss of important services, which tends to harm the rural poor more directly – poor people have limited assets and are more dependent on common property resources for their livelihoods, whilst the wealthy are buffered against loss of ecosystem services by being able to purchase basic necessities and scarce commodities. Our path towards sustainable development, poverty reduction and enhanced human well-being for all, is therefore dependent on how effectively we conserve biodiversity.
What’s special about South Africa’s biodiversity?

South Africa is diverse not simply in terms of our people and culture, but also in terms of our biological resources and ecology. In fact, South Africa is the third most biologically diverse country in the world, after Indonesia and Brazil. The richness of South Africa’s biological resources is well documented in the Endangered Wildlife Trust’s publication *The Biodiversity of South Africa 2002*, which highlights key facts and figures for different ecoregions within South Africa, including marine and freshwater ecoregions. South Africa occupies about 2% of the world’s land area, but is home to nearly 10% of the world’s plants and 7% of the reptiles, birds and mammals. We have three globally recognised biodiversity hotspots; the Cape Floristic Region, which falls entirely within our boundaries; the Succulent Karoo, shared with our neighbour Namibia, and Maputaland-Pondoland, shared with Mozambique and Swaziland. (For more on these and other global biodiversity hotspots see [www.conservation.org](http://www.conservation.org).) Our seas straddle three oceans, the Atlantic, the Indian and the Southern Ocean, and include an exceptional range of habitats, from cool-water kelp forests to tropical reefs. The southern African coast is home to almost 15% of known coastal marine species, providing a rich source of nutrition and supporting livelihoods of coastal communities.

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2. What is a spatial assessment?

Biodiversity, like people and economic activity, is not evenly distributed across the landscape or seascape, but occurs in greater concentrations in some areas than others. A spatial biodiversity assessment takes these geographic variations into account by *mapping* information about:

- biodiversity features (such as species, habitats and ecological processes);
- existing protected areas;
- current patterns of land and resource use;
- likely future patterns of land and resource use.

This mapped information can then be analysed using tools linked to a Geographic Information System (GIS), to help determine geographic priority areas for action.

Spatial assessments or analyses can take place at different spatial scales, from the global scale to the local scale. A national biodiversity assessment is intended to be broad, and will not yield information about, for example, how to manage an individual parcel of land or a specific river or catchment. A national assessment *does* provide a national context for assessments at the sub-national scale, and points to broad priority areas where further investigation, planning and action is warranted.

We are fortunate in South Africa to have a strong focus on spatial planning for all sectors at various levels, from the national to the local. We have an excellent National Spatial Development Perspective (NSDP), which establishes principles to guide investment in infrastructure and development spending. At the local level, every municipality must produce an Integrated Development Plan (IDP) that includes a Spatial Development Framework (SDF). This recognition of the importance of spatial planning presents an exciting opportunity to integrate spatial information on biodiversity priorities into cross-sectoral spatial plans at different spatial scales.

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5 A challenge for the biodiversity sector is to present spatial biodiversity information in a way that is meaningful and relevant for spatial planners in other sectors, and to work constructively with these other sectors to integrate biodiversity priorities. Pilot projects to develop tools and mechanisms for this are currently underway in the C.A.P.E., STEP, SKEP and Maloti-Drakensberg bioregional programmes. SANBI provides technical support for this through partnerships with relevant departments and institutions.
3. South Africa’s approach to biodiversity planning

South Africa is at the forefront of biodiversity planning\(^6\) internationally, and the methods and techniques used in this assessment are at the cutting edge of the discipline.

There are several possible approaches to biodiversity planning. The approach used most often in South Africa, including in this assessment, is referred to as **systematic biodiversity planning**.\(^7\) Systematic biodiversity planning is based on three key principles:

- The need to conserve a **representative sample** of biodiversity pattern, such as species and habitats (the principle of representation);
- The need to conserve the **ecological and evolutionary processes** that allow biodiversity to persist over time (the principle of persistence);
- The need to set quantitative biodiversity-based **targets** that tell us how much of each biodiversity feature should be conserved in order to maintain functioning landscapes and seascapes. These targets should ideally be based on best available science, rather than on arbitrarily defined thresholds (such as 10% of all features).

The **NSBA** is the first ever assessment of biodiversity throughout South Africa. It has four components, dealing with four distinct biological environments:

- terrestrial (land);
- freshwater (rivers and wetlands);\(^8\)
- estuarine (the interface between rivers and sea);
- marine (sea).

\(^6\) Also referred to as conservation planning. We prefer to use biodiversity planning, because the term conservation planning is often associated in people’s minds purely with planning for the establishment or expansion of formal protected areas, rather than with influencing the way resources are used and managed throughout the landscape or seascape.


\(^8\) Limited available spatial data on wetlands meant that we were not able to do a full assessment of wetlands. Wetlands were incorporated in the terrestrial analyses to a limited extent, but should be addressed more fully in future revisions of the NSBA.
Systematic biodiversity planning techniques are more advanced for terrestrial environments than for freshwater, estuarine and marine environments. The NSBA is the first attempt we know of to deal with all four environments in one assessment, and has contributed to furthering the application of systematic planning in freshwater, estuarine and marine environments.

Another important aspect of South Africa’s approach to biodiversity planning, is a focus on ecosystems in addition to species. This is consistent with the Convention on Biological Diversity’s ecosystem approach. The single biggest cause of loss of biodiversity in South Africa, and in most of the world, is loss or degradation of natural habitat and ecosystems. Other important causes of loss of biodiversity are alien invasive species, which often disrupt ecosystem functioning, and over-extraction of natural resources, especially in the marine environment. Historically, conservation efforts have often focused on individual species, often charismatic ones that catch people’s imaginations, such as large mammals. However, the most effective way to conserve the most biodiversity is often to focus on threatened ecosystems rather than individual threatened species. Especially in a country like South Africa that has thousands of threatened species, conserving them one by one is unlikely to get us far. We will return to this theme of threatened ecosystems throughout the report.

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9 The ecosystem approach of the Convention on Biodiversity, developed internationally in the 1980s, is “based on the application of appropriate scientific methodologies focused on levels of biological organisation that encompasses the essential processes and interactions among organisms and their environment”. An ecosystem is defined as “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit” (CBD 2003: 5). The recognition that humans are an integral part of ecosystems is also a key feature of the approach. The ecosystem approach can be used at varying scales.

10 We note that there are exceptions, especially in the marine environment where high numbers of species are specifically targeted for extraction from their habitat.
4. Key strategies for conserving South Africa’s biodiversity

Three key strategies for conserving South Africa’s biodiversity emerge from this assessment. They are discussed in more detail in the sections on “What are the priority actions?” for the terrestrial, river, estuarine and marine environments.

**Strategy 1: Pursue opportunities to link biodiversity and socio-economic development in priority geographic areas**

This involves working with production sectors, private and communal landowners, and other land and resource users, to conserve biodiversity in the context of production landscapes and seascapes, and is often referred to as “mainstreaming biodiversity”.

We have identified nine terrestrial biodiversity priority areas (see Section 6). These areas have high concentrations of biodiversity pattern, and house some of the country’s most important ecological infrastructure. They present opportunities for multi-sectoral bioregional programmes, that involve working with conservation agencies, industry sectors and local communities to build the biodiversity economy. Ensuring access to the natural environment, and tangible benefits to all from the biodiversity economy, especially those excluded in the past, should be a major thrust of bioregional programmes.

Some bioregional programmes are already underway, in the Cape Floristic Region (C.A.P.E.), the Succulent Karoo (SKEP), the Sub-tropical Thicket (STEP), and the Maloti-Drakensberg Transfrontier Project, and others are emerging, for example in the Wild Coast and the Grasslands.

Some of the biodiversity priority areas have a special role to play in producing the country’s water. In these, Catchment Management Agencies will have a key role to play. The river component of the NSBA points to some of the Water Management Areas that need attention most urgently, and emphasises the need to pay increased attention to managing rivers for meeting immediate social and economic needs as well as maintaining their long-term functioning to meet the needs of future generations (see Section 7).

