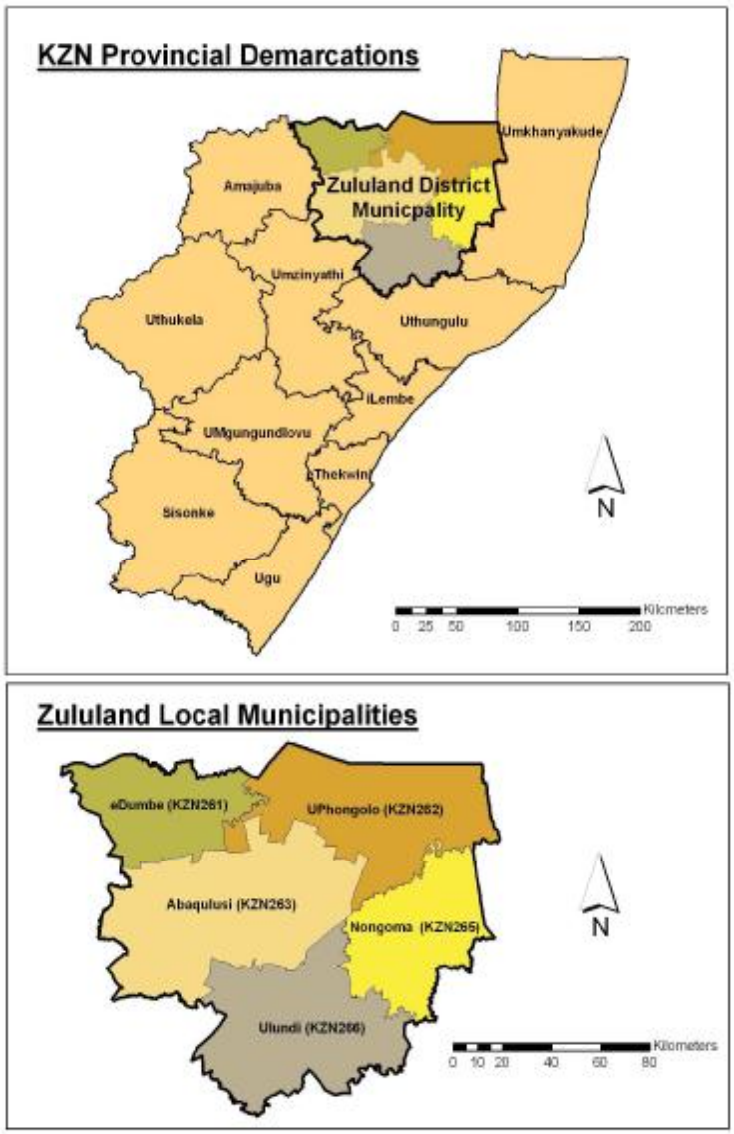
EZEMVELO KZN WILDLIFE

Biodiversity Sector Plan for the Zululand District Municipality, KwaZulu-Natal



Technical Report **February 2010**

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Executive Summary

The Biodiversity Act introduced several legislated planning tools to assist with the management and conservation of South Africa's biological diversity. These include the declaration of "Bioregions" and the publication of "Bioregional Plans". Bioregional plans are usually an output of a systematic spatial conservation assessment of a region. They identify areas of conservation priority, and constraints and opportunities for implementation of the plan. The precursor to a Bioregional Plan is a Biodiversity Sector Plan (BSP), which is the official reference for biodiversity priorities to be taken into account in land-use planning and decision-making by all sectors within the District Municipality. The overall aim is to avoid the loss of natural habitat in Critical Biodiversity Areas (CBAs) and prevent the degradation of Ecological Support Areas (ESAs), while encouraging sustainable development in Other Natural Areas.

The Biodiversity Sector Plan, comprising the CBA and ESA maps and guidelines, provides a framework for the compilation of a bioregional plan in terms of Chapter 3 of the National Environmental Management: Biodiversity Act (NEMBA), Act No. 10 of 2004 and, in so doing, supports the National Biodiversity Framework (2007). All organs of state are obliged to account for biodiversity in their decision-making (National Environment Management Act (NEMA), Act No. 107 of 1998). Furthermore, all spheres of government and all organs of state must co-operate with, consult and support one another.

The consultant team was appointed to fulfill the requirements of a BSP for the Zululand District Municipality, as informed by SANBI, the Bioregional Guidelines (DEAT, 2007), current best practice, and the EKZNW Project Terms of Reference. The final product is a series of maps highlighting those areas that are critically important for biodiversity, with accompanying land-use and management guidelines that serve to guide decision-making and inform multi-sectoral planning. This Biodiversity Sector Plan has followed the guideline regarding the determination of bioregions and the preparation of and publication of bioregional plans.

The process involved extensive mapping of vegetation types and species data (where available), ecological processes, transformation and threats, and setting of biodiversity targets. This information was used to identify Critical Biodiversity Areas and Ecological Support Areas. A Critical Biodiversity Area is considered to be an irreplaceable and highly significant, area that needs to be

maintained in a natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of critical ecosystem services. A Critical Biodiversity Area comprises the best choice of area for achieving biodiversity targets of the relevant biodiversity feature(s). Ecological Support Areas are areas that are not essential for meeting biodiversity targets but which nevertheless play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. Area selection aimed to achieve all the biodiversity targets in the most efficient spatial configuration.

The District encompasses marked biophysical, altitudinal and climatic gradients, which has translated into high faunal and floral biodiversity value, including special and critically important species and ecosystems. The District forms a large part of the Maputaland- Pondoland priority area for conservation action, and is strategically placed to perform a critical ecological function in terms of connectivity and water provision, both nationally and internationally. These factors, combined with significant transformation and land use threats, were significant determinants in area selection, the formulation of land use guidelines, and the identification of key focus areas for conservation action.

The District is 1 468 459 hectares in extent, of which 52.3% has been transformed or is in a degraded state and only 5.5% is contained in protected areas. On a District municipal scale conservation targets could mostly be met but the remaining areas of intact undegraded natural asset offered few choices for meeting these targets, restricting opportunities for ensuring regional connectivity (both terrestrial and aquatic), particularly linkages to Hluhluwe- Imfolozi Park in the south-east in the adjacent municipality, linkages to the west of the District, and southwest – northeast linkages within the District. Conservation targets for all identified biodiversity features were accommodated, with the exception of Delagoa Lowveld, KaNgwane Montane Grassland, and Lebombo Summit Sourveld. In terms of Lebombo Summit Sourveld, it should be possible to cater for provincial conservation targets in adjacent municipalities, which contain meaningful areas of this vegetation type. However, Delagoa Lowveld and KaNgwane Montane Grassland are highly endemic to the Zululand District Municipality, and therefore Provincial conservation targets must be met within this District, as is the case for Swaziland Sour Bushveld, Paulpietersburg Moist Grassland, Northern Zululand Sourveld, Northern Zululand Mistbelt Grassland, Ithala Quartzite Sourveld, and Granite Lowveld. The provincial target areas for each of the aforementioned vegetation types must be met within this District to ensure persistence; this would require rehabilitation of degraded and transformed areas.

Whilst all Critical Biodiversity Areas and Ecological Support Areas require conservation management, a number of key corridor focus areas were identified as priority areas for immediate attention, specifically due to the threat of further transformation. Key corridor issues identified included the provision of meaningful corridors for Wild Dog and Black Rhino territory expansion, establishing linkages along the Phongolo and Mkuze Rivers into Maputaland, and establishing linkages between Hluhluwe-Imfolozi Park and the eMakhosini- Opathe Heritage Park. Local scale corridors were also identified. Other key issues include targeted Protected Area Expansion and Stewardship Programmes, community conservation projects, curtailing indirect mining impacts, and exploring payment for ecosystem services in the District.

The BSP should be updated annually, based on a monitoring programme, new information, and the most recent land cover data available. Reporting should coincide with the municipal Integrated Development Plan and Land Use Management System review cycle, comprising a minimum 5-year cycle.

Disclaimer

The Critical Biodiversity Areas and Ecological Support Areas maps associated with this report are not guaranteed to be free from error or omission. Consequently, the authors and designers hold no responsibility for any inaccuracies or financial loss resulting from the information in this handbook or its associated information. The map, together with the guidelines, serves as the primary biodiversity informant for land-use planning and decision-making, and does not claim to address other land-use or town and regional planning policy.

Suggested Citation

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Abbreviations

BSP	Biodiversity Sector Plan
CBA	Critical Biodiversity Area
ESA	Ecological Support Area
EIA	The National Environmental Management Act: Environmental Impact Assessment Regulations promulgated under section 24(5) of NEMA and published in Government Notice 385 in Government Gazette 28753 of 21 April 2006
EIP	Environmental Implementation Plan
EMF	Environmental Management Framework
EMP	Environmental Management Plan
DEAT	The National Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
EKZNW	Ezemvelo KwaZulu-Natal Wildlife as defined in Act 9 of 1997 to be the KZN Nature Conservation Service
GIS	Geographic Information System
IDP	Integrated Development Plan developed in terms of the Municipal Systems Act
IUCN	World Conservation Union (as commonly referenced)
KZN	KwaZulu-Natal Province of the Republic of South Africa
The Minister	The Minister of Environmental Affairs and Tourism
NEMA	The National Environmental Management Act 107 of 1998
NGO	Non-governmental organisation
NSBA	The National Spatial Biodiversity Assessment (SANBI)
NBSAP	The National Biodiversity Strategy and Action Plan (DEAT)
SANBI	The South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SDF	Spatial Development Framework as required by the Municipal Systems Act for each municipality

Important Concepts

What is biodiversity and why is it important

Biodiversity means the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems (as per the National Environmental Management: Biodiversity Act, No. 10 of 2004). 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 its fishing industry, rangelands that support commercial and subsistence farming, horticultural and agricultural industry based on indigenous species, the tourism industry, aspects of the film industry, and commercial and non-commercial medicinal applications of indigenous resources. Keeping South Africa's biodiversity intact is also vital for ensuring ongoing provision of ecosystem services such as production 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 the socio-economic options for future generations.

What are ecological processes and why is it important to conserve them`

An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients that support the organisms living within them. Ecological processes are processes that play an essential part in maintaining ecosystem integrity. Ecological processes include the cycling of water, the cycling of nutrients, the flow of energy, and biodiversity (as an expression of the process of evolution); this is linked to climate, primary productivity, carbon sequestration, hydrological processes, biophysical habitats, interactions between organisms, movements of organisms, and natural disturbance regimes.

The single biggest cause of biodiversity loss is loss or degradation of natural habitat and ecosystems. A common approach for conserving biodiversity is to develop priorities based on protecting natural 'assets', such as threatened species or depleted ecosystems. This essential approach has a major limitation: asset protection alone cannot conserve biodiversity unless the ecological processes that sustain assets are also maintained. This highlights the essential role of ecological processes in sustaining biodiversity. Key actions to achieve this goal comprise prioritizing preservation and restoration activities to strengthen ecological processes across landscape scales. Conservation strategies that are explicitly directed toward maintaining the integrity of ecological processes have greater potential to sustain biodiversity and evolutionary processes in the long-term

What are ecosystem services and why are they important

An ecosystem means a dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit (as per National Environmental Management: Protected Areas Act, No. 57 of 2003). Ecosystems include the interactions among all organisms in a given habitat. Ecosystem services are defined in Section 1 of the National Environmental Management: Protected Areas Act No. 57 of 2003 as "environmental goods and services" meaning:

(a) benefits obtained from ecosystems such as food, fuel and fibre and genetic resources;
(b) benefits from the regulation of ecosystem processes such as climate regulation, disease and flood control and detoxification; and
(c) cultural non-material benefits obtained from ecosystems such as benefits of a spiritual, recreational, aesthetic, inspirational, educational, community and symbolic nature;"

Sustainable water production is also specifically included under this definition in the context of this study.

Ecosystem Services are the processes by which the environment / ecosystem produces resources that we often take for granted such as clean water, timber, and habitat for fisheries, and pollination of native and agricultural plants. Ecosystems provide *inter alia* "services" that:

- moderate weather extremes and their impacts
- disperse seeds
- mitigate drought and floods
- protect people from the sun's harmful ultraviolet rays
- cycle and move nutrients
- protect stream and river channels and coastal shores from erosion
- detoxify and decompose wastes
- control agricultural pests
- maintain biodiversity
- generate and preserve soils and renew their fertility

- contribute to climate stability
- maintenance of air quality
- purify the air and water
- regulate disease carrying organisms
- fuel and energy
- fodder and fertiliser
- medicinal resources
- pollinate crops and natural vegetation
- enjoyment of scenery
- education

The persistence of biodiversity, as well as health and wellbeing of human populations, depends upon the services provided by ecosystems and their components.

1. Introduction and Background

1.1 The District

Zululand, one of ten district municipalities in KwaZulu-Natal, is located in the northern regions of the Province. The municipality covers an area of approximately 14 810 km². Approximately half of the area is under the jurisdiction of traditional authorities while the remainder comprises predominantly commercially-owned farms and conservation areas. The District comprises the following five local municipalities:

- eDumbe (KZ 261)
- uPhongola (KZ 262)
- Abaqulusi (KZ 263)
- Nongoma (KZ 265)
- Ulundi (KZ 266)

Vryheid (Abaqulusi Municipality) and Ulundi are the two main towns in the district. Pongola and Paulpietersburg (eDumbe Municipality) are small towns, which act as service centres, while Nongoma (Nongoma Municipality) fulfils the same role, but with far fewer and lower order services.

The District Municipality's Integrated Development Plan (Zululand District Municipality 2008) reflects a region that is well endowed with natural water resources, notably the Pongola River, Mkuze River, Black Mfolozi River, and White Mfolozi River, as well as the Pongolapoort Dam, Bivane Dam, Hlobane Dam, Boulder Dam, and Klipfontein Dam. These rivers and dams are fed by many smaller rivers, streams and springs that also serves as water supply for rural communities.

There are three main catchments in the District namely:

- the Pongola in the North
- the Mkuze in the Central areas, and
- the Mfolozi in the South

The district is home to a rich cultural diversity and numerous sites of historical significance, specifically relating to the Zulu nation. It has historically been and is still the home of the Zulu

monarch. Cultural and historical conservation efforts are mainly focused in the Ulundi area and in eMakhosini, which is known as “the Valley of the Zulu Kings”.

1.2 Mandate and Terms of Reference

The KwaZulu-Natal Nature Conservation Board, trading as Ezemvelo KZN Wildlife, is the Nature Conservation Agency in the province of KwaZulu-Natal. Its core disciplines are biodiversity conservation, wise and sustainable use of natural resources, the creation and management of partnerships with stakeholders and communities and the provision of affordable eco-tourism destinations within the Province (Ezemvelo KZN Wildlife, 2008).

The National Environmental Management Biodiversity Act (2004) introduced several planning tools to assist Ezemvelo KZN Wildlife to give effect to their core mandate. This includes the development of bioregional plans that aim to (RSA, 2004):

- Achieve integrated and coordinated biodiversity planning;
- Provide for monitoring of the conservation status of various components of biodiversity; and
- Promote biodiversity research

A Bioregional Plan must be informed by a local ‘biodiversity profile’ or a Biodiversity Sector Plan. The latter will enable Ezemvelo KZN Wildlife to comply with the legal prescripts of the Biodiversity Act and in so doing achieve their core mandate. The consultant team was appointed to fulfil the requirements of a Biodiversity Sector Plan for the Zululand District Municipality, as informed by SANBI, the Bioregional Guidelines (DEAT, 2007), best practice, and the EKZNW Project Terms of Reference, as follows:

1. Provide a biophysical description of the Zululand District Municipality.
2. Provide a spatial plan showing terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning, comprising an integration of the following GIS Layers:

(a) National, Provincial and Municipal Protected Areas – appropriately buffered.

(b) Areas which are critical for the continued provision of ecosystem services –

examples are:

a. areas that are the primary water production areas;

b. wetlands – appropriately buffered; and

c. rivers and riparian zones – appropriately buffered

(c) Macro ecological corridors – broad and fine scale ecological corridors critical for maintaining ecological connectivity at the local, landscape and provincial level.

(d) Indigenous Forests – appropriately buffered – protected under the Forest Act.

(e) Mandatory and Negotiated Reserves (MinSet) – from the most up to date aquatic and terrestrial systematic conservation plan for the region.

(f) Threatened Vegetation Types – highlight vulnerable, endangered and critically endangered vegetation types

(g) 2005 Land cover and current aerial imagery – update transformation layer if required by subtraction.

(h) Capture local knowledge from expert input - Locally gleaned fine scale information and priorities incl. untransformed land, species locations, wetlands cultural, scenic etc

(i) Fine scale ecological corridors – capture local level process and connectivity with expert input.

(j) Threats Layer - Prioritise using primary landscape level threats for the area.

3. The final product is a series of maps highlighting those areas that are critically important for biodiversity, with accompanying land-use and management guidelines. A risk-averse approach was adopted, which takes into account the limits of current knowledge about the consequences of decisions and actions.

2. Purpose and objectives of the Biodiversity Sector Plan

The purpose of the plan is to:

- serve as an information layer for multi-sectoral planning and decision-making processes, specifically at the local scale for integration into local level planning (e.g. IDPs, SDFs, EMFs and EIAs);
- to provide a proactive tool to guide relevant stakeholders, in particular EKZNW staff at a regional level (specifically District Conservation Officers and Community Conservation Officers), as to where to focus biodiversity management programmes, plans and projects;
- provide land use and management guidelines for key stakeholders; and to
- to offer a platform from which further work can be initiated

The objectives of the plan are to:

- Ensure aquatic and terrestrial biodiversity targets are met at the District level;
- Conserve representative samples of biodiversity pattern;
- Conserve the ecological and evolutionary processes that allow biodiversity to persist over time; and
- Serve as a first step towards the development of a Bioregional Plan

The following products form part of a biodiversity sector plan:

- Biodiversity sector plan booklet with map of CBAs and land management objectives.
- Summary stats for municipality (1 page document linked to biodiversity indicators consistent with those used for the National Biodiversity Monitoring and Reporting Framework)
- Wall poster of CBA map
- Shapefiles
- A pamphlet

3. Policy Legal Framework

The National Biodiversity Framework (in terms of Section 39 of the Biodiversity Act) and the Biodiversity Act seeks (amongst other things) to provide for the management and conservation of biological diversity within South Africa and of the components of biological diversity. To do this the Biodiversity Act introduced several legislated planning tools to assist with the management and conservation of South Africa's biological diversity. These include the declaration of "Bioregions" and the publication of "Bioregional Plans". Bioregional plans are usually the outputs of a systematic spatial conservation assessment of a region, identifying areas of conservation priority, and constraints and opportunities for their implementation. The precursor to a Bioregional Plan is a Biodiversity Sector Plan (BSP). The BSP demarcates critical biodiversity features and associated land use and management guidelines within the administrative boundary of the Zululand District Municipality. A key objective of the Biodiversity Sector Plan is to allow for its integration into a Bioregional Plan,

which must be aligned with administrative boundaries; hence the development of the BSP at the District level.

The policy and legal context for the management and conservation of biological diversity in South Africa is provided in Figure 1 below. It serves to highlight that the development of the Zululand Biodiversity Sector Plan in this project is ultimately nested in a formal institutional arrangement comprising of international, national, provincial and local obligations, commitments and targets. Ezemvelo KZN Wildlife is obliged to implement their mandate within this arrangement. Their provincial-specific Biodiversity Spatial Planning Programme (Figure 2) has taken cognizance of these requirements and how the biodiversity planning tools should be aligned with other sectoral planning tools.

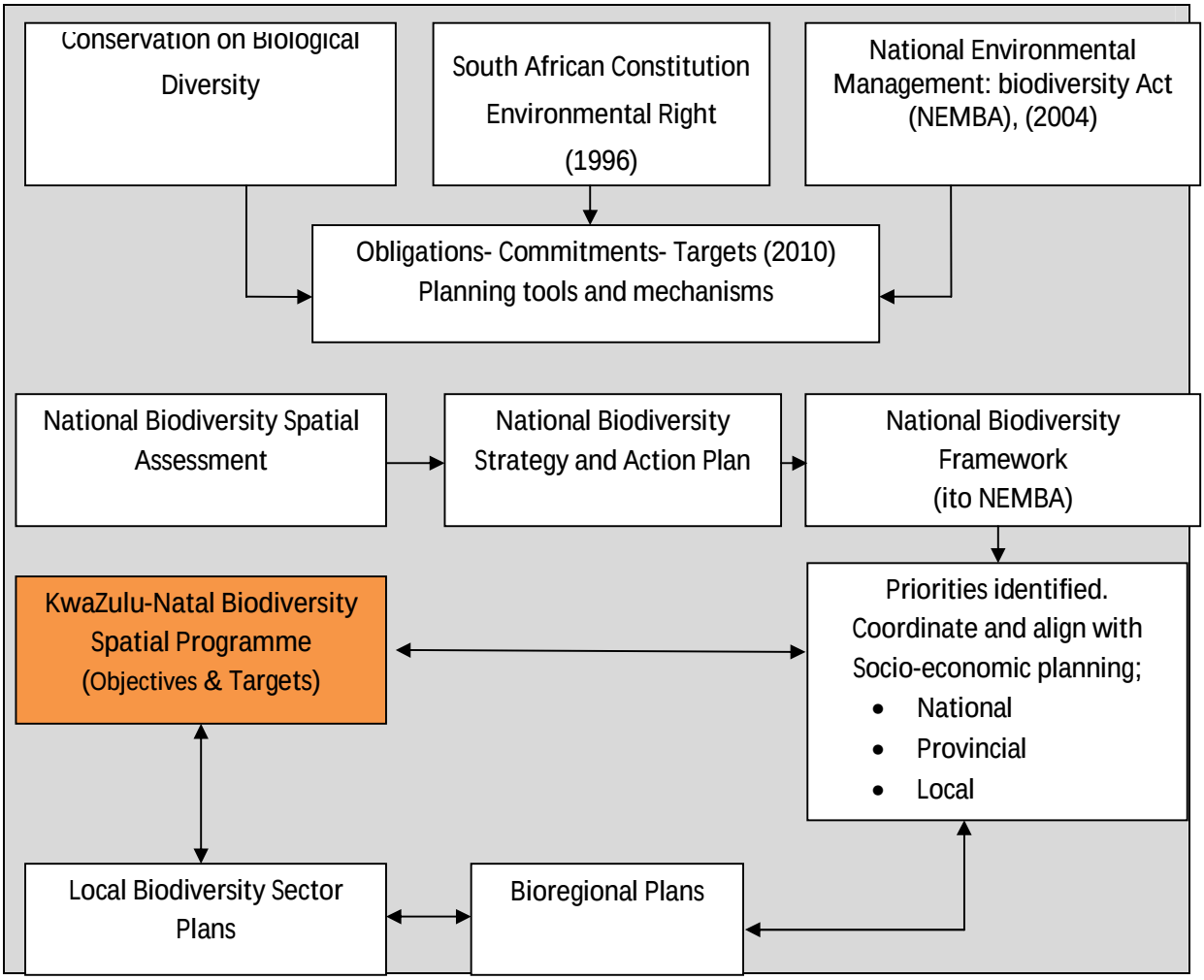

Figure: 1Broad Policy Context for Spatial Biodiversity Assessment and Planning

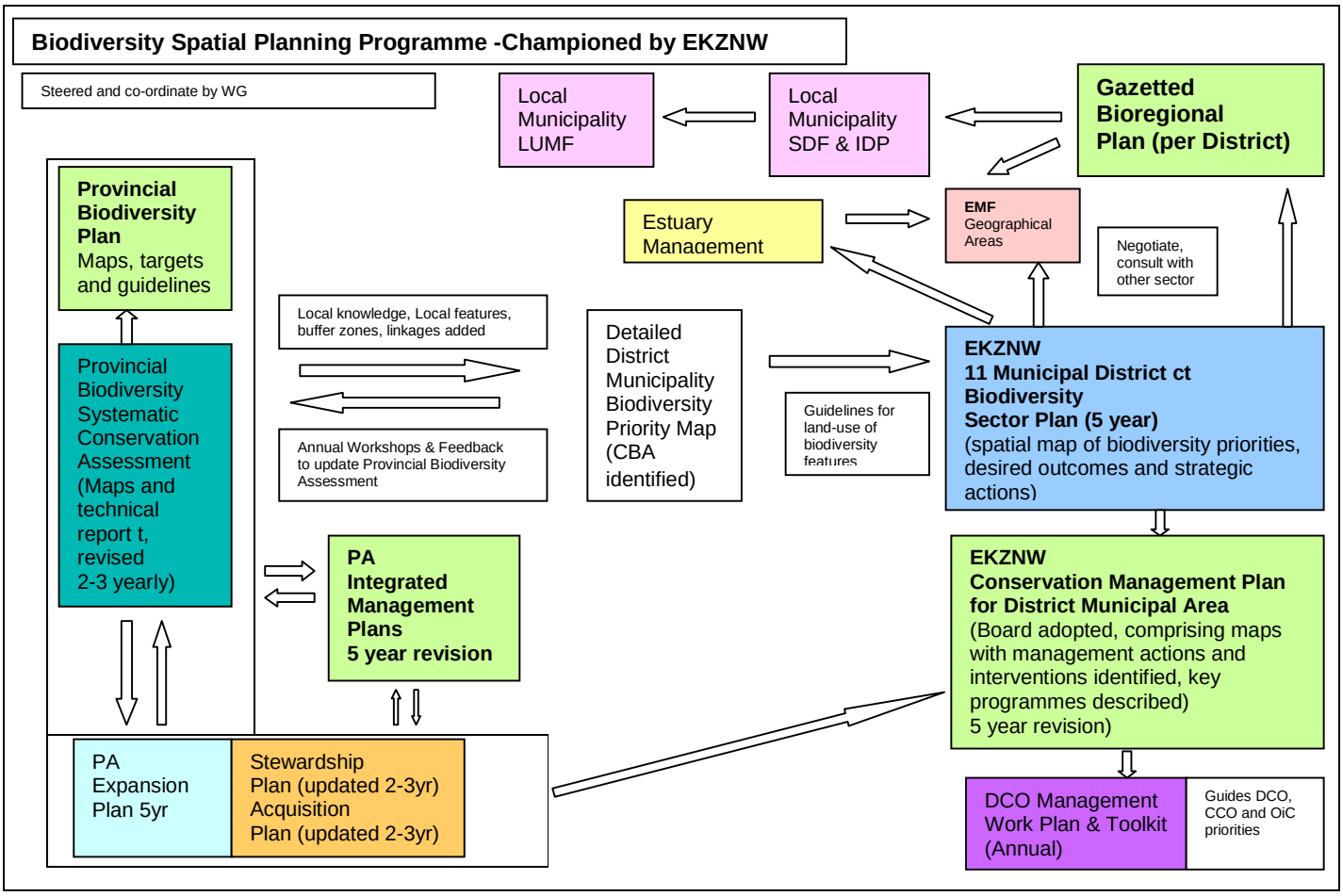

Figure: 2 The KwaZulu-Natal Spatial Biodiversity Programme (Source: Dr P Goodman, Ezemvelo KZN Wildlife)

The KwaZulu-Natal Spatial Biodiversity Programme highlights the following important institutional aspects:

- Biodiversity assessment and planning follows a highly technical and scientific process that provides objective and quantifiable information.
- Local-level biodiversity plans inform and refine the Provincial Biodiversity Plan, improving its scientific basis.
- District Biodiversity Sector Plans will ultimately inform all other sector planning instruments and processes, but are equally important for directing the organisation's own management priorities (e.g. inform District Conservation Operational Plan, Protected Area Expansion, and the Stewardship Plan).

The BSP supports the principles of integrated development planning and sustainable development, in that it should guide natural resource management and feed into land-use planning and decision-making by all sectors whose policies and decisions impact on biodiversity.
This includes assessment processes such as DWAF water licenses, EIPs, EMPs, EMFs, SDFs, IDPs, SEAs, EIAs, Agricultural Applications, Planning Authorisations, and Bioregional Plans.

The plan is the official reference for biodiversity priorities to be taken into account in land-use planning and decision-making by all sectors within the Zululand District Municipality, and should be read in conjunction with other guidelines and biodiversity planning tools that have been produced for the municipality. In general, bioregions and bioregional plans should be aimed at the conservation and management of South Africa's biodiversity. However, it is recognised that ecosystems and geographical features do not always respect international boundaries. As such Section 40(5) of the Biodiversity Act empowers the Minister to enter into an agreement with a neighbouring country to secure the effective implementation of a bioregional plan. Natural asset within Swaziland was therefore considered in this planning exercise.

The BSP complies with NEMA principles in terms of sustainability, in seeking to prevent (i) disturbance of important ecosystems, (ii) loss of biological diversity, pollution and degradation of the environment, (iii) disturbance of landscapes and sites that constitute the nation's cultural heritage, (iv) the irresponsible and inequitable use and exploitation of nonrenewable natural resources, and (v) the development, use and exploitation of renewable resources and the ecosystems to a level beyond which their integrity is jeopardised.

Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The BSP focuses primarily on the biophysical environment; social and economic aspects would be more comprehensively integrated in the development of a Bioregional Plan, which would include the necessary consultation. However, where natural asset is critical to sustainable rural livelihoods, relevant ecosystem services have been considered and mapped.

4. Biophysical profile of the District

4.1 Biophysical Gradient

The Zululand District Municipality comprises significant diversity of relief that is determined by altitude, slope position, aspect, climate, topography and geology, which translates into exceptional terrestrial and aquatic biodiversity, species richness and endemicity. Geological formations in the District have given rise to predominantly rugged terrain with high habitat heterogeneity across altitudinal gradients. A digital elevation model illustrates this structural diversity within the District (Figure 3). Conservation planning must incorporate the range of biophysical factors in order to retain this high biodiversity.

On a provincial scale, the biophysical gradient is relatively pronounced in the Zululand District Municipality, particularly as compared to coastal and southern municipalities in KwaZulu-Natal. The highest areas comprise the western boundary of the District, with height generally increasing from south to north along this boundary, the highest point comprising the extreme north-west corner of the District (2068m). The lowest areas comprise the eastern of the District, with height generally decreasing northwards and southwards from the centre of the eastern boundary. The lowest point comprises the Jozini Dam and areas below the dam (approximately 480m a.s.l.), followed by a point on the Black Mfolozi where it exits the District.

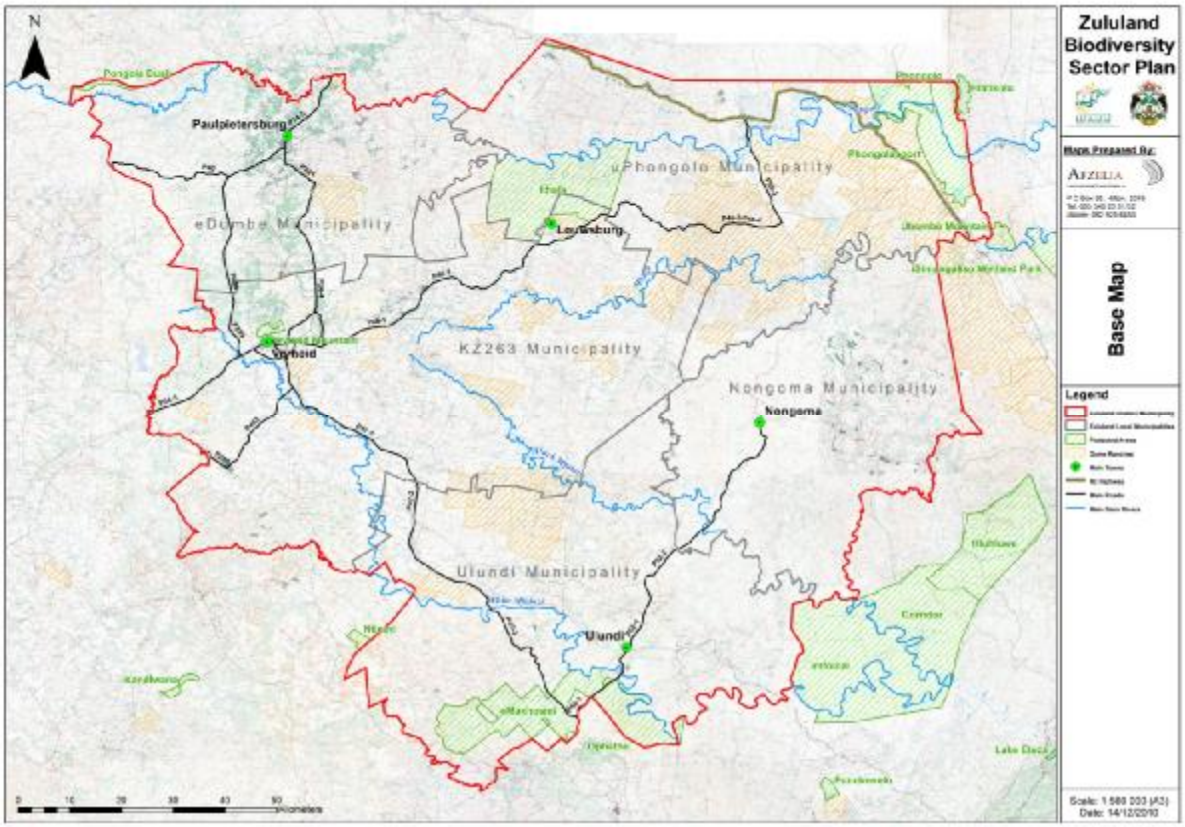

Figure: 3 Base Map

The District is special in that it includes a central highland areas extending from the highland areas in the west (predominantly a component of the Vryheid Formation), stretching towards Louwsburg in the north and Nongoma to the east. The area between Vryheid, Paulpietersburg and Hlobane is dotted with massive free standing sandstone hills like Ngcaka outside Luneburg where Pongola Bush Nature Reserve is situated (2068m.a.s.l), Makateeskop (1736m a.s.l.), Dumbe Mountain (1535m a.s.l.) and Hlobane (1627m a.s.l.). These highland areas extend into the central part of the District, comprising altitudes generally between 1750m and 850m. The overall gradient is in a west to east direction (Figure 4). The District boundary ends just short of the Lebombo Mountains, but includes critically important rivers that cut through this mountain range.

The landscape varies from very flat extensive plains, undulating and rolling landscapes, broad valleys, wide and flat valley basins, rocky lowlands, low mountain ranges, steep to gentle slopes, mountainous areas much incised by river gorges, ridges, scarps and plateaus. Topographical variation includes diversity of aspect associated with the valleys and ridgelines crossing the District, in places providing localised climate variability in cooler sheltered areas, offering fire refugia and suitable habitat for forests (subridge scarps and moist sheltered kloofs). The central highland area extending from the west has resulted in aspect and altitudinal variations across an exceptional diversity of landforms (as described above).

Biophysical gradients extend in all directions, which has resulted in complex hydrological flow patterns within the District. On a local scale hydrological flows are both towards and away from the sea; however, the District includes a number of stem-rivers that generally flow eastwards towards the sea. These rivers originate from the western watershed and the central highland area, flowing through predominantly steep mountainous terrain and river valleys. Hydrological processes have given rise to a number of koppies and ridgelines within flatter areas found in the western and to a lesser extent the eastern parts of the District.

The Zululand District is underlain predominantly by Karoo Sequence basalts, shales, siltstones, sandstones and conglomerates that have been intruded by dolerite dykes, sills and plugs of Jurassic age. Granite, quartzite, basalt, diabase, migmatite, and gneiss are also present; significant areas of granite prevail in the vicinity of Paulpieterburg. The District comprises very little alluvium, which is a feature of a rugged downward eroding landscape. A variety of Karoo Supergroup rocks occur in the area and the District includes Dwyka, Ecca, Beaufort, Lebombo, and Zululand Groups, with Jurassic

dolerite intrusions and quartzite of the Mozaan Group (Pongola Supergroup). Ithala Game Reserve is an important asset in that it comprises almost all of the intact vegetation present within the Mozaan Group areas in the District. Geological exposure is confounded with altitude, especially for the well layered Karoo supergroup. Natal Group Sandstones are largely absent, apart from isolated areas south of Ulundi and east of Nongoma. Geologically the District comprises significant variation over a diverse landscape (Figure 5). Concomitantly, soil forms are highly varied in terms of carbon content, sodium content, depth, drainage, stoniness, fertility, clay and sand content, and resistance to erosion, and include *inter alia* apedal, plinthic, melanic, duplex, and vertisols soils (Figure 6). Soil forms include Glenrosa, Rensburg, Arcadia, Bonheim, Mispah, Hutton, Clovelly, Griffin. Shortlands, Sterkspruit, Valsrivier, and Swartland, which represent a wide range of soil potential.

