GOVERNMENT NOTICE

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

No. 1002 **9 December 2011**

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004)

NATIONAL LIST OF ECOSYSTEMS THAT ARE THREATENED AND IN NEED OF PROTECTION

I, Bomo Edith Edna Molewa, Minister of Water and Environmental Affairs, hereby publish, in terms of section 52(1)(a) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), a national list of ecosystems that are threatened and in need of protection, in the Schedule hereto.

BOMO EDITH EDNA MOLEWA
MINISTER OF WATER AND ENVIRONMENTAL AFFAIRS

SCHEDULE

Threatened Terrestrial Ecosystems in South Africa

Contents

Executive Summary

1 Introduction

2 Purpose and rationale for listing ecosystems

2.1 Purpose of listing ecosystems

2.2 Rationale for listing ecosystems

3 Relevant sections of the Biodiversity Act and other legislation

3.1 Biodiversity Act

3.1.1 Listing of threatened or protected ecosystems

3.1.2 How do threatened ecosystems relate to threatened species?

3.1.3 Bioregional plans

3.1.4 Biodiversity management plans and biodiversity management agreements

3.1.5 Regulations

3.1.6 Norms and standards

3.1.7 Consultation and public participation

3.2 Other legislation with direct links to threatened ecosystems

3.2.1 NEMA

3.2.2 NEMA EIA Regulations

3.2.3 NEMA EMF Regulations

3.3 Other legislation with indirect links to threatened ecosystems

3.3.1 Protected Areas Act

3.3.2 National Forests Act

3.3.3 National Water Act

3.3.4 Marine Living Resources Act

3.3.5 Integrated Coastal Management Act

3.3.6 National Heritage Resources Act

4 Principles and criteria for identifying threatened ecosystems

4.1 Principles for identifying threatened or protected ecosystems

4.2 How have listed ecosystems been defined?

4.2.1 At what spatial scale have ecosystems been defined?
4.2.2 How have ecosystems been delineated?
4.3 Criteria for identifying threatened ecosystems
4.4 How do listed threatened ecosystems relate to ecosystem status in the National Spatial Biodiversity Assessment 2004?

5 Implications of listing threatened ecosystems
5.1 Planning related implications
5.2 Environmental authorisation implications
5.3 Proactive biodiversity management implications
5.4 Monitoring and reporting implications

6 Summary of listed ecosystems

7 Descriptions and maps of individual listed ecosystems
7.1 Explanation of descriptions
7.2 Critically Endangered (CR) ecosystems
7.3 Endangered (EN) ecosystems
7.4 Vulnerable (VU) ecosystems

8 Contact details

Appendix A: Relevant sections of the Biodiversity Act

Appendix B: Relevant sections of NEMA (as amended)

Appendix C: List of workshops and work sessions held

List of Tables

Table 1: Criteria used to identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems
Table 2: Summary statistics for listed ecosystems
Table 3: Summary of listed ecosystems, including reference numbers, divided into critically endangered, endangered and vulnerable ecosystems
Table 4: Summary of listed ecosystems by province

List of Figures

Figure 1: Map of listed ecosystems, showing original extent of ecosystems
Figure 2: Map of listed ecosystems, showing remaining extent of ecosystems

Acronyms

BGIS	Biodiversity GIS (http://bgis.sanbi.org)
BMP-E	Biodiversity management plans for ecosystems
BMP-S	Biodiversity management plans for species
CR	Critically endangered
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EIP	Environmental Implementation Plan
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EN	Endangered
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NLC	National Land Cover
NSBA	National Spatial Biodiversity Assessment
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
TOPS	Threatened or Protected Species
VU	Vulnerable

Executive Summary

This document contains the first national list of threatened terrestrial ecosystems and provides supporting information to accompany the list, including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed terrestrial ecosystems. It also includes individual maps and detailed information for each listed ecosystem. **This document, together with spatial data for listed ecosystems, can be accessed on SANBI's Biodiversity GIS (BGIS) website** (http://bgis.sanbi.org).

References are not provided in this executive summary, but can be found in footnotes in the main document.

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems in one of the following categories:

- **critically endangered (CR) 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;
- **endangered (EN) 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;
- **vulnerable (VU) 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;
- **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable

All stakeholders agreed early on that a **phased approach** should be taken to listing ecosystems, given the complexity of the process. The **first list of ecosystems consists of threatened ecosystems in the terrestrial environment;** future phases will deal with threatened ecosystems in the freshwater, estuarine and marine environments, and with protected

ecosystems in all environments. According to the Biodiversity Act, published lists of ecosystems must be reviewed at least every five years.

At the request of the Department of Environmental Affairs (DEA), SANBI has led the process of identifying threatened ecosystems to be listed, working in close collaboration with DEA, provincial conservation authorities, the Branch: Forestry previously of the Department of Water Affairs and Forestry (DWAF) now located in the Department of Agriculture, Fisheries and Forestry (DAFF), and relevant experts. **All listed ecosystems have been identified based on carefully developed and consistently applied national criteria**. There has been strong emphasis on the use of best available science as well as on the realities of implementation, to ensure that the list of threatened ecosystems is both scientifically rigorous and implementable.

The Biodiversity Act allows the Minister or an MEC to list ecosystems. The current list consists of national threatened terrestrial ecosystems identified based on national criteria, and is thus listed by the Minister. A province may develop additional provincial criteria and identify additional ecosystems to be listed by the MEC. However, to avoid confusion this is discouraged until the process of listing national ecosystems has been well established.

The National Spatial Biodiversity Assessment (NSBA) 2004 included early attempts to identify threatened ecosystems. However, the identification of threatened terrestrial ecosystems for the current phase of listing has been much more detailed and comprehensive, using additional criteria and data. This means that the **list of threatened terrestrial ecosystems presented here supersedes the information regarding terrestrial ecosystem status in the NSBA 2004**. When the National Biodiversity Assessment (NBA) 2011 is published, it will be aligned and consistent with this published list of threatened terrestrial ecosystems.

Why list ecosystems?

The White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (1997) noted that little attention had historically been paid to protection of ecosystems outside protected areas. This laid the basis for the Biodiversity Act to introduce a suite of new legal tools for biodiversity conservation outside protected areas, including listing of threatened or protected ecosystems, listing of threatened or protected species, bioregional plans, biodiversity management plans for ecosystems or species, and biodiversity management agreements.

The **purpose of listing threatened ecosystems** is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The **purpose of listing protected ecosystems** is primarily to preserve witness sites of exceptionally high conservation value. For both threatened and protected ecosystems, the purpose includes enabling or facilitating proactive management of these ecosystems. It is likely that ecosystem listing will also play a symbolic and awareness-raising role; however, this is not the primary purpose of listing ecosystems.

The purpose of listing threatened or protected ecosystems is *not* to ensure the persistence of landscape-scale ecological processes or to ensure the provision of ecosystem services, even though listing ecosystems may contribute towards these important goals.

Bioregional plans published in terms of the Biodiversity Act identify critical biodiversity areas, which will include landscape-scale ecological features (such as ecological corridors and important catchments) which are crucial for biodiversity conservation but which will not be protected through listing of threatened or protected ecosystems. A *Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans* was gazetted in March 2009.

Biodiversity management plans will be a useful tool for active management of threatened ecosystems. Norms and standards for biodiversity management plans for ecosystems are in the process of being developed.

How were listed ecosystems identified?

As a starting point, several **principles** were established for identifying threatened or protected ecosystems:

- The approach must be explicit and repeatable;
- The approach must be target-driven[1] and systematic, especially for threatened ecosystems;

[1] Biodiversity targets, also known as biodiversity thresholds, are explicit quantitative targets that tell us how much of an ecosystem (or other biodiversity feature) needs to be conserved in order to meet our biodiversity goals of representation and persistence. Biodiversity targets are expressed as, for example, numbers of hectares of an ecosystem.

- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed and an ecosystem is listed based on its highest ranking criterion;
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of the ecosystems concerned.