In the marine environment, the links between maintaining the natural resource base and ongoing productivity of key industries such as the fishing industry, are particularly stark. The marine component of the NSBA highlights geographic priorities as well as industry sectors with which we should engage constructively.
Strategy 2: Focus emergency action on threatened ecosystems, to prevent further loss of ecosystem functioning

Threatened ecosystems are found most often in the midst of production landscapes and seascapes, and are often already fragmented or degraded. Emergency action to prevent further loss of functioning will involve using the tools provided by the new Biodiversity Act (for example, listing of threatened ecosystems, implementation of biodiversity management plans – see Section 5), to influence day-to-day decisions about land- and resource use in these ecosystems. Stewardship of threatened ecosystems by individuals, communities and local authorities that work in and manage them is key to ensuring their survival. We hope that popularising the concept of threatened ecosystems and providing clear maps and accompanying information of where and what they are, will in itself begin to influence behaviour and decisions.

Strategy 3: Expand the protected area network

The results of the NSBA show that our protected area network does not conserve a representative sample of South Africa’s biodiversity. We recognise that a range of factors influence where and how protected areas are established and expanded; the goal of representation should be one of these. The marine environment has the lowest levels of protection currently, especially offshore.

Protected areas should bring benefits to surrounding communities. In expanding and managing the protected area network, it is important to focus on local communities as key stakeholders.

This set of strategies brings home the fact that conserving biodiversity is not just about protected areas. Protected areas play a vital role, and a well managed protected area network that includes a representative sample of all ecosystems is an important goal. However, we will never conserve biodiversity effectively through protected areas alone. Conserving biodiversity involves working with land- and resource users, from local communities who rely directly on natural resources for their livelihoods, to big business and industry, to conserve priority areas and manage biodiversity in a way that maintains ecosystem functioning within the production landscapes and seascapes in which people live and work.

11 The IUCN defines a protected area as an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, and managed through legal or other effective means.
Further, the first and second strategies rely in part on building capacity of municipalities to include biodiversity opportunities and constraints in their integrated development planning. **Local government has a key role to play in conserving biodiversity.** We recommend that the NBSAP include a major thrust to support municipalities in their efforts to integrate biodiversity priorities in their IDPs, SDFs, and day-to-day decision-making. We suggest working with the South African Local Government Association (SALGA) to develop a such a capacity-building programme for municipalities. The results of this assessment can help to identify municipalities – those with higher numbers of threatened ecosystems – that require such support most urgently.

**Strategy 4: Fill key information gaps**

A fourth focus area relates to information gaps that hold us back from developing a full picture of our biodiversity resources and constraints. Key gaps for each component are highlighted in Sections 6, 7, 8 and 9. The most important gap is, interestingly, *not* information about where different habitats and species are located, but rather reliable, up-to-date information about where ecosystems have been lost or degraded, especially for terrestrial, river and marine environments. For example, in the terrestrial biodiversity assessment we have used the 1996 National Land Cover to assess where natural habitat has been lost. This is clearly not ideal – since 1996 there have been significant changes in land use in many parts of the country. The 2000 National Land Cover (based on a satellite image taken in 2000) is not yet available, and by the time it is available it will be substantially out of date. It is crucial that we find a way of tracking changes in natural habitat throughout the country at an appropriate spatial scale that yields data that is not several years out of date by the time it is published.
5. Links to policy and legislation

The NBSAP and the NSBA relate to many South African laws and policies across different sectors, and we will not attempt a comprehensive review here. For more information see the forthcoming NBSAP country report, which will be published by DEAT in 2005.

Two new pieces of legislation are particularly important from the point of view of the NSBA: the Biodiversity Act (10 of 2004) and the Protected Areas Act (57 of 2003), both part of the suite of National Environmental Management legislation.

The Biodiversity Act establishes SANBI, making South Africa one of the few countries in the world to have a national institute dedicated to biodiversity. The Act gives SANBI a key role in monitoring and reporting on the status of the countries biodiversity as well as in supporting national and bioregional policy, planning and programmes. SANBI’s role is one of co-ordination and facilitation, working in partnership with a range of existing biodiversity and other institutions.

Chapter 4 of the Biodiversity Act deals with threatened ecosystems and species. One of the key provisions in this Chapter allows the Minister or an MEC to list threatened and protected ecosystems – see the box below. This provision gives us a powerful mechanism to address biodiversity conservation effectively and efficiently, at the ecosystem scale rather than one species at a time. The Act does not specify how threatened ecosystems should be identified; the NSBA provides an excellent starting point for this, based on best available science.

The Biodiversity Act also provides for a National Biodiversity Framework, statutory bioregional plans (for which the NSBA provides a national context), and statutory biodiversity management plans for threatened ecosystems or species.
Threatened and Protected Ecosystems in the Biodiversity Act

The Biodiversity Act includes the following provisions for listing of threatened and protected ecosystems:

52 (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection.

(b) An MEC for environmental affairs in a province may, by notice in the Gazette, publish a provincial list of ecosystems in the province that are threatened and in need of protection.

52 (2) The following categories of ecosystems may be listed in terms of subsection (1):

(a) **critically endangered ecosystems**, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;

(b) **endangered ecosystems**, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;

(c) **vulnerable ecosystems**, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and

(d) **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs (a), (b) or (c).

The **Protected Areas Act** establishes a streamlined set of categories for protected areas. A range of different protected area options are available, both for strict protection as well as more flexible biodiversity management. The Act provides for any land, including private or communal land, to be declared a protected area, and allows for co-management of such a protected area by the landowner(s) or any suitable person or organisation. This means that formal protected area status, with an associated rates exclusion in terms of the Rates Act, is not limited to state-owned land, and that government agencies are not the only organisations that can manage protected areas.

The Biodiversity Act provisions on threatened ecosystems, bioregional plans, and biodiversity management plans, together with the Protected Areas Act provisions for a range of protected area options, including private or communal protected areas, give us powerful tools for achieving biodiversity management and conservation in production landscapes.
The NBSA also relates to international policies and commitments. For example, one of the United Nations’ Millennium Development Goals commits governments to “ensure environmental sustainability” by 2015, including targets around integrating the principles of sustainable development into country policies and programmes (i.e. mainstreaming) and reversing the loss of environmental resources (i.e. biodiversity conservation). Similarly, many of the targets in the Plan of Implementation which came out of the 2002 World Summit on Sustainable Development in Johannesburg are relevant.
6. Terrestrial biodiversity assessment

Current spatial patterns

South Africa has well developed spatial information on ecosystems and species in the terrestrial environment, relative to other countries and relative to the freshwater and marine environments in South Africa. Our spatial information on land use is less well developed.

Ecosystems can be defined in many ways, at different spatial scales. We used SANBI’s recently published vegetation map of South Africa, Lesotho and Swaziland to define terrestrial ecosystems, because this provides a consistent map at an appropriate scale (1:250 000) across the country (see Figure 1). Vegetation types provide a good indication of biodiversity other than plant species, because most animals, birds, insects and other organisms are associated with particular vegetation types. Figure 2 zooms in on a small portion of the vegetation map, to show how detailed it is. Note that the vegetation map includes wetland vegetation types.

Vegetation types can be grouped into biomes (see Figure 3), based on shared ecological and climatic characteristics. South Africa has nine biomes according to the SANBI vegetation map: Albany thicket, desert, forest, fynbos, grassland, nama karoo, savanna, succulent karoo, and wetlands. Some biomes have a richer array of vegetation types than others, with the fynbos biome being the richest (see Figure 4).

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12 We used the beta 4.0 version of the map. The final (alpha) version was not available at the time of writing, but contains changes to the boundaries of a small proportion of vegetation types. Almost all of Lesotho and Swaziland’s vegetation types are shared with South Africa, highlighting the need for a co-operative approach to managing biodiversity across these political boundaries.
Figure 1: The SANBI 2004 vegetation map for South Africa, Lesotho and Swaziland. Of the 441 vegetation types, 440 occur in South Africa.