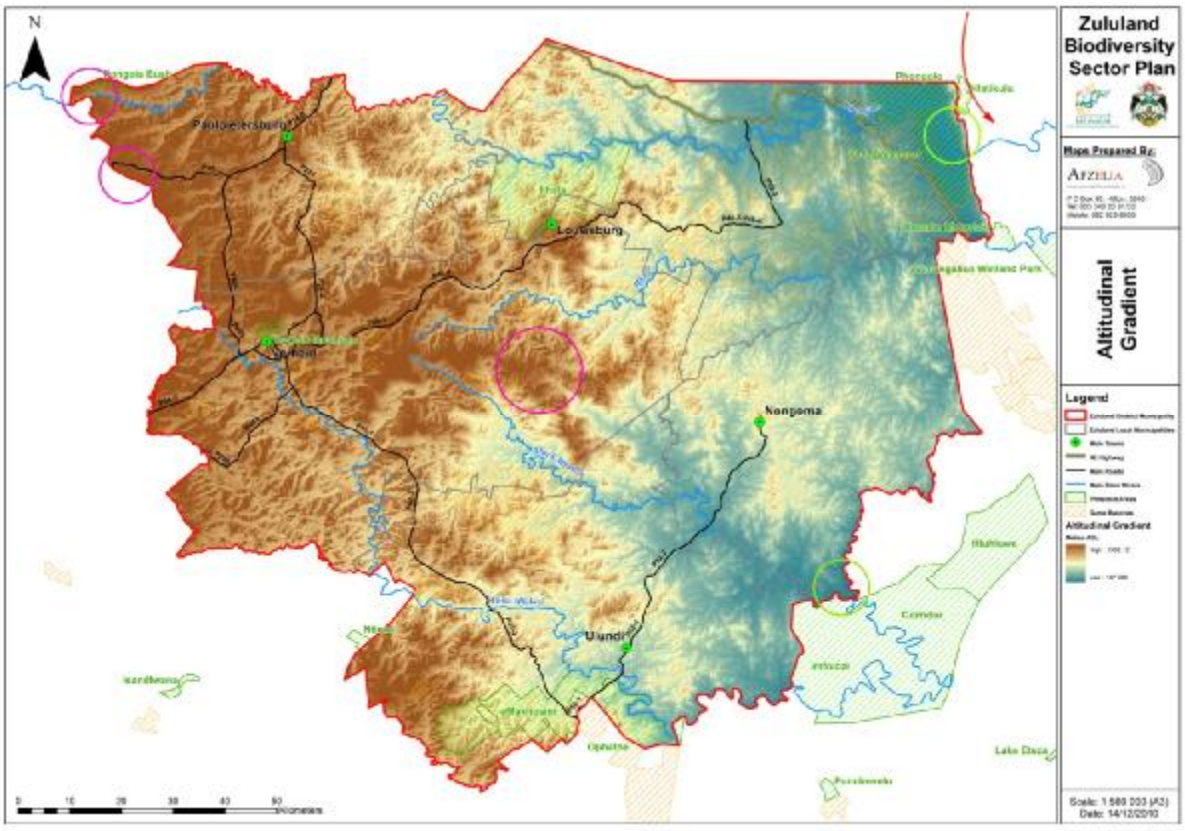

Figure: 4 Altitudinal Gradient in the District

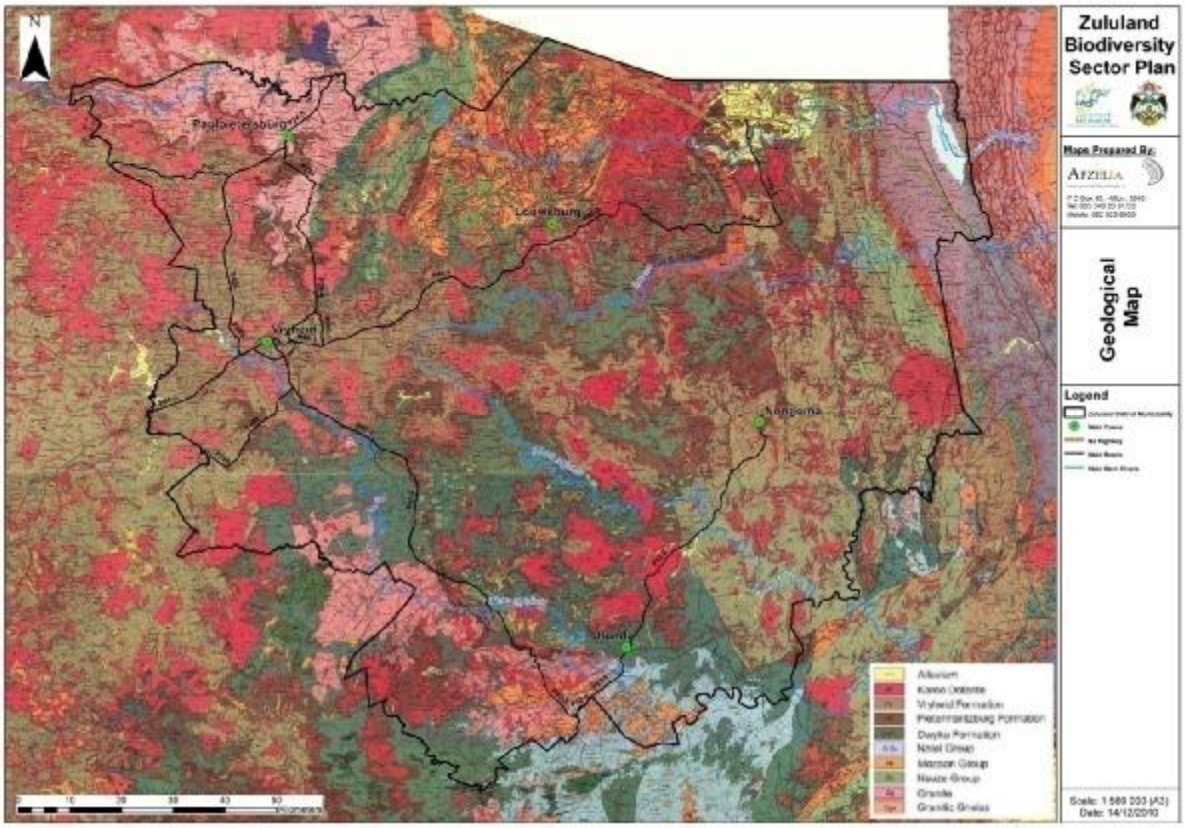

Figure: 5 Geological Series Map of the District

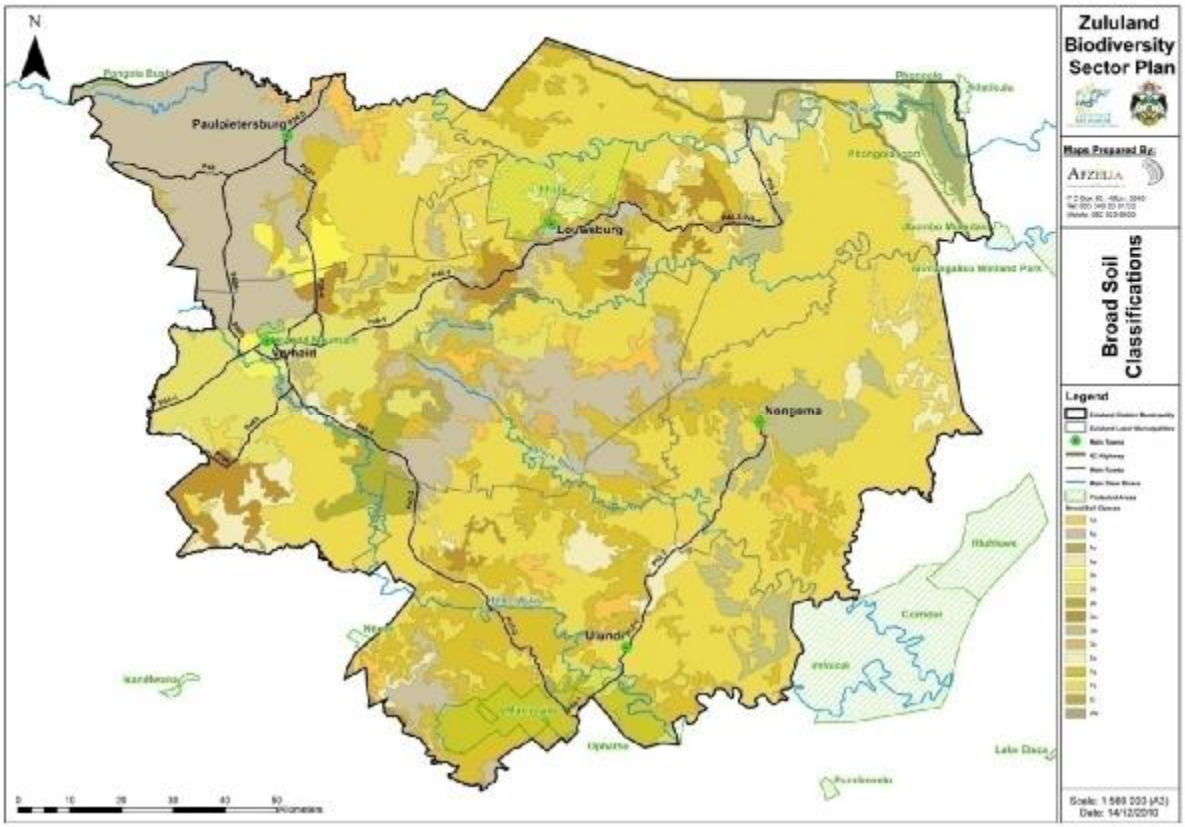

Figure: 6 Broad Soil Classification Map of the District

Varying climatic conditions prevail across the District, as illustrated by varying Mean Annual Precipitation (Figure 7).

With the exception of some precipitation in the south from cold fronts in winter (in the Zululand Lowveld and Mistbelt areas), the region is subject to summer rainfall with dry winters, with rain predominantly falling in early summer, apart from Ithala Quartzite Sourveld (peak rains in midsummer). Mean Annual Precipitation (MAP) ranges from 493mm to 1682mm in the District (predominantly below 900mm in the District), with large scale variations over relatively short distances in certain areas (on account of topographical influences). Rainfall in form of thunderstorms is the prevalent form of precipitation, whilst mist also contributes to precipitation at higher elevations. Mist is however generally an uncommon feature and hail is almost absent across the majority of the in the District. Summers are generally warm to hot, and winters are cool. Mean Annual Temperature ranges generally from approximately 4oC to 20°C, temperatures generally become cooler moving towards the west. Mean annual evaporation varies considerably in the District depending on the relationship of rainfall and temperature.

Climate change scenarios predict major changes in biome distribution in South Africa. Individual species and ecosystems will respond differently to climate change, some potentially increasing in abundance or range, others declining or contracting. Ecosystems will experience changes in their species mix, and these changes may increase their vulnerability to further change or to climate extremes. Models indicate that climate change impacts will largely consist of latitudinal and altitudinal shifts in potential species' distributions while others suggest that the complete disappearance of critical climate types and dependent species are possible. Climate change will affect not only the survivorship of particular species, but also fragment the landscape and affect the natural resources that species have adapted to use in their natural environment. Species are thus marginalised and forced to move elsewhere to find places to live and food to eat. The impact of climate change will therefore increase the risk of species extinction and impact on biodiversity integrity. This District comprises biophysical and altitudinal gradients extending in all directions, primarily as a result of the central and western highland areas, which highlights the critical role that this municipality is likely to perform in biodiversity conservation in response to climate change. The NSBA concluded that this District includes areas of biome resilience, where the current biome may persist in the face of climate change, under different climate change scenarios. However, ongoing fragmentation increases vulnerability to climate change and reduces resilience.

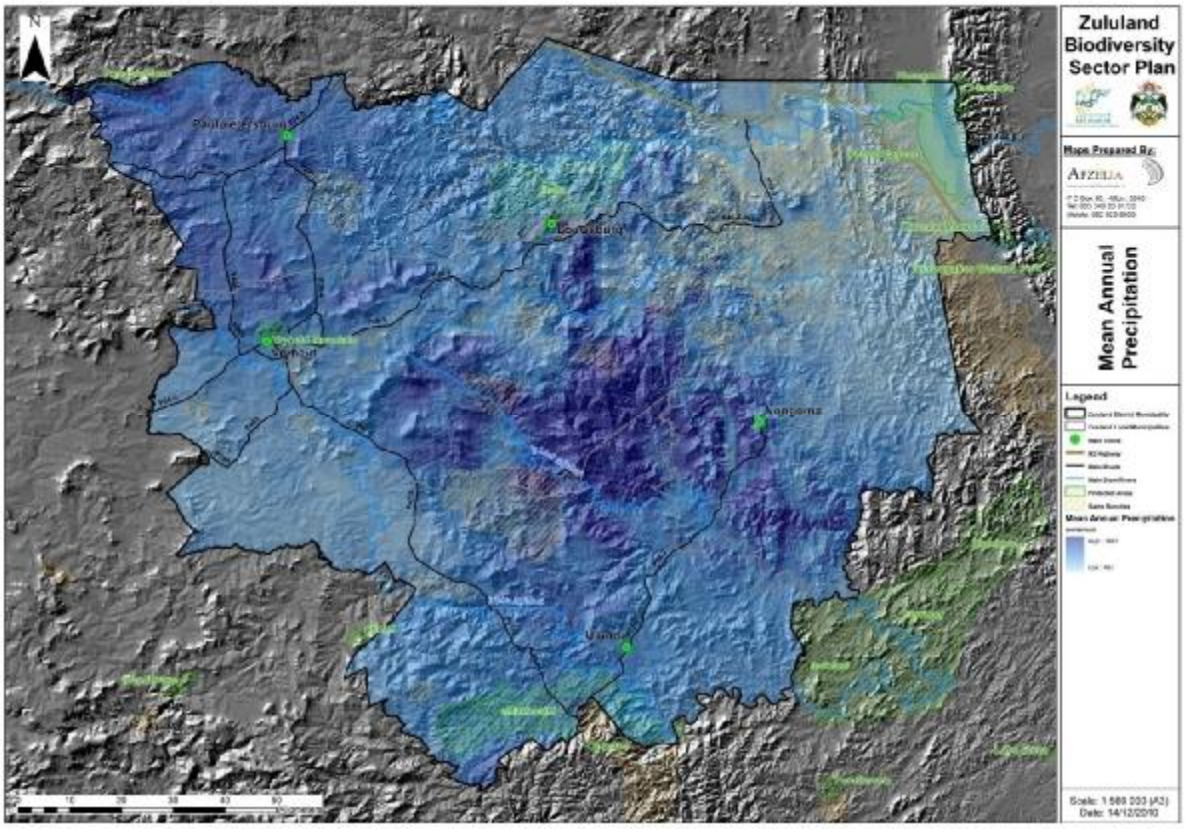

Figure: 7Annual Precipitation Map of the District

4.2 Vegetation, Plant and Animal Species

The District has exceptional heterogeneity in habitat, which translates into rich vegetation diversity, as described in Mucina & Rutherford (2006), comprising lower altitude dense bushveld, savanna and grasslands, extending up to higher altitude mistbelt grasslands, including significant areas of mistbelt and forests. Landscape heterogeneity and reasonably intact vegetation across the municipality, offers a high diversity of habitats which support a large proportion of important faunal and floral species.

From a National perspective, the majority of the District has been identified as reasonably intact whilst the ecosystems comprising the Zululand District Municipality range from Hardly Protected to Moderately Protected (NSBA). The NSBA also identifies the area as comprising many species of special concern, considering both fauna and flora. The NSBA has identified large parts of the District as part of the Maputaland-Pondoland priority area for conservation action.

Approximately half of the vegetation types in the District are classified as Critically Endangered, Endangered or Vulnerable, respectively comprising 8%, 10% and 39% of the municipality's land surface area (Figure 8); a total of 58% of the remaining natural asset in the District classified Critically Endangered, Endangered or Vulnerable. The majority of these vegetation types falls outside of protected areas, private nature reserves and game farms. The demarcation and appropriate management of the best remaining parcels of land within the Zululand District Municipality is therefore critically important for the conservation of these vegetation types in KZN. Appendix 1 provides a summary of the different vegetation types within the municipality.

Fragmented moist upland grasslands in the District form part of the Ekangala Grasslands Project, specifically high-lying areas in the vicinity of Vryheid and Ngome. The area provides habitat for a significant number of priority Red Data and Endemic faunal species. A number of plant species protected in terms of the KwaZulu-Natal Conservation Ordinance and other Red Data species occur within the District (Appendix 2), including at minimum 11 Endangered, 28 Vulnerable, and 95 Lower Risk and Data Deficient species. The majority of these species are grassland and open savanna species, which are vegetation types at most risk of degradation.

The District is vital to a number of Red Data faunal species. The area includes species of national importance, *inter alia* such as Wattled Crane, Rudd's Lark, Oribi, Blue Swallow, African Wild Dog, Black Rhino, a number of vulture species, and a number of less charismatic yet equally important

smaller fauna. Threatened Cape Vulture (*Gyps coprotheres*), as well as other raptors including Verreaux's Eagles (*Aquila verreauxii*), forage throughout the District. White-backed, Lappet-faced, and White-headed Vultures breed in the Pongola Nature Reserve. Whilst Lappet-faced vultures also breed in Ithala Game Reserve, this reserve together with the eMakhosini-Ophathe Heritage Park are also critical foraging areas for vultures. The area in and around Ithala Game Reserve comprises one of the few areas where African Hawk Eagle breed.

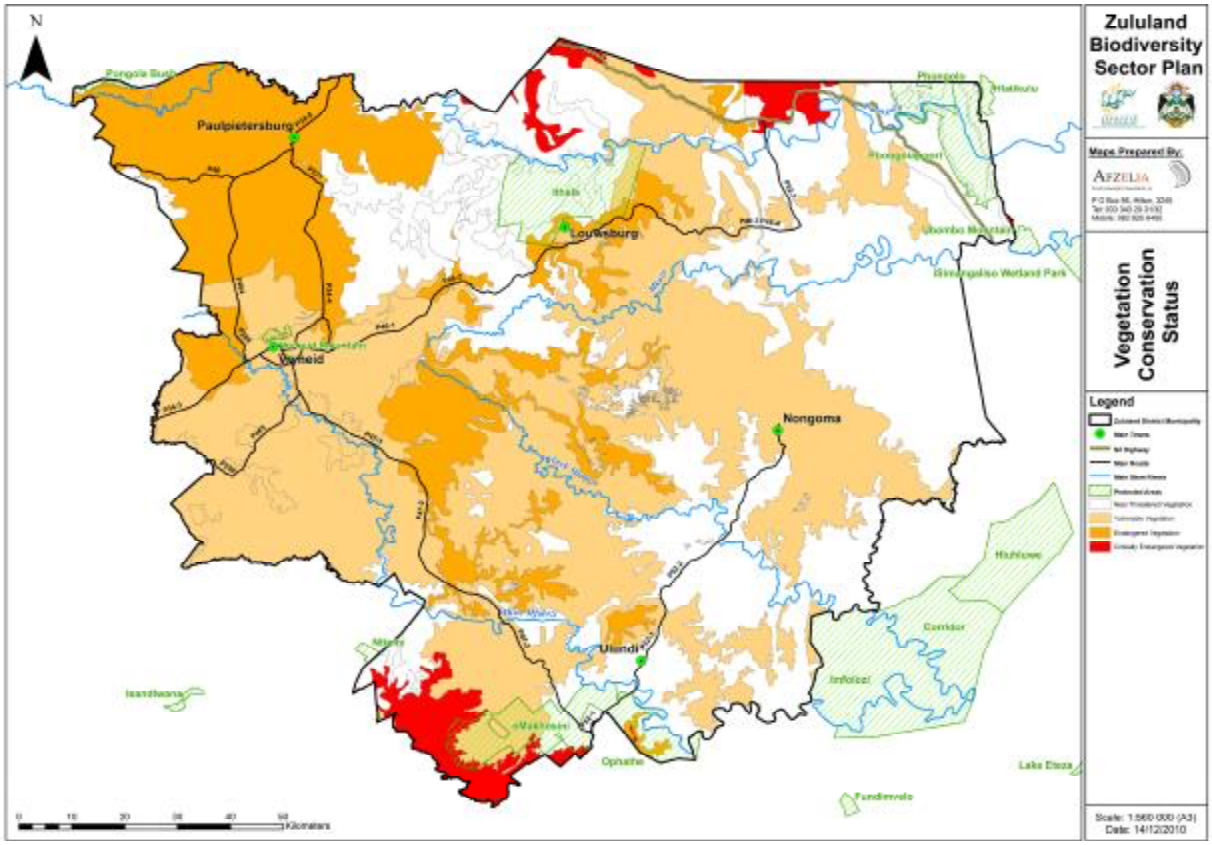

Figure: 8 Modelled vegetation map of threatened vegetation types, illustrating conservation status

Many of the animal species require a large area for foraging of an individual animal, which emphasizes the importance of maintaining large connected areas of natural habitat for ensuring their viability. The protection and appropriate management of the remaining intact habitat within the municipality is critical to ensuring the viability of conservation important faunal species listed above. This pertains particularly to (i) the corridor from the Lebombo Mountains through to Ithala Game Reserve, which includes vast areas of intact natural vegetation and land uses compatible with conservation, and (ii) the corridor from the Babanango area through the eMakhosini-Ophathe Heritage Park, along the Mfolozi River, Hluhluwe-iMfolozi Park, and northwards.

The District is an avifaunal hotspot, comprising in excess of 400 birds. The area is home to at least 2 Critically Endangered species, 4 Endangered species, 35 Vulnerable species, and 50 Near Threatened species. The African Skimmer (*Rynchops flavirostris*) is classified as Regionally Extinct. Five important fish species, 19 mammals, 3 reptiles, and 6 invertebrates have been identified as important. Grasslands are known in general to support high invertebrate diversity across a wide range on invertebrate taxa, but little is known about overall invertebrate distribution within the Zululand District Municipality. It is assumed that invertebrate diversity is related to diversity of vegetation types and plant species. Conserving these should therefore ensure conservation of invertebrate species. Similarly, it is assumed that protection of water resources would ensure the persistence of fish species. Only one conservation-important amphibian species has been identified, namely *Strongylopus wageri* (Plain stream frog).

Whilst the majority of conservation important species as identified in the BSP is not well conserved within existing Protected Areas, the majority of Red Data plant and animal species recordings in the District have been within Protected Areas, special interest areas, and to a lesser extent in private game ranches or private nature reserves; this almost certainly reflects a sampling bias. Few species have been recorded in Traditional Authority Areas, which is most likely indicative that these areas have been subject to the lowest levels of sampling. It may be argued that topographical constraints on settlement expansion, coupled with a dependency on the natural resource base to sustain rural livelihoods, may infer a level of protection and biodiversity resilience that is likely to ensure biodiversity persistence in such areas; the exception would be larger mammals and birds, which would be subject to hunting pressures. The same applies to other inaccessible areas, such as the Pongola River valleys. A significant number of additional faunal and floral species are likely to be present; one therefore needs to adopt the precautionary principle in such areas.

4.3 Wetlands

The wetland systems in the District are distributed in a complex mosaic, occupying a variety of positions in the landscape across altitudinal gradients, ranging from open water bodies, vleis and marshes, down to extensive wetlands associated with stream and river courses. Wetland types in the District have been classified as Highland, Lowland, Midland and Coastal Lowland-Sedge Wetland (Figure 9).

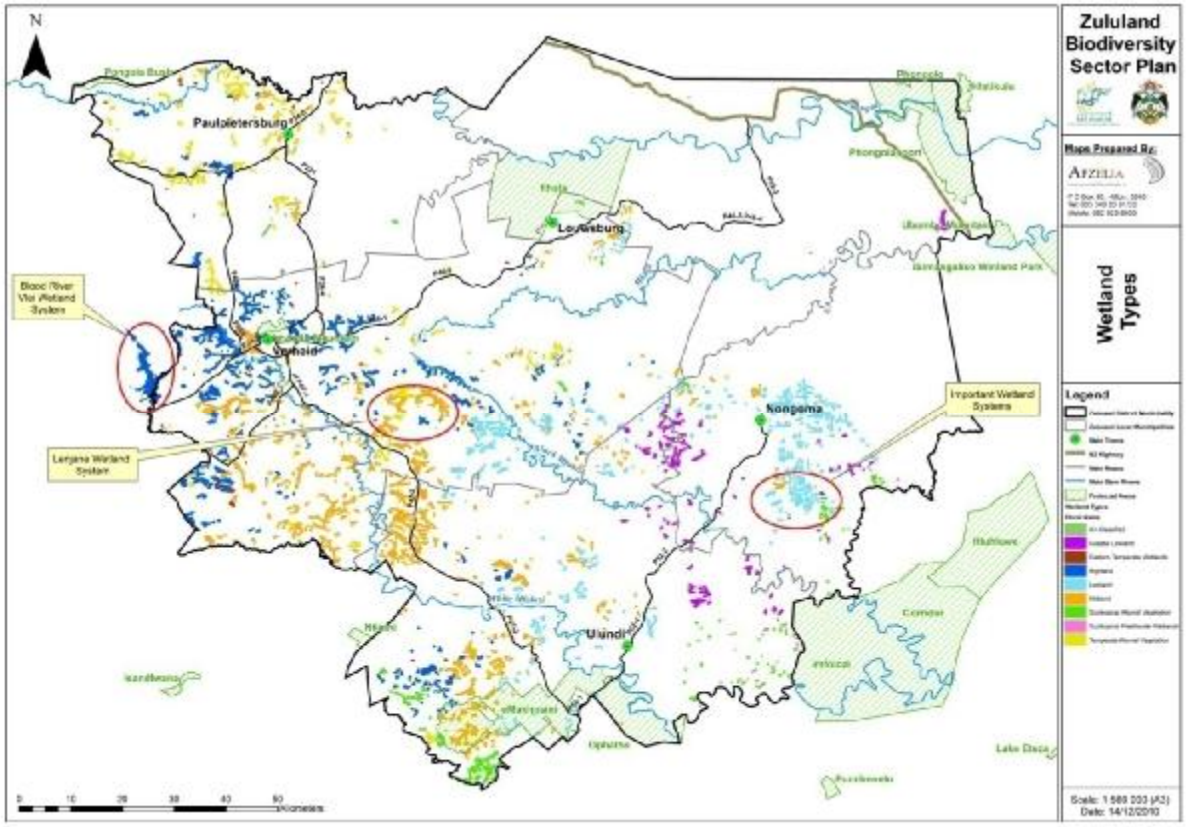

Figure: 9Distribution of wetland types in the District

The wetlands in the District are critical for ensuring sustained water quality and quantity from the major water catchments. Upper catchment wetlands, which play a key role in the hydrological cycle of the catchment in the District, are of particular significance for the maintenance of regular stream-flow patterns, and acceptable water quality levels. The rivers and associated wetlands within this District, particularly upper catchment wetlands, are of international, national, and provincial importance, in providing water to Mozambique, Swaziland, KwaZulu-Natal and other provinces. Apart from providing critical ecosystem goods and services, wetlands are also of major importance

for biodiversity, because of the variety of natural communities associated with them. The role of wetlands is amplified in this District on account of widespread rural settlement and coal mining activities. In certain circumstances wetland use by rural communities have impacted upon the natural functions of such systems. These wetland systems need to be rehabilitated as they perform a vital service to both local and down stream users.

The District includes special wetlands, including the Blood River Vlei Wetland and Lenjane Wetland System; the former is a recommended RAMSAR Site which is nationally listed as an Important Birding Area, recognized as a unique birding area with all three Crane species recorded.

4.4 Ecosystem Processes and Services

Amongst a suite of ecosystem services provided within the municipality, carbon sequestration and the supply and regulation of clean water from the District are the most significant. The availability of quality water is predicted to be the single greatest development constraint facing South Africa. South Africa has a low long-term annual average precipitation (approximately 510 mm/annum) and the District is one of only five areas where the annual average precipitation exceeds evaporation.

More than 60% of river-flow in South Africa arises from only 20% of the land area. The Zululand District Municipality forms part of this 20% and has a wealth of surface water resources as a result of the high rainfall over the area. The north-western most corner and the high-lying central area of the District have been designated areas of importance to water production through surface runoff (Schulze ***et al***, 1997). Special mention is made of the northern boundary of the District, where water supply still exceeds water demand (DWAF, 2004); the majority of KwaZulu-Natal is in a situation where demand exceeds supply.

The main rivers in the District are the Pongola, Mkuze and the Black and White Mfolozi. The Pongola River flows from the Zululand District Municipality (some catchments lie in Swaziland) through Umkhanyakude District Municipality and into Mozambique, where it becomes the Maputo River. At the boundary between Zululand and Umkhanyakude, where the Pongola River passes through the Lebombo Mountains, it has been dammed to form the Pongolapoort or Jozini Dam. The Mkuze River flows into the St Lucia wetlands, whilst the Black and White Mfolozi confluence in uThungulu District Municipality and flow southeast into the Indian Ocean just north of Richards

Bay. The majority of rivers in the District are still intact, but are classified as vulnerable (NSBA, 2004). Importantly, the Phongola River, White Imfolozi, Black Imfolozi, and Mkuze Rivers have been nationally designated as important rivers for representation of biodiversity.

The District is therefore critical for the provision of good quality water to the Pongolapoort Nature Reserve, Pongola Bush Nature Reserve, Ithala Game Reserve, Lake St Lucia, False Bay, eMakhosini-Ophathe Heritage Park, Hluhluwe-iMfolozi Park, Mkhuze Game Reserve, and other smaller protected areas, sustaining water resources within provincially and nationally important eco-tourism destinations. Water supply to some of the country's best and arguably KZN's best protected areas is under significant threat. The water catchments within the District are also the key lifelines for regional development, and are also of major significance for the industrial economy of KwaZulu-Natal, specifically Richards Bay. Local water resource developments within the District are generally small and relate primarily to the needs of farming communities, villages, and a number of towns.

The main surface water resources include the Bivane and Pongolapoort Dams that account for 88% of the available water resources. In the natural state, the water quality is of a high standard. However, localised water quality problems and health risks associated with the proximity of settlements to resources and the lack of sanitation facilities occur within the region. Significant coal mining areas also pose a significant threat. All the major catchment systems are stressed catchments, with winter deficits posing significant threats to the ecological reserve.

The following is a breakdown of the most important catchments in the District.

The Mfolozi catchments

The White Mfolozi catchment consists mostly of commercial farming in the northwest and Traditional Council land in the southeast, with the main activity being cattle farming. Approximately 120 km2 of commercial forestry (or 2.5% of the land cover) and 30km2 of alien vegetation (less than 1% of the land cover) are situated in the upper reaches of the catchment. Only a small portion of the catchment area is irrigated, estimated at about 8km2, downstream of Klipfontein Dam. Some farmers have reduced their irrigation requirements because of the high cost of water. The Hluhluwe-iMfolozi Park lies at the outlet of the catchments from the Zululand District Municipality. Significant towns include Vryheid, Ulundi and Emondlo.

Water resources within the catchments are mostly undeveloped with the most significant being the Klipfontein Dam in the upper reaches. This dam has a capacity of 19 million m3 and was constructed to augment water supply to the towns of Vryheid and Ulundi. Provision was also made for irrigation requirements. Vryheid receives water from Bloemveld and Grootwaagd Dams upstream from the town, and to a lesser extent Klipfontein Dam. Ulundi receives water from an abstraction weir on the White Mfolozi River. River yields are supplemented during low flows with releases from the Klipfontein Dam, which is underutilized and has capacity. However, losses between Klipfontein Dam and the Ulundi weir are large and this method of operation is not efficient.

A significant amount of water is transferred out of the lower White Mfolozi, just before it flows into the sea, to the Mhlathuze catchments for mining use by Richards Bay Minerals. There is a deficit in the lower White Mfolozi during the winter months. This deficit can possibly be overcome by releases from Klipfontein Dam. However the analyses indicate that when the rural water demand increases to 60lcd then there is a shortfall in supply from Klipfontein Dam. This may be resolved by either provision of off channel storage at Ulundi or the reallocation of irrigation water use.

The Black Mfolozi catchments consist mostly of Traditional Authority land, with the main activity being cattle farming. There is approximately 100km2 of commercial forestry (or 3% the land cover) and 20km2 of alien vegetation (or less than 1% of the land cover) situated in the upper reaches of the catchment. Only a small portion of the catchment area is irrigated, estimated at about 15 km2. The Hluhluwe-iMfolozi Park lies at the outlet of the catchment from the Zululand District Municipality. The only significant town is Nongoma.

The water resources of the Black Mfolozi catchments are mostly undeveloped and underutilized. The major water users in these catchments are irrigation and domestic rural water supply. Nongoma receives water from the Vuna River (W22G).

A reconciliation that includes the Usuthu RWSS, with estimated water requirements of 2.5x106m3/annum, indicates that there is a deficit in the lower Black Mfolozi during the winter months owing to large scale irrigation development near the mouth of the Mfolozi River and abstractions for transfer to the Mhlathuze catchments. The confluence of the Black and White Mfolozi Rivers occurs in the Hluhluwe-iMfolozi Park.

The Mkuze Catchments

The Mkuze catchments consist mostly of commercial cattle or game farming, with a small area of Traditional Council land located in the southeast. There is a significant amount of afforestation, estimated to be nearly 114km2 (or 4% of the land cover), and an estimated 49km^2 of alien vegetation (or 2% of the land cover). Irrigation of sugarcane is another significant land use covering area of approximately 68km2 (2.6% of the land cover). The only significant town in the area is Hlobane that is situated river's headwaters. This system is impacted on by the rain shadow of the Lebombo Mountains.

The water resources are mostly undeveloped, with only a number of farm dams for irrigation purposes. The major water users in these catchments are irrigation and commercial forestry. Irrigators abstract water from run-of-river flows or from farm dams, with the exception of Senekal Estates who receive water from the Pongolapoort Dam.

The town of Hlobane obtains its water from the Hlobane and Boulder Dams. There is a deficit in the Mkuze River during both the winter and summer months owing to irrigation utilizing the entire available yield without maintaining water for the Mkhuze Game Reserve.

The Pongola Catchments

The Pongola catchments form part of an International River Basin shared with both Swaziland and Mozambique. Although neither of these countries currently have high demands on these water resources, it may be easier to supply Maputo's future requirements from the Pongola River where there is a surplus (sourced from the Pongolapoort Dam) than from the Inkomati River that is stressed.

The Pongola catchments are characterised by large-scale afforestation estimated at 480km^2 (or 6% of the land cover) in the upper Pongola and Bivane tributaries, and largescale irrigation of approximately 200km^2 (or 2,5% of the land cover) in the W44 catchments upstream of the Pongolapoort Dam. The main irrigated crop is sugarcane. There is approximately 150km^2 of alien vegetation (or 2% of the land cover). The significant towns in the area include, Pongola, Paulpietersburg, Louwsburg, and Frischgewaagd.

The source of the Pongola River is on the eastern escarpment at the border of Mpumalanga and KwaZulu-Natal near Wakkerstroom, from where it flows eastwards carving a gorge through the

Lebombo Mountains before joining the Usuthu River just before the Mozambique border and flowing into the Maputo Basin.

The water resources of the Pongola catchments are fully developed through the Pongolapoort Dam and there is no further scope for increasing the yield as a whole.Recently the Bivane Dam has been constructed in the Bivane catchments to increase the assurance of supply to irrigators upstream of the Pongolapoort Dam. A rapid assessment of the ecological reserve has been carried out for the Pongolapoort and Bivane Dams. There is an existing operating rule that determines the frequency and magnitude of flood releases from the Pongolapoort Dam to meet social and environmental requirements on the flood plains downstream of the dam. These releases reduce the yield of the Pongolapoort Dam substantially (by about 250 million m^3/annum). However, the downstream parties do not always welcome these releases and Mozambique has recently objected, as have riparian farmers along the lower Pongola River. The possible dam sites on the upper Pongola River that have been investigated for the possible transfer of water to the Vaal System will not increase the system yield significantly; only move the yield of the Pongolapoort Dam upstream.

The major water user in these catchments is irrigation. The other significant water user is afforestation (38% of the irrigation requirement). Competition between forestry and irrigation in the Upper Pongola and Bivane catchments resulted in the Impala Water User Association (previously the Impala Irrigation Board) to commission the Bivane Dam to increase the assurance of supply to irrigators. Illegal expansion of irrigation is prevalent.

The town of Pongola receives water from irrigation canals in the lower Pongola catchments, but more recently has also been supplied from the Bivane Dam. Simdlangenstha Phase 1 RWSS receives 90% of its water from Pongola town, which is approximately 10% of the town's own requirements. Simdlangenstha Phase 2 RWSS is planning to get 66% of its water from the Frischgewaagd weir on the Pongola River (W42E 50%), and the remaining 34% from the Monzana River (W42L 15%).

The shortfall in the winter months is due to a combination of the large irrigation requirements and the ecological reserve. Upstream of Bivane Dam there are a few deficits, however below the dam these deficits can be resolved through releases. After supplying the existing downstream requirements from the dam there is no significant spare yield. Another important factor is that the National Water

Resource Strategy (NWRS) recommends that water in the upper Pongola be reserved for possible transfer to the Vaal system in the future. This will definitely reduce the existing available surplus.

Currently many communities within the District rely on groundwater; this includes both formal rural water schemes as well as rudimentary project communities. The rudimentary (survival) service level consists of boreholes equipped with hand-pumps or protected springs supplying at least 5 ℓ/c/d. Owing to the fact that groundwater is utilised extensively in the supply of water services to the rural communities of the District, it is important from a social perspective that groundwater levels and quality are maintained to ensure sustainability and SABS drinking water standards.

Within most of the rural areas the water supply is at the basic national standard (or below), therefore no large volumes of wastewater are produced and no formal wastewater treatment processes are in place. No less than 82% of the population depends on natural sources (rivers, streams, boreholes, and springs) for their water supply. In these areas the wastewater flows directly into the ground via French drains or the like. In addition, there is no current requirement for bulk sanitation disposal as the rural areas are predominantly supplied through Ventilated Improved Pit Latrines and not waterborne sewerage systems. However, no formal contingency plan currently exists for major pollution events.

This particular municipality is therefore at the centre of water supply assurance, and performs a critical function for present and future water supply within its catchment, neighbouring municipalities, neighbouring provinces, and countries. The wetlands, rivers, and grasslands in the District, on which sustained provision of clean water is dependent, are therefore critically important.

The NSBA (Driver *et al*, 2005) complements the NBSAP, led by the Department of Environment Affairs and Tourism (DEAT), which is a component of South Africa's obligations as a signatory to the Convention on Biological Diversity (CBD). The NSBA produced a comprehensive national spatial assessment of South Africa's biodiversity, identifying geographic priority areas for action, for informing policies, plans and actions of a wide range of public and private sectors. The NSBA concluded that the District is a significant contributor in terms of ecosystem services on a national scale, particularly due to its substantial grassland areas. This includes areas of importance to groundwater contribution, surface water runoff, soil protection, carbon sequestration, grazing and supporting services. The District is important for carbon sequestration, particularly the north-eastern

quarter of the District. The primary catchment areas are dominated by fire-climax grasslands and savannas, and when these are well managed they maintain the vegetation cover that ensures the protection of the soil during precipitation events, effective absorption of water into the soil, and the slow release of the water into the system thereafter.

The District includes substantial communal areas which are reliant on the natural resource base for grazing, wood for building materials and fire, medicinal plants, drinking water, and food. The services provided by these ecosystems are therefore critical to the maintenance of biodiversity as well as sustainable rural livelihoods.

Ecological connectivity and porosity is critical in ensuring ecosystem integrity and sustained delivery of ecosystem processes and services. The municipality plays a crucial role in regional ecological connectivity, with critical linkages into adjacent municipalities, provinces and countries. The District forms an integral part of the provincial ecological corridors identified by Ezemvelo KZN Wildlife. Critically, regional connectivity is essential for species with large home ranges, such as African Wild Dog.

The municipality regionally still has a high degree of corridor integrity in the north-south and east-west axes, considering vegetation units and intact riparian systems (see Section 5.3.3).

4.5 Existing Conservation Areas

The District includes a number of Protected Areas and areas of conservation value and sensitivity, including the recently proclaimed Zululand Rhino Reserve (totaling approximately 20 000ha):

- Ithala Game Reserve
- Ngome State Forest
- Pongolapoort Nature Reserve
- Klipfontein Nature Reserve
- Vryheid Nature Reserve
- Pongola Bush Nature Reserve
- Emakhosini Ophathe Heritage Park
- Zululand Rhino Reserve

- Amatshitsholo Community Conservation Area

The District includes the Ntendeka Wilderness Area within the indigenous Ngome ForestSystem, comprising 5 250ha of grasslands and forests, which although small includes significant rare and endemic plants and animals, with high genetic diversity.

In accordance with obligations to international agreements, DEAT has provided national goals[1] of 8% and 12% for formal protection of terrestrial areas by 2010 and 2015, respectively. The Zululand District Municipality does not yet comply with the 2010 target (comprising 1.75% Protected Areas currently).

5. Level of Transformation

The most recent Land Cover data (2005) provided by EKZNW was used to demarcate transformation in the study area. A number of land cover categories were mapped (Table 1).

Table 1Land Classifications used in the Transformation Layer

Category	Notes
Cultivation, commercial, annual crops, dryland	These areas were considered transformed.
Cultivation, commercial, annual crops, irrigated	
Cultivation, subsistence, dryland	
Dams	
Erosion	
Golf courses	
KZN Main & District Roads	
KZN National Roads	
Mines & Quarries	
Old Fields (previously bushland)	
Old Fields (previously grassland)	
Orchards - permanent, irrigated, banana's and citrus	
Orchards - permanent, dryland, cashew nuts	
Orchards - permanent, dryland, pineapples	
Plantation	
Plantation - clearfelled	
Rural dwellings	These areas were considered transformed. Rural dwellings were also buffered by 600m based on a species: area curve for sourveld grasslands as

[1] To achieve the 8 % National goal of formal protection for terrestrial areas under protection by 2010 and 12% by 2015, SANBI and DEAT requested that EKZNW compile a list, in accordance with obligations to international agreements, that indicates the most important land holdings that would be required for conservation management

	established by EKZNW[2].
Smallholdings - grassland	These areas were considered transformed.
Sugarcane, commercial, irrigated & dryland	
Sugarcane, semi-commercial, emerging farmer, irrigated & dryland	
Urban / Built-up	
Additional areas of transformation (from aerial photographs)	Areas that were immediately obvious from spot imagery were manually digitised and included in the transformation layer.
Known approved developments	These areas were considered transformed.

Rural settlement and agricultural activities are responsible for the majority of land transformation in the District (Figure 10). The transformation layer has been presented in the context of existing protected areas and game ranches, which highlights that these land uses have been effective in preserving natural asset in the District. The importance of privately owned game reserves must not be underestimated, as many of these incorporate extraordinary and unique biodiversity asset and natural features.

It is important to note that rural dwellings account for the majority of the transformation mapped below; this is because of the 600, buffers applied to these dwellings. The latter buffer is extremely precautionary in the context of this District as the rugged terrain and vegetation types are likely to render lower species losses over distance from settlement. Removal of the precautionary buffer better illustrates the extent of physically untransformed land in rural areas (Figure 11), and highlights the relatively greater transformation impact as a result of urban and agricultural development. Although currently possibly in a sub-optimal state, these areas are considered important for broad-scale connectivity in having a high potential for rehabilitation, there is likely to be significant variation in the condition of the vegetation with highly intact vegetation in pockets within such areas, and the reliance on the natural resource base by the communities that inhabit these areas renders an intrinsic level of protection.