In deciding on the appropriate **spatial scale** for identifying threatened or protected ecosystems, it was important to consider the purpose and rationale for listing ecosystems as well as the legal implications. These two considerations combined require that **listed ecosystems be defined at the local rather than the regional scale**. For the current phase of listing, threatened terrestrial ecosystems have been delineated based on one of the following: the South African Vegetation Map, national forest types recognised by DAFF, priority areas identified in a provincial systematic biodiversity plan, or high irreplaceability forests patches or clusters systematically identified by DAFF. For future phases of listing, ecosystems may be identified at a finer spatial scale than these units, but will not be identified at a broader spatial scale than these units.

The development of **criteria** for identifying threatened terrestrial ecosystems was done through extensive engagement and consultation with provincial conservation authorities, the Branch: Forestry previously of DWAF and now located in DAFF, and relevant experts, and was based on best available science. The criteria and thresholds for critically endangered, endangered and vulnerable ecosystems are summarised in Table 1 and explained in more detail in the main document. If an ecosystem meets any one of the criteria, it should be listed. If an ecosystem meets more than one criterion, it should be listed based on its highest ranking criterion. For example, if an ecosystem meets the threshold for vulnerable on one criterion and the threshold for endangered on another criterion, it should be listed as endangered.

Table 1: Criteria used to identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems

Criterion	CR	EN	VU
A1: Irreversible loss of natural habitat	Remaining natural habitat ≤ biodiversity target	Remaining natural habitat ≤ (biodiversity target + 15%)	Remaining natural habitat ≤ 60% of original area of ecosystem
A2: Ecosystem degradation and loss of integrity*	≥ 60% of ecosystem significantly degraded	≥ 40% of ecosystem significantly degraded	≥ 20% of ecosystem significantly degraded
B: Rate of loss of natural habitat**			
C: Limited extent and imminent threat*	--	Ecosystem extent ≤ 3 000ha, and imminent threat	Ecosystem extent ≤ 6 000ha, and imminent threat
D1: Threatened plant species associations	≥ 80 threatened Red Data List plant species	≥ 60 threatened Red Data List plant species	≥ 40 threatened Red Data List plant species
D2: Threatened animal species associations**			
E: Fragmentation**			
F: Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan	Very high irreplaceability and high threat	Very high irreplaceability and medium threat	Very high irreplaceability and low threat

* Because of data constraints, Criteria A2 and C have been applied to forests but not to other vegetation types.
** Because of data constraints, Criteria B and D2 are dormant at this stage and thresholds have not been set for these criteria. Further testing of Criterion E is needed to determine whether it is a workable criterion for terrestrial ecosystems.

What are the implications of listing an ecosystem?

There are four main types of implications of listing an ecosystem:

- Planning related implications, linked to the requirement in the Biodiversity Act for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications, in terms of NEMA and EIA regulations;
- Proactive management implications, in terms of the Biodiversity Act;
- Monitoring and reporting implications, in terms of the Biodiversity Act.

The **environmental authorisation implications** are summarised here. The other implications are discussed in the main document.

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010),
- Listing Notice 2: activities that require scoping and environmental impact report (EIR) (R545 of 2010),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m^2 of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means **any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a basic assessment** in terms of the EIA regulations.

It is important to note that **while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem** and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

Summary statistics and maps of listed ecosystems

As shown in Table 2, remaining natural areas in threatened terrestrial ecosystems make up 9.5% of the country, with critically endangered and endangered ecosystems together accounting for 2.7% and vulnerable ecosystems a further 6.8%. The table shows how the ecosystems are distributed by province, and gives approximate areas. The area figures refer to the remaining natural habitat in listed ecosystems, not their original extent. Figure 1 and Figure 2 show the original and remaining extent of the ecosystems respectively.

Table 2: Summary statistics for listed ecosystems

	CR		EN		VU		TOTAL	
	000 ha	%	000 ha	%	000 ha	%	000 ha	%
Eastern Cape	4	0.0	51	0.3	588	3.5	643	3.8
Free State	2	0.0	383	3.0	1 049	8.1	1 433	11.0
Gauteng	99	6.0	95	5.8	189	11.4	384	23.2
KZN	224	2.4	464	5.0	1 164	12.5	1 852	19.9
Limpopo	9	0.1	123	1.0	536	4.3	668	5.3
Mpumalanga	6	0.1	634	8.3	2 226	29.1	2 866	37.5
Northern Cape			35	0.1	109	0.3	144	0.4
North West	186	1.8	452	4.3	1 309	12.3	1 947	18.3
Western Cape	374	2.9	154	1.2	1 083	8.4	1 611	12.5
South Africa	**903**	**0.7**	**2 392**	**2.0**	**8 252**	**6.8**	**11 547**	**9.5**

Table notes:

- Area figures refer to remaining natural area. They have been rounded to nearest thousand hectares so totals may not add up exactly.
- A blank cell indicates that no ecosystems were identified. A zero indicates that one or more ecosystems have been identified but that their total remaining area is less than 1 000ha.