Figure 2: A close-up of the SANBI vegetation map, in the northern KwaZulu-Natal area. Note that the vegetation map includes wetland vegetation types (shown in bright blue).
Figure 3: Biomes in South Africa, Lesotho and Swaziland

Figure 4: Percentage area and number of vegetation types per biome (number of vegetation types is shown on the top of each bar)
South Africa is abundantly rich in both plant and animal species. Because of the huge numbers involved, we decided to focus only on endemic species (species found only in South Africa) and threatened species (species in danger of extinction). We refer to these two categories jointly as species of special concern.

There is no single database of species locations for the whole country, so we were not able to map every single species. For plants, we used SANBI’s PRECIS database, which includes approximately 24 000 plant species. For animals, we were able to include information on mammals, birds, amphibians (frogs and toads), butterflies, scorpions, and scarabs (dung beetles). Figure 5 shows the number of endemic plants per province. Figure 6 shows the number of endemic and threatened animals per province, for the six groups of animals listed above. (Note that these are species endemic to South Africa as a whole, not necessarily to the province. One species might occur in more than one province.)

![Figure 5: Number of endemic plants per province](image)

- Eastern Cape: 3502
- Free State: 675
- Gauteng: 443
- KZN: 1584
- Limpopo: 883
- Mpumalanga: 987
- Northern Cape: 2643
- North West: 460
- Western Cape: 7332

Figure 5: Number of endemic plants per province
Figure 6: Number of animal species of special concern per province, for selected taxa (mammals, birds, amphibians, butterflies, scorpions, scarabs)

As explained in Section 3, when assessing biodiversity it is important to consider not just biodiversity pattern (habitats and species), but also the ecological processes that allow these biodiversity patterns to persist over time. Ecological processes are often difficult to map, because they occur across space and time. Nevertheless, we included several spatial components of ecological processes in the NSBA, shown in Figure 7.

Figure 7: National-scale ecological processes: carbon sequestration, biogeographic nodes, and areas of biome resilience to climate change
Carbon sequestration (natural storage of carbon in plant biomass) is an important counteracting force to human-induced climate change, one of the biggest threats to the persistence of biodiversity. Biogeographic nodes are areas where many different vegetation types come together, creating zones of ecologically important interactions. Areas of biome resilience to climate change are areas where the current biome may persist in the face of climate change, under different climate change scenarios. Water production is another vital ecological process – this is discussed in Section 7.

There are many additional ecological processes that take place at the regional or local scale, such as migration and dispersal corridors, sand movement corridors, and upland-lowland links. We have not attempted to include these, because the NSBA is a national-scale assessment. We recommend that a series of additional spatial components of ecological processes should be included in assessments at the sub-national scale, as has been done in, for example, C.A.P.E., SKEP, STEP.

Current patterns of land use have a great impact on the health and functioning of ecosystems, so it is important to map land use in addition to the biodiversity features themselves. Loss of natural habitat is the biggest single cause of biodiversity loss in terrestrial ecosystems. The most recent available national map showing different types of land use is the 1996 National Land Cover, produced by the Council for Scientific and Industrial Research and the Agricultural Research Council. Some of the National Land Cover categories (cultivated lands, plantations, urban areas, and mines and quarries) represent areas where natural habitat has been irreversibly lost – these, shown in Figure 8, were used to quantify loss of natural habitat for this assessment.

Ideally we would like to be able to quantify and map degradation of natural habitat, in addition to outright loss of natural habitat. However, a national coverage on habitat degradation is not available at a useful scale, so we have not been able to take degradation into account in the terrestrial component. We hope to address this in future revisions of the NSBA.
Results of the assessment

We assessed the **status of terrestrial ecosystems**, using the SANBI vegetation map (Figure 1) and irreversible loss of natural habitat based on the 1996 National Land Cover (Figure 8). The results, shown in Figure 9, tell us how intact and well functioning our ecosystems are. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and its associated ecosystem services, and to loss of species associated with that ecosystem. Least threatened ecosystems are still largely intact; vulnerable ecosystems are reasonably intact, but are nearing the threshold beyond which they will start to lose ecosystem functioning; endangered ecosystems have lost significant amounts of their natural habitat, impairing their functioning; critically endangered ecosystems have so little natural habitat left that not only has their functioning been severely impaired, but species associated with the ecosystem are being lost.

Because the assessment of terrestrial ecosystem status is based on the 1996 National Land Cover, we know it is out of date. Since 1996 significant further loss of natural habitat has taken place, especially in...
some parts of the country such as KwaZulu-Natal. It is likely that more terrestrial ecosystems have become threatened since 1996, so this should be seen as a conservative assessment. Although the NSBA is based on the best available national data, finer scale biodiversity assessments at the regional or local level based on more detailed and up-to-date information may identify additional threatened ecosystems.

Figure 9: Status of terrestrial ecosystems

Some of the key results are shown in Figure 10 and Figure 11. Thirty-four percent of terrestrial ecosystems are threatened. Of these:

- 21 terrestrial ecosystems (5%) are critically endangered. Fourteen of these are in the fynbos biome, five are in the forest biome, one is in the grassland biome, and one is a wetland vegetation type.
- 58 terrestrial ecosystems (13%) are endangered. Most are in the grassland and savanna biomes.
- 70 terrestrial ecosystems (16%) are vulnerable. Most are in the fynbos and grassland biomes.
We also assessed the protection levels of terrestrial ecosystems, to tell us how well our protected area network is performing in terms of representing terrestrial biodiversity.

Prior to the NSBA, there was no map of all the protected areas in South Africa, so the first step was to gather information from the provinces, SANParks and DEAT to compile such a map, shown in Figure 12. There are many different types of protected areas, so it is helpful to group them into a few
streamlined types. Type 1 protected areas include National Parks, Provincial Nature Reserves, Local Authority Nature Reserves and DWAF Forest Nature Reserves. Type 2 protected areas include Mountain Catchment Areas, Wildlife Management Areas, private nature reserves, National Heritage Sites, DWAF Forest Areas, SANDF property, bird sanctuaries, and botanical gardens. Type 3 protected areas include game farms, private game reserves and conservancies. They are completely informal and do not provide secure long-term protection for biodiversity. Only a few protected areas are greater than 100 000 ha, most of them being 1 000 -10 000 ha in size.

Figure 12: Protected areas in South Africa. Type 1 protected areas include national parks and provincial nature reserves, and have a more secure legal status than Type 2 protected areas.

Some of the first protected areas in the world were established here in the late 1800s. However, the earliest approaches to planning were typically *ad hoc* and most protected areas were located in landscapes of low economic potential. South Africa’s protected area network (and those of other countries) was not designed to conserve a representative sample of biodiversity, so it is not surprising that nearly half of our terrestrial ecosystems have no or extremely low levels of formal protection, as shown in Figure 13.
Figure 13: Protection levels of terrestrial ecosystems

Figure 14: Protection levels of terrestrial ecosystems by biome (the number of vegetation types per biome is shown at the top of each bar)
The total percentage of South Africa’s land area in Type 1 and 2 protected areas is nearly 6%. However, the percentage of well protected ecosystems is higher, at 15%. Most of these well protected ecosystems are in the fynbos mountains and the savanna biome, while the most severely under-protected ecosystems tend to be in the succulent karoo, the grasslands, and the fynbos lowlands.

In expanding our protected area network, it makes sense to focus on biomes and ecosystems that are currently under-protected, to bring us closer to the ideal of a representative sample of all ecosystems in protected areas.

Because species distribution data are on the whole available only at a very broad scale, we were not able to look at the numbers of species represented in protected areas. However, we were able to assess the numbers of rare and threatened plant species by province. These results are shown in Figure 15. Figure 6 above shows the number of threatened and endemic animal species per province.

![Figure 15: Numbers of rare and threatened plant species by province](image)

13 A well protected ecosystem is one that has its biodiversity target met in a Type 1 protected area.
Priorities for action

Based on these and other analyses, we identified nine broad geographic priority areas for conservation action, shown in Figure 16. The priority areas reflect a combined analysis of habitats, species, and ecological processes, each weighted equally.

