

**Maruleng
Local Municipality**

Biodiversity Sector Plan Handbook 2019

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MARULENG LOCAL MUNICIPALITY

BIODIVERSITY SECTOR PLAN HANDBOOK 2019

*Supporting land use planning and decision-making in
Critical Biodiversity Areas & Ecological Support Areas
for sustainable development*

Handbook Compiled By

This handbook was prepared as part of the RESILIM-O project (Resilience in the Limpopo River Basin- Olifants Catchment Program) by the Association for Water and Rural Development (AWARD). The project is funded by the United States Agency for International Development (USAID).

Handbook compiled by Deborah Vromans, Stephen Holness, Derick du Toit and William Mponwana for the RESILIM-O Project. AWARD. Hoedspruit. South Africa.

Collaborators of this handbook

Maruleng Local Municipality, AWARD, other stakeholders/collaborators to be included.

For Further Information

The Geographical Information System (GIS) maps used to prepare the Maruleng Critical Biodiversity Areas Map, plus electronic versions of this handbook and JPEG maps, are available on DVD. Copies of the DVD can be obtained from (1) Association for Water and Rural Development (AWARD) (Contact details - Tel: 015 793 0503 / 0145; Email: info@award.org.za; Website: www.award.org.za).

Acknowledgements

Data from the Mopani District Bioregional Plan (LEDET, 2016a) and the Limpopo Conservation Plan version 2 (Desmet et al., 2013) was used to prepare this handbook and the associated statistics and maps. The Waterberg District Bioregional Plan (LEDET, 2016b) informed certain sections of this handbook. The Biodiversity Sector Plans for the Garden Route Initiative (Vromans et al., 2010), Addo Mainstreaming Project (Vromans et al., 2012) and the Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans (DEAT, 2009) were used extensively to guide the report structure and content.

Maruleng CBA Map Compiled By

The Maruleng Critical Biodiversity Areas Map was developed as part of the Mopani District Bioregional Plan (LEDET, 2016a). NuLeaf Planning and Environmental (Pty) Ltd developed the map in 2015/2016 for the Limpopo Department of Economic Development, Environment and Tourism (LEDET), in collaboration with the LEDET, the South African National Biodiversity Institute (SANBI), South African National Parks (SANParks) and various stakeholders within the Mopani District (including the Maruleng Municipality).

The protected area layer was updated and integrated into the CBA Map for the biodiversity sector plan based on the latest protected area data.

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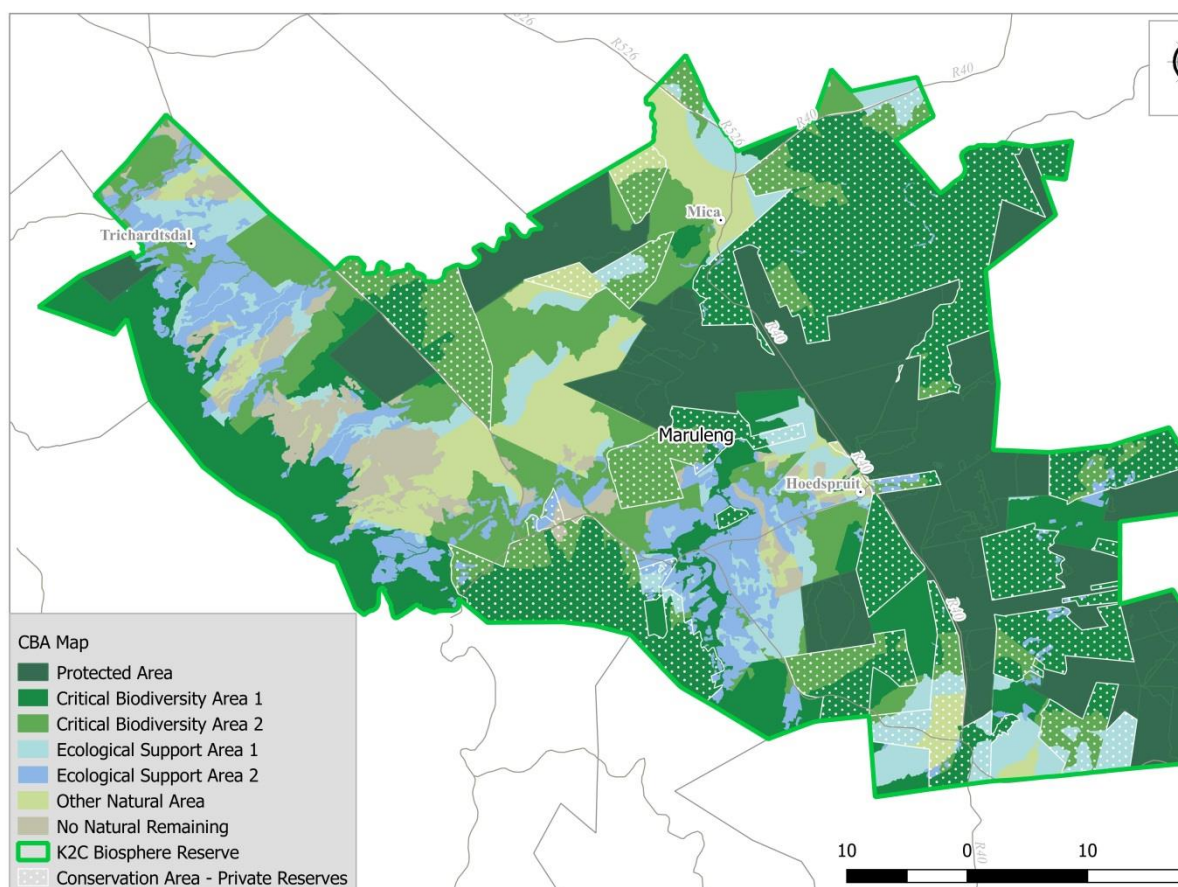
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Preface

This handbook presents the map of Critical Biodiversity Areas and Ecological Support Areas developed for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (LEDET, 2016a). The map was developed for the Limpopo Department of Economic Development, Environment and Tourism (LEDET) by NuLeaf Planning and Environmental (Pty) Ltd in collaboration with the LEDET, the South African National Biodiversity Institute (SANBI), South African National Parks (SANParks) and various stakeholders within the Mopani District (including the Maruleng Municipality). The Mopani District Bioregional Plan was developed in 2015 / 2016 and is thus based on data available at that time.

This handbook was therefore prepared to accompany and further explain the Mopani District Bioregional Plan, as it relates to the Maruleng Municipality. It provides biodiversity data specific to the Maruleng Municipality landscape, along with explanatory information, to assist in the uptake of the Mopani District Bioregional Plan at the local level.



Map of Critical Biodiversity Area Critical Biodiversity Areas and Ecological Support Areas for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (2016)

The map of Critical Biodiversity Areas and Ecological Support Areas for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (2016), is based on the provincial map developed in the provincial Limpopo Conservation Plan version 2 (Desmet et al., 2013).



The provincial map was further refined in 2015/2016 to align with other relevant spatial plans for the District, such as the Olifants and Letaba Catchment Environmental Management Framework (EMF), the Kruger to Canyon (K2C) Biosphere Reserve, municipal Spatial Development Frameworks (SDFs) and improved land cover (DEA, 2013-2014).

Section 4 presents a series of biodiversity-compatible land uses recommended for the Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) and Other Natural Areas (ONA), including land management guidelines for CBA and ESA. The land use guidelines were based on the Mopani District Bioregional Plan and were further aligned with the Waterberg District Bioregional Plan (LEDET, 2016b).

The map of Critical Biodiversity Areas and Ecological Support Areas is the primary biodiversity informant for multi-sectoral planning and land development applications. It is intended to support land use planning and decision-making⁹ to ensure sustainable development. It therefore serves to inform the planning and management tools that the Maruleng Municipality is required to develop, most importantly the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and land use scheme.

Refer to the table of contents for easy access to those sections of the handbook most useful to you.



Section 1

Introduction & Objectives



Sustainable development can only be achieved through the protection and management of our natural resources. To ensure sustainable development, **biodiversity** ('the natural environment') must, by law, be taken into account when developing spatial planning tools (e.g. spatial development frameworks, land use schemes) or when authorizing land development applications (e.g. rezoning applications, environmental impact assessments).

To enable this, scientists have researched Maruleng's biodiversity ('the natural environment') to determine the location of priority areas for protection and for appropriate land use activities. Based on the available biodiversity data, such as threatened species, vegetation, rivers and wetlands, the natural landscape has been classified according to its biodiversity importance, namely Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas and No Natural Remaining. This information has been synthesised into a map of Critical Biodiversity Areas and Ecological Support Areas for the Maruleng Municipality, referred to as the **Maruleng Critical Biodiversity Areas Map** (Refer Section 3, Figure 12).

All organs of state are obliged to consider biodiversity in their decision-making and to make use of the most up to date information (National Environmental Management Act 107 of 1998). Furthermore, all spheres of government and all organs of state must co-operate with, consult and support one another.

In this regard, the CBA Map should be the common reference of biodiversity priority areas for supporting municipalities and other sectors in multi-sectoral planning procedures⁹.

1.1 The Maruleng Biodiversity Sector Plan & Mopani District Bioregional Plan (LEDET, 2016a)

The Maruleng Biodiversity Sector Plan presents the map of Critical Biodiversity Areas and Ecological Support Areas developed for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (LEDET, 2016a¹) (Figure 1). It serves to accompany and further explain the Mopani District Bioregional Plan, as it relates to the Maruleng Municipality. Thus, it provides biodiversity data specific to the Maruleng Municipality landscape (Section 2), along with explanatory information, to assist in the uptake of the Mopani District Bioregional Plan at the local level.

The protected area map, as reflected in the Mopani District Bioregional Plan, was updated to reflect the current protected areas in the Maruleng Municipality (for this biodiversity sector plan handbook).

¹ At the time of preparing this handbook, the Mopani District Bioregional Plan was undergoing the process of being published in terms of the National Environmental Management: Biodiversity Act (10 of 2004).

Central to the map of Critical Biodiversity Areas and Ecological Support Areas (Figure 12, Section 3) are the biodiversity-compatible land use guidelines (Section 4) and the Geographical Information System (GIS) maps.

The GIS maps include:

Primary data:	<p>Critical Biodiversity Areas Map (includes all CBA Map categories: Protected Areas, Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas and No Natural Remaining, including Conservation Areas).</p> <ul style="list-style-type: none"> Users can download this data from the SANBI BGIS website (http://bgis.sanbi.org/SpatialDataset) or contact the Association for Water and Rural Development (AWARD) (Contact details - Tel: 015 793 0503 / 0145; Email: info@award.org.za; Website: www.award.org.za).
Associated data:	<p>South African vegetation types (2012), wetlands, key rivers, land cover.</p> <ul style="list-style-type: none"> Users can download the vegetation, river and wetland data from the SANBI BGIS website (http://bgis.sanbi.org/SpatialDataset). Users can download the DEA land cover data and protected areas layer from the DEA website: https://egis.environment.gov.za/national_land_cover_data_sa; https://egis.environment.gov.za/protected_areas_database.

Refer to Section 3.1.1 for additional information regarding the development of the CBA Map.

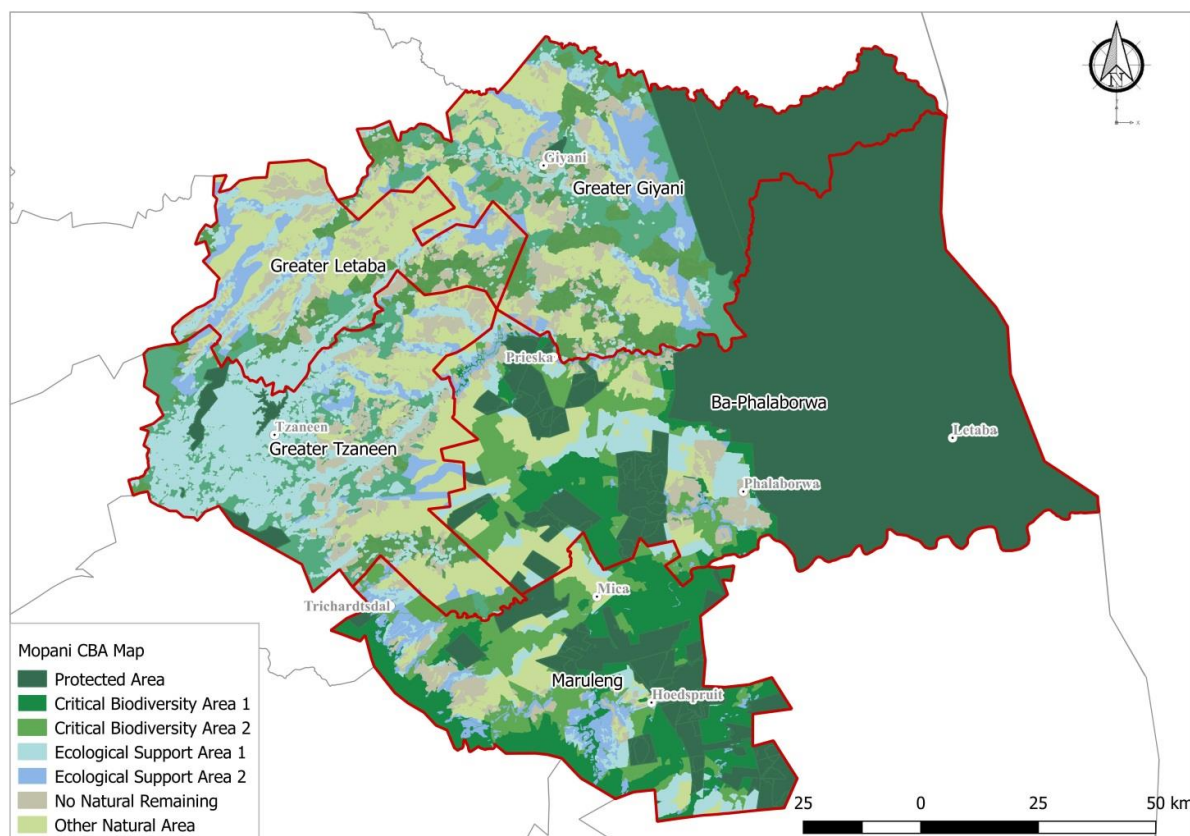


Figure 1. Map indicating the Maruleng Municipality in relation to the Mopani District Bioregional Plan’s Critical Biodiversity Areas Map (LEDET, 2016a) with the updated protected area layer for the Maruleng and Ba-Phalaborwa Municipalities (developed for the Biodiversity Sector Plan).



Mariepskop, is part of the Northern Drakensberg and has unique vegetation unlike the typical vegetation of the Lowveld



The unique vegetation of Mariepskop is both important from a traditional medicinal & adventure recreational point of view



1.2 Intended uses & users of the Maruleng Biodiversity Sector Plan

The Maruleng Biodiversity Sector Plan is based on the Mopani District Bioregional Plan's Critical Biodiversity Areas Map (LEDET, 2016). It was compiled to support the Maruleng Municipality in integrating biodiversity into their spatial planning and land management processes, as indicated in Table 1.

The map of Critical Biodiversity Areas and Ecological Support Areas for the Maruleng Municipality is the official reference for biodiversity priorities within the municipality. All sectors involved in land use planning; and whose decisions impact on biodiversity; should take the map into account.

Table 2 presents those departments and sectors that are required, by law, to consult the published² Mopani District Bioregional Plan. Since the Maruleng Biodiversity Sector Plan is the municipal version of the Mopani District Bioregional Plan, intended users can consult this handbook and the municipal specific data for additional support.

Table 1. Intended uses of the Maruleng Biodiversity Sector Plan (the municipal version of the Mopani District Bioregional Plan)

1. Proactive forward planning	Serves as an input into planning tools, such as IDPs, SDFs, EMFs, Municipal Open Space Systems and land use schemes.
2. Reactive land use decision-making	Provides guidance for evaluating Environmental Impact Assessments, Basic Assessments, agricultural land use permits, water use authorisations and development control decisions through land use legislation (e.g. rezoning and subdivision approvals).
3. Proactive conservation	Provides input into decisions on the expansion of protected areas through land acquisition by the state and biodiversity stewardship agreements with private or communal landowners.

² Published in terms of the National Environmental Management: Biodiversity Act (NEMBA) (10 of 2004).



Table 2. Intended users of the published Mopani District Bioregional Plan, showing mandatory & recommended uses (from the Waterberg District Bioregional Plan, 2016). The Maruleng Biodiversity Sector Plan can be consulted for municipal specific data.

Users	Mandatory uses	Recommended uses
Any organ of state that must prepare an Environmental Implementation Plan (EIP) or Environmental Management Plan (EMP) in terms of Chapter 3 of NEMA	Must consider the Bioregional Plan in developing the EIP or EMP.	Should integrate PAs, CBAs, ESAs, ONAs and other relevant guidelines and recommendations from the Bioregional Plan into the EIP and EMP.
Environmental decision-makers who are required by section 2(1)(c) of NEMA to apply the NEMA section 2 principles in their decision-making (with mandatory and recommended uses)		
National Department of Environmental Affairs	Must consider the Bioregional Plan before issuing environmental authorisations on applications dealt with at a national level.	Should take the Bioregional Plan into account in their planning processes and in their programmes.
Limpopo Department of Economic Development, Environment and Tourism (LEDET)	Must consider the Bioregional Plan before issuing environmental authorisations. Should take the Bioregional Plan and identified CBAs and ESAs into account in their comments on applications	Should take the Bioregional Plan into account in their authorisations as part of the EIA and BA processes.
Municipalities (with mandatory and recommended uses)		
Mopani DM (and the local municipalities)	Must align its Integrated development Plan (IDP) and Spatial Development Framework (SDF) with the published Bioregional Plan and must demonstrate how the Bioregional Plan may be implemented. Must also take the Bioregional Plan into account in issuing planning authorisations. An approved bioregional plan cannot be in conflict with an approved SDF and vice versa.	Should integrate PAs, CBAs, ESAs, ONAs and other relevant guidelines and recommendations from the Bioregional Plan into Environmental Management Frameworks (EMFs) and land use schemes.



Environmental decision-makers who are required by section 2(1)(c) of NEMA to apply the NEMA section 2 principles in their decision-making (with recommended uses only)	
User	Recommended Uses
National and Provincial Department of Agriculture, Forestry and Fisheries (DAFF)	Should take the Bioregional Plan into account in their planning processes and in their programmes. The Department of Agriculture should take the Bioregional Plan into account in planning Land Care activities, farm planning, ploughing and subdivision applications, land reform and Area Wide Planning, and in the development of policy, legislation or guidelines for land use planning and management.
Department of Water and Sanitation	Should take the Bioregional Plan into account in their authorisations as part of the EIA process. Should take the Bioregional Plan into account in their planning processes and in their programmes e.g. Water Development Plans
Department of Mineral Resources	Should take the Bioregional Plan into account in their authorisations for prospecting and mining, and mining development plans, especially Strategic Infrastructure Projects related to the Northern Mineral Belt (e.g. mining licence areas).
Department of Co-operative Governance, Human Settlements and Traditional Affairs (COGHSTA Limpopo)	Should take the Bioregional Plan into account when planning human settlements; when reviewing municipal IDPs and when developing provincial SDFs.
Department of Roads and Transport	Should take the Bioregional Plan into account when planning roads and other transport infrastructure.
Department of Health and Social Development	Should take the Bioregional Plan into account when developing social development plans.
DRDLR Department of Rural Development and Land Reform	Should take the Bioregional Plan into account when developing rural development plans.
Office of the Premier (OTP)	Assisting with the mainstreaming of the Bioregional Plan within provincial government; and 'clearing-house' for the spatial data.
Other intended users of the Bioregional Plan	
Working for Water, Working for Wetlands, LandCare	Should take the Bioregional Plan into account in planning and scheduling their activities.
Environmental and planning consultants	Should take the Bioregional Plan into account when undertaking Strategic Environmental Assessments and Environmental Impact Assessments or when developing IDPs, SDFs or EMFs for a municipality.
Conservation NGOs	Should use the Bioregional Plan to guide comments on land use change applications, and to direct conservation initiatives.
Private and communal landowners	Should use the Bioregional Plan if they want more information about the biodiversity importance of their land.
Private developers and businesses	Should facilitate their process of obtaining development rights by utilising the Bioregional Plan to identify appropriate areas for different types of land use in order to avoid unnecessary delays and costs associated with submitting inappropriate development proposals, which are unlikely to be approved.



1.3 Limitations of the Maruleng Biodiversity Sector Plan

This biodiversity sector plan handbook presents the map of Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) developed for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (LEDET, 2016a).

The Mopani District Bioregional Plan is based on the systematic biodiversity plan or CBA map that was developed in the provincial Limpopo Conservation Plan version 2 (Desmet et al., 2013), which was further refined based on data available during 2015 / 2016 (Refer Section 3.1.1).

Limitations of the map of Critical Biodiversity Areas & Ecological Support Areas:

- The Maruleng CBA Map can be used at a scale of 1:50 000. Although land cover data was corrected during the development of the CBA Map for the Mopani District Bioregional Plan, specialist interpretation of the biodiversity features and land cover data is required at the site level.
- Therefore, the Maruleng CBA Map **does not replace site level assessments**. *It must be used in combination with site level assessments*, for land use change or development applications, particularly for Environmental Impact Assessments, Basic Assessments, Water Use License Applications/General Authorisations and rezonings/subdivisions.
- The CBA Map and BSP cannot be used on its own in land use applications and multi-sectoral planning procedures. It simply provides information on biodiversity (i.e. provides only one information layer of the many layers required in land use planning); and must be used in conjunction with other land use or town and regional planning application procedures and principles.
- On-going changes in land use and associated land cover (e.g. natural areas versus cleared areas), which result in the loss of natural habitat, as well as changes in the distribution (e.g. in response to climate change) or knowledge of biodiversity, may impact on the spatial configuration of the current CBA and ESA network. Loss of natural habitat (e.g. clearing vegetation) is likely to result in other natural areas being designated as CBAs when the CBA Map is revised.

“ *In South Africa, the total value of ecosystems is conservatively estimated at R27 billion per annum (Turpie et al., 2003).* ”



Handmade household implements are influenced by the available biodiversity



Many water resources provide valuable recreational activities provided they are not polluted



1.4 Ecosystem services, ecological infrastructure, the economy & poverty alleviation

Ecosystem services

All social and economic sectors are dependent on biodiversity because it delivers **ecosystem services**⁸, which are fundamental to our survival.

Ecosystem services can be divided into four groups, which in turn provide vital services, as follows:

Provisioning services	A regular supply of clean water and oxygen (clean air) Food and fibre (clothing) Medicines and genetic resources
Regulating services	Flood attenuation Erosion control (due to plants protecting soils along river banks) Pest control and pollination (vital for the fruit industry) Carbon storage ⁸ (to counteract climate change)
Supporting services	Primary production Nutrient cycling (important for plant growth and survival) Livestock grazing (vital to farmers)
Cultural services	Spiritual and cultural areas Recreational areas (nature-based tourism)

Ecological infrastructure

Naturally functioning ecosystems that deliver ecosystem services are referred to as **ecological infrastructure** (e.g. rivers and mountain catchments that supply water for human consumption). Ecological infrastructure is the equivalent of society's built infrastructure, such as roads and factories, which support socio-economic development.

Examples of key ecological infrastructure & ecosystem services in Maruleng

In Maruleng, biodiversity contributes significantly to economic development through the provision of ecosystem services, such as water, food, fuel, fibre and medicines. It is the basis for nature-based tourism, such as in the Kapama Game Reserve and Thornybush Nature Reserve.

Biodiversity is also particularly important in terms of providing grazing land for livestock and insect pollination for agricultural crops, such as vegetation crops along the Olifants, Blyde and Rietspruit rivers; and fruit orchards (mango, citrus) along the Blyde River and Rietspruit River.

The Northern Drakensberg, which borders the western perimeter of the municipality, is a high priority water production area, referred to as a Strategic Water Source Area, as it supplies large quantities of fresh water to Maruleng. The Makhutswi, Mounqwane, Malomanye, Molomahlapi, Blyde and Olifants rivers are key suppliers of water for human consumption.



This rich & varied biodiversity is a unique feature providing the basis for tourism and cultural identity



Indigenous vegetation is an important varied diet in the rural household.

Here morogo is dried & stored for eating in winter months



Refer Sections 2.3 - 2.6 for the services offered by the various ecosystems e.g. vegetation, freshwater and ecological corridors.

Biodiversity loss and associated loss of economic growth

The loss of biodiversity through disturbance or development has impacts on ecosystem functioning and reduces the delivery of ecosystem services and as a result, economic growth. For example, the water holding capacity of a catchment area⁹ is reduced by the removal of vegetation, which reduces water supplies downstream.

This also leads to erosion and heavy silt loads which then necessitate increased municipal spending (e.g. dredging etc.). Water becomes more costly to supply, reducing finances for other service delivery. Furthermore, after the removal of plant cover, heavy rainfall results in flooding, and homes and roads are washed away, with the rural poor often being the most severely affected. The loss of natural bush can impact on nearby agricultural crops as a reduction in insect pollinators leads to smaller harvests, with fewer jobs leading to greater poverty.

Biodiversity & poverty alleviation

Biodiversity has the potential to provide for nature-based community initiatives that support poverty alleviation thereby creating jobs in industries such as eco-tourism, wild cut-flowers, professional nature guiding, and bee farming. Some of these initiatives are good examples of collaborative programmes involving a range of national agencies and municipalities at the local level e.g. SANParks 'People and Conservation' (Section 5.3.1.9).

Other programmes, such as the 'working for water programme' and 'working for wetlands programme', which involves clearing alien invasive plants and the restoration of wetlands and rivers, contributes to job creation while safeguarding biodiversity and associated ecosystem services (e.g. water supply, flood attenuation, soil erosion protection, prevention of sedimentation).

The sale of biodiversity based crafts is a valuable form of local economic development that should be supported by municipalities





“Biodiversity is the mainstay of our agricultural economy, providing ecosystem services such as grazing for livestock; and insect pollination for food and fruit crops. Every aspect of our livelihoods depends on these services.”



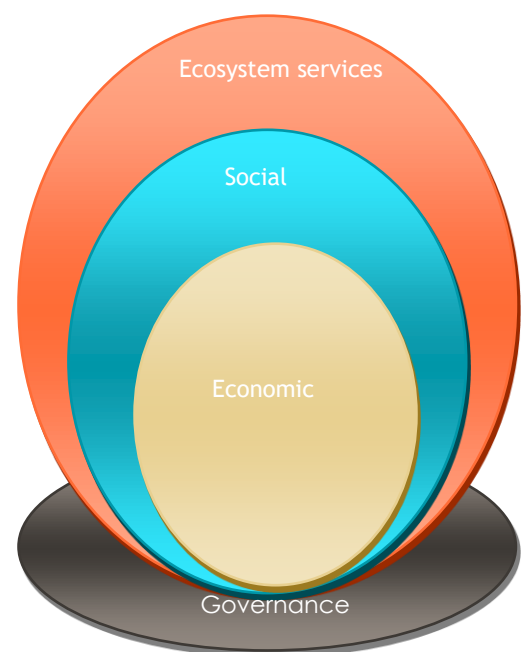
“Future generations will face significant ecological, economic, social and cultural costs if we do not acknowledge that human well-being is dependent on protecting biodiversity”



Managing biodiversity to sustain and improve the availability of ecosystem services

- Application of the CBA Map and guidelines ensures that we maintain nature's valuable ecosystems services for sustainable economic and social development (Refer Section 3 and Section 4).
- Land management activities that improve biodiversity include, for example:
 - Alien plant clearing programmes. These initiatives not only provide employment and training opportunities, but increase river flow and therefore water supplies to communities.
 - Protecting and restoring wetlands and rivers by retaining the natural indigenous vegetation that borders and supports these systems.
 - Protecting and improving the water quality of rivers and associated wetlands. The Olifants River has been referred to as one of the most polluted rivers in southern Africa (CSIR, 2012).
 - Refer to Section 4.4. for the land use management guidelines.


Biodiversity should be viewed as the cornerstone of sustainable development. Both natural and social capital provides the input for economic capital. The ability of nature to manage the waste generated by economic activity (e.g. pollution) has a major effect on economic success. If we fail to recognize the challenge of separating economic growth and poverty eradication from rising levels of natural resource-use and waste, we will undermine economic growth and poverty eradication. Continued inequality and a declining resource base requires that we go beyond thinking in terms of trade-offs and the 'triple bottom line'³.



“We must accept that there are non-negotiable ecological thresholds required to sustain our natural capital & that we must adopt the precautionary principle³ in this approach.

(National Framework for Sustainable Development, 2008).

³ Triple bottom line: Also referred to as the 3 pillars of sustainability, namely ecological integrity, social justice and economic efficiency, where economic capital is dependent on natural and social capital.



“Biodiversity is the basis of many of our industries e.g. water supply and insect pollination to the citrus industry; and provides wood fuel and a place for traditional ceremonies. Biodiversity also provides input into the economy through eco-tourism, while creating employment opportunities. Developments that destroy natural landscapes will reduce the tourism potential of the region”



1.5 Biodiversity & climate change

Climate change is one of the biggest challenges facing humankind. Even if we achieve significant reductions in emissions of greenhouse gases (CO₂, methane etc.), global climate change is inevitable. The ‘business as usual’ approach to climate change will cost as much as between 5 % and 20% of global Gross Domestic Product every year.

Climate change poses significant threats to the basic provisions of life: water, health, food production and the environment, while the poorest communities are most likely to be the hardest hit.

In the Limpopo Province predictions suggest potentially hotter temperatures. Rainfall predictions, on the other hand, are less certain with some models suggesting decreased rainfall over the long term, but which remain within the range of present-day variability. Other models suggest increased rainfall (DEA, 2015).

According to a study by Davis et al (2010) in the Kruger to Canyon Biosphere Reserve, an increase in total annual rainfall is anticipated for the entire region, with potential increases along the escarpment, but possible decreases in the northern areas. The number of rainfall events is predicted to increase, which may result in an increase in flooding during the rainy season. A mean annual temperature increase of between 0.8°C - 3.05°C is expected. This may have significant consequences for biological triggers and crop calendars. With an increase in temperature, it is likely that evaporation and evapotranspiration rates are likely to increase. This may intensify the knock-on effects for the incidence and intensity of drought events, even though rainfall is likely to increase (Davis et al., 2010).

The Limpopo Province Green Economy Plan has been developed as ‘*the necessary tool for Climate Proofing of planning and behaviour*’. Municipalities are seen as key role-players in developing the green economy and thus contributing to sustainable development.



“Both the burning of fossil fuels and the removal of large expanses of vegetation has been identified as the potential cause of increased CO₂ input into the atmosphere, resulting in expediting global climate change”



“Climatologists predict a 50% reduction in rain-fed agricultural yield in some African countries by the 2020s (Intergovernmental Panel on Climate Change, 2007). By protecting biodiversity we protect ourselves against climate change”



Climate change highlights the importance of protecting our water resources from over-abstraction, degradation and the spread of invasive alien plants. The Critical Biodiversity Areas map identifies the catchment⁹ areas that are critical in this regard as they are the primary source of our water supply. Alien invasive plants use more water than indigenous plants, reducing water supply for human consumption and economic activities. Reduced alien infestations will result in increased water supply, a reduction in erosion and sediment deposition during severe rains and optimum regeneration of our natural bush.

To ensure resilience against the impacts of climate change, landscape corridors need to be kept intact to function as ecological process areas. These corridors enable the migration and persistence of plants, animals and birds despite changing climatic conditions. Examples of these corridors are the river valleys extending from the inland mountainous areas to the lowland areas.

Climate change temperature increases may result in increased fire frequencies, while large expanses of alien plants are likely to fuel more frequent fires. An integrated alien and fire management plan is therefore essential to ensure both the removal of invasive alien plants as well as controlled burning (see Section 5.3.1.4 and 8).

What can Maruleng Municipality do to increase our resilience to climate change?

At the local level, one of the most effective ways of mitigating against climate change is to manage land use in Critical Biodiversity Areas and Ecological Support Areas. As a strategy against the impacts of climate change, the CBA Map has identified a network of important biodiversity areas linking the inland mountains to the lowland areas, as well as along the key rivers (Refer Section 2.6).

- The following guidelines assist in integrating climate change into land use planning and decision-making:
- Securing the CBA network (refer Figure 13).
- Maintain intact riparian (river bank) vegetation to avoid flooding and to protect water resources.
- Protect wetlands and rehabilitate degraded wetlands (as they act as sponges thereby reducing downstream flooding).
- Protect water resources and encourage recycling and re-use of water.
- Restrict building to above the 1:100 year flood-line, or higher (where necessary); and beyond natural floodplains.
- Protect major landscape corridors⁹ with biodiversity-compatible land uses to allow for species migration (persistence) and carbon storage.
- Restore and maintain biodiversity for carbon storage⁹ to reduce the impacts of rising temperatures due to global warming.
- Remove alien invasive plants to yield more water and reduce fire damage.
- Implement appropriate fire management practises to reduce fire damage and maintain biodiversity.
- These guidelines also assist with Disaster Management, using preventative rather than costly reactive measures.



Refer to Section 5.3.2.1 regarding recommendations for a 'municipal climate change management plan

Climate Change Adaptation Projects in Mopani District

In order to respond to climate change, climate smart agriculture interventions, such as:

*drip irrigation,
composting,
crop rotation &
introduction of drought resilient crop,*

are adopted which also support rural livelihoods & agricultural practices in the Giyani and Letaba Local Municipalities (Mopani District Municipality).

Responding to water security challenges due to climate change & rising temperatures has resulted in the establishment of the "Ga-Ntata rainwater harvesting system & rain gauge" project, also in the Mopani District

(<http://www.sanbi.org/news/small-grants-facility-project>).



Section 2

Biodiversity profile for the Maruleng Municipality





2.1 What is biodiversity?

Biodiversity is the scientific term which refers to the ‘natural environment’ or ‘nature’. It encompasses the diversity of all living biota - plants, animals, insects, micro-organisms etc., and also the interactions that sustain and which enable them to persist into the future.

Biodiversity is comprised of the following:

Biodiversity pattern	The way in which the components of biodiversity are spatially arranged. Biodiversity pattern can be expressed as: Different vegetation types (such as Savanna or Grassland), or Natural habitats (the natural home of a living organism such as a wetland), or; Specific features (populations of rare plants which grow in a specific area and nowhere else).
Ecological processes	The actions and interactions which enable natural systems to function as healthy, working systems. For example: Insect and bird pollination, movement of animals along river and mountain corridors, nutrient recycling.
Evolutionary processes	The series of actions which enable new species to evolve in response to changing conditions over extended time periods. This is particularly important in the face of climate change.
Ecological Drivers	The variety of factors, such as rainfall, temperature, fire, grazing and browsing (herbivory) etc., which maintain the functioning and health of natural systems.
Ecosystem	A natural system which is comprised of all the living organisms (plants, animals etc.) and the non-living aspects of the environment (water, air, soil etc.), in a particular area, which both function together as a unit. A mountain ecosystem, for example, is very different to a lowland ecosystem because they are comprised of different plants, animals and climates. Ecosystems can operate at any scale from very small (e.g. a small wetland) to an extensive landscape (an entire mountain catchment ^s area).
Ecosystem Services	Ecosystems deliver a number of ecosystem services. For example, healthy ecosystems provide us with water to drink, foodstuffs, wood fuel, medicines, clean air and a buffer against flooding (Refer Section 1.4). Ecosystems that deliver ecosystem services are also referred to as ecological infrastructure.

The interdependence of ecological processes & biodiversity pattern

Ecological processes and biodiversity pattern are interdependent - with processes dependent on the health and integrity of the component biodiversity, while pattern is maintained by processes. There are situations where even though pattern is disrupted, certain processes are able to continue functioning e.g. riparian zones (riverbank vegetation) and wetlands in areas of intensive agriculture may still play an important role in maintaining water quality in rivers that flow through these areas. Biodiversity is maintained by ecological processes at the micro-scale (such as in pollination and nutrient cycling via microbial action) through to the mega-scale (natural events e.g. fire, flood; migration of species along river valleys or coastal areas, quality and quantity of water feeding rivers and estuaries; marine sand movement and the seasonal mountain-to-coast migration of birds that pollinate plants).