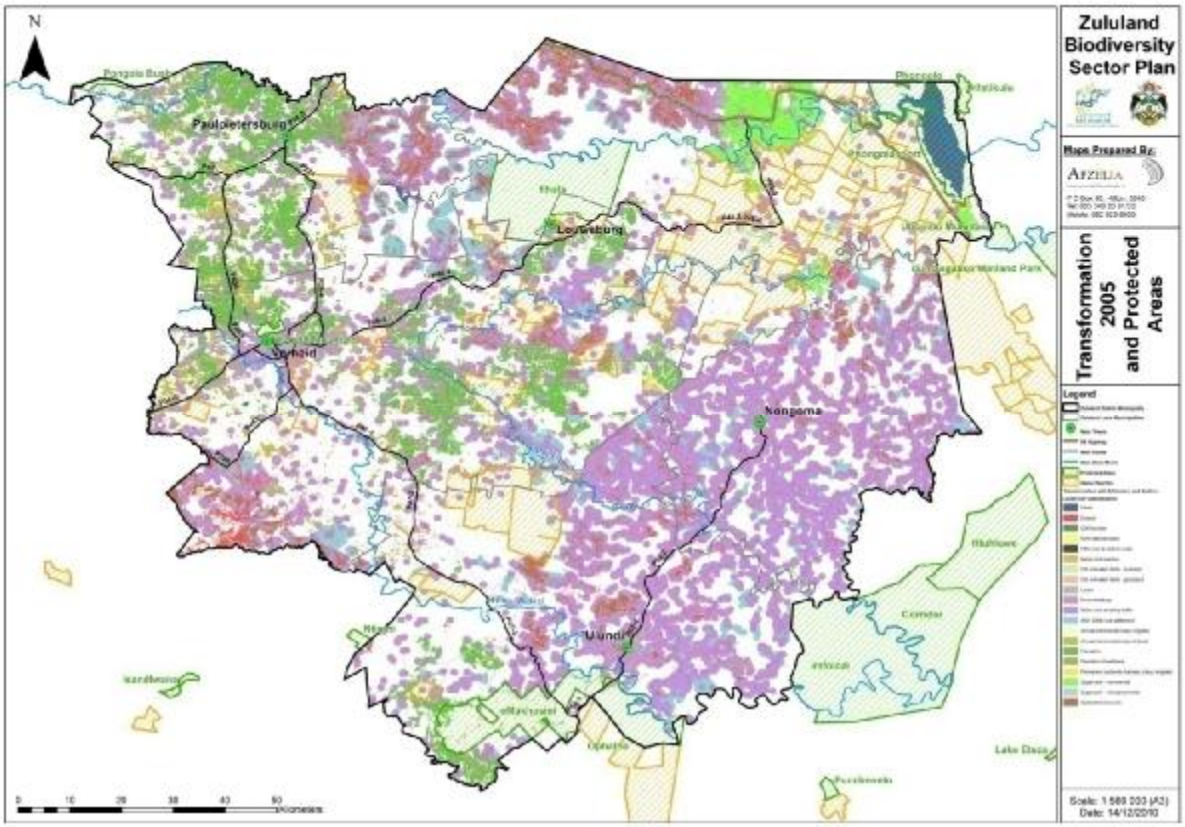

Figure: 10Map of Transformation in the District Relative to Protected Areas

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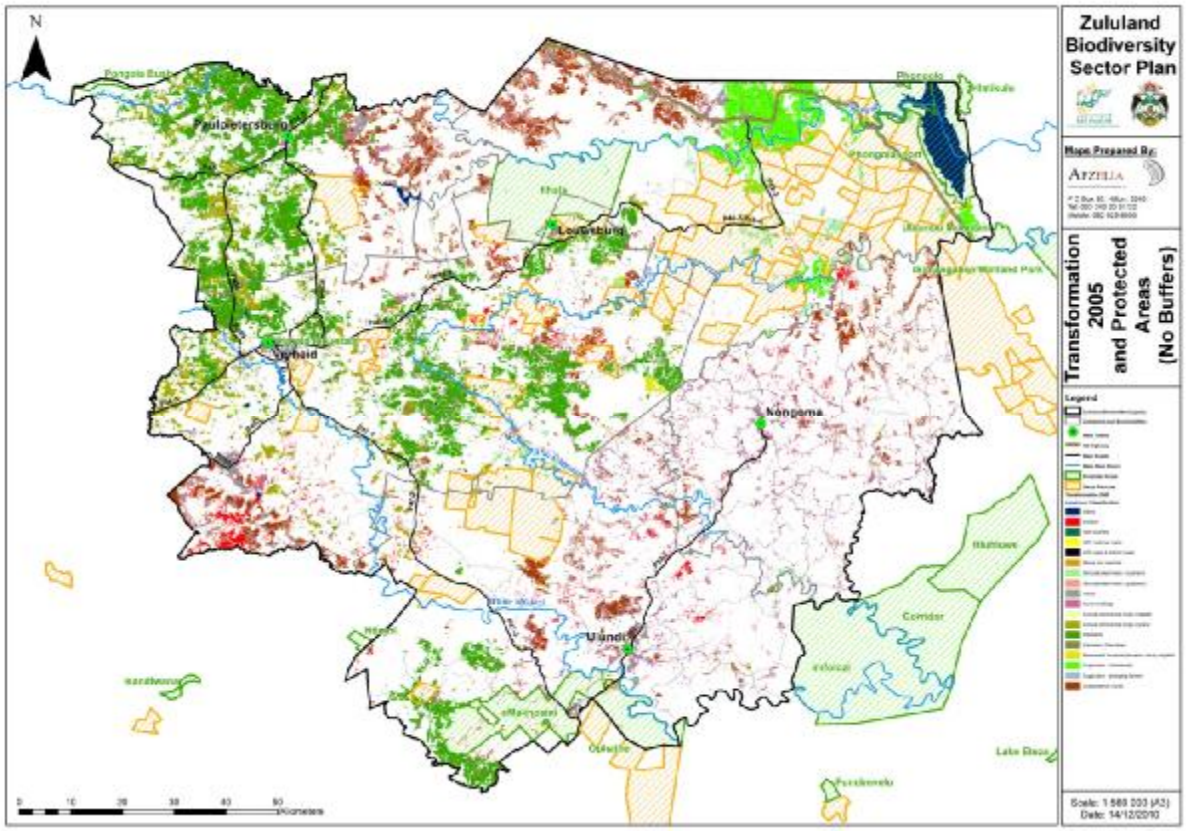

Figure: 11Transformation with Protected Areas and Game Ranches (excluding buffers)

7. Biodiversity Feature Mapping

7.1 Introduction

The purpose of this exercise was to map the critically important biodiversity features and ecological processes required for meeting biodiversity targets within the District. This was achieved through a spatial assessment of all available biodiversity information for the District, selecting those areas that represent the best options for achieving biodiversity targets. The final product is a series of maps highlighting those areas that are critically important for biodiversity, with accompanying land-use planning and decision-making guidelines. Maps important in decision-making are also included in the report.

The Guideline regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans (DEAT, 2008) refers to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). In terms of this guideline and the SANBI Bioregional Planning Workshop (September 2008), a CBA is considered an area that is irreplaceable and highly significant, and needs to be maintained in a natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. It comprises an area that is vital to ecosystem / species persistence (based on a biodiversity feature relative to its target). Maintaining an area in a natural state can include biodiversity-compatible land uses and resource uses. Ecological Support Areas are areas that are not essential for meeting biodiversity targets but which nevertheless play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in ESAs may be lower than that recommended for critical biodiversity areas. Corridors are generally defined as ESAs, especially if providing links between CBA areas. The BSP also included areas important for ecosystem services as ESAs. Where a critical corridor is in the process of being broken or is under threat of being broken, then it is defined as CBA.

The following biodiversity features were included in the CBA maps:

- EKZNW terrestrial systematic conservation plan - Irreplaceable areas
- EKZNW Aquatic Earmarked Catchments

- Vegetation types
- Individual plant species of conservation significance
- Individual animal species of conservation significance
- Wetland types
- Protected Areas

Ecological processes operating across a range of temporal and spatial scales are critical for maintaining biodiversity. Conservation planning is essentially a spatial analytical process, and it is therefore necessary that ecological processes are mapped. Mapping of processes was done through the identification of spatial surrogates which describe the geographic distribution of key ecological processes operating to ensure the persistence of biodiversity within the planning domain. Ecological processes were also integrated into conservation planning through choices made in compiling the various layers used in the planning procedure as well as in rules and decisions applied during area selection / and prioritisation. It was decided to limit consideration of ecological processes and ecosystem services to those critically linked to biodiversity conservation at the District scale, considering hydrological process and ecological connectivity.

The following features were included in the maps of ESAs:

- Important national, regional and local corridors for biodiversity
- All wetlands for their role in hydrological functioning
- Important water yield areas
- Important stem rivers and quinery catchments intersected by these rivers
- Important ecological goods and services areas required for sustainable rural livelihoods

In addition to the CBA and ESA maps, the following were also mapped:

- Transformed areas where essentially no natural vegetation remained, including eroded areas and areas unlikely to present viable long term options for conservation. All areas included in the transformation layer are described in Appendix 4).
- Areas of natural vegetation not required to meet biodiversity targets.
- Areas in which possible future land use would be incompatible or in conflict with biodiversity conservation

o High potential agricultural land
o Good potential agricultural land
o Potential and existing mining areas
o Potential commercial forestry areas
o Areas of high erosion potential
o Identified development nodes
o Municipal growth areas as identified by the District Spatial Development Framework, Local Economic Development Strategy and Tourism Plan

The above maps and associated land use and management guidelines should serve to focus conservation efforts in the District, and feed into multi-sectoral planning and assessment processes.

7.2 Methodology

Biodiversity features mapped were clearly defined and delineated according to very specific criteria, with a defensible rationale for their selection. The selection of areas was based on conserving biodiversity within areas where the majority of targets can be achieved at the lowest area cost considering potential threats to biodiversity. Biodiversity targets were based on sound underlying ecological principles and existing quantitative data where available. Targets were not set for ecological processes; rather priority areas were identified. A summary of targets is provided in Table 2.

Table 2: Biodiversity Targets for Identified Biodiversity Features

Biodiversity Feature	**Target**
SANBI vegetation map types	19-29.55% of the vegetation type as per EKZNW targets
Forest types	61.61-66.61% of forest patches as per EKZNW targets; the remaining forests were also mapped due to their scarce and localized distribution within the planning domain, and on account of their inferred protection through the National Forests Act
Wetland types	20% of the total area of each wetland type including 100m buffers; 100% of the wetlands (including 30m buffers) to cater for hydrological processes
Priority species (fauna & flora)	100% of all known locations

The mapping exercise as a first step captured the EKZNW terrestrial and aquatic systematic biodiversity plans, was augmented with more detailed information obtained from expert opinion, key

stakeholders[2]3, local knowledge, and additional Geographic Information Systems, and followed sound ecological principles.

The following surfaces for Geographical Information Systems were included in the assessment or informed decision-making:

- EKZNW terrestrial systematic conservation plan
- Aquatic Earmarked Catchments
- Vegetation types
- Red Data Species
- Locations of priority plant species
- Locations of priority animal species
- Rivers
- Quinery catchments
- Wetlands and Classifications
- Important water yield catchments
- Protected Areas
- EKZNW Protected Areas Expansion
- EKZNW Game Ranches
- EKZNW potential stewardship sites
- EKZNW corridor plan
- Wild Dog Expansion Plan
- Sites of Conservation Significance
- Conservancies
- Living cultural heritage sites
- 2005 EKZNW Transformation layer
- Existing and Potential Mining Areas
- Zululand District Municipality SDF
- Agricultural potential
- Erosion potential

[2] The following key stakeholders were contacted, *inter alia*, EKZNW (Protected Areas Planning, Biodiversity Planning, Biodiversity Research, District Conservation Officers, Ecological Advice, Officers in charge of reserves), Non-Governmental Organisations / Conservation Authorities (SANBI (and Enkangala Grassland), WESSA, EWT, WWF), Organs of State (Zululand District Municipality, Department of Agriculture and Environmental Affairs, Department of Water Affairs and Forestry, Department of Minerals and Energy, Department of Transport (National and Provincial), Tourism KZN, Amafa aKwaZulu-Natali), and Eskom

- Zululand District Municipality Infrastructure Data
- Tribal and Urban area demarcations
- Land Restitution Data
- ENPAT forestry data
- Potential Small-grower forestry data
- Spot 5 Imagery
- 2005 Landcover for Zululand
- 1: 50 000 Topological Maps
- 100m and 50m Contours

All CBAs and ESAs were represented on a single map, supported by a series of lower order maps. Contextual information, such as towns, roads, administrative boundaries, and rivers were included in the maps for reader orientation (included as a separate map in Appendix 6). The level of detail in the mapping exercise was dependent on the quality of the input data. The most accurate, up-to-date data available were used in the mapping exercise. The mapping scale was set at a minimum of 1:50 000 to achieve a reasonably high level of spatial accuracy. This was considered an appropriate scale for informing land-use planning and decision-making. The information has been presented in a format to allow for periodic review and updating of the information. The GIS layers and accompanying metadata have been compiled in accordance with the standards set by SANBI's Biodiversity GIS Unit (BGIS).

A coarse rule-based approach was integrated into the mapping exercise where appropriate, including the following:

- Protected Areas and Irreplaceable areas (in terms of the EKZNW terrestrial systematic conservation plans) formed the basis of area selection, where possible establishing linkages and selecting adjacent areas in order to achieve biodiversity targets. Areas within private or community nature reserves and game reserves were only specifically integrated into the maps where these areas were considered a more compatible land use in comparison to other land use options in an area.
- The mapping exercise aimed to maximise connectivity through a system of ecological linkages within the district and with adjoining districts. Cognisance was taken of important biodiversity linkages into adjacent municipalities.

- Areas of transformation and human activity were avoided to reduce the likelihood of edge effects on important biodiversity areas.
- Large areas were selected in preference to small areas on account of the impact of fragmentation. The preferred shape of selected areas comprised those with a low edge-to-area ratio, which minimizes edge effects. Parcels of land less than 12 hectares in extent were excluded from area selection unless such patches comprise known important biodiversity features.
- Areas comprising significant altitudinal gradients and high diversity of relief were selected wherever possible to allow for species shifts in response to climate change.
- A risk-averse approach was adopted where possible whereby those areas with the least threat and highest likelihood of being well managed were selected in preference to areas at risk.
- Inaccessible areas were selected where possible.

7.3 Critical Biodiversity Areas

7.3.1 EKZNW Terrestrial Systematic Conservation Plan (CPlan)

The EKZNW systematic terrestrial conservation plan for the District was incorporated into the maps by clipping the Irreplaceable areas in the Provincial plan to the District. The systematic conservation plan is a spatially explicit map that identifies those portions of land that are required in a compatible type of land use so that the biodiversity goals and targets for the Province can be achieved.

Critically important areas (CPlan Irreplaceability >80 Percent) were located in the District as illustrated in Figure 12. The best options for conservation generally reflect the less transformed areas in the District, with the exception of important areas adjacent to Hluhluwe iMfolozi Park identified as critical areas for Black Rhino. The predominant land use within irreplaceable areas comprises protected areas and private and community game reserves, which are generally compatible with conservation objectives, provided appropriate management guidelines are followed.

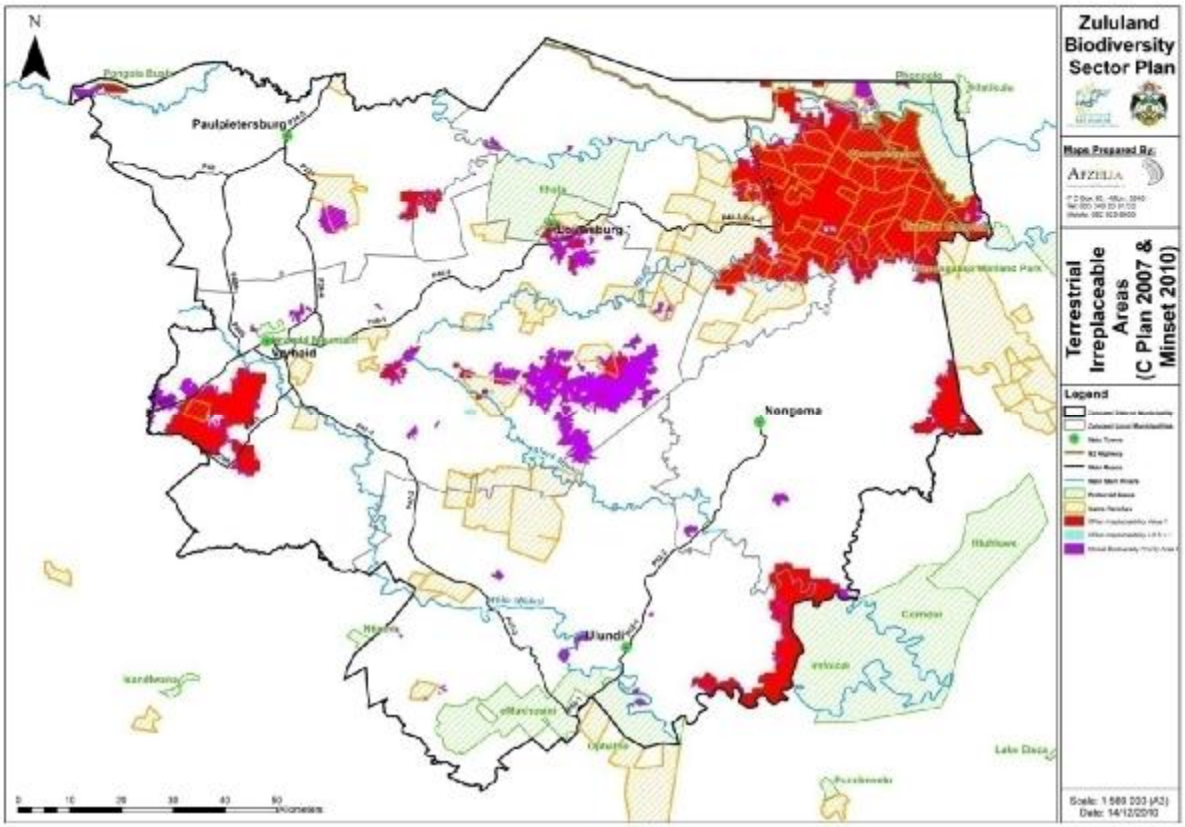

Figure: 12Terrestrial Irreplaceable Areas

7.3.2 EKZNW Aquatic Earmarked Catchments

The EKZNW systematic aquatic conservation plan for the District was incorporated into the maps by clipping the Earmarked (Irreplaceable) areas in the Provincial plan to the District. The systematic conservation plan is a spatially explicit map that identifies those portions of land that are required in a compatible type of land use so that the biodiversity goals and targets for the Province can be achieved.

Critically important areas for aquatic biodiversity are illustrated in Figure 13 below; significantly, these catchments are predominantly located along the stem rivers of the District, along river corridors.

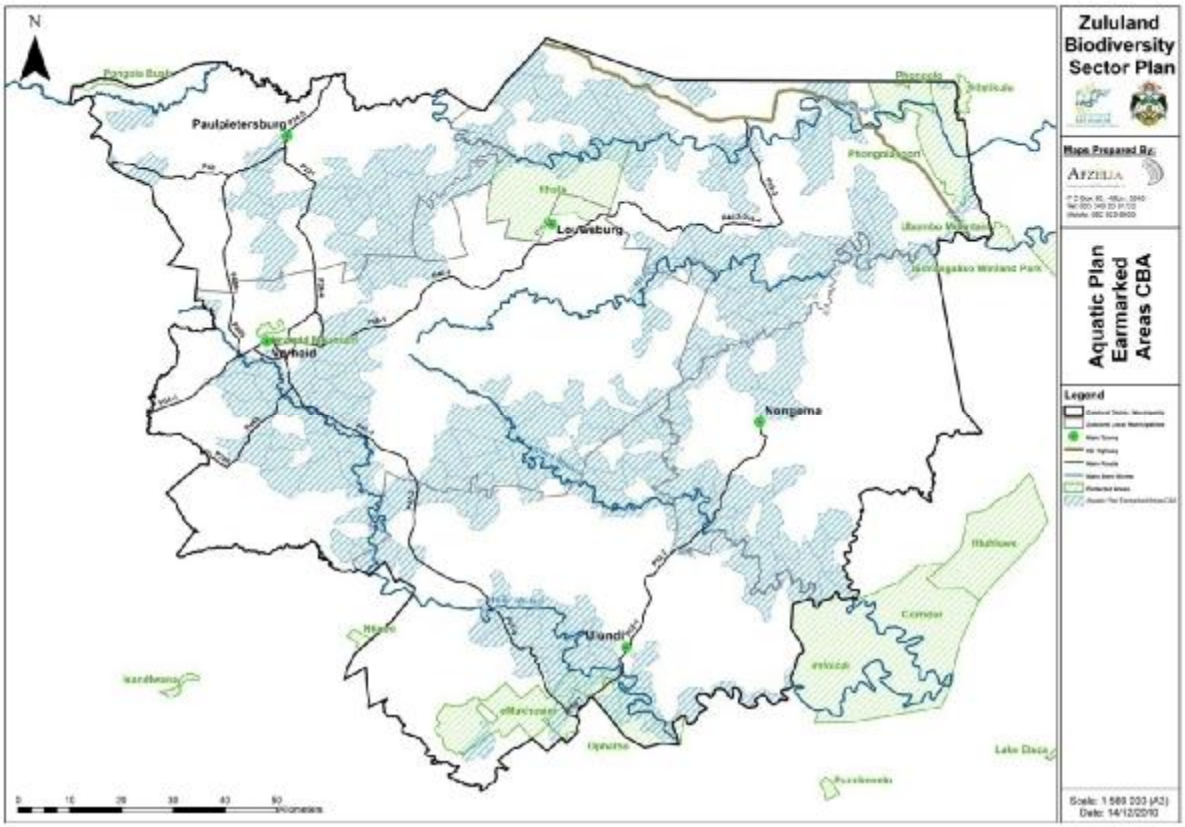

Figure: 13Aquatic Earmarked Catchments

7.3.3 Vegetation Types

SANBI have adopted the vegetation types described and mapped by Mucina and Rutherford (2006) as the basis for conservation planning of country's ecosystem types. These vegetation types supersede all previous efforts of national and provincial vegetation classification (e.g. Acocks 1953, Low & Rebelo 1996, and Camp 1999) and therefore have formed the basis of this exercise in conservation planning. However, EKZNW uphold additional vegetation types in the Province, and vegetation mapping and targets was therefore based on the EKZNW vegetation type set.

Target sources for vegetation types were obtained from EKZNW. Note that the percentage target applies to the historical extent of that vegetation type in the country, and that this percentage was applied to the District planning domain. Vegetation targets were increased where possible by ±5% for each vegetation type on the assumption that the extent of transformation is likely to have exceeded that revealed by the 2005 Landcover Data, possible errors in the 2005 Landcover Data, and potential edge effects. Table 3 lists the vegetation type targets.

Table 3: Biodiversity Targets for Vegetation Types

Vegetation Type	EKZNW vegetation conservation target	KwaZulu-Natal Conservation Status
Delagoa Lowveld	**19**	**Critically Endangered**
KaNgwane Montane Grassland	**24**	**Critically Endangered**
Lebombo Summit Sourveld	**24**	**Critically Endangered**
Midlands Mistbelt Grassland	**23**	**Critically Endangered**
Dry Ngongoni Veld (Ngongoni Veld)	25	Endangered
Paulpietersburg Moist Grassland	29.55	Endangered
Glencoe Moist Grassland (N KZN Moist Grassland)	24	Vulnerable
Granite Lowveld	19	Vulnerable
Income Sandy Grassland	23.56	Vulnerable
Northern KwaZulu-Natal Moist Grassland	24	Vulnerable
Northern Zululand Mistbelt Grassland	23	Vulnerable
Northern Zululand Sourveld	19	Vulnerable
Eastern Mistbelt Forest (Southern Mistbelt Forest)	66.5	Least threatened
Eastern Scarp Forest (Scarp Forest)	61.61	Least threatened
Ithala Quartzite Sourveld	27	Least threatened
KwaZulu-Natal Highland Thornveld	23.22	Least threatened
Makatini Clay Thicket	19	Least threatened
Pondoland Scarp Forest (Scarp Forest)	66.61	Least threatened
Southern Lebombo Bushveld	24	Least threatened
Swaziland Sour Bushveld	19	Least threatened
Tshokwane-Hlane Basalt Lowveld	19	Least threatened
Wakkerstroom Montane Grassland	26.56	Least threatened
Zululand Lowveld	19	Least threatened

The modelled distribution of vegetation types within the District is illustrated in Figure 8. The remaining intact natural vegetation in the District is illustrated in Figure 14 in 15. The former has adopted the precautionary principle, assuming degradation adjacent to existing settlements, whilst the latter illustrates only actual physical transformation; this illustrates the additional vegetation losses likely due to degradation associated with human activities.

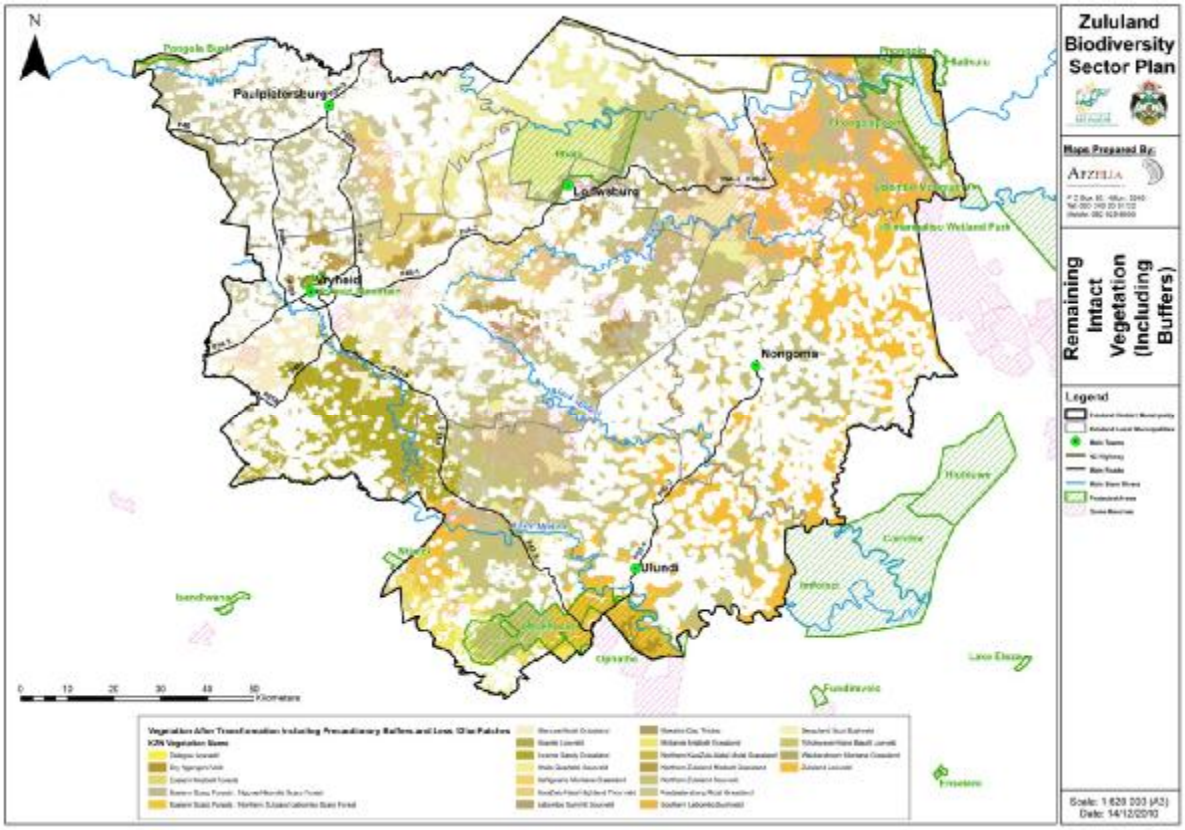

Figure: 14Remaining intact vegetation in the District, including precautionary buffers

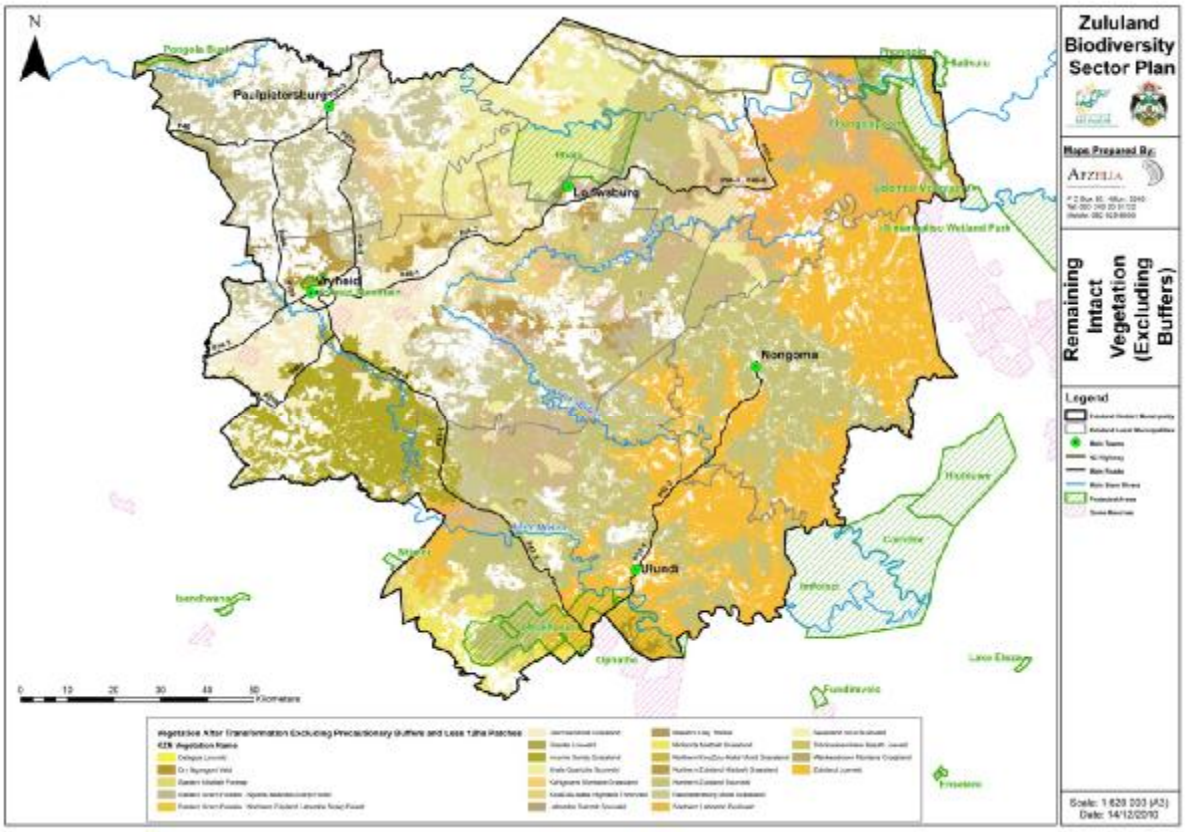

Figure: 15 Remaining intact vegetation in the District, excluding precautionary buffers

Included vegetation areas should be sufficiently large to allow for the occurrence of disturbance processes (e.g. fire), and the subsequent recovery of biodiversity features after a disturbance. Furthermore, larger areas will potentially be able to support larger populations with a greater chance of persistence in the long term. It was sought to select areas with the potential to maintain viable populations for a wide range of species with a wide range of area requirements. Small remnant areas smaller than 12 ha were therefore excluded unless in Protected Areas, recognising that the species whose area requirements would be met on these areas would be accommodated in any event. Small areas are more vulnerable to transformation and it is more difficult to manage biodiversity on them. Accordingly, the largest contiguous areas possible were selected, retaining connectivity between vegetation types where possible.

The latter rule did not apply to forests as small patches and habitat edges appear to be ecologically viable (Kotze and Lawes, 2007). The Biogeographical history and present physical diversity play a

major role in the evolution and persistence of the diversity of forest in KwaZulu-Natal. Forest areas that were not included within target areas were included in the vegetation maps due to the scarce and localised distribution of forests within the planning domain, and on account of their inferred protection through the National Forests Act.

A number of areas were identified as particularly sensitive by DCOs and other local experts, as illustrated in Figure 16. Wherever possible, the abovementioned areas were incorporated into the vegetation CBA.

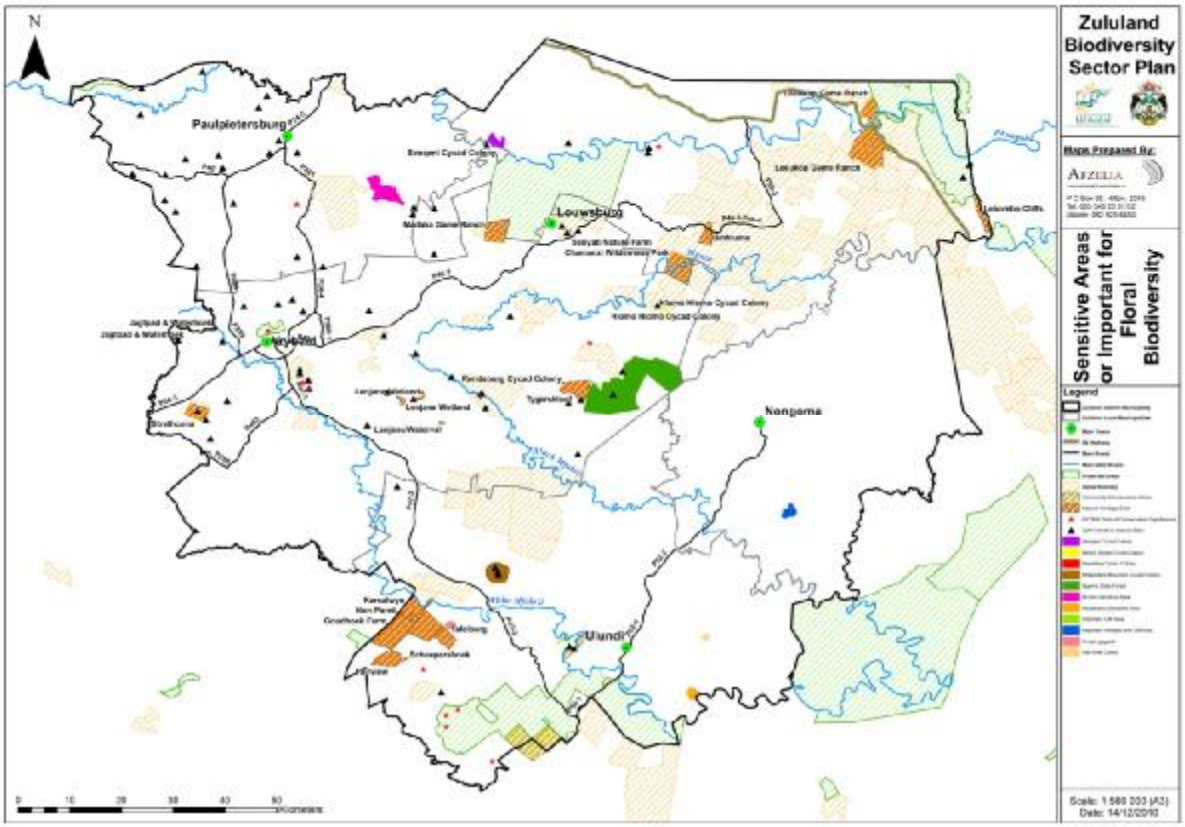

Figure: 16 Sensitive areas and important for floral biodiversity conservation

The outcomes of the mapping exercise were as follows:

a) Targets were achieved for all vegetation types with the exception of Delagoa Lowveld, KaNgwane Montane Grassland, and Lebombo Summit Sourveld. SPOT imagery revealed that much of the vegetation modelled as intact was in fact, degraded and unlikely to contribute significantly to conservation. The above vegetation types were also highly fragmented, with a significant area comprising parcels of land less than 12 hectares in extent.

b) In terms of Lebombo Summit Sourveld, it should be possible to cater for provincial conservation targets in adjacent municipalities, which contain meaningful areas of this vegetation type.

c) Delagoa Lowveld and KaNgwane Montane Grassland are highly endemic to the Zululand District Municipality, and therefore Provincial conservation targets must be met within this District, as is the case for Swaziland Sour Bushveld, Paulpietersburg Moist Grassland, Northern Zululand Sourveld, Northern Zululand Mistbelt Grassland, Ithala Quartzite Sourveld, and Granite Lowveld. The provincial target areas for each of the aforementioned vegetation types should be met within this District to ensure persistence; this would require rehabilitation of degraded and transformed areas.

d) The required targets for Dry Ngongoni Veld (Ngongoni Veld), Makatini Clay Thicket, Southern Lebombo Bushveld, Tshokwane-Hlane Basalt Lowvel, and Swaziland Sour Bushveld are almost entirely met within existing Protected Areas. Eastern Mistbelt Forest (Southern Mistbelt Forest), Ithala Quartzite Sourveld, Lebombo Summit Sourveld, and Midlands Mistbelt Grassland are partially represented within Protected Areas. The remaining vegetation types are insignificantly represented within Protected Areas.

e) The final configuration of vegetation areas was successful in ensuring connectivity among vegetation types, linking Protected Areas with large parcels of intact vegetation, and establishing north-south and east west corridors through the District. However, high transformation levels along the north-west boundary, central area and northern boundary of the District has significantly reduced connectivity in these areas and into the adjacent

District municipality and Swaziland. The two north-south corridors are however under significant transformation pressure.

f) Limited available areas for meeting conservation targets of some vegetation types meant that selecting areas without significant threat was not always possible. The most significant threat comprises expansion of rural settlements. Potential agricultural and forestry development was considered lower risk as the majority of high potential agricultural land has already been developed.

g) Importantly, it was possible to select vegetation target areas within the EKZNW identified corridors, and the corridors identified by this study. Target areas were also selected to incorporate red data plant species distributions where possible.

Vegetation statistics are provided in Appendix 5 and the best area for achieving vegetation type and plant species targets have been mapped in Figure 17. Figure 18 illustrates natural areas that were not required for meeting conservation targets ('Other Natural Areas').

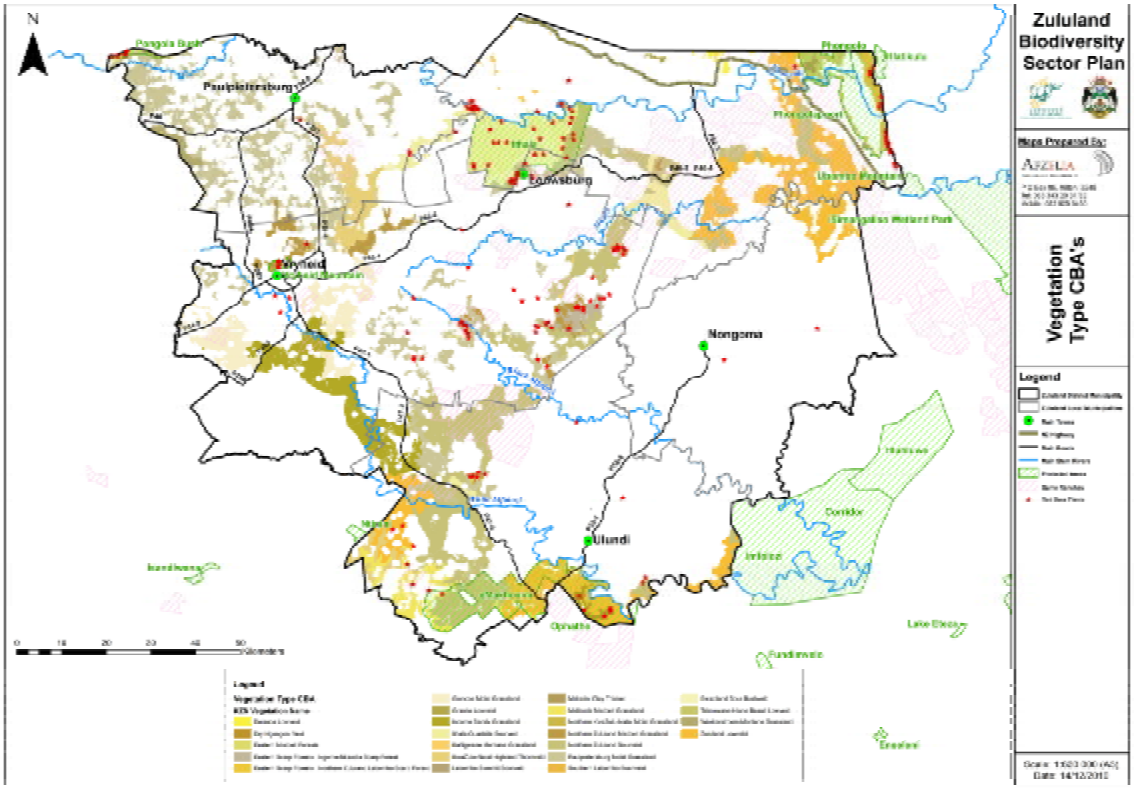

Figure: 17 Vegetation Critical Biodiversity Areas

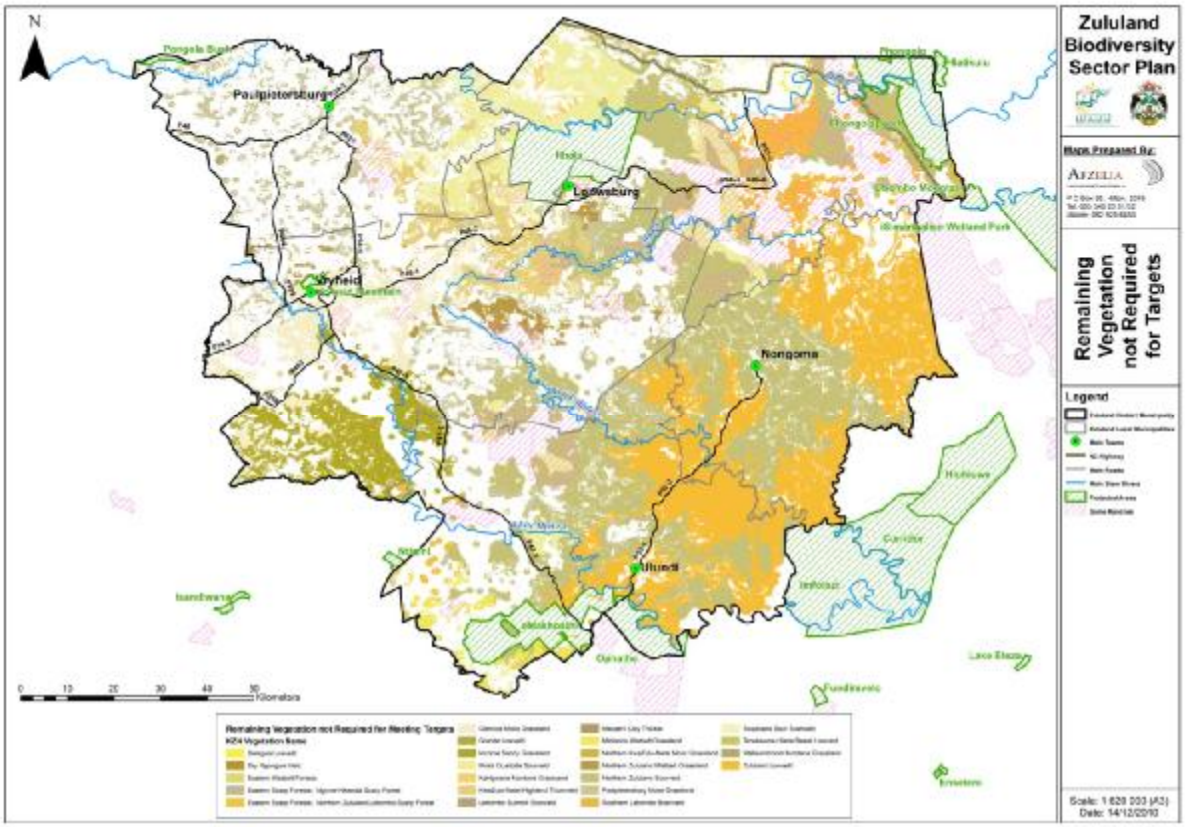

Figure 18 Remaining vegetation excluding precautionary buffers not required for meeting vegetation target.