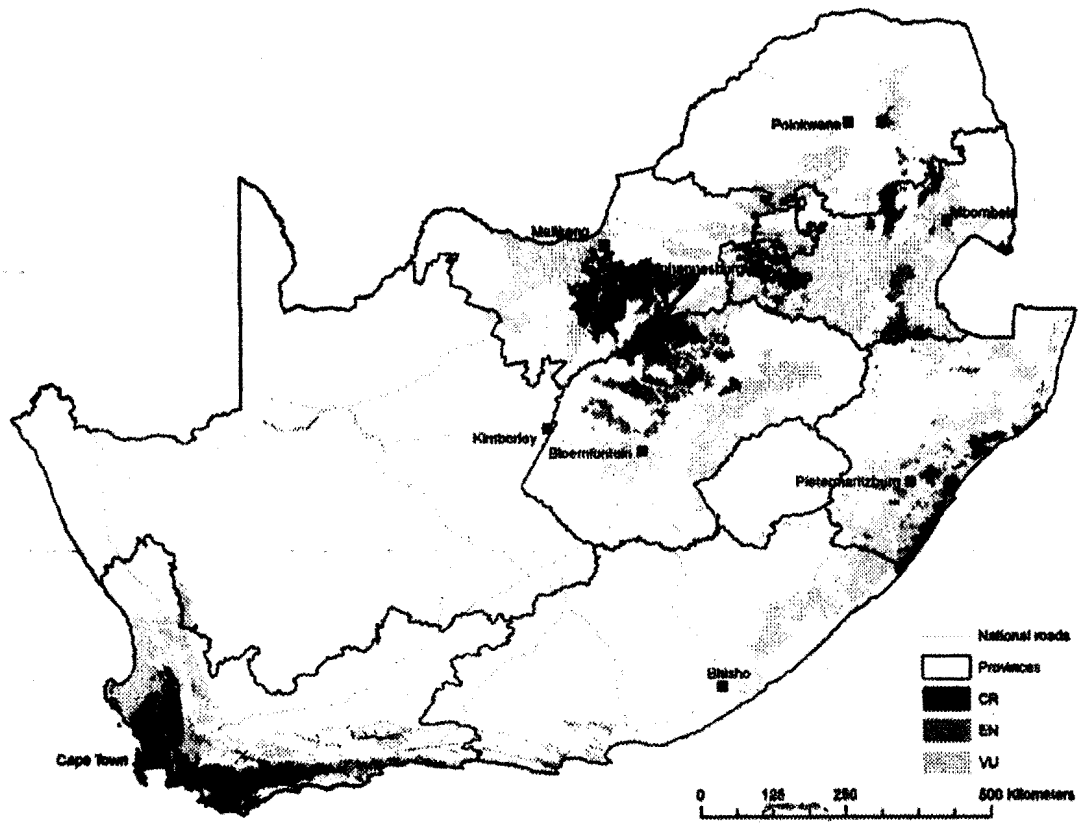

Figure 1: Map of listed ecosystems, showing original extent of ecosystems

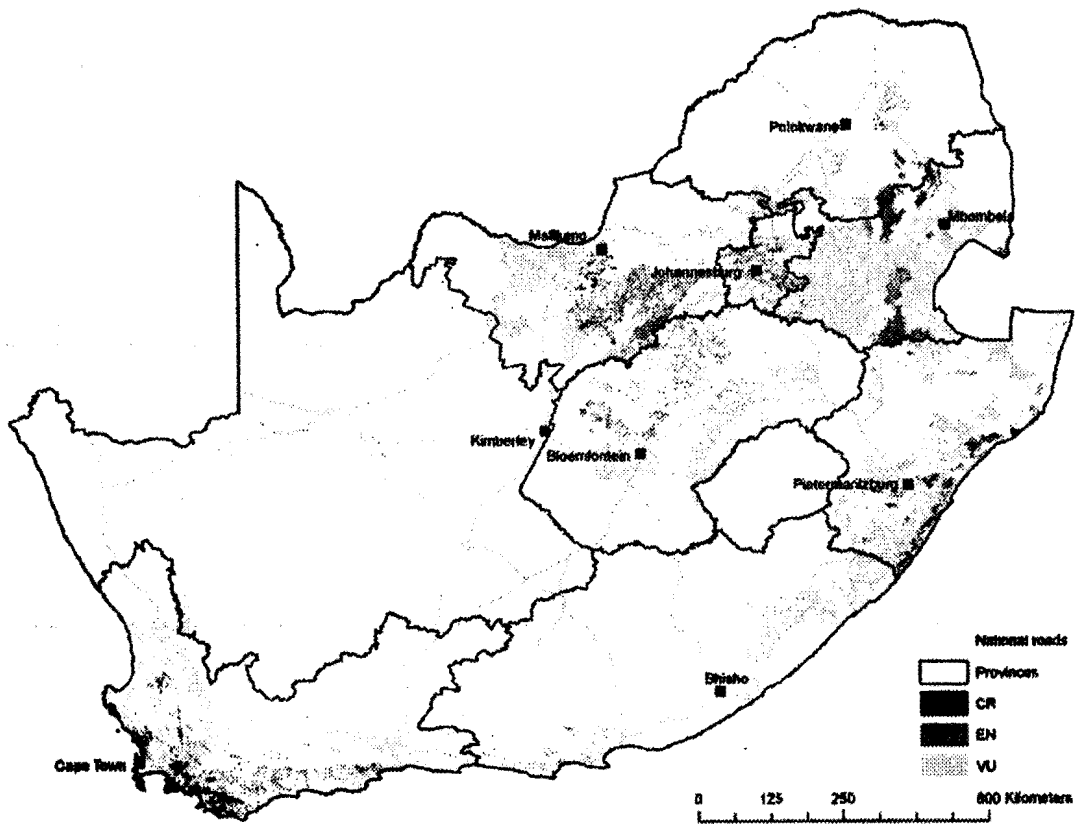

Figure 2: Map of listed ecosystems, showing remaining extent of ecosystems

1 Introduction

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (hereafter referred to as the Biodiversity Act) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Department of Environmental Affairs (DEA) requested the South African National Biodiversity Institute (SANBI) to assist in the process of listing threatened or protected ecosystems.

The listing of threatened or protected ecosystems will take place across all environments including terrestrial, freshwater, estuarine and marine. However, all stakeholders have agreed that it makes sense to take a phased approach to listing of ecosystems, given the complexity of the task. The first list of ecosystems consists of **threatened ecosystems in the terrestrial environment**; future phases will deal with threatened ecosystems in the freshwater, estuarine and marine environments, and with protected ecosystems in all environments.[2] Once these lists have been published they will be reviewed at least every five years as required in the Biodiversity Act.

SANBI has led the process of identifying threatened ecosystems to be listed, working in close collaboration with DEA, provincial conservation authorities, the Branch: Forestry previously of the Department of Water Affairs and Forestry (DWAF) now located in the Department of Agriculture, Fisheries and Forestry (DAFF), and relevant experts. All listed threatened ecosystems have been identified based on carefully developed and consistently applied national criteria. There has been strong emphasis on the use of best available science as well as on the realities of implementation, to ensure that the list of threatened ecosystems is both scientifically rigorous and implementable.

The Biodiversity Act allows for the Minister or an MEC to list threatened or protected ecosystems. The current phase of listing ecosystems includes national listed ecosystems only. All ecosystems listed have been identified according to national criteria and are ecosystems of national significance. Provinces may choose to develop further provincial criteria and to identify additional ecosystems for provincial lists; however, for practical implementation-related reasons

[2] The exception to this is some azonal (e.g. wetland and alluvial) vegetation types identified in the South African Vegetation Map which have been included in the current phase. These azonal vegetation types represent transitions between the terrestrial and freshwater environments. See Section 4.2 for more on how ecosystems were defined.

this is discouraged until the national listing process is well established (i.e. until ecosystems from all environments, terrestrial and aquatic, have been listed and the lists reviewed at least once). The National Spatial Biodiversity Assessment (NSBA) 2004[3] included early attempts to identify threatened ecosystems. However, the identification of threatened terrestrial ecosystems for the current phase of listing has been much more detailed and comprehensive, using additional criteria and data. This means that, once finalised and published in terms of the Biodiversity Act, **the list of threatened terrestrial ecosystems presented here will supersede the information regarding terrestrial ecosystem status in the NSBA 2004**. When the National Biodiversity Assessment (NBA) 2011 is published, it will be aligned and consistent with this published list of threatened terrestrial ecosystems.

This document contains the first national list of threatened terrestrial ecosystems, provides supporting information to accompany the list, and includes individual maps and detailed information for each listed ecosystem. It is structured as follows:

- Section 2 explains the **purpose and rationale** for listing threatened or protected ecosystems,
- Section 3 gives an overview of the relevant sections of the **Biodiversity Act and other legislation** with links to the listing of threatened or protected ecosystems,
- Section 4 explains the principles established and the approach taken to listing ecosystems including the **criteria** developed for identifying threatened ecosystems,
- Section 5 deals with the **implications** of listing a threatened ecosystem,
- Section 6 gives **summary information** on the list of threatened terrestrial ecosystems,
- Section 7 provides **individual maps and descriptions** for each listed ecosystem,
- Section 7 gives **contact details** for further information.

This document, together with spatial data for listed ecosystems, can be accessed on SANBI's Biodiversity GIS (BGIS) website (http://bgis.sanbi.org).

[3] Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005. National Spatial Biodiversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa. *Strelitzia* 17. South African National Biodiversity Institute, Pretoria.

2 Purpose and rationale for listing ecosystems

2.1 Purpose of listing ecosystems

The purpose of listing **threatened ecosystems** is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing **protected ecosystems** is primarily to preserve witness sites of exceptionally high conservation value. For both threatened and protected ecosystems, the purpose includes enabling or facilitating proactive management of these ecosystems. It is likely that ecosystem listing will also play a symbolic and awareness-raising role; however, this is not the primary purpose of listing ecosystems.

The purpose of listing threatened or protected ecosystems is *not* to ensure the persistence of landscape-scale ecological processes or to ensure the provision of ecosystem services, even though listing ecosystems may contribute towards these important goals. Bioregional plans published in terms of Section 40 of the Biodiversity Act provide maps of critical biodiversity areas, including areas important for the persistence of landscape-scale ecological processes. See Section 3.1.3 of this document for more on bioregional plans and the relationship between threatened ecosystems and critical biodiversity areas.

2.2 Rationale for listing ecosystems

In order to conserve biodiversity effectively, we need to:

- Conserve a **representative sample** of all components of biodiversity (genes, species, ecosystems), which is known as the principle of representation;
- Ensure the continued functioning of **ecological and evolutionary processes** that allow biodiversity to persist over time, which is known as the principle of persistence.

Systematic biodiversity planning (also referred to as systematic conservation planning) is a spatial planning approach, widely used and well developed in South Africa, which identifies geographic priority areas required to achieve these representation and persistence goals.

Broadly speaking, there are two main strategies for ensuring that the geographic priority areas identified in systematic biodiversity plans remain in a well managed natural state:

- Strategy 1: Consolidation and expansion of the protected area network;
- Strategy 2: Integrated management aimed at conservation of critical biodiversity areas outside the protected area network.

The protected area network, for various historical reasons, is biased towards certain ecosystems (such as savanna and mountain fynbos ecosystems) and does a poor job of protecting other ecosystems (such as succulent karoo, grasslands, fynbos lowlands, Nama karoo, almost all freshwater ecosystems, estuaries, and offshore marine ecosystems).