Flower of the indigenous Kudu lily



Fruit of the Sycamore fig



Leaves & pods of the Silver cluster leaf (*Terminalia*) is characteristic of a tree for thousands of years in the processing of metals. Nowadays this species is harvested heavily used for firewood and has led to it being given protected status





The Weeping wattle (*Peltophorum*) is a fairly common tree with a multitude of uses such as medicinal purposes, cattle fodder, shade & fuelwood



The Natal mahogany is fairly common in the Lowveld region



“ Since we are totally dependent on natural systems for food and water, it is essential that land use decisions are guided by biodiversity priorities and the maintenance of healthy functioning ecosystems (ecological infrastructure), now and in the future. This is the essence of sustainable development. ”

2.2 Why is Maruleng’s biodiversity so important?

Maruleng Municipality is home to three threatened ecosystem types. These include the Endangered Tzaneen Sour Lowveld that extends across the mountainous areas, the Vulnerable Lowveld Riverine Forest, along the Blyde River, and the Vulnerable Legogote Sour Bushveld. In addition to this, the municipality supports three vegetation types that are endemic⁴ and two that are near endemic to the Limpopo Province. Gravelotte Rocky Bushveld, Pong Dolomite Mountain Bushveld and Tzaneen Sour Lowveld are endemic, whereas Lowveld Rugged Mopaneveld and Ohrigstad Mountain Bushveld are near endemic.

Several threatened floral species are supported in the Maruleng Municipality, some of which include the Critically Endangered cycads, *Encephalartos cupidus*, *E. dolomiticus*, *E. inopinus*, and *E. dyerianus*, as well as the Endangered tree, *Warburgia salutaris*, and including the endemic and Vulnerable *Searsia batophylla* (Refer Section 2.5). *E. dolomiticus* occurs in shallow soils on dolomite ridges and is endemic to South Africa. *E. dyerianus*, another endemic, grows in Gravelotte Rocky Bushveld.

The Ga-Selati, Blyde and Klaserie Rivers are priority rivers in the Maruleng Municipality as they support the Southern Dwarf Minnow (*Opsaridium peringueyi*), a fish species of special concern (Refer Section 2.5). The Blyde and Klaserie rivers are both in a good ecological state (healthy condition), thus raising their status as high priority rivers, while the Blyde River also supports the Critically Endangered Lowveld Riverine Forest. Refer to Section 2.4 for important aquatic (water) features.

The Kruger to Canyon (K2C) Biosphere Reserve covers the entire municipality, and extends beyond its boundaries, stretching across the Limpopo and Mpumalanga provinces. It is the third largest biosphere in the world encompassing savanna, forest and grassland biomes. Biosphere Reserves are geographical areas representing priority terrestrial, aquatic (and coastal) ecosystems that promote the conservation and sustainable utilization of biodiversity. Biosphere Reserves are nominated by national governments all over the world and are internationally recognized by declaration through UNESCO.

⁴ Endemic: A plant, animal, or a vegetation type, which is restricted to a particular region, and which occurs nowhere else in the country or world.



Tourism is a non-consumptive use of South Africa's biodiversity



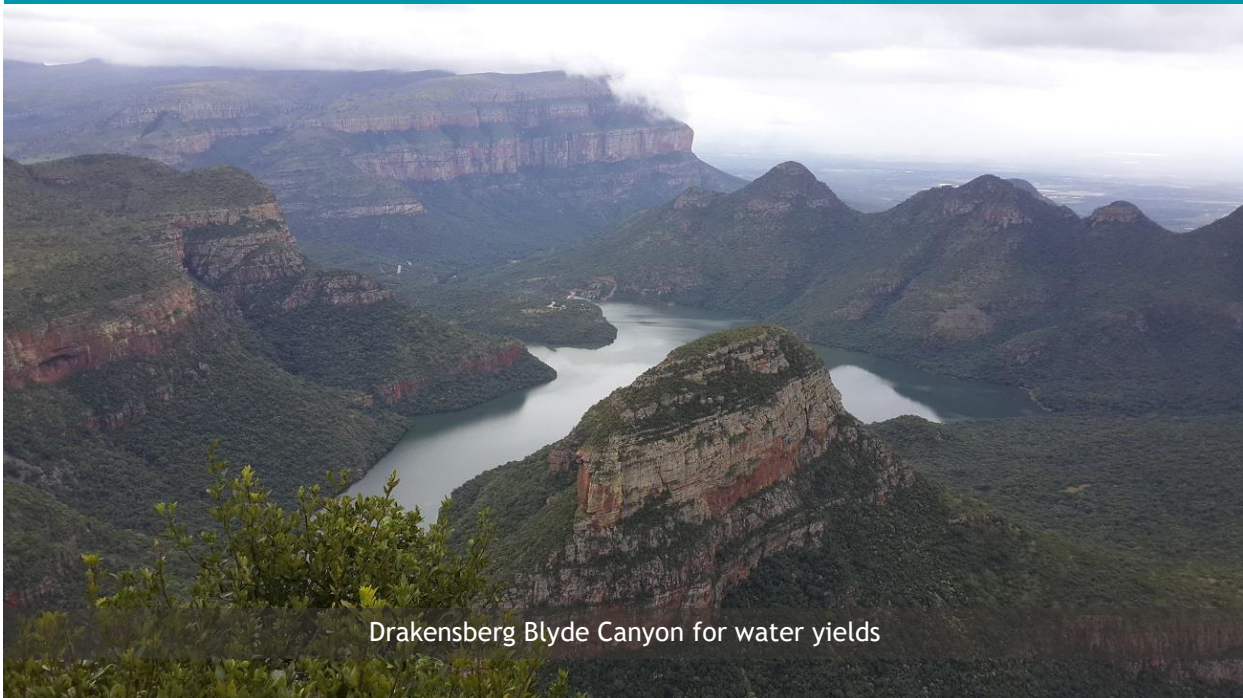
Indigenous plant *gushe*



2.2.1 Natural Wonders' of Maruleng Municipality

Some examples of the numerous 'Natural Wonders' that occur within the Maruleng Municipality.

These 'Natural Wonders' demonstrate the importance of the biodiversity representative of the municipal landscape



Drakensberg Blyde Canyon for water yields



Big 5 which includes the rhino which are on the Endangered animal species list



2.3 Terrestrial (land) ecosystems

Definition:

Terrestrial ecosystems are found on land and exclude aquatic features (Section 2.4). Terrestrial ecosystems are categorised according to broad vegetation types or Biomes (e.g. Savanna) and then further classified according to a specific habitat type. For example, Granite Lowveld is a specific vegetation or habitat type that establishes due to specific soils, geology and climate, and which attracts specific fauna, that falls within the Savanna Biome.

The 13 vegetation types in Maruleng Municipality are derived from the ‘Vegetation of South Africa, Lesotho and Swaziland’ (Mucina and Rutherford, 2012) (Table 3). The Maruleng Municipality is largely comprised of Savanna vegetation types, but also supports Forest, Grassland and one Azonal Vegetation type (Figure 2). Azonal Vegetation types are associated with riverine or wetland systems, and are thus the result of the presence of water, salts and specific soils. Figure 2 and 3 below show the historical and current extent of the vegetation types. Detailed vegetation type descriptions are available from ‘The Vegetation of South Africa, Lesotho and Swaziland’ (Mucina and Rutherford, 2006) or bgis.sanbi.org/Projects/Detail/101.

Three of the 13 vegetation types are threatened, namely the Endangered Tzaneen Sour Lowveld and the Vulnerable Lowveld Riverine Forest and Legogote Sour Bushveld (Table 3, Figure 4). Three of the vegetation types are endemic and two are near endemic to the Limpopo Province (Table 3, Figure 5).



The production of various food crops depends on healthy ecosystems for nutrient rich soil, clean water and air



Table 3. List of the vegetation types in the Maruleng Municipality, with associated statistics, including provincial ecosystem status, ecosystem protection level and endemism

Vegetation Type	Biome	National and Limpopo Statistics						Maruleng Municipality Statistics				
		Biodiversity Target (%)	Ecosystem Threat Status (National)	Ecosystem Threat Status (Limpopo)	Protection Level (National)	Protection Level (Limpopo)	Endemism (Limpopo)	Original Extent (ha) Municipality	Natural & Semi-Natural (ha)	Natural & Semi-Natural (%)	Not Natural (ha)	Not Natural (%)
1.Granite Lowveld	S	19	LT	LT	Moderately	Not	Not	285699	256190	89.7	29509	10.3
2.Gravelotte Rocky Bushveld	S	19	LT	LT	Not	Poorly	Endemic	674	672	99.7	2	0.3
3.Legogote Sour Bushveld	S	19	VU	VU	Poorly	Not	Not	2678	2378	88.8	300	11.2
4.Lowveld Riverine Forest	F	31	VU	VU	Well	Well	Not	530	402	75.8	129	24.2
5.Lowveld Rugged Mopaneveld	S	19	LT	LT	Well	Well	Near	1495	1488	99.5	8	0.5
6.Northern Escarpment Afromontane Fynbos	G	27	LT	LT	Well	Not	Not	47	47	100.0	0	0.0
7.Northern Escarpment Quartzite Sourveld	G	27	LT	LT	Moderately	Well	Not	7677	7676	100.0	0	0.0
8.Northern Mistbelt Forest	F	30	LT	LT	Well	Well	Not	3502	3493	99.8	9	0.2
9.Ohristad Mountain Bushveld	S	24	LT	LT	Moderately	Poorly	Near	98	98	100.0	0	0.0
10.Phalaborwa-Timbavati Mopaneveld	S	19	LT	LT	Well	Well	Not	4391	4391	100.0	0	0.0
11.Poung Dolomite Mountain Bushveld	S	24	LT	LT	Moderately	Poorly	Endemic	308	308	100.0	0	0.0
12.Subtropical Freshwater Wetlands	AV	24	LT	LT	Well	Poorly	Not	83	83	100.0	0	0.0
13.Tzaneen Sour Bushveld	S	19	VU	EN	Poorly	Poorly	Endemic	18062	17033	94.3	1028	5.7

Key:

- **Biome:** F = Forest; S = Savanna; AV = Azonal Vegetation.
- **Biodiversity target** refers to the minimum proportion of each ecosystem (vegetation) type that needs to be kept in a natural or near-natural state in order to maintain viable representative samples of all ecosystem types, including the majority of species associated with them.
- **Ecosystem Threat Status:** LT = Least Threatened, VU = Vulnerable, EN = Endangered.
- **Ecosystem Protection Level:** Not = Zero or less than 5 % of biodiversity target, Poorly = 5-49 % of biodiversity target, Moderately = 50-99 % of biodiversity target, Well = >=100 % of biodiversity target. Refer Section 2.7.
- **Endemism:** Endemic = More than 80% of national extent occurs in the Province; Near-Endemic = More than 60% of national distribution within the Province.

An aerial photograph of a lush, green landscape. The foreground shows a river with several large, reddish-brown rocks protruding from the water. The middle ground is filled with dense, green vegetation, including trees and shrubs. The background shows a vast expanse of similar vegetation stretching towards the horizon. The overall scene is a natural, undisturbed environment.

Key vegetation types of the Maruleng Municipality:

All the vegetation types are delineated as Critical Biodiversity Areas (CBA) in the best and most efficient areas in order to meet the national biodiversity targets.

This means that all the vegetation types are classified as CBA where it is located in a landscape corridor to promote connectivity. The biodiversity target area (hectares) of all the vegetation types is therefore included in the CBA network to ensure that these areas are not modified (cleared) in the future.

Refer to the CBA Map (Figure 13) to give you an indication of where the vegetation types are delineated as CBA.

For the GIS shapefile of the vegetation types, refer to the SANBI BGIS website (<http://bgis.sanbi.org/SpatialDataset>).

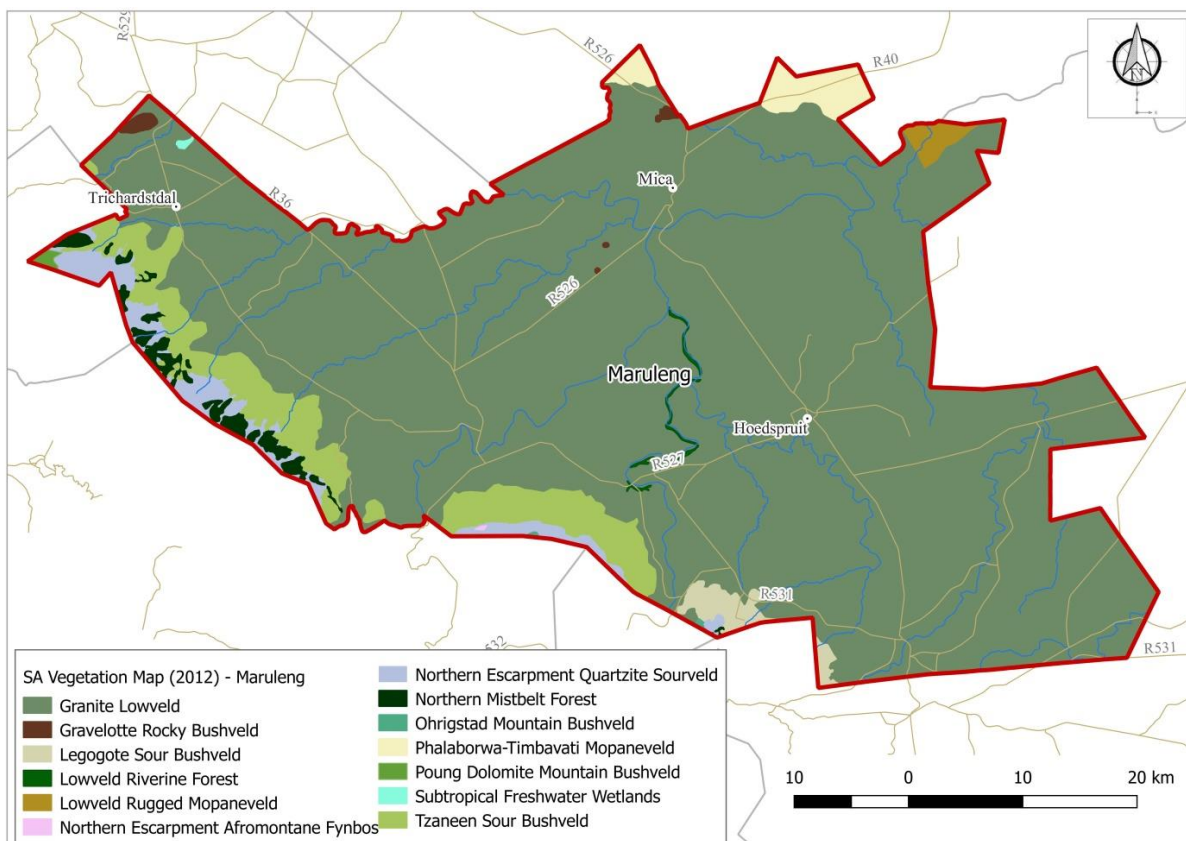


Figure 2. Map indicating the historical extent of vegetation types within the Maruleng Municipality prior to urban and agricultural development (pre-clearance).

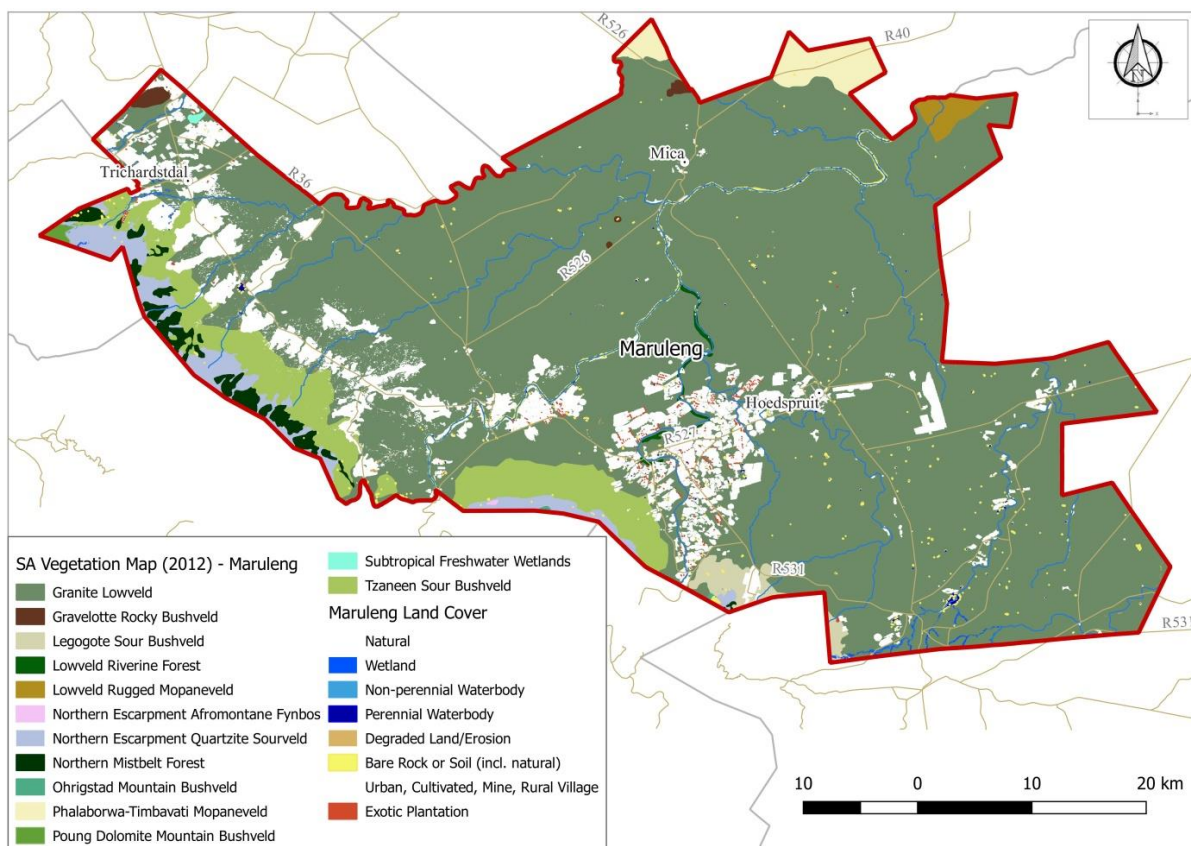


Figure 3. Map indicating the current extent of vegetation within the Maruleng Municipality, subsequent to urban and agricultural development (post clearance).

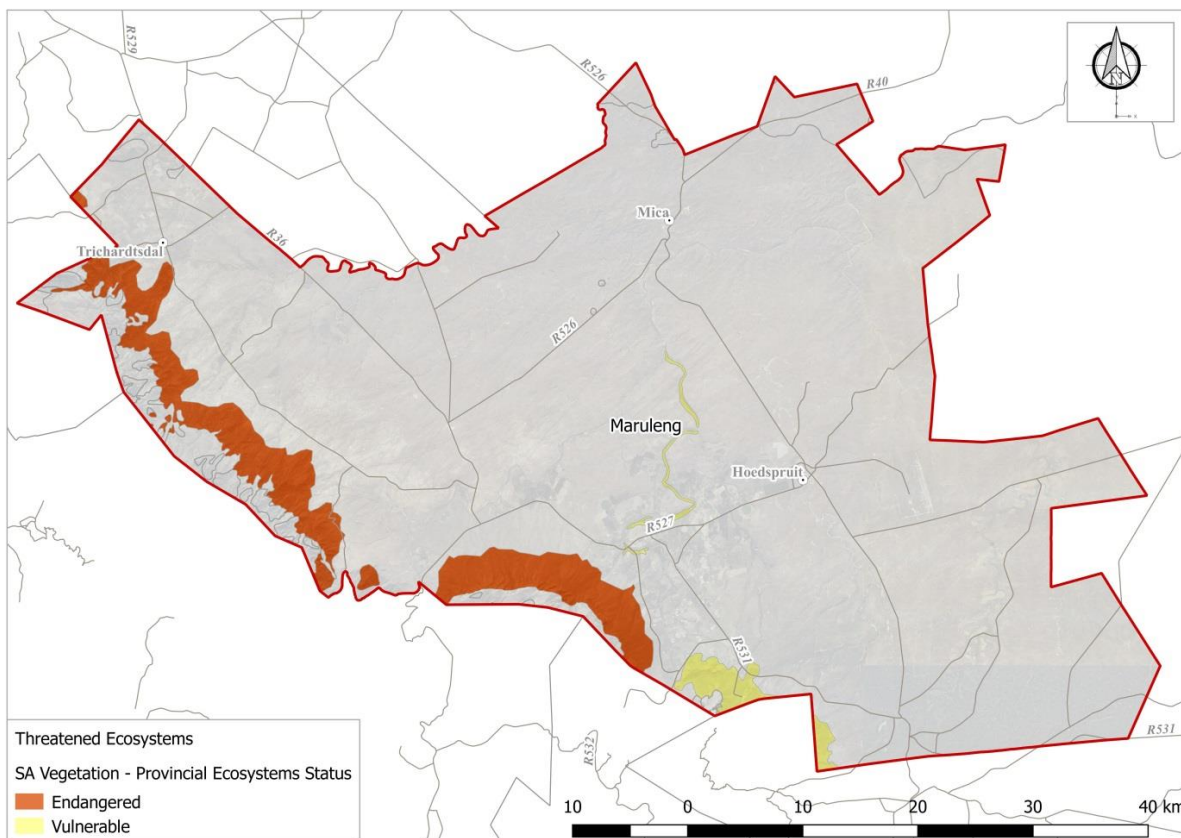


Figure 4. Threatened ecosystems (vegetation types) within the Maruleng Municipality (Provincial Ecosystem Status).

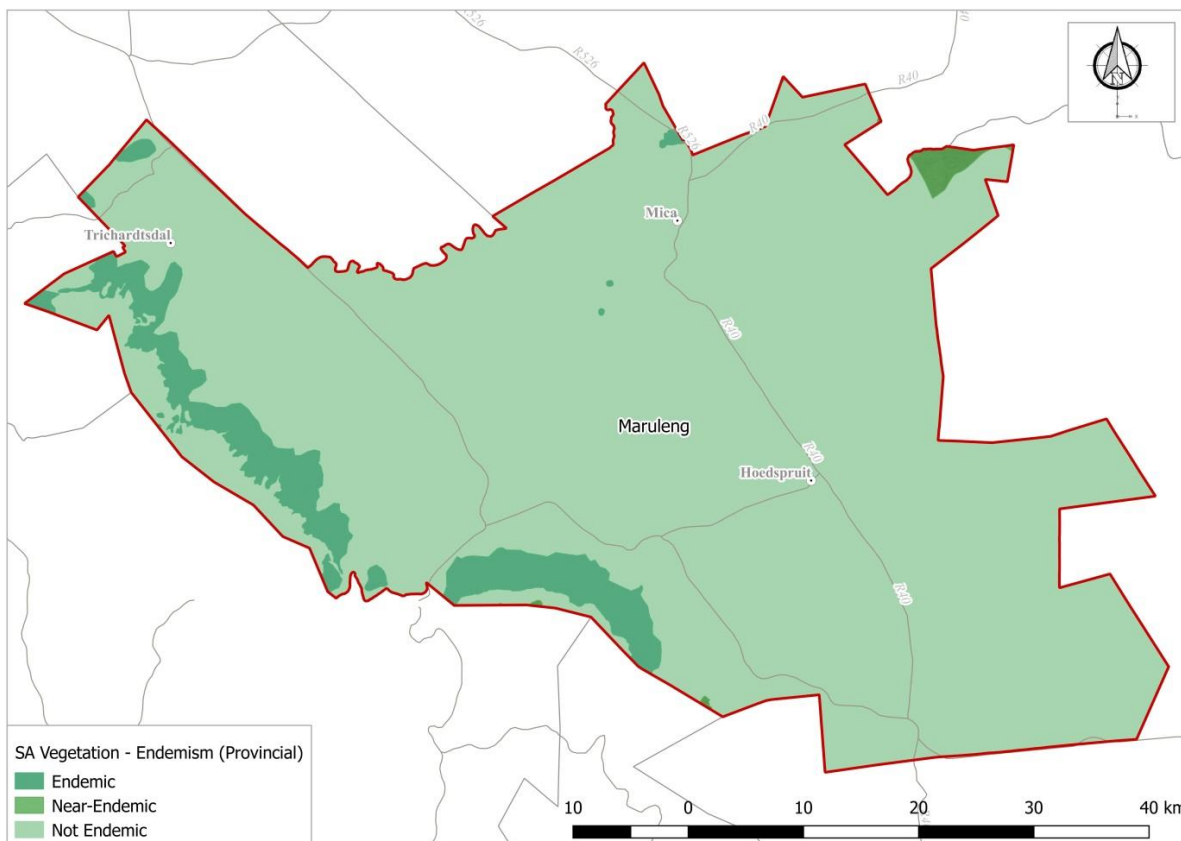


Figure 5. Endemic and near-endemic ecosystems (vegetation types) within Maruleng Municipality (Limpopo Provincial Endemism).



Terrestrial ecosystem services - What our natural habitat does for us

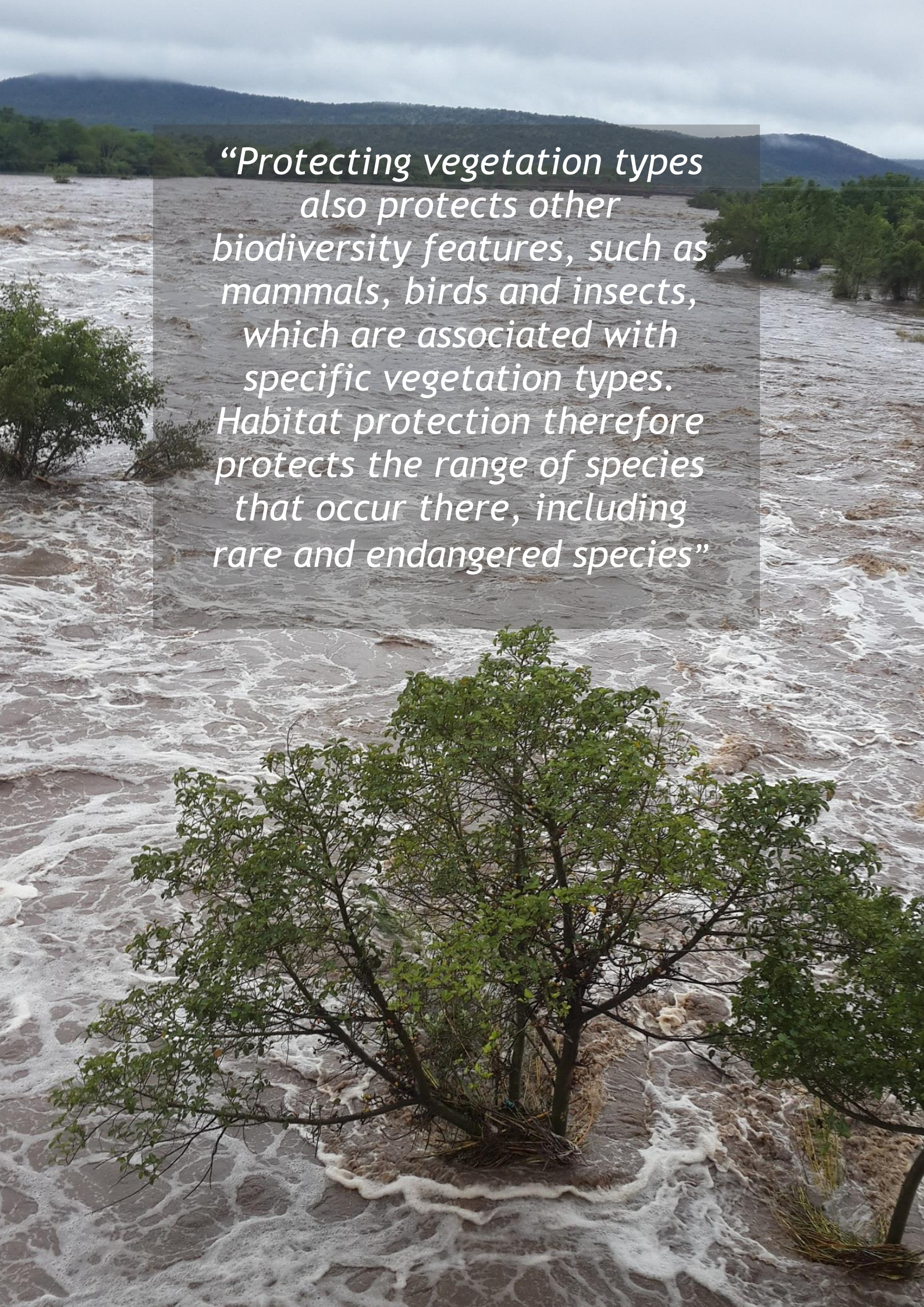
Human survival is entirely dependent on the delivery of ecosystem services. The maintenance of these ecosystems and their supporting 'ecological infrastructure' is a key socio-economic imperative. Degradation or destruction of the natural environment can lead to high socio-economic costs.

Although this is not an exhaustive list, the following services are delivered by terrestrial ecosystems:

- Buffers against natural hazards such as fire and floods, regulation of water supply, forage for grazing livestock and wildlife, provision of food, fibre, medicinal and cosmetic plants, provision of cleaner air, improved resilience against climate change by storage of excess carbon released as carbon dioxide through burning fossil fuels i.e. carbon storage, support of the horticultural and wildflower industries, provision of natural spaces for spiritual ceremonies, recreation and tourism; and contribution to natural and cultural heritage.

Terrestrial ecosystems are protected by various pieces of legislation, such as:

- The Listed Activities in terms of the National Environmental Management Act (NEMA) 107 of 1998 protects indigenous vegetation depending on certain criteria, for example, development within a Critical Biodiversity Area requires a basic assessment.
- The National Forest Act (NFA) 84 of 1998 protects certain tree species and national forest types. Two forest types have been mapped in the Maruleng Municipality, Lowveld Riverine Forest, which is Vulnerable and supported along the Blyde River; and Northern Mistbelt Forest, which is Least Threatened and supported in the Northern Drakensberg (Figure 2 and 3).
- The National Environmental Management: Biodiversity Act (NEMBA) (10 of 2004) protects certain species and threatened ecosystems, known as Listed Threatened Ecosystems. The Listed Threatened Ecosystems are represented by the national South African vegetation types (Mucina and Rutherford, 2012). Three are listed, namely the Endangered Tzaneen Sour Lowveld and the Vulnerable Lowveld Riverine Forest and Legogote Sour Bushveld (Figure 2, 3 and 4).



“Protecting vegetation types also protects other biodiversity features, such as mammals, birds and insects, which are associated with specific vegetation types. Habitat protection therefore protects the range of species that occur there, including rare and endangered species”



2.4 Freshwater ecosystems

Definition:

A freshwater ecosystem (aquatic feature) is comprised of the living organisms (e.g. fish and plants) and the non-living components (e.g. nutrients and minerals in the soils and surrounding water).

Freshwater ecosystems described here include wetlands and rivers. They are grouped together in this section to emphasize their inter-connectedness. This means, activities which impact on one part will have consequences on another part. For example, whatever takes place in the upper reaches of a river, in the mountains, will impact on the lower reaches of the river. Further, land use activities within the catchment (land surrounding aquatic ecosystems) have an impact on the condition of wetlands and rivers which fall within the catchment e.g. a reduction in vegetation cover will increase soil erosion and may increase sedimentation of rivers or wetlands downstream, including dams that supply water (Refer Section 2.4.3: Catchments).

South Africa is a water-scarce country, and our freshwater ecosystems are under severe pressure as a result of many competing demands on our limited water resources. It is crucial that efficient water use is encouraged, for example through demand control, recycling, re-use and rainwater harvesting.

2.4.1 Wetlands

Definition:

Wetlands occur where water covers the soil permanently or periodically, at or near the surface. These waterlogged soils determine the types of plants that can grow, referred to as hydrophytes or obligate wetland species. Semi-aquatic and aquatic fauna are supported in wetland systems, such as waterbirds, frogs, wasps and springtails.

More than half of South Africa's wetlands have already been destroyed (for example by urban expansion or cultivation), with severe consequences for water quality, consistency of water supply and flood control. Significant economic costs can be encountered where wetlands have been cleared or where inadequate natural buffers remain around wetlands (i.e. vegetation bordering the wetland), due to flooding, sedimentation and erosion downstream. High expenditure is required for controlling invasive plants, mosquitoes, sedimentation, eutrophication (nutrient enrichment and oxygen depletion) and the rehabilitation of disturbed areas.

Wetlands of the Maruleng Municipality

Numerous wetlands have been mapped within the Maruleng Municipality by the National Freshwater Ecosystem Priority Areas (NFEPA) Project (Nel et al., 2011) (**Figure 6**). The NFEPA map distinguishes between natural wetlands and artificial water bodies e.g. dams, as well as FEPA-priority and non-priority wetlands. A range of wetland types occur in the municipality (Table 4) (see box insert below). Wetlands were grouped according to vegetation types, which in the Maruleng Municipality include the Lowveld Group 3, Lowveld Group 7, and Mopani Group 4 (Nel and Driver, 2012).



It is important to note, however, that national wetland mapping products, such as NFEPA, are not accurate and should be verified in the field. A new National Wetland Map has been developed (refer to SANBI BGIS).

Table 4. The wetland types in the Maruleng Municipality (Ollis et al., 2013; SANBI, 2009)

Wetland Type	Description
Depressions (pans)	Depressions occur in closed elevation contours with the central area being the deepest. Rainfall and groundwater discharge are key water sources, including interflow and overland flow. Depressions are referred to as pans when they are flat-bottomed and basins if they are round-bottomed.
Channelled valley bottom wetlands	Channelled valley bottom wetlands are the most common wetlands in Maruleng. They are mostly flat and have a well-defined stream or river channel. Water is sourced from the river, when it overtops, and from the adjoining valley slopes.
Un-channelled valley bottom wetlands	Un-channelled valley bottom wetlands do not have a well-defined stream or river channel and mostly have a flat valley-bottom. Water sources are usually from an upstream channel and from the adjacent slopes.
Floodplain wetlands	Floodplain wetlands are formed by adjacent lowland or upland river floodplains and are usually flat or gently sloping. Over-spilling of water from the river channel is the primary source of water.
Flat wetlands	Flat wetlands are either located on open plains or on benches. They are near-level wetland areas with little or no relief (slope). Rainfall is the primary source of water.
Seep	Seep wetlands are located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Subsurface flow from upslope is the main source of water.
Valley head seep	A gently-sloping, typically concave wetland located on a valley floor at the head of a drainage line/stream/river. Subsurface flow is the primary source of water.



Priority Wetlands

Priority natural wetlands or FEPA-priority wetlands and wetland clusters (as identified in NFEPA) are Critical Biodiversity Areas (CBA). All other natural wetlands not included as CBA are Ecological Support Area (Refer Table 11, Criteria). Therefore, the CBA Map should only incorporate natural wetlands.

The National Freshwater Ecosystem Priority Areas project (NFEPA) (Nel et al., 2011) maps natural wetlands and artificial wetlands. The NFEPA project identified priority natural wetlands or FEPA-priority wetlands (includes wetland clusters), which are distinguished from other wetlands (not classed as priorities) (*Figure 6*). Natural areas beyond these FEPA-priority wetlands are also CBA FEPA-priority wetlands are considered important due to the presence of rare plants, threatened frogs and/or wetland-dependent birds. A wetland cluster is a group of wetlands within 1 km of each other and which are surrounded by relatively natural vegetation. The wetland clusters maintain important ecological processes e.g. such as the movement of insects and frogs between wetlands (Driver et al., 2011). All the NFEPA wetlands were mapped at a scale of 1:50 000. Consequently, not all the wetlands in the municipality have been accurately mapped or mapped at all.

The presence and extent of a wetland and its buffer of natural vegetation on a site should be confirmed by a specialist.



Ecosystem Services - What our wetlands do for us

Wetlands, together with an associated buffer of natural vegetation, perform a number of valuable functions, especially in relation to:

- **Water quality and quantity:**
Filtering and purifying water, trapping sediment, controlling peak floods and storing flood waters, supporting stream base flow during the dry season, groundwater discharge/recharge), and
- **Wildlife habitat:**
Providing habitat for amphibians, birds, fish, insects and mammals for all or parts of their life cycles.

Wetlands are protected by various pieces of legislation, such as:

- The National Water Act (36 of 1998) requires that reserve determination studies are undertaken to identify the ecological reserve requirements of a wetland.
- A water use license application or general authorisation is required for all development within 500 m of a wetland (Section 21c and 21i of the National Water Act).
- The National Environmental Management Act (107 of 1998) in terms of principle (r) and the listed activities (Section 24).
- The Conservation of Agricultural Resources Act (43 of 1983); in which no activities are allowed within the flood area or within 10 meters horizontally outside the flood area. [*To be replaced by the Sustainable Use of Agricultural Resources Bill*].