7.3.4 Plant Species

On account of the strong influence of habitat and other environmental factors on the current distributions of priority plant species (e.g. distance from settlement; proximity to protected, and river corridors), including these environmental factors in the conservation assessment would adequately accommodate the priority plant species. Non-priority plant species were considered to be adequately conserved by CBAs and ESAs and were thus not explicitly considered in the conservation assessment because terrestrial and aquatic habitats act as surrogates for them. Priority plant species included 11 Endangered and 28 Vulnerable species.

The District includes specific areas of high biodiversity importance. Nhlazatshe Mountain is recognized as an important refuge for *Encephalartos natalensis* (cycad) as well as a host of other rare endemic plant species, incklusing *Eriosema zuluense* and *Selago longicalyx*. This mountain complex is biogeographically important in being part of the Midlands Centre of Plant Endemism, includes 4 vegetation types on account of biophysical and topographical diversity, and is a critical stepping stone for mountain top plant communities. The Van Rensberg Cycad Colony is another critically important unprotected area, which comprises the largest known *Encephalartos natalensis* (cycad) colony, and is registered as a National Heritage Site. The *Encephalartos natalensis* (cycad) colony in the eMakhosini-Ophathe Heritage Park is another critical conservation area for this species. The Madaka Game Reserve includes a secluded population of *Protea comptonii* which has an extremely restricted distribution outside Protected Areas in the District (known only from three populations outside Ithala Game Reserve, and it is registered as a National Heritage Site. The District includes *Encephalartos aemulans,* also situated on private land in the Dhlomo dhlomo area. *Aloe vryheidensis* and *Cyrtanthus brachysiphon* colonies are situated on the Sanyati Nature Farm, the former comprising the only known population of this particularly rare aloe in KZN, and the latter representing an isolated population in northern KZN; this site has also registered as a National Heritage Site. The Bivane Dam is another area critical for plant species conservation. The above areas are all outside of Protected Areas yet are critical
for biodiversity conservation; these areas have therefore been included as potential Stewardship and Protected Areas Expansion Sites.

A 100 % target of all known locations was set for priority plant species in order to secure their persistence. Ecologists and organisations with significant local knowledge were requested to identify

important locations for these species. For the others, all areas containing a known location of at least one priority species were selected.

In cases where a priority plant species location did not fall within an area designated for meeting vegetation type targets, a buffer of 500m was seen as appropriate for ensuring the persistence of this species, acknowledging that sampling in that area may be inadequate and it is likely that other specimens of this species are found in that locality. It was possible to incorporate the locations of all known locations of most of the priority species into the vegetation type CBAs. Appendix 2 lists all priority species; CBAs are illustrated in Figure 19 below.

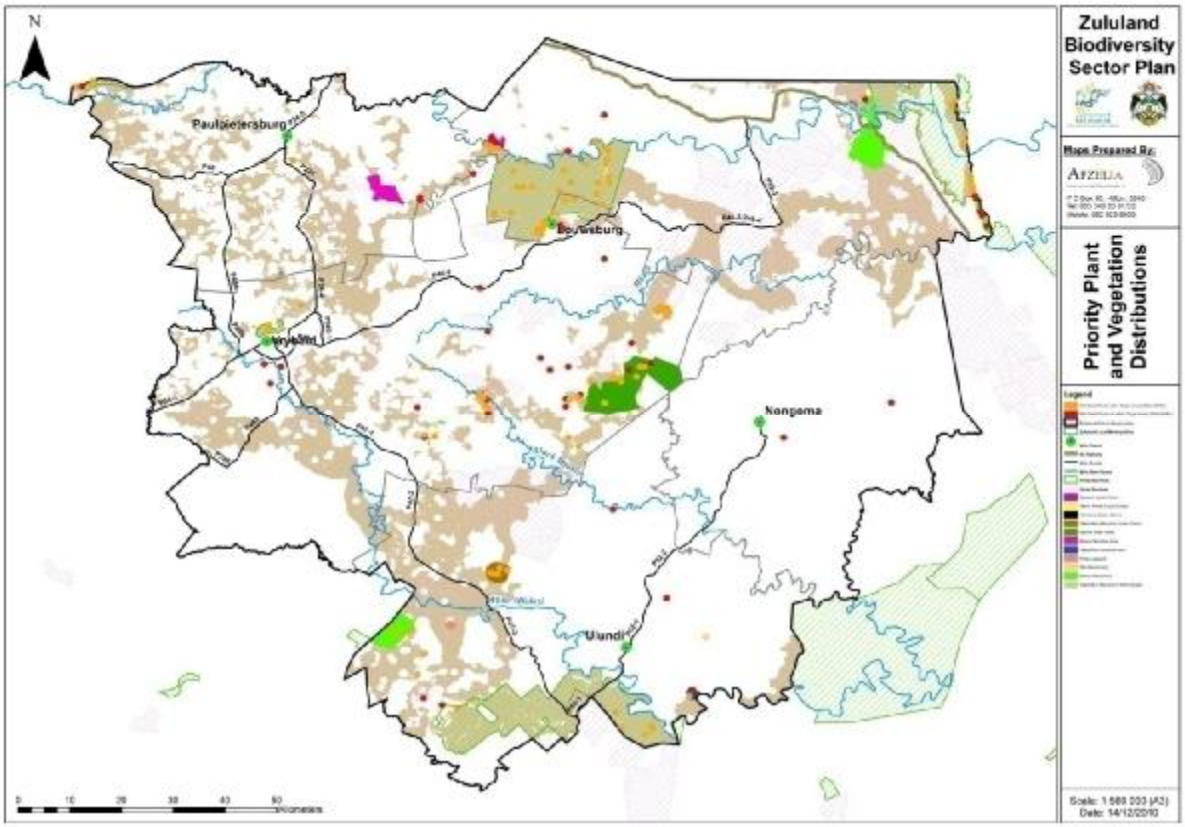

Figure: 19Priority plant and vegetation species distributions

7.3.5 Fauna

Habitat and other environmental factors (e.g. distance from settlement; proximity to protected areas, river corridors) may strongly influence current distributions of animal species. Inclusion of these factors was therefore deemed to integrate adequately animal species in the assessment. A persistence target of 100% was set for all priority species, whose localities were mapped where accurate information was available.

For a set of priority species (Appendix 3), all known recent locations, or nesting or roosting sites of birds with large ranges (e.g. vultures), were included. Important bird species were identified from Barnes (2000), local input and EKZNW databases. Any such location was deemed to be a CBA.

Non-priority species were considered to be catered for within CBAs and ESAs. These species were therefore not explicitly considered in the conservation assessment, as terrestrial or aquatic habitats act as adequate surrogates for these species. Critical Biodiversity Areas are illustrated in Figure 20 below.

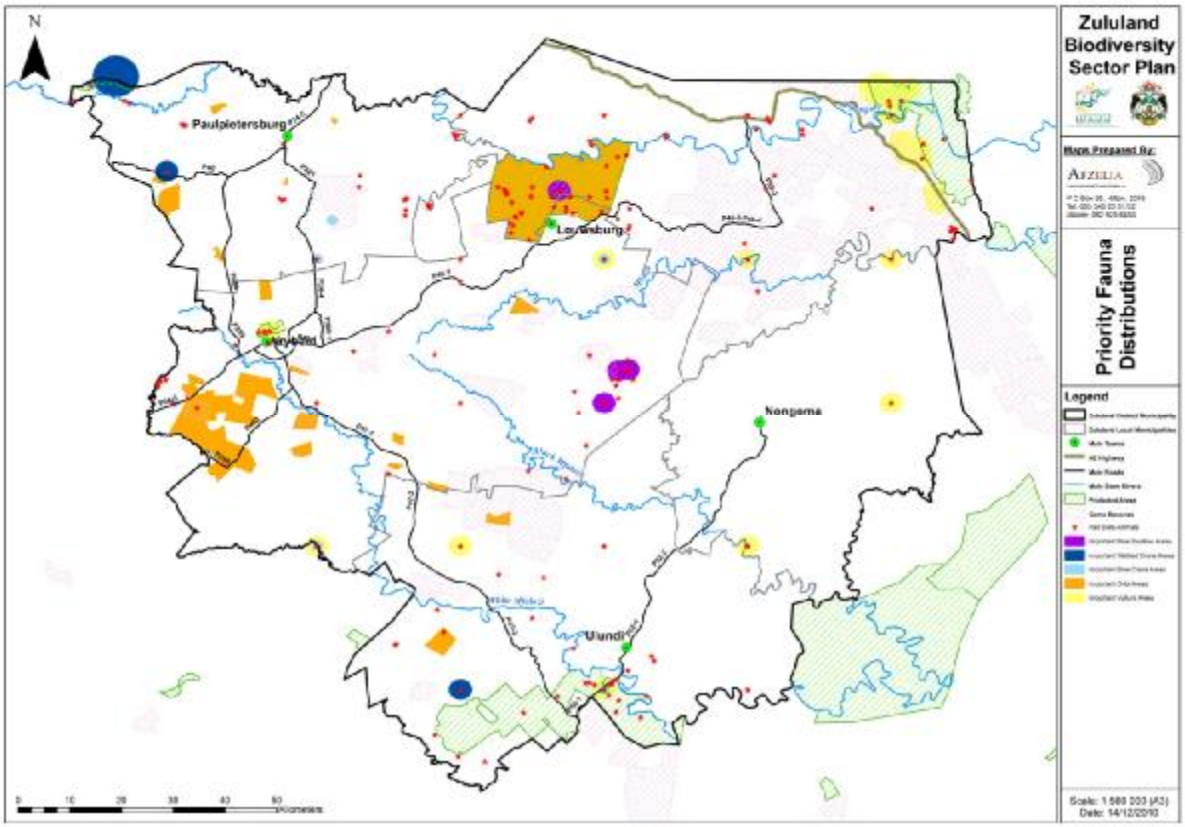

Figure: 20Priority fauna distributions

7.3.6 Wetland Types

It is preferable for areas selected for the conservation of freshwater biodiversity features to be of high ecological integrity as they will most accurately represent the biodiversity of a region. Preference was therefore given to areas which presented a realistic opportunity for the persistence of natural hydrological regimes. Selecting areas of high ecological integrity also provides a more pragmatic solution, as selected areas would be closer to natural conditions, thus requiring less management intervention (for example rehabilitation).

Wetland mapping was carried out using the Ezemvelo KZN Wildlife wetland dataset (from which dams were removed). Wetland types included in the study comprised Highland, Midland, Lowland types, and Coastal Lowland-Sedge Wetland, as defined by EKZNW criteria. Whilst not mapped in the planning domain, every effort should be made to conserve high altitude bogs, due to the critical water supply and discharge function of these bogs, as well as their role as filters in the maintenance of water quality. These areas are not adequately protected in the District by Protected Areas; there is a paucity of protected areas and private and communal game reserves within the high-lying areas of the District. Whilst these areas are relatively inaccessible and therefore less likely to be impacted, of concern is afforestation in these areas.

The study adopted the 20% national standard for wetland conservation, and included a 100m buffer on all wetlands to ensure persistence of important wetland biodiversity features. Entire wetland units were selected for achieving the target i.e. fragments of wetland units were not selected as they comprise functional units and must stay intact for ecological functioning. The areas selected for achieving the 20% target for each wetland type were identified as follows:

- Intact wetlands were identified by subtracting the EKZNW transformation layer (excluding buffers to rural dwellings) from the wetland areas.
- Wetlands were selected in order of preference as below:
    - All wetlands contained within and intersecting with Wattled Crane nest site buffer areas
    - All wetlands contained within and intersecting with Protected Areas
    - Wetlands contained entirely within the vegetation type CBA
    - Wetlands not contained entirely within, but intersecting a vegetation

CBA, selecting the largest wetlands

o Provided the above conditions were met, where a choice could be made between selecting wetlands within aquatic earmarked areas or outside of aquatic earmarked areas, the former was chosen

The above process secured wetlands within areas of least transformation. The majority of wetland type targets were achieved within private lands as opposed to Protected Areas and Private and Community Game Reserve, and are situated primarily within the vegetation type CBA, the vegetation corridors, and Wattled Crane nest site buffer areas.

The major catchment rivers within the District and distribution of wetlands are illustrated in Figure 21. The distribution of wetlands largely reflects the climatic and topographical variation in the District.

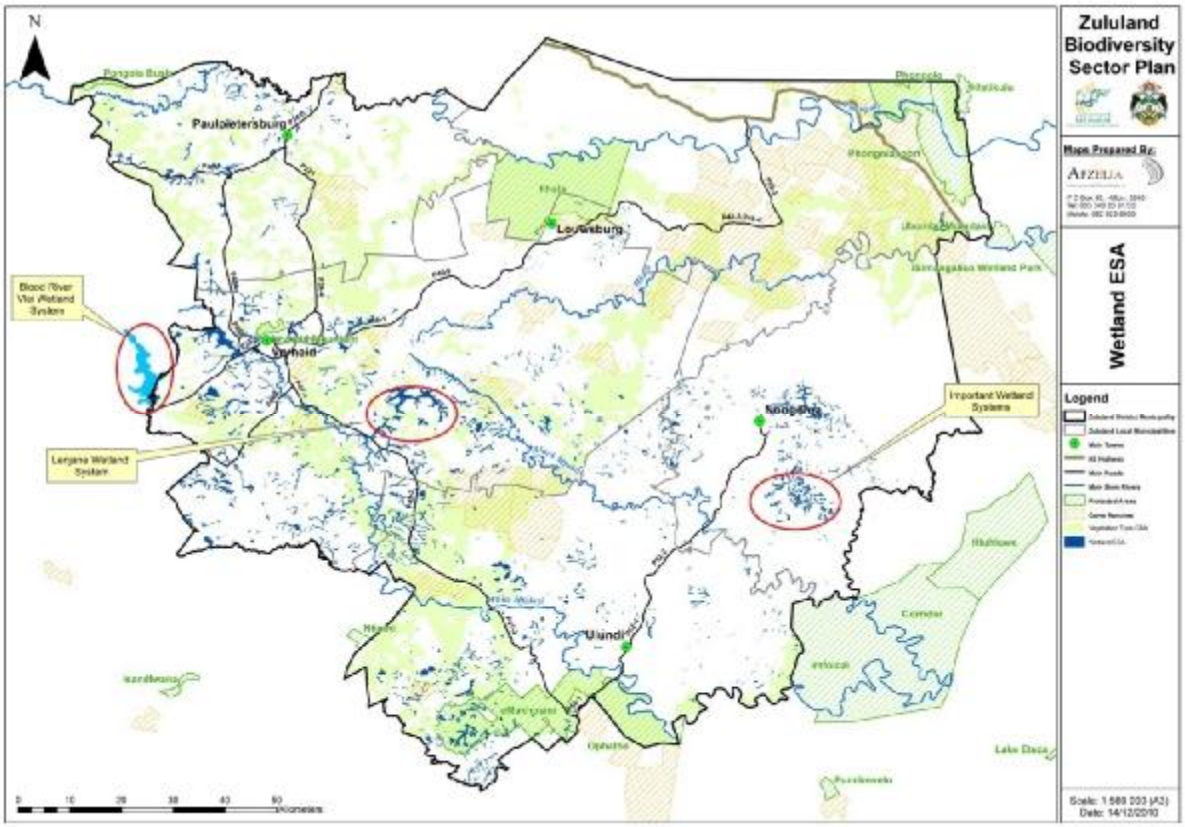

Figure: 21Wetlands Ecological Support Area

7.3.8 Protected Area

A Protected Area is defined as:
- any area declared or proclaimed as such in terms of section 3 or listed in the Second Schedule to the KwaZulu-Natal Nature Conservation Management Act No. 9 of 1997; or
- any of the protected areas referred to in section 9 of the National Environmental Management: Protected Areas Act No. 57 of 2003.

Existing Protected Areas formed a core for achieving biodiversity targets through selecting adjacent areas as part of vegetation CBAs and establishing linkages. This served to buffer protected areas and to increase their spatial scale of ecological functioning.

This would serve to increase the likelihood of conserving key species and habitats within reserves at the level at which they occurred when the KZN Systematic Conservation plan was developed.

Formal Protected Areas are listed in Table 4. The area selection process highlighted that the spatial distribution of Protected Areas in the District was not adequately aligned across biophysical gradients, and was distorted in favour of lowland areas (as illustrated in Figure 22). Phongola Bush Nature Reserve and Vryheid Mountain Nature Reserve, albeit relatively small, do contribute towards higher altitude Protected Areas. Fortunately, lower lying Protected Areas are nested within largely natural areas, which have the potential to be linked to each other and higher altitude areas towards the centre and western boundary of the District, offering opportunities for Protected Areas Expansion along altitudinal gradients. This is relevant for accommodating altitudinal movement of species in response to climate change.

Table: 4Protected Areas in the District Municipality

Name	Management Authority	Proclaimed Name	Proclamation Year	Total Area (Ha)	Area of PA within ZDM (Ha)	Proclaimed
Ithala	EKZNW	Ithala Game Reserve	1973	29653.00	29356.91	Yes
Phongolo	EKZNW	Phongolo Game Reserve	1894	10485.00	5333.55	yes
Phongolapoort	EKZNW	Phongolapoort Nature Reserve	1979	11917.00	15085.24	15085.24
eMakhosini	EKZNW & AMAFA	eMakhosini Heritage Park	2006	18919.00	20913.12	partial
Ophathe	EKZNW & AMAFA	Ophathe Game Reserve	1991	8825.00	8056.31	yes
Pongola Bush	EKZNW	Pongola Bush Nature Reserve	1973	858.00	882.42	yes

Vryheid Mountain	EKZNW	Vryheid Mountain Nature Reserve	1984	720.00	750.58	Yes
Zululand Rhino Reserve						yes

To achieve the 8 % National goal of formal protection for terrestrial areas under protection by 2010 and 12% by 2015, SANBI and DEAT have requested that EKZNW compile a list, in accordance with obligations to international agreements, that indicates the most important land holdings that would be required for conservation management (Wakelin & Porter, 2007, unpublished). The District does not comply with the 2010 target (including only 1.75% Protected Areas currently). The vegetation CBA has, where possible, made provision for the most important land holdings identified by EKZNW for the Protected Area Expansion programme.

The existing Protected Area Network was included in the base layer for the District. Landowner Associations, such as conservancies, were not included on the maps. Private Game Reserves and Private Nature Reserves were mapped as second order conservation areas; the latter designation was assigned as land under private ownership is generally subject to commercial land use which in most circumstances does not translate into conservation objectives and goals. It is however recognised that these areas represent opportunities for stewardship and protected area expansion initiatives.

The critical linkage between Ithala Game Reserve and the Phongolapoort Nature Reserve must be established; this linkage has been strengthened by the recently proclaimed Zululand Rhino Reserve. Extension of the aMakhosini-Ophathe Heritage Park southwards, eastwards and westwards must be taken into account in biodiversity planning in the adjacent Districts. The Lake Jozini Transfrontier Park is also a critical Protected Area initiative in the region, which has been taken into account in this study.

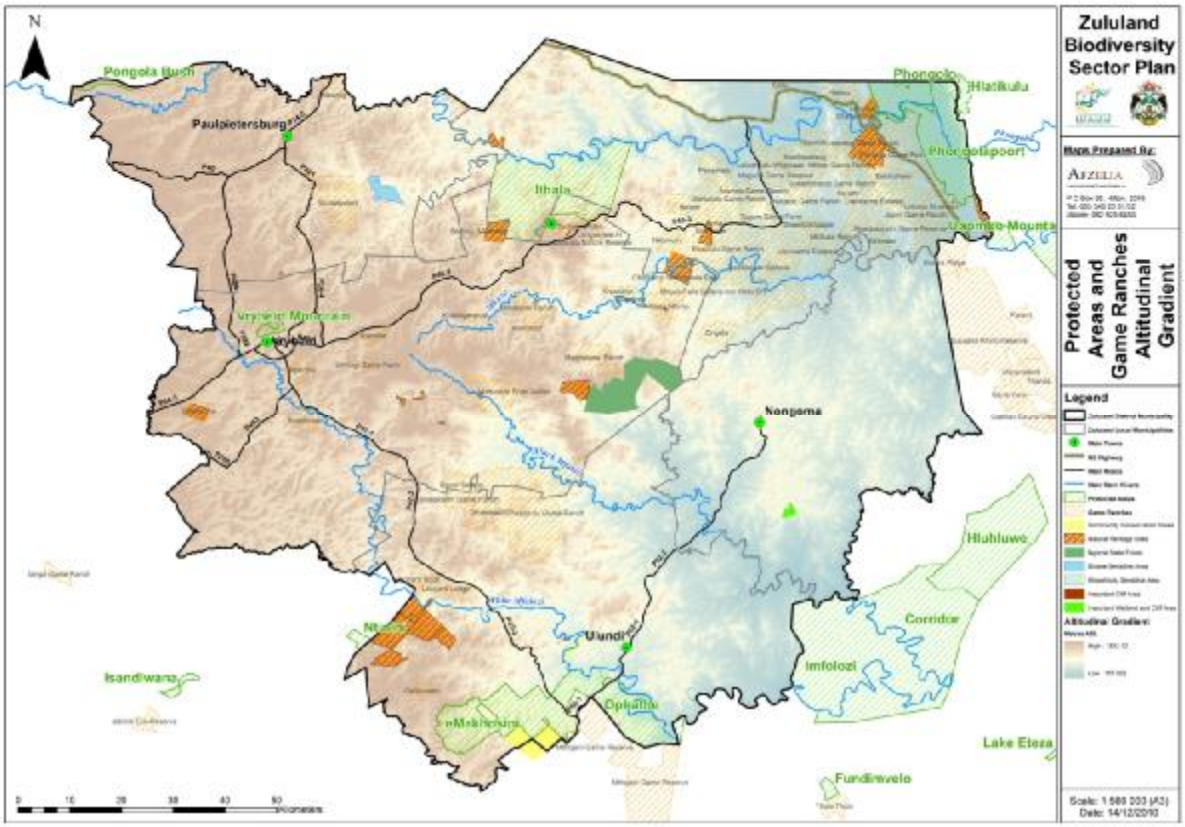

Figure: 22Protected Areas and game ranches altitudinal gradient

7.4 Ecological Support Areas

7.4.1 Background

Although this is not an exhaustive list, the following services are examples of those which may be delivered by terrestrial ecosystems:

- Buffers against natural hazards such as fire and floods;
- Regulation of water supply;
- Forage for grazing livestock and wild animals;
- Provision of food, fibre, medicinal and cosmetic plants;
- Provision of cleaner air;
- Improved resilience against climate change by storage (above- and below-ground) of excess carbon released as carbon dioxide through burning fossil fuels;
- Support of the horticultural and wildflower industries;
- Provision of natural spaces for recreation and tourism; and
- Contribution to natural and cultural heritage

Human welfare and economic development is also heavily reliant on our natural aquatic ecosystems. These water systems and their adjoining buffer of natural vegetation, deliver a number of services associated with improved water quality and ensuring supplies. They serve to:

- Improve water quality through filtering and purifying water, trapping sediment, controlling erosion (thereby minimising excessive sedimentation) and recharging aquifers;
- Increase water quantity through storing flood waters and supporting stream base flow during the dry season;
- Provide a wildlife habitat for amphibians, birds, fish and mammals for all or portions of their life cycles;
- Provide water for agricultural, industrial and domestic use;
- Attenuate and regulate floods;
- Provide food and medicinal plants;
- Transport and / or purify biodegradable wastes;
- Support tourism, recreational and cultural use; and

- Enhance property values

7.4.2 Ecological Corridors

The maintenance of connectivity is essential to a number of movement-related ecological processes, including species migrations, seasonal and altitudinal dispersal, and range displacement in response to climate change. Ecological connectivity and porosity is critical in ensuring ecosystem integrity and sustained delivery of ecosystem processes and services.

The District has identified a number of environmental linkages throughout the regions, mainly related to the river systems, the Paris dam, Ithala Game Reserve, Pongolapoort Biosphere Reserve as well as the eMakhosini-Ophathe Heritage Park - Hluhluwe-Umfolozi Park cross border linkage (Zululand District Municipality 2008) to the north east and the north west linkage with Gelijkwater Grassland Nature Reserve and Ntinini Nature Reserve. This information was included in the more detailed corridor assessment undertaken in this project.

The ecological corridor ESA does not relate to specific biodiversity targets, but rather regional connectivity to ensure persistence of ecosystem processes. A number of ecological principles formed the basis of the area selection process, as follows:

a) Corridors located along major climatic and upland-lowland gradients, including east–west and north-south corridors, were selected in order to cater for potential impacts of climate change on the biota of the region.
b) The principle of connectivity within and between vegetation types was a key principle in the selection of vegetation CBAs. The vegetation CBAs therefore formed the basis of the ecological corridor ESA for the District.
c) Large areas were selected in preference to small areas on account of the impact of fragmentation.
d) Vegetation corridors were demarcated to align with corridors identified by the NSBA, adjacent municipalities, the Lake Jozini Transfrontier Park Programme with Swaziland, Wild Dog Corridors, and EKZNW identified corridors.

The municipality regionally still has a high degree of corridor integrity in the north-south and east-west axes, considering vegetation units. East-west linkages are substantial along the northern and southern boundaries of the District, but are incomplete and fragmented in the centre of the District. North-south corridors are found between Vryheid and Louwsburg, diagonally across the centre of the District (south-west to north-east), and along the eastern boundary of the District, primarily through Traditional Council lands. Ridge line corridors are reasonably intact (most probably as a result of inaccessibility). Lower level corridors within the District cater for local ecological processes, although some key linkages have been fragmented significantly. Three corridors have been identified through Nongoma, linking Hluhluwe-iMfolozi Park and other important conservation areas in the adjacent District to critically important areas in the Zululand District Municipality.

The corridors have also been aligned to cater for Wild Dog migrations, critically important species, and critical linkages into areas adjacent to the District.

7.4.3 River Corridors

The majority of rivers in the District are still intact, but are classified as vulnerable (NSBA, 2004). Importantly, the Phongola River, White Imfolozi, Black Imfolozi, and Mkuze Rivers have been nationally designated as important rivers for representation of biodiversity, and are critical for sustaining water resources within provincially and nationally important ecotourism destinations. The stem rivers are also important movement corridors, with the Mkuze River and Phongola River providing essential corridors through the Lebombo Mountains. Maintaining the remaining natural systems along the main stem rivers was therefore considered critical for ensuring continued delivery of ecosystem services and connectivity required for biodiversity persistence. River corridors comprised all stem rivers and all quinery[3] catchments intersected by these rivers, including stem rivers adjoined by heavily transformed areas.

Riparian corridors have been fragmented in lower lying gently sloping areas on account of agricultural practices and rural and urban settlement along rivers.

[3] Water catchments are classified as follows, from largest to smallest: Primary, Secondary, Tertiary, Quaternary, and Quinery catchments, each are nested within the previous category

7.4.4 Wetlands

All wetlands are essential for maintaining hydrological services, including flow regulation, water purification and preventing sedimentation. Accordingly, a persistence target of 100% of all wetlands was adopted, including a 30m buffer on each wetland to ensure sustained wetland functioning. The 100 % wetland target is based on wetland functioning to ensure the delivery of ecosystem services goods and services, rather than biodiversity targets.

The majority of wetlands within the District are nested within supporting CBAs and ESAs.

7.4.5 Ridgeline Corridors

Corridors were demarcated to include the main climatic, upland-lowland, and altitudinal gradients, which should contribute to ameliorating the potential impacts of climate change on the biota of the region. The spatial extent of these ridgeline corridors was determined by the level of transformation within adjacent areas. Significant east-west ridgeline corridors were identified, extending across the range of altitudinal gradients in the District.

7.4.6 Important Water Yield Areas

A number of water catchments in the District fall into the top ten percent of the tertiary and quaternary catchments in South Africa in terms of Mean Annual Runoff, which jointly yield 50% of the country's water. Fortunately the main water catchments in the District are still classified as Intact; although the main stem rivers are considered Vulnerable (less than 60% of the rivers' length is still intact). Special mention is made of the northern boundary of the District, where water supply still exceeds water demand (DWAF, 2004); the majority of KwaZulu-Natal is in a situation where demand exceeds supply.

A surface of especially important catchments for water yield was provided by EKZNW and incorporated into the BSP. The high water yield areas are primarily located in the central and north-western areas of the municipality.

7.4.7 Ecosystem Services to Rural Communities

The District includes substantial communal areas which are reliant on the natural resource base for grazing, wood for building materials and fire, medicinal plants, drinking water, and food. The services provided by these ecosystems are therefore critical to the maintenance of biodiversity as well as sustainable rural livelihoods.

The remaining natural asset within communal areas in the District have therefore been classified as a ESA (Figure 23), due to the essential ecosystem services that they deliver.

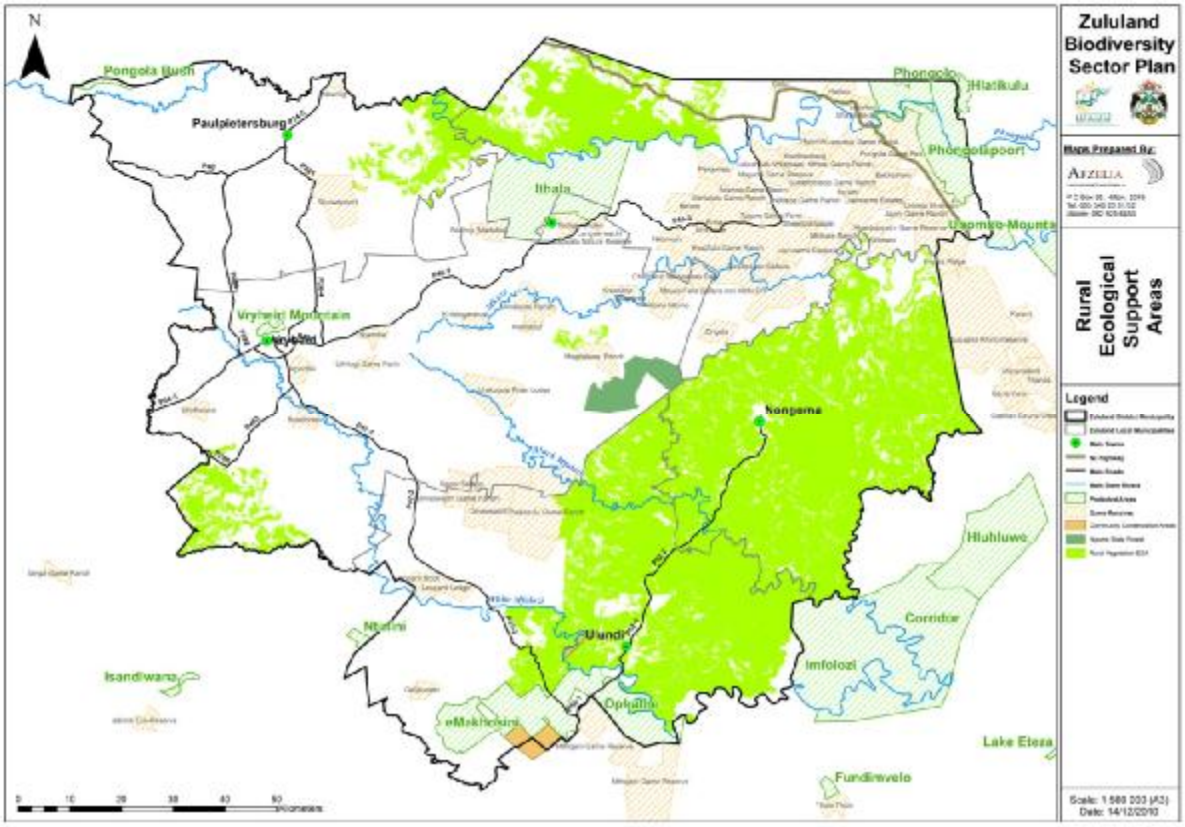

Figure: 23Critical Ecosystem Support Areas in the District, relevant to rural communities

7.4.8 Mapping Outputs

The Terrestrial and Aquatic Ecological Support Areas have been illustrated in Figures 24 and 25, respectively.

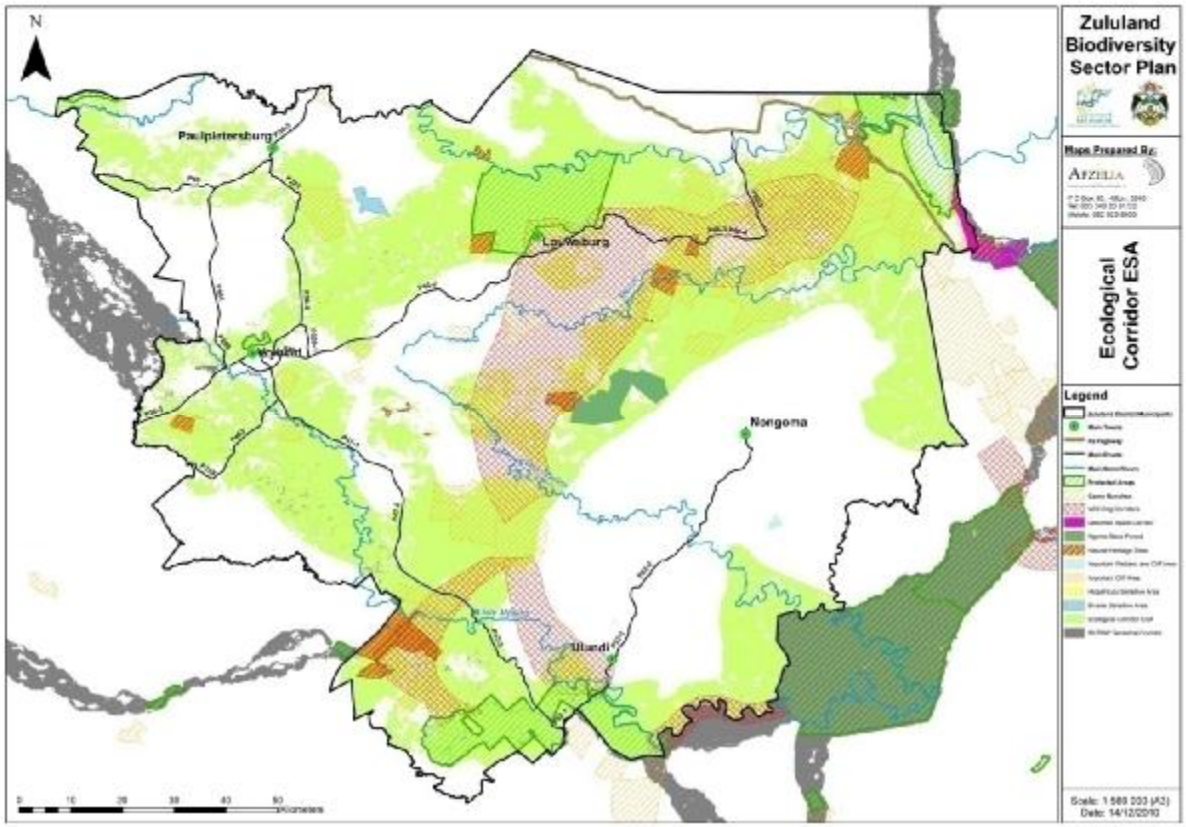

Figure: 24Potential Biological Corridors Linkages in the District

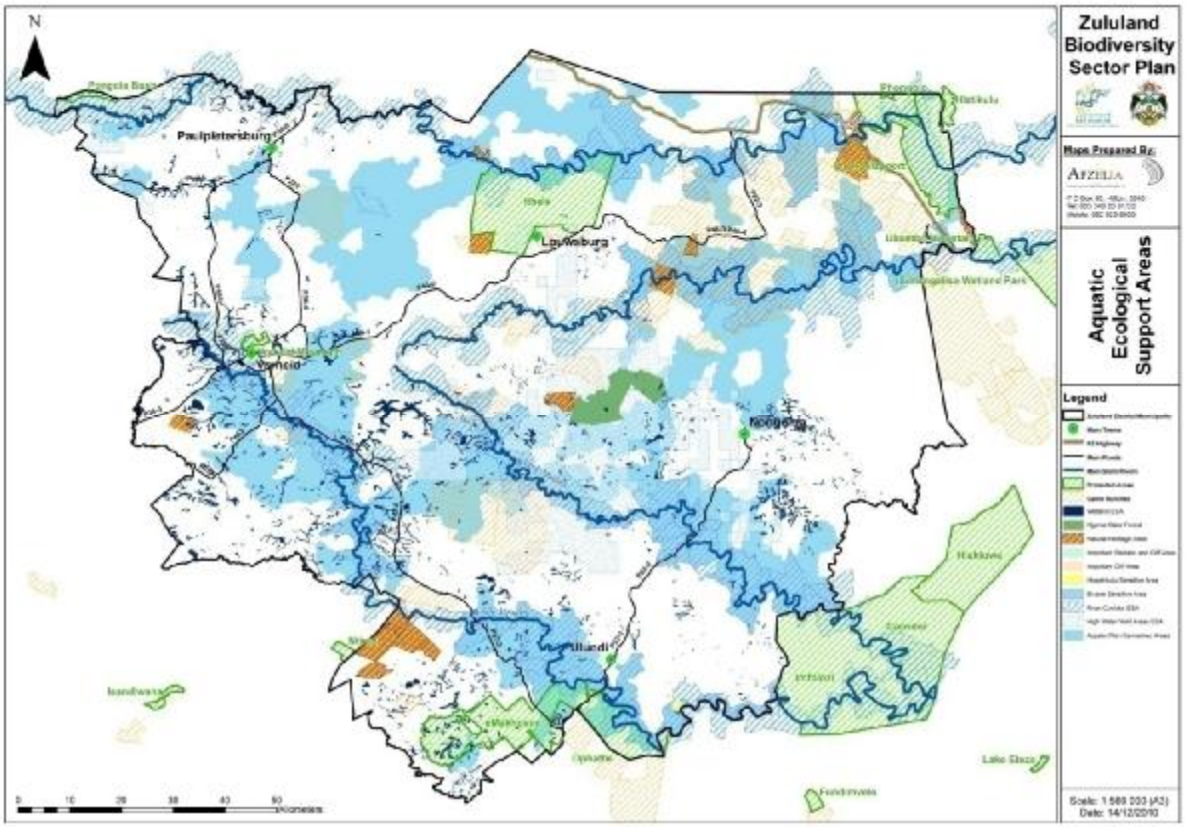

Figure: 25Aquatic Ecological Support Areas

8. Land Use Guidelines

Compatible and incompatible land uses and specific management recommendations have been provided for CBAs and ESAs to safeguard critically important natural asset identified in the BSP. This section provides guidelines for land-use planning and decision-making, and for land and resource use management. The aim of these guidelines is the effective management of biodiversity as required in Section 41(a) of the Biodiversity Act (Act Nr. 10 of 2004) and in terms of the National Environment Management Act (107 of 1998).