This makes the second strategy all the more important for ecosystems that are poorly protected by the protected area network. These ecosystems often occur in production landscapes where options for formal protection through the protected area network are reduced. Yet, as the White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (White Paper on Biodiversity, 1997) notes, **little attention has historically been paid to the protection of ecosystems outside protected areas**. The White Paper thus helped set the scene for listing of threatened or protected ecosystems even though it does not refer to them directly. Its Policy Objective 1.2 is especially relevant: maintain and strengthen existing arrangements to conserve South Africa's indigenous biodiversity, both inside and outside of protected areas.

In the discussion of this policy objective, the White Paper notes: "South Africa has a substantial body of law to conserve biodiversity, especially within protected areas and for several plant and vertebrate species. However, *past approaches to biodiversity conservation have not given adequate attention to the conservation of landscapes and ecosystems outside of protected areas*..." (emphasis added).

The White Paper commits government to achieving Policy Objective 1.2 through collaborating with interested and affected parties to:

- Conserve important components of biodiversity through a variety of mechanisms such as legislation, planning controls, guidelines, and protected area designations, giving priority to components of biodiversity requiring urgent protective measures;

- *Introduce legal measures and incentives to conserve important ecosystems, habitats, and landscapes outside of protected areas*, including rangelands and their associated vegetation and indigenous wildlife resources.

According to the White Paper, important components of biodiversity include ecosystems and habitats that:

- contain high diversity,
- contain large numbers of endemic or threatened species,
- are relatively pristine,
- are important nursery or spawning areas,
- are under particular threat,
- are important for endangered or migratory species,
- adjoin conserved ecosystems and habitats,
- are of social, economic, cultural or scientific importance, or
- are unique, representative of or associated with key evolutionary, biological or other life-supporting processes.

In response to the historical lack of attention highlighted in the White Paper to conserving biodiversity outside the protected area network, the Biodiversity Act introduced several new legal tools, including listing of threatened or protected ecosystems. It is important to note that listing threatened or protected ecosystems is just one tool to achieve conservation objectives. Others include:

- Publishing bioregional plans,
- Listing threatened or protected species and accompanying regulations,
- Biodiversity management plans for ecosystems or species,
- Biodiversity management agreements
- Invasive alien species regulations.

Systematic biodiversity planning is an important element in the implementation of several of these tools. It provides the basis for bioregional plans published in terms of the Biodiversity Act (see Section 3.1.3) and for protected area expansion strategies (including the National Protected Area Expansion Strategy led by DEA and approved in March 2009), and assists with the identification of threatened ecosystems (see Section 4.3).

3 Relevant sections of the Biodiversity Act and other legislation

The Biodiversity Act establishes the framework for listing threatened or protected ecosystems, drawing on policy objectives established in the White Paper on Biodiversity. As noted, the Biodiversity Act also provides for several related tools, including bioregional plans, biodiversity management plans, biodiversity management agreements and listed species.

Several other pieces of legislation have direct or indirect links with the Biodiversity Act's provisions on listed ecosystems. Legislation with direct links to listed ecosystems includes:

- National Environmental Management Act (Act 107 of 1998, as amended) (NEMA),
- NEMA Environmental Impact Assessment Regulations (EIA Regulations),
- NEMA Environmental Management Framework Regulations (EMF Regulations).

Legislation with indirect links to listed ecosystems includes:

- National Environmental Management: Protected Areas Act (Act 57 of 2003),
- National Forests Act (Act 84 of 1998),
- National Water Act (Act 36 of 1998),
- Marine Living Resources Act (Act 18 of 1998),
- Integrated Coastal Management Act (Act 24 of 2008),
- National Heritage Resources Act (Act 25 of 1999).

This section briefly summarises the relevant sections of the Biodiversity Act and discusses links with other legislation.

3.1 Biodiversity Act

This section summarises the Biodiversity Act's provisions on listing of ecosystems, and looks at other relevant aspects of the Biodiversity Act dealing with:

- Listing of species,
- Bioregional plans,
- Biodiversity management plans and biodiversity management agreements,
- Regulations,

- Norms and standards,
- Consultation and public participation.

The full text of the relevant sections of the Biodiversity Act is available in Appendix A.

3.1.1 Listing of threatened or protected ecosystems

Sections 52 to 55 of the Biodiversity Act deal directly with listing threatened or protected ecosystems. The Minister may publish a national list of ecosystems that are threatened and in need of protection, and an MEC may publish a provincial list of such ecosystems with the concurrence of the Minister.[4]

The following categories of ecosystems may be listed:

- **critically endangered (CR) 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;
- **endangered (EN) 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;
- **vulnerable (VU) 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;
- **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.[5]

According to the Act:

- The location of each ecosystem on the list must be described "in sufficient detail".
- The Minister (or MEC) must review the published list of ecosystems at least every five years.

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[4] As noted in Section 1, the current phase of listing ecosystems includes national listed ecosystems only.
[5] As noted in Section 1, in the current phase of listing criteria for identifying protected ecosystems have not been developed and protected ecosystems have not been listed.

- The Minister may identify any process or activity in a listed ecosystem as a threatening process. Note that in the current phase of listing, threatening processes have not been identified.
- An organ of state that must prepare an environmental implementation or environmental management plan (EIP or EMP) in terms of Chapter 3 of NEMA (i.e. all national departments and provinces), and a municipality that must adopt an integrated development plan (IDP) in terms of the Municipal Systems Act (Act 32 of 2000), must take into account the need for the protection of listed ecosystems (see Section 5 for more on the implications of this important provision).

3.1.2 How do threatened ecosystems relate to threatened species?

The Biodiversity Act also provides for listing threatened or protected species (Sections 56-57). Lists of threatened or protected species with accompanying regulations were gazetted in February 2007 and amended in December 2007, January 2008 and February 2009.[6]

Only species threatened by restricted activities as defined in the Biodiversity Act have been included in the lists of threatened or protected species. The Biodiversity Act defines restricted activities as:

- hunting, catching, capturing or killing any living specimen;
- gathering, collecting or plucking any specimen;
- picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen;
- importing or exporting any specimen;
- having in possession or exercising physical control over any specimen;
- growing, breeding or in any other way propagating any specimen or causing it to multiply;
- conveying, moving or otherwise translocating any specimen;
- selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any way acquiring or disposing of any specimen.

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[6] Threatened or Protected Species Regulations R.152 (Government Gazette No. 29657, 23 February 2007); Publication of Lists of Critically Endangered, Endangered, Vulnerable and Protected Species R.151 (Government Gazette No. 29657, 23 February 2007); Threatened or Protected Species Amendment Regulations R.1188 (Government Gazette No. 30568, 14 December 2007); Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species Lists R.1187 (Government Gazette No. 30568, 14 December 2007); Threatened or Protected Species Amendment Regulations R.69 (Government Gazette No. 30703, 28 January 2008); Threatened or Protected Species Amendment Regulations R.209 (Government Gazette No. 31962, 27 February 2009); Threatened or Protected Species Second Amendment Regulations R.210 (Government Gazette No. 31963, 27 February 2009).

This list of restricted activities does *not* include destruction of the habitat of a species, which is the main driver of loss of terrestrial species. Many species are threatened only by habitat loss; however, these species have not been listed in terms of the Biodiversity Act. Partly for this reason Criterion D: Threatened Species Associations was developed for listing ecosystems (see Section 4.3 of this document). This criterion identifies ecosystems containing high numbers of threatened species. However, it will not be possible to protect all species threatened by habitat loss via the ecosystem listing process, partly because knowledge of the locations of these species is incomplete.

3.1.3 Bioregional plans

The Biodiversity Act allows for the publishing of bioregional plans. The purpose of a bioregional plan is to provide a map of critical biodiversity areas with accompanying land-use planning and decision-making guidelines, to inform land-use planning, environmental assessment and authorisations, and natural resource management by a range of sectors whose policies and decisions impact on biodiversity. Bioregional plans are intended to feed into multi-sectoral planning and assessment processes such as Environmental Management Frameworks (EMFs), Spatial Development Frameworks (SDFs), IDPs, Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs).