2.4.2 Rivers

Definition:

Rivers are defined as linear landforms with a clearly discernable bed and banks that carries surface water either permanently or periodically. It includes the active channel and the riparian zone (Ollis et al., 2013).

“ Predictions suggest that South Africa’s water supplies will reach their limits between 2020 & 2030. Encouraging efficient water use is therefore crucial, for example through demand control, recycling, re-use and rainwater harvesting. Compliance with the water use guidelines associated with the CBA Map will assist in the protection of our water resources. ”

An aerial photograph of a river system in a semi-arid region. The river flows through a landscape of dry, brownish vegetation and rocky terrain. The water is dark blue, but large sections are covered with bright green algal blooms. The background shows a hillside with sparse, dry trees and shrubs under a clear blue sky.

“The extent & condition of natural vegetation in a catchment, and especially wetlands, has a direct impact on the health of a river”



Rivers are under enormous pressure owing to development, pollution, erosion, sedimentation and the spread of water-thirsty alien plants. The health of a river ecosystem is largely dependent on the presence of natural vegetation or “riparian habitat” along its banks, including good vegetative cover within the surrounding landscape, referred to as the catchment area. Riparian bank vegetation filters pollutants, helps maintain water temperatures, supplies organic matter (‘food’) in support of aquatic life (fish, insects etc.) and acts as a natural buffer to adjacent land uses. The roots of the riparian plants also reduce the effects of floods, by binding river banks and thus preventing erosion and sedimentation. Bank storage is also increased by slowing surface water run-off during floods. For these reasons, it is essential that new developments are separated from a river and its “riparian habitat” by a buffer area (Refer Guidelines Section 4.4).

Rivers of the Maruleng Municipality

Rivers within the municipality are located within the Olifants Water Management Area. The Elands, Wilge, Steelpoort, Olifants and Letaba are its major rivers.

In the Maruleng Municipality, the Olifants River, which flows into the Municipality from the west, is the major river. All the other rivers flow into the Olifants River and include from north to south, the Ga-Selati, Makhutswi, Molomahlapi, Blyde, Rietspruit, Sandspruit, Kasserie and Monwana rivers (Figure 7). The Olifants River eventually flows into the Letaba River before reaching Mozambique.

All these rivers have their source beyond the municipal boundaries, which demonstrates the importance of upstream and downstream land use practices which impact on other water users not situated in Maruleng.



Many of the clean streams in our area are an important source of water during droughts or other climate change phenomena

Priority Rivers

All these rivers and streams form part of Critical Biodiversity Areas or Ecological Support Areas (Figure 7).

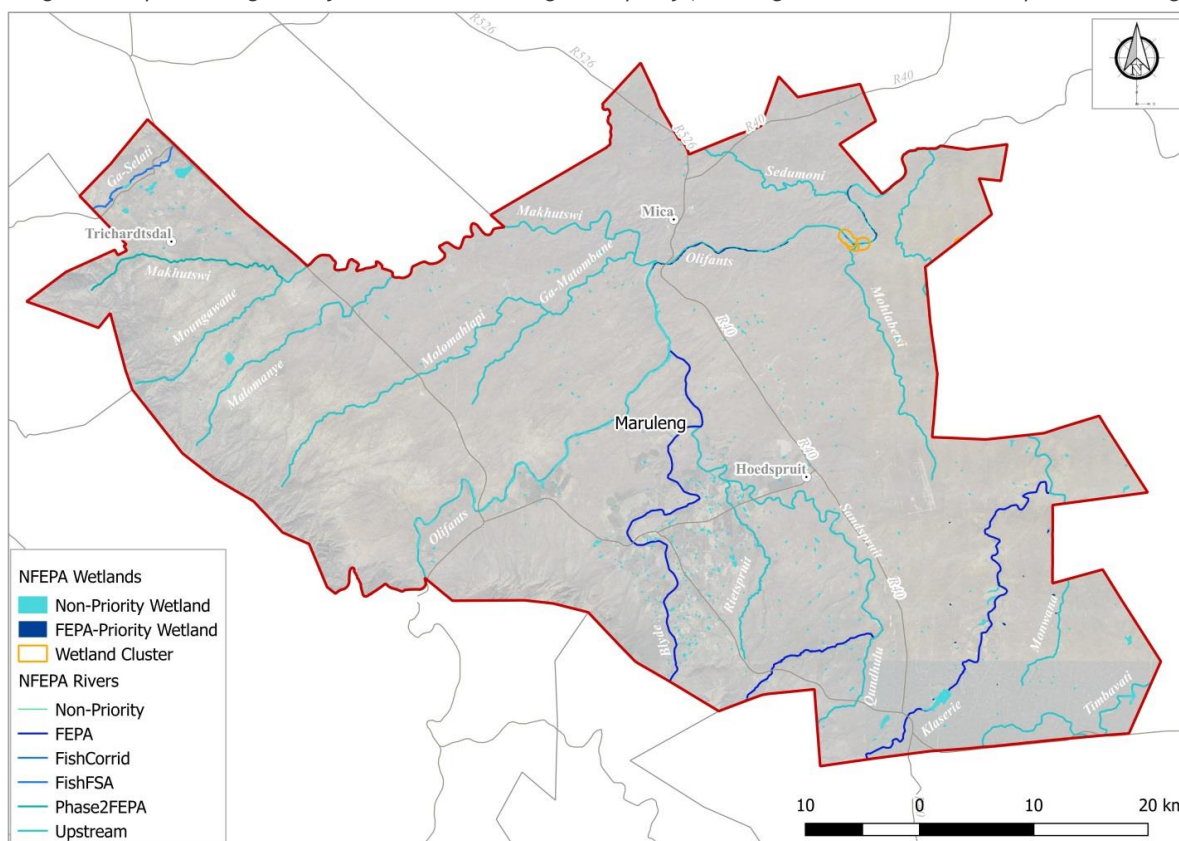
The National Freshwater Ecosystem Priority Areas (NFEPA) project has identified important river reaches (river section), called River FEPAs (Nel et al., 2011). In the municipality, these include the Blyde and Klaserie rivers (Figure 7). River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. They are rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. For river FEPAs the associated sub-quaternary catchment or the surrounding land and smaller stream network should be managed to maintain the good condition of the river reach (Driver et al., 2011) (Figure 7).

Other priority river reaches are **Fish Support Areas (FishFSA)**, which are important for the continued migration of threatened fish. The Ga-Selati River, which flows through the north-western corner of the municipality, is a Fish Support Area. The goal is to keep these rivers in a good condition to prevent further loss of these fish. All the other river reaches of the Maruleng Municipality qualify as **Upstream Management Areas**. Land use in these catchments need to be managed to prevent the degradation of downstream FEPAs.

The Makhutswi River is a **Phase 2 FEPA**, which is a moderately modified river reach (C ecological category) whose condition should not be further degraded as they may be targeted for rehabilitation once River FEPAs are rehabilitated. Because the health of a river is dependent on the condition and extent of vegetation in the surrounding catchment (landscape), all the catchments associated with these rivers are also NFEPA priorities (Section 2.4.3 and Figure 7).

For the GIS shapefile of the NFEPA RIVERS, refer to the SANBI BGIS website (<http://bgis.sanbi.org/SpatialDataset>)

Figure 7. Map indicating the key rivers in the Maruleng Municipality (including the wetland habitats as presented in Figure



6). Refer to the associated priority river catchments in Figure 8.

Riverine ecosystem services - What our rivers do for us

- Rivers are central to human welfare and economic development: They provide water for agricultural, industrial and domestic use; flood attenuation and regulation; food and medicinal plants; transport and/or purification of biodegradable wastes; tourism, recreational and cultural uses; and higher property values.

Rivers are protected by various pieces of legislation, such as:

- The National Water Act (NWA) lists certain rivers, protecting them from ad hoc abstraction and other activities, which require that a potential water user acquires a license from Department of Water and Sanitation (General Authorisations in terms of Section 39 of the NWA). Further to the Act, reserve determination studies must be undertaken to identify the ecological reserve requirements of a river.
- A water use license application or general authorisation is required for all development within 100 m of a river (Section 21c and 21i of the National Water Act).
- Certain Listed Activities in terms of the National Environmental Management Act (107 of 1998) protect rivers.
- According to Section 144 of the NWA, all new township developments must delineate the 1:100 year flood line on a map.



2.4.3 Catchments

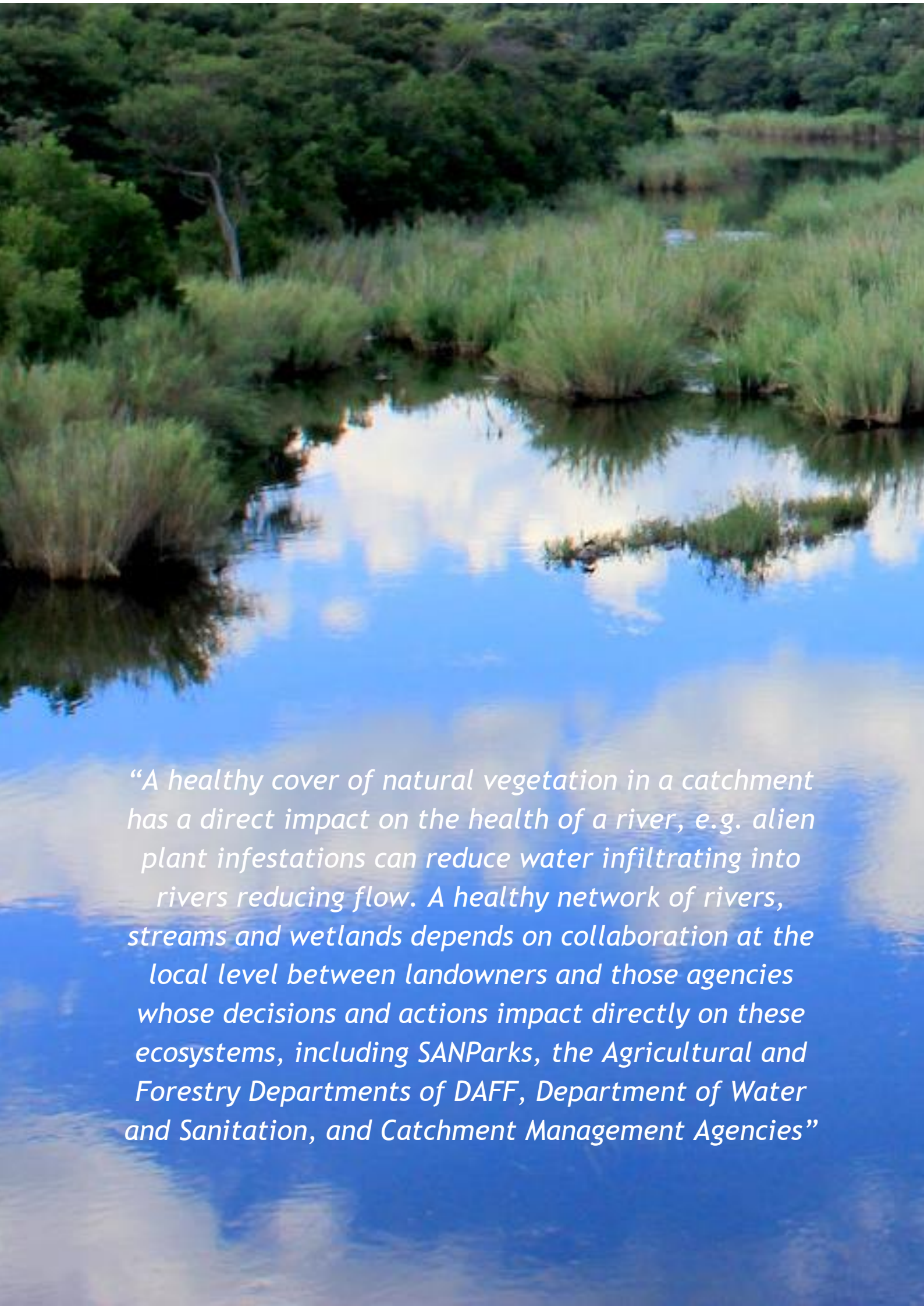
Definition:

A catchment⁵ is the land or geographical region where water from rain (or snow) drains downhill into a river and/or wetland. Catchments include the rivers, streams and wetlands, as well as the land surface (with vegetation cover) from where the water drains into freshwater ecosystems.

Catchments are separated by geographical barriers, such as ridges, hills or mountains. As a result, entire catchments must be managed to protect the freshwater (aquatic) ecosystems they support. Catchments may include entire mountain ranges of major river systems and are essential for maintaining key hydrological (river) processes, involving both surface and ground water.

The extent and condition of natural vegetation in a catchment, especially around wetlands, has a direct impact on the health of a river. Land use activities (e.g. water abstraction, agriculture, and alien vegetation) in the higher catchment areas and along the upper river reaches negatively affect aquatic ecosystems lower in the catchment, as well as downstream areas. Where catchments have lost natural plant cover and where rivers have been straightened or cut off from adjacent wetlands, the impacts are widespread. Flood flows are intensified, the natural ability of the floodplain⁸ to absorb flood water is reduced, erosion is increased and downstream areas experience increased sedimentation. This emphasises the importance of appropriate land management practices in river catchments to ensure good water flows e.g. a good cover of intact pristine⁹ vegetation on catchment slopes which receive the highest rainfall will ensure the delivery of reliable, good quality water supplies downstream.

⁵ A South African Quaternary Catchment boundary map is available, which demarcates the smallest spatial reference of catchments. The larger catchments include, in consecutive order, primary, secondary and tertiary catchments i.e. quaternary catchments are a subdivision within tertiary catchments. Sub-quaternary catchments are a subdivision within the quaternary catchments.



“A healthy cover of natural vegetation in a catchment has a direct impact on the health of a river, e.g. alien plant infestations can reduce water infiltrating into rivers reducing flow. A healthy network of rivers, streams and wetlands depends on collaboration at the local level between landowners and those agencies whose decisions and actions impact directly on these ecosystems, including SANParks, the Agricultural and Forestry Departments of DAFF, Department of Water and Sanitation, and Catchment Management Agencies”



Catchments of the Maruleng Municipality

Maruleng Municipality falls within the Olifants Water Management Area, which is comprised of 5 primary catchments, including the Olifants, Letaba, Elands, Wilge, and Steelpoort catchments. The Maruleng Municipality falls within the Olifants catchment (Primary Catchment B), which is characteristic by the Drakensberg Mountains to the west (along the western boundary of the municipality), which give way to undulating plains and the low plains for much of the remaining municipal domain. The secondary catchments comprising the municipal domain are the Olifants River Catchment B7 and the Wilge River Catchment B6.

Priority catchments of the Maruleng Municipality (Figure 8)

(This section describes river catchments that are of significant importance for biodiversity within the Maruleng Municipality.)

Because the health of a river is dependent on the condition of the vegetation supported in the surrounding catchment, all the priority sub-quaternary catchments associated with the priority rivers indicated in Section 2.4.2 (Figure 7) are also classified as priority catchments by the National Freshwater Ecosystem Assessment (Nel et al., 2011) (Figure 8).

A high proportion of the priority catchments fall within the Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) network, unless where natural land cover (vegetation) has been modified (cleared) for urban or rural settlements, or if natural land cover (vegetation) is classified as Other Natural Area (Figure 12).

Most of the agricultural lands along the Ga-Selati River, Makhutswi River, Olifants River, Blyde River and Klaserie River are ESA as they still support ecological processes (e.g. linkages important for pollination and animal movement, riparian areas) while other catchment areas along these or other rivers that have been irreversibly modified by urban development are not CBA or ESA.

Strategic Water Source Areas

The Wolkberg Strategic Water Source Areas (SWSA) encompasses some of the priority catchments in Maruleng, which fall along the Northern Drakensberg escarpment. SWSA are a national priority as they represent areas that supply a disproportionate amount of mean annual run-off to a geographical region of interest, therefore providing high water yields that support socio-economic development.

For the GIS shapefile of the NFEPA catchments, refer to the SANBI BGIS website (<http://bgis.sanbi.org/SpatialDataset>).

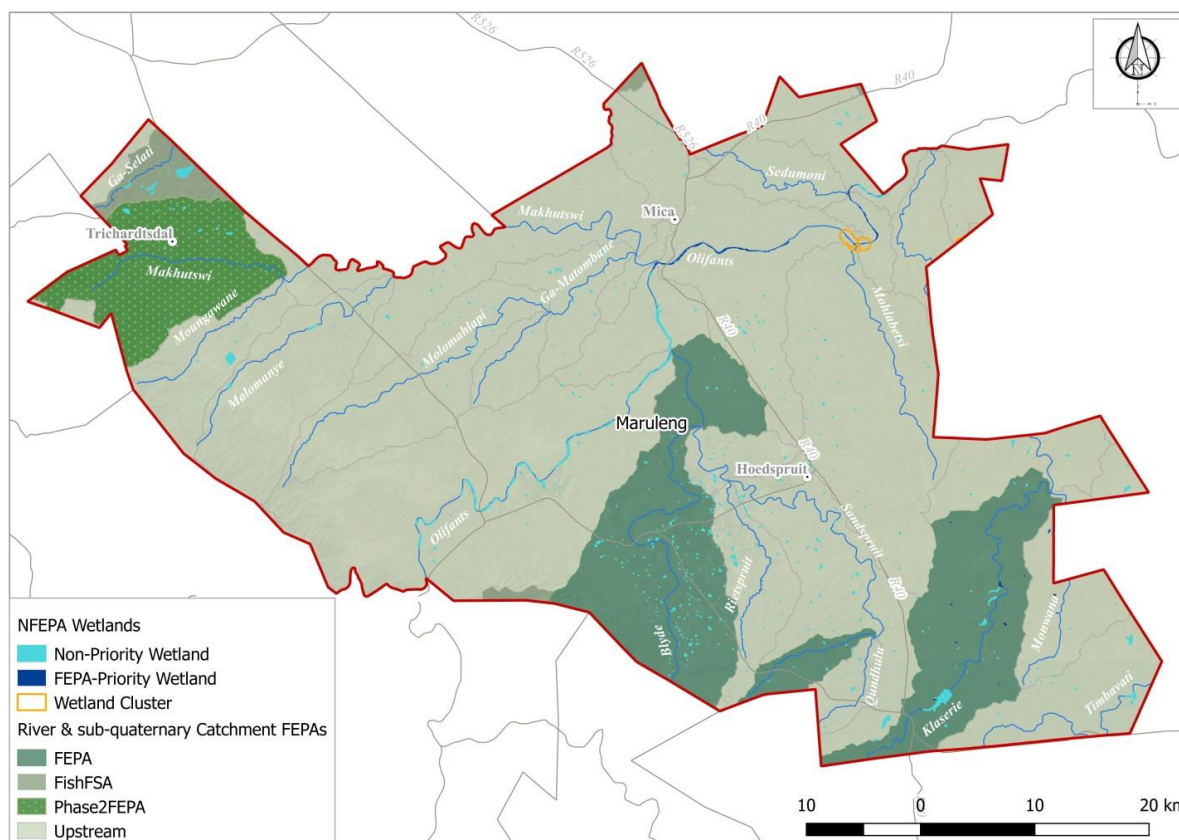


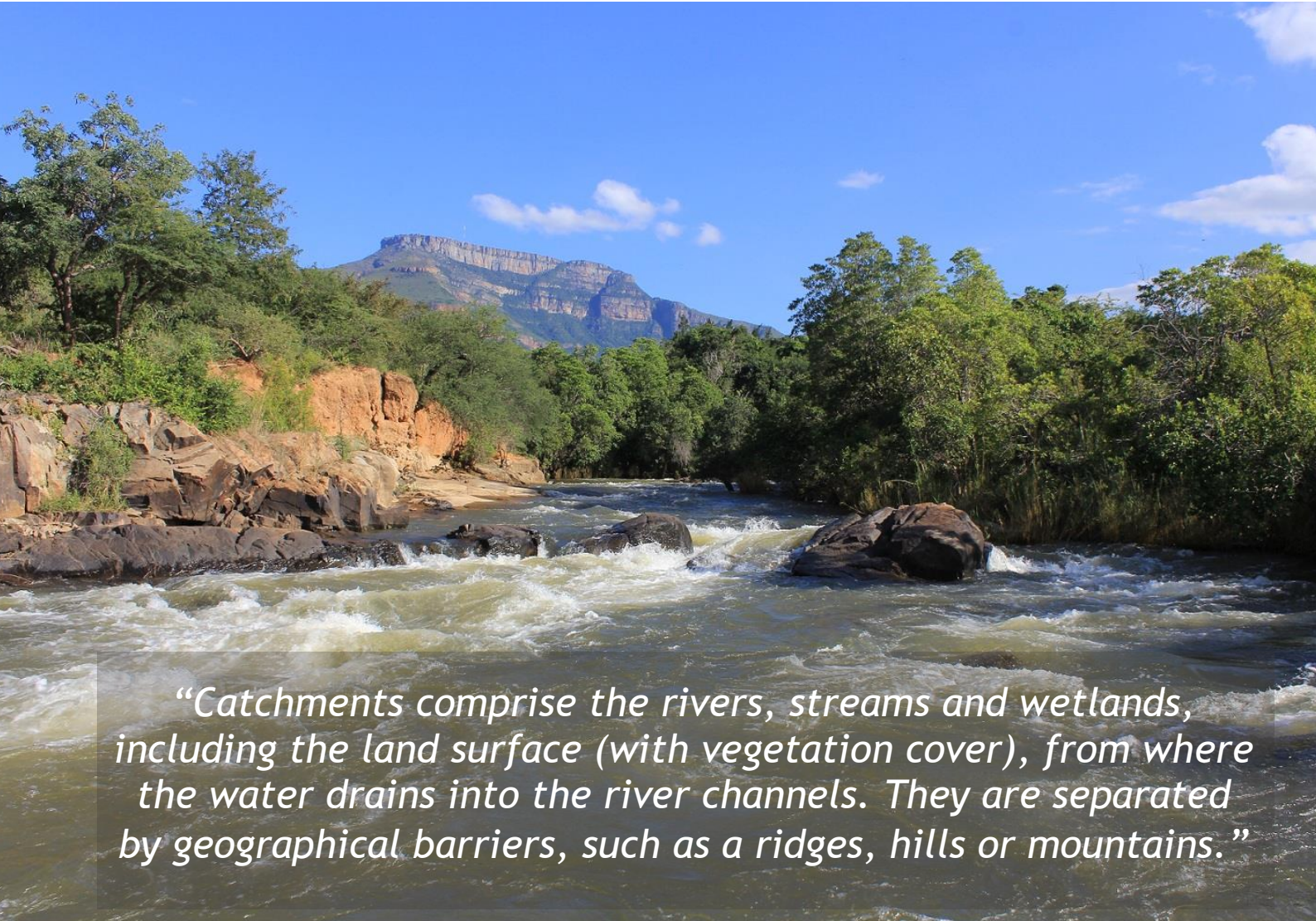
Figure 8. Map indicating the priority catchments associated with the priority rivers (Figure 7) in the Maruleng Municipality (including the wetland habitats as presented in Figure 6).

Catchments that deliver water supplies

Key water sources are from the Olifants, Blyde, Makhutswi, Mougwane, Malomanye, Molomahlapi and Rivers. The Blyde River is a source of water for Hoedspruit and Klaserie.

Rural communities collect water directly from rivers, wetlands and dams, including boreholes. The demand is greatest below the Drakensberg Mountains, to the north-west and including the Makhutswi, Mougwane, Malomanye, Molomahlapi and Olifants Rivers. Boreholes are provided by the Limpopo Department of Water Affairs and Forestry, which supply these western communities, whereas boreholes for Mica and Kampersrus are provided by the Department of Public Works (Maruleng SDF, 2014).

“ Ultimately all water supply in the municipality originates from the escarpment, referred to as a Strategic Water Source Area. ”



“Catchments comprise the rivers, streams and wetlands, including the land surface (with vegetation cover), from where the water drains into the river channels. They are separated by geographical barriers, such as a ridges, hills or mountains.”



“The extent and condition of natural vegetation in a catchment has a direct impact on the health of a river. Activities higher upper in a catchment and also in the upper river reaches (e.g. water abstraction, agriculture, and alien vegetation) negatively affects areas downstream.”



2.5 Species of special concern

Species of special concern refers to red data species and includes the locations where these species are known to occur. Red data species are plant, animal or other organisms (e.g. reptiles, insects etc.) that have been assessed and classified according to their potential for extinction in the near future.

All species that are listed in the IUCN Red Data Book are classified as Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened or Least Concern. IUCN Red Data species are those species classified as Extinct, Critically Endangered, Endangered or Vulnerable. The South African Red List of South African Plants categorises Critically Endangered, Endangered or Vulnerable species as threatened species, and further classifies species into species of conservation concern, which include the categories Near Threatened, Critically Rare, Rare, Declining and Data Deficient. All these categories combined are referred to as species of special concern.

The species of special concern (SSC) were derived from expert knowledge and known locations or habitats in which these species are present. Special habitats were identified for specific SSC (plant, animal, bird, fish, etc.). The distribution of these plants, as captured in the South African PRECIS⁶ plant database, was mapped according to their location in a Quarter Degree Square (i.e. an area of approximately 30 km by 30 km covered by one 1:50 000 South African topographical map). A selection of the species of special concern within the Ba-Phalaborwa region is presented in Table 5 below (red data category is based on the latest listings available for South Africa (Regional) or IUCN where indicated).

Table 5. A selection of key species of special concern (SSC) within the Maruleng Municipality

Note: Common names for fauna in alphabetical order for ease of reference.

SPECIES	COMMON NAME	SA RED DATA CATEGORY
PLANTS (FLORA)		
<i>Aloe hardyi</i>	Mountain/ Penge Aloe	Rare
<i>Aloe thompsoniae</i>	Wolkberg Cliff Aloe	Rare
<i>Asparagus fouriei</i>	No common name known	Vulnerable
<i>Brachystelma parvulum</i>	No common name known	Vulnerable
<i>Clivia caulescens</i>	Stem Clivia	Near Threatened
<i>Combretum petrophilum</i>	Olifants River Bushwillow	Rare
<i>Dioscorea sylvatica</i>	Forest Elephant's foot	Vulnerable
<i>Dracaena transvaalensis</i>	Photsoloma / Wolkberg Dragon Tree	Rare
<i>Drimia sanguinea</i>	Blueweed	Near Threatened
<i>Elaeodendron transvaalense</i>	Monamane/bushveld saffron	Near Threatened
<i>Encephalartos brevifoliolatus</i>	Escarpment cycad	Extinct in the Wild
<i>Encephalartos cupidus</i>	Blyde river cycad	Critically Endangered
<i>Encephalartos dolomiticus</i>	Wolkberg cycad	Critically Endangered

⁶ National Herbarium Pretoria (PRE) Computerised Information System. Search on <http://posa.sanbi.org/searchspp.php>



SPECIES	COMMON NAME	SA RED DATA CATEGORY
PLANTS (FLORA) (continue)		
<i>Encephalartos dyerianus</i>	Lowveld/Lillie cycad	Critically Endangered
<i>Encephalartos inopinus</i>	Lydenburg cycad	Critically Endangered
<i>Encephalartos lebomboensis</i>	Lebombo cycad	Endangered
<i>Encephalartos paucidentatus</i>	Barberton cycad	Vulnerable
<i>Faurea macnaughtonii</i>	Terblanz beechwood	Rare
<i>Gasteria batesiana</i>	Knoppies Cow tongue	Rare
<i>Gladiolus pavonia</i>	No common name known	Critically Endangered
<i>Helichrysum junodii</i>	No common name known	Rare
<i>Protea laetans</i>	Blyde sugarbush/protea	Vulnerable
<i>Prunus africana</i>	African cherry	Vulnerable
<i>Pseudognaphalium luteo-album</i>	No common name known	Rare
<i>Searsia batophylla</i>	Bramble Currant	Vulnerable
<i>Thesium davidsonae</i>	No common name known	Vulnerable
<i>Thesium gracilentum</i>	No common name known	Vulnerable
<i>Thorncroftia media</i>	No common name known	Critically Rare
<i>Warburgia salutaris</i>	Pepper-bark tree	Endangered
BIRDS		
<i>Podica senegalensis</i>	African Finfoot	Vulnerable
<i>Tyto capensis</i>	African Grass Owl	Vulnerable
<i>Nettapus auritus</i>	African Pygmy Goose	Vulnerable
<i>Macheiramphus alcinus</i>	Bat Hawk	Endangered
<i>Terathopius ecaudatus</i>	Bateleur	Endangered
<i>Ciconia nigra</i>	Black Stork	Vulnerable
<i>Turnix nanus</i>	Black-rumped Buttonquail	Vulnerable
<i>Anthropoides paradiseus</i>	Blue Crane	Critically Endangered
<i>Hirundo atrocaerulea</i>	Blue Swallow	Critically Endangered
<i>Lioptilus nigricapillus</i>	Bush Blackcap	Vulnerable
<i>Poicephalus robustus</i>	Cape Parrot	Endangered
<i>Gyps coprotheres</i>	Cape Vulture	Endangered
<i>Stephanoaetus coronatus</i>	Crowned Eagle	Vulnerable
<i>Neotis denhami</i>	Denham's Bustard	Vulnerable
<i>Rostratula benghalensis</i>	Greater Painted-snipe	Vulnerable
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near Threatened
<i>Necrosyrtes monachus</i>	Hooded Vulture	Endangered
<i>Ardeotis kori</i>	Kori Bustard	Near Threatened
<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable
<i>Torgos tracheliotos</i>	Lappet-faced Vulture	Endangered
<i>Crithagra citrinipectus</i>	Lemon-breasted Canary	Near Threatened
<i>Leptoptilos crumeniferus</i>	Marabou Stork	Near Threatened
<i>Polemaetus bellicosus</i>	Martial Eagle	Endangered
<i>Zoothera gurneyi</i>	Orange Ground Thrush	Near Threatened
<i>Scotopelia peli</i>	Pel's Fishing Owl	Endangered
<i>Ephippiorhynchus senegalensis</i>	Saddle-billed Stork	Endangered



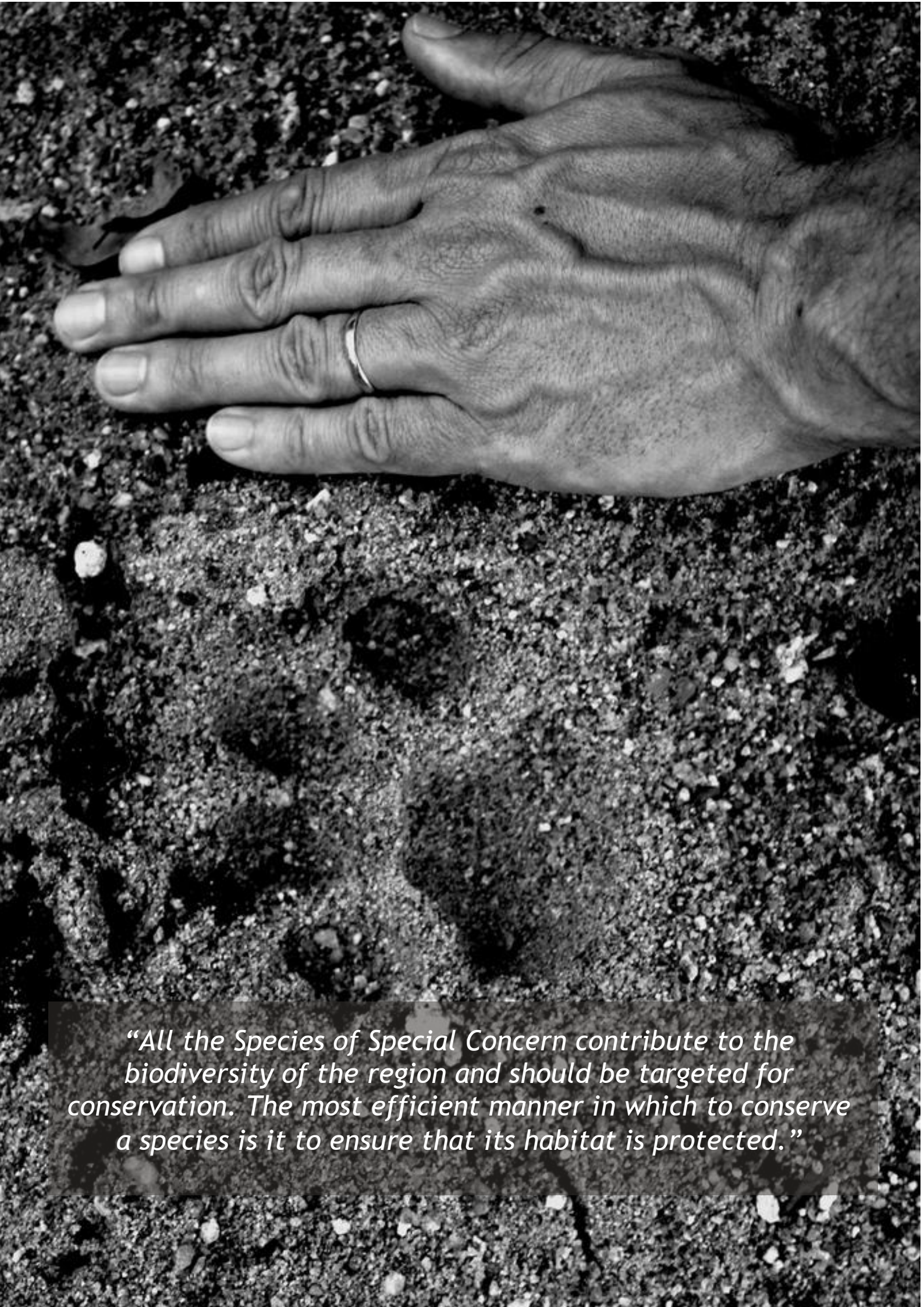
SPECIES	COMMON NAME	SA RED DATA CATEGORY
BIRDS (continue)		
<i>Sagittarius serpentarius</i>	Secretary bird	Vulnerable
<i>Geronticus calvus</i>	Southern Bald Ibis	Vulnerable
<i>Bucorvus leadbeateri</i>	Southern Ground-Hornbill	Endangered
<i>Sarothrura affinis</i>	Striped Flufftail	Vulnerable
<i>Falco fasciinucha</i>	Taita Falcon	Critically Endangered
<i>Aquila rapax</i>	Tawny Eagle	Endangered
<i>Gorsachius leuconotus</i>	White-backed Night Heron	Vulnerable
<i>Gyps africanus</i>	White-backed Vulture	Vulnerable
<i>Aegyptius occipitalis</i>	White-headed Vulture	Critically Endangered
MAMMALS		
<i>Acinonyx jubatus</i>	Cheetah	Vulnerable
<i>Diceros bicornis</i>	Black Rhino	Critically Endangered
<i>Panthera leo</i>	Lion	Least Concern - Regional/ Vulnerable (IUCN)
<i>Cloeotis percivali</i>	Short-Eared Trident Bat	Endangered
<i>Lycaon pictus</i>	Wild Dog	Endangered
<i>Ceratotherium simum</i>	White Rhino	Vulnerable
REPTILES		
<i>Crocodylus niloticus</i>	Nile Crocodile	Vulnerable
<i>Aspidelaps scutatus intermedius</i>	Lowveld shield nosed snake	Least Concern (Endemic)
FISH		
<i>Opsaridium peringueyi</i>	<i>Southern Dwarf Minnow</i>	Least Concern*

* Although Least Concern, this species is identified as a SSC by the MPAH data.

- **Red listings:** BirdSA Checklist (2018), 2016 Red List of Mammals of South Africa, Lesotho & Swaziland, SA Red Data Book: Butterflies (2009), 2014 Atlas and Red List of the Reptiles of South Africa, Lesotho & Swaziland, SANBI Threatened Species Programme (<http://redlist.sanbi.org/>), or otherwise indicated as per IUCN red list of threatened species (<http://www.iucnredlist.org/>).

*“Increasing demands
for rhino horn has
had devastating
effects on this
species in the
region”*





“All the Species of Special Concern contribute to the biodiversity of the region and should be targeted for conservation. The most efficient manner in which to conserve a species is it to ensure that its habitat is protected.”