We would like to stress firstly that the boundaries of these areas are rough, not exact, and secondly that this map does not imply that there is no important biodiversity in the rest of the country. However, given limited resources (people, time, and money), we cannot act everywhere at once, so it makes sense to focus our actions on places where the return is likely to be greatest. These priority areas also highlight places where neighbouring provinces need to co-operate in managing significant biodiversity resources that cross provincial boundaries.

In deciding when and how to act within these priority areas, it is useful to understand the socio-economic context and likely future pressures on biodiversity. This is often best done at the local level; however, a national picture provides a useful starting point. We looked at four factors that increase pressure for conversion of natural habitat to other land uses: suitability of land for crop agriculture, afforestation, or mining, and increases in population density (which signal likely urban expansion). We also looked at two factors that increase the likelihood that remaining natural habitat will become degraded: invasion of alien plants, and degree of fragmentation of natural habitat. These six factors are shown in Figure 17. They are not evenly distributed throughout the landscape. For example, crop potential is a greater pressure on

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**Figure 16: Nine broad priority areas for conservation action**

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biodiversity in grasslands priority areas, while afforestation is of greater concern in the Maputaland Pondoland priority area. This starts to give us clues about the kind of industry engagement and management approach that is required to conserve biodiversity in different priority areas.

We suggest five inter-linked sets of actions to conserve terrestrial biodiversity in priority areas:

1. **Work with production sectors** that are major land users (such as agriculture, infrastructure and property development, forestry and mining), to develop and implement sector-specific wise-practice guidelines to minimise loss of natural habitat in threatened ecosystems, and to protect ecosystem functioning. For example, in the Cape Floristic Region the wine industry has incorporated biodiversity criteria and guidelines in its Integrated Production of Wine guidelines, through the Biodiversity and Wine Initiative, led by the industry in partnership with conservation NGOs.
2. **Strengthen bioregional programmes.** As explained briefly in Section 4, bioregional programmes are multi-sectoral programmes that provide a framework for collaborative conservation action, often across administrative or political boundaries. Existing bioregional programmes are C.A.P.E., STEP, SKEP and the Maloti-Drakensberg Transfrontier Project; emerging ones include the Wild Coast Sustainable Development Project and the Grasslands bioregional initiative. Bioregional programmes can include fine-scale biodiversity planning initiatives in local areas of particular concern, for example where biodiversity is under great pressure and/or where few options remain for meeting biodiversity targets. It is vital that the products that emerge from such fine-scale biodiversity plans are appropriate and useful for local-level decision-making by municipalities and other land-use decision-makers, such as the Department of Agriculture and provincial environmental affairs departments. Local and district municipalities should be seen as key stakeholders in bioregional programmes.

3. **Minimise loss of habitat in threatened ecosystems.** This can be achieved through at least two mechanisms:
   a. By promoting stewardship among private and communal landowners. This involves increasing the capacity of provincial conservation agencies or departments to work outside of protected areas, with a range of landowners and land users. Indeed, it often requires a review of the strategic direction of these organisations, and a shift from seeing extension positions as entry-level positions to seeing extension work as specialised and highly skilled. Stewardship involves wise management of land, including, for example, sustainable grazing practices, clearing invasive alien species, conserving wetland areas, and not ploughing last remaining fragments of natural habitat in critically endangered ecosystems.
   b. By using regulations in terms of the Biodiversity Act to restrict certain land uses in listed threatened ecosystems (see Section 5).

4. **Prevent and manage the spread of invasive alien species**, by focusing alien clearing efforts, such as Working for Water, on areas where socio-economic needs (e.g. water production and poverty alleviation) coincide with areas of high biodiversity priority.

5. **Expand protected areas to achieve representation targets**, in consultation with implementing agencies such as SANParks and provincial conservation agencies and departments. The information provided by the NSBA is one factor that should guide protected area expansion. We recognise fully that there are other, often management related, factors involved (such as economies of scale and efficiencies in the configuration of protected areas).
How this assessment can be improved

As explained above, our assessment of the status of terrestrial ecosystems is based on estimates of loss of natural habitat from the 1996 National Land Cover, and must therefore be seen as a conservative assessment. As soon as the 2000 National Land Cover becomes available, SANBI will redo the assessment and publish the new results. However, this will still be several years out of date. **There is an urgent need for up-to-date, country-wide information on loss and degradation of natural habitat.** The lack of this information, together with similar information for the freshwater and marine environments, is by far the **biggest limiting factor** in the NSBA.

Another gap is **spatial information on the economic value of natural resources**, including ecosystem services, highlighting biodiversity features of especially high value such as wetlands. For terrestrial biodiversity, a national list of useful species and other directly consumed components of biodiversity, together with data on their location, would strengthen the NSBA.

A third gap is spatial information on the cultural value of natural resources. This may be best included in biodiversity plans at the regional or local scale, rather than the national scale. However, we highlight it here because such information is important for making links between biodiversity and other aspects of the socio-economy.
7. River biodiversity assessment

Current spatial patterns

The river component of the NSBA is based on the work of the DWAF-CSIR-WRC National Freshwater Biodiversity Initiative, and is the first ever systematic assessment of river biodiversity in South Africa.\footnote{For more on this ongoing initiative see www.csir.co.za/rivercons. The first phase is due to be completed in 2005, and the results presented here should be seen as work in progress. (DWAF = Department of Water Affairs and Forestry, CSIR = Council for Scientific and Industrial Research, WRC = Water Research Commission)}

The National Freshwater Biodiversity Initiative developed a new way of mapping river biodiversity, using river heterogeneity signatures. The signatures are based on geomorphology (the nature of the landscape through which a river flows) and hydrology (the amount of water flow in a river, and how variable the flow is). Figure 18 shows the resulting 120 river signatures. These should be seen as preliminary, and are likely to be refined. Rivers that share the same signature are regarded as sharing similar biodiversity.

![Figure 18: River heterogeneity signatures for South Africa, Lesotho and Swaziland. Unique combinations of geomorphic provinces and hydrological index represent unique signatures.](image)

\footnote{For more on this ongoing initiative see www.csir.co.za/rivercons. The first phase is due to be completed in 2005, and the results presented here should be seen as work in progress. (DWAF = Department of Water Affairs and Forestry, CSIR = Council for Scientific and Industrial Research, WRC = Water Research Commission)}
River ecosystems, in addition to being home to large numbers of fish and other species, are crucial for the production of the country’s water supply. Together with wetlands, they play a key role in purifying and delivering the water on which our economy and quality of life depends. Well functioning, intact river and wetland ecosystems also crucial for flood control.

The state of river ecosystems depends not only on what happens in river themselves and on their banks, but also on how land is managed throughout whole catchments. Figure 19 shows the top ten percent of tertiary and quaternary catchments in South Africa (in terms of Mean Annual Run-off), which jointly yield fifty percent of the county’s water. Many of them occur along the escarpment and in other mountainous areas. It is especially important that the use and management of land in these catchments does not compromise our water production infrastructure, for example through stripping of natural vegetation for forestry or crops in critical catchment areas.

![Figure 19: High water yield catchments. These quaternary catchments (dark blue) and tertiary catchments (light blue) yield approximately 50% of the country’s water supply.](image)

In the terrestrial component we used information from the National Land Cover to assess where terrestrial biodiversity is still intact, and where it has been lost. In the river component, we used the national Water Situation Assessment Model, which assigns a present ecological status category (PESC) to each quaternary catchment, ranging from A (natural, unmodified) to F (critically modified), based on
expert assessment of the integrity of river habitat.\textsuperscript{15} Both instream habitat and riparian (river bank) habitat were considered, but only the mainstem rivers were assessed, not their tributaries. Figure 20 shows the results: 26\% of quaternary catchments are intact (category A or B), 48\% are moderately modified (category C) and 26\% are transformed (categories D-F).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{river_integrity.png}
\caption{River integrity per quaternary catchment. Integrity assessment was based on mainstem rivers, and considered integrity of instream and riparian habitat.}
\end{figure}

As noted in Section 1, we were not able to undertake a full assessment of wetland ecosystems, because of lack of appropriate national data on wetlands. However, we hope to address this in future revisions of the NBSA,\textsuperscript{16} so that the river component can be expanded to become a freshwater component. In the absence of a full national assessment of wetlands, we would like to emphasise that all wetlands play a significant ecological role, especially with respect to ensuring water quality and a consistent water supply, and special care should be taken not to disturb their functioning.