A published bioregional plan is a spatial plan showing terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecological processes. These areas are referred to as critical biodiversity areas, and should remain in a natural or near-natural state. A bioregional plan may also identify ecological support areas which support the ecological functioning of critical biodiversity areas and/or deliver ecosystem services, and which should remain in at least an ecologically functional state. A bioregional plan must include guidelines for avoiding loss or degradation of natural habitat in critical biodiversity areas and ecological support areas. **Critically endangered ecosystems will always form a subset of critical biodiversity areas**, in regions for which bioregional plans have been published.

A *Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans* was gazetted in March 2009.[7] Several bioregional plans are in the process of being developed.

3.1.4 Biodiversity management plans and biodiversity management agreements

Sections 43 to 46 of the Biodiversity Act deal with biodiversity management plans and biodiversity management agreements. Any person, organisation or organ of state can develop a draft biodiversity management plan and submit it to the Minister for approval, for:

- a listed ecosystem,
- an ecosystem which is not listed but which does warrant special conservation attention.

Biodiversity management plans can also be developed for species.

Before approving and publishing a draft biodiversity management plan, the Minister must identify a suitable person, organisation or organ of state willing to be responsible for the implementation of the plan, determine the manner of implementation of the plan, and assign responsibility for the implementation of the plan to the identified person, organisation or organ of state.

The Minister may enter into a biodiversity management agreement with the identified person, organisation or organ of state, or any other suitable person, organisation or organ of state, regarding the implementation of a biodiversity management plan.

A biodiversity management plan must be aimed at ensuring the long-term survival in nature of the species or ecosystem to which the plan relates, and must provide for the responsible person, organisation or organ of state to monitor and report on progress with implementation of the plan.

The Minister must review a published biodiversity management plan at least every five years, and assess compliance with the plan and the extent to which its objectives are being met.

National Norms and Standards for the Development of Biodiversity Management Plans for Species (BMP-S) have been developed by DEA and were gazetted in March 2009.[8]

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[7] Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans (Government Gazette No.32006, 16 March 2009).

Norms and standards for biodiversity management plans for ecosystems (BMP-E) are in the process of being developed.

3.1.5 Regulations

Section 97 of the Biodiversity Act deals with regulations. The Minister may make regulations relating to minimising the threat to the ecological integrity of a listed ecosystem. The Minister may also make regulations relating to the monitoring of compliance with and enforcement of norms and standards referred to in Section 9 of the Biodiversity Act (see Section 3.1.6).

3.1.6 Norms and standards

Section 9 of the Biodiversity Act deals with norms and standards. The Minister may issue norms and standards for the achievement of any of the objectives of the Act, including restriction of activities which impact on biodiversity and its components. Norms and standards may apply nationwide, in a specific area only, or to a specific category of biodiversity only. The Minister may set indicators to measure compliance with the norms and standards.

3.1.7 Consultation and public participation

Sections 99 and 100 of the Biodiversity Act deal with consultation and public participation. Before exercising the powers discussed above, the Minister must consult all Cabinet members whose areas of responsibility may be affected, consult the MEC for Environmental Affairs of each province that may be affected, and allow for public participation.

Public participation requirements are as follows: The Minister must give notice of the proposed exercise of the power in the Gazette, and in at least one newspaper distributed nationally or distributed in a particular area if only that area is affected. The notice must invite members of the public to submit written representations on, or objections to, the proposed exercise of the power within 30 days, and must contain sufficient information to enable members of the public to

[8] Norms and Standards for the Development of Biodiversity Management Plans for Species R.214 (Government Gazette No. 31968, 3 March 2009).

submit meaningful representations or objections. The Minister may in appropriate circumstances allow oral representations or objections. The Minister must give due consideration to all representations or objections received or presented before exercising the power.

3.2 Other legislation with direct links to threatened ecosystems

3.2.1 NEMA

The full text of the relevant sections of NEMA is available in Appendix B.

Section 24 of NEMA, which has been amended several times, deals with environmental authorisations. Subsections 24(2) and (3) allow the Minister or MEC to identify geographical areas, based on environmental attributes and as specified in spatial development tools that have been adopted by the competent authority, in which specified activities may not commence without environmental authorisation or in which specified activities may be excluded from environmental authorisation. The Minister or MEC may compile information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account by every competent authority.

Before identifying an activity or geographical area in terms of Subsection 24(2), the Minister or MEC must publish a notice in the Gazette:

- specifying, through description, a map or any other appropriate manner, the activity or area that it is proposing to list,
- inviting interested parties to submit written comments on the proposed listing within a specified period,
- giving the competent authorities and the date on which the list comes into effect.

In terms of Subsection 53(2) of the Biodiversity Act, **a listed ecosystem is identified as a geographical area in terms of Subsection 24(2) of NEMA.** Also in terms of Subsection 53(2) of the Biodiversity Act, a threatening process in a listed ecosystem becomes a specified activity in terms of Subsection 24(2) of NEMA.

3.2.2 NEMA EIA Regulations

The current EIA Regulations (R543, R544, R545, R546 of 2010)[9] were promulgated in June 2010 and came into effect on 2 August 2010. They are intended to streamline the environmental authorisation process for developers and for competent authorities (usually provincial environmental affairs departments on behalf of MECs for the environment).

The EIA Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010),
- Listing Notice 2: activities that require scoping and environmental impact report (EIR) (R545 of 2010),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

The list of threatened ecosystems is directly relevant to Activity 12 in Listing Notice 3. Activity 12 relates to the clearance of 300m^2 of more of vegetation, which will trigger a basic assessment in the following geographical areas:

- within **any critically endangered or endangered ecosystem listed in terms of Section 52 of the Biodiversity Act**, or prior to the publication of such a list within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004,
- within critical biodiversity areas identified in bioregional plans,
- within the littoral active zone or 100m inland from the high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line in urban areas.

A basic assessment in terms of Listing Notice 3 is triggered only in those parts of critically endangered and endangered ecosystems where natural habitat remains.

DEA and some provincial environmental affairs departments have developed guidelines on the interpretation of listed activities, which should be consulted for more detail.

[9] Government Gazette No. 33306, 18 June 2010, as corrected on 30 July 2010 (R660 of 2010) and 10 December 2010 (R1159 of 2010).

3.2.3 NEMA EMF Regulations

NEMA Section 24(3) provides the basis for the development of Environmental Management Frameworks, for which regulations have been published (R547 of 2010). An EMF is an environmental planning tool that specifies areas where certain land uses are most compatible or incompatible with environmental opportunities and constraints in the landscape. **Listed ecosystems should be incorporated into EMFs**, with restrictions on any loss of natural habitat in critically endangered or endangered ecosystems.

3.3 Other legislation with indirect links to threatened ecosystems

3.3.1 Protected Areas Act

The National Environmental Management: Protected Areas Act (2003) (hereafter referred to as the Protected Areas Act) defines four main categories of protected areas:

- Special nature reserves (can be declared only by the Minister)
- National Parks (can be declared only by the Minister)
- Nature reserves (can be declared by the Minister or MEC)
- Protected environments (can be declared by the Minister or MEC)

Any of these four categories of protected area can be declared on privately owned land, at the request or with the consent of the landowner(s).

The Protected Areas Act also recognises world heritage sites, marine protected areas, specially protected forest areas, and mountain catchment areas, all of which are declared in terms of other Acts.

Protected ecosystems in terms of the Biodiversity Act are *not* intended to be equivalent to any of these categories of protected areas. Listing of ecosystems is intended to complement the Protected Areas Act. There is no substitutability between the protected area categories and the listing categories.

However, there is potential overlap between the rationale for declaration of protected environments and listing threatened ecosystems. A protected environment can be declared "to protect the area if the area is sensitive to development" or "to protect a specific ecosystem outside a special nature reserve, world heritage site or nature reserve" (Subsection 28(2)).

In some cases, listed ecosystems may occur inside protected areas. It is important from the point of view of developing protected area management plans to know if there are ecosystems inside protected areas that are threatened, so that these ecosystems can be appropriately managed.

3.3.2 National Forests Act

In terms of the National Forests Act (1998), trees in all indigenous forests are protected, and some indigenous forests are declared specially protected forest areas.

Chapter 3 of the National Forests Act deals with special measures to protect forests and trees.