2.6 Ecological process areas & climate change

Ecological Process Areas

Ecological process areas are the physical “spaces” where ecological processes, such as pollination, seed dispersal, nutrient cycling, animal migrations, and fire, take place. These processes enable natural systems to function as healthy, working systems.

In the case of **evolutionary processes** and impending climate change, it is even more important that these areas where species are generated are managed appropriately. For example, where different soil types meet, referred to as soil interface zones, this juxtaposition enables certain plants to adapt to the varying soils, and new plants evolve.

Ecological process areas operate at different scales. Large ecological process areas are commonly referred to as landscape corridors or ecological corridors. Ecological corridors are comprised of large tracts of natural habitat, such as major river systems or mountain ranges and ridges. They serve as landscape-scale “highways”, allowing plants, birds and animals to migrate along them in response to any changes in climate. These highways run along key rivers from the higher inland regions and plateaus, and across the lower lying areas. A landscape corridor may cover a variety of habitat types, such as pristine Savanna and Alluvial Vegetation types, disturbed and/or degraded habitats (alien plant infestation), and special habitats (e.g. wetlands), even agricultural lands.

Smaller ecological process areas include, for example, the natural vegetation (buffer) around an isolated wetland or the plants that border river banks, known as riparian vegetation. These areas are important as they regulate surface run off into wetlands and rivers thereby preventing erosion and sedimentation, reducing downstream flooding, while providing habitat and food for fauna (e.g. birds, insects, frogs) associated with the wetlands and rivers.

Ecological Process Areas & Sustainable Development

The objective of sustainability is to ensure the persistence of critical ecological processes along a number of gradients and for these to interlink, where possible. For example, a river corridor following the gradient from inland mountains to the lower plains links areas of different soil and geological types, as well as spanning the east-west gradient. A network of corridors provides the best design to support ecological processes and the movement of species.

Landscape corridors, which extend beyond local municipal and provincial boundaries, also serve to protect the source of rivers to ensure good quality, water yield from mountain catchments, and to support rare or threatened species. They deliver invaluable ecosystem services that are too costly or impossible to produce artificially, functioning at scales impossible for society to duplicate.

Climate Change Mitigation & Adaptation

In the face of escalating water needs and global climate change, it is vital that landscape corridors, as well as dolomite aquifers, wetland and riparian buffers, are managed effectively against the loss of intact habitat and that the natural landscape is not fragmented into disconnected portions.



Ecological process issues important for climate change mitigation and adaptation thus include:

- **Large-scale hydrological processes:** The Northern Drakensberg supplies large quantities of fresh water to the Maruleng Municipality via the rivers that flow from the mountain through the municipality. It is thus a high priority water production area, referred to as the Wolkberg Strategic Water Source Area, which should be protected to ensure continued supply of good quality water.
- **Wetlands, riparian areas and associated buffers:** Retaining wetlands, riparian areas (riverbank vegetation) and associated buffers are important for the range of ecosystem services these provide, particularly flood attenuation and regulation.
- **Dolomitic aquifers:** These are valuable subterranean water reservoirs that act as rainfall sponges, thereby reduce downstream flooding. Land use in these landscapes should not significantly degrade the recharge of these aquifers. Maruleng supports key karst/limestone/dolomite aquifers. The Pong Dolomite Mountain Bushveld represents some of the areas that would support important aquifers.
- **Climate change refugia:** These include high altitude grasslands, kloofs and south facing mountain slopes as well as high species diversity; high topographic diversity; and, strong biophysical gradients (e.g. high altitude, rainfall or temperature gradients). This is a key component of the climate resilience layer (Refer Section 5.3.1.2).
- **Large, intact landscapes:** Large, intact landscapes regulate good quality water supplies, reduce flooding downstream and store larger quantities of carbon, thereby mitigating against potential future climate change impacts (refer ecosystem services below).
- **Corridors and connectivity:** Retaining landscape connectivity is critical for the long-term persistence of biodiversity and for adaptation to climate change. It allows species to respond and adapt to the impacts of climate change, such as migrations up the elevation gradient to cooler climatic conditions.
- **Avoiding High-Risk Zones:** An important consequence of climate change is the likely increase in extreme flooding. Retaining intact natural habitat, especially wetlands, riparian habitat and floodplains, is crucial to reducing the severity of flood events; as they play an important role in regulating hydrological processes, such as storm water runoff. Wetlands, riparian areas, and especially active floodplains, are considered high-risk zones. Where possible, settlements, infrastructure and agricultural activities should avoid these high-risk zones to reduce the long term impacts of climate change. This is of particular relevance to the poorer communities.

Refer Section 5.3.1.2 - Climate Change Resilience Map (Figure 14) and Climate Change Priorities Map (Figure 15).

Landscape Corridors of the Maruleng Municipality

Landscapes corridors are a combination of Critical Biodiversity Areas and Ecological Support Areas that follow the major rivers, thus linking upland and lowland habitats, as well as linking to the higher lying mountainous terrain of the Drakensberg (includes Wolkberg), a strategic water source area. Rivers and their associated riparian or riverbank habitats, including associated catchments, therefore provide the basis for these large-scale (landscape level) ecological processes (Figure 12, Section 3).

Although mining can provide important revenue for development, careful planning needs to ensure that the negative effects are well regulated and contained



The extensive use of pesticides and herbicides can have a devastating effect on food chains and so affect much of the biodiversity in a region.





Ecosystem services - what our Landscape Corridors (ecological infrastructure) do for us

Ecological or landscape corridors provide valuable ecosystem services that are often impossible or very costly to replicate or offset.

- Landscape corridors absorb rainfall over immense areas, and act as vast sponges storing rainfall water and then releasing it slowly through the dry season. In this way, corridors serve to protect the source of rivers and ensure water yield from the associated catchments.
- The quality and quantity of water supplies are maintained, providing for human consumption and socio-economic development, while ensuring the survival of downstream wetlands and rivers, which in turn deliver other ecosystem services e.g. the purification of water by riparian and wetland plants and soils.
- The scenic or aesthetic value of large landscape corridors contributes significantly towards tourism and recreation.

2.7 Protected Areas, Conservation Areas & Ecosystem Protection Level

Protected Areas are the core areas in the network of biodiversity; and are vital in supporting ecological sustainability and enhancing resilience to climate change. Protected Areas within the Municipality can be divided into two main categories, namely formal Protected Areas and Conservation Areas (Table 6, Figure 9).

Protected Areas (*Figure 9*)

Protected Areas are areas of land or water that are formally protected by and gazetted in terms of the National Environmental Management: Protected Areas Act (NEMPAA) 57 of 2003. These areas are managed mainly for biodiversity conservation, allow for long term security of tenure and are recognized as such by the National Protected Areas Expansion Strategy, which seeks to expand Protected Areas in South Africa. The NEMPAA distinguishes between several categories of Protected Areas, namely special nature reserves, national parks, nature reserves, and protected environments. It also recognises World Heritage Sites declared in terms of the World Heritage Convention Act (49 of 1999); marine protected areas (MPAs) in terms of the Marine Living Resources Act (18 of 1998) and/or the NEMPAA; specially protected forest areas declared in terms of the National Forests Act (84 of 1998); and mountain catchment areas declared in terms of the Mountain Catchment Areas Act (63 of 1970). Note that these can include privately-owned areas if they have been formally declared as National Parks, Nature Reserves or Protected Environments under NEMPAA.

Conservation Areas (*Figure 9*)

Conservation areas are those areas of land not formally protected by and gazetted in terms of the NEMPAA, but are informally protected by the current landowners and users, and managed at least partly for biodiversity conservation. Conservation Areas therefore do not allow for long-term security of tenure.



They could include areas covered by Biodiversity Agreements in terms of the National Environmental Management: Biodiversity Act (10 of 2004), non-declared Private Nature Reserves and conservancies. Conservancies are agreements for co-operation among neighbouring landowners, and require no legal long-term commitment from the landowners.

Kruger to Canyon Biosphere Reserve (Figure 9)

The Kruger to Canyon Biosphere Reserve covers the entire municipality, and encompasses land beyond its boundaries. The Kruger to Canyon Biosphere Reserve is technically considered to be a Conservation Area.

Refer to **Table 6** below for the extent (hectares and %) of Protected Areas and Conservation Areas, including the Kruger to Canyon Biosphere Reserve (Figure 9).

Table 6. Total area of Protected Areas (PA) and Conservation Areas (CA), includes the Kruger to Canyon Biosphere Reserve, for the Maruleng Municipality (Figure 9)

Size of Municipality	Protected Area		Conservation Area		Kruger to Canyon Biosphere	
	ha	%	ha	%	ha	%
324 429,5	78 398,9	24,2	100 349,0	30,9	324 429,4	100,0

Note: The entire municipal area is covered by the various PA & CA categories. The municipality is covered entirely by the biosphere, which is technically a CA, while more than half of the municipality includes PAs and CAs.

The Limpopo Protected Area Expansion Strategy (LPAES) (2014)

The Limpopo Protected Area Expansion Strategy (LPAES) (Desmet et al., 2014) identifies focus areas for expansion of the protected area network within the Limpopo Province, and thus the Maruleng Municipality, which includes the Selati-Letaba and Kruger to Canyons Biosphere Reserve Focus Areas (Figure 9).

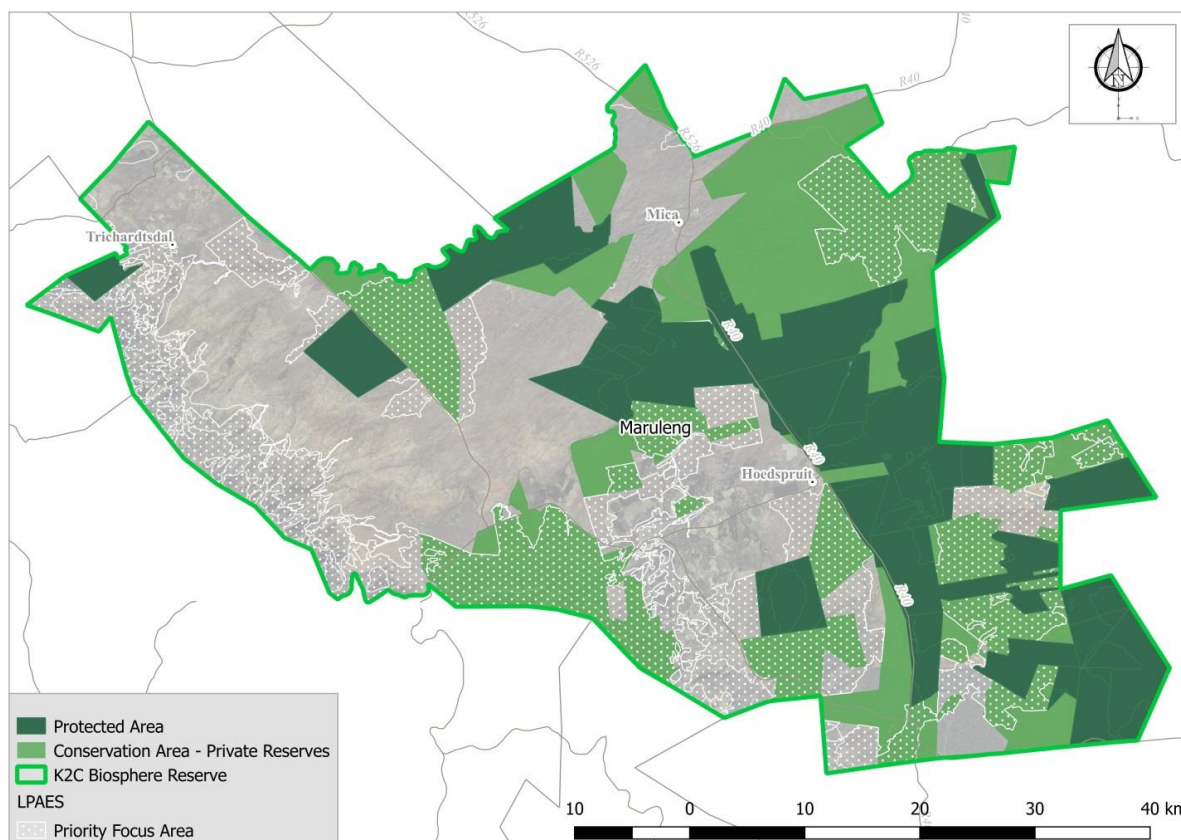


Figure 9. Protected Areas and Conservation Areas in the Maruleng Municipality, including the Limpopo Protected Area Expansion Strategy (LPAES) focus areas (Desmet et al., 2014).

“ It is important to note that existing Protected Areas do not necessarily protect or conserve examples of all the different ecosystems which occur in the region i.e. not all types are represented. ”

Refer to ‘ecosystem protection level’ below (provincial level protection) (Table 7). In the instance of Maruleng Municipality, most of the vegetation types are moderately to well protected, while the remaining 6 are ‘not protected’ (1) and ‘poorly protected’ (5)(Figure 10).

The network of CBA and ESA presented on the CBA Map (Figure 12) does include a representative sample of all ecosystem types. These areas should be proactively targeted for formal protection or management via other mechanisms e.g. conservation areas, zoning. Once verified on the ground, these biodiversity priority areas need to be coupled to an implementation strategy developed in collaboration with the key stakeholders in the region (e.g. municipalities, conservation agencies etc.). Stakeholders should also be urged to develop a catchment planning approach for their implementation strategy, as these areas provide input into the management policy of Catchment Management Agencies (Sections 5.3.1.8 and 5.3.1.9).

Recycled items reduce the pressure of heavy harvesting of biodiversity



The massive planting of commercial crops has led to massive pressure on the local biodiversity



The encroachment of alien species as seen on the foothill of Mariepskop is a serious threat to both the water resources and the vegetation.





Ecosystem Protection Level

Ecosystem protection level is the measurement of how well an ecosystem type is represented in the existing protected area network. It is calculated as the proportion of the biodiversity target for each vegetation type that is included in the statutory protected area network (Government of South Africa, 2010). The biodiversity target refers to the minimum proportion of each ecosystem (vegetation) type that needs to be kept in a natural or near-natural state in order to maintain viable representative samples of all ecosystem types, including the majority of species associated with those ecosystem types.

Ecosystem protection level is divided into four categories (Driver et al., 2012):

1. Not protected: < 5% of its biodiversity target is met within Protected Areas.
2. Poorly protected: 5 % - 49 % of its target is met in Protected Areas.
3. Moderately protected: 50 % - 99 % of its target is met in Protected Areas.
4. Well protected: 100% or more of its target is met in Protected Areas.

According to the provincial ecosystem protection levels, three (3) vegetation types are not protected, namely Granite Lowveld, Legogote Sour Bushveld and Northern Escarpment Afromontane Fynbos; five (5) are poorly protected, Gravelotte Rocky Bushveld, Ohrigstad Mountain Bushveld, Pong Dolomite Mountain Bushveld, Subtropical Freshwater Wetlands and Tzaneen Sour Lowveld, whereas the remaining six (6) vegetation types are well protected (Table 7 & Figure 10). The not protected ecosystems cover the majority of the municipal planning domain.

Table 7. Provincial protection levels for ecosystems occurring in the Maruleng municipality

Vegetation Type - Ecosystem Protection Level (Provincial Level Protection)	
Not protected (< 5 % of biodiversity target met in protected areas)	Granite Lowveld Bushveld Legogote Sour Bushveld Northern Escarpment Afromontane Fynbos
Poorly protected (5 - 49 % of biodiversity target met in protected areas)	Gravelotte Rocky Bushveld Ohrigstad Mountain Bushveld Pong Dolomite Mountain Bushveld Subtropical Freshwater Wetlands Tzaneen Sour Lowveld
Moderately protected (50-99 % of biodiversity target met in protected areas)	None
Well protected (≥ 100 % of biodiversity target met in protected areas)	Lowveld Riverine Forest Lowveld Rugged Mopaneveld Northern Escarpment Quartzite Sourveld Northern Mistbelt Forest Phalaborwa-Timbavati Mopaneveld Tsende Mopaneveld

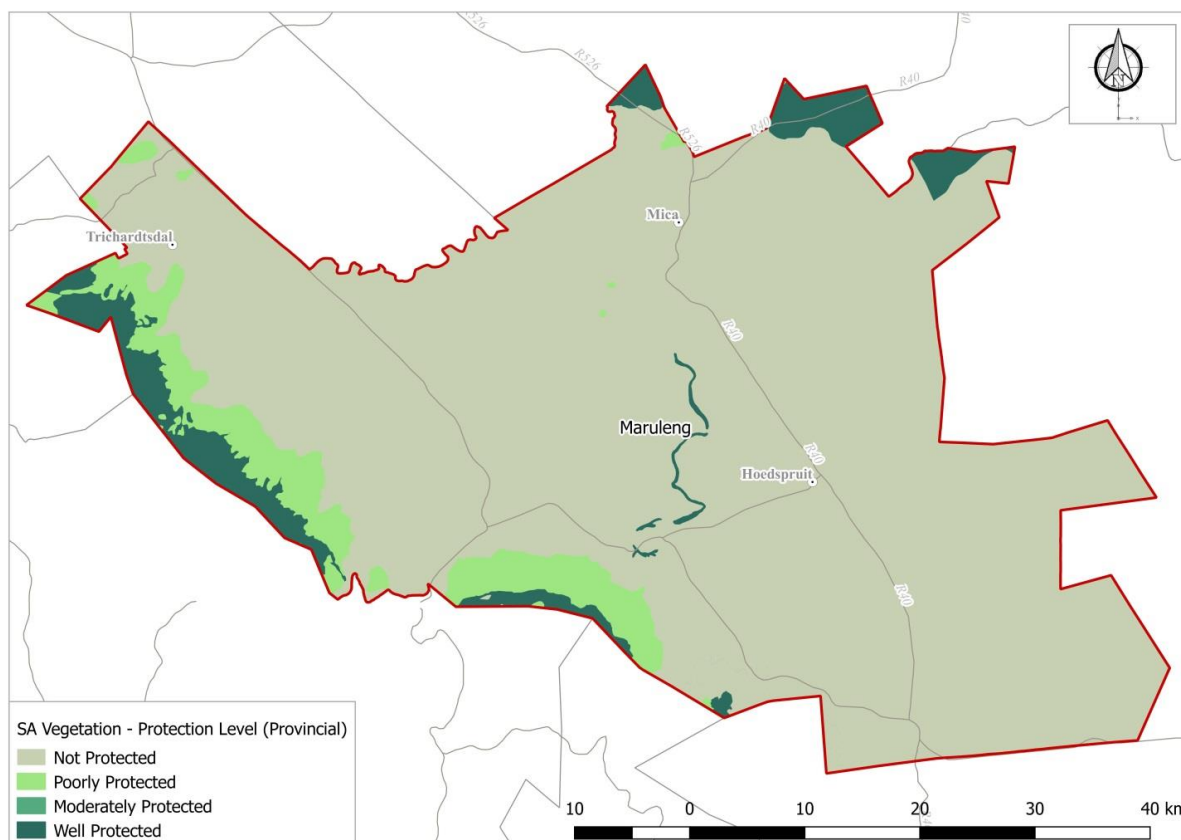


Figure 10. Ecosystem protection levels in the Maruleng Municipality (provincial protection levels) (Desmet et al., 2013).

2.8 Land cover in the Maruleng Municipality: Levels of modification & degradation

Definition:

The term land cover describes the level of change or modification of natural ecosystems, meaning habitats or vegetation cover. Land cover can range from natural to near-natural areas, degraded³ and overgrazed, to areas which have been irreversibly modified³ (e.g. urban development).

Thus, land cover indicates to us how much biodiversity remains in the landscape and the amount of land that has been degraded or modified. It is one of the most important layers in determining ‘where’ the biodiversity priority areas are positioned in the landscape.

Land Cover in the Maruleng Municipality

Table 8 and Figure 11 present the broad land cover categories that have been mapped in the Maruleng Municipality (LEDET, 2016a). The national land cover map (DEA, 2013 - 2014) was used to improve upon the ‘on-ground’ accuracy of land cover in the municipal planning domain. However, the scale of the national land cover was done at a 30 m resolution (this means two objects 30 meters long or wide, sitting side by side, can be separated (resolved) on an image), while some areas were poorly classified.



Further improvement of the land cover was undertaken for the Maruleng Municipality (in 2018), in particular around urban and rural settlement areas, as well as mining and agricultural areas. This involved using available land cover and heads-up digitizing to more accurately reflect existing land cover. For example, cleared areas that were previously indicated as CBA or ESA 1 were re-classified as ESA 2 or No Natural Remaining, thus representing actual site conditions.

Ground-truthing was not possible and thus spatial inaccuracies in the land cover and classification errors will be evident at the site level. This highlights the importance of site assessments when considering applications for land use changes.

Table 8. Summarized land cover categories for the Maruleng Municipality showing levels of modification and degradation, including natural or near-natural areas (DEA, 2013-2014).

Category	Specific Category	Area (ha)	Area (%)
Natural & Semi-Natural	Bare Ground (Rock)	605.2	0.2%
	Degraded	736.9	0.2%
	Grasslands	18,016.5	5.5%
	Indigenous Forest	2,144.9	0.7%
	Low shrubland	1,876.0	0.6%
	Thicket /Dense bush	54,258.1	16.7%
	Wetlands	504.0	0.2%
	Woodland/Open bush	21,6118.9	66.4%
Not Natural	Cultivated (commercial annual crops non-pivot)	2,495.1	0.8%
	Cultivated (commercial annual crops pivot)	2,242.2	0.7%
	Cultivated (commercial permanent orchards)	13,523.8	4.2%
	Cultivated (subsistence crops)	1,781.5	0.5%
	Mines	106.1	0.0%
	Plantations / Woodlots	125.7	0.0%
	Settlements	10,330.6	3.2%
	Waterbodies	380.1	0.1%
<i>This data excludes the improvement of the land cover in 2018 for the CBA Map.</i>			



“All human life is entirely dependent on the natural resources and services delivered by ecosystems. These are not infinite, meaning that there are ecological limits to development”

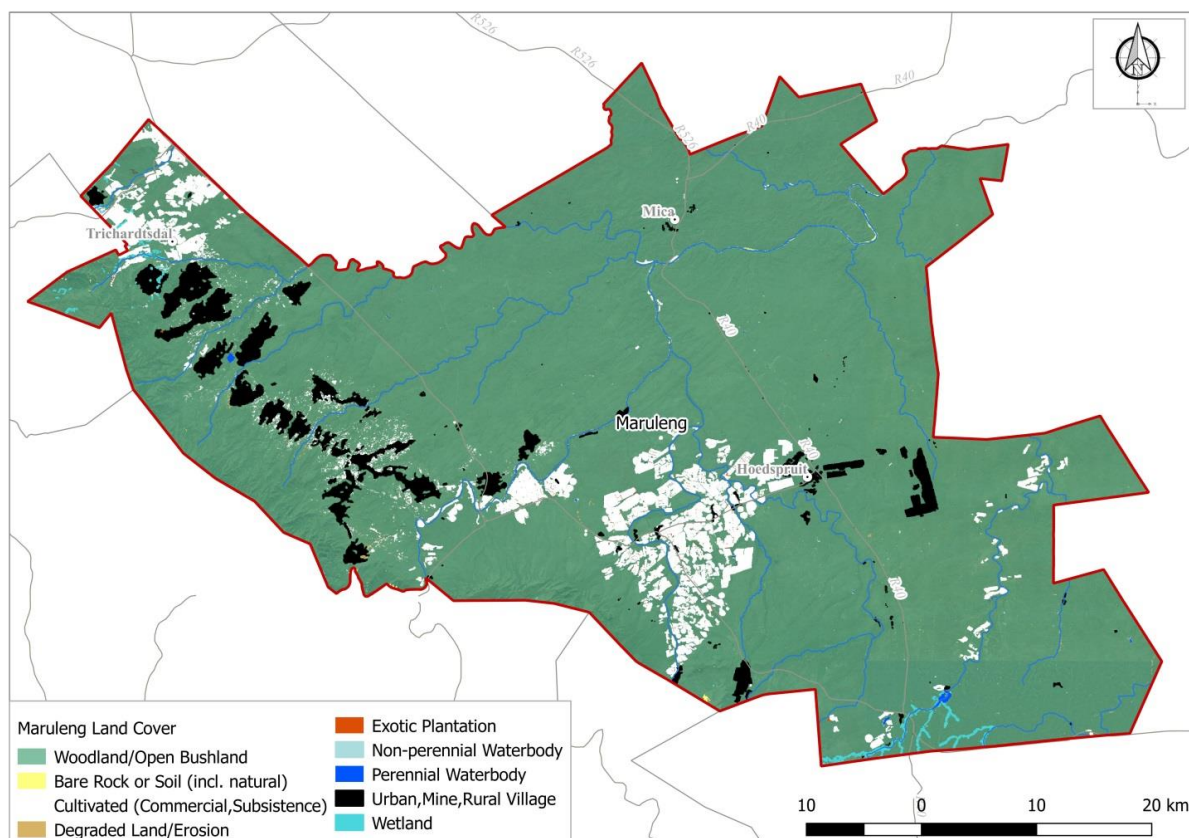


Figure 11. Map indicating land cover showing levels of modification and degradation, including natural to near-natural areas, within the Maruleng Municipality

Users can download the DEA land cover data from the DEA website: https://egis.environment.gov.za/national_land_cover_data_sa.

2.8.1 Current threats to biodiversity

The dominant land use activities in the Municipality that cause modification (loss) or degradation (deterioration) of the natural environment are listed in Table 9 below.

Table 9. Current threats to biodiversity

Terrestrial ecosystems (on land)	Aquatic ecosystems (associated with water)
Expanding agriculture.	Contamination of groundwater due to lack of a reticulated sanitation systems.
Uncontrolled development e.g. expansion of rural and urban settlement areas.	Surface water pollution due to sewage leakages and release of industrial waste into streams as well as illegal solid waste dumping along rivers.
Deforestation or over-harvesting of fuel wood due to poverty, lack of knowledge, unemployment, unclear land policy, traditional practices and economic gains.	Siltation of rivers due to removal of riparian vegetation and associated soil erosion.
Encroachment by alien invasive plants	Uncontrolled abstraction for agricultural development.
Uncontrolled veld fires often due to negligence and uncontrolled burning.	
Overstocking and associated over-grazing.	

Section 3

Map of Critical Biodiversity Areas & Ecological Support Areas for the Maruleng Municipality





3.1 What is a Critical Biodiversity Areas (CBA) map?

A CBA Map is a systematic biodiversity plan produced at a scale of 1:50 000, that delineates on a map Protected Areas, Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas and No Natural Remaining.

Systematic Biodiversity (conservation) Planning identifies those areas which are most in need of conservation & protection in order to meet **National Biodiversity Targets** (also referred to as Biodiversity thresholds).

These areas represent the Critical Biodiversity Areas on the map. Note that the Protected Areas also include the target areas and are essentially CBA (Protected Area).
(Refer to the Glossary).

Protected Areas, Critical Biodiversity Areas and Ecological Support Areas are referred to as the **Biodiversity Priority Areas** (Table 10). Central to the CBA Map is a series of land use guidelines (Section 4).

The broad objective of the CBA Map is to ensure appropriate land use planning for sustainable development, to reduce cumulative impacts on biodiversity and to promote integrated management of natural resources.

Refer to Section 3.2 for the CBA Map (Figure 12), associated descriptions (Table 10) and criteria that defined the categories on the CBA Map (Table 11).

3.1.1 How was the Critical Biodiversity Areas (CBA) Map produced?

The map of Critical Biodiversity Areas and Ecological Support Areas developed for the Maruleng Municipality forms part of the Mopani District Bioregional Plan (LEDET, 2016a).

The Mopani District Bioregional Plan CBA Map is based on the provincial map generated in the provincial Limpopo Conservation Plan version 2 (Desmet et al., 2013), which was developed by LEDET. It was further refined to align with other relevant spatial plans for the District, such as the Olifants and Letaba Catchment Environmental Management Framework (EMF), the Kruger to Canyon Biosphere Reserve, municipal Spatial Development Frameworks (SDFs) and available land cover (see below Section 3.1.2).

The CBA Map was developed in 2015 / 2016, and was thus based on data available at that time. Integration of the new data therefore resulted in a refinement of the 2013 provincial CBA Map.



For a detailed explanation of how the CBA Map for the Mopani District was generated, refer to the Mopani District Bioregional Plan ‘Process and Consultation Report’

(Appendix 3: *Technical Notes on the update of Critical Biodiversity Areas and Ecological Support Areas for the Mopani District Bioregional Plan*). **However, it should be noted that the Protected Areas have been updated for this Biodiversity Sector Plan handbook and associated CBA Map.**

3.1.2 How accurate is the Critical Biodiversity Areas (CBA) Map?

The spatial accuracy of the CBA Map is limited by the accuracy of the biodiversity information (e.g. vegetation map, location of wetlands and rare species), the date of aerial imagery used to digitize land cover and the existing land cover data used to develop the map (DEA, 2013-2014). Some of the information used to delineate the CBA and ESA is therefore based on broad-scale maps of biodiversity pattern (e.g. vegetation and wetland maps,) and ecological processes (landscape corridors).BAB

The provincial systematic biodiversity plan (Desmet et al., 2013), on which the CBA Map is based, was designed to be used at a **scale of 1:50 000**.

Due to corrections in land cover during the development of the CBA Map for the Mopani District Bioregional Plan, the Maruleng CBA Map’s land cover data was improved upon. The scale of the CBA Map was not refined and therefore remains at **1:50 000 scale**. Consequently, specialist verification of the data is required at the site level.

3.2 The Maruleng Municipality Critical Biodiversity Areas (CBA) Map

Figure 12 below presents the map of Critical Biodiversity Areas and Ecological Support Areas for the Maruleng Municipality, as part of the Mopani District Bioregional Plan (LEDET, 2016a).

The CBA Map assists with identifying appropriate areas for development within the Maruleng Municipality, from a biodiversity perspective, in order to promote sustainable development.

Refer to Section 5 for guidance on integrating the CBA Map in land use planning and decision-making.

3.2.1 Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) & Biodiversity Targets

Table 10 below presents the standard definitions of Critical Biodiversity Areas, Ecological Support Areas and biodiversity targets. Refer to Table 11 below for the criteria that were used to delineate the categories on the CBA Map.



Table 10. Description of Critical Biodiversity Areas, Ecological Support Areas & Biodiversity Targets

CBA map category / term	Definition
<p>Critical Biodiversity Areas (CBA)</p>	<ul style="list-style-type: none"> ■ CBA are terrestrial (land) and aquatic (water) areas which must be safeguarded in their natural or near-natural state as they are critical for conserving biodiversity and maintaining ecosystem functioning. ■ These include natural / near-natural areas that are required: <ol style="list-style-type: none"> i. To meet national biodiversity thresholds[§]; ii. To ensure the continued existence and functioning of species[§] and ecosystems[§], including the delivery of ecosystem services[§]; and/or iii. As important locations for biodiversity features or threatened species.
<p>Ecological Support Areas (ESA)</p>	<ul style="list-style-type: none"> ■ ESA are supporting zones that prevent the degradation of Critical Biodiversity Areas and formal Protected Areas[§]. ■ Although many ESA consist of natural bush/veld, there are areas of land - partially or wholly modified or degraded[§] - that have been classified as ESA even though they are no longer in a natural state. Although these areas are heavily degraded or modified, they still play an important role in supporting ecological processes. This is particularly the case with riparian areas, some key catchment areas and key pieces of corridors.
<p>Biodiversity Targets</p>	<p>Target areas (hectares) of biodiversity which must be safeguarded for the component plants and animals to exist and for ecosystems to continue functioning (e.g. pollination, migration of animals) i.e. the target areas comprise the Protected Area and CBA network.</p> <p>Targets for various types of habitats (e.g. vegetation types, estuaries, rivers etc) are set nationally within the National Spatial Biodiversity Assessment (NSBA) planning process i.e. National Biodiversity Thresholds. Refer to the glossary.</p>

3.2.2 Criteria used to map the categories on the Critical Biodiversity Areas (CBA) Map

Criteria defining the CBA Map categories are presented in Table 11 below. The criteria will assist specialists responsible for verifying the accuracy of the CBA Map during site level surveys and assessments.

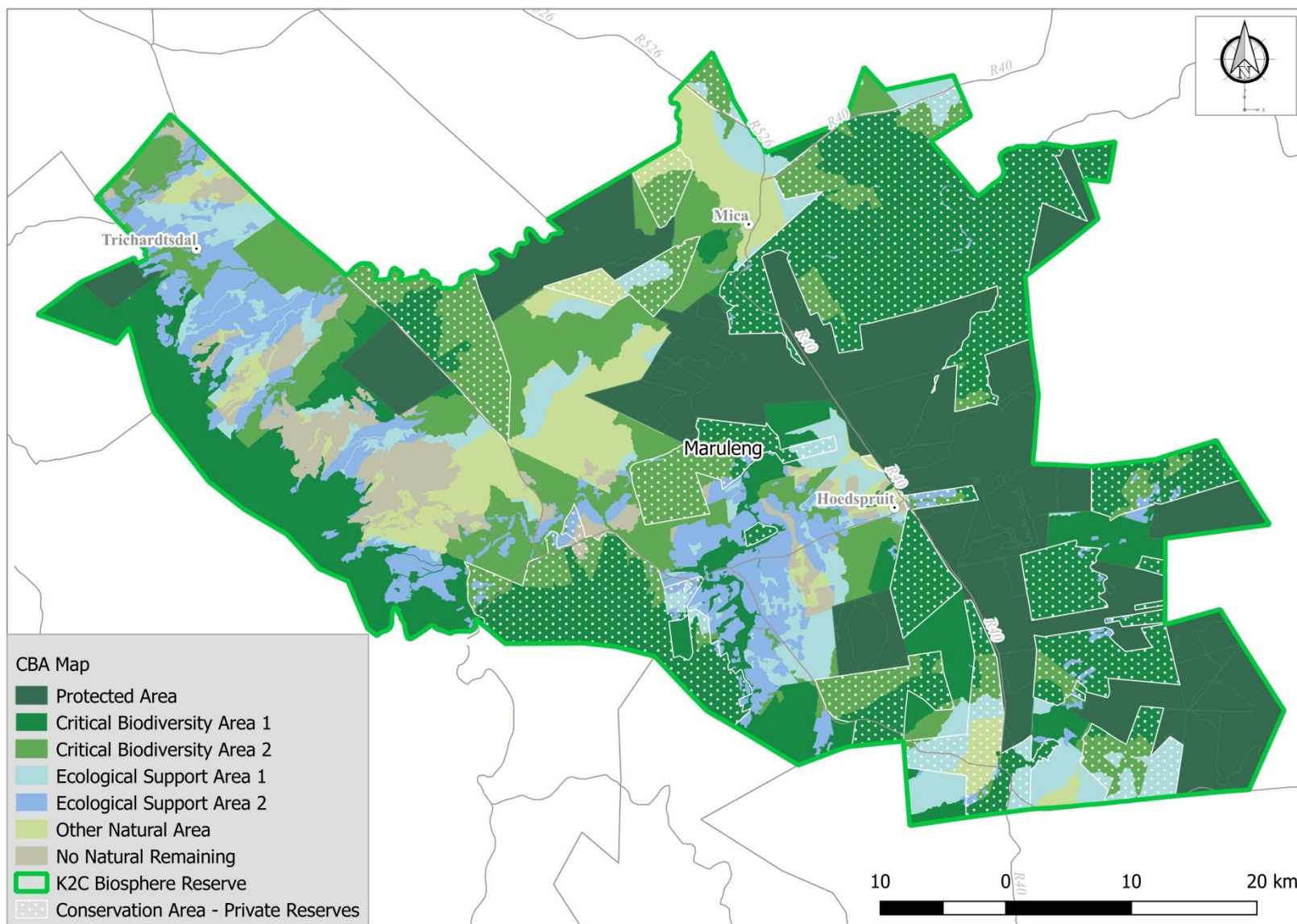


Figure 12. The Maruleng Critical Biodiversity Areas Map, developed as part of the Mopani District Bioregional Plan (LEDET, 2016a).