All the guidelines are informed by the 'Desired Management Objective' for the different categories included in the CBA Maps, as well as the relative impact of a land-use activity on biodiversity. The Desired Management Objective refers to both biodiversity pattern and / or ecological process. In formal Protected and Critical Biodiversity Areas, it is important to maintain both biodiversity pattern and ecological processes, while in Ecological Support Areas the emphasis is on safeguarding ecological processes. The following land management objectives are relevant:

- Natural - ecosystems and species largely intact and undisturbed
- Near Natural - ecosystems and species largely intact and undisturbed
- Functional - ecosystems moderately disturbed but still able to maintain basic functionality; individual species may be severely disturbed; these comprise areas that are important for the maintenance of ecosystem services and ecological functioning, regardless of the level of disturbance and degradation

The Biodiversity Sector Plan, comprising the CBA maps and guidelines, provides a summary of the best available biodiversity information for use in the decision-making process. The information should be used in conjunction with the municipality's Spatial Development Framework (SDF) and zoning scheme, as well as other non-spatial biodiversity information.

Municipalities in particular have a specific role to play in ensuring that appropriate environmental authorisations are in place and that correct procedures are followed before any change in land-use is approved. A wide range of authorities can benefit from consulting the BSP, *inter alia:*

- Local municipalities

- National and provincial environmental and planning departments
- National and provincial agricultural departments
- Department of Minerals and Energy to inform mining applications
- Department of Water and Environmental Affairs when processing water use licenses.

If a proposed land use change cannot avoid impacting on a CBA, the CBA aps serve as an early warning signal that a biodiversity assessment needs to be undertaken prior to any decision about the proposed change in land-use. In general, though, planning should aim to steer development away from CBAs and into areas that are more resilient to environmental degradation. However, if consultation of the CBA maps indicates that a proposed activity (i.e. not only activities controlled by the EIA regulations) is located within a Critical Biodiversity Area or Ecological Support Area, then further investigation is essential before any decision can be made regarding land-use change. The CBA Map should be used to indicate potential constraints to development on a site and serve as an early warning signal that in-depth biodiversity assessment might be required.

Given that CBA maps were based on best available data, and that it was not possible to survey all land within the municipalities at a fine enough scale, it is possible that the presence of important biodiversity features (e.g. Species of Special Concern) have not been fed into the maps. For this reason, specialist assessments should also be carried out in the Other Natural Areas that are known to harbour important biodiversity asset.

It is important to note that while the map can assist with a desk-top preparatory assessment of the site at a local and strategic level, it should not, under any circumstances, replace a site assessment by a relevant biodiversity specialist.

The following guidelines are proposed measures for the effective management of biodiversity and the components of biodiversity in the region, as required in Section 41(a) of the Biodiversity Act.

Table 5: Framework for Land-Use Planning and Decision-Making Guidelines

Map Category	**Land management objective**	**Appropriate / compatible land uses and activities**	**Inappropriate / incompatible land uses and activities**	**Restricted - Land use possible under strict controls only in order to avoid impacts on biodiversity**
Critical Biodiversity Area Protected Areas	Natural	Dictated by EKZNW integrated management plan	Dictated by EKZNW integrated management plan	Dictated by EKZNW integrated management plan
Critical Biodiversity Area EKZNW Aquatic Earmarked Catchments EKZNW Irreplaceable Terrestrial Planning Units Vegetation types Floral and faunal priority species Wetland types	Natural	• Conservation Protected Areas e.g. Proclaimed Private or Community Nature / Game Reserves • Non-proclaimed Private or Community Nature / Game Reserves / Game Farms • Low intensity sustainable[5] nature based activities e.g. camping, horse riding, heritage trails, wilderness trails, hiking, environmental education, birdwatching, botany trails, swimming, orienteering, fishing, climbing, abseiling, sports	• Urban or industrial development • Intensive / large scale tourism and commercial development • Agri-industry • Subdivision of land[6] • Mining and quarries • Afforestation • New agricultural cropping • Expansion of existing settlements • Impoundments and large scale water abstraction schemes • Self-guided 4x4 trails, new roads • Introduction of alien fauna • Introduction of alien flora • Aerial application of	• Infrastructural development e.g. public roads, powerlines, water pipelines etc • Guided / self-guided 4x4 trails (well managed, on existing roads) • Small scale holiday or rural residential accommodation in support of eco-tourism and natural resources e.g. small lodges, campsite, caravan park etc • Rural business / rural industry • Community facilities and institutions

[5] In relation to the use of a biological resource, means the use of such resource in a way and at a rate that would not lead to its long-term decline; would not disrupt the ecological integrity of the ecosystem in which it occurs; and would ensure its continued use to meet the needs and aspirations of present and future generations of people (as per National Environmental Management: Biodiversity Act, No. 10 of 2004).

[6] This relates to the fragmentation of the landscape through subdivision of large farms into smaller less economically viable farms, which results in greater pressure on the remaining natural resources of smaller farming entities. This also relates to indirect impacts such as increased infrastructural development, increased demand for services, fencing, more roads, etc.

Map Category	Land management objective	Appropriate / compatible land uses and activities	Inappropriate / incompatible land uses and activities	Restricted - Land use possible under strict controls only in order to avoid impacts on biodiversity
		Abseiling, sports climbing, mountaineering, mountain biking, etc • Agricultural cropping enterprises on existing cultivated lands • Public / private conservation initiatives • Trails • Permitted hunting • Sustainable extensive commercial and communal livestock production	pesticides • Ribbon development • Cultivation of virgin land • Irrigated Crop Cultivation • Expansion of existing settlements • Any land use or activity significantly impacting on ecological process and impacting on biodiversity attributes identified in CBAs • Aircraft landing facilities • Recreational motor bikes	
Ecological Support Area Ecological Corridors Community Ecosystem Services Important Water Yield Areas Ridgeline Corridors Wetlands River Corridors	Functional, ideally Near natural	• Conservation • Protected Areas e.g. Proclaimed Private or Community Nature / Game Reserves • Non-proclaimed Private or Community Nature / Game Reserves / Game Farms • Low intensity sustainable nature-based activities e.g. camping, horse riding, heritage trails, wilderness trails, hiking, environmental education, birdwatching, botany trails, swimming, orienteering, fishing, climbing,	• Urban or industrial development • Intensive / large scale tourism and commercial development • Subdivision of land • Mining and quarries • Afforestation • New agricultural cropping • Irrigated Crop Cultivation • Expansion of existing settlements • Impoundments and large scale water abstraction schemes • Introduction of alien fauna • Introduction of alien flora • Aerial application of	• Infrastructural development e.g. public roads, powerlines, water pipelines etc • Low intensity commercial and tourism development • Small scale holiday or rural residential accommodation in support of eco-tourism and natural resources e.g. small lodges, campsite, caravan park etc • Self-guided 4x4 trails (well managed, on existing roads) • Self-guided 4x4 trails, new roads

Map Category	Land management objective	Appropriate / compatible land uses and activities	Inappropriate / incompatible land uses and activities	Restricted - Land use possible under strict controls only in order to avoid impacts on biodiversity
		abseiling, sports climbing, mountaineering, mountain biking, etc • Agricultural cropping enterprises on existing cultivated lands • Public / private conservation initiatives • Trails • Permitted hunting • Sustainable extensive commercial and communal livestock production	pesticides • Ribbon development • Cultivation of virgin land • Expansion of existing settlements • Any land use or activity significantly impacting on ecological process and impacting on biodiversity attributes identified in ESAs	• Agri-industry • Aircraft landing facilities • Recreational motor bikes • Rural business / rural industry • Community facilities and institutions

Table: 6Framework for Environmental Management within Critical Areas

Critical Biodiversity Areas and Ecological Support Areas	Key objectives	Key management measures
All CBAs and ESAs Including Irreplaceable Areas, Aquatic Earmarked Areas, and Protected Areas	Conserve relevant biodiversity attributes; prevent ecological degradation, further loss of natural asset, alterations in hydrological regimes, and water pollution	• Alien plant eradication (incl. private and Working for Water) • Wetland rehabilitation (incl. private and Working for Wetlands) • Appropriate burning regimes (incl. private and Working for Fire) • Appropriate livestock and game stocking densities (adhering to conservation friendly stocking rates) • Sustainable harvesting of biodiversity resources • Reduction in chemicals, nutrients, poisons, bacterial inputs, detergents and other pollutants • Erosion stabilisation and prevention • Provision of meaningful buffers from transformation • Reduction of landscape fragmentation • Rehabilitation of degraded aquatic and terrestrial habitat

		• Regular area inspections by authorities • Incorporation into Protected Areas Network / stewardship programmes • Payment for ecosystem services should be explored further • Enforcement of NEMA Duty of Care
Priority faunal species	Protect current populations, increase abundance and distribution of animal species	• Expansion programmes for priority faunal species • Maintenance of habitat requirements for faunal species • Protection of nesting and roosting sites • Vultures: protect nesting and roosting sites from any form of disturbance • Quality control of carcasses offered in vulture restaurants • Environmental education re persecution of Vultures and other species • Employ recognised procedures as per Working Groups and EKZNW • Expansion of Crane Custodian Programme • Employ recognised procedures as per Crane Foundation and EKZNW • Expansion of Oribi Custodian Programme • Prevention of poaching • Exclusion of dogs in faunal priority CBAs
Priority floral species CBA vegetation type CBA	Prevent ecological degradation and further loss of vegetation	• Zero tolerance of harvesting • Protection of forest edges from fire • Exclusion of domestic livestock from forests • Maintenance of ecotones
Wetlands, important water yield areas, and stem rivers	Improve biodiversity and hydrological integrity of aquatic systems	• Reinstatement of vegetation cover to 30m from edge of wetland / riparian area if it has been cultivated • Provision of off-stream washing facilities • Upgrade of sanitation facilities in communal areas
Ecological Corridors	Prevent ecological degradation and retain connectivity	• All of the above management measures • Establishment of meaningful corridors, prevention of ribbon development

8. Competing Land Uses and Activities that Threaten CBAs and ESAs

8.1 Background

The inclusion of threats in the conservation assessment attempts to reduce potential conflicts between areas selected for conservation and areas with development imperatives and/or vulnerability to degradation. Furthermore, incorporating vulnerability into the assessment allows proactive development of action plans to mitigate threats in priority areas.

Approximately 46% of the District forms part of the grassland biome, of which a significant portion has undergone large scale transformation, with recent changes in conservation status (e.g. re-classification from least threatened to vulnerable). The NSBA has identified future threats to the District comprising high alien plant invasion suitability, high afforestation potential, and an increase of population density (NSBA).

Zululand is primarily a rural district with a population of 957 700 people living in 866 dispersed settlements and six urban areas. The number of households is estimated at 168,018 with an average household size of 5.7. Most of the rural settlements are small, making service delivery costly. Poor sanitation is prevalent in the rural areas, with more than half the households disposing of waste in their own dumps and using informal latrines.

Approximately half of the District falls under traditional tenure. Most of the balance is in private ownership (mainly commercial farms), while relatively small areas are in state ownership, or private ownership in towns. The state land comprises mainly nature conservation areas and Department of Water Affairs and Forestry water resources and public works land.

The District has a low level of infrastructural development, with a relatively low diversity of land uses, which in part is attributed to the dominant land tenure systems and accessibility. The district is relatively remote from the province's major development centres, i.e. Durban, Richards Bay / Empangeni and Pietermaritzburg and the main growth corridors along the N3 and N2 routes. However, the district does have a secondary corridor of national significance. The coal-line corridor, which runs from Richards Bay, through Ulundi, Vryheid and Paulpietersburg and on to the mining areas of Mpumalanga, is an important route in the national rail and road network.

The dominant land use in private and tribal lands is commercial and small-scale subsistence agriculture, respectively. The settlement pattern reveals that 65% of the district's population live in rural villages, many at some distance from the main road network. The geological formations in the District have given rise to predominantly rugged terrain, with settlement and agricultural development focusing on more accessible flatter areas. Settlement patterns in steeper communally-owned areas reflect the spatial configuration of access roads.

Up to the early 1990s, Zululand's economic base depended heavily on coal mining, supported by agriculture, transport, trade and government services. Formal economic activity was strongly concentrated in the then Vryheid magisterial district, from which no less than 73% of GGP was generated. Vryheid (urban population 24 670) is a commercial and business centre, while Ulundi (urban population 55 000) is an administrative centre with the seat of the District Municipality and a well-equipped airport; Ulundi has experienced significant growth in recent times. Nongoma and Belgrade have been identified as Rural Service Centres. A significant weakness was, and remains, the reliance on the primary sector (44.4% of GGP), and the underdeveloped manufacturing sector, which contributed only 6.4 % of GGP. By the late-1990s Zululand had experienced an economic decline due to the effects of open market policy on coal mining and agriculture. By 2000 all but one (Zululand Anthracite Colliery) of the large-scale mining operations had closed. Although tourism has started to play a larger role, this by no means fills the gap caused by the closing of the mines. Agriculture remained the primary economic activity in the District. The informal sector (mainly petty commodity trading) has also grown considerably over the last decade, but is constrained by the slump in primary and secondary sectors of the formal economy. Zululand's potential for economic growth lies in tourism and agriculture; however, mining has persisted and being extensively explored.

The municipality recognises the tourism potential of the area and has identified a need to market Zululand as a tourist and investment opportunity to attract development, and to promote Zululand as a International Tourism Destination. Zululand is a favourite haunt of both local and international bird watchers. One of Africa's most established and celebrated ecotourism initiatives, the Zululand Birding Route (ZBR), along with the established Greater Limpopo Birding Route, are worth an estimated R50 million per year in direct economic value to the South African region. Conservationists have pointed out that many of the 70 top 'birding sites' on the ZBR have been saved by this economic incentive toward conserving sites important for birds and biodiversity.

Most of the eco-tourist facilities are located in the north and north-eastern areas of the district (including Ithala Game Reserve, the Pongolapoort Dam and biosphere and the new Paris Dam as well as a number of private game ranches. Other eco-tourist facilities are found in the south at Ulundi (eMakhosini-Ophathe Heritage Park) and at various private game farms. A majestic expanse of indigenous mountain forest is located south of Ithala. A gravel road winds its way into a less well known part of the District, to the Ngome Forest and, within it, the Ntendeka wilderness area. The Hluhluwe-iMfolozi Park flanks Zululand municipality on the east. There is significant potential for integrating cultural and heritage tourism with conservation land uses in the District. The most significant of these are in and surrounding the eMakhosini- Ophathe Heritage Park, coupled with the cultural and historical sites around Ulundi town. Other important tourist areas relate to the battlefields around Vryheid and Babanango, extending beyond the Zululand District, and the promotion of game reserves such as Thaka Zulu. An important link road is the P700, which runs from Ulundi to the Cengeni Gate of Hluhluwe-iMfolozi Park. This is a vital link in order to realize the tourism potential of Zululand. The upgrading of the R66, the P700, and the P701 would complete the regional road network and provide good access for tourists traveling from Mpumalanga to the KwaZulu-Natal Game Reserves.

Eco-tourism is demonstrating significant growth in the District, in addition to the above opportunities identified by the municipality. The most significant gains arguably comprise the recently proclaimed Zululand Rhino Reserve and regional initiatives such as the Jozini Dam Transfrontier Project with Swaziland and the Zululand Corridor. A potential cross-district linkage identified by the municipality is in the southeast, from eMakhosini-Ophathe Heritage Park to the Hluhluwe-iMfolozi Park, which would arguably render significant tourism impetus to the area.

The relationship between ecosystem integrity and land use is well established and recognition thereof is crucial in the description of the biodiversity profile of an area. Land uses compatible with biodiversity objectives and goals are those under which most biodiversity and associated processes are expected to persist in the long-term. In general, land uses that result in irreversible loss of natural habitat have the highest impact on biodiversity, and land uses that allow for natural habitat to remain largely intact, have a lower impact on biodiversity; the single most important indicator is the proportional loss of a cover of natural vegetation to some other form of cover. A study by O'Connor and Kuyler (2005), concluded that conservation, livestock or game ranching had the lowest impact

on biodiversity integrity and retained substantial natural asset, while that for tourism/recreation was intermediate. All other land uses examined as part of the study (rural settlement, dryland cropping, irrigated cropping, dairy farming, plantation forestry, and urban settlement) had a severe impact. Impact on biodiversity integrity depended mainly on the extent of transformation and fragmentation, which accounted for the greatest impact on habitats and species, and impairment of landscape functioning.

Future land use threats are best quantified by an evaluation of the Spatial Development Framework and a review of activities that impact on the natural resource base, in this District comprising primarily agricultural potential (Figure 26 & 27). Areas of future infrastructural development and tourism development within the District comprise primarily water and sanitation projects which, if implemented sustainably, are unlikely to significantly transform significant areas of natural asset. Tourism development at the right scale offers an opportunity for conservation-compatible development. Development corridors pose greater threats to natural asset on account of urban-type development, often linear in nature, with which large scale direct transformation and indirect biodiversity impacts are associated, impacting on connectivity. Development corridors in the District are generally outside of the identified Vegetation CBAs and Vegetation Corridor ESAs. An area of concern comprises the Primary Development Corridor from Hluhluwe-iMfolozi Park to Ulundi.

The most significant land use threat comprises intensive agricultural development, on account of scale of potential transformation. Most small-scale farmers practise extensive livestock grazing, dry land cropping, and some vegetable gardening, whilst private agricultural operations are large scale, more diverse, more productive, and strongly commercially oriented. Zululand has a moderate agricultural potential, with high agricultural potential to the North and North east of the region. Moderate agricultural resources are scattered throughout the District. The following is a précis of agricultural activity per region:

ABAQULUSI (VRYHEID)

This municipality has medium to high agricultural potential, with grain crops, timber and semi intensive beef farming being the main enterprises at present. The district consists largely of commercial farms and this is where most of the land reform projects have taken place to date. The proposed sesame seed and Coronation mine agri-village are in this district. The two abattoirs in Vryheid will fulfil an important role in a beef-marketing programme for the Zululand District Municipality. The Lenjane forestry farm workers equity share project is also being planned at the present.

EDUMBE (PAULPIETERSBURG)

This local municipality has the highest potential for rain fed agriculture and consists largely of commercial forestry farming. In the communal areas of this municipality there is potential for small grower forestry, but this has not yet been developed mainly because of distances to markets. No development projects are currently planned or implemented and a pecan nut project has been referred to in the literature, but no detailed planning has begun.

uPHONGOLA

The main commercial enterprises in this municipality are irrigated sugarcane and game farming replacing beef operations. The irrigated sugar has been expanded as a result of the construction of the Paris Dam and this has included opportunities for black sugar farmers. The second small grower sugar project is in the process of being planned. There is potential in the District for citrus and sub tropical fruit under irrigation. The DEDT have approved funding for a fruit canning project in the municipality

NONGOMA

The entire municipality consists of communal settlement and a mixture of farming takes place by small holders with cattle and goats being the most important enterprises. The district consists mainly of valley bushveld, so the agricultural potential is low unless irrigation is available. Two programmes that will take place in the district are improving production and marketing of vegetables on the Bulelwane project as well as improving access to markets for beef farmers.

ULUNDI

This district is also predominantly valley bushveld as well as communal ownership of land. The Black Umfolozi irrigation scheme is being planned here and could represent the beginning of some

substantial irrigation developments in the future. The highlands of Babanango are dominated by corporate forestry. There is however potential land reform as well as irrigation opportunities from farm dams.

Although the District implements a number of agricultural projects, the projects that will have the most significant spatial impact, are those redistribution and restitution projects that are implemented on behalf of the Department of Land Affairs. Key areas of concern in respect of potential conflict with biodiversity objectives include the following initiatives:

- Development of agriculture along Ulundi - Richards Bay corridor
- Expansion of irrigated croplands in the Pongola area
- Biofuel initiatives

A number of projects have been identified by the Department of Environment, Agriculture and Tourism, as part of the Agrarian Revolution Programme. The Department of Water Affairs and Forestry has also identified 9 288 hectares of land for small-grower timber expansion. Agricultural development compatible with biodiversity objectives comprise the development of livestock and game farming potential on communal lands and land acquired by land reform beneficiaries.

Most high potential agricultural land in the District has already been cultivated, and is therefore probable to be shown as transformed in the transformation layer. A comparison of agricultural potential (Figure 26) with agricultural transformation (Figure 27) illustrates this relationship. Avoidance of this threat is inferred by staying as far as possible away from areas identified as previously transformed for agricultural use in the transformation layer.

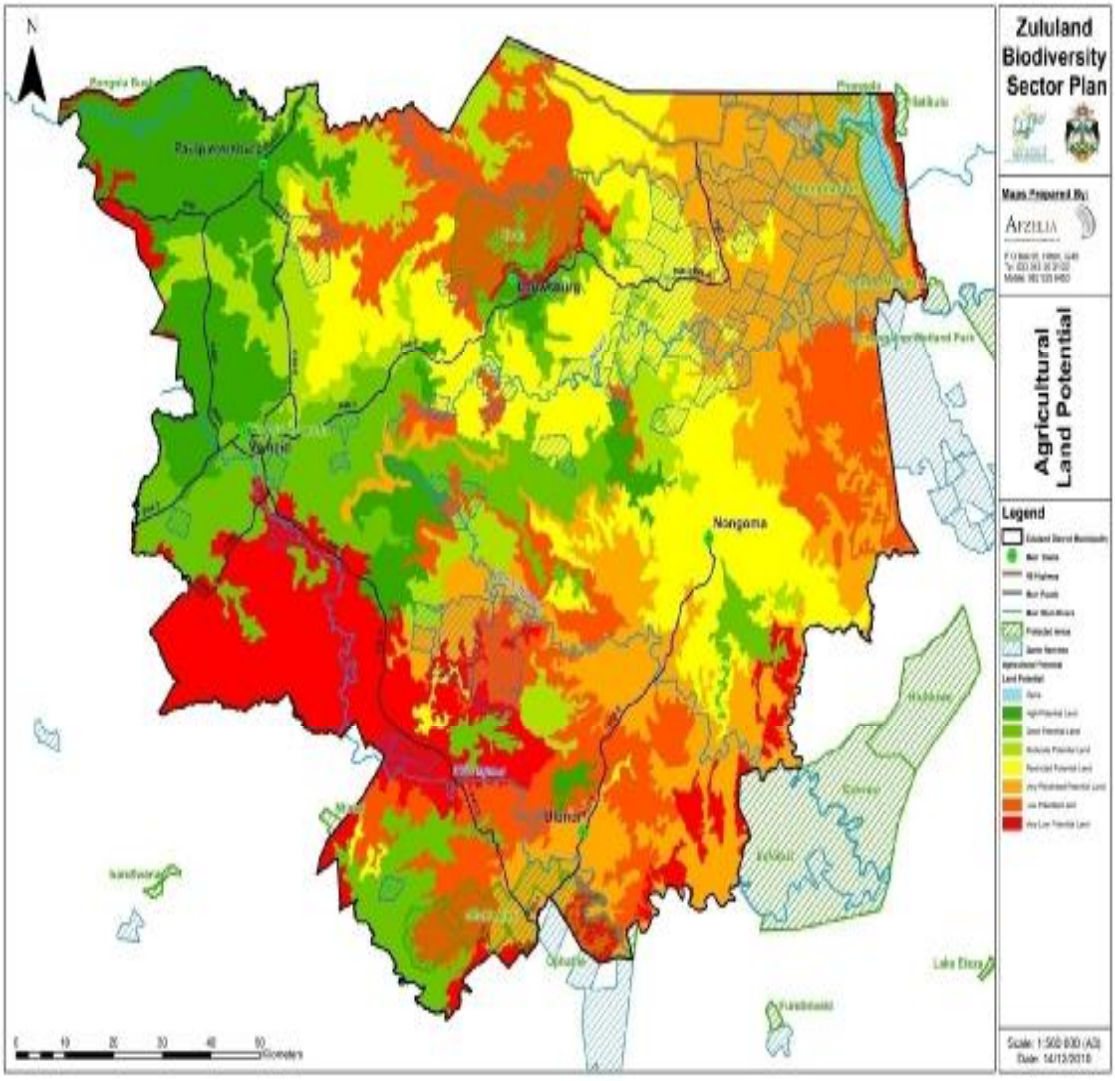

Figure: 26Potential agricultural land

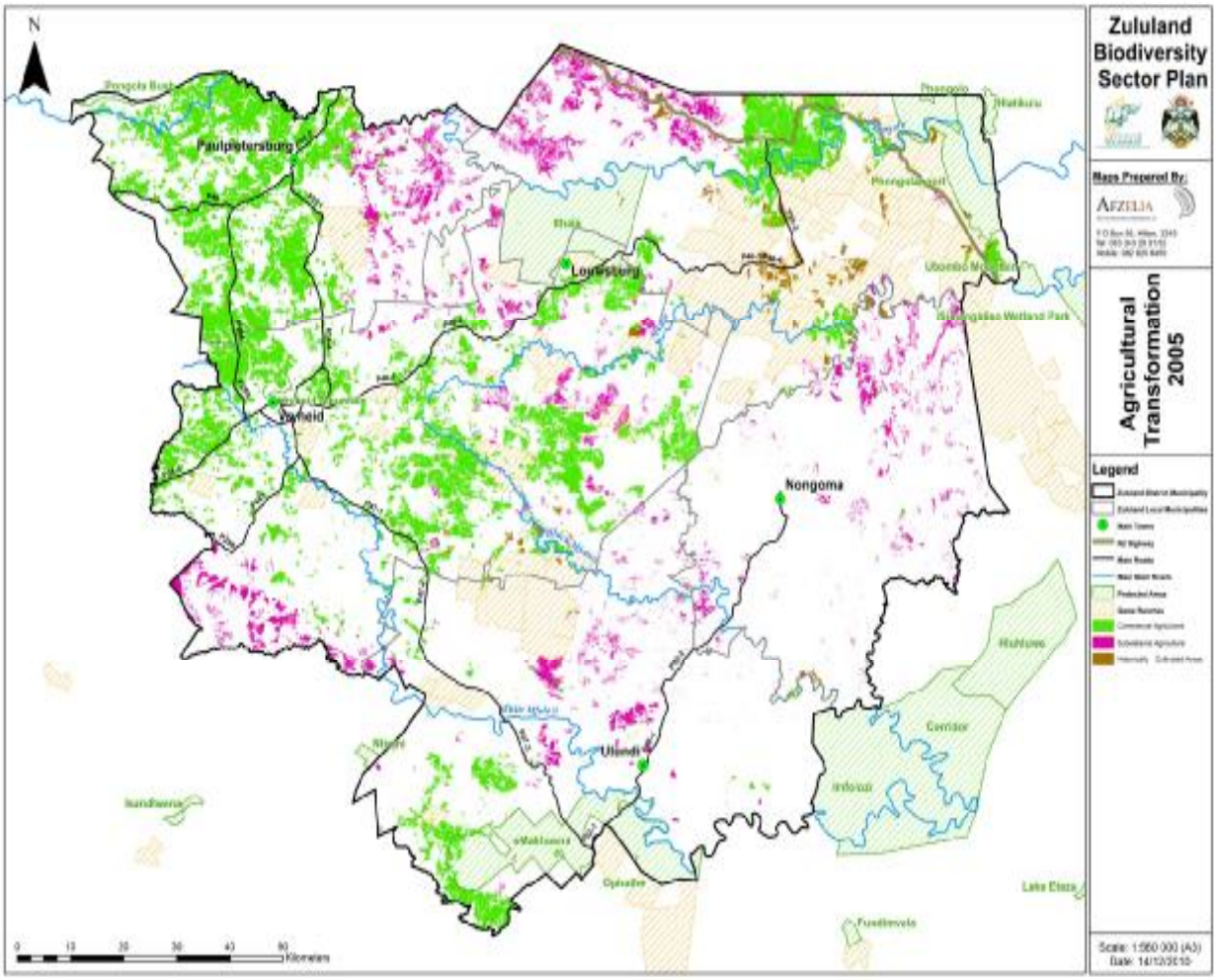

Figure: 27Agricultural land transformation

8.2 Comparison of Land Uses

The best options for conservation are Protected Areas, within which Wilderness[7] areas tend to retain the highest degree of ecological integrity. However, biodiversity loss can also be expected in Protected Areas on account of insufficient size, adjacent fragmentation and transformation, human impacts, climate change, and nutrient deposition.

Extensive livestock and game ranching based on natural grassland are the next most compatible land uses for biodiversity conservation, provided lands are not overgrazed. The extensive nature of livestock ranching means that poor management, particularly overgrazing and injudicious use of fire, can negatively impact large areas of land. Fire management is a significant determinant of the extent to which the above land use can contribute to biodiversity targets. Many of the grasslands are fire-climax and it is necessary that when fire is applied as a management tool that it be done in way that simulates natural processes. Whilst fire is essential to the system, unfortunately fire is generally applied at too frequent intervals (annually) to encourage a "spring flush". Negative impacts are exacerbated where grazing is applied shortly after burning at intensive stocking rates. Unfortunately due to the seasonal palatability of the grasslands in the District this is a common management strategy for both commercial and subsistence farmers. This practice has resulted in a loss of biodiversity, significant loss of basal cover, increased soil loss through sheet and gully erosion and an increase in the occurrence and spread of alien invasive vegetation. This impact is being experienced in areas critical for biodiversity conservation, such as the Nzahlatshe Mountain.

This translates into a negative impact on catchment integrity; stream flow in the dry season may be reduced or may cease to flow, summer flows may be exacerbated leading to flooding, soil erosion increases, veld productivity is reduced, seasonal water scarcity, poorer water quality and increased water vulnerability. In addition, the life span of water storage and abstraction infrastructure is seriously reduced through sedimentation. With 98% of surface waters in South Africa already allocated to users, the adoption of new supply enhancement strategies is urgent.

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[7] Wilderness Area: Means "an area designated ……for the purpose of retaining an intrinsically wild appearance and character, or capable of being restored to such and which is undeveloped and roadless, without permanent improvements or human habitation" as defined by the National Environmental Management: Protected Areas Act No. 57 of 2003.

The largest water user in ZDM is the irrigation sector (approximately 50%), predominantly for sugarcane in the Pongola catchments. The ecological reserve accounts for 40% of the water use in the ZDM. There is also a significant proportion of forestry in the ZDM that is classified and regulated as a stream flow reduction activity (SFRA). Over the entire ZDM a surplus water yield is available, almost entirely due to the Pongolapoort/Jozini Dam that is not fully utilised. However many uncertainties exist relating to the magnitude of this surplus and these need to be resolved before any large-scale allocations are made.

The Pongola River may experience some deficits during the winter months that can either be resolved by releases from Bivane Dam or off channel storage to make use of the summer surpluses. In addition, the lower Mfolozi and Mkuze catchments have a yield deficit due to large irrigation abstraction and water transfer from the Mfolozi to the Mhlathuze catchments6. However, some surplus yield may be available from the Klipfontein Dam in the upper reaches of

the Mfolozi catchments and using off channel storage for summer surpluses, although compulsory licensing may be required to resolve these deficits. This will be determined and implemented by the catchment management agency (CMA) through their catchment management strategy (CMS). As the Mkuze Catchments experience both winter and summer deficits, these catchments should not be targeted as a water resource for any of rural water supply schemes.

Expectations are that the overall ZDM population will experience little change within the next 25 years, with a decline in rural population likely to be balanced by increased urbanisation. Concomitantly, multiple livelihood strategies are common, integrating informal economic activities with traditional dependency on natural resources. Dependency on natural resources of the region by most rural communities is an issue of concern. The unnaturally high concentration of people in rural areas, coupled with the expansive nature of settlement, has resulted in significant pressure on natural resources. Over-grazing, injudicious burning regimes, sheet and donga erosion, unsustainable harvesting of plants, hunting of wildlife, and the spread of alien invasive plants are the primary threats.

The relationship between crop production and biodiversity conservation is largely negative. If such activities have occurred in an area, then that area is considered unsuitable for meeting conservation goals. Grassland or savanna biodiversity does not readily recover from transformation to pastures,

croplands, or timber plantations once these land uses are abandoned. Current cropland, pastures and commercial forestry were represented as transformed areas in the BSP. These land uses, especially commercial afforestation, impact negatively on porosity (the ease with which organisms can move through the landscape), connectivity and water resources. In terms of water resources, irrigation practises in agricultural production generally increase water use and chemical inputs into the environment. Where natural grasslands have been converted to intensive and irrigated pastures biodiversity loss is comparable with crop production. However, well managed agricultural areas have the potential to contribute to the delivery of some ecosystem services, although at a reduced rate in comparison with natural conditions.

Land transformed to urban use inherently experiences the greatest loss in biodiversity integrity through direct loss of natural asset, increased demands on natural resources, increases in pollution, and negative impacts on ecosystem processes. Potential future areas of development and settlement were identified in the SDF of the municipality's IDP. Roads impact on biodiversity through direct transformation, associated infrastructural impacts, and human activity, and have an effect on connectivity and porosity that is disproportionate to the area transformed. Roads also often result in ribbon development on account of improved accessibility. The identification of roads as development corridors amplifies this risk.

8.3 Alien Plants and Bush Encroachment

Apart from directly impacting on the integrity of habitat for indigenous biota, alien invasive plants can alter ecosystem functioning, substantially reduce the productive value of land, and significantly impact hydrological functioning depending on the scale of the invasion and the type of alien species. Alien infestations may result in marked declines in stream flow; transformation of vegetation composition and structure; local extirpation of individual plant or animal species or plant communities; alteration of patterns of nutrient cycling and fire regime; accelerated soil erosion; and rendering areas less accessible to management. In terms of livelihoods, invasive alien plants may impact on tourism and agricultural production. Alien trees frequently disrupt tourism view-sheds, and dense bramble may block access paths. This loss of productive land to alien plant invasions is a significant concern as it often results in increasing pressure and degradation on remaining land that may promote further invasion of alien plants. In many cases, the cost of clearing a dense infestation exceeds the value of the land, resulting in significant management costs that need to be borne by the

landowner thus reducing profit margins (in commercial ventures) or increasing the vulnerability of the rural poor. There is however, an opportunity for contributions to rural livelihoods through employment opportunities in eradication operations, as well as the beneficiation of some species as they provide materials for the production of various household and saleable items such as building material, fuel wood, crafts and furniture.

The Working for Water Programme is a DWAF funded programme that targets the removal of invasive alien vegetation from riparian zones using local labour. The target is to improve surface flow volumes and quality thereby providing further water available for reticulation. The District itself is unaware of any Working for Water Programme currently operating or planned within their area.

Bush encroachment is also a key threat in the region. Climate change is purported to favour the expansion of woody species. Coupled with changes in burning and grazing regimes, woody species, particularly, *Acacia* species have encroached into grassland areas, replacing high biodiversity value grasslands with relatively low diversity bushveld and dense savanna.

8.4 Soil Erosion Potential

Soil erosion negatively impacts on ecosystem integrity through habitat degradation and suboptimal ecosystem services. The ARC Potential Soil Erosion Map (Le Roux, 2008) was used to identify areas of high erosion potential (Figure 28). High erosion areas were avoided where possible.

The majority of areas subject to significant erosion potential are located within rural settlement areas, particularly the high erosion risk areas, especially within the Nongoma Local Municipality and in the vicinity of Ulundi.

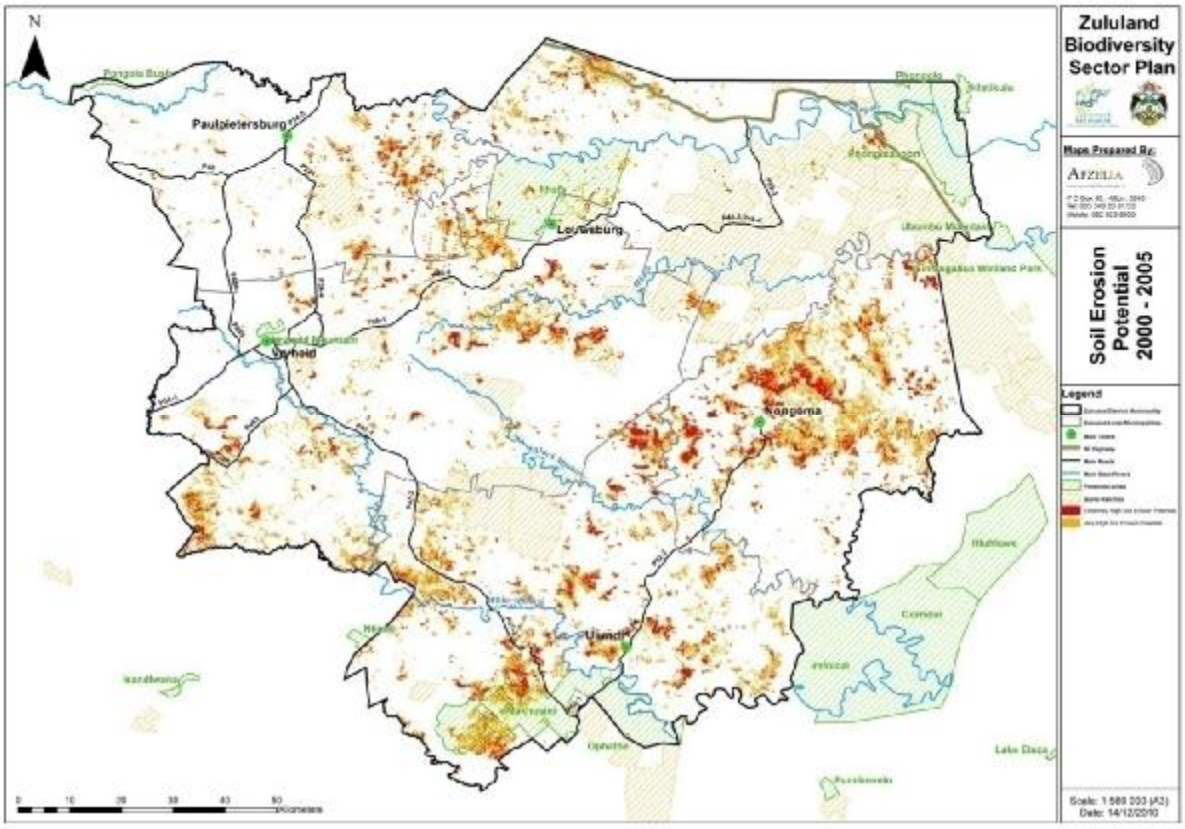

Figure: 28 Soil Erosion Potential in the District

8.5 Mining

Coal mining areas pose a significant threat to water quality, particularly in this District as the majority are situated in the headwaters of the major river systems in the District (Figure 29), which also comprise high water yield areas (Figure 30). Recognising coal as a critical national resource for power generation, is was assumed that existing mines and potential mining areas have a high probability that they will eventually be mined. Coal mining is highly invasive, especially open cast mining as is practised in KZN.

All coal seams plus a 2 km buffer (determined by EKZNW research) were therefore represented as threats and avoided wherever possible (Figure 31). If a coal seam plus buffer intersected an area that was critical for meeting a vegetation target, a mandatory conservation area, or an essential corridor, then the vegetation has been represented with the implication that such areas should not be mined. Note that the buffer accommodates only the direct impacts of coal mining and not the indirect impacts such as acid mine drainage.

Other potential mining activities, such as gold and diamond mining generally pose only direct threats to biodiversity through transformation activities.