- Part 1 (Section 7) prohibits the destruction of indigenous trees in any natural forest without a licence. The Minister can declare a group of indigenous trees to be a forest even if their crowns are not largely contiguous, based on scientific advice that the trees make up a forest.
- Part 2 (Sections 8-11) allows the Minister to declare certain forests specially protected forest areas.
    - A state forest or part of it can be declared a specially protected forest area
    - Land can be purchased or expropriated and declared a specially protected forest area
    - At the request of or with the consent of a landowner outside a state forest, the Minister can declare a specially protected forest area.
- Specially protected forest areas must fall into one of the following categories: forest nature reserve, forest wilderness area, any other type of protected area which is recognised in international law or practice
- Part 3 (Sections 12-16) allows the Minister to declare a tree, a group of trees, a woodland, or a species of tree as protected
- Part 4 (Sections 17-18) gives the Minister powers to intervene urgently to prevent deforestation and to rehabilitate deforested areas

The process of declaring a specially protected forest area, protected woodland or a protected group of trees is considerably more onerous than the process of listing a threatened or protected ecosystem. The Biodiversity Act can therefore complement the National Forests Act in this regard.

3.3.3 National Water Act

The National Water Act (1998) defines a water resource as a watercourse (including wetlands), surface water, estuary or aquifer. The Act places strong emphasis on sustainable use of water resources, and its purpose includes "protecting aquatic and associated ecosystems and their biological diversity" (Subsection 2(g)).

Chapter 3 deals with protection of water resources, and establishes a series of measures for achieving this, including:

- A classification system for water resources (Part 1, Section 12);
- Resource quality objectives, which depend on the class of the water resource (Part 2, Sections 13-15);
- The Reserve (Part 3, Sections 16-18). The ecological reserve is the water required to protect the aquatic ecosystems of the water resource, and varies depending on the class of the water resource.

The implementation of the National Water Act is supported by the National Water Resource Strategy and the Water Resource Classification System. It includes the establishment of Catchment Management Agencies and the development of Catchment Management Strategies.

The listing of threatened or protected inland water ecosystems should complement the objectives of the National Water Act by highlighting aquatic ecosystems that require special attention from an ecological point of view. Listed freshwater and estuarine ecosystems should feed into the water resource classification process and the development of Catchment Management Strategies.

3.3.4 Marine Living Resources Act

Chapter 4 (Section 43) of the Marine Living Resources Act (1998) allows for the declaration of marine protected areas, which are recognised by the Protected Areas Act. Other spatial tools in the Act include the declaration of fisheries management areas (Section 15), priority fishing areas (Section 17) and subsistence fishing zones (Section 19).

As with terrestrial protected areas declared in terms of the Protected Areas Act, marine protected areas and listed marine ecosystems should complement each other. Also as with terrestrial protected areas, a listed marine ecosystem could occur within a marine protected area, highlighting the need for appropriate management of the ecosystem within the protected area.

3.3.5 Integrated Coastal Management Act

The aims of the Integrated Coastal Management Act (2008) include establishing a system of integrated coastal and estuarine management in order to promote the conservation of the coastal environment, maintaining the natural attributes of coastal landscape and seascape, and ensuring that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable.

Chapter 2 considers the coastal zone including the composition of the coastal protection zone (Section 16), the declaration of special management areas (Section 23), and the establishment of coastal set-back lines (Section 25), all of which should consider and include listed threatened or protected ecosystems.

Chapter 4 deals with estuaries and states that all estuaries must be managed in a co-ordinated and efficient manner and in accordance with a national estuarine management protocol to be prescribed by the Minister. This chapter also allows for the development of estuarine management plans. Listed estuarine ecosystems should be taken into account in the development of the national estuarine management protocol as well as in estuarine management plans.

Chapter 6 provides for the preparation and adoption of a national coastal management programme by the Minister (Section 44) for managing the coastal zone; the preparation and adoption of a provincial coastal management programme by the MEC of each coastal province (Section 46); and the preparation and adoption of a coastal management programme for the coastal zone in coastal municipalities (Section 48). Section 56 provides for coastal planning schemes. Coastal management programmes and coastal planning schemes should take listed threatened or protected ecosystems into account.

Chapter 7 refers to the protection of the coastal environment with Part 2 (Section 62) referring to the regulation of the coastal zone and Part 3 (Sections 63-64) referring to environmental authorisations for coastal activities. Again, these should take listed threatened or protected ecosystems into account.

3.3.6 National Heritage Resources Act

According to the National Heritage Resources Act (1999), the national heritage estate may include "landscapes and natural features of cultural significance" (Section 3). There are three grades of heritage resources, corresponding more or less to heritage resources of national, provincial and local significance (Section 7). Chapter 2 of the Act allows for the declaration of national and provincial heritage sites (Section 27), protected areas surrounding national or provincial heritage sites (Section 28), and heritage areas in town and regional planning schemes or other spatial plans (Section 31). An inventory of the national heritage estate must be compiled (Section 39); however, maps of spatial heritage resources do not seem to be required as part of this inventory.

It may be useful in subsequent phases of the ecosystem listing process to explore potential links between listed protected ecosystems in terms of the Biodiversity Act, and heritage sites, protected areas and heritage areas identified in terms of the National Heritage Resources Act.

4 Principles and criteria for identifying threatened ecosystems

From the outset of the process of listing threatened ecosystems, it was clear that a systematic, rigorous process was required to identify threatened or protected ecosystems for listing. There needed to be a clear set of criteria based on best available science, rather than a haphazard or unscientific approach.

As a starting point, SANBI researched similar processes in other countries. Not many countries have attempted something similar, with Australia the most similar. Most of the relevant initiatives are international, not linked to national legislation, and attempt to identify sites or regions of biodiversity importance rather than threatened ecosystems. Most focus on terrestrial environments only. Nevertheless, valuable lessons for South Africa included the following:

- criteria must be scientifically credible, practical and simple;
- different thresholds may be required for different environments;
- the most appropriate scale for mapping ecosystems depends on a range of factors including the nature of the ecosystems and the available data.

Sets of principles and criteria were then developed through a series of workshops with relevant stakeholders and experts (see Appendix C for a list of workshops held and organisations involved). In particular, the following provincial conservation authorities played a major role: CapeNature, Ezemvelo KwaZulu-Natal Wildlife, Gauteng Department of Agriculture, Conservation and Environment (GDACE), and Mpumalanga Tourism and Parks Agency (MTPA).

This section sets out the principles and criteria for identifying listed ecosystems, and briefly discusses how listed ecosystems have been defined and delineated.

4.1 Principles for identifying threatened or protected ecosystems

A set of principles was established to guide the approach to identifying threatened or protected ecosystems for listing:

- The approach must be explicit and repeatable;

- The approach must be target-driven[10] and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed and an ecosystem is listed based on its highest ranking criterion;
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, and must translate into spatially explicit identification of ecosystems.

These principles apply across all the environments (terrestrial, freshwater, estuarine and marine) even when the criteria and thresholds differ across the environments. Taking these principles into account, the following three-stage process was established to list ecosystems:

- Develop, test and refine criteria for identifying threatened or protected ecosystems;
- Identify threatened or protected ecosystems based on those criteria;
- List threatened or protected ecosystems.

4.2 How have listed ecosystems been defined?

4.2.1 At what spatial scale have ecosystems been defined?

The Biodiversity Act defines an ecosystem as a dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit. This definition can be sensibly applied at a range of spatial scales, from very small (e.g. a small forest patch, a tidal pool, a rotting log) to very large (e.g. a primary catchment, the savannah biome).

In deciding on the appropriate spatial scale for listing threatened or protected ecosystems, it was important to consider the purpose and rationale for listing ecosystems as well as the legal implications. As discussed in Section 2.1, the purpose of listing threatened ecosystems is in the first instance to reduce the rate of ecosystem and species extinction, rather than to ensure the persistence of landscape-scale ecological processes or to ensure the provision of ecosystem services. As discussed in Section 3.2.2, loss of natural habitat in a critically endangered or

[10] Biodiversity targets, also known as biodiversity thresholds, are explicit quantitative targets that tell us how much of an ecosystem (or other biodiversity feature) needs to be conserved in order to meet our biodiversity goals of representation and persistence (see Section 2.2). Biodiversity targets are expressed as, for example, numbers of hectares of an ecosystem.

endangered ecosystem triggers a basic assessment report in terms of the NEMA EIA regulations. These two considerations combined require that **listed ecosystems be defined at the local rather than the regional scale**.