Table 11. Criteria used to define the CBA Map categories

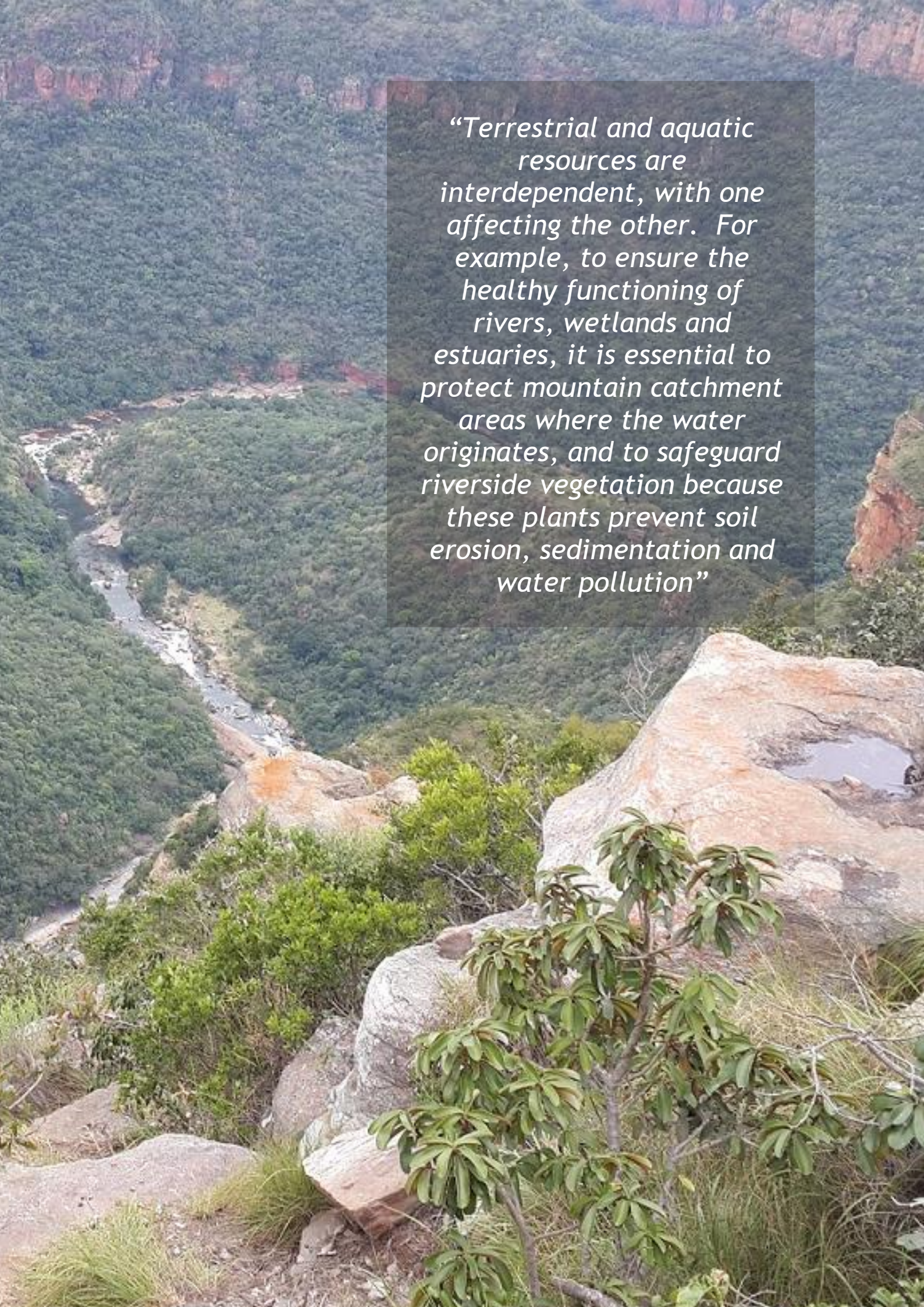
CBA map category name and criterion	Description of biodiversity features used to define the CBA map category	CBA map level codes
Protected Areas		
Protected Areas	<p>Protected Areas recognised in the Protected Areas Act including South African National Parks, LEDET nature reserves and private nature reserves gazetted under NEM:PAA.</p> <p>Note that the Protected Areas (PA) are required to meet targets and are an intrinsic part of the CBA network. Intact areas in PA are required to meet targets, therefore it is important that in any instance where a Protected Area has been incorrectly mapped, that these sites are assumed to be CBA2. Only in cases where the PA status is incorrect and there is clear evidence of complete biodiversity loss at a site, would it be acceptable to treat the site as No Natural Remaining. These issues would need to be dealt with when the systematic conservation plan (or CBA Map) is updated.</p>	PA
Critical Biodiversity Area 1		
Irreplaceable Sites	<p>Planning units with high irreplaceability values based on the MARXAN analysis, i.e. areas or sites that are mandatory if biodiversity targets are to be achieved. These include irreplaceable areas for:</p> <ul style="list-style-type: none"> ■ Threatened species (including all sites for Critically Endangered and Endangered plants, and all threatened butterflies). ■ Threatened ecosystems (especially Critically Endangered and Endangered, where these are found). ■ All forest areas. ■ Ecological processes (including Critical Biodiversity Corridor Linkages in the provincial biodiversity corridor network where existing conversion of natural landscapes to other uses has severely restricted options for maintaining connectivity in the natural landscape). ■ Key ecological infrastructure (e.g. most sites in Strategic Water Source Areas). ■ Key areas for climate change adaptation (e.g. areas for Ecosystem-based Adaptation and key intact areas of plant centres of Endemism). 	CBA1



CBA map category name and criterion	Description of biodiversity features used to define the CBA map category	CBA map level codes
Critical Biodiversity Area 1 (continue)		
FEPA Rivers	All FEPA rivers (FEPA 1) buffered by 100m as identified in NFEPA	
FEPA wetlands	Natural FEPA-priority wetlands as identified in NFEPA.	
FEPA wetland Clusters	Natural FEPA wetland clusters as identified in NFEPA	
Critical Biodiversity Areas 2		
Best design sites	<p>Planning units selected in the revised district MARXAN analysis, i.e. where options exist to achieve targets these are areas or sites that are selected to achieve biodiversity targets based on spatial context or avoidance of conflict with other land uses.</p> <p>These include areas that represent the best design to meet remaining targets for:</p> <ul style="list-style-type: none"> ■ Threatened and other important species (especially the best design areas to meet targets for Vulnerable plant and other species, and best design portions of Important Bird Areas). ■ Ecosystems (terrestrial and aquatic). ■ Ecological processes (including the remainder of the provincial biodiversity corridor network). ■ Ecological infrastructure. ■ Additional areas for climate change adaptation (e.g. areas for Ecosystem-based Adaptation). <i>(includes extensive grazing areas)</i> 	
Ecological Support Areas		
Other wetlands	All other natural wetlands not included as CBA.	
Important Bird Areas	Remaining portions of Important Bird Areas not included as CBA.	
Important habitats for climate change adaption	Hills and ridges identified, and other high value ecological support features or high value climate change adaptation features which were not identified as CBA.	
Biodiversity Corridors (remaining areas)	Any remaining areas of the provincial-level biodiversity corridor network which could not be identified as CBA but where some remaining function needs to be retained (often highly impacted sections).	
FEPA river buffers (100m)	Buffer areas around any river identified as a FEPA (any category) where these have not been identified as a CBA.	ESA1 if natural ESA2 if not natural



CBA map category name and criterion	Description of biodiversity features used to define the CBA map category	CBA map level codes
Ecological Support Areas (Continue)		
Buffers on large rivers (1000m)	Buffer areas around all larger rivers where the site is not a CBA.	ESA1 if natural ESA2 if not natural
FEPA catchments	Areas of FEPA catchments (Category 1 & 2) not included as CBA.	
Strategic Water Source Areas	Remaining areas not included as CBA.	
Other Natural Areas	All remaining natural areas not included in the above CBA or ESA categories.	ONA
No Natural Remaining	These are areas that have been irreversibly modified and do not contribute significantly to maintaining biodiversity pattern or ecological processes and include urban and rural settlements; cultivated lands; and mining areas.	NNR
Conservation area categories		
Category	Description of conservation area category	Codes
Conservation Areas (Non-gazetted private reserves)	Conservation Areas (e.g. non-gazetted private reserves) are not a specific category on the CBA map but rather were used to inform CBA identification. The guideline for the underlying CBA category should be applied.	CA (Overlay)
Conservation Areas (Biosphere Reserve)	The entire municipality is in the Kruger 2 Canyons Biosphere Reserve. These areas are not treated as a specific category on the CBA map but rather were used to inform CBA identification. The guideline for the underlying CBA category should be applied.	CA (Outline)

A scenic view of a river valley with a semi-transparent text box overlaid. The river flows through a lush green valley, surrounded by dense forest and rocky terrain. The text box is centered in the upper half of the image, containing a quote about the interdependence of terrestrial and aquatic resources.

“Terrestrial and aquatic resources are interdependent, with one affecting the other. For example, to ensure the healthy functioning of rivers, wetlands and estuaries, it is essential to protect mountain catchment areas where the water originates, and to safeguard riverside vegetation because these plants prevent soil erosion, sedimentation and water pollution”



3.2.3 Quantitative values (hectares/percentage) of the Critical Biodiversity Areas (CBA) Map categories

The quantitative values (hectares and percentage) of the categories on the CBA Map are indicated in Table 12 below. These values can be used to assist in monitoring the state or condition of the environment (State of Environment Reporting: Section 5.3.1.1) and for monitoring and reviewing the CBA Map (Section 6.2).

Table 12. The extent (hectares and percentage) of protected areas, critical biodiversity areas, ecological support areas and other CBA map categories in the Maruleng CBA map

CBA Map Category	Area (ha)	Area (%)
Protected Area	78 411,5	24,2
Critical Biodiversity Area 1	94 464,9	29,1
Critical Biodiversity Area 2	44 183,6	13,6
Ecological Support Area 1	22 194,9	6,8
Ecological Support Area 2*	32 940,2	10,2
Other Natural Area	19 259,7	5,9
No Natural Remaining	32 958,4	10,2
Grand Total	324 413,2	100,0
PA, CBA, ESA	272 195,1	83,9
Areas with partial or full overlap with some of the CBA Map categories		
K2C Biosphere Reserve	324 429,4	100,0
Conservation Area (non-gazetted private reserves)	100 349,0	30,9

* Noting that ESA 2 are agricultural landscapes i.e. i.e. no natural habitat.

Important Note:

The Protected Areas also represent the biodiversity target areas and are essentially CBA (Protected Area). They are thus an intrinsic component of the CBA network.

Section 4

Land use guidelines





This section provides a series of land use guidelines for land use planning and decision-making, as well as general land management guidelines for the sound management of Maruleng's biodiversity.

The guidelines are based on the Limpopo C-Plan v2 (Desmet et al., 2013) and the Mopani District Bioregional Plan (LEDET, 2016a), but have been further developed to align with land use zoning categories, as per the Waterberg District Bioregional Plan (LEDET, 2016b).

The aim of the guidelines is the effective management of biodiversity as required in terms of Section 41(a) of the National Environmental Management: Biodiversity Act (10 of 2004) and the National Environmental Management Act (107 of 1998), while supporting land use legislation which requires municipalities to consider biodiversity.

4.1 Recommended biodiversity-compatible land use guidelines matrix

The land use guidelines (Table 14) are informed by the land management objective (Table 13) for each category on the CBA Map as well as the relative impact of a land use activity on biodiversity.

The Land Management Objective for a parcel of land or aquatic ecosystem refers to the ecological state or condition in which it should be maintained or managed. In broad terms, the biodiversity priority areas (PA, CBA and ESA) need to be managed in a healthy and functioning condition while the heavily impacted or modified areas can be further developed.

The land use guidelines (*Table 14*) have been informed by:

1. Land Management Objective (Table 13).
2. The likely impact of land and water use activities on biodiversity (i.e. the choice of development should be guided by the potential impact on the receiving environment).

Refer to Table 14 for the recommended biodiversity compatible land use guidelines matrix.



Table 13. Land Management Objectives for the CBA Map categories

CBA Map Category	Land Management Objective
<p>Protected Areas & Critical Biodiversity Area 1 (CBA1)</p>	<p>Maintain as natural conservation or production landscapes that maximize the retention of biodiversity pattern and ecological process:</p> <ul style="list-style-type: none"> ■ Ecosystems and species fully intact and undisturbed ■ These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. ■ These are landscape that are at or passed their limits of acceptable change.
<p>Critical Biodiversity Area 2 (CBA2)</p>	<p>Maintain as near-natural production landscapes that maximize the retention of biodiversity pattern and ecological process:</p> <ul style="list-style-type: none"> ■ Ecosystems and species largely intact and undisturbed. ■ Areas with intermediate irreplaceability or some flexibility in terms of area required for meeting biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. ■ These are landscapes that are approaching but have not passed their limits of acceptable change.
<p>Ecological Support Area 1 (ESA1)</p>	<p><i>Maintain as ecologically functional landscapes that retain basic natural attributes (generally natural or near-natural areas):</i></p> <ul style="list-style-type: none"> ■ Ecosystem still in a natural or near-natural state, and has not been previously developed. ■ Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. ■ Individual species or other biodiversity indicators may be severely disturbed or reduced. ■ These are areas with low irreplaceability with respect to biodiversity pattern targets only.
<p>Ecological Support Area 2 (ESA2)</p>	<p><i>Maintain as ecologically partly-functional landscapes that retain some natural attributes (generally cultivated areas):</i></p> <ul style="list-style-type: none"> ■ Ecosystem NOT in a natural or near-natural state, which has been previously developed (e.g. ploughed). ■ Ecosystems significantly disturbed but still able to maintain some ecological functionality. ■ Individual species or other biodiversity indicators are severely disturbed or reduced. ■ These are areas with low irreplaceability with respect to biodiversity pattern targets only.
<p>Other Natural Areas & No Natural Remaining</p>	<p><i>Production landscapes:</i> manage land to optimize sustainable utilization of natural areas.</p>



Table 14. Recommended land uses per land use zone as per the Biodiversity Sector Plan (BSP)

Important Notes:

- The land use zones are based on those recommended under the Spatial Planning Land Use Management Act, 16 of 2013 ('schedule 2 land use purposes')
- These land use guidelines serve as the primary biodiversity informant to land use planning and decision-making, and cannot grant or take away existing land use rights.
- The land use guidelines are only offered for the **biodiversity priority categories** (PA, CBA, ESA), and not the remaining categories. Always prioritize for sustainable development, within general rural land-use principles, when considering land and water use applications in remaining categories i.e. other natural areas.

No	Land Use Zone	Associated Land use Activities	PA	CBA1	CBA2	ESA1	ESA2	ONA	NNR
1	Environmental Conservation (& similar zones in EMFs etc.)	Conservation management, low-intensity eco-tourism activities and sustainable consumptive activities. This includes both gazetted Protected Areas (NEMPA) and non-gazetted conservation areas.	Y	Y	Y	Y	Y	Y	Y
2	Tourism and Accommodation	Low Impact Eco-Tourism (e.g. lodge or other ecotourism infrastructure on game reserve)	Y	Y	Y	Y	Y	Y	Y
		Medium Impact Tourism / Recreational and Accommodation.	N	R	R	R	R	Y	Y
		High Impact Tourism / Recreational and Accommodation (e.g. golf and polo estates).	N	N	N	N	R	Y	Y
3	Rural Residential	Low density rural housing or eco-estates.	N	R	R	R	R	Y	Y
		Moderate density rural housing or eco-estates.	N	N	R	R	R	Y	Y
		Traditional Communal Areas and Rural Communal Settlement (New).	N	N	N	R	R	Y	Y
4	Agriculture	Extensive Game Farming	Y	Y	Y	Y	Y	Y	Y
		Extensive Livestock Production	N	Y	Y	Y	Y	Y	Y
		Extensive Game Breeding (≥ 100 ha camps)	N	R	R	Y	Y	Y	Y
		Low Impact Extensive Game Breeding (permeable fencing and camps > 100 ha)	N	Y	Y	Y	Y	Y	Y
		Intensive Game Breeding (< 100 ha camps, high stocking densities, impermeable fencing)	N	N	N	R	R	Y	Y
		Arable Land - Dryland and Irrigated Crop Cultivation	N	N	N	N	R	Y	Y
		Plantation Forestry: Timber Production.	N	N	N	N	R	Y	Y
5	Open-Space	Public or Private Open-Space (Modified), includes recreational areas, parks etc. i.e. loss of indigenous vegetation	N	N	N	N	Y	Y	Y
		Public or Private Open-Space (Natural) - includes natural open space (indigenous vegetation retained or rehabilitated in ESA2)	Y	Y	Y	Y	Y	Y	Y
6	Residential	Low, low-medium, medium-high, and high density urban residential development.	N	N	N	N	N	Y	Y



No	Land Use Zone	Associated Land use Activities	PA	CBA1	CBA2	ESA1	ESA2	ONA	NNR
7	Urban Influence	An amalgamation of land use zones, including Institutional, Urban Influence, General Mixed Use, Low Impact Mixed Use, Suburban Mixed Use and General Business.	N	N	N	N	N	Y	Y
8	Low or High Impact and General Industry	Low Impact, General Industry and High Impact Industry (Urban & Business Development).	N	N	N	N	N	Y	Y
9	Transport Services	Transportation service land uses e.g. airports, railway stations, petro-ports and truck stops, bus and taxi ranks and other transport depots.	N	N	N	R	R	Y	Y
10	Roads and Railways	Existing and planned linear infrastructure such as hardened roads and railways, including activities and buildings associated with road construction and maintenance, e.g. toll booths, construction camps and road depot sites. (Linear Engineering Structures)	N	N	R	R	R	Y	Y
11	Utilities	Linear engineering structures, such as pipelines, canals and power lines. (Linear Engineering Structures)	N	R	R	R	R	Y	Y
		Small-scale Infrastructural installations, including wastewater treatment works and energy sub-stations	N	N	R	R	R	Y	Y
		Large-scale Infrastructure installations, including bulk water transfer schemes, impoundments (Water Projects & Transfers), and energy-generation facilities.	N	N	N	N	R	Y	Y
		Renewable Energy (Photovoltaic farms and solar arrays)	N	N	N	R	R	Y	Y
		Renewable Energy (wind farms)	N	N	R	R	R	Y	Y
12	Quarrying and Mining	Prospecting and Underground Mining	N	N	N	R	R	Y	Y
		Quarrying and opencast mining (includes surface mining, dumping & dredging).	N	N	N	N	N	Y	Y
		Hydraulic Fracturing	N	N	R	R	R	Y	Y
Special Management Overlay Zone									
13	CBA Map Overlay Zone / Bioregional Planning Overlay Zone / Environmental Management Overlay Zone	These are areas that are designated as priority areas for protection, namely CBAs and ESAs. Therefore the land use activities for CBA and ESA above will apply.	Land use activities for CBA and ESA above will apply						

Recommended biodiversity-compatible land use guidelines matrix (adapted from the MPTA, 2014; DEA&DP, 2004).

Y = YES, permitted and actively encouraged activity;
 N = NO, not permitted, actively discouraged activity; and,
 R = RESTRICTED to compulsory, site-specific conditions & controls when unavoidable, not usually permitted.



“ The purpose of the guidelines is to encourage development which avoids or has minimal biodiversity impacts, especially in CBA and ESA. In general, land uses that result in irreversible loss of natural habitat (such as cultivation, afforestation, urban development and mining) have the highest impact on biodiversity; and are considered **biodiversity-incompatible** land use activities. Land uses that allow for natural habitat to remain intact (such as appropriately managed grazing by either livestock or game or sustainable harvesting of natural products from the wild), have the lowest impact on biodiversity; and are therefore considered **biodiversity-compatible** land use activities. ”





4.2 Descriptions of land use zoning categories & activities

Table 15 below presents a description of the land use zones referred to in Table 14, along with the associated land use activities (adopted from the Mpumalanga Biodiversity Sector Plan handbook (MPTA, 2014)).

The land use zones have been aligned as far as is possible with land use zones generally used in land use schemes, and the linkage to the Spatial Planning and Land Use Management Act (16 of 2013) 'schedule 2 land use purposes' is indicated.

Table 15. Land use zoning categories and activity descriptions

Descriptions of land use zoning categories
Land use zone 1: Environmental conservation
<p>The Environmental Conservation zone (as well as similar zones in EMFs etc.) provides for conservation purposes which includes a range of land use activities where biodiversity conservation is the primary land use objective.</p> <p>The Environmental Conservation zone includes:</p> <ul style="list-style-type: none">■ Conservation management activities in formal protected areas and informal Conservation Areas managed for biodiversity (wildlife production and recreational/educational tourism);■ Low-intensity eco-tourism activities (such as hiking trails) and■ Sustainable consumptive activities (e.g. sustainable harvesting of natural resources such as medicinal plants), conducted in natural habitats on public or private land. <p>This land use zone corresponds to the SPLUMA scheduled land use purpose 'conservation purpose'.</p> <p>These land use activities provide the following:</p> <ul style="list-style-type: none">■ Protection of the natural environment and natural processes for their historic, scientific, landscape, biodiversity, habitat, or cultural values.■ Provision facilities which assist in public education and the integration of the built and natural environments, with minimal degradation of the natural environment or natural processes.■ Creation of a holistic framework where culturally significant and historical sites are accorded equal status and value along with new developments.■ The sustainable provision of ecosystem services to the community. <p>Subject to appropriate controls, planning and management, these land use activities can be accommodated in CBAs and ESAs. It is the preferred land use in CBAs and ESAs. Where there is a requirement to use natural resources, this should be demonstrably sustainable. This would include the concept of catchment management and protection for water security.</p>



Descriptions of land use zoning categories

Land use zone 2: Tourism & accommodation

The Tourism and Accommodation zone provides opportunities for the development of a broad range of tourist and recreational facilities, inclusive of tourism, recreation and accommodation facilities.

Tourism and Accommodation includes two sub-categories:

- a] **Low impact eco-tourism facilities** include activities such as outdoor recreation (e.g. hiking trails, 4 x 4 tracks), camping sites, gift shops, restrooms and non-place-bound tourist and recreation facilities such as paint-ball parks (in natural settings). In addition, lodges and other similar facilities on a game reserve with large expanses of natural cover are considered low impact so long as the facilities will not cover more than 0.1% of the original natural area (i.e. a maximum of 1 hectare of impact per 1000 hectares of natural cover).
- b] **Medium-impact facilities** include tourism and accommodation that has a moderate impact on the natural environment, but does not include typical smaller eco-tourism type facilities (e.g. a lodge) with large expanses of natural cover where the facilities will not cover more than 0.1% of the original natural area (i.e. a maximum of 1 hectare of impact per 1000 hectares of natural cover - as indicated above).
- c] **High-impact facilities** include developments such as large resorts, golf courses and golf estates, polo estates, and the like.

This land use zone corresponds to the SPLUMA scheduled land use purpose 'any other purpose that may be prescribed', i.e. where an appropriate zone is developed for the land use scheme since it does not fall within the other categories.

Low Impact tourism and accommodation facilities that are in support of sustainable rural tourism, rural businesses and communities and that provide for the rural recreational and leisure needs of urban dwellers, could be allowed in protected areas, CBAs and ESAs subject to the appropriate biodiversity related controls being in place. In all cases, permission would be required to ensure that these land uses do not compromise the specific biodiversity objectives of the area, that the location of infrastructure is within already-modified areas (if possible), that large-scale tourist facilities are kept to the urban fringe and that infrastructure development is kept out of ecologically sensitive areas and priority ecological corridors.

Land use zone 3: Rural residential

The Rural Residential zone makes provision for residential and recreational non-urban infrastructure associated with rural landscapes, including the villages and gardens of traditional areas (but excluding subsistence agriculture).

Rural Residential includes four sub-categories:

- a] **Low-Density Rural Housing or Eco-Estate**, the establishment of lifestyle estates or investment-type recreational ownership of facilities such as share-block schemes, multi-ownership reserves and **eco-estates** but excludes golf and polo estates. Infrastructure development within CBA1, CBA2, ESA1 and ESA2 may be suitable if the property size exceeds 250 ha and if over 90% of the land is not modified in any way (through the establishment of infrastructure or gardens) / retained as natural habitat.



Descriptions of land use zoning categories

- b] **Moderate Density Rural Housing or Eco-Estates:** As above but moderate densities. Infrastructure development within CBA2, ESA1 and ESA2 may be suitable if the property size exceeds 250 ha and if over 80% of the land is not modified in any way (through the establishment of infrastructure or gardens) / retained as natural habitat.
- c] **Traditional Communal Areas (New),** which includes gardens and villages, but excluding subsistence agriculture. This land use should not currently be sited in CBA, but may currently be sited in ESA2. The land use guidelines thus serve to inform proposed / new traditional communal areas.
- d] **Rural (Communal) Settlement (New),** which encompasses new residences for farm workers and retirees i.e. where housing is available to farm workers who currently live on the farm and will be residing there in future, either due to personal preference (e.g. their tenure rights, rural surroundings, place for retirement, etc.) or because circumstances require it (e.g. working hours, etc.).

This land use zone corresponds to the SPLUMA scheduled land use purpose 'residential purpose' and represents rural residential housing.

The purpose of this land use zone is:

- To create the opportunity for people to enjoy a semi-rural lifestyle and yet have ready access to the full range of physical and social services which are available in the adjacent urban areas.
- To allow only a limited number of ancillary uses so as to protect the primary **low-density residential or agricultural land use**.
- To ensure that urban agricultural activities are undertaken in a sustainable manner and in accordance with the relevant environmental principles.

Low to Moderate Density Rural Housing or Eco-Estates and the development of some lifestyle estates can be compatible in CBAs and ESAs if land portions are large, the development footprint is small, and if impacts are carefully assessed and managed. As per the specifications above, (a) Low Density Rural Housing or Eco-Estates within CBA1, CBA2, ESA1 and ESA2 may be suitable if the property is > 250 ha and if over 90% of the land is retained as natural habitat; (b) Moderate Density Rural Housing or Eco-Estates within CBA2, ESA1 and ESA2 may be suitable if the property is > 250 ha and if over 80% of the land is retained as natural habitat. In some cases, these kinds of land uses can therefore increase the amount of land available for conservation. Applications should be handled on a case-by-case basis and the EIA and National Water Act regulations applied.

The following conditions should be considered:

- Intensive recreational developments such as golf and polo estates, which result in significant habitat loss and which represent urban development outside the urban edge, are not compatible with CBAs.
- Any infrastructural developments in CBA1s should be avoided unless the land use qualifies as a low density eco-estate (see densities above).
- Rural Residential development within CBAs and ESAs can be considered if the houses and infrastructure are clustered, and meet other criteria and densities that are consistent with the land management objectives (Table 13).



Descriptions of land use zoning categories

- Residential developments within ESAs must consider the functionality of the ESA which may be related to connectivity and their role as ecological corridors. In these cases residential houses and infrastructure should not disrupt or fragment the corridor, or establish impermeable fences or boundaries to disrupt faunal movement.
- Rural (Communal) Settlement should not involve the cadastral fragmentation of agricultural landscapes and; where possible, clustering of units in distinct housing precincts located in visually unobtrusive locations and existing footprints, but enjoying convenient access to the rural access network should be encouraged.

Land use zone 4: Agriculture

The Agriculture zone accommodates a range of land uses including:

- a] Extensive Game Farming and Livestock Production (where 'extensive' means at low stocking rates over large areas).
- b] Game Breeding (Extensive, Low Impact Extensive and Intensive Game Breeding).
- c] Arable Land, including cultivation of irrigated and dryland crops, orchards and multi-cropping systems.
- d] Plantation Forestry, including all kinds of commercial timber plantations, woodlots, and converted infestations of invasive alien woody species.
- e] Agricultural Infrastructure, including agri-industrial facilities, agri-villages, buildings, houses, sheds, and intensive animal production facilities.

This land use zone corresponds to the SPLUMA scheduled land use purpose 'agricultural purpose', and is sub-divided into the land use activities above.

Many zonation schemes distinguish between a number of agriculture zones (e.g. Agriculture 1, Agriculture 2) based on agricultural land use activities and consent uses. This handbook presents the various land uses above characteristic of agricultural practices in the province which could be used to develop distinct agricultural zones that could be aligned with the CBA Map categories.

Although many land uses are freely permitted within the agricultural zone, all of them, other than extensive livestock and game production, have significant impacts on biodiversity, and are largely incompatible with biodiversity conservation objectives. They may even accelerate degradation by causing habitat loss, soil erosion and hydrological changes. Their impacts vary from moderate to severe depletion of natural biota and disturbance of ecosystem functioning. However, they can still contribute to the overall functionality of a landscape and allow for the movement and foraging of animals.

Extensive Game Farming and Livestock Production

Extensive Livestock and Game Farming (Ranching) is the management of large areas of natural (unimproved) rangelands with the commercial objective of producing livestock or game animals for hunting or to sell as live animals or processed animal products. This specifically excludes feedlots and intensive game breeding farms.



Descriptions of land use zoning categories

This land use is considered to be compatible with biodiversity objectives of some protected areas (such as Protected Environments), CBAs and ESAs, under certain conditions, including:

- A biodiversity and veld condition assessment should underpin the calculation of carrying capacity.
- Game and livestock stocking rates should never exceed the recommended carrying capacity.
- If the irreplaceability of the site is due to the presence of a grassland vegetation feature, then exclusive sheep farming should be avoided and stocking rates of concentrate grazers, such as blesbok, should be conservative (this may mitigate against commercial-scale production).
- Appropriate grazing and burning regimes must be employed to ensure that rangeland condition does not deteriorate, specifically in terms of implementing a rotational burning and grazing system that allows for adequate rest of the vegetation.
- A coherent management plan that governs grazing, burning and invasive alien plant control (and other aspects of farm management) must be in place.
- Sensitive habitats and species-rich areas, such as intact grasslands, wetlands, rivers and forests, should ideally be delineated accurately and zoned separately (this could include the Environmental Conservation Zone or CBA Map Overlay Zone).
- Ecologically and economically sustainable management is applied to farm portions above a certain minimum size, based on ecological and economic viability.

Game Breeding

Extensive Game Breeding is a key land use activity in the region. Extensive game breeding takes place on camps ≥ 100 ha in size. Stocking rates are within the recommended ecological carrying capacities and there is limited use of supplementary feed.

Low impact extensive game breeding would include fencing that is permeable to smaller fauna and larger paddocks of at least 100ha. Stocking rates are within the recommended ecological carrying capacities, and there is limited use of supplementary feed.

Intensive Game Breeding is the subdivision of grazing veld into small camps (less than 100ha) using fencing that does not allow free movement of indigenous, smaller wildlife (e.g. small mammals, reptiles, etc.). The extreme forms of fencing used in game breeding create impenetrable barriers to movement across the landscape. Game breeding also involves supplemental feeding of animals and stocking rates in excess of recommended carrying capacities. Game breeding is considered a form of feedlot intensive animal production resulting in severe biodiversity (loss of species) and ecological impacts (overgrazing, landscape fragmentation) that are difficult to mitigate.

- Game breeding can only be permitted in CBA if camps are ≥ 100 ha and within the ecological carrying capacity of the vegetation type / veld and there is limited use of supplementary feed.
- Game breeding that is more intensive - with camps that are less than 100 ha in size as indicated above - should not be permitted in CBA, but can be permitted in ESA if sensitively designed to mitigate impacts as ESA are generally important for hydrological processes.



Descriptions of land use zoning categories

- Fencing systems must allow for natural species movement for smaller species.
- Conversion to a game breeding facility requires (1) registration with LEDET; and, (2) an environmental assessment.

Arable Land

The Arable Land category is subdivided into two sub-categories, which includes all forms of:

- Irrigated crops
- Dry crops

These crops include for example orchards, pastures and improved grasslands; and are an intensive form of cultivation.

Any activity that turns the soil or replaces the natural vegetation with a crop generally results in loss of ecosystem composition and structure and is not considered compatible with the biodiversity objectives of protected areas (with some exceptions in Protected Environments), CBAs, and some ESAs.

Plantation Forestry

Plantation Forestry involves timber production and includes:

- All land planted to trees (primarily pine, gum and wattle species) for commercial timber or pulp production, irrespective of the size of the area. It excludes the natural, open areas that remain unplanted within a plantation.

Although very similar to arable land in terms of biodiversity impact, plantations have been separated out due to the unique nature of their land management context.

All planted areas are considered to be incompatible with biodiversity objectives of protected areas (although some Protected Environments might include afforested areas), CBAs and most ESAs. It should be noted however, that the unplanted areas within plantations often harbour important biodiversity and can make an important contribution to meeting biodiversity conservation goals and for providing connectivity between natural areas across landscapes. This means that with sound planning, the biodiversity-compatibility of plantation forestry can be improved, but afforested land must be covered by the necessary plantation permits and the management of the plantation and associated lands must adhere to industry best-practice guidelines. Forestry Stewardship Council (FSC) certification is encouraged. Monoculture of alien timber species is discouraged, as this impacts heavily on hydrology and soil erosion, and holds high potential for the introduction and spread of a variety of aggressive invasive alien plants.



Descriptions of land use zoning categories

Agricultural Infrastructure

Agricultural Infrastructure includes:

- All the land use categories associated with infrastructure in the agricultural sector, including facilities associated with agri-industry (the processing of agricultural products close to the land where these are produced) and intensive animal production (the production of confined animals that are dependent primarily on imported food, including dairy cattle in feedlots, piggeries, and fish farms in rivers).

These land uses have impacts that are felt beyond the direct footprint of the land use activity itself, impacting on ecosystem functionality. All such Infrastructure is considered incompatible with the land management objectives of protected areas (including Protected Environments) and CBAs. It can be considered in ESA with restrictions.

Land use zone 5: Open-space

Open Space includes

- Public or Private Open-Space (Modified), which includes recreational areas, parks etc. where there is a loss of indigenous vegetation or natural cover. This is not compatible with PA, CBA and ESA 1.
- Public or Private Open-Space (Natural), which includes natural open spaces where the indigenous vegetation or natural cover is retained. This is compatible with PA, CBA1, CBA2 and ESA 1. If ESA 2 are rehabilitated / revegetated, this land use would be applicable to ESA 2.

Open Space provides for:

- Appropriately situated sites that are easily accessible for recreational purposes and activities for local and designated communities (including the physically challenged, the elderly, women, and children), and are located and maintained to attract visitors and tourists.
- Parks, botanical gardens and other open spaces as well as corridor linkages between open areas for passive recreational purposes.

This land use zone corresponds to the SPLUMA scheduled land use purposes 'public purpose' or 'recreational purposes'.

Although there may be some infra-structural development associated with this land use zone, it could potentially be compatible with some of the management objectives of CBAs and ESAs **if it secures significant areas of natural habitat**. However, this would need to be decided on a case-by-case assessment of the nature of the land use and the context of the area. In CBAs or ESAs, Open Space that maintains and enhances the natural habitat should be permitted.



Descriptions of land use zoning categories

Land Use Zone 6: Residential

The Residential zone includes:

- Residential housing in the urban context where the use of land is primarily for human habitation, and comprises a dwelling house, group housing and flats. It provides for safe and sustainable residential environments for all communities. It limits the allowable ancillary uses to those that can be accommodated within the residential fabric with minimal impact or disruption.

This land use zone corresponds to the SPLUMA scheduled land use purpose 'residential purpose', and represents urban residential housing.

Many zonation schemes distinguish between a number of categories of residential (e.g. Residential Zone 1, Residential Zone 2) based on density (e.g. low, low-medium, medium-high, and high), however, these have been grouped into a single category in this handbook as the impacts on biodiversity objectives, and the recommended land use guidelines, are very similar.

Residential land uses are generally not compatible with the land management objectives of protected areas, CBAs or ESAs. **ESA2 are usually floodplains, which should not be intensified or built up.** Subject to the necessary authorisations, residential housing can be considered in ONAs or areas with No Natural Habitat Remaining. Urban expansion should be managed through the delineation of an urban edge, and all residential developments (and their associated infrastructure) should be located within the urban edge.

Land use zone 7: Urban influence

Urban Influence includes:

- An amalgamation of a number of land use zones (including Institutional, Urban Influence, General Mixed Use, Low Impact Mixed Use, Suburban Mixed Use and General Business) that have similar impacts on biodiversity.

This land use zone corresponds to a mix of the SPLUMA scheduled land use purposes, namely: 'commercial purposes', 'educational purposes', 'institutional purpose', 'business purposes' and 'residential purposes'.

In all cases, the land uses allowed in these zones are **not** compatible with protected areas, CBAs or ESAs.



Descriptions of land use zoning categories

Land use zone 8: Low or high impact & general industry

This zone encompasses industrial land use activities and corresponds to the SPLUMA scheduled land use purpose ‘industrial purposes’.