\textsuperscript{15} Kleynhans, C.J. 2000. Desktop estimates of the ecological importance and sensitivity categories (EISC), default ecological management classes (DEMC), present ecological status categories (PESC), present attainable ecological management classes (present AEMC), and best attainable ecological management class (best AEMC) for quaternary catchments in South Africa. \textit{DWAF report}. Institute for Water Quality Studies.

\textsuperscript{16} In collaboration with the Working for Wetlands programme, housed in SANBI.
Results of the assessment

We assessed the status of river ecosystems based on the river signatures in Figure 18 and the integrity of mainstem rivers in Figure 20. The results are shown in Figure 21 and Figure 22. Of South Africa’s 120 river signatures, 82% are threatened. A disturbing 44% are critically endangered, 27% are endangered, 11% are vulnerable, 18% are least threatened. A critically endangered river signature is one for which there are few remaining intact examples, thus putting the biodiversity patterns and ecological processes associated with that river signature at risk.

Figure 21: Status of river ecosystems (mainstems only)
Comparing the status of terrestrial ecosystems with the status of river ecosystems, we see that 5% of terrestrial ecosystems are critically endangered, while 44% of river ecosystems are (compare Figure 21 and Figure 22 with Figure 9 and Figure 10). A third of terrestrial ecosystems are threatened, compared with 82% of river ecosystems. This striking difference reflects the fact that South Africa is a water-scarce country, with multiple demands, from urban settlements, agriculture and industry, on our limited water resources. Many of our mainstem rivers are heavily utilised, and our river ecosystems are, in general, under more pressure than our terrestrial ecosystems.

For terrestrial ecosystems we assessed not just at their current status but also at their current protection levels. However, for river ecosystems, defining “protection” is more difficult than for terrestrial ecosystems. The establishment and management of formal protected areas has usually focused on protecting terrestrial ecosystems, with little emphasis on proclaiming protected areas for the purpose of conserving entire river lengths. In any case this is not a practical management option for most rivers, which cross great distances in the landscape. A good example of this is evidenced by the Kruger National Park, South Africa’s flagship national park. Rivers in the region of the Kruger National Park flow in an east-west direction, whilst the park spans the landscape in a north-south direction. This means that all the major rivers flow through the park, rather than being contained within the park.

More importantly, rivers are impacted by activities that happen throughout their entire catchments, so even if a whole river length is included in a protected area, the river is subject to impacts that could originate far away. However, rivers that do flow through protected areas often show significant recovery (i.e. their health is in much better condition downstream of the protected area than upstream of the
protected area). This highlights the positive impact that good land management of the surrounding landscape can have on river condition – emphasizing the importance of taking an integrated resource management approach which considers the combined needs of terrestrial and freshwater biodiversity, inside and outside protected areas.

**Priorities for action**

Quality, quantity and sustainability of water resources are fully dependent on good land management practices within catchments. The fate of our country’s natural water resources therefore relies on an integrated approach to managing water and land, to achieve ecological and socio-economic sustainability. We need to pay increased attention to managing rivers for meeting immediate social and economic needs as well as maintaining their long-term functioning to meet the needs of future generations. The establishment of Catchment Management Agencies, which will develop Catchment Management Strategies, is an important step towards achieving this.

This assessment provides guidelines on which Water Management Areas need urgent attention from a biodiversity perspective. The mainstem rivers of the Berg, Breede, Gouritz, Middle Vaal, and Upper Vaal Water Management Areas are the most severely threatened in South Africa, followed by the Olifants/Dooring, Fish to Tsitsikamma, Crocodile/Marico, and Olifants. These Water Management Areas, shown in the darkest two shades of blue in Figure 23, all have over 75% of their mainstem rivers in a critically endangered or endangered state. From a biodiversity point of view, these Water Management Areas should receive top priority in terms of the development and implementation of Catchment Management Strategies, in order to prevent further loss of biodiversity and ecosystem functioning.

In addition to highlighting priority Water Management Areas, we emphasise the following sets of actions to conserve river biodiversity and functioning:

1. **Integrate land and water policy and management, as a basis for integrated management strategies.** Since DWAF is the national custodian of inland water resources and DEAT is the national custodian of biodiversity, conservation of freshwater biodiversity cannot be successful without achieving some interface in policy and strategies between these two departments. Both national departments have undertaken rigorous policy revision during the past decade. However, their respective initiatives have mostly built on department-specific terminology, concepts and understanding. The challenge is to find common ground for the systematic conservation of freshwater biodiversity, where the two parties can combine their skills and resources towards scientifically sound conservation designs and practically feasible implementation plans.
Development of criteria for river management that address social, economic and ecological sustainability, would be one step towards achieving this.

2. **Feed information from this assessment into DWAF’s Catchment Management Strategies**, to help determine how many rivers, and which rivers, need to be managed in a natural or moderately impacted state.

3. **Determine ecological reserves** in terms of the National Water Act (1998), especially for rivers in priority Water Management Areas or those identified as priorities in Catchment Management Strategies.

4. **Integrate rivers into bioregional plans and programmes**, and fine-scale biodiversity assessments. Biodiversity assessments have traditionally has a strong terrestrial bias. However, exciting early steps towards integrating terrestrial and freshwater biodiversity are being made in some regional and local plans. Lessons from these should be captured and shared.
How this assessment can be improved

River biodiversity assessment is in its early developmental stages, and the results reported here are preliminary. Some of the key limitations that need attention in the next five years to improve this assessment are as follows:

- The river assessment should be extended to become a freshwater assessment, including wetlands and groundwater.
- The river heterogeneity signatures need to be further developed, refined, and reviewed by river ecologists.
- River integrity data which accurately reflects the condition of both mainstem rivers and their tributaries, need to be developed at a national scale. It is important to bring catchment-based state-of-rivers reporting together to form a national state of rivers report, which can accurately reflect the condition of at least the 1:500 000 rivers in South Africa.
- Key riverine processes, such as connectivity, should be incorporated in the assessment.
- Spatial information on relevant socio-economic factors, such as water-stressed catchments, should be compiled.
8. Estuarine biodiversity assessment

Current spatial patterns

Estuaries are formed where freshwater from rivers runs out to the sea. The influence of the tides and the changing mixture of freshwater and seawater make estuaries special ecosystems that are important for a range of ecological processes and ecosystem services. For example, they provide breeding areas and nurseries for marine species, including economically important fish, and they channel nutrient and sediment flows from rivers into the sea, contributing to the productivity of marine ecosystems.

South Africa has 259 estuaries. They are sparse along the west cost, increasing in density as one moves eastwards. This reflects that fact that the western part of the country is arid, with relatively few rivers, while the eastern part is wetter, with more rivers.

The value of estuarine fisheries and the contribution of estuaries to marine fisheries in South Africa was recently estimated to be R923 million (nearly a billion Rand) per year – an average of R3.6 million per estuary.17

Estuaries can be divided into five different types: estuarine bays, permanently open estuaries, river mouths, estuarine lakes, and temporarily closed estuaries. These estuary types are distributed across three zones: the cool temperate zone (on the west coast), the warm temperate zone (on the south coast), and the subtropical zone (on the east coast), giving us 13 estuarine zonal-types, or 13 groups of estuaries (see Table 1). Each of these groups can be considered a broad estuarine ecosystem type.