4.2.2 How have ecosystems been delineated?

For the current phase of listing, threatened terrestrial ecosystems have been delineated based on one of the following: the South African Vegetation Map[11], national forest types recognised by DAFF[12,13], priority areas identified in a provincial systematic biodiversity plan[14], or high irreplaceability forests patches or clusters systematically identified by DAFF.[15] For future phases of listing and revision of lists, ecosystems may be identified at a finer spatial scale than these units, but will not be identified at a broader spatial scale than these units.

It is important to note that **while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is only triggered in remaining natural habitat within each ecosystem** and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

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[11] Mucina, L. & Rutherford, M.C. (eds). 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

[12] Von Maltitz, G., Mucina, L., Geldenhuys, C., Lawes, M., Eeley, H., Adie, H., Vink, D., Flemming, G. and Bailey, C. 2003. Classification system for South African Indigenous Forests. An objective classification for the Department of Water Affairs and Forestry. Environmentek Report ENV-P-C 2003-017, CSIR, Pretoria.

[13] The South African Vegetation Map identifies eight forest groups and four national forest types. DAFF recognises 26 national forest types, including the four national forest types identified in the South African Vegetation Map, and a further 22 national forest types which make up the eight forest groups identified in the South African Vegetation Map. For the purpose of listing ecosystems, DAFF's 26 national forest types have been used rather than the forest groups from the South African Vegetation Map.

[14] Provincial plans used in the current phase of listing were: Gauteng C-Plan V2 (2006), Mpumalanga Biodiversity Conservation Plan (2007), and KwaZulu-Natal Terrestrial Conservation Plan (C-Plan) V4 (2007). Ecosystems were named based on location and distinguishing features, not necessarily the associated vegetation types.

[15] Berliner, D. 2005. Systematic conservation plan for the forest biome of South Africa: Approach, methods and results of the selection of priority forests for conservation action. Department of Water Affairs and Forestry, Pretoria. The National Forest Inventory did not include complete spatial data for all forest patches and clusters when the systematic biodiversity plan for the forest biome was undertaken. DWAF has subsequently identified and mapped some additional forest patches and clusters which are considered highly irreplaceable.

4.3 Criteria for identifying threatened ecosystems

The development of scientifically credible, practical and simple criteria was the starting point for identifying listed ecosystems. A rigorous process of developing and testing criteria for threatened terrestrial ecosystems was followed, involving extensive expert engagement and consultation. See Appendix C for a list of workshops held and organisations represented.

As mentioned in Section 4.1, the decision was made to use the same logic as is used in the IUCN Red Listing process for species. If an ecosystem meets any one of the criteria, it should be listed. If an ecosystem meets more than one criterion, it should be listed based on its highest ranking criterion. For example, if an ecosystem meets the threshold for vulnerable (VU) on one criterion and the threshold for endangered (EN) on another criterion, it should be listed as endangered.

As discussed, a phased approach is being taken to listing ecosystems because of the complexity of the process, with the first phase focusing on threatened terrestrial ecosystems. Six criteria were developed to identify threatened terrestrial ecosystems. Of these six criteria, four (A, C, D and F) have been used in the current phase of listing and the remaining two (B and E) are dormant owing to lack of data. Table 1 summarises the six criteria and the thresholds for the four active criteria. Each criterion is explained in more detail below.

Table 1: Criteria used to identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems

Criterion	CR	EN	VU
A1: Irreversible loss of natural habitat	Remaining natural habitat ≤ biodiversity target	Remaining natural habitat ≤ (biodiversity target + 15%)	Remaining natural habitat ≤ 60% of original area of ecosystem
A2: Ecosystem degradation and loss of integrity*	≥ 60% of ecosystem significantly degraded	≥ 40% of ecosystem significantly degraded	≥ 20% of ecosystem significantly degraded
B: Rate of loss of natural habitat**			
C: Limited extent and imminent threat*	--	Ecosystem extent ≤ 3 000ha, and imminent threat	Ecosystem extent ≤ 6 000ha, and imminent threat
D1: Threatened plant species associations	≥ 80 threatened Red Data List plant species	≥ 60 threatened Red Data List plant species	≥ 40 threatened Red Data List plant species
D2: Threatened animal species associations**			
E: Fragmentation**			
F: Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan	Very high irreplaceability and high threat	Very high irreplaceability and medium threat	Very high irreplaceability and low threat

* Because of data constraints, Criteria A2 and C have been applied to forests but not to other vegetation types.
** Because of data constraints, Criteria B and D2 are dormant at this stage and thresholds have not been set for these criteria. Further testing of Criterion E is needed to determine whether it is a workable criterion for terrestrial ecosystems. Criterion E may be applied in future to most terrestrial ecosystems, but will not be applied to forest ecosystems as the forest biome is naturally fragmented.

Criterion A1: Irreversible loss of natural habitat

This criterion identifies ecosystems that have undergone loss of natural habitat, impacting on their structure, function and composition. Loss of natural habitat includes outright loss, for example the removal of natural habitat for cultivation, building of infrastructure, mining etc., as well as severe degradation. For this purpose, habitat is considered severely degraded if it would be unable to recover to a natural or near-natural state following the removal of the cause of the degradation (e.g. invasive aliens, over-grazing), even after very long time periods.

For the current phase of listing, Criterion A1 has been applied to ecosystems defined as national vegetation types in the South African Vegetation Map[16] or as national forest types recognised by DAFF. The thresholds for this criterion are based on the biodiversity targets developed in the National Spatial Biodiversity Assessment (NSBA) 2004. The biodiversity target for a vegetation type is the proportion of the original extent of the vegetation type required to conserve the majority of species associated with that vegetation type.[17,18] It is expressed either as a percentage of the original extent of the vegetation type or in hectares. Biodiversity targets for national vegetation types range from 16% to 36%, with higher targets for more species rich vegetation types. For example, a species rich vegetation type with an original extent of 10 000ha could have a biodiversity target of 30% or 3 000ha.

An ecosystem is categorised as critically endangered if the extent of remaining natural habitat in the ecosystem is less than or equal to its biodiversity target. This threshold indicates a loss of species and change in species composition within the ecosystem. For example, a 10 000ha ecosystem with a biodiversity target of 30% would be categorised as critically endangered if 3 000ha or less of the ecosystem remained in a natural state (or conversely if more than 7 000ha of the original extent of the ecosystem had been lost). An ecosystem is categorised as endangered if the extent of remaining natural habitat in the ecosystem is less or equal to than its biodiversity target plus15%. This threshold provides a buffer for critically endangered ecosystems. For example, the 10 000ha ecosystem with a biodiversity target of 30% would be categorised as endangered if 4 500ha (45%) or less of the ecosystem remained in a natural state. An ecosystem is categorised as vulnerable if the extent of remaining natural habitat in the ecosystem is less than or equal to 60% of the original extent of the ecosystem. This threshold indicates a loss of ecosystem functioning. For example, a 10 000ha ecosystem would be categorised as vulnerable if 6 000ha or less of the ecosystem remained in a natural state. Note that while the Criterion A thresholds for critically endangered and endangered ecosystems vary depending on the biodiversity target for the ecosystem, the threshold for vulnerable ecosystems is independent of the biodiversity target.

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[16] For future phases, it may make sense to apply this criterion to recognised vegetation sub-types as well as to national vegetation types. However, an agreed method for identifying vegetation sub-types and a process for recognising them would be pre-requisites for this.

[17] Biodiversity targets are calculated based on the species-area curve method (Desmet, P. & Cowling, R. 2004. Using the species-area relationship to set baseline targets for conservation. *Ecology and Society* 9(2))

[18] The systematic biodiversity plan for the forest biome included targets for national forest types. However, these targets were not set using the species-area curve method developed in the NSBA 2004. For the purpose of listing ecosystems, the biodiversity targets for national forest types were revised using the species-area curve method.