- a] **Low Impact Industry, General Industry and Industry:** These land uses are not biodiversity compatible and should not be located in protected areas, CBAs and ESA1s. They can be located in ESA2s with the necessary restrictions, and are preferable in areas with No Natural Habitat Remaining, subject to the appropriate authorisations.
- b] **The High Impact Industry zone accommodates:** Intensive, high-impact industries, which have high local impacts (e.g. high levels of air, water and noise pollution and heavy traffic) as well as significant dispersed and cumulative impacts.

These types of industrial developments have significant and wide-ranging impacts that may have effects hundreds of kilometres from their source, especially along river systems. High-impact industrial development is not compatible with biodiversity and should not be located in protected areas, CBAs and ESA1s. They can be located in ESA2s but only with the necessary restrictions.

Land use zone 9: Transport services

This zone accommodates transportation service functions and land uses such as:

- Airports, railway stations, petro-ports and truck stops, bus and taxi ranks and other transport depots.

This land use zone corresponds to the SPLUMA scheduled land use purpose ‘transport purposes’, which corresponds to the above land use activities.

These services should be located so that they provide the catalyst for local economic development whilst ensuring that they are developed in accordance with EIA requirements and on-going environmental monitoring procedures.

All the land uses allowed in this zone are not compatible with protected areas, and can only be considered, under permit, with restrictions, in CBAs and ESAs where it is certain they will not impact on neighbouring biodiversity priority areas. Preferable sites are areas with No Natural Habitat Remaining.

Land use zone 10: Roads & railways

Roads and Railways include:

- All existing and future planned linear infrastructure, such as hardened roads and railways.
- All activities and buildings associated with road construction and maintenance, e.g. toll booths, construction camps and road depot sites. It does not include power and telephone lines (which are accommodated under the next category, referred to as Utilities).



Descriptions of land use zoning categories

This land use zone corresponds to the SPLUMA scheduled land use purpose ‘transport purposes’, which includes roads, railways and associated construction and maintenance activities.

The land uses allowed in this zone can be biodiversity-sensitive and compatible with the land management objectives of CBAs, and ESAs under certain conditions, but should be discouraged where the management objective is the maintenance of ecological connectivity across the landscape, or where the installation of the infrastructure would disrupt this connectivity. In all other cases, transportation infrastructure could be allowed in CBAs and ESAs under certain conditions, and subject to the necessary environmental authorisations and other relevant approvals.

The design of the transportation network should:

- Avoid impacts (direct or indirect) on CBAs and ESAs, especially connectivity of the landscape and local corridors. Transport infrastructure should not be located in sensitive areas such as river and wetland buffers, and should avoid flood-lines.

Land use zone 11: Utilities

The Utilities zone allocates land for the provision of a diverse range of services such as:

- Water and sewerage works, linear structures (such as pipelines, canals and power lines) and other similar utilities. The Utilities zone should be located at a distance from residential or other land uses where they may detract from levels of amenity or safety.

This land use zone corresponds to the SPLUMA scheduled land use purpose ‘government purposes’ where it relates to activities or the use of land by national government, provincial government and a municipality to give effect to its governance role. In this handbook it extends to include parastatal companies, such as Eskom, the South African National Roads Agency (SANRAL), including other agencies, such as water service boards.

They should also be located such that disruption to natural areas and water courses through the laying of service pipelines or cables is minimised by adhering to sound environmental management principles.

Linear Structures: Pipelines, Canals, Catchment Transfers and Power Lines

- The structures included here are similar to transport services and roads and railways, but also include those linear engineering structures not included under Transport, Roads and Railways, such as pipelines, conveyor belts, power lines, canals, and so on. These can have measurable impacts on particular species, for example the impacts of power lines on birds.

The land uses allowed in this zone can be biodiversity-sensitive and compatible with the land management objectives of CBAs and ESAs. Linear infrastructure could be allowed in CBAs and ESAs under certain conditions, and subject to the necessary environmental authorisations and other relevant approvals. Linear infrastructure should not be located in sensitive areas such as river and wetland buffers, and should avoid flood-lines.



Descriptions of land use zoning categories

Small-scale Infrastructural installations, including wastewater treatment works and energy sub-stations

- This category includes a wide range of infrastructural installations serving rural and urban areas, including wastewater treatment works and energy-generation facilities (powers station).

Sewerage works may have significant impacts on water quality and flow in rivers and wetlands. This land use category also falls outside of the municipal land use zonation system but is important when considering impacts on freshwater CBAs and ESAs.

The land uses could be allowed in CBA2s and ESAs under certain conditions, and subject to the necessary environmental authorisations and other relevant approvals. Footprints should not be located in river and wetland buffers, and should avoid flood-lines.

Large-scale Infrastructure installations, including bulk water transfer schemes, impoundments (Water Projects & Transfers), and energy-generation facilities

- This category should not be permitted in PAs, CBAs and ESAs.

Renewable Energy (PV farms and solar arrays)

- This category includes extensive areas of PV farms resulting in intensive or high impacts; and thus should not be permitted in PAs, CBAs and ESA1s, and should be 'restricted' in ESA2s.

Renewable Energy (wind farms)

- This category includes extensive areas of wind farms but due to the nature of the infrastructure (wind turbines with access roads) the resulting impacts are not as intensive; and can thus be restricted in CBA2s, ESA1s and ESA2s; but should not be permitted in PAs and CBA1s.

Other Utilities

- This category provides for any other land uses not specified in any of the other categories, and may include a wide variety of infrastructure, such as radio masts, electrical sub-stations and other such utilities.

Generally, land uses in the utilities category are not compatible with the land management objectives of freshwater CBAs or ESAs, but could be allowed, under certain conditions in protected areas, and terrestrial CBAs and ESAs.

Land use zone 12: Quarrying & mining

The Quarrying and Mining zone includes all forms of mineral extraction and is sub-divided into two sub-categories:

- Prospecting and underground mining.
- Quarrying and opencast mining (includes strip mining, surface mining, dumping and dredging).
- Hydraulic Fracturing



Descriptions of land use zoning categories

- It also encompasses the surrounding footprint of associated activities including the establishment of residential areas, waste dumps, settlement ponds and disposal sites, urban waste sites and landfill sites.

This land use zone corresponds to the SPLUMA scheduled land use purpose 'mining purposes'.

Prospecting versus mining applications

Prospecting, particularly bulk sampling and the fracturing of water tables, can have negative impacts on the environment. Prospecting also includes associated disturbances such as the construction of roads. Although prospecting does not automatically lead to the issuing of mining rights, it does grant the prospecting license holder the exclusive right of applying to mine the mineral resource.

- Prospecting can be 'restricted' in CBA2s, ESA1s and ESAs; but should not be permitted in PAs and CBA1s.

Underground mining versus open-cast / surface mining

The Quarrying and Mining zone can also be split into surface and underground mining activities. Although impacts from underground mining may be less than open-cast mining, impacts need to be considered in terms of both terrestrial and freshwater ecosystems. Ideally, no underground mining infrastructure should be located in or adjacent to terrestrial or freshwater CBAs and ESAs and no open-cast mining should occur in these biodiversity priority areas.

- Quarrying and opencast mining should not be permitted in PAs, CBAs and ESAs.

Hydraulic Fracturing

- Hydraulic Fracturing should not be permitted in PAs and CBA1s, but can be 'restricted' in CBA2s, ESAs.

The following conditions should be observed:

- The NFEP Implementation Manual (Driver et al., 2011) recommends that mining should not take place within 1 000 m of the outer edge of a generic 100 m wetland buffer (i.e. 1,1 km if the buffer is 100 m).
- Buffer widths should be determined based on the guidelines in the NFEP Implementation Manual, or according to the Department of Water and Sanitation buffer tool, when it is available.
- Ideally, effluent should be reflective of Resource Quality Objectives, as determined by a Reserve Determination, or should be determined on the basis of species sensitivities.

Land use zone 13: CBA map planning overlay zone / Bioregional planning overlay zone / Environmental management overlay zone

The objective of the CBA Map Planning Overlay Zone / Bioregional Planning Overlay Zone is to provide a mechanism to protect biodiversity and promote sustainable development. This zone enables the Council to determine development management provisions that respond to specific biodiversity issues and characteristics of CBAs and ESAs. Contractual obligations can be placed on landowners where additional land use rights have been granted (DEA&DP, 2004).



Descriptions of land use zoning categories

This zone includes:

The overlay zone can be utilized to protect land that is classified as CBAs and ESAs (and potentially ONAs where this is deemed necessary), that fall partially within any other land use zone above. For example, on land zoned as agriculture, but which still supports natural or near-natural areas on a portion of the land parcel. It could also include agricultural zoned land that is classified as ESA, for example along a river; where the land use should not be further intensified. The land use activities permitted in this zone should therefore correspond to the recommended land uses (Table 14) for the respective categories, particularly CBAs and ESAs.

This land use zone corresponds to the SPLUMA scheduled land use purpose ‘any other purpose that may be prescribed, which in this instance is CBA Map Overlay Zone / Bioregional Planning Overlay Zone / Environmental Management Overlay Zone i.e. where an appropriate zone is developed for the land use scheme.



Natural heritage sites have also got an important contribution to cultural value and to the profile of an area

The careful zoning of industrial activities is critical for ensuring the health of people, biodiversity and all ecosystems





4.3 A comparison of the recommended land use guidelines for the Mopani District Bioregional Plan (2016) compared with the biodiversity sector plan

Table 16 below provides a comparison of the land use guidelines recommended in the Mopani District Bioregional Plan (October 2016, Tables 3 to 7) versus the biodiversity sector plan (Table 14 & 15 above).

Important Notes:

- The BSP land use zones have been aligned as far as is possible with land use zones generally used in municipal land use schemes in South Africa. Consequently, some differences exist between the Mopani District BRP (which presents broad land uses) and the BSP (which provides detailed land uses with the associated range of land use activities). In addition, land uses that are typically practiced in the municipal area are included to reflect the reality on the ground (e.g. game breeding). The BSP LUG therefore support and build-upon the Mopani District BRP.
- It is strongly recommended that future updates on the Mopani BRP are (a) Made more specific in terms of detailing land uses; and (b) Rationalized to better reflect current activities which occur in the district within CBA and ESA; and which (to date) have largely been compatible with maintaining the biodiversity values of these areas.



Table 16. A comparison of the recommended land use guidelines for the Mopani District Bioregional Plan compared with the Biodiversity Sector Plan

CBA Map Category	Mopani District BRP recommended land use <i>(Table 3-7 of the BRP handbook)</i>	Mopani district BRP land use not recommended <i>(Table 3-7 of the BRP handbook)</i>	Biodiversity Sector Plan <i>(Table 14 & 15)</i> <i>Key Differences with Mopani District BRP land use guidelines</i>
PA	<ul style="list-style-type: none"> - Conservation and associated activities (such as eco-tourism operations) and required support infrastructure. 	<p>Other land uses</p>	<p>The following additional land use activities are “Permitted” (Y):</p> <ul style="list-style-type: none"> - Extensive Game Farming - Public or Private Open Space (Natural) i.e. indigenous vegetation retained. <p>Reasons for permitting these land uses in the BSP: These land uses are not considered to be in conflict with the Mopani BRP.</p> <p>Extensive Game Farming retains natural vegetation cover by ensuring appropriate wildlife stocking rates, while providing secure habitats for extirpated wildlife, with conservation as the overall management objective. Public or Private Open Space (Natural) specifically retains natural vegetation cover.</p>
CBA 1	<ul style="list-style-type: none"> - Conservation and associated activities. - Extensive game farming and eco-tourism with strict controls on environmental impacts and carrying capacity. - Extensive livestock production with strict controls control on environmental impacts and carrying capacity. - Required support infrastructure. - Urban open space (natural). 	<ul style="list-style-type: none"> - Urban land uses (residential, golf estates, rural residential, resorts, business, mining and industrial infrastructure such as roads, power lines and pipelines) - Intensive animal production (all types including dairy farming, feedlots, imported foodstuffs and improved / irrigated pastures) - Arable agriculture (forestry, dryland and irrigated cropping) - Smallholdings. 	<p>The following land use activities are “Restricted” (R):</p> <ul style="list-style-type: none"> - Medium Impact Tourism / Recreational and Accommodation. - Low density rural housing/eco-estate. - Linear engineering structures, such as pipelines, canals and power lines (i.e. Utilities Zone 11). <p>Low density rural housing can be interpreted as not belonging within an urban land use category, however no such land use sub-division is catered for in the Mopani District BRP.</p>



CBA Map Category	Mopani District BRP recommended land use <i>(Table 3-7 of the BRP handbook)</i>	Mopani district BRP land use not recommended <i>(Table 3-7 of the BRP handbook)</i>	Biodiversity Sector Plan <i>(Table 14 & 15)</i> <i>Key Differences with Mopani District BRP land use guidelines</i>
			<p><u>Reasons for permitting these land uses in the BSP:</u></p> <p><u>'Medium Impact Tourism & Accommodation' and 'Low Density Rural Housing/Eco-Estate'</u> are “restricted” rather than “prohibited” as these facilities would support overall land use that is compatible with maintaining CBA values. Therefore, when evaluating the suitability of both land uses, the focus should be on whether the overall land use of the entire property is compatible with maintaining the values of the CBA, rather than being focused on the specific local impacts of the facility. Importantly, careful design should be employed to minimize impacts from the facilities themselves.</p> <p>Rural housing can serve to expand the conservation estate (outside of protected areas) if appropriately developed and managed to minimize ecological impacts. These land uses typically characterise rural areas and can benefit biodiversity in the long term. The idea is to conserve extensive natural areas relative to the developed area. Importantly, in the context of Mopani District, this category is largely limited to very low density eco-estates, often with fairly extensive open areas between small residential plots.</p> <p>Appropriately designed estates which avoid sensitive areas could be compatible with maintaining landscape values and hence are a “restricted” rather than “prohibited” land use. It is critical that this category only includes very low density eco-estates which have been carefully designed to avoid impacts.</p>



CBA Map Category	Mopani District BRP recommended land use (Table 3-7 of the BRP handbook)	Mopani district BRP land use not recommended (Table 3-7 of the BRP handbook)	Biodiversity Sector Plan (Table 14 & 15) Key Differences with Mopani District BRP land use guidelines
			<p><u>Permitting linear engineering structures</u> accommodates practical requirements for socio-economic development that are unavoidable, while ensuring appropriate controls are implemented to reduce ecological impacts. Given that a relatively large portion of the Mopani District is within CBA 1 and CBA 2, it is unrealistic to completely exclude linear infrastructure from these areas.</p> <p>Therefore, on a case by case basis, we need to carefully evaluate and mitigate impacts where these are unavoidable.</p>
CBA 2	<p>Current extensive agricultural practices</p> <ul style="list-style-type: none"> - Game and ecotourism operations (with strict controls). - Above CBA 1 activities. 	<ul style="list-style-type: none"> - Urban land uses (as above) - More intensive agriculture than is currently undertaken on site. - Note: Certain activities may be permitted subject to detailed impact assessments to ensure that developments are designed to ensure the CBA network still meets the required targets. 	<p><u>The following land use activities are “Restricted” (R):</u></p> <ul style="list-style-type: none"> - Medium Impact Tourism / Recreational and Accommodation. - Low density rural housing/eco-estate. - Moderate density rural housing. - Roads & Railways (with associated buildings/depots). - Linear engineering structures, such as pipelines, canals and power lines. - Small-scale infrastructural installations. - Renewable Energy (wind farms). - Hydraulic fracturing. <p>These can be interpreted as “certain activities may be permitted”.</p> <p><u>Reasons for permitting these land uses in the BSP:</u></p> <p>Refer above. These land uses are less intensive in nature and although there are likely to be site level impacts, if well managed they can support an overall land use which is compatible with maintaining biodiversity values. Importantly, the overall land use and activity of ‘Moderate Density Rural Housing’ needs to be compatible with maintaining CBA features on site.</p> <p>In addition, given that a relatively large portion of the Mopani District is in CBA 1 and CBA 2, it is unrealistic to completely exclude linear infrastructure from these areas. Therefore, on a case by case basis, we need to carefully evaluate and mitigate impacts where these are unavoidable.</p>



CBA Map Category	Mopani District BRP recommended land use <i>(Table 3-7 of the BRP handbook)</i>	Mopani district BRP land use not recommended <i>(Table 3-7 of the BRP handbook)</i>	Biodiversity Sector Plan <i>(Table 14 & 15)</i> <i>Key Differences with Mopani District BRP land use guidelines</i>
ESA 1	<ul style="list-style-type: none"> - Conservation. - Extensive game farming and ecotourism operations. - Extensive livestock production. - Urban open space systems - Low density rural residential. - Small holdings or resorts where development design and overall development densities allow maintenance of ecological functioning. 	<ul style="list-style-type: none"> - Urban land uses (as above) - Intensive animal production. - Arable agriculture. - Note: Certain activities may be permitted subject to detailed impact assessments to ensure that developments are designed to maintain overall ecological functioning of ESAs. 	<p><u>The following land use activities are “Restricted” (R):</u></p> <ul style="list-style-type: none"> - Moderate density rural housing. - Traditional Communal Areas and Rural Communal Settlement (New). - Intensive Game Breeding - Transport Service. - Roads & Railways (with associated buildings/depots). - Linear engineering structures, such as pipelines, canals and power lines. - Small-scale infrastructural installations. - Renewable Energy (wind and solar farms). - Prospecting and Underground Mining. - Hydraulic fracturing. <p>These can be interpreted as “certain activities may be permitted”.</p> <p><u>Reasons for permitting these land uses in the BSP:</u> Refer above CBA 2.</p>
ESA 2	<ul style="list-style-type: none"> - Existing activities should be maintained, or - Transition to less intensive land uses. 	<ul style="list-style-type: none"> - Intensification of land use. <p><i>i.e. any land use that results in additional impacts on ecological functioning, mostly associated with the intensification of land use in these areas, is not permitted.</i></p>	<p><u>The following land use activities are “Restricted” (R):</u></p> <ul style="list-style-type: none"> - Medium Impact Tourism / Recreational and Accommodation - Low and Medium density rural housing. - Traditional Communal Areas and Rural Communal Settlement (New). - Intensive Game Breeding. - Prospecting and Underground Mining. - Hydraulic fracturing. - Including the other less intensive land uses that are “Restricted”. <p>These can be interpreted as “less intensive land uses” that should not result in additional impacts on ecological functioning if appropriately controlled and managed.</p> <p><u>Reasons for permitting these land uses in the BSP:</u> For reasons stated above, as long as current ecological functions are maintained.</p>





4.4 Recommended land management guidelines

Table 17 below contains broad land management guidelines for land categorised as CBA and ESA, which are compatible with the land management objectives presented in Table 13.

These guidelines should be used in conjunction with available ecosystem guidelines and/or other guidelines when undergoing land development applications (e.g. EIAs, water use licenses, mining or agricultural applications etc.), where applicable:

- NFEPA Implementation Manual for Freshwater Ecosystem Priority Areas (Driver et al., 2011).
- Wetland offsets: A Best-Practice Guideline for South Africa (Macfarlane et al., 2014).
- Buffer zone guidelines for rivers, wetlands and estuaries (Macfarlane and Bredin, 2016 & 2017).
- Guidelines for Development within Kruger to Canyons Biosphere Region. Download at <http://www.kruger2canyons.org/01-17%20-%20K2C%20Development%20Guidelines.pdf>.
- Grassland Ecosystem Guidelines (SANBI, 2013).
- Grazing and Burning Guidelines (SANBI, 2014).
- Guidelines for Game Farming (developed by the Department of Local Government and Human Settlements).
- Mining and Biodiversity Guideline (SANBI, 2013).
- The Western Cape Provincial Guideline on Biodiversity Offsets can also be consulted for additional support (DE&ADP, 2007).



Table 17. Recommended land management guidelines in Critical Biodiversity Areas & Ecological Support Areas

Land Management Guidelines: Critical Biodiversity Areas And Ecological Support Areas
General Management Recommendations
<p>Managing loss of natural habitat in CBAs:</p> <ul style="list-style-type: none">■ Further loss of natural habitat should be avoided in CBA 1, whereas loss should be minimized in CBA 2 i.e. land in these two categories should be maintained as natural vegetation cover as far as possible and the development of degraded or modified areas targeted.■ CBA 1s and CBA 2s not formally protected should be rezoned where possible to conservation or an appropriate zoning, and where possible declared in terms of the Protected Areas Act.■ CBA 1 and CBA 2 can act as possible biodiversity offset receiving areas.■ The provincial biodiversity stewardship programme may wish to prioritise privately owned erven in CBA 1s and CBA 2s to be incorporated into the protected area network through biodiversity stewardship agreements. The provincial protected area expansion strategy to use the CBA Map in prioritising these erven.■ Degraded or disturbed CBA 1s and CBA 2s should be prioritized for rehabilitation through programmes such as Working for Water and Working for Wetlands. An invasive alien vegetation eradication programme should be implemented. If threatened species are identified as being present, rehabilitation programs should explicitly consider these species in the development of restoration programs. Rehabilitation activities should be undertaken in such a way that does not negatively impact on the survival of threatened species. <p>Managing loss of ecological functionality in ESAs:</p> <ul style="list-style-type: none">■ In ESA 1s, maintain in a functional state, avoid intensification of land uses, and rehabilitate to a natural or near-natural state, where possible.■ In ESA 2s, additional impacts on ecological processes should be avoided.■ Maintain connectivity between CBAs, continue ecosystem functioning within the CBA corridors and prevent the degradation of adjacent CBAs. <p>General management guidelines in CBAs and ESA1s:</p> <ul style="list-style-type: none">■ An Environmental Management Plan should be compiled where required in CBA 1, CBA 2 and ESA 1. The Environmental Management Plan to include invasive alien species control, fire management, prevention of overgrazing etc. Fire management is especially important and should be appropriately managed for the particular vegetation type(s) on site.■ Control of illegal activities, such as hunting and dumping, which impact on biodiversity, should be prioritized in CBA 1s, then CBA 2s then ESA 1s.■ Prioritise CBA 1s for LandCare projects, Working for Water, beneficial green economy projects (e.g. alien clearing, rehabilitation) and NGOs to direct their conservation projects, programmes and activities, thereafter CBA 2s and then ESA 1s. In some cases, ESA 2s might be suitable sites for such projects.



Land Management Guidelines: Critical Biodiversity Areas And Ecological Support Areas

- The introduction and breeding of alien species should not be permitted in CBAs and ESAs.
- The restriction of animal movement (especially of threatened species) due to impenetrable fences should be discouraged, where possible.

General management guidelines in Aquatic CBAs and ESAs:

- Maintain water quality and flow regimes as close to natural as possible.
- Where Ecological Reserves or Environmental Flow Requirements have been determined these should be strictly adhered to. Where these have not been determined, determination should be prioritized for all CBA and ESA rivers and wetlands.
- All effluent (including municipal, mining and industrial waste water) as well as acid mine drainage should be treated to the required specifications before release.
- Storm water flow should be managed to avoid degradation of CBAs and ESAs.
- Where CBAs and ESAs include floodplains (e.g. areas within the 1:100 year flood line), riparian areas (e.g. as a minimum, a 32m buffer around rivers) or buffers around wetlands, management activities should ensure that these remain in a natural state or are rehabilitated to a natural state. Do not permit infilling, excavation, drainage, hardened surfaces (including buildings and asphalt), intensive agriculture or any new infrastructure developments within a river, riparian area, wetland or buffer area. In addition to avoiding irreversible modification of natural vegetation cover, other activities such as livestock access may need to be controlled and alien vegetation managed to avoid damage to banks, riparian areas, wetlands and buffer areas.
- Where necessary, the site development plan should indicate the 1:100 year flood line, as determined by a professional engineer. If the development is not subject to flood lines this should be confirmed by a professional engineer.
- Areas that are degraded or disturbed should be rehabilitated through programmes, such as Working for Water and Working for Wetlands; and an invasive alien vegetation eradication programme implemented.
- Linear infrastructure that crosses CBAs is not desirable, whereas for ESAs 1 and 2, linear infrastructure features designed to cross rivers and riparian areas are permitted subject to appropriate impact minimisation, avoidance, mitigation and offset.
- Creation of berms, roads, culverts, canalisation, channelization, invasive alien vegetation, impoundment, abstraction, well points, storm-water or other point source inflows, irrigation return flows, grazing / trampling, agriculture, golf courses, suburban gardens, artificial deepening and drainage, should be avoided within CBAs, whereas for ESAs these impacts should be avoided, where possible, within the 1:100 year flood line.

Where rezoning, land use change and infrastructure is proposed, the following guidelines are recommended:

- Refer to Section 5.1 - Guide to integrating the critical biodiversity areas map into environmental impact assessments and land use change applications.
- Biodiversity or ecological specialist to conduct an ecological assessment.



Land Management Guidelines: Critical Biodiversity Areas And Ecological Support Areas

- Land use changes that may impact on the population viability of listed threatened species should be assessed by a specialist.
- Rezoning in CBAs and ESAs:
 - **In CBA1 and CBA2:** Rezoning of properties to afford additional land use rights that will result in increased biodiversity loss should not be granted (i.e. permission to increase the permitted number of units per erf or per hectare should not be granted).
 - **CBA2** may have alternative sites for the relevant target to be met elsewhere in the landscape. Consequently, if the loss of CBA 2 is unavoidable, the biodiversity offset should be to identify an alternative CBA 2 site prior to the environmental authorisation or should be a condition specified in the environmental authorisation. Construction can therefore not proceed without the identification of an alternative CBA 2 site.
 - **In ESA1:** Rezoning of properties to afford additional land use rights that will result in increased impacts on ecological processes should not be granted, unless significant net conservation gains can be achieved, ecosystem functioning and connectivity of ESAs will not be compromised, and biodiversity impacts with regard to species and habitats are of at an acceptable significance and mitigated where possible.
 - **In highly modified ESA2s that are still important for supporting ecological processes:** Current land uses should either be maintained or less intensive land uses permitted (e.g. game farming, game reserves, eco-tourism facilities, low density rural residential), intensification of land use should be avoided (e.g. a transition from extensive agriculture to urban or mining). If cultivation is no longer viable then these areas should be targeted for ecological restoration.
- Infrastructure in CBA and ESA:
 - **In CBA1:** The installation of infrastructure in CBA 1s is not desirable and should only be considered if all alternative alignment and design options have been assessed and found to be non-viable. Under such conditions, at least a Basic Assessment (BA) should be undertaken, and if approved, a comprehensive Environmental Management Plan (EMP) must be developed and best-practice restoration efforts strictly implemented.
 - **In CBA2:** Should additional infrastructure be required in CBA 2, the requirements of threatened species should be taken into account. At least a Basic Assessment (BA) should be undertaken for any development which results in the intensification of land use, and if intensification of land use is approved, an Environmental Management Plan (EMP) must be developed to minimize impacts on threatened species.
 - Infrastructure developments should be limited to existing degraded / modified footprints, if and where present.
 - **In ESA2:** Infrastructure should be designed to avoid additional impacts on ecological processes (e.g. ensuring that hydrological functioning of runoff flow rate, quantity and quality are not impacted; or, landscape connectivity is not reduced through, for example, fencing).
 - Units carefully dispersed or clumped to achieve least impact, particularly with regard to threatened species, habitat loss and fragmentation.
 - A site development plan should be compiled and approved by the municipality and LEDET.
 - A services report should be compiled by a professional engineer and a services agreement drawn up with the local municipality. Long term maintenance of infrastructure should be indicated, for example road, sewage and water supply infrastructure.

Consult the Mopani District Bioregional Plan Guidelines - Part 4,
Tables 3 - 7 - for additional support.



Section 5

Additional measures for biodiversity
in the Maruleng Municipality



5.1 Guide to integrating the Critical Biodiversity Areas Map into Environmental Impact Assessments & land use change applications

As indicated in Section 1.2, the Biodiversity Sector Plan provides guidance for evaluating environmental impact assessments (EIAs), basic assessments, agricultural land use permits, water use licensing decisions and development control decisions through land use legislation (e.g. rezoning and subdivision approvals).



Scientists assessing river health by investigating the state of its biodiversity



The following steps should be taken when consulting the Biodiversity Sector Plan / CBA Map in reactive decision making processes.

5.1.1 Step 1: Assess the Biodiversity Sector Plan / CBA Map Information

Consult the following GIS data to determine the CBA Map category, biodiversity features and land cover on the property:

- Consult the CBA Map GIS shapefile to determine the category of the property (CBA, ESA, ONA and/or No Natural Remaining).
- Consult the associated GIS shapefiles to determine the presence of specific biodiversity features on the property e.g. wetland, river, vegetation type.
- Important Note:
- The updated CBA Map for the Municipality corrected (as far as possible) natural versus artificial wetlands. However, the individual wetlands are not displayed in the CBA Map. Natural wetlands are either CBA or ESA 1.
- Consult the 'Land Cover' GIS shapefile to determine the land cover category of the property (natural, degraded, irreversibly modified etc.).
- Important Note:
- The updated CBA Map for the Municipality corrected (as far as possible) additional areas that are modified. These areas represent No Natural Remaining or ESA 2 on the CBA Map.

Users can download the vegetation, river and wetland data from the SANBI BGIS website (<http://bgis.sanbi.org/SpatialDataset>), as well as the land cover data from the DEA website: https://egis.environment.gov.za/national_land_cover_data_sa.

For non-GIS users, a user friendly APP and A3 Mapbook can also be used to interrogate the CBA Map in relation to the property in question.



5.1.2 Step 2: Assess other available information

Consult other available information to assist with interpreting the biodiversity of the property and surrounding area. This is especially important since the Biodiversity Sector Plan CBA Map was not done at a fine-scale / accurate scale. For example:

- Consult the Land use Decision Support Tool on the SANBI BGIS website at <http://bgis.sanbi.org> to determine property specific details, and aerial imagery via Google Earth, if necessary.
- Consult the SANBI website for additional biodiversity information resources at <http://www.sanbi.org/information>.
- Consult up-to-date orthophotos, aerial or satellite imagery and Google Earth imagery to assess the presence of natural vegetation on site and/or the level of modification or degradation.
- The National and provincial Protected Area Expansion Strategies can be consulted to identify focus areas for expansion of the protected area network (downloadable from the SANBI BGIS website).
- The Provincial SDF can be consulted for land use policy recommendations.
- Other strategic guidelines can be consulted e.g. Guidelines for Game Farming (developed by the Department of Local Government and Human Settlements), Grazing and Burning Guidelines (SANBI, 2014); NFEPA Implementation Manual for Freshwater Ecosystem Priority Areas (Driver et al., 2011), Guidelines for Development within Kruger to Canyons Biosphere Region (unpublished report), Mining and Biodiversity Guideline (SANBI, 2013); Wetland offsets Guideline (MacFarlane et al., 2014), Buffer zone guidelines for rivers, wetlands and estuaries (Macfarlane and Bredin, 2016 & 2017) etc.

5.1.3 Step 3: Site Verification

A biodiversity specialist or ecologist should conduct a site visit to verify that the Biodiversity Sector Plan CBA Map is accurate. This is especially important since the CBA Map was not done at an accurate scale.

The role of the specialist is to confirm or modify the CBA classification of the site based on observed conditions. As a minimum the following should be determined by the specialist, namely:

Ground-verify that the CBA Map input biodiversity features and criteria (i.e. vegetation types, aquatic habitats, species of conservation concern, etc., see

- Table 11) and context information (e.g. land cover) are accurately mapped and classified:
 - Confirm the land cover category of the property (natural, degraded, irreversibly modified) and neighbouring properties.
 - As a minimum confirm and accurately map all terrestrial and aquatic biodiversity features used in determining the CBA map. Emphasis should also be on ecological processes (e.g. landscape fragmentation and connectivity) therefore it is important that as a minimum the land cover of neighbouring properties should also be confirmed.
 - Based on the criteria laid out in
 - Table 11, confirm or modify the CBA Map category of the property (CBA, ESA, ONA and/or No Natural Habitat Remaining).



- As a minimum the specialist should produce an ecological sensitivity map for the property that accurately delineates and specifies:
 - The CBA Map category and associated land management objective.
 - The land cover category.
 - Vegetation type(s), ecosystem status and ecosystem protection level.
 - Other biodiversity features that have not been mapped or have not been accurately mapped (e.g. threatened species, wetlands, natural areas), which should have been classified as a CBA or ESA.
 - Particularly for extensive sites, indicate the likelihood of presence of species of special concern and/or special habitats.
 - Ecological process areas which either delineates the presence of a mapped CBA or ESA corridor, small scale corridors (e.g. along a stream, drainage lines) or process areas (e.g. rivers, wetlands and associated buffers).
 - Recommended buffers for wetlands, rivers and other special habitats or species.
 - Level of disturbance of the vegetation type(s) i.e. pristine (high sensitivity), moderately degraded (moderate sensitivity) or highly degraded (low sensitivity); stating the degree of intactness, including the identification of alien invasive species.
 - Potential for rehabilitation/restoration.
 - The ecological sensitivity map should be provided in shapefile format, with the proposed development area (go area) and the area that will not be developed (no go area) presented in hectares (extent of go and no go area per cadastral unit).

Refer to the detailed terms of reference recommended in Step 5 (Section 5.1.5).

5.1.4 Step 4: Consult the guidelines for land use planning and decision-making (Section 4)

Once the CBA Map category of the property has been verified (Step 3), consult the land management objective (Table 13), recommended biodiversity-compatible land uses (Table 14) and land management guidelines (Table 15) in Section 4. A comparison of the BSP land use guidelines with the Mopani District BRP is provided in Table 16.

5.1.5 Step 5: Follow the terms of reference for environmental assessments (recommended by the Botanical Society of South Africa - Conservation Unit)

The terms of reference recommended by the Botanical Society of South Africa (Conservation Unit) should then be followed as part of the environmental assessment process (basic assessment or full EIA):

1. Provide a general overview of the affected area in terms of connectivity, corridors, and ecological viability of the affected area:
 - 1.1. In terms of biodiversity pattern, identify or describe:
 - a] Community and ecosystem level.



- b] The main vegetation type⁷, the aerial extent and interaction with neighbouring types, soils or topography.
- c] The types of plant communities that occur in the vicinity of the site.
- d] Threatened ecosystems⁸.
- e] The types of animal communities (fish, invertebrates, birds, mammals, reptiles etc.).

1.2. In terms of species level:

- a] Threatened species⁹ (give location if possible using GPS).
- b] The viability and estimated population size of the Threatened species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident; Medium 40-70% confident;
- c] Low 0-40% confident).
- d] The likelihood of other Threatened species, or species of special concern, occurring in the vicinity (include degree of confidence).

1.3. Other biodiversity pattern issues:

- a] Any significant landscape features or rare or important vegetation/faunal associations such as wetlands, alluvium, seeps, quartz patches, dolomitic eyes, tufas or salt marshes in the vicinity.
- b] The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- c] The condition of the site in terms of current or previous land uses.

1.4. In terms of biodiversity (ecological) processes, identify or describe:

- a] The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- b] Any spatial component of an ecological process that may occur at the site or in its vicinity (i.e. corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- c] Any possible changes in key ecological processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- d] The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the channel flow regime (surface and groundwater) and naturally-occurring riparian vegetation.
- e] Would the conservation of the site lead to greater viability of the adjacent ecosystem by securing any of the functional factors listed in (1.4a)?
- f] Would the site or neighboring properties potentially contribute to meeting regional biodiversity targets for both biodiversity pattern and ecological processes?

⁷ Mucina L, Rutherford MC & Powrie LW (eds) (2005) *Vegetation Map of South Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps*. South African National Biodiversity Institute, Pretoria. <http://bgis.sanbi.org/>.

⁸ *National Spatial Biodiversity Assessment* <http://bgis.sanbi.org/>.

⁹ Raimondo et al. (2010) *Red List of South African Plants*. www.sanbi.org.



- g] Is this a potential candidate site for conservation stewardship? Contact LEDET for information on the stewardship programme.
 - h] What is the significance of the potential impact of the proposed project, alternatives and related activities -- with and without mitigation -- on biodiversity pattern and ecological processes (including spatial components of ecological processes) at the site, landscape and regional scales?
2. Indicate on a topographical map, orthomap or on aerial imagery, preferably at a scale of 1:10 000 (and less):
 - a] The area that would be impacted on by the proposed development.
 - b] The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise modified.
 - c] Areas, including the site and surrounds that must remain intact as corridors or ecological “stepping stones”.
 3. Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes. Indicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
 4. Indicate limitations and assumptions, particularly in relation to seasonality.
 5. Indicate how biodiversity considerations have been used to inform socio-economic aspects of the proposed project, e.g. through changes to the location or layout of infrastructure, or retaining public access to biodiversity-related resources such as grazing.