<table>
<thead>
<tr>
<th>Estuary Type</th>
<th>Cool Temperate</th>
<th>Warm Temperate</th>
<th>Subtropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine Bay</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Permanently open</td>
<td>2</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>River mouth</td>
<td>2</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Estuarine lake</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Temporarily closed</td>
<td>7</td>
<td>88</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 1: Estuaries can be divided into five types, which are distributed across three zones, resulting in 13 groups of estuarine ecosystems

Figure 24: Estuaries in South Africa are sparse along the west coast, increasing in density as one moves east

The health of all estuaries was rated by estuary experts in 2000, as excellent (in near pristine condition, negligible human impact), good (no major negative human-related influences on either the estuary or the catchment), fair (noticeable degree of ecological degradation in the catchment and/or estuary, moderate impact), or poor (major ecological degradation arising from a combination of human-related influences, high impact). Overall, 62% of South Africa’s estuaries are in good or excellent condition.

Pressures on estuaries come from two main sources: activities that occur within and immediately around them (direct pressures), and from activities that reduce the flow of freshwater into estuaries (pressures on freshwater inputs).

Direct pressures on estuaries include:

- loss or alteration of natural estuary habitat (for example due to the construction of marinas and jetties);

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changes in mouth dynamics, such as the manipulation of mouths to maintain constant water levels or prevent flooding of holiday homes;

• overexploitation of estuarine resources such as fish;

• sedimentation of estuaries due to poor catchment or mouth management;

• recreational disturbance;

• pollution, for example release of sewage into Knysna estuary.

Pressures on freshwater inputs include:

• reductions in freshwater inputs due to upstream abstraction or afforestation;

• increase in freshwater inputs due to agricultural or sewage return flows;

• reductions in water quality, due to poor catchment management, polluted return flows and effluent disposal.

As indicated in these lists, catchment health is an important factor in estuary health. For example, if there is little natural land cover in a catchment, and much of the catchment’s water is used for agricultural or industrial purposes, the estuaries linked to that catchment are likely to be in a poor state of health. A general trend is that estuaries fed by larger catchments tend to be in poorer health than the estuaries in neighbouring smaller catchments. This is partly because larger catchments have larger rivers, and larger rivers tend to be more heavily utilised; and partly because estuaries fed by larger catchments are usually larger, and thus attract more coastal development and other economic activity.

Results of the assessment

We assessed the status of estuarine ecosystems based on the 13 groups of estuaries in Table 1 and the estuary health assessment done in 2000. Although 62% of South Africa’s estuaries are in good or excellent condition, these healthy estuaries are not distributed evenly across the different groups of estuaries. Some groups of estuaries are more heavily impacted than others, as shown in Table 2. Critically endangered groups of estuaries have few or no estuaries that are still in excellent or good health, and are thus in severe danger of losing biodiversity, functioning and value. Three groups of estuaries are fall in this category: cool temperate river mouths, cool temperate temporarily open estuaries, and subtropical estuarine bays. All estuary groups on the west coast are under a lot of pressure. This is partly because there are only a few large estuaries along this coastline, each linked to a major river system and a large catchment that is heavily utilised.
Table 2: Status of estuarine ecosystems

<table>
<thead>
<tr>
<th>Ecosystem type</th>
<th>Cool temperate (west coast)</th>
<th>Warm temperate (south coast)</th>
<th>Subtropical (east coast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine bays</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanently open estuaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>River mouths</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estuarine lakes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporarily open estuaries</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LEGEND
- Critically endangered group of estuaries
- Endangered group of estuaries
- Vulnerable group of estuaries
- Least threatened group of estuaries

Figure 1 shows the number of estuary groups in each ecosystem status category. Seventy-seven percent of estuary groups are threatened, and 23% are critically endangered. The overall picture is less dramatic than for river ecosystems, but worse than for terrestrial ecosystems.

Figure 25: Number of estuary groups per ecosystem status category

We also assessed protection levels of estuarine ecosystems. Because an estuary is impacted by activities that occur far from the estuary itself, it is difficult to protect an estuary fully. To complicate matters further, terrestrial protected areas tend to include only the upper portion of an estuary, while marine protected areas tend to include only the lower portion of an estuary. There are few estuaries that
fall wholly within a protected area, and only five – those in the Tsitsikamma National Park – in which fishing or consumptive use of any kind is totally banned. An additional nine estuaries have high levels of protection, for example through restrictions on activities in sections of the estuary, and restrictions on development in the surrounding area. A further 27 estuaries have medium or low levels of protection.

The 14 estuaries with high levels of protection are not distributed evenly across the different groups of estuaries, resulting in some estuary groups that are relatively well protected, and others that are poorly protected, as shown in Table 3. It is useful to compare the protection level of each group with its status.

**Table 3: Protection levels of estuarine ecosystems**

<table>
<thead>
<tr>
<th>Estuarine bays</th>
<th>Cool temperate (west coast)</th>
<th>Warm temperate (south coast)</th>
<th>Subtropical (east coast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine bays</td>
<td>LT</td>
<td>CR</td>
<td>VU</td>
</tr>
<tr>
<td>Permanently open estuaries</td>
<td>EN</td>
<td>EN</td>
<td>LT</td>
</tr>
<tr>
<td>River mouths</td>
<td>CR</td>
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<td>EN</td>
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<tr>
<td>Estuarine lakes</td>
<td>VU</td>
<td>EN</td>
<td>CR</td>
</tr>
<tr>
<td>Temporarily open estuaries</td>
<td>CR</td>
<td>VU</td>
<td>EN</td>
</tr>
</tbody>
</table>

The status of each group of estuaries is also shown in the table: CR = critically endangered; EN = endangered; VU = vulnerable; LT = least threatened.

**Priorities for action**

All estuaries are highly valuable natural systems that deliver ecosystem services and economic benefits, so we should aim to maintain all estuaries in a functioning state. Fortunately, many of the human activities associated with estuaries are compatible with their conservation, as long as the activities are managed appropriately. Use and conservation of estuaries can go together. In this context, the following priority actions are identified:

1. **Determine the freshwater reserve for priority estuaries.** The National Water Act (1998) makes provision for Resource Directed Measures, which include setting a freshwater reserve for estuaries. Setting this reserve has only been carried out for a handful or estuaries so far. The assessment of
status and protection levels of estuarine ecosystems should assist in determining priority estuaries that urgently need to have their freshwater reserve determined and implemented. Those groups of estuaries that are critically endangered and not protected at all (for example, cool temperate river mouths) are likely to be of greatest immediate concern. This should be done in conjunction with the Consortium for Estuarine Research and Management (CERM).

2. **Expand the number of protected estuaries, to maintain a core set of estuaries in a natural or near-natural state.** CERM has identified 32 estuaries that should make up this core set, 11 of which already have some level of protection. Extending appropriate levels of protection to the remaining 21 should be a priority action. This is likely to mean limits to certain human activities in these estuaries, but not necessarily maximum levels of protection. For critically endangered groups of estuaries, it may be important to focus conservation attention on the remaining examples that are in good or excellent health, or in the absence of any healthy estuaries in the group, on rehabilitating at least one estuary in the group.

3. **Integrate resource management and land-use planning.** As with rivers, integrated planning and management of water and land throughout catchments is a priority if we are to maintain estuary functioning and value. It does not help to protect an estuary itself if, for example, higher up in the catchment effluent flows into the river are at dangerous levels. Ideally estuaries, along with rivers, should be integrated into fine-scale biodiversity assessments, as one step towards achieving this.

### How this assessment can be improved

On the whole, information available about South African estuaries is excellent, thanks to the work of our vibrant and committed community of estuary researchers and managers. Nevertheless, several improvements could be made, including the following:

- A review of the estuary classification system, to remove ambiguities and devise a more robust system that will be useful in applied conservation research.
- A quantitative assessment of estuary health. The methods developed for reserve determination need to be applied at a national scale, albeit at a desktop or rapid level if necessary. This will provide a better baseline from which to manage estuaries and determine their freshwater requirements, as well as for monitoring the effects of conservation efforts.
- Quantifying interactions between estuarine and marine ecosystems. Our understanding of estuarine ecosystem functioning is poor, especially with respect to functions such as nursery areas and outputs to the marine zone.
9. Marine biodiversity assessment

Current spatial patterns

Before the NSBA, marine habitats had never been mapped for all of South Africa’s waters. There was no consensus on an approach for mapping marine habitats, or even agreement that this was possible, with little spatial assessment ever having been done in the marine environment. The NSBA marine team led a series of workshops with marine managers and experts, in Cape Town, Durban and Port Elizabeth, to agree on an approach, and then gathered the data required to do the mapping. The result is the 34 marine biozones shown in Figure 26. The biozones extend from the coastal (or supratidal) zone to the end of the Economic Exclusion Zone (EEZ), which marks the end of South African waters. They are mapped at a broad scale, with room for refinement in future revision of the NSBA or in systematic biodiversity plans for particular sections of coast and sea.