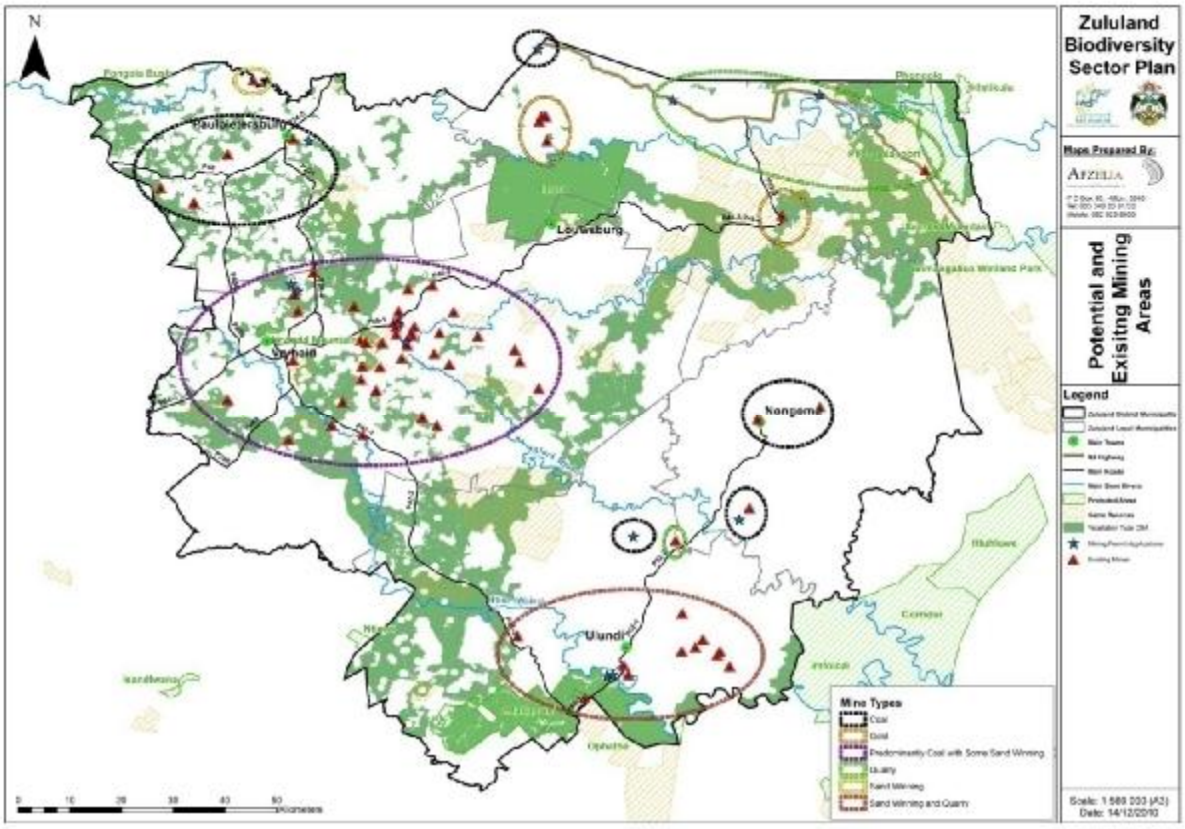

Figure: 29 Potential and existing mining areas in the District

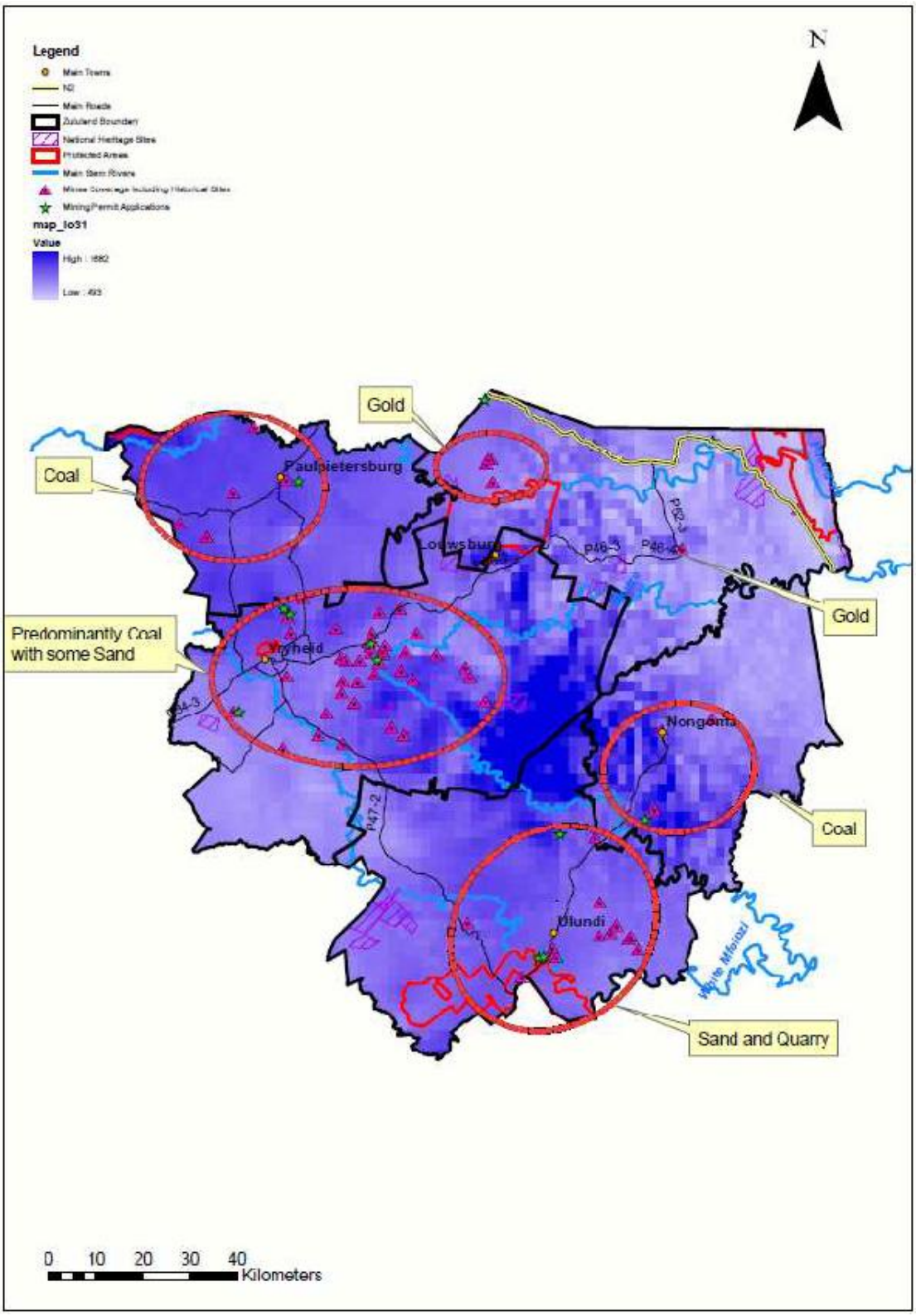

Figure: 30 Mean annual precipitation relative to potential and existing mining areas in the District

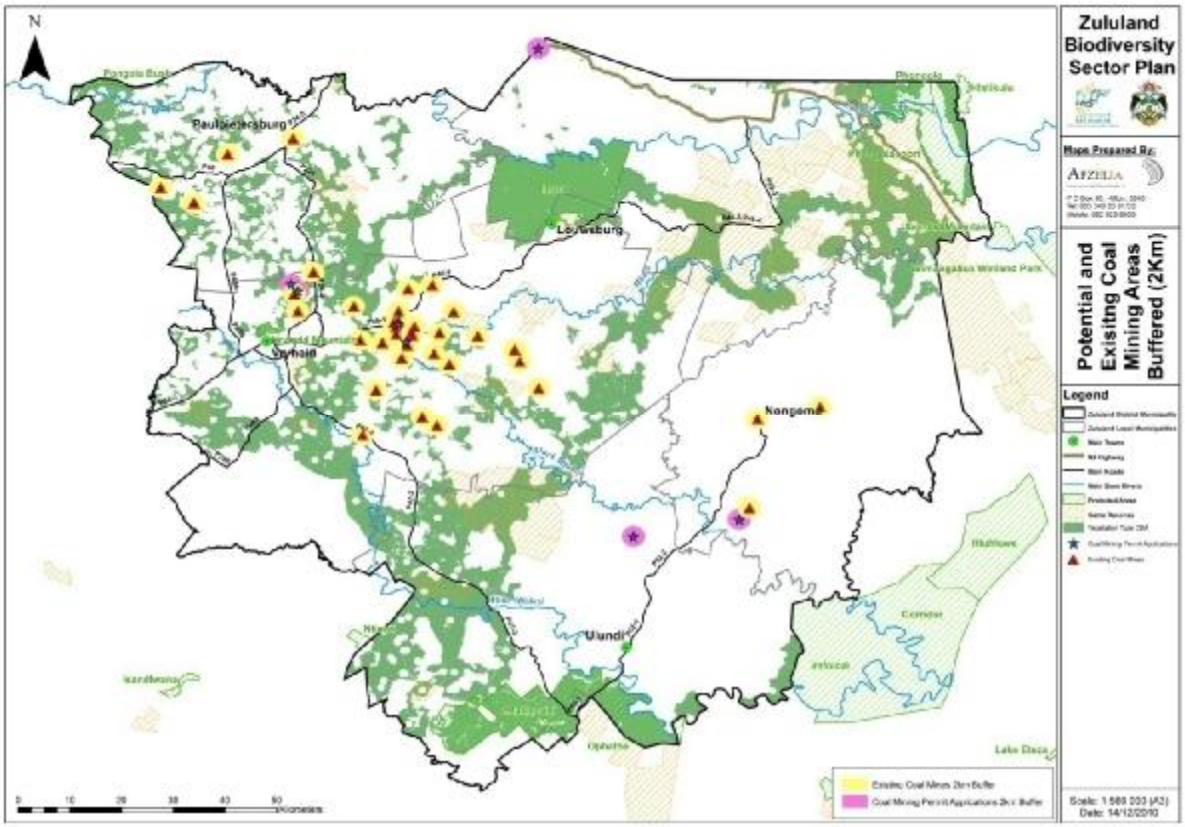

Figure: 31 Potential and existing coal mining areas buffered

8.6 Threats Not Addressed

The spatial distribution of threats has some limitations due to lack of available data, and it was not possible to assess all threats, as follows:

- Although communal livestock grazing is a dominant land use in parts of the District, it was not possible to spatially represent grazing impacts across the project area due to a lack of reliable data on cattle numbers and grazing areas.
- The spread of invasive alien plants was also not assessed.

9. Conclusions

The final configuration of areas, as illustrated in consolidated format in Figures 32 and 33, highlighted a number of issues and achieved the following major biodiversity objectives:

(i) Conservation targets could mostly be met in the District but the remaining amount of natural asset offered relatively few choices in meeting these targets, primarily on account of large scale transformation and land use threats.

(ii) Area selection within the District was constrained by extensive land transformation, comprising expanding settlement and commercial agricultural enterprises; transformation due to commercial and industrial development is minor in comparison. The extent of transformation restricted opportunities for ensuring regional connectivity (both terrestrial and aquatic), inferring a high management requirement of the remaining natural asset in order to ensure persistence of sub-optimal linkages.

(iii) Conservation targets for all identified biodiversity features were accommodated, with the exception of Delagoa Lowveld, KaNgwane Montane Grassland, and Lebomb Summit Sourveld. In terms of Lebombo Summit Sourveld, it should be possible to cater for provincial conservation targets in adjacent municipalities, which contain meaningful areas of this vegetation type. However, Delagoa Lowveld and KaNgwane Montane Grassland are highly endemic to the Zululand District Municipality, and therefore Provincial conservation targets must be met within this District, as is the

case for Swaziland Sour Bushveld, Paulpietersburg Moist Grassland, Northern Zululand Sourveld, Northern Zululand Mistbelt Grassland, Ithala Quartzite Sourveld, and Granite Lowveld; this would require rehabilitation of degraded and transformed areas.

(iv) The spatial configuration of ESAs and CBAs has allowed for adequate east-west and north-south ecological corridors. Opportunities exist for strengthening ecological corridors, particularly along the southern and eastern boundaries of the District, as well as the north-eastern corner of the District.

(v) Ecological corridors in this District must cater for large-scale movement corridors for example, to cater for Wild Dog populations, in addition to local scale connectivity. The spatial configuration of CBAs has achieved connectivity across the entire biophysical and altitudinal gradient of the District, and was successful in incorporating the majority of Sites of Conservation Significance, Living Cultural Heritage Sites[8], Game Farms, known movement corridors, and critical areas as identified by the EKZNW conservation plan.

. (vi) The spatial distribution of Protected Areas in the District highlighted that the spatial distribution of Protected Areas in the District was not adequately aligned across biophysical gradients, and was distorted in favour of lowland areas. The spatial configuration of CBAs also allows for opportunity for meeting protected areas expansion targets within areas identified by the EKZNW Protected Areas Expansion Programme and Stewardship Programme.

(vi) The spatial configuration of ESAs is in support of identified CBAs. However, identified ecological corridors all comprise high risk linkages on account of fragmentation and land use threats, with the exception of the Ithala Game Reserve / Pongolapoort linkage.

(vii) Coal mining, water abstraction, high potential agricultural land, potential forestry areas, and areas likely to experience settlement expansion, pose the greatest threats to identified CBAs.

[8] Incorporation of Living Cultural Heritage Sites, wherever possible, provides additional motivation for the preservation of critically important natural asset

(viii) Riparian areas have been negatively impacted on primarily as a result of large scale land transformation associated with commercial agriculture; water pollution from coal mining is also a significant threat. The majority of wetlands within the District are fortunately nested within reasonably intact natural areas.

(ix) The District provides a critical ecosystem service in terms of water provision and carbon sequestration.

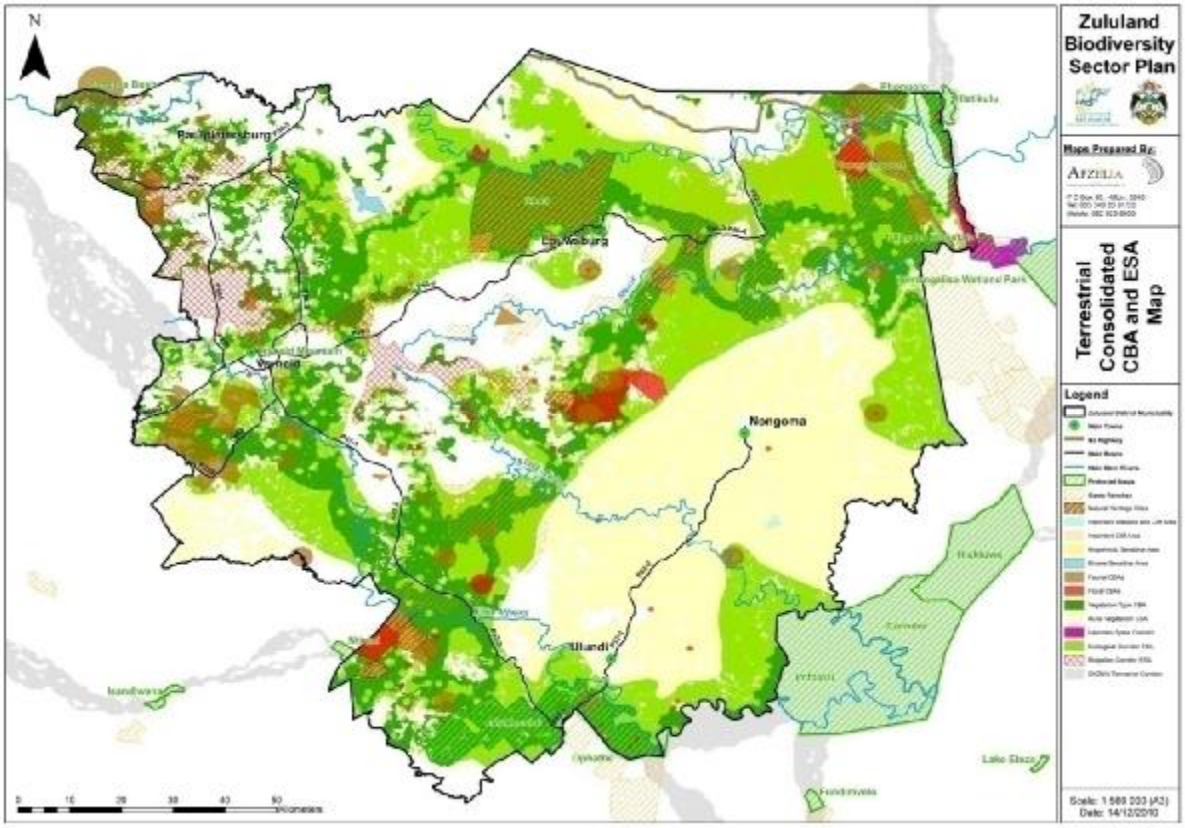

Figure: 32 Terrestrial Consolidated CBA and ESA Map

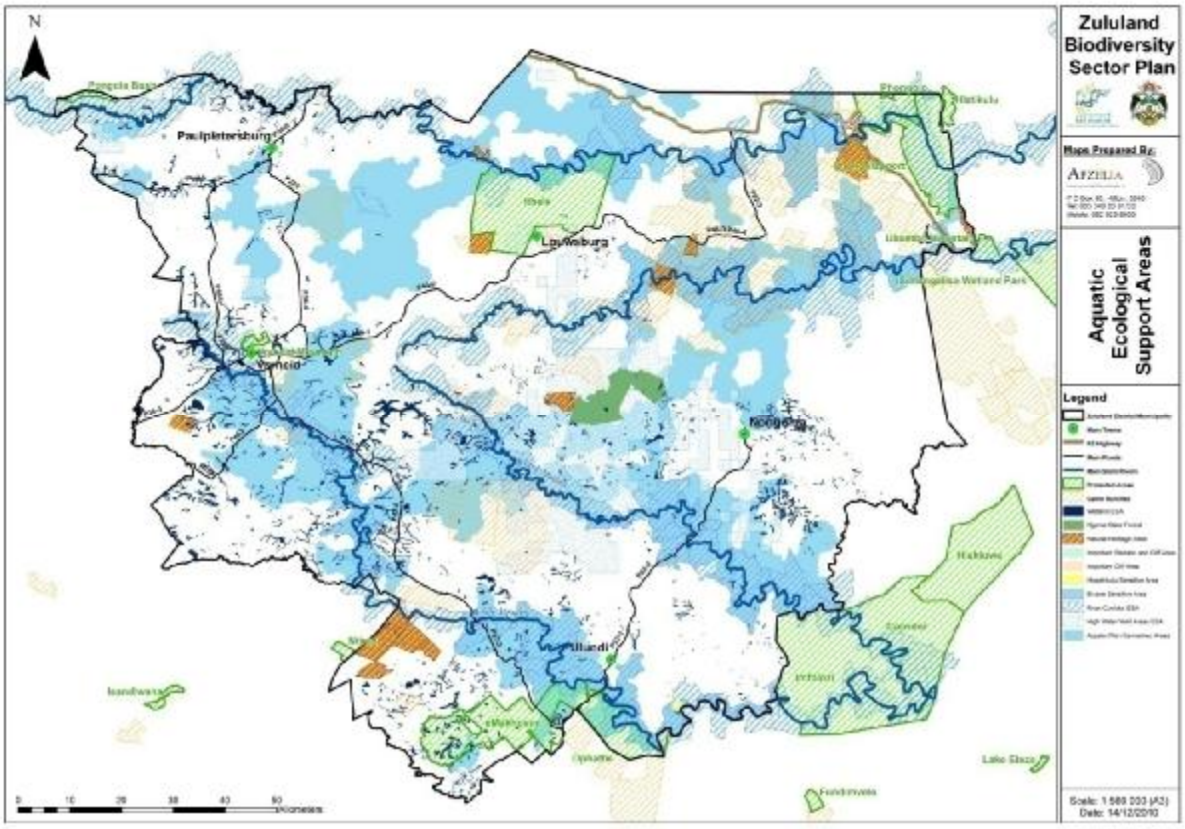

Figure: 33 Aquatic Consolidated CBA and ESA map

10. Recommendations

The following is essential to achieving biodiversity targets in the long term:

(i) Conservation efforts must be focused on CBAs and ESAs identified within the BSP, focusing on 'at risk' areas, considering the most important areas for conservation. In order to create a conservation management priority map, biodiversity features were firstly ranked according to their perceived biodiversity significance, where after each specific ranking was assigned a value (Classification) and an intersect analysis was performed. The classification values from all layers within the intersecting areas were then summed, and from this output it was possible to identify priority areas for conservation management according to the values of the summed classifications. The Provincial CPlan Irreplaceable Areas and Aquatic Plan Earmarked Areas were ranked highest, followed by the various CBAs, and finally corridor ESAs under threat (designated as CBAs). This exercise highlighted a number of key focus areas (red – highest priority, dark green – lower priority), illustrated in Figure 34.

Ezemvelo KZN Wildlife should increase their presence in these areas through regular monitoring and interaction with landowners, and management inputs should focus on controlling further land transformation and degradation.

(ii) Development threats, particularly from areas designated for development in the SDF and IDP, and as a consequence of potential rural settlement expansion, must be addressed at a strategic planning level to ensure that development does not take place at the expense of critical biodiversity asset.

(iii) Land use and environmental management guidelines provided in the BSP must be integrated into multi-sectoral planning, including EKZNW conservation programmes, the municipal Integrated Development Plan and Spatial Development Plan, and the Provincial Spatial Economic Development strategy; this should be monitored by EKZNW.

(iv) Water quality management is essential in the Aquatic Ecological Support Areas, Wetland CBA and the Earmarked Aquatic Planning Units. Management actions should focus on reducing soil erosion and chemical and microbial inputs, and the management of associated terrestrial vegetation to ensure sustained inflow of clean water.

(v) Opportunities for conservation-oriented local economic development must be explored within CBAs and ESAs, particularly within areas adjacent to Protected Areas, areas earmarked for the Stewardship and Protected Areas Expansion Programmes, and areas contributing to sustainable rural livelihoods, keeping in mind the need to secure land within formal conservation land use across the entire biophysical gradient. Conservation land use must be investigated as a tool for economic empowerment of local communities.

(vi) Payment for ecosystem services should be explored by EKZNW in conjunction with private land owners and local communities, emphasizing potential socio-economic benefits.

(vii) The ecological linkages identified on the interface between the District and adjacent municipalities, and Swaziland, must be taken into account in conservation planning adjacent Districts.

(viii) The importance of conserving endemic vegetation types within the municipality must comprise a core focus of EKZNW; any activity that could result in a further loss of these vegetation types must be critically evaluated, and rehabilitation efforts to reclaim degraded areas must be considered.

(ix) Additional water impoundments and proposed abstraction schemes within the District must be critically evaluated.

(x) The EKZNW CPlan should be re-run at the District level, based on any new data, and biodiversity targets scaled to the District Level. Planning Units would then better reflect the municipal context at a finer-scale, based on the best realistic conservation options in the landscape. This is considered a critical task as a consequence of rapidly retreating options in the District.

(xi) The BSP should be updated regularly within EKZNW, based on a monitoring programme and the most recent land cover data available, to inform decision-making within the planning department and other relevant EKZNW structures. Multi-sectoral reporting should at a minimum coincide with the municipal Integrated Development Plan and Land Use Management System review cycle, comprising a minimum 5-year cycle.

(xii) Not all of the “Inappropriate / incompatible land uses and activities” provided in the Land Use Guidelines require environmental authorisation in terms of the NEMA Environmental Impact Assessment Regulations (2006), and therefore would not be subject to any environmental authorisation process. The BSP, apart from being the precursor to a Bioregional Plan, provides an opportunity for the competent authority to initiate an Environmental Management Framework for the District, adopting the CBAs and ESAs as

Geographical Areas within an Environmental Management Framework. A key outcome of an EMF is the re-evaluation of the applicability of scheduled Listed Activities in terms of NEMA, whereby Listed Activities may be amended or additional activities may be promulgated in sensitive areas; the EMF therefore provides an opportunity for ensuring that critically important biodiversity is adequately considered in authorisation processes.

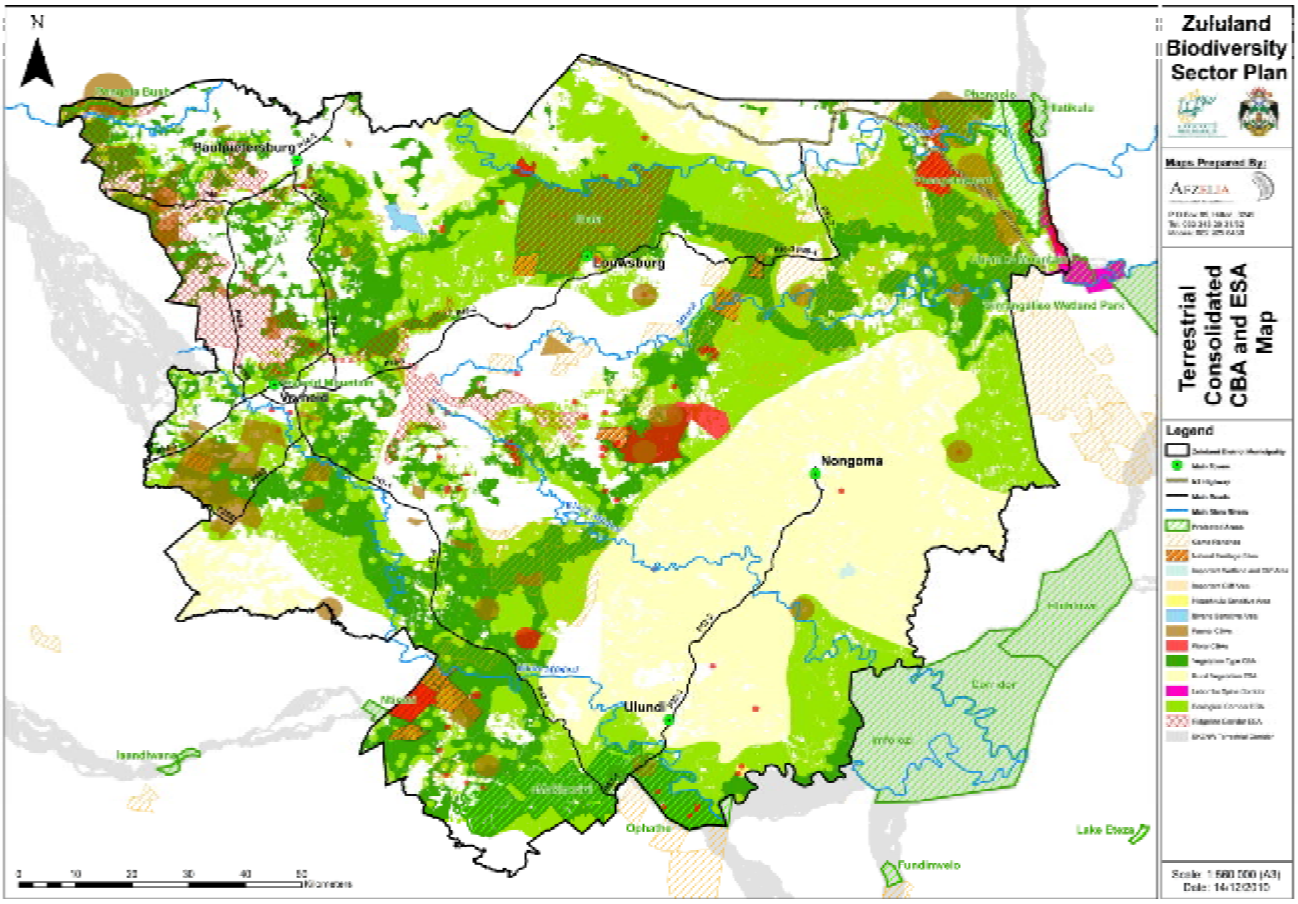

Figure: 34 Terrestrial Consolidated CBA and ESA map

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Appendices

Appendix 1 Diversity in Vegetation Units Relevant to the Zululand District Municipality (please consult Mucina& Rutherford, 2006, for additional detail referred to below)

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
Glencoe Moist Grassland	This vegetation type is classified as KwaZulu-Natal Moist Grassland in Mucina and Rutherford (2006). It is expected that Glencoe Moist Grassland will be recognised as a discrete vegetation type by Mucina & Rutherford in the next iteration of vegetation classification.				
Income Sandy Grassland	880 - 1 340m (mainly 1 120 - 1 240m).	Very flat extensive areas with generally shallow, poorly drained, sandy soils supporting low, tussock—dominated sourveld forming a mosaic with wooded grasslands (with *Acacia sieberiana* var. *woodii)* and on welldrained sites with the trees A. *karroo, A. nilotica, A. caffra* and *Diospyros lycioides*. On disturbed sites *A. sieberiana* var. *woodii* can form sparse woodlands. *Aristida congesta, Cynodo dactylon* and *Microchloa caffra* are common on shallow soils (Camp 1999c).	Sandstones and shale of the Madzaringwe Formation (Ecca Group of Karoo Supergroup) supporting poorly drained sandy soils, mostly of the Glenrosa form. Most important land types Ca, Bb and Fb.	Region of summer rainfall, with most precipitation occurring between October and March (overall MAP 750mm; range 650 - 800mm), much of which falls as thundershowers often accompanied by hail. MAT is just below 17°C, and mean annual evaporation 1 845mm. Frost moderate (Camp 1999c). See also climate diagram for Gs 7 Income Sandy Grassland	None noted in Mucina & Rutherford
KwaZulu-Natal Highland Thornveld	920 -1 440m.	Hilly, undulating landscapes and broad valleys supporting tall tussock grassland usually dominated by *Hyparrhenia hirta*, with occasional savannoid woodlands with scattered *Acacia sieberiana* var. *woodii* and in small pockets also with *A. karroo* and *A. nilotica*. where It occurs on both dry valleys and moist upland.	A variety of Karoo Supergroup rocks occur in the area, including the Dwyka, Ecca and Beaufort Groups and marginally also Jurassic dolerite intrusions. Yellowbrown soils over plinthic subsoil and shallow duplex soils are common. Red and black heavy soils are derived from dolerites and show high resistance to erosion. The unit falls within various land types, including Ca, Eb, Fa, Db and Bb.	Summer rainfall. MAP about 750 mm (79 rain days per year; Camp 1999c). The midwinter months of June and July have 2.6 rain days on average. Much of the summer precipitation comes in form of thunderstorms (63 and 56 thunderstorm days per year for Ladysmith and Estcourt, respectively). Mist is uncommon (14 days of mist per year for both Ladysmith and Estcourt). MAT 15.6—19.0°C (overall average 16.5°C). Summers are warm to hot, winters are cool. There are 15 frost days per year. The mean annual evaporation recorded at Estcourt is 1 725mm, while the range for the entire vegetation unit is 1 706 - 1 918mm (Camp 1999c), the overall average	

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
				1 830mm. See also climate diagram for Gs 6 KwaZulu-Natal Highland Thornveld	
Makatini Clay Thicket	40-140m	Comprises a mixed, but mainly simple-leaved short bushland and thicket with emergent trees up to 10 m and a generally dense dominant shrub layer 1-4 m tall. It occurs on the lower slopes and bottomland areas of gently undulating terrain. Small clay-bottom, endorheic pans occur commonly at low points in the terrain	Underlying geology comprises mostly Cretaceous sandstones, siltstones and conglomerates of the Zululand Group (Mzinene and Makatini Formations). Dominant soils are vertic or melanic clays and clay loams of the Rensburg, Arcadia and Bonheim forms. They are characterised by being poorly drained, with calcium carbonate concretions on the surface or in the Ahorizon. Land types mainly Ea and Dc with some Ae and Db	Rainfall occurs in summer with dry winters. MAP about 500-750 mm. No incidence of frost. See also climate diagram for SVI 21 Makatini Clay Thicket	**Important Taxa** Small Trees: *Acacia luederitzii* var. *retinens* (d), *A. grandicornuta, A. nilotica, Albizia anthelmintica, Berchemia zeyheri, Ozoroa engleri, Schotia capitata, Sideroxylon inerme, Spirostachys africana.* Tall Shrubs: *Euclea divinorum* (d), *Croton menyharthii, Ehretia rigida* subsp. *rigida, Erythroxylum delagoense, Euclea schimperi, Lycium acutifolium, Rhus gueinzii.* Low Shrubs: *Barleria elegans, Ecbolium glabratum, Solanum capense.* Succulent Shrub: *Euphorbia grandicornis.* Graminoids: *Bothriochloa insculpta, Chloris mossambicensis, Dactyloctenium australe, Enteropogon monostachyus, Panicum deustum, P maximum, Sporobolus nitens.* Herbs: *Blepharis integrifolia, Centema subfusca.* Succulent Herb: *Orbea paradoxa.* **Endemic Taxon** Geophytic Herb: *Raphionacme elsana.* **Conservation** Least threatened. Target 19%. Some 42% statutorily conserved in the Greater St Lucia Wetland Park (Mkhuze) and Ndumo Game Reserve. About 7% already transformed, mainly by cultivation
Lebombo Summit Sourveld	600-803m	Ridge plateaus and adjacent slightly sloping flanks covered with open, tall, sour, wiry grasslands, often dotted with low bushes and solitary savanna trees.	Shallow soils of Glenrosa and Mispah forms over Jozini Formation rhyolite lavas (Karoo Supergroup). Heavier soils have developed over dolerite in places. Rocky outcrops are typical. Land types mainly Fa, Ea and lb	Summer rainfall with little rain in winter. MAP about 600-1 050 mm. Generally frost-free. See also climate diagram for SVI 17 Lebombo Summit Sourveld	**Important Taxa** Small Trees: *Acacia caffra, Encephalarto ngoyanus.* Tall Shrubs: *Diospyros dichrophylla, Gnidia caffra, Grewia monticola.* Low Shrubs: *Crossandra greenstockii, Diospyros galpinii, D. lycioides* subsp. *nitens, Phyllanthus glaucophyllus, Polygala producta, RueIlia cordata, Senecio medley-woodii.* Semiparasitic Shrub: *Thesium jeanae.* Graminoids: *Andropogon gayanus* (d), *Elionurus muticus* (d), *Heteropogon contortus* (d), *Themeda triandra* (d), *Brachiaria serrata, Cymbopogon caesius, Hyparrhenia filipendula, Hyperthelia dissoluta, Schizachyrium sanguineum, Tristachya leucothrix.* Herbs: *Argyrolobium adscendens, Berkheya*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					insignis, Blepharis integrifolia, Crabbea hirsuta, Gazania krebsiana subsp. *serrulata, Gerbera ambigua, Helichrysum nudifolium* var. *pilosellum, H. rugulosum, Indigofera sanguinea, Lepidagathis scabra, Vemonia oligocephala, Zornia capensis.* Succulent Herb: *Australluma ubomboensis.* Geophytic Herb: *Hypoxis hemerocallidea.* **Biogeographically Important Taxon** (Lebombo endemic) Geophytic Herb: *Pachycarpus lebomboensis.* **Endemic Taxa** Herb: *Cyphostemma barbosae.* Succulent Herb: *Orbea ubomboensis.* **Conservation** One of the most endangered vegetation types in KwaZulu-Natal due to alien plant (Lantana camara) encroachment, heavy livestock grazing and expanding cultivation. Target 24%. About 4% is statutorily conserved in the Mananga Cycad Colony, Ubombo Mountain, Phongolapoort and Hlatikulu Nature Reserves. Very small portion also conserved in the private Masibekela Wetland Reserve. At least 41 % already transformed, almost all by cultivation. Rural settlements are concentrated in these areas. Heavy utilisation and population density may have contributed to the open and less wooded aspect of this vegetation unit. Erosion is very low due to the hard substrate. **Remark** Culturally important Gwaliweni Forest (classified as part of Scarp Forest) borders on this vegetation unit
KaNgwane Montane Grassland	880- 1740m	Largely comprised of undulating hills and plains that occur on the eastern edge of the Escarpment. This unit is transitional between the Highveld and Escarpment and contains elements of both. The vegetation structure is comprised of a short closed grassland layer with many forbs, and a few scattered shrubs on the rocky outcrops	Mostly on granite of the Mpuluzi Granite (Randian Erathem), Archaean gneiss giving rise to melanic soils, with intrusions of diabase. Land types Ac, Fa and Ba.	Early summer rainfall, with MAP 910 mm, ranging between 800 and 1 250 mm. This unit has a wide range of frost frequency (3- 20 days per year), with most frost days occurring in the western regions. See also climate diagram for Gm 16 KaNgwane Montane Grassland (Figure 8.36).	**Important Taxa** Graminoids: *Alloteropsis semialata* subsp. *eckloniana* (d), *Brachiaria serrata* (d), *Cyperus obtusiflorus* (d), *Diheteropogon amplectens* (d), *D. filifolius* (d), *Eragrostis racemosa* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Loudetia simplex* (d), *Monocymbium ceresiiforme* (d), *Rendlia altera* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *Andropogon schirensis, Bewsia biflora, Bulbostylis burchellii, Ctenium concinnum, Cymbopogon caesius, Cyperus obtusiflorus* var. *obtusiflorus, Digitaria diagonalis, D. tricholaenoides,*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Eragrostis chloromelas, E. plana, Eulalia villosa, Panicum ecklonii, P natalense, Paspalum scrobiculatum, Schizachyrium sanguineum, Setaria nigrirostris, S. sphacelata. Herbs: *Ipomoea oblongata* (d), *Acalypha peduncularis, A. villicaulis, Alepidea setifera, Argyrolobium speciosum, Aster harveyanus, Berkheya setifera, Corchorus con fusus, Cyathula cylindrica, Dicoma zeyheri, Dimorphotheca jucunda, Eriosema cordatum, Euryops laxus, E. transvaalensis* subsp. *setilobus, Helichrysum adenocarpum, H. cephaloideum, H. nudifolium* var. *nudifolium, Mohria caffrorum, Pentanisia angustifolia, P prunelbides* subsp. *latifolia, RueIlia patula, Schistostephium crataegifolium, Senecio panduriformis, Sonchus wilmsii, Thunbergia atriplicifolia, Vernonia natalensis, V oligocephala.* Geophytic Herbs: *Agapanthus inapertus* subsp. *inapertus, Boophone disticha, Cheilanthes deltoidea, C hirta, Eucomis montana, Gladiolus ecklonii, Habenaria dregeana, Hypoxis iridifolia, H. rigidula* var. *pilosissima, Moraea pubiflora, Pteridium aquilinum, Watsonia latifolia, Zantedeschia albomaculata* subsp. *macrocarpa.* Succulent Herbs: *Aloe integra, A. kniphofioides.* Small Trees: Atacia *caffra, Faurea rochetiana,* Pachystigma *macrocalyx.* Tree Fern: *Cyathea dregei.* Tall Shrubs: *Calpurnia glabrata, Cephalanthus natalensis,* Diospyros *lycioides* subsp. *guerkei, Vernonia tigna.* Low Shrubs: *Heteromorpha involucrata* (d), *Anthospermum rigidum* subsp. *rigidum, Asparagus cooperi, A. virgatus, Athrixia phylicoides, Diospyros scabrida* var. *cordata, Gymnosporia heterophylla, Indigofera* comosa, *Myrsine africana, Rhus discolor, Schistostephium rotundifolium* **Biogeographically Important Taxa** (Barberton endemic, Northern sour- veld endemic) Herbs: *Hemizygia modesta, H. thomprottii,*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Selago stewartii. Geophytic Herb: *Watsonia watsonioides.* Succulent Herb: *Kleinia galpinii.* Low Shrub: *Hemizygia albiflora".* **Endemic Taxa** Herbs*: Lotononis difformis, L. spicata, Streptocarpus occultis.* Low Shrub*: Syncolostemon cornptonii.* **Conservation** Vulnerable. The conservation target 27% with only 0.4% protected within any formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam and Songimvelo). A number of private conservation areas protect small patches of this unit. It is well suited for afforestation and 30% has already been converted to plantations of alien trees. A further 6% is under cultivation. Erosion potential very low (55%) and low (7%). **Remark** This area occurs on the southern edge of the Barberton Centre of Endemism
Ithala Quartzite Sourveld	44-1360m	Low mountain ranges and undulating hills with rocky lowlands. The general pattern is a mosaic of woody shrubs and small trees in rocky areas, interspersed in the grass layer. Vegetation structure varies according to altitude and rockiness, but the basal density of the grass sward is relatively low. This unit occurs in the zone between Grassland and Savanna where the dominant grassland gives way to woodland as elevation decreases. The grasslands are speciesrich covering a variety of altitudes but sharing common species unique to the dystrophic quartzite geology.	Quartzite of the Mozaan Group (Pongola Supergroup) of the Randian age supporting shallow soils typical of Fb (prevalent) and Fa (marginal) land types.	Rainfall peaks in midsummer. MAP from about 1 200 mm in the west to 570 mm in the east (MAP 795 mm). Frost does occur, but is infrequent. See also climate diagram for Gs 2 Ithala Quartzite Sourveld (Figure 8.61*).*	**Important Taxa** Small Trees: *Combretum molle* (d), *Englerophytum magalismontanum* (d), *Syzygium legatii* (d), *Acacia caffra, A. davyi, Cassipourea swaziensis, Cussonia natalensis, Dombeya cymosa, Faurea rochetiana, F saligna, Ficus burtt-davyi, Lannea discolor, Pachystigma macrocalyx, Pavetta edentula, Protea caffra* subsp. *caffra, P roupelliae* subsp. *roupelliae, Pterocarpus angolensis.* Tall Shrubs: *Morella pilulifera* (d), *Pavetta gracilifolia* (d); *Protea gaguedi, Rhus pallens, R. pentheri.* Woody Climber: *Jasminum multipartitum.* Low Shrubs: *Gymnosporia tenuispina* (d), *Helichrysum lepidissimum.* Wakkerstroom Montane Grassland is largely devoid of *Pteridium aquilinum.*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Vegetation and Landscape Features	Vegetation and Landscape Features	Endemic taxa / Biogeographically important taxa / Remarks
Midlands Mistbelt Grassland	760-1400m	Hilly and rolling landscape mainly associated with a discontinuous eastfacing scarp formed by dolerite intrusions (south of the Thukela River). Dominated by forb-rich, tall, sour *Themeda triandra* grasslands transformed by the. invasion of native 'Ngongoni grass (*Aristida junciformis* subsp. *junciformis*). Only a few patches of the original species-rich grasslands remain	Apedal and plinthic soil forms derived mostly from Ecca Group (Karoo Supergroup) shale and, minor sandstone and less importantly from Jurassic dolerite dykes and sills. Dominant land type Ac, followed by Fa	Summer rainfall, with MAP of 915 mm, range 730-1 280 mm. Heavy and frequent occurrence of mist provides significant amounts of additional moisture (Cedara near Pietermaritzburg has 46 misty days per year). Some of the rain is in the form of cold frontal activity, mainly in winter, spring and early summer. Thunderstorms are common in summer and autumn (Cedara: 60 days of thunderstorms per year). Mean annual evaporation 1 463-1 797 mm (Camp 1999a). MAT 15.8°C, absolute minimum temperature was recorded in this region in June (-10.8°C). Frosts are generally moderate, but occasional severe frost may also occur. Further climatic conditions include short-term drought spells, hail and hot northwestern berg winds occurring particularly in spring and early summer. See also climate diagram for Gs 9 Midlands Mistbelt Grassland (Figure 8.61)	Taxa Graminoids: Andropogon appendiculatus (d), Aristida junciformis subsp. galpinii (d), Diheteropogon filifolius (d), Eragrostis plana (d), Hyparrhenia hirta (d), Sporobolus africanus (d), Themeda triandra (d), Tristachya leucothrix (d), Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Brachiaria serrata, Cymbopogon caesius, C. nardus, Digitaria diagonalis, D. tricholaenoides, Diheteropogon amplectens, Elionurus muticus, Eragrostis capensis, E. curvula, E. racemosa, Eulalia villosa, Harpochloa falx, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Panicum aequinerve, P ecklonii, P natalense, Paspalum dilataturn, P scrobiculaturn, P urvillei, Setaria nigrirostris, S. sphacelata, Sporobolus centrifugus, Trachypogon spicatus. Herbs: Acalypha glandulifolia Acanthospermum australe, Berkheya rhapontica subsp.

					aristosa, B. setifera, Commelina africana, Conyza pinnata, Eriosema salignurn, Helichrysum cephaloideum, H. simillimum, Indigastrum fastigiatum, Kohautia amatymbica, Nidorella auriculata, Pentanisia prunelloides subsp. latifolia, Sebaea sedoides var. schoenlandii, Spermacoce natalensis, Thunbergia atriplicifolia, Vemonia dregeana, V natalensis, Wahlenbergia undulata. Herbaceous Climber: Vigna nervosa. Geophytic Herbs: Pteridium aquilinum (d), Corycium nigrescens, Drimia macrocentra, Eriospermum ornithogaloides, Gladiolus ecklonii, Habenaria dives, H. dregeana, Hypoxis multiceps, H. rigidula var. pilosissima, Rhodohypoxis baurii var. baurii, R. baurii var. platypetala, Satyrium longicauda.