All mapped information should be provided in shapefile (GIS) format, with the proposed development area (go area) and the area that will not be developed (no go area) presented in hectares (extent of go and no go area per cadastral unit).

This data should be integrated into a GIS land use management database to monitor changes in the CBA Map and the loss of biodiversity.

*“The Mopani District Bioregional Plan,
once published in terms of the NEMBA,
will require updating every 5 years”*





5.1.6 Frequently asked questions when using the CBA Map

1. *What if the CBA Map or associated maps (e.g. land cover map/shapefile) indicate that the property is located within a CBA or ESA but the site visit reveals that the property is degraded or that no natural habitat occurs on the site (i.e. it is modified / cleared)?*

There are a number of possible explanations for this:

- 1a] **If there is a match between site conditions and the land cover map/shapefile, then the CBA Map is correct.**

- i. **Example A:** The site is categorized as a CBA, the land cover category is degraded and the physical site assessment reveals that the property is degraded.
 - Some degraded sites are deliberately classified as CBA. In these cases the land cover map will show the site as degraded. The systematic planning process ‘chooses’ pristine (natural) vegetation over degraded vegetation unless there are no more options or no more pristine sites left, i.e. when irreplaceable features are present on a degraded site, the national biodiversity target cannot be met elsewhere (therefore the degraded site becomes critical for meeting targets) or where an area is required for ecological processes e.g. landscape corridors. In such a case, the management guideline is to rehabilitate if possible, and to discourage land use activities that have any further impact on biodiversity.
- ii. **Example B:** The site is categorized as an ESA, the land cover category is degraded (or modified) and the site assessment reveals that the property is degraded (or modified).
 - Degraded (e.g. invaded by alien invasive plants) and modified areas (e.g. agricultural land in floodplains, riparian areas and wetland areas) are categorized as ESA. The land cover map will show the site as degraded or modified. This is because they are currently or potentially still important for supporting ecological processes (e.g. wetland buffer areas, riparian areas and floodplains, linkages important for pollination and animal movement). In such instances, the management guideline is to rehabilitate if possible, and to discourage further hardening of the land in modified areas.

- 1b] **If there is a mismatch between site conditions and the land cover map/shapefile, then the CBA Map is in question.**

- The site may have been incorrectly classified as CBA/ESA due to an error in the land cover map, or alternatively a disturbance to the site has occurred subsequent to the development of the CBA Map. In these cases the site visit will show that the land cover on site is different to that indicated in the land cover map. The site must then be assessed for its potential to be rehabilitated and/or its role as part of a landscape corridor. Further, the proposed activity at the site should be investigated in terms of its potential impact on adjacent correctly classified CBA and ESA.

The bottom line is that a suitably qualified specialist is needed to interpret the site in relation to the CBA Map and associated data and criteria (e.g. land cover, vegetation type, ecosystem status etc.). Confirmation through a site visit (i.e. ground- truthing) is essential in all cases because a site that is degraded may still be of biodiversity significance.

2. *What if natural habitat is found on a site but this is not indicated on the land cover map/shapefile (and therefore not classified as a CBA or ESA)?*



Such inaccuracies may result from inconsistencies in scale or classification error. If the map shows that no vegetation remains, but a site visit reveals the presence of natural habitat, refer to the vegetation data (GIS maps) to determine the vegetation type and its ecosystem status. The site must then be assessed for the presence of features that would make it important for biodiversity conservation (e.g. wetlands, special habitats or species of special concern), which would classify it as a CBA. By identifying these biodiversity features (i.e. the selection criteria in Table 11), it may be possible to determine the correct CBA Map category. The precautionary principle⁸, and all applicable objectives and recommended policies (Section 4 of this handbook) should still be applied during decision-making.

3. Do 'Other Natural Areas' still require a biodiversity assessment?

Yes, in Other Natural Areas it is important to check for special biodiversity features, e.g. wetlands or species of special concern (i.e. threatened species). Knowledge of special features or species is incomplete, and therefore it is critical to verify that they do not occur on the site.

4. How does the National Equivalent ecosystem status⁹ relate to the CBA Map?

All natural intact patches of Critically Endangered (CR) and Endangered (E) ecosystems or features are CBA. Endangered **Tzaneen Sour Bushveld** is supported in the municipality. For Vulnerable (V) or Least Threatened (LT) vegetation types, the most efficient areas (i.e. on the least amount of land possible) that can meet national biodiversity targets have been included in CBA. All remaining areas are categorized as Other Natural Areas. This is done to ensure that an optimal layout of V and LT vegetation types is conserved, while still meeting national biodiversity targets, and to prevent further fragmentation of these categories over time. Note that none of the SA vegetation types that occur within the municipality are Endangered or Vulnerable (Table 3).

5. How do Biodiversity Offsets⁹ relate to the CBA Map?

CBA are ideal biodiversity offset receiving areas. Conservation agencies and/or LEDET could be consulted to identify CBA offset receiving areas. The 'Western Cape Provincial Guideline on Biodiversity Offsets' is available at www.capegateway.gov.za/deadp. To maintain national biodiversity targets and ensure sustainable development, no pristine CBA (or part thereof) should be lost to development. If this is unavoidable, such a loss should be offset. Development in CBA 1 should be guided by the land use guidelines (Table 14 and 15).

CBA 2 may have alternative sites for the relevant target to be met elsewhere in the landscape. Consequently, if the loss of CBA 2 is unavoidable, the biodiversity offset should be to identify an alternative CBA 2 site prior to the environmental authorisation or should be a condition specified in the environmental authorisation. Construction can therefore not proceed without the identification of an alternative CBA 2 site.

6. How do CBA and ESA affect existing land use rights?

CBA Maps cannot grant or take away existing land use rights. They are intended to inform proposed land use changes.



7. Will all CBA become Protected Areas?

It is not possible for all CBA to be formally conserved in Protected Areas. Nonetheless, all should be afforded some form of protection e.g. formal Protected Areas in terms of NEMPAA, appropriate zoning (in municipal land use schemes) and as other Conservation Areas (stewardship agreements or conservancies). CBA Maps will be used to inform the ideal location of future Protected Areas, priority landscape corridors, stewardship activities and conservancies etc.

8. What does it mean if we lose a CBA?

The CBA Map identified areas for conserving biodiversity pattern and process targets on the least amount of land possible (with information available at the time). The conversion of habitat within a CBA means that there will be a permanent loss of an important ecological feature or part (or whole) of a landscape corridor. Furthermore, that more land may be required to meet the same targets.

9. Will the CBA Map ever change?

Land use is dynamic and all maps require updating. It may be updated due to (1) errors in the land cover map, (2) unavoidable loss of CBA and ESA and (3) improved knowledge of biodiversity (e.g. identifying new locations of rare species). The Mopani District Bioregional Plan, once published in terms of the NEMBA, will require updating every 5 years. The current CBA Map should inform future updates.

10. Which vegetation map was used in the development of the Maruleng Critical Biodiversity Areas Map?

The 'National Vegetation Map of South Africa' (Mucina and Rutherford, 2006). Although some changes were made to Woodbush Granite Grassland and some of the forests (due to available fine-scale data) during the development of the provincial Limpopo Conservation Plan version 2 (Desmet et al., 2013), none of these vegetation types occur in Maruleng.

11. How does the Maruleng Critical Biodiversity Areas Map relate to the Mopani District Bioregional Plan and the provincial CBA Map (Desmet et al., 2013)?

The Maruleng CBA Map forms part of the Mopani District Bioregional Plan (LEDET, 2016), which is based on the provincial map developed in the provincial Limpopo Conservation Plan version 2 (Desmet et al., 2013). Integration of new data in 2015 / 2016 during the development of the Mopani District CBA Map resulted in a refinement of the provincial CBA Map. It thus supersedes the provincial CBA Map.

The CBA Map for Maruleng further updated the Mopani District Bioregional Plan (2016) in terms of (i) land cover, with associated CBA Map classification; and (ii) Protected Areas data. Land cover, in particular around urban and rural settlement areas, as well as mining and agricultural areas, was further refined and corrected based on available land cover and heads-up digitizing to more accurately reflect existing land cover (in 2018). For example, cleared areas that were previously indicated as CBA or ESA 1 were re-classified as ESA 2 or No Natural Remaining, thus representing actual site conditions. The Protected Areas, as reflected in the Mopani District Bioregional Plan, were updated to reflect the current Protected Areas in the Municipality, as per the South African Protected Areas Database (SAPAD) (DEA, 2013/14).



12. Are fine-scale biodiversity plans replacing broad-scale biodiversity plans (e.g. NSBA, STEP, ECBCP)?

Fine-scale biodiversity plans provide more accurately mapped information for site-specific decisions (but still require verification). The most recent biodiversity plans at the finest scale should take precedence over other biodiversity plans when informing land use planning and decision-making.

13. What land cover map was used?

A new land cover map for the Mopani District Bioregional Plan (LDEDET, 2016a) was developed based on the national land cover data (DEA, 2013-2014). The land cover was done at a 30 m resolution and some land cover was poorly classified. Therefore, spatial and land cover category inaccuracies will be evident at the site level (Figure 11, Section 2.8). Refer to 'query 11' above detailing further refinements to the land cover data.

14. What wetland data was used and how accurate is the data?

The National Freshwater Ecosystem Priority Assessment wetlands data (Nel et al., 2011) was used in the Mopani District Bioregional Plan. The data is not accurate and must always be verified, especially if it is a natural or artificial wetland. There are many instances where wetlands were not mapped but exist in the landscape. The update of the CBA Map for the Municipality verified natural versus artificial wetlands, which then affected the CBA Map classification surrounding it within a 500m radius. *Note however, that the individual wetlands are not displayed in the CBA Map. Natural wetlands are either CBA or ESA 1 (as per the criteria Table 11).*

A new National Wetland Map has been developed and can be accessed from SANBI BGIS.

15. What is the scale of the CBA Map?

Approximately 1:50 000.



5.2 Guide to integrating the Critical Biodiversity Areas (CBA) map into the Spatial Development Framework

As indicated in Section 1.2, the Maruleng Biodiversity Sector Plan (BSP), as a component of the Mopani District Bioregional Plan (LEDET, 2016a), serves as input into a range of proactive land use planning mechanisms at the municipal level. Most importantly, the BSP serves as the environmental component of the Integrated Development Plan (IDP) and Spatial Development Framework (SDF), which further informs the various municipal sector plans (e.g. water, transport, agriculture, and housing).

The SDF is a legally binding spatial framework that promotes sustainable environmental, economic and social development in a municipality. Municipalities are obliged to develop maps termed Spatial Development Frameworks¹⁰ (SDFs) which indicate desired patterns of land use and provide strategic guidance in the location and nature of development and conservation. The SDF map is also accompanied by the SDF report. The SDF map is the spatial depiction of an Integrated Development Plan (IDP); and should be interpreted as **the tool which integrates all sector plans**.

The SDF must ensure sustainability (Section 7b of the Spatial Planning and Land Use Management Act, 16 of 2013; and Section 26 of the Municipal Systems Act, 32 of 2000). Refer to Figure 13 and Table 18 demonstrating the alignment of the IDP and SDF processes.

The Critical Biodiversity Areas (CBA) Map and the guidelines provide crucial information which assist in the development of an SDF, namely:

- **Strategic Environmental Assessment¹¹ (SEA):** According to legislation¹², SDFs should include an SEA and must be aligned with those of neighbouring municipalities. A municipal SEA identifies areas where particular development types can occur and "red-flags" or cautions against development in sensitive areas. The CBA Map provides more accurate spatial information and policy guidelines for incorporation into an SEA map.
- **Urban Edge Demarcation[§]:** The SDF must delineate urban edges around existing urban nodes to protect the rural environment from urban sprawl and to encourage efficient settlement patterns. The CBA Map can be used to delineate the urban edge.
- **Land Use Schemes[§]:** During the revision of the municipal land use scheme and when rezoning or subdivision applications are being processed in terms of the Spatial Planning and Land Use Management Act (16 of 2013), the CBA Map should be consulted in order to avoid environmentally sensitive areas.

¹⁰ Section 26 of the MSA stipulates: An integrated development Plan must reflect - (e) a spatial development framework which must include the provision of basic guidelines for a land use management system for the municipality.

¹¹ DEAT has published (1) A Guideline Document - Strategic Environmental Assessment in South Africa (2000); and (2) Strategic Environmental Assessment Guideline - Integrated Environmental Guideline Series 4 (2007).

¹² Section 21j of the Spatial Planning and Land Use Management Act (16 of 2013).



- **Environmental Management Frameworks⁹ (EMF)** designate areas on a map where development can or cannot occur without an authorization, thereby streamlining the process of authorising developments. EMFs also provide management priorities.

The CBA Map, for the most part, was aligned with the Olifants and Letaba Catchment EMF (required as part of the legal process of gazetting the Mopani District Bioregional Plan). Zone G (Tzaneen / Phalaborwa Activity Corridor) falls within CBAs and ESAs, and thus approval of inappropriate land uses should avoid CBAs and ESAs within Zone G. The CBA Map can be used to inform any new EMFs.

- **Urban Open Space Systems (UOSS)** provide ecosystem services at the local level e.g. clean air, fresh water, wastewater purification, flood protection and recreational space. In some instances, a CBA Map may assist in identifying certain areas that provide ecosystem services within urban settlements. In others, the ecological concepts of the CBA Map may be carried through to UOSS, such as avoiding drainage areas and wetlands.
- **Policy guidelines:** The land use guidelines (Section 4) provide key policy recommendations for input into the SDF and associated Land Use Management System.
- The municipality is encouraged to develop a **GIS Land Use Management Database to monitor land use changes in CBA and ESA** as part of their Land Use Management System. Refer Section 5.3.1.1.

The CBA Map and guidelines can be used to guide the location and nature of development and conservation, whilst aligning with adjacent municipal SDFs. These products also promote the establishment of ‘Sustainable Human Settlements’⁹ by encouraging nodal development and protecting ecosystem services/ecological infrastructure

5.3 Guide to integrating the Critical Biodiversity Areas (CBA) map into the Integrated Development Plan

The Biodiversity Sector Plan (as part of the published Mopani District Bioregional Plan) should be used in various multi-sectoral planning procedures to promote sustainable development, especially at the municipal level.

The Integrated Development Plan (IDP) reflects multi-sectoral planning at the municipal level. It must comply with the ‘Environmental Right’ of the Constitution (Section 24) and the NEMA principles (Section 2). In order to ensure environmental sustainability¹³, it usually includes an Environmental Sector Plan (or Integrated Environmental Management Programme).

The Biodiversity Sector Plan provides a CBA Map and guidelines for use in developing the IDP through the SDF. The SDF (see section 5.2 above) indicates the location of identified projects during the

¹³ IDP Guide Pack: General Overview Integrated Development Planning. Prepared by the Department of Provincial and Local Government.



‘projects phase’ of the IDP, thereby integrating the two processes (see Table 18 below), including the various sector plans (e.g. transport, water).

The CBA and ESA should be the spatial focus of biodiversity conservation projects identified in the projects phase e.g. eco-tourism, rehabilitation (Section 5.3.1.9).

Part of the Environmental Sector Plan (see Section 5.3.1 below) can comprise a range of environmental management tools to promote sustainability and compliance with various planning and environmental legislation. The Biodiversity Sector Plan (as part of the published Mopani District Bioregional Plan) should be used as input from the biodiversity sector into the Environmental Sector Plan (Figure 13)

Table 18. A guide to incorporating the Maruleng Biodiversity Sector Plan, as part of the Mopani District Bioregional Plan) into the IDP and SDF (adapted from the Pierce and Mader (2006)).

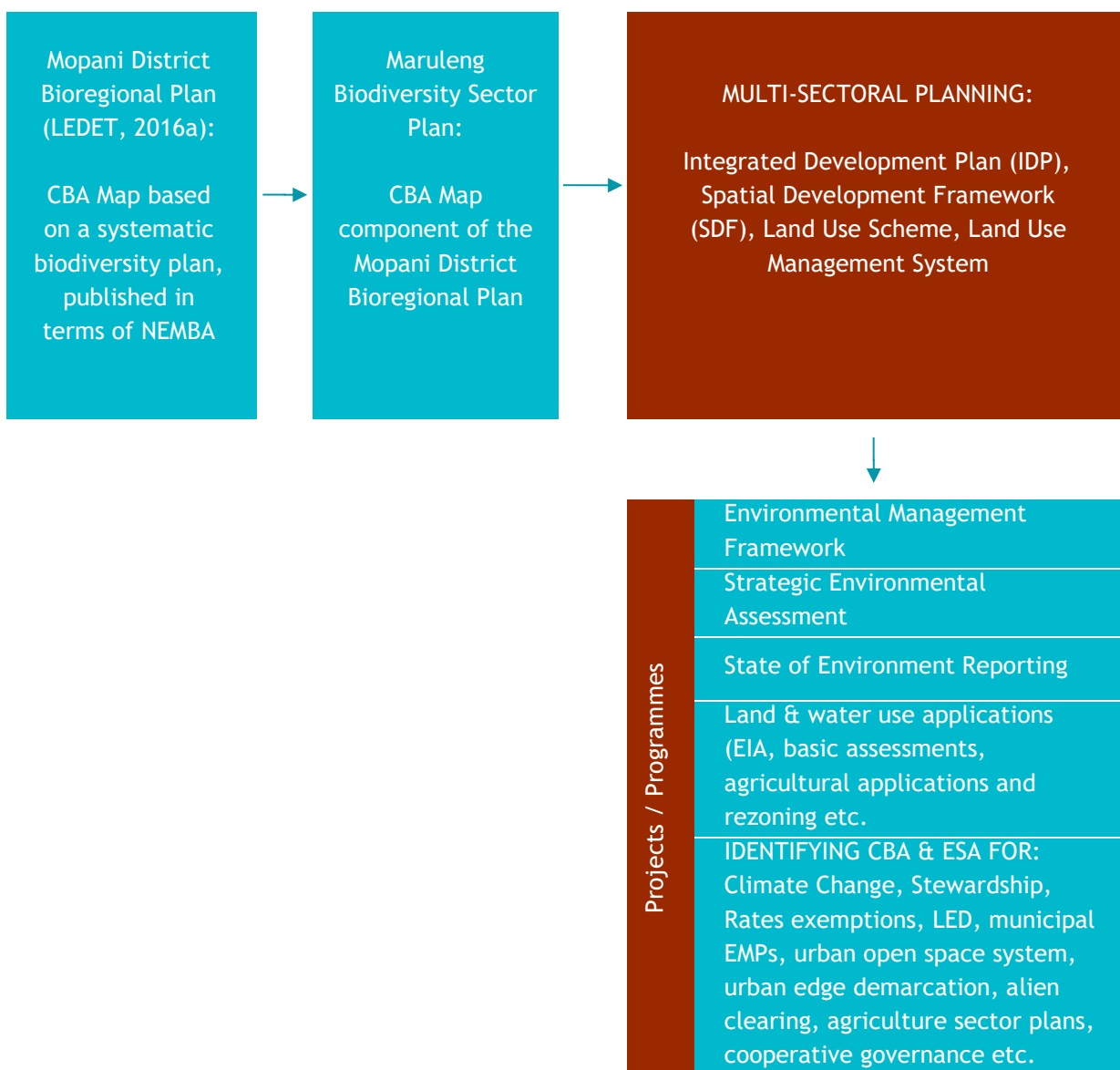
IDP Phases	Basic elements in developing the SDF	Use of the Biodiversity Sector Plan (CBA Map and guidelines)
Phase 1: Analysis		
<ul style="list-style-type: none"> - Gather all information. - Analyse information for - <ul style="list-style-type: none"> i] trends; ii] issues that can be shown on a map. - Identify needs, including normalisation after apartheid, transport etc. - Report for public comment. 	<p>Biodiversity importance of land (or category on the CBA Map), current land use, agriculture, the built environment, infrastructure, transport routes, watersheds, geology etc., heritage sites, State of Environment Reporting, Strategic Environmental Assessment.</p> <ul style="list-style-type: none"> i] trends (e.g. the direction in which the town is growing, land suitable for development); ii] issues (e.g. a need for housing, schools or a clinic in a certain area; protecting ecosystem services). 	<p>Planners and decision-makers use the Maruleng Biodiversity Sector Plan (Mopani District Bioregional Plan) Critical Biodiversity Areas Map and guidelines to identify which areas to develop and which to leave undeveloped and conserved.</p>
Phase 2: Strategy		
<ul style="list-style-type: none"> - Identify vision, mission, objectives, strategies for dealing with needs, problems and issues, such as Local Economic Development (LED), poverty alleviation, the natural environment, possible projects. - Reports for public comment. 	<p>Critical Biodiversity Areas Map indicates: Priority areas for conservation, opportunities and constraints on developments.</p> <ul style="list-style-type: none"> - Report(s) for public comment. 	<p>Plan which areas to develop and which to leave undeveloped and conserved.</p>



IDP Phases	Basic elements in developing the SDF	Use of the Biodiversity Sector Plan (CBA Map and guidelines)
Phase 3: Projects		
<ul style="list-style-type: none"> - Identify priorities, refine projects. Prioritise projects and finances, which together influence the SDF. Assess environmental impacts of projects. 	<p>Critical Biodiversity Areas Map indicates areas where restoration projects or other biodiversity related projects for poverty alleviation can take place e.g. Working for Water, Green Economy etc.</p>	<p>Identify areas for restoration projects, or other biodiversity related projects.</p>
Phase 4: Integration		
<ul style="list-style-type: none"> - 5-yr financial plan and programmes for capital investment, integrated LED, environment (including biodiversity), poverty alleviation, gender equity etc. - Draft IDP report for public comment. 	<p>Draft report and map based on the Critical Biodiversity Areas Map with overlying infrastructure and land uses, sites for integrated projects (e.g. large scale housing development, poverty alleviation projects e.g. restoration), open spaces, urban edge, development nodes, corridors, cemeteries, waste sites, social and emergency services.</p> <p>Draft SDF report and map for public comment.</p>	<p>Provincial officials, NGOs and public to ensure that the CBA Map is upheld.</p>
Phase 5: Approval		
<ul style="list-style-type: none"> - Final IDP report approved based on the Critical Biodiversity Areas Map and other BSP information. 	<p>Final SDF report and map approved based on the Critical Biodiversity Areas Map and other BSP information.</p>	<p>Councillors, municipal officials, provincial officials, NGOs and the public to ensure that the CBA Map is upheld.</p>



Figure 13. Diagram indicating integration of the Biodiversity Sector Plan (BSP), as part of the Mopani District Bioregional Plan, into municipal planning. The SDF is the tool that integrates all sector plans in the IDP process



5.3.1 The Environmental Sector Plan of the IDP

The Biodiversity Sector Plan is only one component of the Environmental Sector Plan (or Environmental Management Programme), which covers a range of environmental management issues e.g. control of wastewater discharge, air pollution, land degradation and soil erosion. The Environmental Sector Plan of the IDP comprises projects or programmes that aim at achieving environmental sustainability. These can be mechanisms or tools for ensuring the protection of CBA and ESA. Note that the projects list below is not an exhaustive list of all potential environmental projects.



5.3.1.1. State of the Environment Reporting: Data collection & management

A key mechanism for monitoring the state of biodiversity is a State of Environment Report (SoER). The Critical Biodiversity Areas Map can be used to inform the SoER as it provides information on the extent of PA, CBA and ESA in the Municipality (Refer Table 12).

a] Data collection and management in relation to the CBA Map

In order to monitor the loss of CBA and ESA, the municipality is encouraged to develop a **GIS Land Use Management Database**. The GIS Land Use Management Database should record the extent (ha) loss of natural habitat within each CBA Map category at the time land development applications are approved.

Applicants should therefore submit the final approved development area (ha) as a GIS shapefile (map) for inclusion into the GIS database, which should form part of the municipal Land use Management System.

This will also allow the Municipality to evaluate future applications and to assist with monitoring changes in the CBA Map (as part of the Mopani District Bioregional Plan).

The following indicators¹⁴ are recommended for monitoring the state of biodiversity in relation to the CBA Map:

- a. Hectares/percentage loss of CBA and ESA over time.
- b. Hectares/percentage of CBA and ESA that are formally protected.
- c. Hectares/percentage of CBA and ESA that are appropriately zoned for protection.
- d. Extent (ha) of invasive alien plant clearing, wetland and riparian rehabilitation etc.
- e. Number/proportion of threatened species and ecosystems.

The biodiversity indicators identified in the published Mopani District Bioregional Plan must be used in municipal SoERs.

The Mopani District Bioregional Plan (LEDET, 2016a) recommends the development of a District-wide GIS database to manage approved land development applications, within each local municipality. The database should be updated annually to track the loss of biodiversity.

¹⁴ Refer National DEAT Guidelines: National Core Set of Environmental Indicators for state of environment reporting in South Africa (CSIR, 2001).



5.3.1.2. Municipal climate change management plan to protect biodiversity and society

In order to increase the Municipalities resilience to climate change impacts, a climate change management plan should be developed that aims to safeguard biodiversity priority areas, to assist communities in social priority areas and to identify other actions to mitigate and adapt to the adverse effects of climate change e.g. alternative energy, community awareness raising etc.

The Department of Environmental Affairs has established a website that provides municipalities & other stakeholders with information and tools to respond to climate change at a local level (www.letsrespondtoolkit.org).

The Mopani District Municipality Climate Change Response Plan (2016) was developed (<https://drive.google.com/file/d/0B8W6Tw5QBaPDSmdiT3JueGh5bTg/view>).

5.3.1.2.a Biodiversity and social priority areas

The RESILIM-O and the K2C GEF programmes undertook to develop a ‘Climate Change Resilience Map’ and a ‘Climate Change Priorities: Integrated Ecosystem-based Adaptation to Climate Change Map’ to assist municipalities (and other stakeholders) in identifying these biodiversity and social priority areas.

Climate Change Resilience Map (Figure 14)

The climate change resilience map was integrated into the CBA Map and includes biodiversity features that should be protected as these areas are critical to increasing society’s resilience to climate change impacts.

The climate change resilience map is based on the principle that some biodiversity features are more likely to be more important for supporting resilience of natural landscapes to climate change, compared with other biodiversity features. These biodiversity features include:

- Riparian corridors and buffers; areas with high temperature, rainfall and altitudinal gradients; areas of high diversity; areas of high plant endemism; refuge sites including south-facing slopes and kloofs; and priority large un-fragmented landscapes. Refer Section 2.6.

These biodiversity features were mapped, and then combined to provide a single map of natural areas important for resilience of biodiversity to climate change (Figure 14); at the landscape scale. Retaining these areas in a natural or near-natural state will allow ecosystems and species to adapt to climate change, thus supporting healthy landscapes and the ability of ecosystems to continue to provide ecosystem services e.g. water provision, flood mitigation etc.

The CBA Map and recommended land use guidelines (Section 4) should therefore be adopted to safeguard these areas, which were integrated into the CBA Map (Figure 12). The single most important climate change adaption action the municipality can take is to secure the CBA network through appropriate.

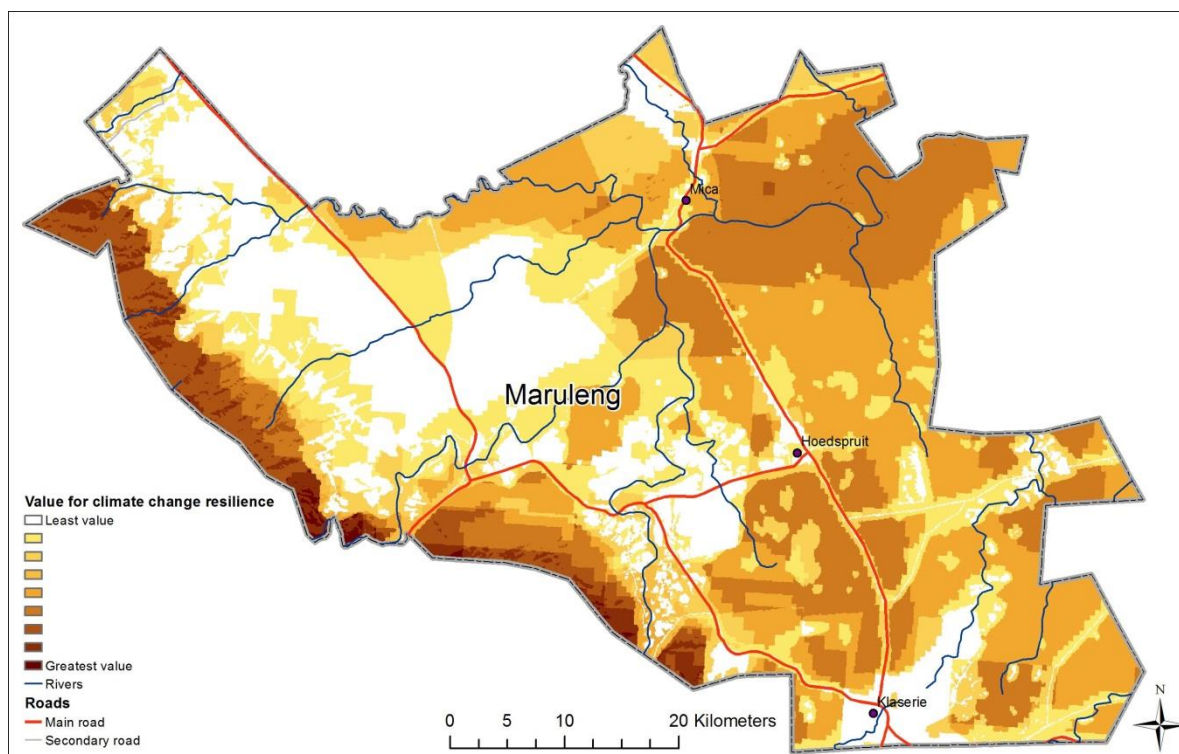


Figure 14. The climate change resilience map, which indicates biodiversity features important for supporting resilience of “landscapes” to climate change (these areas are built into the CBA map).

Climate Change Priorities: Integrated Ecosystem based Adaptation to Climate Change Map (Figure 15)

This map is based on the concept of Ecosystem-based Adaptation to climate change. The Convention on Biodiversity defines Ecosystem-based Adaptation as “*the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change*”. The first major international report on Ecosystem-based Adaptation was published by the World Bank in 2009. South Africa’s National Climate Change Response White Paper supports this approach.

In addition to supporting well-functioning landscapes in the long term, some of the areas important for climate change resilience may also provide more specific, immediate benefits that assist directly with human adaptation to the impacts of climate change, known as ecosystem-based adaptation (refer below). Ecosystem-based Adaptation has the potential to be both more effective and less costly than engineered solutions, and can be more easily applied in rural landscapes. Implementation efforts can also be easily aligned with job creation and other projects with significant social benefits.

Ecosystem-based Adaptation focuses on managing, conserving and restoring ecosystems to buffer humans from the impacts of climate change, instead of relying only on engineered solutions. This approach is suggested to be particularly effective in helping society cope with extreme climate events such as droughts, floods and storms. For example, buffers of natural vegetation along riparian corridors and around wetlands have been shown to mitigate floods, reduce erosion and improve water quality. In many cases Ecosystem-based Adaptation can work hand in hand with engineered adaptation responses.



Ecosystem-based Adaptation requires investing in maintaining and restoring ecological infrastructure, which frequently has the added benefit of creating jobs and contributing to livelihoods, especially in rural economies most at risk from adverse climate change impacts. In some instances ecosystem-based adaptation simply requires that healthy natural ecosystems are left alone to do what they already do best, and ensuring that they are not converted to intensive, high impact land uses. In other cases it requires rehabilitation of impacted ecosystems, for example clearing invasive alien plants in mountain catchments to increase water supply rather than building desalination plants or dams.

The approach taken to identifying areas important for Ecosystem-based Adaptation included a combination of:

- 1] **Ecological Infrastructure:** e.g. areas important for water provision and flood mitigation e.g. mountain catchments, floodplains, river and wetland buffers.
- 2] **Climate Resilience:** e.g. corridors, linkages, climate refugia.
- 3] **Biodiversity Priorities** :e.g. elements from the CBA Map.
- 4] **Social Priorities:** e.g. areas of highest social demand, particularly where the poorest people are most directly dependent on natural resources (e.g. firewood, grazing, water etc.) for their livelihoods.

The municipality is encouraged to develop rural projects to support communities in social priority areas. These projects should be developed with support from the relevant national or provincial departments, including other potential initiatives in the region, for example:

- Implementing sustainable agricultural practices e.g. crop or livestock rotation (grazing plans).
- Supplying rainfall tanks.
- Sustainable firewood lots.
- Removal of alien invasive plants to improve water supply and reduce fire risk (Refer Section 5.3.1.5 and 5.3.1.7).
- Rehabilitation of degraded landscapes, riparian areas etc. (Refer Section 5.3.1.7).

Also Refer Section 5.3.1.9 for agencies that assist with protecting biodiversity.

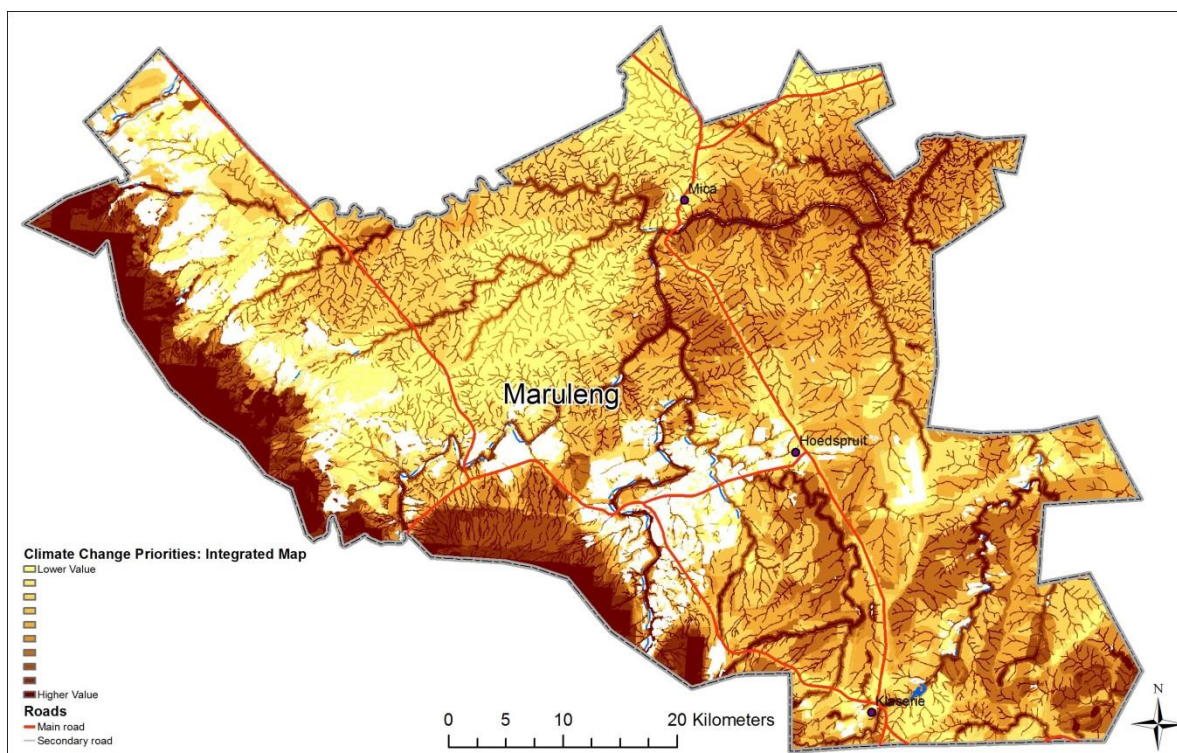


Figure 15. Climate Change Priorities: Integrated Ecosystem-based Adaptation to Climate Change Map.