Figure 26: Marine biozones, extending from the coast to the end of South Africa’s Economic Exclusion Zone
Marine species distribution data is limited, more so than for terrestrial species. Nevertheless, we gathered what was available, which included some fish distribution data, seaweed data, and intertidal invertebrates.

The integrity of different marine habitats had also not been mapped prior to the NSBA. We used quantitative expert assessment of the impacts of nine major categories of resource use and other influences on the marine environment, in each marine biozone. Again, marine managers and experts in around the country were involved in the process.

The nine major categories of impacts are shown in the thumbnail maps in Figure 27. They are: extractive marine living resource use, mining, mariculture,\(^\text{19}\) alien invasive species, pollution (including oil pollution, shipping-related pollution, and many sources of pollution deriving from inland land uses), coastal development, non-extractive recreational activities (such as off-road vehicles and boat-based tourism), climate change, catchment management issues (including over-abstraction of freshwater and siltation).

A bar graph of total scores for each category shows that overall, extractive marine living resource use is by far the biggest pressure on marine biodiversity (see Figure 28). The main forms of extractive marine living resource use are commercial and recreational fishing. It also includes subsistence fishing, illegal poaching, aquarium trade, ornamental shell trade, magico-medicinal trade, and mangrove harvesting.

Extractive marine living resource use directly affects all marine biozones except the abyss, which is too deep to reach using current fishing technology, and has the greatest impacts in areas that are the most accessible. Pollution and mining are the next most serious pressures, but mining is restricted to particular biozones, especially on the west coast where diamond mining is a major activity.

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\(^{19}\) Mariculture is an important growth industry, and need not have negative impacts if carefully managed. However, if poorly managed it can result in habitat loss, eutrophication, introduction of invasive species and the spread of disease. Even mariculture based on indigenous species can pose a significant risk to marine biodiversity, with genetically manipulated animals impacting on local stocks when they escape and breed with wild populations. It is important that applications for new mariculture activities are adequately assessed, and that environmental monitoring of existing and new mariculture activities is undertaken.
Figure 27: Impacts on marine ecosystems (current levels)

Figure 28: Total scores for each category of impacts on marine ecosystems, current and future
Results of the assessment

We assessed the status of marine ecosystems, using the marine biozones (Figure 26) and the current levels of impact on those biozones (Figure 27). The results are shown in Figure 29 and Figure 30. Sixty-five percent of marine biozones are threatened, with 12% critically endangered, 15% endangered, 38% vulnerable, and 35% least threatened.

The critically endangered marine biozones are West Coast supratidal (i.e. coastal), Namaqua intertidal (the area between the high-tide and low-tide marks), Namaqua shallow photic, and Namaqua deep photic. All are part of the broad Namaqua marine bioregion. Both mining and commercial fishing are responsible for the Critically Endangered status of the west coast biozones. The endangered marine biozones include supratidal (coastal) biozones and intertidal biozones, reflecting in large part the impact of extraction of marine living resources. In general, biozones further from the shore are less threatened, as they are less accessible to human-related impacts.

The overall picture for marine ecosystems is less dramatic than for rivers or estuarine ecosystems, but worse than for terrestrial ecosystems. Arguably on the upside for marine ecosystems is the fact that some of the impacts of extractive marine living resource use are reversible, if overharvesting of marine resources is stopped. For example, as long as fish stocks are still above a certain threshold, they can and do recover if fishing effort is reduced. However, in the course of harvesting marine resources, irreversible damage is often done to the habitat, such as when the sea bed is trawled for fish. Our marine ecosystems play a vital direct economic role. We need to be careful that in extracting economic value from them now, we do destroy their long-term productive capacity. All indications are that this is a real danger that faces South Africa.
Figure 29: Status of marine biozones

Figure 30: Number of biozones per ecosystem status category
We also assessed **protection levels of marine ecosystems**. Figure 31 shows South Africa’s marine protected areas (MPAs), which had not been comprehensively mapped prior to the NSBA. The following categories of MPAs are identified:

- **Category 1:** no-take MPAs (MPAs in which no marine living resource extraction is permitted)
- **Category 2:** other MPAs (MPAs in which some extraction is permitted, e.g. fishing from the shore)
- **Category 3:** closed areas (the three closed areas near East London)\(^\text{20}\)
- **Category 4:** proposed MPA (the proposed Namaqualand MPA)

Some MPAs are divided into different zones: no-take zones (Category 1) and zones in which some resource extraction is permitted (Category 2). The NSBA marine team also mapped existing MPAs in detail, showing the different zones within each MPA. Figure 32 shows an example from the east coast, giving a close up of the Pondoland and Aliwal Shoal MPAs.

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\(^{20}\) Other closed areas exist, for example, areas closed to trawling. These play an important role in protecting marine biodiversity. The three closed areas near East London are the ones most likely to achieve marine protected area status in the near future.
Figure 32: Close-up of the Pondoland MPA and the Aliwal Shoal MPA

Based on Category 1 (no-take) MPAs, we assessed protection levels of marine biozones. Figure 33 shows the results. Twenty-three of the 34 biozones have either zero or poor protection. None of the Namaqua biozones is protected, and no part of the lower slope or the abyss in South Africa’s EEZ is protected.

Our coastline is relatively well protected. However, although 23% of the coastline falls within Category 1-3 MPAs, only 9% of this is no-take. In addition, this 23% is not evenly distributed among bioregions, and is thus not representative of South Africa’s coastal marine biodiversity. The entire Namaqua bioregion (on the west coast) has no MPA, whereas the Delagoa bioregion (south of the Mozambique border) enjoys over 20% protection in no-take MPAs.
Moving away from the coastline, only 0.4% of South Africa’s EEZ falls within MPAs, and of this, only 0.2% is no take. The addition of the proposed Namaqualand MPA to the MPA estate would more than triple the sea surface area under protection, but still bring the total percent of the EEZ protected up to only 1.3%, well below the minimum 20% recommendations of the World Parks Congress in 2003.21

Priorities for action

The west coast biozones not only have the least protection (currently zero), but also experience the greatest pressures. Conservation intervention in these biozones is an urgent priority.

As we have emphasised, priorities for conservation action should be informed by our socio-economic context. For the terrestrial component we were able to assess some of the socio-economic opportunities and constraints on biodiversity using available spatial data (see Figure 17). For the marine component, such data were not available, so we asked marine managers and experts to give quantitative estimates of

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21 The 2003 World Parks Congress in Durban recommended that the minimum targets for the protection of marine biodiversity should be 20-30% of each habitat (World Parks Congress 2003 Recommendation 5.22. Stream: Marine).
future pressures on marine biodiversity in each of the 34 biozones, based on a ten year time horizon. The results are shown in Figure 34, and in Figure 29 above. Future pressures on marine biodiversity follow the same overall pattern as current pressures. The difference is that all are predicted to increase in the next ten years.

In this context, we suggest the following sets of priority actions to conserve marine biodiversity:

1. **Engage with the commercial fishing industry** to find ways to reduce negative impacts on marine biodiversity (both on fish stocks themselves, and on marine habitats, especially soft-bottom trawling grounds), thus contributing to the long-term health of the industry. Owing to the high number of species (~340) used by South African fisheries, more species-level interventions may be required in the marine environment than in the terrestrial environment.