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Low Shrubs: *Helichrysum sutherlandii, Leonotis ocymifolia, Otholobium caffrum* **Biogeographically Important Taxa** (both Southern distribution limit) Herb: *Anisopappus smutsi*i. Succulent Herb*: Aloe kniphofioides*. **Endemic Taxa** Herbs: *Acalypha entumenica, Selago longiflora.* Geophytic Herbs*: Asclepias woodli, Albuca xanthocodon, Dierama luteoalbidum, Kniphofia latifolia, Pachycarpus rostratus, Watsonia canaliculata*. Low Shrubs*: Helichrysum citricephalum, Syncolostemon latidens.* Conservation Endangered (one of the most threatened vegetation types of KwaZulu-Natal). Target 23%. Only a small fraction (about 0.5%) statutorily conserved in number of reserves such as Ngeli, Impendle, Blinkwater, Qudeni, Doreen Clark, Karkloof and Queen Elizabeth Park—still heavily underrepresented in conservation plans (see also analysis of 'Natal Mistbelt' by Scott-Shaw et al. (1996). More than half already transformed for plantations, cultivated land or by urban sprawl. Uncontrolled fires and poorly regulated grazing by livestock add to threats to *this unique grassland*. Some aliens (including *Solanum mauritianum*, species of *Rubus, Acacia, Pinus* and *Eucalyptus*) are of concern in places. Erosion is very low (68%) and low (24%). **Remark 1** As pointed out by Camp (1999a), the difference between BRG 5 (Moist Midlands Mistbelt) and BRG 6 (Dry Midlands Mistbelt) lies basically in precipitation: the latter occurring in regions receiving between 738-825 mm, while the former receives more than 800 mm on average per year as a rule. Both BRGs are considered by Camp (1999a) as different moisture phases of the same vegetation type. The consideration of 800 mm is very informative from the point of view of

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					moisture status of soils and might also be of agricultural importance. However, the lack of striking differences in vegetation patterns does not justify separation of the BRGs as distinct vegetation units. Extensive patches of the Eastern Mistbelt Forests in KwaZulu-Natal and Transkei Mistbelt Forests in the Eastern Cape (for the concepts see Von Maltitz et al. 2003) are embedded within the region of the Midlands Mistbelt. **Remark 2** The Mistbelt of KwaZulu-Natal is an important, although still not a formally recognised, centre of endemism (see Van Wyk & Smith 2001).

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
Granite Lowveld	250-700m	Tall shrubland with few trees to moderately dense low woodland on the deep sandy uplands with *Terminalia sericea, Combretum zeyheri* and C. *apiculatum* and ground layer including *Pogonarthria squarrosa, Tricholaena monachne* and *Eragrostis rigidior*. Dense thicket to open savanna in the bottomlands with Acacia *nigrescens, Dichrostachys cinerea, Grewia bicolor* in the woody layer. The dense herbaceous layer contains the dominant *Digitaria eriantha, Panicum maximum* and *Aristida congesta* on fine-textured soils, while brackish bottomlands support *Sporobolus nitens, Urochloa mosambicensis* and *Chloris virgata*. At seep lines, where convex topography changes to concave, a dense fringe of *Terminalia sericea* occurs, with *Eragrostis gummiflua* in the undergrowth	From north to south, the Swazian Goudplaats Gneiss, Makhutswi Gneiss and Nelspruit Suite (granite gneiss and migmatite), and further south still, the younger Mpuluzi Granite (Randian) form the major basement geology of the area Archaean granite and gneiss weather into sandy soils in the uplands and clayey soils with high sodium content in the lowlands	Summer rainfall with dry winters. MAP from about 450 mm on the eastern flats to about 900 mm near the escarpment in the west. In a north-south direction, MAP of the unit appears to peak in Swaziland. Generally a frost-free region. Mean monthly maximum and minimum temperatures for Skukuza 39.5°C and —0.1°C for January and June, respectively. Corresponding values for Hoedspruit 38.0°C and 3.7°C for January and July, respectively. See also climate diagram for SVI 3 Granite Lowveld	**Important Taxa** Tall Trees: *Acacia nigrescens* (d), Scierocarya *birrea* subsp. *caffra* (d). Small Trees: *Acacia nilotica* (d), *Albizia harveyi* (d), *Combretum apiculaturn* (d), C. *imberbe* (d), C. *zeyheri* (d), *Ficus stuhlmannii* (d), *Peltophorum africanum* (d), *Pterocarpus rotundifolius* (d), *Terminalia sericea* (d), *Acacia exuvialis, A. gerrardii, Bolusanthus speciosus, Cassia abbreviata* subsp. *beareana, Combretum collinum* subsp. *suluense, Dalbergia melanoxylon, Gymnosporia glaucophylla, Lannea schweinfurthii* var. *stuhlmannii, Pavetta schumanniana, Plectroniella armata, Terminalia prunioides.* Tall Shrubs: *Combretum hereroense* (d), *Dichrostachys cinerea* (d), *Euclea divinorum* (d), *Strychnos madagascariensis* (d), *Gardenia volkensii, Hibiscus micranthus, Tephrosia polystachya.* Low Shrubs: *Abutilon austro-africanum, Agathisanthemum bojeri, Aptosimum lineare, Barleria elegans, Clerodendrum tematurn, Commiphora africana, Gossypium herbaceum* subsp. *africanum, Pavonia burchellii.* Woody Climber: *Sphedamnocarpus pruriens* subsp. *pruriens.* Herbaceous Climber: *Rhynchosia totta.* Graminoids: *Brachiaria nigropedata* (d), *Digitaria eriantha* subsp. *eriantha* (d), *Eragrostis rigidior* (d), *Melinis repens* (d), *Panicum maximum* (d), *Pogonarthria squarrosa* (d),

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Aristida congesta, Bulbostylis hispidula, Chlons mossambicensis, Enneapogon cenchroides, Heteropogon contortus, Leptochloa eleusine, Perotis patens, Schmidtia pappophoroides, Sehima galpinii, Tricholaena monachne, Urochloa mosambicensis. *Herbs: Achyranthes aspera, Aspilia mossambicensis, Becium filamentosum, Chamaecrista absus, Commelina benghalensis, C. erecta, Cucumis africanus, Evolvulus alsinoides, Heliotropium strigosum, Hermbstaedtia odorata, Hibiscus praeteritus, Indigofera filipes, I. sanguinea, Kohautia virgata, Kyphocarpa angustifolia, Leucas glabrata, Ocimum gratissimum, Phyllanthus maderaspatensis, Pupalia lappacea, Dahlia capensis subsp. vulgaris, Waltheria indica.* Succulent Herbs*: Orbea rogersii, Stapelia leendertziae.* **Conservation** Vulnerable. Target 19%. Some 17% statutorily conserved in the Kruger National Park. About the same amount conserved in private reserves mainly the Selati, Klaserie, Tirnbavati, Mala Mala, Sabi Sand and Manyeleti Reserves. More than 20% already transformed, mainly by cultivation and by settlement development. Erosion is Wry low to moderate. **Remark** Further research may reveal a need to differentiate the northern from the southern parts of this unit. - (d), *Lopholaena platyphylla.* Succulent Shrub: *Crassula caulis.* Graminoids: *Heteropogon contortus* (d), *Hyperthelia soluta* (d), *Loudetia simplex* (d), *Monocymbium ceresiifom,* (d), *Panicum natalense* (d), *Themeda triandra* (d), *Trachypog spicatus* (d), *Bothriochloa insculpta, Diheteropogon ampy,n tens, Melinis nerviglumis, Pogonarthria squarrosa,* Sporobolus *pectinatus.* Herbs: *Anisopappus smutsii* (d), *Xerophyta n-t*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Vegetation and Landscape Features	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					nervis. Succulent Herb: *Aloe cooperi* subsp. *cooperi.* *Succulpii* Herbaceous Climber: *Ceropegia sandersonii.* **Biogeographically Important Taxa** Low Escarpment endemic, Northern sourveld endemic) Small Tree: *Protea* com,p*tonii.* Tall Shrub: *Tricalysia capensis* var. *galpinii* (d). Low schub: *Hemizygia macrophylla.* Succulent Shrub: *Aloe suprafoliata.* (d). Herbs: *Melanospermum italae, Thomcroftia Longiflora* Geophytic Herb: *Gladiolus vernus.* **Endemic Taxa** Tall Shrub: *Euclea natalensis* subsp. *Magutensis* Succulent Shrub: *Aloe dewetii.* Graminoid: *Danthoniopsis scopulorum.* Geophytic Herb: *Gladiolus scabridus* **Conservation** Least threatened. The target of 27% has not been reached. A total of 10% of this unit is protected within the Ithala Game Reserve. Land use pressures on this unit are low probably because of its low nutrient status and rocky nature Approximately 5% is under plantations and a further 5% has, been transformed into cultivated land. Soil erosion potential is low. **Remarks** This naturally fragmented vegetation unit is characterised by its rocky and nutrientpoor soils which support a unique assemblage of plant species. It shares some species with the nutrient-poor soils of the Northern Escarpment (e.g. *Syzgium legatii)* and Barberton areas (e.g. *Thorncroftia longiflora, Protea comptonii).* These latter units have a higher MAP

Scarp Forest	50-600m	Tall (15-25 m), species-rich and structurally diverse, multilayered forests, with well-developed canopy and understorey tree layers, but a poorly developed herb layer. Buttressed stems are common in the Scarp Forest. The most conspicuous trees are *Buxus macowanii, B. natalensis, Drypetes gerrardii, Englerophytum natalense,*	Natal Sandstone outcrops (Msikaba Group Sandstones in Pondoland) as well ,as syenitic granite, rhyolite of the Jozini Formation of the Lebombo Group (Karoo Supergroup) and other Karoo sedimentary rocks; supporting nutrient poor, leached and shallow soils		**Important Taxa** Tall Trees: *Buxus natalensis* (d), *Drypetes gerrardii* (d), *Englerophytum natalense* (d), *Harpephyllum caffrum* (d), *Heywoodia lucens* (d), *Rothmannia globosa* (d), *Commiphora harveyi*, C *woodii, Drypetes arguta, Manilkara discolor, Nectaropetalum capense, Nuxia congesta,*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Olinia emarginata, Ptaeroxylon obliquum, Pterocelastrus tricuspidatus, Vitellariopsis marginata. Small Trees: *Buxus macowanii* (d), *Rinorea angustifolia* (d), *Dombeya cymosa, Encephalartos natalensis, E. villosus, Ochna natalitia, Strychnos henningsii, S. mitis.* Herbaceous Climbers: *Flagellaria guineensis, Thunbergia alata.* Tall Shrubs: *Memecylon natalense* (d), *Eugenia natalitia*. Low Shrub: *Stangeria eriopus.* Soft Shrub: *Piper capense.* Herbs: *Begonia dregei, B. homonyma, Streptocarpus grandis, S. johannis.* Geophytic Herb: *Clivia miniata.* **Biogeographically Important Taxon** Tall Shrub: *Pseudoscolopia polyantha* (disjunct populations also in Capensis in AZa 1 Fynbos Riparian Vegetation). **Endemic Taxa** Tall Trees: *Millettia grandis* (d), *Oricia bachmannii* (d), *Philenoptera sutherlandii* (d), *Umtiza listeriana* (d), *Celtis mildbraedii, Colubrina nicholsonii, Cryptocarya myrtifolia, C. wyliei, Dahlgrenodendron natalense, Jubaeopsis caffra, Manilkara nicholsonii, Maytenus oleosa, Pseudosalacia streyi, Rinorea domatiosa.* Small Trees: *Alberta magna, Albizia suluensis, Apodytes abbottii, Canthium vanwykii, Encephalartos woodii* (extinct in the wild), *Gerrardanthus tomentosus, Rhynchocalyx lawsonioides, Tarchonanthus trilobus* var. *trilobus.* Woody Climber: *Podranea ricasoliana* (d). Epiphytic Herb: *Bolusiella maudiae.* Epiphytic Shrub: *Dermatobotrys saundersii. Epiphytic*

					Parasitic Shrubs: *Actinanthella wyliei, Helixanthera woodii.* Tall Shrubs: *Eugenia simii, E. verdoorniae, Gymnosporia bachmannii, Justicia bolusii, J. petiolaris subsp. bowiei, Oxyanthus pyriformis, Putterlickia retrospinosa*. Soft Shrubs*: Heterosamara galpinii, Metarungia galpinii.* Herbs*: Impatiens flanaganiae, Plectranthus oribiensis, P praetermissus, Streptocarpus fasciatus, S. kentaniensis, S. lupatanus, S. porphyrostachys, S. primulifolius subsp. formosus.* Geophytic Herbs: *Clivia robusta (d), C. gardenii.* Succulent Herbs*: Plectranthus emstii, P hilliardiae subsp. australis, P hilliardiae subsp. hilliardiae, P oertendahlii, P saccatus var. longitubus.* **Conservation** Least threatened in protected areas, but exposed to over-exploitation elsewhere. Target 40%. More than 20% statutorily conserved in Umtiza and Manubi Nature Reserves, Dwesa-Cwebe Wildlife Reserve & Marine Sanctuary, Hluleka, Mount Thesiger, Umkambati, Umtamvuna, Oribi Gorge, Vernon Crookes, Krantzkloof, Nkandla, Ongoye, Dlinza, Entumeni, Ghost Mountain and Hlatikulu (Gwalinweni) Nature Reserves as well as in Hluhluwe-iMfolozi Park. Still most of the approximately 70 smaller scarp forests between Durban and Umtamvuna are not protected. Proclamation of the planned Pondoland National Park is expected to improve the conservation status of these unique forests along the Wild Coast. Smaller patches of the northern scarp forests are protected in the Barberton area, in southern Kruger National Park and in some Swaziland nature reserves. Almost 5% has been transformed for cultivation or plantations. Aliens such as *Chromolaena odorata, Solanum mauritianum, Melia*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					azedarach, *Lantana camara* and *Litsea sebifera* are of concern locally. Collapse of traditional authorities in both Eastern Cape (especially in Transkei and in KwaZulu) has led to uncontrolled use of forests formerly protected under the authority of headmen and chiefs. Bark stripping, muthi collection, deadwood extraction, and land claims may become other major sources of threat to the existence of some forest patches (Von Maltitz et al. 2003). *Dahlgrenodendron natalense* and *Metarungia galpinii* are listed as endangered. *Encephalartos ngoyanus*, *Eugenia simii*, *Jubaeopsis caffra* and *Rhynchocalyx lawsonioides* are vulnerable. *Encephalartos woodii* (formerly found only in the Ongoye Forest) is extinct in the wild, and survives in about five individuals in various living botanical collections. **Remarks** Biogeographically (and from the point of view of biodiversity) this is probably the most valuable forest in South Africa housing many endemic species, six endemic genera and one endemic family (Rhynchocalycaceae) of trees and relict occurrences of small populations of *Encephalartos*, suggesting that this vegetation unit is biogeographically ancient. The endemism in the herbaceous understorey is also high, particularly in the genera *Plectranthus* and *Streptocarpus*. The Pondoland Scarp Forest is a core vegetation unit of the Pondoland Centre of Endemism as defined by Van Wyk & Smith (2001).

Delagoa Lowveld	150-450m	Dense tree or tall shrub layer dominated by *Acacia welwitschii*, often forming thickets. Herb layer has in addition to grass species a wide variety of forms. Areas are often heavily grazed which sometimes drastically reduces the grass cover	Karoo Supergroup shale and lesser sandstone layers are punctuated by sheets and dykes of Jurassic dolerite. Soils (Sterkspruit, Swartland and Estcourt soil forms) are rich in sodium and very susceptible to erosion. Land types include Dc and Ea.	Summer rainfall with dry winters. MAP about 450-850 mm. Generally a frost-free region. See also climate diagram for SVI 4 Delagoa Lowveld	**Important Taxa** Small Trees: *Acacia senegal* var. *rostrata* (d), *A. welwitschii subsp. delagoensis* (d), *Albizia petersiana* (d), *Schotia capitata* (d), *Spirostachys africana* (d), *Pappea capensis.* Tall Shrubs: *Euclea divinorum* (d), *Maerua parvifolia (d), Boscia mossambicensis, Dichrostachys cinerea, Ehretia rigida* subsp. *rigida, Flueggea virosa, Grewia bicolor, Rhus gueinzii.* Low Shrubs: *Abutilon austro*a *fricanurn,*

Vegetation unit	**Altitudinal Range**	**Vegetation and Landscape Features**	**Geology and Soils**	**Climate**	**Endemic taxa / Biogeographically important taxa / Remarks**
					lusticia flava, Zanthoxylum humile. Woody Climbers: *Cordia ovalis* (d), *Capparis tomentosa.* Graminoids: *Chloris virgata* (d), *Panicum coloratum* (d), *P maximum* (d), *Sporobolus nitens* (d), *Aristida congesta, Chloris roxburghiana, Dactyloctenium aegyptium, Tragus berteronianus.* Herbs: *Blepharis integrifolia, Kyphocarpa angustifolia, Ruellia patula.* Succulent Herb: *Aloe parvibracteata* **Conservation** Vulnerable. Target 19%. About 18% statutorily conserved in the Kruger National Park. Some 33% transformed, almost all by cultivation.

Ngongoni Veld	400-900m	Dense, tall grassland overwhelmingly dominated by unpalatable, wiry Ngongoni grass *(Aristida junciformis)*, with this monodominance associated with low species diversity. Wooded areas (thornveld) are found in valleys at lower altitudes, where this vegetation unit grades into SVs 3 KwaZulu-Natal Hinterland Thornveld and SVs 7 Bhisho Thornveld. Termitaria support bush clumps with *Acacia* species, *Cussonia spicata, Ziziphus mucronata, Coddia rudis, Ehretia rigida* etc.	Acid, leached, heavy soils are derived from Karoo Supergroup sediments (including significant Dwyka tillites) and intrusive Karoo dolerites. Also Glenrosa and Mispah soils occur. Land types Fa, Ab, Ac and Aa.	Summer rainfall with some rain in winter. MAP about 700-1100mm. Some valleys are sheltered and may show weak rainshadow effects. Frost infrequent, occurring mainly where cold air becomes trapped in valleys. Mean monthly maximum and minimum temperatures for Melmoth 37.0°C and 4.9°C for October and July, respectively. Corresponding values for New Hanover 38.2°C and —0.2°C for January and June, respectively. See also climate diagram for SVs 4 Ngongoni Veld	**Important Taxa** Small Trees: *Acacia natalitia, A. nilotica, A. sieberiana* var. *woodii.* Low Shrubs: *Agathisanthemum bojeri, Euryops laxus, Gnidia anthylloides.* Graminoids: *Aristida junciformis* subsp. *junciformis* (d), *Bothriochloa insculpta, Eragrostis curvula, Hyparrhenia hirta, Panicum maximum, Paspalum scrobiculatum, Sporobolus africanus, S. pyramidalis, Themeda triandra.* Herbs: *Chamaecrista mimosoides, Conostomium natalense, Gerbera ambigua, Helichrysum allioides, Hermannia grandistipula, Pentanisiaprunelloides, Selago tarachodes, Senecio exuberans, Vernonia galpinii.* Geophytic Herbs: *Hypoxis argentea, Watsonia densiflora.* Succulent Herb: *Aloe minima.* Conservation Vulnerable. Target 25%. Only less than 1% of the unit is statutorily conserved in the Ophathe and Vernon Crookes Nature Reserves. Some 39% has been transformed for cultivation, plantations and urban development. **Remarks** Within KwaZulu-Natal, this vegetation unit comprises mainly Camp's (1999a) BRG 3and BRG 4, representing wet and dry forms of Ngongoni veld, respectively. His distinction is based on MAP of 800 mm, which is assumed to have significant agricultural importance (see Camp 2001). Major floristic differences have yet

Vegetation unit	**Altitudinal Range**	**Vegetation and Landscape Features**	**Geology and Soils**	**Climate**	**Endemic taxa / Biogeographically important taxa / Remarks**
					to be shown. Camp (19.99a), in accordance with Acocks (1953), considers the Ngongoni Veld to be secondary.
Northern KwaZulu-Natal Moist Grassland	1 040 - 1 440m.	Hilly and rolling landscapes supporting tall tussock grassland usually dominated by Themeda triandra and Hyparrhenia hirta. Open Acacia sieberiana var. woodii savannoid woodlands encroach up the valleys, usually on disturbed (strongly eroded) sites.	Mudstones, sandstones and shales of the Beaufort and Ecca Groups of the Karoo Supergroup predominate and are intruded by dolerites of Jurassic age. Land types Bb, Ac, Fa and Ca.	Summer rainfall, with overall MAP of 840mm (710- 1 120 mm; Camp 1999a), mainly as summer thunderstorms. Mist occurs frequently on hilltops in spring and early summer but summe droughts are also frequent. Summers are warm to hot, with maximum temperature recorded in the hottest month of January (Bergville MAT 27.8°C). MAT is around 16°C, but some localities may reach	**Biogeographically Important Taxa** (both Low Escarpment endemics) Succulent Herb: *Aloe modesta*. Low Shrub: *Bowkeria citrina*.

				17°C. Frosts are severe and occur about 20 days per year. Mean annual evaporation recorded at Bergville is 1 895mm. See also climate diagram for Gs 4 Northern KwaZulu-Natal Moist Grassland.	
Northern Zululand Sourveld	450-900m	The dominant structural vegetation type is wooded grassland, in places pure sour grasslands and rarely also dense bushveld thickets. Terrain is mainly low, undulating mountains, sometimes highly dissected, and also some moderately undulating plains and hills	*Well-drained and shallow soil forms (Glenrosa and Mispah forms) derived from various lithologies; predominantly, Dwyka Group diamictites, but also shale, siltstone and sandstone from the Madzaringwe and Pietermaritzburg Formations, all of the Karoo Supergroup. Archaean granite and gneiss are also significant. Land types mainly Fb and Fa, with some Ac*	Summer rainfall with a little rain in winter. MAP about 600-1 050 mm reaching a maximum, for example, in the region northwest of Nongoma, towards the mistbelt Ngome Forest. Frost very infrequent to occasional. See also climate diagram for SVI 22 Northern Zululand Sourveld	**Important Taxa** Small Trees: *Acacia sieberiana* var. *woodii (d),* A. *natalitia, A. nilotica, A. tortilis* subsp. *heteracantha, Plectroniella armata.* Tall Shrubs: *Gardenia volkensii, Gnidia caffra, G. kraussiana.* Low Shrubs: *Agathisanthemum bojeri, Chaetacanthus burchellii, Crossandra fruticulosa,* C. *greenstockii, Diospyros galpinii, Phyllanthus glaucophyllus, RueIlia cordata, Syncolostemon argenteus, Tetraselago natalensis.* Succulent Shrub: *Aloe vanbalenii.* Woody Climber: *Cryptolepis oblongifolia.* Herbaceous Climber: *Cyphostemma schlechteri.* Graminoids: *Eragrostis curvula* (d), *Hyparrhenia hirta* (d), *Microchloa caffra* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Alloteropsis semialata* subsp. *semialata, Digitaria argyrograpta, D. tricholaenoides, Diheteropogon amplectens, Elionurus muticus, Loudetia simplex, Trachypogon spicatus.* Herbs: *Alepidea longifolia, Argyrolobium*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					adscendens, Aster bakerianus, Berkheya speciosa, Chascanum hederaceum, Crabbea hirsuta, Gazania krebsiana subsp. *serrulata, Gerbera ambigua, Helichrysum mixtum, H. nudifolium* var. *pilosellum, Hemizygia pretoriae* subsp. *pretoriae, Hermanni grandistipula, Hypericum aethiopicum Lichtensteinia interrupts, Pimpinella caffra, Senecio glaberrimus, S. latifolius, Stachys nigricans, Vernonia galpinii, V oligocephala.* *Geophytic Herbs: Hypoxis hemerocallidea,* *Pachycarpus concolor*. Succulent Herbs: *Aloe minima, A. parvibracteata, Senecio oxyriifolius.* Geoxylic suffrutex: *Salacia kraussii.* **Conservation** Vulnerable. Target 19%. Only 4% statutorily conserved, mainly in the Hluhluwe iMfolozi Park and Ithala Game Reserve. Some 22% already transformed, mainly by cultivation and plantations. Erosion is generally moderate to high. **Remark** Northern Zululand Sourveld can be seen as a northern extension of the SVs 4 Ngongoni Veld
Paulpietersbrg Moist Grassland	920- 1500m	Mainly undulating with moderately steep slopes, but valley basins are wide and flat and mountainous areas occur mostly along the northern and eastern boundary. Tall closed grassland rich in forbs and dominated by *Tristachya leucothrix, Themeda triandra* and *Hyparrhenia hirta*. Evergreen woody vegetation is characteristic on rocky outcrops	This area is underlain by Archaean granite and gneiss partly covered by Karoo Supergroup sediments (Madzaringwe Formation) and intruded by Karoo Dolerite Suite dykes and sills. Dominant soils on the sedimentary parent material are yellow apedal, well drained, with a depth of >800 mm and a clay content of >35%, representing the soil series: Hutton, Clovelly and Griffin. Shortlands soils are dominant on dolerite. Dominant land type Ac, with Fa and Ba of	Summer rainfall, with MAP 900 mm. Warm-temperate climate, MAT close to 17°C, with fairly frequent frosts. See also climate diagram for Gm 15 Paulpietersburg Moist Grassland (Figure 8.36)	**Important Taxa** Graminoids: *Alloteropsis semialata* subsp. *eckloniana* (d), *Andropogon schirensis* (d), *Brachiaria serrata* (d), *Ctenium concinnum* (d), *Cymbopogon caesius* (d), *Digitaria tricholaenoides* (d), *Eragrostis racemosa* (d), *Harpochloa falx* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Loudetia simplex* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Rendlia altera* (d), *Setaria nigrirostris* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Andropogon appendiculatus, Cynodon hirsutus, Diheteropogon amplectens, D. filifolius, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, Festuca scabra, Melinis nerviglumis, Panicum ecklonii, P natalense, Trachypogon spicatus, Urelytrum agropyroides.* Herbs: *Argyrolobium speciosum* (d), *Cissus diversilobata* (d), *Dicoma zeyheri* (d), *Eriosema kraussianum* (d), *Geranium wakkerstroomianum*

			subordinate importance		

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					(d), Helichrysum nudifolium var. nudifolium (d), Ipomoea oblongata (d), Pelargonium luridum (d), Acalypha glandulifolia, A. peduncularis, Acanthospermum australe, Aster bakerianus, Becium filamentosum, Berkheya setifera, Dicoma anomala, Euryops laxus, E. transvaalensis subsp. setilobus, E. transvaalensis subsp. transvaalensis, Helichrysum rugulosum, H. simillimum, lndigofera hilaris var. hilaris, L velutina, Kohautia amatymbica, Pearsonia grandifolia, Pentanisia prunelloides subsp. latifolia, Senecio bupleuroides, S. coronatus, S. inornatus, S. isatideus, S. latifolius, Sonchus nanus, Thunbergia atriplicifolia, Vernonia capensis, V natalensis, Xerophyta retinervis. Herbaceous Climber: *Rhynchosia totta*. Geophytic Herbs: *Chlorophytum haygarthii* (d), *Gladiolus aurantiacus* (d), *Agapanthus inapertus* subsp. *intermedius, Asclepias aurea, Cheilanthes hirta, Cyrtanthus tuckii* var. *transvaalensis, Hypoxis colchicifolia, H. costata, H. rigidula* var. *pilosissima, Moraea brevistyla, Pteridium aquilinum, Watsonia latifolia, Zantedeschia rehmannii.* Succulent Herbs: *Aloe ecklonis, A. maculata, Lopholaena segmentata.* Small Trees: *Canthium ciliatum* (d), *Dombeya rotundifolia, Vangueria infausta.* Succulent Tree: *Aloe marlothii* subsp. *marlothii.* Tall Shrubs: *Calpurnia sericea* (d), *Rhus rehmanniana* (d), *Diospyros lycioides* subsp. *guerkei, Euclea crispa* subsp. *crispa.* Low Shrubs: *Rhus discolor* (d), *Anthospermum rigidum* subsp. *pumilum, A. rigidum* subsp. *rigidum, Clutia monticola, Diospyros galpinii, Erica oatesii, E. woodii, Hermannia geniculata, Indigofera arrecta, Otholobium wilmsii, Polygala uncinata,*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Pseudarthria hookeri, Rubus rigidus. Succulent Shrub: *Euphorbia pulvinata* **Biogeographically Important Taxa** (all Low Escarpment endemics) Succulent Herb: *Aloe modesta.* Low Shrubs: *Bowkeria citrina, Hemizygia macrophylla, Lotononis amajubica.* **Endemic Taxon** Succulent Shrub: *Aloe reitzii* var. *vernalis*. **Conservation** Vulnerable. Target 24%. Only very small portion statutorily conserved in Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. Some private reserves protect small patches (Rooikraal, Mhlongamvula, Kombewaria). About one third already transformed by plantations or cultivated land. Heavy livestock grazing and altered fire regimes have greatly reduced the area of grasslands of high conservation value. Aliens such as species of *Acacia, Eucalyptus* and *Pinus* are of major concern in places. Erosion very low (80%) or low (13%)
Northern Zululand Misbelt Grassland	Zululand Misbelt Grassland 780- 1540m	Gentle to steep upper slopes of mountains formed by hard dolerite dykes dominated by relatively forbrich, tall sour *Themeda triandra* grasslands	Shales and sandstones of the Madzaringwe and Pietermaritzburg Formations (both Karoo Supergroup) as well as intrusive rocks of the Karoo Dolerite Suite. Dominant soil forms are Hutton, Clovelly and Griffin and are well drained, having 15-35% clay in the A-horizon. Dominant land type Ac, followed in importance by Fa and Ab	Summer rainfall, with overall MAP around 960 mm, reaching 1 130 mm in places. Moisture-laden air frequently blows in from the southeast and is forced up 400- 500 m over the mountains, creating 'mistbelt' conditions (particularly in spring and summer) that contribute to precipitation. MAT is 17.2°C (16- 17.4°C) and mean annual range of evaporation is close to 1 790 mm. See also climate diagram for Gs 1 Northern Zululand Mistbelt Grassland (Figure 8.61)	**Important Taxa** Graminoids: *Themeda triandra* (d), *Tristachya leucothrix* (d), *Alloteropsis semialata* subsp. *eckloniana, Andropogon schirensis, Aristida monticola, Brachiaria serrata, Cymbopogon nardus, Cyperus albostriatus, Ehrharta erecta* var. *erecta, Elionurus muticus, Eragrostis plana, E. racemosa, Hyparrhenia hirta, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Panicum deustum, Paspalum scrobiculatum, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Sporobolus africanus, Trachypogon spicatus.* Herbs: *Aeschynomene micrantha, Conostomium natalense, Helichrysum chionosphaerum, H. nanum, H. nudifolium* var. *oxyphyllum, H. nudifolium* var. *pilosellum, H. umbraculigerum, Hermannia grandistipula.* Geophytic Herbs: *Cheilanthes hirta, Oxalis*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					smithiana, Watsonia latifolia. Small Tree: *Apodytes dimidiata* subsp. *dimidiata.* Low Shrubs: *Asparagus virgatus, Clutia pulchella.* Succulent Shrub: *Aloe arborescens* **Biogeographically Important Taxon** (Low Escarpment endemic) Herb*: Melanospermum italae.* **Endemic Taxa** Herbs: *Dracosciadium italae, Helichrysum ingomense, Selago barbula.* Geophytic Herbs: *Brachystelma ngomense, Dierama erectum, Schizoglossum ingomense.* **Conservation** Vulnerable. Target 23%. Only about 3% statutorily conserved in the Ithala Game Reserve and in the Ntendeka Wilderness Area of the Ngome State Forest (Scott-Shaw et al. 1996, Scott-Shaw 1999). Some 22% has been transformed for plantations or cultivated land. Threats to the remaining grasslands are heavy selective grazing by livestock and extensive annual burning. Spread of alien *Acacia meamsii* and *Eucalyptus* species is of serious concern. Erosion very low (47%), moderate (29%), low (14%) and high (10%)
Southern Lebombo Bushveld	100-600m	Open Bushveld with dominant *Acacia* and *Combretum* species. *Themeda triandra* is the dominant grass on undisturbed sites. On very shallow soils (e.g. slopes of deep gorges or exposed ridges) with *Aloe marlothii, Euphorbia confinalis* and thickets of 0/ea *europaea* subsp. *africana and Combretum woodii.* Dry slopes may be dominated by *4ndrostachys johnsonii* in the northern parts	Shallow lithosols developing over rhyolites of the Jozini Formation, Lebombo Group (Karoo). Soils shallow Glenrosa and Mispah forms. Land types are unclassified in Swaziland and in South Africa the dominant land type is Fb	Shallow lithosols developing over rhyolites of the Jozini Formation, Lebombo Group (Karoo). Soils shallow Glenrosa and Mispah forms. Land types are unclassified in Swaziland and in South Africa the dominant land type is Fb	**Important Taxa** Tall Trees: *Acacia burkei* (Lebombo form), *A. nigrescens.* Small Trees: *Acacia davyi, A. gerrardii, Atalaya alata, Bridelia cathartica, Combretum apiculaturn,* C *molle, Commiphora harveyi, Croton gratissimus, Encephalartos lebomboensis, Erythroxylum emarginatum, Manilkara concolor, Peltophorum africanum, Pterocarpus rotundifolius, Strychnos gerrardii, Teclea gerrardii, Turraea floribunda, Vepris reflexa, Vitex obovata* subsp. *obovata.* Succulent Trees: *Euphorbia confinalis* (d), *Aloe marlothii* subsp. *marlothii, Euphorbia cooperi, E. tirucalli.* Tall Shrubs: *Diospyros dichrophylla* (d), *Cassipourea mossambicensis, Coptosperma supraaxillare, Dichrostachys cinerea, Euclea schimperi,* *Galpinia transvaalica, Hibiscus micranthus,*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Karomia speciosa, Maerua rosmarinoides, Olax dissitiflora, Olea europaea subsp. africana, Pouzolzia mixta, Rhus gueinzii. Low Shrubs: Barleria saxatilis, Jatropha variifolia, Mundulea sericea, Polygala producta. Succulent Shrubs: Aloe spicata (d), A. vanbalenii (d), A. chabaudii, Euphorbia knuthii subsp. knuthii. Soft Shrub: Metarungia longistrobus. Woody Climbers: Asparagus buchananii, Cissus quadrangularis, Combretum woodii, Pristimera longipetiolata, Sphedamnocarpus pruriens subsp. pruriens. Herbaceous Climber: Coccinia rehmannii. Graminoids: Brachiaria xantholeuca, Digitaria eriantha subsp. eriantha, Enneapogon cenchroides, Panicum deustum, P maximum, Themeda triandra, Trachypogon spicatus. Herbs: Hibiscus meyeri subsp. meyeri, H. pedunculatus, Pupalia lappacea Geophytic Herbs: Cheilanthes hirta, Gladiolus hollandii, Pellaea calomelanos, Sansevieria hyacinthoides. Succulent Herbs: Aloe parvibracteata, Stapelia unicornis. Epiphytic Geophytic Herb: Acampe pachyglossa. Epiphytic Succulent Herb: Ansellia africana. Biogeographically Important Taxa (Northern KwaZulu-Natal endemic, Lebombo endemic) Geophytic Herb: Pachycarpus lebomboensis. Succulent Herb: Gasteria batesiana var. batesiana Endemic Taxa Small Trees: Encephalartos aplanatus, E. senticosus. Succulent Tree: Euphorbia keithii. Epiphytic Geophytic Herb: Polystachya zuluensis. Conservation Least threatened. Target 24%. Some 10% statutorily conserved in the Mlawula Nature Reserve, Greater St Lucia Wetland Park, Mananga Cycad Colony as well as in the Ubombo Mountain and