The spatial analysis for this criterion used the best available land cover data. For Free State, Limpopo, North West and Northern Cape the best available land cover data was provided by combining the National Land Cover (NLC) 2000 and the NLC 1996. Eastern Cape, Gauteng, KwaZulu-Natal, Mpumalanga and Western Cape had land cover data layers that improved on the NLC 2000 and NLC 1996. These improved data layers were clipped into the combined NLC 2000 and NLC 1996 to make a new "mosaic" national land cover layer that represented the best available land cover data for the country. Land cover categories that were considered to represent outright loss of natural habitat were cultivated areas, forestry plantations, mines and quarries, and urban or built-up areas. Information on severe degradation was included where available; however, degradation has to date been poorly mapped in South Africa, and distinctions between moderate and severe degradation are usually not made in available spatial information.

Criterion A2: Ecosystem degradation and loss of integrity

This criterion identifies ecosystems that are significantly degraded. For the purpose of ecosystem listing, significant degradation is defined as significant changes to the structure, function or composition of the ecosystem that would take several decades to recover if the cause of the degradation was removed.

Consistent national data on degradation in national vegetation types is not available, and definitions of degradation and methods for assessing the extent and degree of degradation have not been widely agreed on or standardised. This meant it was not possible to apply Criterion A2 to national vegetation types in the current phase of listing. However, for forest ecosystems there is sufficient agreement on definitions of degradation and approaches for assessing degradation to apply Criterion A2 to national forest types. Criterion A2 was thus applied only to forest ecosystems.

An expert assessment of the extent of degradation in national forest types was conducted. Forest ecosystems were assessed using the following three factors:

- Condition of the forest ecosystem including:
    - Canopy condition,
    - Forest margin condition (including fire),
    - Understorey condition (including invasive species, overgrazing and cattle trampling);

- Loss of natural habitat in the matrix (i.e. in the surrounding non-forest landscape);
- Over-harvesting of particular species using a harvesting pressure index.

Thresholds for critically endangered, endangered and vulnerable ecosystems were determined by the proportion of the forest ecosystem that was significantly degraded. If more than 60% of the ecosystem was significantly degraded the ecosystem was categorised as critically endangered, if more than 40% was significantly degraded it was categorised as endangered, and if more than 20% was significantly degraded it was categorised as vulnerable. These thresholds are slightly higher than for Criterion A1 to allow for the fact that the forest biome in South Africa is naturally rare and fragmented relative to other biomes.

Criterion B: Rate of loss of natural habitat

This criterion identifies ecosystems that have not yet lost a large amount of natural habitat but are experiencing unusually high rates of habitat loss. Criterion B is dormant for the current phase of listing as the data needed to operationalise the criterion is not available.

Criterion C: Limited extent and imminent threat

This criterion identifies ecosystems of small geographic extent that are faced with an imminent threat. The intention is to identify small ecosystems or ecosystems with very little remaining natural habitat that could be entirely destroyed by a few developments (for example, a small coastal vegetation type in an area with significant coastal development pressures).

Ecosystems cannot be listed as critically endangered using this criterion because an ecosystem of limited extent has not necessarily *already* undergone severe degradation of ecological structure, function or composition as a result of human intervention (as is required by the definition in the Biodiversity Act of a critically endangered ecosystem). An ecosystem can be listed as endangered if it is less than 3 000 hectares in size and as vulnerable if it is less than 6 000 hectares in size. However, it can only be listed if there is a high degree of imminent threat associated with the ecosystem.

Criterion C was applied to national forest types. Imminent threat was based on the assessment of development pressure (including urban, industrial, mining) done as part of DAFF's systematic biodiversity plan for the forest biome.

Criterion D: Threatened species associations

This criterion identifies ecosystems that contain a high number of threatened species, indicating that the ecosystem itself is threatened even if it has not been identified as threatened under the other criteria (for example because of data limitations associated with the other criteria). Further, as discussed in Section 3.1.2, threatened species listed in terms of the Biodiversity Act include only those species threatened by restricted activities as defined in the Biodiversity Act. These restricted activities do not include habitat loss, yet habitat loss is one of the key threats facing most species that are classified as threatened in Red Lists. Criterion D thus also helps to protect species threatened by habitat loss.

Criterion D is split into two sub-criteria: Criterion D1: Threatened plant species associations; and Criterion D2: Threatened animal species associations. In the current phase of listing only Criterion D1 has been applied. Criterion D2 will remain dormant until further data is available and further work has been done to operationalise the criterion.[19] The thresholds for Criterion D2 will differ from those set for Criterion D1.

Criterion D1: Threatened plant species associations

An ecosystem is categorised as critically endangered if 80 or more threatened Red Data List plant species (as assessed by the Red List of South African Plants[20]) are associated with the ecosystem, endangered if 60 or more threatened Red Data List plant species are associated with the ecosystem, and vulnerable ecosystems if 40 or more threatened Red Data List plant species are associated with the ecosystem.

Threatened Red Data List plant species include the IUCN Red Data List categories of critically endangered (CR), endangered (EN), vulnerable (VU), extinct (EX), and extinct in the wild (EW). They do not include plant species listed under the category Vulnerable D2 (VU D2), which

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[19] Good data on how many animals are threatened in South Africa is lacking for many taxonomic groups. For relatively well understood and charismatic groups such as large mammals and birds there is reasonable data, but it is not straightforward to link these animals with particular ecosystems at the local scale. For example, does one include only those ecosystems in which the animals are or were resident, or also ecosystems in which they are or were present episodically? Substantial work would be needed to establish the implications of using current vs historical ranges of threatened animal species for the purpose of identifying threatened ecosystems. There are many ecosystems in South Africa from which previously widespread but now threatened species (such as rhinos, elephants, wild dogs, cheetahs, and vultures) have been lost. Using historical distributions would create many data challenges; using only current distributions could create a perverse incentive to eliminate threatened animals from ecosystems in order to prevent the ecosystems from being listed. These and other issues need to be resolved before Criterion D2 can be operationalised.

[20] Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama, P.A. (eds). 2009. Red List of South African Plants. *Strelitzia* 25, South African National Biodiversity Institute, Pretoria.

identifies species with a restricted area of occupancy (i.e. species that are naturally rare). In order to determine the number of threatened plant species associated with an ecosystem, both specimen records and observation records were used. Criterion D1 was applied to national vegetation types and national forest types.

Of all the ecosystems in South Africa, only fynbos ecosystems meet the high thresholds set for Criterion D1. This highlights both the exceptional diversity of the fynbos biome and the extent to which it is under pressure.

Criterion E: Habitat fragmentation

This criterion identifies ecosystems which have been compromised by habitat fragmentation. Initial testing was done on this criterion but due to the complexity of measuring fragmentation, which is heavily scale dependent, and of determining its effects on ecosystems, additional research and testing is required before Criterion E can be operationalised. It has been agreed that it does not make sense to apply Criterion E to forest ecosystems because of the naturally fragmented nature of the forest biome.

Criterion F: Priority areas for meeting explicit biodiversity targets as defined by a systematic biodiversity plan

This criterion allows for the very detailed biodiversity information used in systematic biodiversity plans to be drawn on in the ecosystem listing process. For the current phase of listing only provincial biodiversity plans were considered, as well as DAFF's systematic biodiversity plan for the forest biome.[21] Systematic provincial biodiversity plans for Gauteng, Mpumalanga and KwaZulu-Natal were used (see Section 4.2.2). These provincial plans have been undertaken according to well-established systematic biodiversity planning principles, at a fine enough scale and with sufficient consistency between them to provide a strong basis for identifying national threatened ecosystems.[22]

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[21] A number of systematic biodiversity plans have been done at local and regional scales in various parts of the country. SANBI's recommendation is that even in future phases of ecosystem listing only systematic biodiversity plans that are recognised by provincial conservation authorities or by relevant national departments such as DAFF should be used to identify threatened ecosystems using Criterion F.

[22] Some other provinces had recently completed or were in the process of developing provincial systematic biodiversity plans. The Eastern Cape Biodiversity Conservation Plan and the North West Biodiversity Conservation Assessment were not completed in time to be included in this process, and may be at too broad a spatial scale to provide the basis for identifying ecosystems using Criterion F. Further testing would be required to determine this.