2. **Engage with other industry sectors**, including the mining industry (especially the diamond industry on the west coast), the coastal property development sector, and the emerging mariculture industry,
to develop and implement sector-specific wise-practice guidelines to reduce impacts on marine habitats.

3. **Expand marine protected areas**, especially in the Namaqua bioregion, and beyond the coastal region into the deep sea region. Representative protection of the South African EEZ cannot be achieved with coastal MPAs that extend two or three nautical miles offshore. The proposed Namaqualand MPA will play an important role in this regard. We note that MPAs do not always ensure adequate protection of their biodiversity, and more effort needs to go into ensuring compliance within MPAs.

4. As we have stressed in the terrestrial, river and estuarine components, an **integrated approach to managing resources at the local level** is required, especially for coastal regions not in MPAs. This will require support to coastal municipalities.

**How this assessment can be improved**

Systematic spatial assessment of marine biodiversity is, like that for river biodiversity, in its early developmental stages, and spatial data for the marine environment are limited. The following would address some of the key information gaps which have limited this assessment:

- Improved mapping of the distribution of marine species, especially fish and species of special concern in other taxa;
- Improved classification and mapping of marine habitats, including reefs and sandy beaches;
- Improved mapping of the disturbance and loss of marine habitats, including soft-bottom trawling grounds and coastal access points;
- Identification and mapping of marine ecological processes, such as fish aggregation areas and upwelling.
- Spatial data on the economic value of marine resources.

As data improve, the assessment can be expanded to more species and more habitats, at finer scales. An additional challenge is to improve our understanding of the moving component of biodiversity in the marine environment, which is much more difficult to map and thus to deal with effectively in a spatial assessment.
10. Next steps

The NSBA 2004 is a starting point in many ways. It has fed into the NBSAP, and will feed into the National Biodiversity Framework. The Biodiversity Act requires that the National Biodiversity Framework be reviewed every five years, and SANBI’s intention is to review the NSBA to fit into this five-yearly cycle. However, it is likely that substantially better information on integrity of terrestrial and marine habitats, and national information on wetlands, will be available sooner than five years. SANBI hopes to update this assessment when such information becomes available. There is also a need to further integrate the terrestrial, river, estuarine and marine components, for example by identifying overall priorities for all four environments combined.

Another next step is to make links between the NSBA and other spatial policies and planning instruments, such as the National Spatial Development Perspective, and Provincial Spatial Development Frameworks. Even though the NSBA is a national-scale assessment, parts of it are at a fine enough scale to be applied directly in local SDFs. The terrestrial ecosystem status assessment in particular is relevant at the local scale.

The NSBA provides a tool for ongoing monitoring and reporting on the state of biodiversity. We propose the development of a national biodiversity management scorecard, based on a set of headline indicators drawn from the NSBA. A first attempt is included below, to stimulate discussion.

Proposed National Biodiversity Management Scorecard

**Purpose:** To provide a five-yearly snap shot of progress on managing South Africa’s biodiversity

**Example**

<table>
<thead>
<tr>
<th></th>
<th>Spatial information about biodiversity features</th>
<th>Spatial information about ecosystem integrity</th>
<th>Ecosystem status</th>
<th>Protection levels</th>
<th>Wise management of ecosystems outside protected areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrestrial</td>
<td>B</td>
<td>C-</td>
<td>C+</td>
<td>C+</td>
<td></td>
</tr>
<tr>
<td>River</td>
<td>C-</td>
<td>C-</td>
<td>E+</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Wetland</td>
<td>E</td>
<td>E</td>
<td>Unknown</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
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<td>A</td>
<td>B-</td>
<td>C-</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Marine</td>
<td>D-</td>
<td>E</td>
<td>D-</td>
<td>E+</td>
<td></td>
</tr>
</tbody>
</table>
Draft criteria

Spatial information about biodiversity features (including habitats, species and ecological processes):

- Completeness of data (e.g. is the whole country covered, are all taxa covered?)
- Scale of data (is the spatial scale of the data appropriate for a national assessment?)
- Reliability of data (how confident are we in the data?)
- Recency of data (are the data up to date?) (note that different updating timescales are appropriate for different types of data)

Spatial information about ecosystem integrity:

- Completeness of data (e.g. is the whole country covered, are all relevant aspects covered? (e.g. degradation in terrestrial ecosystems))
- Scale of data (is the spatial scale of the data appropriate for a national assessment?)
- Reliability of data (how confident are we in the data?)
- Recency of data (are the data up to date?)

Ecosystem status:

- What proportion of ecosystems are threatened?
- To what extent is the loss ecosystem functioning irreversible?

Protection levels:

- What proportion of ecosystems are well protected?
- Does the protected area network include a representative sample of different types of ecosystems?
- What are the overall levels of protection?

Management of ecosystems outside formal protected areas:

- To be developed
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  - Participants at the first national NBSAP workshop on 17-18 March 2004, who digested the first draft NSBA products and provided valuable feedback
  - Participants at the NetBio workshops, which gave biodiversity-related NGOs an opportunity to input into the NBSAP process, who gave valuable feedback on the draft NSBA products

For the terrestrial component

Principal contributors to the terrestrial component were:

- Mathieu Rouget (SANBI)
- Belinda Reyers (CSIR-Environmentek)
- Zuziwe Jonas (SANBI)
- Philip Desmet (Leslie Hill Institute for Plant Conservation, University of Cape Town)
- Mandy Driver (Botanical Society of South Africa)
- Kristal Maze (SANBI)
- Richard Cowling (University of Port Elizabeth)

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Appendix: Possible Applications of NSBA Products

The main spatial products of the National Spatial Biodiversity Assessment are:

1. Status of ecosystems (identifies which ecosystems are most threatened)
2. Protection levels of ecosystems (identifies which ecosystems are least protected)
3. Future pressures on biodiversity (terrestrial and marine only)
4. Overall priority map

Possible applications of each of these products are listed below.

1. Status of ecosystems

Main applications:

- Identification of threatened ecosystems for listing in terms of the Biodiversity Act
- Guide for determining which ecosystems need biodiversity management plans in terms of the Biodiversity Act
- Tool for monitoring and reporting requirements of the Minister in terms of the Biodiversity Act
- Basis for identifying environmentally sensitive areas in terms of NEMA s24(2)b

Additional applications:

- Identification of threatened ecosystems can be done by province, district and local municipality, highlighting opportunities for provinces and municipalities to contribute to national biodiversity priorities. For example, municipalities could take threatened ecosystems into account in their rates policies and SDFs.
- Could help to identify municipalities (those with higher numbers of threatened ecosystems) that require support to integrate biodiversity considerations into their IDPs and SDFs
- Can feed into and inform EMPs and EIPs drawn up by provinces and national departments

2. Protection levels of ecosystems

- Identifies gaps in the protected area system, providing a basis for national prioritisation of expansion of the protected area network
- Tool for monitoring the effectiveness of the protected area system, required in terms of the Protected Areas Act
3. **Future pressures on biodiversity**

- Flags key land- and resource-use pressures – important for regulating activities in threatened ecosystems, and for determining listed activities in terms of NEMA s24
- Highlights industrial and other sectors with which to enter into environmental management co-operation agreements, in priority areas
- Highlights areas of potential conflict with other major land-use departments, e.g. Agriculture, so that conflicts can be pre-empted
- Gives the Minister a "regional context" tool for assessing the impact of large development proposals

4. **Overall priority map**

- Guide for bioregional planning: highlights areas where bioregional plans and/or provincial spatial biodiversity plans are urgently required
- Highlights opportunities to link biodiversity to regional development priorities
- Provides a focus for government land management programmes such as NAPCCD and LandCare
- Highlights areas in which clearing of invasive aliens supports the achievement of biodiversity conservation targets
- Feeds directly into the other NBSAP components

In addition, the NSBA’s **analysis of species of special concern** can be used to:

- Provide a guide for drawing up provincial and national threatened and protected species lists required in terms of the Biodiversity Act
- Provide a guide for deciding which biodiversity management plans for species should be developed and approved in terms of the Biodiversity Act