					Phongolapoort Nature Reserves. A further 1%

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Geology and Soils	Endemic taxa / Biogeographically important taxa / Remarks
					is conserved in the private Masibekela Wetland. About 9% of the area has been transformed, mainly by cultivation. **Remarks** Some of the prehistory of mankind has been revealed in the Lebombo Mountains. The border cave is the site of one of the world's earliest records of *Homo sapiens* (100 000-200 000 BP). This unit is part of the Maputaland CE
Southern Mistbelt Forest	850- 1600m	On the Great Escarpment (Amathole, Transkei Escarpment) and in the KwaZulu-Natal Midlands these forests are tall (15-20 m tall) and multilayered (having two layers of trees, a dense shrubby and understorey and a well developed herb layer). The forests found on low-altitude scarp are low (in places having th character of a scrub forest), and although less structured into different tree layers, the are still species-rich. The tall forests show a mix of coarse-grained, canopy gap/disturbance-driven dynamics and fine-grained, regeneration characteristics. The Amathole mist belt forests are dominated by emergent trees of *Afrocarpus falcatus* and a range of deciduous and semi-deciduous species such as *Celtis africana, Calodendrum capense, Vepris* lanceo*lata* and *Zanthoxylum davyi.* Further east (Transkei, KwaZulu Natal Midlands) *Podocarpus henkelii* becomes prominent in the canopy layer. Deciduous elements play an important role	Some of the soils are deep, loamy and with high nutrient status, developed on weathered dolerite intrusions or mudstones, shales and sandstones of the Karoo Supergroup (on Great Escarpment). The soils supporting forests of low-lying scarps are shallower as they developed on quartzitic Witteberg Sandstones or sandstones of the Karoo Supergroup		**Important Taxa** Tall Trees: *Afrocarpus falcatus* (d), *Apodytes dimidiata* subsp. *dimidiata* (d), *Celtis africana* (d), *Chionanthus foveolatus* subsp. *foveolatus* (d), *C. peglerae* (d), *Cunonia capensis* (d), *Curtisia dentata* (d), *Kiggelaria africana* (d), *Olea capensis* subsp. *macrocarpa* (d), *Podocarpus henkelii* (d), *P latifolius* (d), *Protorhus longifolia* (d), *Ptaeroxylon obliquum* (d), *Rapanea melanophloeos* (d), *Rhus chirindensis* (d), *Scolopia mundii* (d), *S. zeyheri* (d), *Vepris lanceolata* (d), *Xymalos monosnora* (d), *Combretum kraussii, Elaeodendron croceum, E. zeyheri, Halleria lucida, Mimusops obovata, Ochna arborea* var. *arborea, Ocotea bullata, Pleurostylia capensis, Psydrax obovata* subsp. *elliptica, Zanthoxylum davyi.* Small Trees: *Canthium ciliatum* (d), *C. inerme* (d), *Cassipourea flanaganii* (d), *Clausena anisata* (d), *Eugenia capensis* (d), *Gymnosporia buxifolia* (d), *Maerua racemulosa* (d), *Ochna serrulata* (d), *Scutia myrtina* (d), *Trichocladus ellipticus* (d), *Trimeria grandifolia* (d), *Allophylus dregeanus, Diospyros whyteana, Mystroxylon aethiopicum, Rinorea angustifolia.* Tall Shrubs: *Burcheffia bubalina* (d), *Carissa bispinosa* subsp. *zambesiensis* (d), *Grewia occidentalis* (d), *Calodendrum capense, Diospyros scabrida* var. *cordata, Hyperacanthus amoenus, Maesa alnifolia.*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Low Shrub: *Azima tetracantha* (d). Soft Shrubs: *Hypoestes aristata* (d), *lsoglossa woodii* (d). Herbs: *Streptocarpus daviesii, S. haygarthii, S. pentherianus, S. polyanthus* subsp. *comptonii, S. polyanthus* subsp. *polyanthus.* Geophytic Herb's: *Dietes iridioides* (d), *Dryopteris inaequalis* (d), *Polystichum pungens* (d). Graminoid: *Oplismenus hirtellus* (d). **Endemic Taxa** Tall Shrub: *Eugenia zuluensis* (d). Herbs: *Plectranthus elegantulus, P rehmannii, Pyrrosia africana, Streptocarpus bolusii, S. candidus, S fanniniae, S. silvaticus.* **Conservation** Least threatened. Target 30%.\ Some 8% statutorily conserved (including forests under DWAF jurisdiction) in the Eastern Cape encompassing the Bosberg Nature Reserve, Greater Addo Elephant National

Swaziland Sour Bushveld	400-1100m	Open to closed, medium to tall tree layer with closed well-developed grass layer. Very hilly with moderate to steep slopes, positioned at higher altitudes than the adjacent SVI 3 Granite Lowveld to the east	Grey soils derived mostly from Randian granites (Mpuluzi and Mswati) and Swazian granites and gneisses (Usutu Suite and Ngwane gneiss). The area reaches to the Onverwacht Group of the Barberton Greenstone Belt in the far north. Soils are dark, very clayey, of the Sterkspruit, Valsrivier, Swartland soil forms. Land types were unclassified in Swaziland, but elsewhere they are mainly Fa, Fb and Ae.		**Important Taxa** Tall Tree: *Philenoptera violacea*. Small Trees: *Acacia davyi (d), A. natalitia (d), A. sieberiana var. woodii (d), A. tortilis subsp. heteracantha (d), A. gerrardii, Combretum molle, C. zeyheri, Englerophytum magalismontanum, Faurea rochetiana, F saligna, Pavetta edentula, Vangueria madagascariensis, Vitex obovata subsp. obovata, Ziziphus mucronata*. Succulent Tree: *Aloe marlothii* subsp. *marlothii*. Tall Shrubs: *Dichrostachys cinerea (d), Calpumia glabrata, Cliffortia strobilifera, Crotalaria monteiroi, Elaeodendron transvaalense, Heteromorpha arborescens* var. *abyssinica, Rhus pallens, R. pentheri, Tricalysia Ianceolata*. Low Shrubs: *Barleria obtusa, Crossandra fruticulosa, Gnidia splendens, Gymnosporia heterophylla, Jatropha latifolia* var. *angustata, J. latifolia var. swazica, Justicia flava, Passerina*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					filiformis, Rhus grandidens. Woody Climbers*: Helinus integrifolius, Putterlickia verrucosa. Graminoids: Panicum maximum (d), Themeda triandra (d), Enteropogon monostachyus, Sporobolus fimbriatus, S. nitens.* Herbs: *Becium obovatum, Gerbera viridifolia, Helichrysum miconiifolium, Hemizygia pretoriae* subsp. *pretoriae, Nidorella auriculata.* Geophytic Herbs*: Eulophia petersii, Hypoxis rigidula* **Biogeographically Important Taxa** (Northern KwaZulu Natal endemic, Northern Sourveld endemic) Low Shrub: *Hemizygia gerrardii*. Geophytic Herb: *Haemanthus pauculifolius* **Endemic Taxa** Geophytic Herbs*: Drimiopsis pusilla, D. reilleyana*. **Conservation** Vulnerable. Target 19%. About 6% statutorily conserved in mainly the Songimvelo, Ithala and Malalotja Nature Reserves, and a further 0.5% conserved in the Mlilwane Game Sanctuary in Swaziland. Some 21% has been transformed by cultivation and plantations **Remark** In this savanna vegetation unit with the highest MAP, Philenoptera vio/acea is not as restricted to water courses in contrast to its generally close association with water course areas in the drier vegetation units of the Lowveld and Mopane Bioregions
Tshokwane-Hlane Basalt Lowveld	180-400m	Usually fairly flat plains with open tree savanna, often dominated by tall *Sclerocarya birrea* and *Acacia nigrescens* with a moderately developed shrub ayer and a dense herbaceous layer. On some sloping areas with , shallower soils, trees are stunted (e.g. *A. nigrescens)*	The Letaba Formation basalts of the Karoo Supergroup in this area give rise to black, brown or red clayey soils, usually not more the 1m deep. Vertisols, such as the Arcadia soil form, occur in low-lying areas and concave plains. Land types mainly Ea with some Dc	Summer rainfall with dry winters. MAP about 400-800 mm in the southernmost part in Swaziland. Mean monthly maximum and minimum temperatures for Satara (in the north of the nit) 40.2°C and 4.2°C for January and June, respectively. See also climate diagram for SVI 5 Tshokwane-Hlane Basalt Lowveld	**Important Taxa** Tall trees: *Acacia nigrescens* (d), *Sclerocarya birrea* subsp. *Caffra* (d), *Philenoptera violacea.* Small trees: *Acacia borlea, A. gerradii, A. nilotica, A. tortilis* subs. *heteracantha, Albizia harveyi, Combretum hereroense,C. imberbe, Lannea schweinfurthii* var. *stuhlmannii, Pterocarpus rotundifolus.* Tall shrubs: *Dichrostachys cinerea, Grewia bicolor, Gymnosporia maranguensis, Rhus gueinsii.* Low shrubs: *Acalypha sesetalis, Dicoma tomentosa, Hermannia glanduligera, Justicia flava, J. protracta* subs *protracta, Seddera suffruticosa, Tragia dioica.*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Herbaceous Climber: *Commicarpus plumbagineus* Graminoids: *Bothriochloa radicans* (d), *Digitaria eriantha* subsp. *Eriantha* (d), *Panicum coloratum* (d), *P maximum* (d), *Themeda triandra* (d), *Urochloa mosambicensis* (d), *Aristida congesta, Cenchrus ciliaris, Eragrostis 140ontan, Heteropogon contortus.* Herbs: *Chamaecrista mimosoides, Gisekia 140ontana140, Thunbergia dregeana.* Succulent herbs: *Aloe 140ontana, Orbea paradoxa, 0. Rogersii.* **Endemic Taxon** Low Shrub*: Boscia foetida* subsp. *Minima*. **Conservation** Least threatened. Target 19%. About 64% statutorily conserved mainly in the Kruger National Park, but also in the Mlawula Nature Reserve. In addition, over 3% conserved mainly in the Hlane Game Sanctuary. About 17% transformed, almost all by cultivation. **Remarks** Different parts of this unit can show different rates of change over years, including some parts with very little change (Coetzee et al. 1977). Mapped as part of this unit is the small area (3% of the unit) east of Kumana waterhole, south of Satara (Kumana Sandveld of Gertenbach 1983b), which is on sandstone, but contains dolerite intrusions with clayey soil as well as some surface shales with sodium-saturated soil
Wakkerstroom Montane Grassland	1440- 2200m	This unit is a less obvious continuation of the Escarpment that links the southern and northern Drakensberg escarpments. It straddles this divide and is comprised of low mountains and undulating plains. The vegetation comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and Leucosidea thickets occurring along steep, mainly eastfacing slopes and drainage areas. *L. sericea* is the dominant woody pioneer	The mudstones, sandstones and shale of the Madzaringwe and Volksrust Formations (Karoo Supergroup) were intruded by voluminous Jurassic dolerite dykes and sills. Ac land type dominant, while Fa and Ca are of subordinate importance	Rainfall peaks in midsummer. Rainfall 800-1 250 mm per year (MAP 902 mm). This unit experiences an orographic effect which results in a locally higher precipitation than the adjacent areas. Winters very cold and summers mild (MAT 14°C). See also climate diagram for Gm 14 Wakkerstroom Montane Grassland (Figure 8.36).	**Important Taxa** Small Trees: *Canthium ciliatum, Protea subvestita.* Tall Shrubs: *Buddleja salviifolia* (d), *Leucoside sericea* (d), *Buddleja auriculata, Diospyros lycioides* subsp. *Guerkei, Euclea crispa* subsp. *Crispa, Rhus 140ontana, R. rehmanniana, R. transvaalensis.* Low Shrubs: *Asparagus devenishii* (d), *Cliffortia Tinearifolia* (d), *Helichrysum melanacme* (d), *H. splendidum* (d), *Anthospermum rigidum* subsp. *Pumilum, Clutia natalensis, Erica oatesii, Felicia filifolia* subsp. *Filifolia, Gymnosporia heterophylla, Helichrysum hypoleucum, Hermannia geniculata,*

		species that invades areas as a result of grazing mismanagement			*lnulanthera dregeana, Metalasia densa, Printzia pyrifolia, Rhus discolor, Rubus ludwigii* subsp. *ludwigii.* Graminoids: *Andropogon schirensis* (d), *Ctenium concinnum* (d), *Cymbopogon caesius* (d), *Digitaria tricholaenoides* (d), *Diheteropogon amplectens* (d), *Eragrostis chloromelas* (d), *E. plana* (d), *E.* racemosa (d) *Harpochloa falx* (d), *Heteropogon contortus* (d), *Hyparrhenia' hirta* (d), *Microchloa caffra* (d), *Themeda triandra (d) Trachypogon* *spicatus* (d), *Tristachya leucothrix* (d), *Alloteropsi*s *semialata* subsp. *eckloniana, Aristida junciformis* subsp. *galpinii, Brachiaria serrata, Diheteropogon filifolius, Elionurus muticus, Eragrostis capensis,* *Eulalia villosa, Festuca scabra, Loudetia simplex, Rendlia altera, Setaria nigrirostris.* Herbs: *Berkheya onopordifolia* var. *glabra* (d), *Cephalaria natalensis* (d), *Pelargonium luridum* (d), *Acalypha depressinerva, A. peduncularis, A. wilmsii, Aster bakerianus, Berkheya setifera,* *Euryops transvaalensis* subsp. *setilobus, Galium thunbergianum* var. *thunbergianum, Geranium ornithopodioides, Helichrysum cephaloideum, H, cooperi, H. monticola, H. nudifolium* var. *nudifolium, H. oreophilum, H. simillimum, Pentanisia prunelloides* subsp. *latifolia, Plectranthus laxiflorus, Sebaea leiostyla, S. sedoides* var. *sedoides, Selago densiflora,* *Vernonia hirsuta, V natalensis, Wahlenbergia cuspidata.* Geophytic Herbs: *Hypoxis costata* (d), *Agapanthus inapertus* subsp. *intermedius, Asc/epias aurea, Cheilanthes hirta, Corycium dracomontanum,* C. *nigrescens, Cyrtanthus tuckii* var. *transvaalensis, Disa versicolor, Eriospermum cooperi* var. *cooperi, Eucomis bicolor, Geum capense,* *Gladiolus* ecklonii, *G. sericeovillosus* subsp. *sericeovillosus, Hesperantha coccinea, Hypoxis rigidula* var. *pilosissima, Moraea brevistyla, Rhodohypoxis baurii* var. con *fecta.* Semiparasitic Herb: *Striga bilabiata* subsp. *bilabiata.* **Biogeographically Important Taxa** (Low Escarpment endemic, Northern sourveld endemic) Low Shrubs: *Bowkeria citrina, Lotononis* *amajubica, Protea parvula*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Succulent Herb: *Aloe modesta* **Endemic Taxa** Herbs: *Helichrysum aureum* var. *argent,eum. . Selago longicalyx.* Geophytic Herbs: *Kniphofia* sp. nov.*(laxiflora* Form C'), *Nerine platypetala.* Woody Climber: *Asparagus fractiflexus.* **Conservation** Least threatened. Conservation target 27 less than 1% is statutorily protected in the Paardeplaats Nature Reserve. There are 10 South African Natural Heritage Sites in this unit, although very little of it is formally protected. Land use pressures from agriculture are low (5% cultivated) probably owing to the colder climate and shallower soils. The area is also suited to afforestation, with more than 1% under *Acacia mearnsii* and *Eucalyptus* plantations. The black wattle (*Acacia mearnsii*) is an aggressive invader of riparian areas Erosion very low (78%) and low (19%). **Remarks** This unit represents the northernmost distribution limit for many plant taxa that occur on the Drakensberg Escarpment (e.g. *Helichrysum hypoleucum* and *Protea subvestita)* to the' south, as well as the southernmost limitfor plants occurring on the Northern Escarpment (e.g. *Protea parvula).* It also contains many of its own endemics, and is under investigation as a possible centre of endemism. The higher rainfall and more temperate climate on a some- what raised escarpment have possibly been conducive to the evolution of local endemics. Unlike its adjacent units, the Wakkerstroom Montane Grassland is largely devoid of *Pteridium aquilinum*

Zululand Lowveld	50-450m	Extensive flat or only slightly undulating landscapes supporting complex of various bushveld units ranging from dense thickets of *Dichrostachys cinerea* and *Acacia* species, through park-like savanna with flat-topped A. tortilis to tree-dominated woodland with broad- leaved open bushveld with *Sclerocarya birrea*	Black-clay soils and duplex soils derived from a distinct variety of clastic sediments of the Dwyka, Ecca, Beaufort and igneous rocks of the Lebombo Groups (all of the Karoo Supergroup). Also welldrained soil forms occur especially on stony slopes.	Summer rainfall with some rain in winter. MAP about 500-900 mm (highest in the southeast). Generally a frost-free area. Mean monthly maximum and minimum temperatures for Mpila Camp (Hluhluwe-iMfolozi Park) 38.5°C and 7.8°C for February and June,	**Important Taxa** Tall Trees: *Acacia burkei* (d), *A. nigrescens Sclerocarya birrea* subsp. *caffra (d).* Small Trees*: Acacia tortilis subsp. heteracantha* (d*), A. gerrardii, A. natalitia, A. nilotica, A. senegal var. rostrata, A. welwitschii* subsp. *Boscia albitrunca, Combretum apiculatum,* C *molle, Dzoroa paniculosa, Phoenix reclinata, Schotia brachypetala, 5pirostachys africana,*

		subsp. *caffra* and *A. nigrescens*. Tall grassveld types with sparsely scattered solitary trees and shrubs form a mosaic with the typical savanna thornveld, bushveld and thicket patches.	Land types Fb and Ea, with some Db and Dc	respectively. See also climate diagram for SVI 23 Zululand Lowveld.	*Teclea gerrardii, Ziziphus mucronata.* Succulent Trees: *Aloe marlothii* subsp. *marlothii, Euphorbia grandidens, E. ingens.* Tall Shrubs: *Dichrostachys cinerea* (d), *Euclea divinorum* (d), *Coptosperma supra-axillare, Crotalaria monteiroi, Euclea crispa* subsp. *crispa, E. schimperi, Galpinia transvaalica, Gardenia volkensii, Gymnosporia maranguensis, G. senegalensis, Jatropha zeyheri, Lycium acutifolium, Olea europaea* subsp. *africana, Tarchonanthus parvicapitulatus, Tephrosia polystachya, Triumfetta pilosa* var. *tomentosa.* Low Shrubs: *Barleria obtusa, Crossandra greenstockii, Felicia muricata, Gymnosporia heterophylla, Indigofera trita* subsp. *subulata, Justicia flava, J. protracta* subsp. *protracta, Melhania didyma, Orthosiphon serratus, Pearsonia sessilifolia, RueIlia cordata, Sida serratifolia, Tetraselago natalensis.* Succulent Shrubs: *Euphorbia grandicornis, E. trichadenia, E. vandermerwei.* Soft Shrub: *Pavonia columella.* Herbaceous Climber: *Fockea angustifolia.* Graminoids: *Dactyloctenium australe* (d), *Enteropogon monostachyus* (d), *Eragrostis capensis* (d), *E. curvula* (d), *E. racemosa* (d), *Heteropogon contortus* (d), *Panicum maximum* (d), *Sporobolus pyramidalis* (d), *Themeda triandra* (d), *Aristida bipartita, A. congesta, Bothriochloa insculpta, Chloris mossambicensis, Cymbopogoacaesius, Digitaria natalensis, Leptochloa eleusine, Panicum deustum, Schizachyrium sanguineum, Setaria incrassata, Sporobolus nitens, Trachypogon spicatus, Tristachya leucothrix.* Herbs: *Acrotome hispida, Argyrolobium rupestre, Aspilia mossambicensis, Chamaecrista biensis,* C. *mimosoides, Corchorus asplenifolius, Felicia mossamedensis, Gerbera ambigua, Helichrysum rugulosum, Hibiscus pusillus, Kohautia virgata, Lotononis eriantha, Senecio latifolius, Stachys aethiopica, Tragia meyeriana, Vernonia capensis.* Succulent Herb: *Aloe parvibracteata.*

Vegetation unit	Altitudinal Range	Vegetation and Landscape Features	Geology and Soils	Climate	Endemic taxa / Biogeographically important taxa / Remarks
					Biogeographically Important Taxa Small Tree: *Acacia theronii* (Broadly disjunct distribution). Tall Shrub: *Lycium shawii* (Southern distribution limit). **Conservation** Vulnerable. Target 19%. Some 11% statutorily conserved mainly in the Hluhluwe-iMfolozi Park and Phongolapoort Nature Reserve. Almost 1% is protected in the private Masibekela Wetland. Much of the area between Magudu, Mkuze and Nongoma is managed as private game farms and lodges. About 26% of the area has been transformed, mostly by cultivation. Erosion is variable from low to high. **Remark** Most of the Hluhluwe-iMfolozi Park is covered by tall Grassveld and Thornveld of this vegetaion unit

Appendix 2 Red Data Plant Species

Priority Plant Species in the District

Scientific Name	Red Data Status
Adenia natalensis	Extinct
Acalypha entumenica	Endangered
Brachystelma ngomense	Endangered
Cyrtanthus brachysiphon	Endangered
Encephalartos aemulans	Endangered
Orbeopsis gerstneri subs. *gerstneri*	Endangered
Pachyacris sp. nov. B.	Endangered
Pachyacris sp. nov. C	Endangered
Warburgia salutaris	Endangered
Celtis mildbraedii	Endangered locally, lower risk globally
Ceropegia stenantha	Endangered locally, globally not evaluated
Emplactanthus cordatus	Endangered locally, globally not evaluated
Albizia suluensis	Vulnerable
Aloe gerstneri	Vulnerable
Ansellia africana	Vulnerable
Bonatea saundersiae	Vulnerable
Bowiea volubilis	Vulnerable
Bowkeria citrina	Vulnerable
Ceropegia cimiciodora	Vulnerable
Dierama erectum	Vulnerable
Dracosciadium italae	Vulnerable
Encephalartos lembomboensis	Vulnerable
Encephalartos ngoyanus	Vulnerable
Encephalartos senticosus	Vulnerable
Eucomis autumnalis subs. *clavata*	Vulnerable
Euphorbia franksiae	Vulnerable
Gladiolus scabridus	Vulnerable
Haworthia limifolia	Vulnerable
Helichrysum ingomense	Vulnerable
Melanospermum italae	Vulnerable
Ocotea kenyensis	Vulnerable
Orbea paradoxa	Vulnerable
Protea comptonii	Vulnerable
Schizochilus gerrardii	Vulnerable
Scilla natalensis	Vulnerable
Scolopia oereophila	Vulnerable
Senecio villifructus	Vulnerable
Streptocarpus sp. nov. (T. Edwards *ined.*)	Vulnerable
Erica revoluta	Vulnerable locally, lower risk (near threatened) globally
Olyra latifolia	Lower Risk (least concern)
Ornithogalum saundersiae	Lower Risk (least concern)
Otiophora calycophylla subs. *calycophylla*	Lower Risk (least concern)
Pachycarpus campanulatus var. *camanulatus*	Lower Risk (least concern)
Pelargonium mutans	Lower Risk (least concern)
Protea gaguedi	Lower Risk (least concern)
Rhus dracomontana	Lower Risk (least concern)
Ruellia malacophylla	Lower Risk (least concern)
Salpinctium natalense	Lower Risk (least concern)
Seemannaralia gerrardii	Lower Risk (least concern)
Streptocarpus fanniniae	Lower Risk (least concern)
Streptocarpus molweniensis	Lower Risk (least concern)
Tinnea galpinii	Lower Risk (least concern)
Aloe modesta	Data Deficient
Aloe reizii	Data Deficient
Barleria argillicola	Data Deficient
Bolusiella maudiae	Data Deficient
Danthoniopsis scopulorum	Data Deficient
Delosperma gracile	Data Deficient
Delosperma smythae	Data Deficient

Dierama dubium	Data Deficient
Dierama sp. (Gerstmer 4697, [PRE])	Data Deficient
Disa zuluensis	Data Deficient
Eulophia cooperii	Data Deficient
Eulophia leachii	Data Deficient
Hemizygia gerrardii	Data Deficient
Kniphofia tysonii subs. *lebomboensis*	Data Deficient
Lessertia macroflara	Data Deficient
Lessertia sp. nov.(M-J Balkwill *ined.*)	Data Deficient
Moraea marionae	Data Deficient
Pachycarpus dealbatus var. nov.	Data Deficient
Pachystigma sp. nov. (Gerstner 4069 [NH])	Data Deficient
Pahycarpus mackenii	Data Deficient
Polygala arcuata	Data Deficient
Selago barbula	Data Deficient
Selago longicalyx	Data Deficient
Senecio mbuluziensi	Data Deficient
Senecio viscidulus	Data Deficient
Steonoglottis woodii	Data Deficient
Strictocardia laxiflora var. *woodii*	Data Deficient
Thesium junodii	Data Deficient
Thesium virens	Data Deficient
Urginea kniphofiodes	Data Deficient
Zaluzianskya pilosa	Data Deficient
Zaluzianskya sp. nov. (hillard & Burtt 8537 [NU])	Data Deficient
Schizoglossum ingomense	
Eriosema zuluense	
Breonida salicina	
Ceropegia crabii	

Appendix 3 Priority Animal Species

Scientific Name	Common Name	Class	Red Data Category
Strongylopus wageri	Plain stream frog	Amphibian	Near Threatened
Rynchops flavirostris	African Skimmer	Bird	Regionally Extinct
Bugeranus carunculatus	Wattled Crane	Bird	Critically Endangered
Hirundo atrocaerulea	Blue Swallow	Bird	Critically Endangered
Ephippiorhynchus senegalensis	Saddlebilled Stork	Bird	Endangered
Gypaetus barbatus	Bearded Vulture	Bird	Endangered
Sterna balaenarum	Damara Tern	Bird	Endangered
Turnix hottentotta	*Turnix hottentotta*	Bird	Endangered
Aegypius occiptalis	White-headed Vulture	Bird	Vulnerable
Aegypius tracheliotus	Lappet-faced Vulture	Bird	Vulnerable
Anthropoides paradiseus	Blue Crane	Bird	Vulnerable
Anthus brachyurus	Shorttailed Pipit	Bird	Vulnerable
Aquila rapax	Tawny Eagle	Bird	Vulnerable
Ardeotis kori	Kori Bustard	Bird	Vulnerable
Balearica regulorum	Crowned Crane	Bird	Vulnerable
Bucorvus leadbeateri	Ground Hornbill	Bird	Vulnerable
Buphagus africanus	Yellowbilled Oxpecker	Bird	Vulnerable
Caprimulgus natalensis	Natal Nightjar	Bird	Vulnerable
Circaetus fasciolatus	S. Banded Snake Eagle	Bird	Vulnerable
Circus ranivorus	African Marsh Harrier	Bird	Vulnerable
Columba delegorguei	Delegorgue's Pigeon	Bird	Vulnerable
Crex crex	Corncrake	Bird	Vulnerable
Diomedea cauta	Shy Albatross	Bird	Vulnerable
Eupodotis cafra	Whitebellied Korhaan	Bird	Vulnerable
Falco naumanni	Lesser Kestrel	Bird	Vulnerable
Geronticus calvus	Bald Ibis	Bird	Vulnerable
Gorsachius leuconotus	Whitebacked Night Heron	Bird	Vulnerable
Gyps africanus	Whitebacked Vulture	Bird	Vulnerable
Gyps coprotheres	Cape Vulture	Bird	Vulnerable
Halcyon senegaloides	Mangrove Kingfisher	Bird	Vulnerable
Hemimacronyx chloris	Yellowbreasted Pipit	Bird	Vulnerable
Morus capensis	Cape Gannet	Bird	Vulnerable
Neotis denhami	Stanley's Bustard	Bird	Vulnerable
Neotis ludwigii	Ludwig's Bustard	Bird	Vulnerable
Pelecanus rufescens	Pinkbacked Pelican	Bird	Vulnerable
Phalacrocorax neglectus	Bank Cormorant	Bird	Vulnerable
Podica senegalensis	African Finfoot	Bird	Vulnerable
Polemaetus bellicosus	Martial Eagle	Bird	Vulnerable
Scotopelia peli	Pel's Fishing Owl	Bird	Vulnerable
Terathopius ecaudatus	Bateleur	Bird	Vulnerable
Torgos tracheliotus	Lappetfaced Vulture	Bird	Vulnerable
Trigonoceps occipitalis	Whiteheaded Vulture	Bird	Vulnerable
Tyto capensis	Grass Owl	Bird	Vulnerable
Alcedo semitorquata	Halfcollared Kingfisher	Bird	Near-threatened
Anastomus lamelligerus	Openbilled Stork	Bird	Near-threatened
Apalis ruddi	Rudd's Apalis	Bird	Near-threatened
Batis fratrum	Woodwards' Batis	Bird	Near-threatened
Buphagus erythrorhynchus	Redbilled Oxpecker	Bird	Near-threatened
Centropus bengalensis	Black Coucal	Bird	Near-threatened
Centropus grillii	Black Coucal	Bird	Near-threatened
Charadrius pallidus	Chestnutbanded Plover	Bird	Near-threatened
Ciconia episcopus	Woollynecked Stork	Bird	Near-threatened
Ciconia nigra	Black Stork	Bird	Near-threatened
Circus macrourus	Pallid Harrier	Bird	Near-threatened
Circus maurus	Black Harrier	Bird	Near-threatened
Eupodotis caerulescens	Blue Korhaan	Bird	Near-threatened
Eupodotis melanogaster	Blackbellied Korhaan	Bird	Near-threatened
Falco biarmicus	Lanner Falcon	Bird	Near-threatened
Falco peregrinus	Peregrine Falcon	Bird	Near-threatened
Glareola nordmanni	Blackwinged Pratincole	Bird	Near-threatened
Glareola pratincola	Redwinged Pratincole	Bird	Near-threatened
Haematopus moquini	African Black Oystercatcher	Bird	Near-threatened
Hydroprogne caspia	Caspian Tern	Bird	Near-threatened

Hypargos margaritatus	Pinkthroated Twinspot	Bird	Near-threatened
Leptoptilos crumeniferus	Marabou Stork	Bird	Near-threatened
Lioptilus nigricapillus	Bush Blackcap	Bird	Near-threatened
Macronectes halli	Northern Giant Petrel	Bird	Near-threatened
Macronyx ameliae	Pinkthroated Longclaw	Bird	Near-threatened
Microparra capensis	Lesser Jacana	Bird	Near-threatened
Mirafra albescens	Karoo & Barlows' Lark	Bird	Near-threatened
Mirafra cheniana	Melodious Lark	Bird	Near-threatened
Mirafra chuana	Shortclawed Lark	Bird	Near-threatened
Mirafra curvirostris	Longbilled Lark	Bird	Near-threatened
Mycteria ibis	Yellowbilled Stork	Bird	Near-threatened
Nectarinia neergaardi	Neergaard's Sunbird	Bird	Near-threatened
Nettapus auritus	Pygmy Goose	Bird	Near-threatened
Pelecanus onocrotalus	White Pelican	Bird	Near-threatened
Phalacrocorax capensis	Cape Cormorant	Bird	Near-threatened
Phalacrocorax coronatus	Crowned Cormorant	Bird	Near-threatened
Phoeniconaias minor	Lesser Flamingo	Bird	Near-threatened
Phoenicopterus ruber	Greater Flamingo	Bird	Near-threatened
Platysteira peltata	Wattle-Eyed Flycatcher	Bird	Near-threatened
Procellaria aequinoctialis	Whitechinned Petrel	Bird	Near-threatened
Rostratula benghalensis	Painted Snipe	Bird	Near-threatened
Sagittarius serpentarius	Secretarybird	Bird	Near-threatened
Schoenicola brevirostris	Broadtailed Warbler	Bird	Near-threatened
Serinus citrinipectus	Lemonbreasted Canary	Bird	Near-threatened
Smithornis capensis	African Broadbill	Bird	Near-threatened
Spizocorys sclateri	Sclater's Lark	Bird	Near-threatened
Stephanoaetus coronatus	Crowned Eagle	Bird	Near-threatened
Sterna caspia	Caspian Tern	Bird	Near-threatened
Vanellus melanopterus	Blackwinged Plover	Bird	Near-threatened
Zoothera gurneyi	Orange Thrush	Bird	Near-threatened
Brycinus lateralis	Striped robber	Fish	
Chiloglanis emarginatus	Phongolo suckermouth	Fish	
Clarias theodorae	Snake catfish	Fish	
Myxus capensis	Freshwater mullet	Fish	
Opsaridium peringueyi	Southern barred minnow	Fish	
Doratogonus avius	Solitary black millipede	Invertebrate	Vulnerable
Doratogonus hoffmani	Hoffman's black millipede	Invertebrate	Vulnerable
Gegenes hottentota	Marsh Hottentot Skipper	Invertebrate	
Lepidochrysops swanepoeli	Swanepoel's Blue	Invertebrate	
Metisella meninx	Marsh Sylph	Invertebrate	
Papilio euphranor	Bush Kite Swallowtail	Invertebrate	
Myotis tricolor	Temmincks' Hairy Bat	Mammal	Near-threatened
Cercopithecus albogularis labiatus	Sykes' monkey	Mammal	
Crocidura cyanea infumata	Reddish-grey musk shrew	Mammal	Data Deficient
Crocidura mariquensis	Swamp musk shrew	Mammal	Data Deficient
Crocuta crocuta	Spotted hyena	Mammal	Near-threatened
Damaliscus lunatus lunatus	Tsessebe	Mammal	Endangered
Diceros bicornis minor	Black rhinoceros	Mammal	Vulnerable
Grammomys dolichurus	Woodland thicket rat	Mammal	Data Deficient
Lemniscomys rosalia	Single-striped grass mouse	Mammal	Data Deficient
Lycaon pictus pictus	African wild dog	Mammal	Endangered
Manis temminckii	Ground pangolin	Mammal	Vulnerable
Mellivora capensis capensis	Honey badger, Ratel	Mammal	Near-threatened
Miniopterus schreibersii natalensis	Schreiber's long-fingered bat	Mammal	Near-threatened
Mystromys albicaudatus	White-tailed mouse	Mammal	Endangered
Ourebia ourebi ourebi	Oribi	Mammal	Endangered
Panthera leo leo	Lion	Mammal	Vulnerable
Parahyaena brunnea	Brown hyaena	Mammal	
Philantomba monticola bicolor	Blue duiker	Mammal	Vulnerable
Poecilogale albinucha	African striped weasel	Mammal	Data Deficient
Homoroselaps dorsalis	Striped Harlequin Snake	Reptile	
Kinixys natalensis	Natal Hinged Tortoise	Reptile	
Python sebae natalensis	SA Python	Reptile	

Appendix 4 Vegetation Statistics Relevant to the Zululand District Municipality

Vegetation Types of ZDM	Historical vegetation type areas (ha)	Percentage of provincial total area of vegetation type	Physical area transformed in 2005 land cover (ha)	Area in Protected Areas (ha)	Area remaining after transformation (2005 land cover), inspection of aerial photos, < 12 ha vegetation patches removed, and avoiding degraded areas (ha)	% of vegetation type transformed (lost)	Conservation target %	Area needed to meet conservation targets (ha)	Final vegetation CBAs (ha)	Comment	Excess/deficit relative to target (negative values denote a deficit i.e. Targets cannot be achieved)
Delagoa Lowveld	8770.56	98.83	7750.57	0.00%	1019.99	88.37	19.00%	1666.41	1566.27	Under target (No More Available in ZDM to Meet Conservation Targets). Critical for the Province as few options exist outside of this municipality.	-100.13
Dry Ngongoni Veld (Ngongoni Veld)	1859.04	0.69	2.41	100.00 %	1856.63	0.13	25.00%	464.76	1856.63	Target achieved. Conservation Target is met within ZDM Protected Areas	1391.87
Eastern Mistbelt Forest (Southern Mistbelt Forest)	1998.16	6.02	486.85	42.70%	1511.32	24.36	66.50%	1328.78	1371.25	Target achieved. All of the remaining vegetation must be conserved.	42.47
Eastern Scarp Forest (Scarp Forest) Includes: Northern Zululand Lebombo Scarp Forest, Ngome Nkandla Scarp Forest	5362.07	24.08	1288.44	3.77%	4073.63	24.03	61.61%	3303.57	3929.70	Target achieved. All of the remaining vegetation must be conserved.	626.12
Glencoe Moist Grassland (N KZN Moist Grassland)	79009.79	26.07	45018.48	0.05%	33991.31	56.98	24.00%	18962.35	19043.85	Target achieved.	81.50
Granite Lowveld	3553.46	98.90	3244.34	0.00%	309.11	91.30	19.00%	675.16	694.24	Additional areas to meet conservation targets found through	19.09

Vegetation Types of ZDM	Historical vegetation type areas (ha)	Percentage of provincial total area of vegetation type	Physical area transformed in 2005 land cover (ha)	Area in Protected Areas (ha)	Area remaining after transformation (2005 land cover), inspection of aerial photos, < 12 ha vegetation patches removed, and avoiding degraded areas (ha)	% of vegetation type transformed (lost)	Conservation target %	Area needed to meet conservation targets (ha)	Final vegetation CBAs (ha)	Comment	Excess/deficit relative to target (negative values denote a deficit i.e. Targets cannot be achieved)
										inspection of Aerial Photography – few options, any additional loss would result in deficit. Critical for the Province as few options exist outside of this municipality.	
Income Sandy Grassland	94325.19	20.19	44490.86	0.00%	49834.33	47.17	23.56%	22223.01	24110.34	Target achieved.	1887.32
Ithala Quartzite Sourveld	96684.60	99.90	31183.66	25.63%	65500.94	32.25	27.00%	26104.84	26872.02	Target achieved. Critical for the Province as few options exist outside of this municipality.	767.18
KaNgwane Montane Grassland	8016.59	98.08	7298.05	0.00%	718.53	91.04	24.00%	1923.98	718.53	Under target (No More Available in ZDM to Meet Conservation Targets). Critical for the Province as few options exist outside of this municipality.	-1205.45
KwaZulu-Natal Highland Thornveld	64289.34	12.82	29657.88	0.00%	34631.45	46.13	23.22%	14927.98	15193.55	Target achieved.	265.57
Lebombo Summit Sourveld	329.09	2.77	285.14	75.44%	43.95	86.64	24.00%	78.98	43.95	Under target (No More Available in ZDM to Meet Conservation	-35.03

Vegetation Types of ZDM	Historical vegetation type areas (ha)	Percentage of provincial total area of vegetation type	Physical area transformed in 2005 land cover (ha)	Area in Protected Areas (ha)	Area remaining after transformation (2005 land cover), inspection of aerial photos, < 12 ha vegetation patches removed, and avoiding degraded areas (ha)	% of vegetation type transformed (lost)	Conservation target %	Area needed to meet conservation targets (ha)	Final vegetation CBAs (ha)	Comment	Excess/deficit relative to target (negative values denote a deficit i.e. Targets cannot be achieved)
										Targets)	
Makatini Clay Thicket	784.46	2.29	4.98	92.94%	779.48	0.64	19.00%	149.05	777.75	Target achieved.	628.71
Midlands Mistbelt Grassland	27332.38	4.62	13988.24	13.54%	13344.14	51.18	23.00%	6286.45	8243.19	Target achieved.	1956.74
Northern KwaZulu-Natal Moist Grassland	235.25	1.64	182.99	0.00%	52.25	77.79	24.00%	56.46	66.48	Additional areas to meet conservation targets found through inspection of Aerial Photography - Not very much more available so any loss would result in the ZDM not meeting conservation targets for this Vegetation Type	10.02
Northern Zululand Mistbelt Grassland	47376.96	100.00	28882.54	4.88%	18494.42	60.96	23.00%	10896.70	11383.15	Target achieved. Critical for the Province as no options exist outside of this municipality.	486.45
Northern Zululand Sourveld	380915.11	78.99	184139.73	6.75%	196775.38	48.34	19.00%	72373.87	73349.43	Target achieved. Critical for the Province as few options exist outside of this municipality.	975.56
Paulpietersburg Moist Grassland	254528.88	84.03	168212.06	2.58%	86316.82	66.09	29.55%	75213.28	76466.31	Target achieved.	1253.03

Vegetation Types of ZDM	Historical vegetation type areas (ha)	Percentage of provincial total area of vegetation type	Physical area transformed in 2005 land cover (ha)	Area in Protected Areas (ha)	Area remaining after transformation (2005 land cover), inspection of aerial photos, < 12 ha vegetation patches removed, and avoiding degraded areas (ha)	% of vegetation type transformed (lost)	Conservation target %	Area needed to meet conservation targets (ha)	Final vegetation CBAs (ha)	Comment	Excess/deficit relative to target (negative values denote a deficit i.e. Targets cannot be achieved)
										Critical for the Province as few options exist outside of this municipality.	
Southern Lebombo Bushveld	3545.81	3.02	436.04	83.19%	3109.76	12.30	24.00%	850.99	2587.10	Target achieved. Conservation Target is met within ZDM Protected Areas	1736.11
Swaziland Sour Bushveld	34865.37	100.00	12146.55	27.76%	22718.82	34.84	19.00%	6624.42	8600.90	Target achieved. Critical for the Province as no options exist outside of this municipality.	1976.48
Tshokwane-Hlane Basalt Lowveld	19476.40	Unavailable – still to be Obtained	4766.92	35.90%	14709.48	24.48	19.00%	3700.52	5391.03	Conservation Target is met within ZDM Protected Areas	1690.52
Wakkerstroom Montane Grassland	3081.19	2.19	639.76	4.08%	2441.43	20.76	26.56%	818.36	2392.97	Target achieved.	1574.60
Zululand Lowveld	332119.81	49.73	184106.10	9.24%	148013.71	55.43	19.00%	63102.76	64801.55	Target achieved. Critical for the Province as few options exist outside of this municipality.	1698.78