5.3.1.2.b Other actions to mitigate and adapt to the adverse effects of climate change

Other actions to mitigate and adapt to the adverse effects of climate change may include projects relating to, for example:

- **Climate change mitigation:** Alternative energy projects (clean energy and energy efficiency), community awareness raising, green waste management and recycling, reducing carbon emissions, green buildings, transport and land use management. *Land use management should be guided by the CBA map (Figure 12) and associated land use guidelines (Section 4), especially beyond the urban edge.*
- **Climate change adaption:** Water management (recycling, re-use, rainfall tanks, maintenance of infrastructure), adaptive agricultural practices, alternative livelihoods and reducing flood risk (see below).
 - *Reduce flood risk to rural and urban communities:* Identifying and mapping high flood risk areas in the SDF; i.e. areas along rivers and floodplains that are likely to be flooded and pose a risk to existing communities or which should be avoided in planning future settlement areas.
 - The protection of biodiversity is another adaption strategy. This means adopting the CBA map, which is based on the climate change resilience map (see above); developing projects based on Ecosystem-based Adaptation (see above) and developing other projects related to the protection of biodiversity (refer sections below).

Support from the relevant national and provincial departments should be sought to assist the municipality in funding and developing mitigation and adaption projects, where possible; and as identified in the Limpopo Climate Change Response Strategy 2016-2020; for integration into the IDP.



Alternatively, support from other organizations, such as AWARD and K2C Biosphere Reserve, could be investigated (e.g. K2C biosphere/ SANParks Working for Ecosystems programmes (which rehabilitate degraded landscapes), stewardship etc.).

Participation in the Green Municipality Competition and supporting the green economy, led by the LEDET, improves the municipality's ability to respond to climate change. Refer to the Limpopo Climate Change Response Strategy 2016-2020 (LEDET) and the Limpopo Green Economy Plan (LEDET, 2013).

5.3.1.3. Developing environmental policies, by-laws and fiscal measures to protect biodiversity

The municipality can develop environmental policies and by-laws to protect CBAs and ESAs. This could include:

a] Policies and by-laws in terms of the Spatial Planning and Land Use Management Act (16 of 2013):

Municipalities can develop policies or by-laws concerning spatial planning, land development and land use; and for enforcing its land use scheme. *Therefore the CBA Map and land use guidelines can be incorporated into these policies.*

b] Financial measures in terms of the Municipal Property Rates Act¹⁵ (6 of 2004):

Opportunities to promote the protection of biodiversity are presented by the Municipal Property Rates Act (6 of 2004). The council of a municipality must adopt a policy on the levying of rates on rateable property (Chapter 2, Section 3). In the case of private land that includes CBA and ESA, municipalities can encourage the management of biodiversity by applying the following:

- **Rates Exemption:** this may be applied on land where there is a conservation management plan, a contractual agreement and title deed restrictions (i.e. not a formal Protected Area in terms of NEMPAA, which is subject to 'rates exclusions'). *Section 17 (1) (e) of the Municipal Property Rates Act states that special nature reserves, national parks and nature reserves are excluded from paying property rates. This exclusion applies only to those portions of the land that are not used for commercial, business, agricultural or residential purposes.*
- **Rates Rebate:** where there is a conservation management plan, the rebate agreement is short-term (e.g. 5 years) and is at least on a par with the agricultural rebate extended to landowners in some areas.
- **Rates Re-evaluation:** where the valuation system reflects a reduction in property value (for rates purposes) if the land is managed for conservation. The municipality can approach a landowner

¹⁵ See also Botha, M., 2004. *Environmental analysis of the Property Rates Act (Act no. 6 of 2004)*. Botanical Society Conservation Unit. See Section 5.3.1.9 of this handbook for contact details.



with a proposal of environmental servitude and re-evaluation. If the landowner agrees, a notarial deed is drawn up, and upon signature, the municipality can revalue the land.

- **Not reducing land value** (and therefore rates) where land is infested with invasive alien species **nor increasing rates** where land contains CBA and ESA.

CBA and ESA can be used to inform biodiversity rates exemptions, rebates and re-evaluations, including the valuation of land. They should be accurately delineated by landowners, municipalities and/or LEDET (with specialist input), to prevent indiscriminate applications for rebates or exemptions.

In the case of rateable property, municipalities can encourage the management of biodiversity/environment by applying:

- **Environmental Management Levy:** Levying charges to rate payers based on a sliding scale that is directly linked to specific environmental management objectives. The funds generated are therefore earmarked for specific expenses relating to environmental management activities and not just an extra cost in the general budget.

According to the Municipal Systems Act (32 of 2000), Section 74(2), a tariff policy must adopt - principle (d) tariffs must reflect the costs reasonably associated with rendering the service, including capital, operating, maintenance, administration and replacement costs, and interest charges; and principle (h) the economical, efficient and effective use of resources, the **recycling of waste, and other appropriate environmental objectives must be encouraged.**

Rates policy and by-laws can therefore contribute to services, projects or programmes related to safeguarding the environment, such as managing wastewater pollution (complying with green drop), urban greening, water conservation, recycling, alien plant control and post rehabilitation for increased water yields and preventing flood damage etc.

Environmental By-Laws

Municipalities are able to develop by-laws in terms of Section 156(2) of the Constitution (Act 108 of 1996), and may get assistance in this regard from National Environmental Affairs in terms of Section 46(2) of NEMA. By-laws can be established to give effect to Section 4(2)(i) of the Municipal Systems Act, namely a healthy and safe environment. Section 11(3)(e) of the Municipal Structures Act (117 of 1998) states that “A municipality exercises its legislative or executive authority by implementing applicable national and provincial legislation and its by-laws.

Biodiversity by-laws can thus be developed within the framework of NEMA and the NEMBA for the management, regulation and conservation of biodiversity (Wessels, Unknown). In instances where landowners do not comply with these by-laws, penalties can be applied.



The DEA, for example, has developed guidelines to assist municipalities to include a solid waste tariffs policy as part of the municipal tariff policy and by-laws (Refer <http://sawic.environment.gov.za/> and <http://sawic.environment.gov.za/documents/1350.pdf>). In addition, they have developed the national DEA Model By-Law¹ on Waste Management which can be adopted by municipalities.

Municipalities are therefore encouraged to implement rates policies and by-laws that support environmental management activities, and which can contribute to job creation.

c] Fiscal incentives - Income Tax Act (58 of 1962)

The Income Tax Act also allows for further opportunities to promote the protection of biodiversity in the municipality.

To provide for tax incentives, the Revenue Laws Amendment Act (60 of 2008) introduced section 37C into the Income Tax Act, with effect from 8 January 2009. This was unsuccessful, and resulted in the introduction of section 37D, effective as of 1 March 2015.

Section 37C of the Income Tax Act now deals primarily with Protected Environments and Biodiversity Management Agreements in conjunction with Nature Reserves and National Parks.

Section 37D of the Income Tax Act gives a tax deduction to landowners of proclaimed nature reserves or a National Park. The landowner of a nature reserve or National Park can deduct 4% of the value of the declared land from their taxable income each year for 25 years.

Refer to the SANBI Biodiversity Advisor site for more information:
<http://biodiversityadvisor.sanbi.org/industry-and-conservation/biodiversity-stewardship/tax-incentives>

5.3.1.4. An Environmental Management Plan for municipal-owned land

The management of natural resources is a cross-cutting exercise, requiring the collaboration of a range of agencies and departments (e.g. LEDET, SANParks, DWS etc.) (Refer Section 5.3.1.9). These agencies should provide assistance to municipalities in developing management plans for all municipal-owned land that include CBA and ESA. In addition, projects with biodiversity benefits (e.g. invasive alien plant clearing, eco-tourism, sustainable medicinal harvesting) can be identified and implemented as part of IDP and LED processes (Refer Sections 5.3.1.7 and 5.3.1.8).



5.3.1.5. A Municipal Invasive Alien Species Management Plan

Infestations of invasive alien plants pose serious threats to municipal infrastructure and functioning, as well as to biodiversity. Their massive fuel loads often lead to uncontrollable fires, and they reduce water supply and spoil scenery, impacting negatively on tourism and agricultural potential.

Municipalities are responsible for preparing an invasive species management plan for municipal-owned land as part of their IDP and for controlling listed invasive species on municipal land (in terms of NEMBA Sections 76(2) and 73(2) respectively). They are encouraged to form partnerships with agencies involved in clearing invasive species, such as DWS and the Department of Agriculture (of DAFF). CBA and ESA are priority areas for alien clearing.

5.3.1.6. Protecting biodiversity through stewardship

The National Environmental Management: Protected Areas Act (57 of 2003) provides for any land to be declared a formal Protected Area (PA), and allows for co-management of such a PA by the landowner(s) or any suitable person or organisation. Stewardship programmes (e.g. LEDET, K2C stewardship programme) work with private landowners and municipalities to secure CBA and ESA as formal PA, namely Contract Nature Reserves, National Parks or Protected Environments; or through other suitable stewardship options. Significant benefits and incentives are available to landowners of formal PA. Municipalities are encouraged to facilitate stewardship in CBA and ESA through rates exclusions etc. (Section 5.3.1.3).

All formal Protected Areas are eligible for rates exclusions in terms of the Municipal Property Rates Act (6 of 2004), Section 17.

The National Biodiversity Framework promotes the establishment and strengthening of provincial stewardship programmes and identifies local authorities as one of the lead agents. CBA and ESA are an important focus for stewardship programmes.



5.3.1.7. Building the Green Economy: Protecting biodiversity and supporting local economic development (LED)

Biodiversity-compatible Local Economic Development (LED) should be focused in CBA and ESA. Some of these projects could include: alien clearing, wetland and riparian rehabilitation, rehabilitating degraded lands, community-based eco-tourism projects and craft markets, which are based on sustainable harvesting, wildflower harvesting, bee farming or the natural products sector (medicinal herbs, aromatherapy oils etc.).

Government Programmes supporting Local Economic Development (LED)

There are various government programmes that assist with protecting biodiversity, while creating jobs e.g. People and Conservation (SANParks), People and Parks (National DEA), LandCare (Agricultural Department of DAFF), Working for Water (DWS, SANParks), Working for Fire (Forestry Department of DAFF), Working for Wetlands (DWS and SANBI), and the Green Economy (LEDET). Many of these programmes fall within the Poverty Relief Programme or the Expanded Public Works Programme.

Poverty Relief Programme (Poverty Relief Fund) or the Expanded Public Works Programme (EPWP):

- **EPWP: Environmental and Cultural Sector:** The Department of Environmental Affairs leads this programme (visit www.epwp.gov.za).
- **EPWP: Infrastructure Sector:** The Department of Public Works leads this programme, which provides infrastructure grants to provinces and municipalities.
- **The Beekeeping for Poverty Relief:** Joint venture between the ARC-Plant Protection Research Institute, Department of Science and Technology, the Department of Social Development and the Department of Agriculture.

Municipalities can be the implementing agent of a poverty relief project. Municipalities, with the assistance of other agencies, could encourage the development of small scale community projects that provide benefits for poor rural and urban communities and the environment. Further details on biodiversity and job creation can be obtained from the STEP Handbook (Pierce and Mader, 2006).



“ Projects related to the safeguarding or restoring of biodiversity should be located in CBA and ESA. In this way, the CBA Map enables the identification of IDP projects and supports LED and poverty alleviation, while promoting sustainable economic growth. ”





5.3.1.8. Co-operative management measures for protecting biodiversity

The CBA Map and guidelines serve as the common reference point for cooperative governance in relation to biodiversity and sustainable development (Refer Section 5.3.1.9 for agencies that can assist with biodiversity protection).

Area Wide Plans:

The CBA Map can be used as the biodiversity informant to Area Wide Plans (AWPs). AWP map existing farms, agricultural expansion areas and important natural areas to identify conflict areas and to ensure biodiversity is protected for sustainable agricultural development. Although the LandCare Area Wide Planning process is a Department of Agriculture process, municipalities which have a strong agricultural economy could request AWP as part of their agricultural sector plans.

Catchment Management Agencies (CMAs):

The delegation of water resource management from central government to catchment level is being achieved through the establishment of CMAs¹⁶. These agencies comprise all relevant water users. The Biodiversity Sector Plan, as part of the Mopani District Bioregional Plan, should therefore be incorporated into the work of CMAs, as indicated by the National Biodiversity Framework (2009).

Fire Protection Associations (FPAs):

FPAs are voluntary associations that may be formed by landowners to manage and extinguish bush fires under the National Veld and Forest Fire Act (101 of 1998). Municipalities are obliged to be members and should encourage landowners to join local FPAs. The Department of Forestry assists with developing area-specific Fire Action Plans. The Biodiversity Sector Plan, as part of the Mopani District Bioregional Plan, can be used to inform Fire Action Plans (visit www.firewisesa.org.za).

Co-operative Governance Structures:

Conservation agencies such as SANParks and provincial authorities (LEDET, DWS, DAFF), together with municipalities, should investigate possible structures for this purpose. Such cooperative management measures are promoted by the National Biodiversity Framework (Section 4.2.6); and the NEMA Principle which requires intergovernmental co-ordination and organization of policies, legislation and actions relating to the environment.

5.3.1.9. Agencies that can help protect and manage biodiversity

The management of natural resources and healthy ecosystems is a cross-cutting exercise that requires the coordination and collaboration of a range of agencies. Agencies responsible for the protection of biodiversity should provide input into environmental assessments on specific sites. Agencies able to assist with biodiversity related inputs are listed below:

South African National Biodiversity Institute (SANBI): The national body responsible for the management and conservation of South Africa's biodiversity. It is involved in the implementation of bioregional programmes, policy development, alien eradication, research and monitoring, including other conservation initiatives, such as the Custodians of Rare and Endangered Wildflowers or CREW (www.sanbi.org) - Pretoria Head Office (012) 843 5000 or Kirstenbosch (021) 799 8738.

¹⁶ Refer to the Guidelines for the development of Catchment Management Strategies <http://www.dwaf.gov.za/>



The Biodiversity GIS (BGIS) Unit: This unit is responsible for the management of SANBI's spatial biodiversity planning information. It is the South African portal for the provision of biodiversity information in an easily accessible and freely available format on its website. All information relating to the biodiversity planning projects in South Africa can be downloaded or obtained from BGIS (www.bgis.sanbi.org) - Cape Town (021) 799 8738.

South African National Parks (SANParks): The national authority for Protected Areas involved in incorporating biodiversity into land use planning and decision-making, park planning and expansion; community projects and the management of National Parks (www.sanparks.co.za). Refer below to the various programmes implemented by SANParks in collaboration with other institutions.

SANParks Biodiversity Social Projects programme has three main objectives: poverty relief, community upliftment and nature-conservation; on SANParks protected areas, Integrated Land Use Zones (previously referred to as buffer zones) and controlled areas. The programme is funded by the environmental programmes of the DEA, and managed by the Kruger to Canyon (K2C) Biosphere Reserve (see below).

Kruger to Canyon (K2C) Biosphere Reserve: The K2C Biosphere Reserve manages programmes which are funded or implemented by SANParks and / or DEA, including the SANParks Environmental Monitors (e.g. CSA Herd Monitors, Rhino Ambassadors) and the SANParks Working for Ecosystems programmes (which rehabilitate degraded landscapes).

The K2C acts as the implementer of the GEF Protected Area and Mainstreaming Project, involving both SANBI and SANParks. It includes the K2C stewardship, Greater Kruger Bufferzone and Development Planning components.

In the K2C Biosphere it is required that the K2C is registered as an Interested and Affected Party by Environmental Assessment Practitioners conducting basic assessments or environmental impact assessments.

Tel: 015 917 1838 / info@kruger2canyons.org. Download the K2C development guidelines at <http://www.kruger2canyons.org/01-17%20-%20K2C%20Development%20Guidelines.pdf>.

AWARD (Association for Water and Rural Development): AWARD implements the USAID RESILIM-O programme (Resilience in the Limpopo River Basin-Olifants River Catchment). The programme aims to improve trans-boundary management and governance of water and biodiversity in the Olifants River catchment. RESILIM-O focuses on building resilience in the Olifants River catchment. RESILIM-B is a sister programme that works on the wider Limpopo Basin. AWARD is currently implementing projects to improve the capacity of stakeholders to sustainably manage water resources and biodiversity in the Olifants catchment. For an electronic version of this handbook, the GIS shapefiles and JPEG maps.

Contact AWARD at Tel: 015 793 0503 / 0145; Email: info@award.org.za;

Website: www.award.org.za).

Conservation South Africa (CSA): CSA funds projects that assist local communities in protecting natural habitats while supporting their livelihoods. For example, CSA has partnered with the Kruger to Canyon Biosphere Reserve to support the Mnisi, Mametja and Moletete Rangeland Management Programmes, of which the K2C Rangeland Restoration Project restores grass cover in rangelands by reducing bush encroachment. This in turn improves grazing capacity thus supporting sustainable rural livelihoods

(https://www.conservation.org/global/ci_south_africa/Pages/conservation-south-africa.aspx).



Southern African Wildlife College focuses on providing assorted training interventions relating to natural resource management, and specialises in equipping a new generation of conservation managers with the necessary skills.

Email: info@sawc.org.za /Tel: (015) 793 7300

Provincial Department of Economic Development, Environmental and Tourism (LEDET): The provincial environmental department is the principal decision-making authority for development activities that impact on natural habitat in Limpopo (EIAs and basic assessments), including biodiversity conservation and environmental programmes (e.g. Green Economy). LEDET is the leading agency for developing critical biodiversity area maps and bioregional plans in the Province; and also funds the provincial stewardship programme (see K2C Biodiversity Stewardship programme above).

General Enquiries - Tel: (015) 293 8300; Bioregional Planning - Tel: (015) 295 5637; EIAs and basic assessments - Tel: (051) 295 4016.

The National Department of Environmental Affairs (DEA) is involved in land use decisions and the protection of biodiversity. They also run various programmes that can assist municipalities in the protection of the environment.

(<http://www.environment.gov.za/>) - For the Local Government Support unit contact (012) 310 3042; National Branch (012) 310 3955.

The Department of Water and Sanitation is the custodian of freshwater (aquatic) ecosystems and is involved in water use decisions, including the rehabilitation of rivers and wetlands and the removal of alien invasive species

(www.dwaf.gov.za) - National Branch (012) 336 7500. Polokwane (015) 290 1200.

Department of Agriculture, Forestry and Fisheries: The Department of Agriculture - LandCare/Area Wide Planning: This department supports farm planning, the clearing of invasive alien species, rehabilitation and encourages communities to adopt an ecologically sustainable approach to the management of the environment and natural resources

(www.nda.agric.za). National Branch (021) 799 8790.

The Department of Forestry is the principal national decision-making and managing authority for forest ecosystems, and is involved in the development of Fire Action Plans.

Botanical Society of South Africa (BotSoc): The Conservation Unit of the Botanical Society undertakes strategic conservation projects, often in partnership with other organizations, to achieve long-term conservation and sustainable use of biodiversity

(www.botanicalsociety.org.za) - Cape Town (021) 797 2090 or info@botanicalsociety.org.za. Limpopo Branch: 015 296 2293

Endangered Wildlife Trust (EWT): EWT supports the conservation of threatened species and threatened ecosystems, and implements or facilitates biodiversity stewardship. The National Biodiversity and Business Network, launched by EWT in 2013, aims to assist businesses with integrating biodiversity into their operations, e.g. including buffers around rivers in agricultural landscapes, establishing mechanisms to reduce bird mortalities due to ESKOM powerlines

(Website: <https://www.ewt.org.za>).



Section 6

Monitoring, reviewing & updating
the Critical Biodiversity Areas map





6.1 Roles & responsibilities for monitoring, reviewing and updating

The Maruleng Biodiversity Sector Plan's Critical Biodiversity Areas (CBA) Map forms part of the Mopani District Bioregional Plan (LEDET, 2016a). Review and update of the published¹⁷ Critical Biodiversity Areas (CBA) Map, where and if necessary, is required every 5 years in terms of the National Environment Management: Biodiversity Act (10 of 2004).

The LEDET is the agency responsible for the update of the Mopani District Bioregional Plan's CBA Map, whereas the Mopani District Municipality is the lead implementing agency for the Mopani District Bioregional Plan.

The Maruleng Municipality will be responsible for assisting with the update and review of the Critical Biodiversity Areas Map in the following manner (Refer Part 6.1.1 of the Mopani District Bioregional Plan document):

1. Representation on the Bioregional Plan Coordination Committee (to be convened).
2. Ensuring that the Mopani District Bioregional Plan, and thus the Maruleng CBA Map, remains current, effective and in force.
3. On-going evaluation of the use of the bioregional plan (Maruleng CBA Map) in land-use planning and decision-making.
4. Recommendations regarding the review and revision of the bioregional plan (Maruleng CBA Map).
5. Revision of IDPs/SDF's in response to the bioregional plan (Maruleng CBA Map).
6. Gathering data on **performance indicators** (Refer Section 6.2 below).
7. Submitting data to the Mopani District Municipality and the Co-ordination Committee for use as key indicators for monitoring effectiveness of the bioregional plan (Maruleng CBA Map).

6.2 Performance indicators for monitoring, reviewing & updating

With regards to point 6 and 7 above, the Mopani District Bioregional Plan (LEDET, 2016a) recommends a list of performance indicators for monitoring and updating of the Critical Biodiversity Areas (CBA) Map (Part 6.1.2).

Table 19 provides the list of recommended performance indicators, which will be required to be collated by the Maruleng Municipality. These indicators can be linked to monitoring the state of the environment, Section 5.3.1.1.

¹⁷ Published in terms of the National Environment Management: Biodiversity Act (10 of 2004).



Table 19. List of performance indicators required to be collated by the Maruleng Municipality for monitoring and updating the Mopani District Bioregional Plan

Calculate Percentage (%) and area (hectares) of Critical Biodiversity Areas and Ecological Support Areas 1 (over the period of evaluation) -
1. Contained within conservation orientated zones within Spatial Development Frameworks, Land Use Schemes and Environmental Management Frameworks.
2. Under some form of conservation management, including both formal protection and conservation stewardship agreements.
3. Where subdivision has been approved or where increased development rights have been granted.
4. Where appropriate biodiversity management interventions have been applied (e.g. clearing of invasive alien species, biodiversity management plans).
5. Lost (or irreversibly modified) due to various land use changes/developments.
6. In a natural or near-natural state (key indicators would be level of invasive alien vegetation infestation, level of degradation due to overgrazing, sand mining or dumping etc.)
7. Rehabilitated to its desired state (e.g. alien vegetation cleared).





Section 7

Glossary



Glossary¹⁸

- **Aquatic features or ecosystems** refer to rivers, wetlands and estuaries or natural water features.
- **Aquifer** Underground water-bearing areas.
- **'Best design'** refers to an identified network of natural sites that meet pattern and process thresholds in all vegetation types in a spatially efficient and ecologically robust way, and aim to avoid conflict with other activities (e.g. economic activity) where it is possible to achieve biodiversity thresholds elsewhere. The 'best design' sites include the largest, most intact, least disturbed, connected and/or adjacent areas required in terms of meeting pattern and process thresholds.
- **Biodiversity** The wide variety of plant and animal species in their natural environment. It not only refers to species (plants, animals and micro-organisms), but also to ecosystems, landscapes, and the ecological and evolutionary processes that allow biodiversity to persist over time. It includes the diversity within species, between species, and of ecosystems.
- **Biodiversity offsets** Conservation activities intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects. It usually involves setting aside land in a similar ecosystem elsewhere, at the cost of the developer. See biodiversity receiving areas below.
- **Biodiversity offset receiving areas** These are areas in the landscape that are selected to compensate for the unavoidable and negative impacts of a proposed development. They are usually of equal or greater biodiversity importance to the area of land impacted on or lost.
- **Biodiversity Pattern** is the term for the way in which the components of biodiversity are spatially arranged, and in this document, refers to specific vegetation types or habitat types, e.g. forest or fynbos, a population of rare and endemic species, or other biodiversity features, e.g. a river, wetland (vlei). The habitat type or feature is home to specific animals, plants, birds, insects and other organisms, for example Blue Duiker in forests.
- **Biodiversity Plan(ning)** A map of information about biodiversity features (species, ecosystems, ecological processes), existing Protected Areas; current patterns of land use; and potential and conflicting patterns of land use. These mapped features can be linked for further analysis using Geographic Information Systems (GIS) to identify areas of highest biodiversity importance and to determine priority areas for action.
- **Biodiversity priority areas** In this handbook, the term biodiversity priority areas refers to formal Protected Areas, Critical Biodiversity Areas and Ecological Support Areas.
- **Biodiversity Sector Plan** A tool that feeds into a range of multi-sectoral planning and assessment processes to inform land use planning and decision-making. As a minimum, it should include a Critical Biodiversity Areas Map, a Biodiversity Sector Plan handbook with land use management guidelines and a municipal biodiversity profile; and all relevant GIS shapefiles. It is often a precursor to a gazetted bioregional plan, but in this instance, it has been developed to accompany and further explain the Mopani District Bioregional Plan, as it relates to the Maruleng Local Municipality.

¹⁸ Part of this glossary is drawn from the *Putting Biodiversity Plans to Work (Job and Driver, 2006)* and the *Eastern Cape Biodiversity Conservation Plan (Berliner and Desmet, 2008)*.



It provides biodiversity data specific to the Maruleng Municipality landscape, along with explanatory information, to assist in the uptake of the Mopani District Bioregional Plan at the local level. See 'Bioregional Plan' below.

- **Biodiversity Target** (or threshold) is a target area (hectares) which must be safeguarded in order for the component plants and animals to exist and for ecosystems to continue functioning (e.g. pollination, migration of animals). If the threshold for a feature is exceeded (i.e. the extent of the feature is reduced through human activities), the threat arises that ecosystems will deteriorate/collapse, which will severely impact on the delivery of ecosystem services. The thresholds drive the 'amount' of an ecosystem type (e.g. vegetation type) is selected on the CBA Map. It answers the query: 'How much do we need to achieve a living landscape' (e.g. number of hectares). Biodiversity Thresholds are the cornerstone of the systematic biodiversity planning approach and are based on species diversity and richness within each vegetation type. Legislative control also influences target setting, for example Forests are protected by legislation therefore a target of 100 % is set i.e. all the remaining forests require protection.
- **Bioregion** A land and water territory, the limits of which are not politically bound, but which are defined by the geographical boundaries of human communities and ecological systems. Also a geographical space that contains one whole, or several nested, ecosystems characterised by landforms, vegetative cover, human culture and history as identified by local communities, governments and scientists.
- **Bioregional Plan (published in terms of the NEMBA)** A bioregional plan is based on a systematic fine-scale biodiversity plan (ideally at a scale of 1:10 000; or \leq 1:50 000). It includes a Critical Biodiversity Areas map and land and water use guidelines. The compilation and monitoring of bioregional plans is usually the responsibility of the conservation authority or provincial environmental department or of a municipality, if the capacity exists. Municipalities must be consulted in the publishing process. After its publication, the bioregional plan must be taken into account in all future planning by a municipality. A bioregional plan should be compiled for a municipality or cluster of municipalities. Refer to the 'Guideline regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans'.
- **Bioregional planning** refers to land use planning and management that promotes sustainable development by recognising the relationship between, and giving practical effect to, environmental integrity, human-well-being and economic efficiency within a defined geographical space, the boundaries of which are determined in accordance with environmental and social criteria. It is an internationally recognised planning concept aimed at achieving sustainable development.
- **Biodiversity priority areas** In this handbook the term refers to formal Protected Areas, Critical Biodiversity Areas and Ecological Support Areas.
- **Cadastral unit** A single property or erf.
- **Carbon storage** (or carbon sequestration) is the storage of carbon dioxide or other forms of carbon through biological, chemical or physical processes. This reduces the impact of carbon, a greenhouse gas, on climate change. In this handbook carbon storage refers to the storage of carbon in plants (via biological processes).
- **Catchment** A catchment is the area (a geographical region) where water from rain (or snow) becomes concentrated and drains downhill into a river or lake. The term includes all land surface, streams, rivers, and lakes between the source and where the water enters the ocean.
- **Connectivity** "Functional" connectivity refers to the ability of connective corridors to sustain ecosystem processes common to linked patches (it is the opposite of fragmentation).



- **Conservancy** Agreements for co-operation among neighbouring landowners for conservation purposes, and which require no legal long-term commitment from landowners.
- **Conservation** The safeguarding of biodiversity and its processes (often referred to as biodiversity conservation).
- **Conservation areas (in the context of this document)** Land under some form of conservation agreement other than those via the NEMPAA. They are not considered formally protected areas, as they are not gazetted in terms of the NEMPAA and do not allow for long term security of tenure. For example Private Nature Reserves declared in terms of provincial ordinances, Biodiversity Agreements in terms of the Biodiversity Act, and conservancies.
- **Corridor/s** - see ecological process areas
- **Critical Biodiversity Areas (CBA)** These are terrestrial (land) and aquatic (water) features (e.g. vleis, rivers and estuaries) in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning in the long term (which is particularly important in the face of climate change). They are identified through a systematic biodiversity planning approach (see below).
- **Critical Biodiversity Areas Map** A fine-scale systematic biodiversity plan that delineates on a map Critical Biodiversity Areas and Ecological Support Areas which require safeguarding to ensure the continued existence of biodiversity, its ecological processes (e.g. animal migration, pollination) and its ecosystem services e.g. water supply. The map also delineates formal Protected Areas, Other Natural Areas and No Natural Remaining.
- **Delineate [a wetland]** Determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators.
- **Degraded** landscapes are areas of indigenous habitat that are infested with alien plants, overgrazed or have been impacted in some other manner. These areas are still able to function ecologically (e.g. animals still make use of these areas); albeit in a deteriorated state. Degraded areas have the potential to be restored or rehabilitated.
- **Demand control** Controlling the use of water to ensure that the volume of water use for domestic, industrial and other uses by society is reduced and controlled. This is implemented through various mechanisms, such as recycling, re-use of water, limiting water use to certain periods etc.
- **Ecological process** Natural operations which occur within ecosystems and maintain them as working systems. Ecosystems work because they are kept “alive” by ecological processes such as pollination, nutrient cycling, natural disturbance (e.g. fire, grazing), migration of species, and soil maintenance. Other examples of processes include plant-herbivore processes, lowland to upland gradients, predator-prey relationships, migration and exchange between inland and coastal systems (often along river corridors), seasonal migration of animals, and hydrological regimes (e.g. rivers, wetlands).
- **Ecological process areas** are important for maintaining **ecological processes** (see above). These can either be large scale corridors stretching across entire mountain ranges or from the mountain range to the sea (i.e. landscape, ecological or regional corridors), or they can be small scale such as the buffer area around an isolated wetland.
- **Ecological Reserve** The ecological reserve refers to that portion of streamflow which must remain in rivers to ensure the sustainable healthy functioning of aquatic ecosystems (i.e. the river and its associated wetlands and estuaries).



- **Ecological Sensitivity Map** is a map indicating the relative ecological sensitivity and vulnerability of a planning domain/ area. A sensitivity analysis is conducted to guide the project design in terms of layouts and to determine the most appropriate development scenario. The sensitivity analysis is based on ecological criteria. The map should delineate (a) vegetation type(s) on site of varying sensitivity i.e. whether it is a CBA or Other Natural Area etc., and the ecosystem status (Refer to Appendix A); (b) disturbance of the vegetation type(s) and levels of disturbance on site i.e. pristine (high sensitivity), moderately degraded (moderate sensitivity) or highly degraded (low sensitivity), including the identification of alien invasive species; (c) potential for rehabilitation/restoration; (d) presence of or likelihood of presence of Species of Special Concern⁹; (e) any special features (if applicable); and (f) ecological process areas which delineate either the presence of a mapped CBA corridor (ecological process area or landscape corridor) or the potential for small-scale corridors on site, e.g. along a stream, drainage lines.
- **Ecological Support Area** A supporting zone (ecological) or area required to prevent degradation of Critical Biodiversity Areas and formal Protected Areas, usually located adjacent to or which link CBA and/or Protected Areas. Some of these areas may already be transformed or degraded, but they still support ecological processes.
- **Ecosystem** A natural system that represents the interactions between plants, animals, insects, micro-organisms and the non-living environment (e.g. soil, air, water). Ecosystems can operate at different scales - from very small (a pond) to whole landscapes (an entire water catchment area). In the CBA Map, different types of vegetation were recognised as ecosystems.
- **Ecosystem services** The benefits that people get from nature, such as a regular supply of clean water, flood control, prevention of erosion, pollination (important to the fruit industry, for example), carbon storage (to counteract global warming), stone and sand for building, and clean air vital for our survival i.e. 'what nature does for us'.
- **Ecosystem threat status** Describes the condition of an areas biodiversity relative to past, present and future threats, and is an indicator of the level of safeguarding required for the continued existence of the biodiversity which is found in that particular area. Ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving the majority of species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem. Four Ecosystem status classifications types exist, namely Critically Endangered, Endangered, Vulnerable and Least Threatened.
- **Eco-status** The overall ecological status of an aquatic resource in which it should be managed as determined by the Reserve Determination Methodology (developed by the Department of Water Affairs). For example, Eco-status A requires that a river or wetland be managed in its natural state and is not subject to impacts. It indicates the level of protection a river or wetland should receive.
- **Ecotone** A transitional zone between two or more ecosystems (such as a forest and fynbos) which may display characteristics of both. For example, between forests and fynbos, the ecotone comprises hardy pioneer plants that can recover rapidly after disturbance and can protect the forest from fire and the drying effects of the sun.
- **Endemic** A plant or animal species, or a vegetation type, which is naturally restricted to a particular defined region (not to be confused with indigenous). For example, a plant may be endemic to a certain region, which means it is restricted to this area and does not grow naturally anywhere else in the country or world.



- **Environmental Management Framework (EMF)** An EMF allows environmental constraints and opportunities to be examined at a regional level to influence project-specific decisions before they are made. They identify opportunities and constraints to developments, and also allow for the consideration of cumulative effects that may be expected in the study area. They inform land use decision-making processes once development proposals are submitted.
- **Environmental Management Plan (EMP)** The EMP provides specifications that the landowner shall adhere to, in order to minimise adverse environmental impacts associated with a land use activity e.g. alien plant management on land for conservation. In terms of proposed developments, an EMP can be defined as “an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced”. EMPs are therefore important tools for ensuring that the management actions arising from Environmental Impact Assessment (EIA) processes are clearly defined and implemented through all phases of the project life-cycle.
- **Floodplain** a smooth, relatively flat valley floor next to and formed by a river or stream subject to periodic overflows.
- **Fine-Scale Biodiversity Plans** are more accurate maps of biodiversity prepared at a scale of 1:5 000 - 1:50 000 (or finer) and which identify important areas for conservation and sustainable management. See systematic biodiversity plan below.
- **Fragmentation [of habitat]** The breaking up of a continuous habitat, ecosystem, or land use type into smaller fragments.
- **Function/functioning/functional** Used here to describe natural systems working or operating in a healthy way (opposite to dysfunctional which means working poorly or in an unhealthy way)
- **GIS and GIS shapefiles** A GIS is a computer technology that combines geographic data (the location of man-made and natural features on the earth’s surface) and other types of information (names, classifications, addresses and much more) to generate visual maps and reports. A GIS can play a major role in integrating information from a variety of databases to identify problems and explore solutions (Adapted from Looney 2000 *Beyond Maps - GIS and Decision-making in Local Government*).
- **Ground truthing** is the verification of mapped information with real features on the site.
- **Groundwater** is the term for any water found subsurface in the saturated zone below the water table, i.e. the water table marks the upper surface of the groundwater systems.
- **Habitat** The natural home of a plant or animal species. Generally those features of an area inhabited by animal or plant which are essential to its survival. The habitat of a frog might be a wetland.
- **Hotspot** Biodiversity hotspots are areas of high species diversity, which are also under serious threat.
- **Indigenous** Naturally occurring or “native” to a broad area, such as South Africa.
- **Intact/ecological integrity** Used here to describe natural environment that is not badly damaged, and is still operating healthily.
- **Integrated management** in this handbook refers to the management of land use in an integrated fashion. This implies the need to consider the socio-economic and environmental (biodiversity) impact of land use change and development to ensure sustainable development. The principles of accountability, participation, equitability and sustainability are promoted.



- **Invasive alien species** Invasive alien species means any *non-indigenous* plant or animal species whose establishment and spread outside of its natural range threatens or has the potential to threaten natural ecosystems, habitats or other species ecosystems; and may result in economic or environmental harm, or harm to human health.
- **Land cover** The substance which covers the land, e.g. natural vegetation, roads, factory, or bare ground. In the context of this document, land cover gives an indication of the level of transformation of natural ecosystems and can range from natural through to irreversibly transformed. Land cover cannot always be equated to land use, e.g. bare land can either be borrow pits (where the land use is mining) or natural bare soil (where the land use may be conservation). It is one of the crucial components of systematic biodiversity planning (see below).
- **Landscape corridor** - see ecological process area.
- **Land use** is the human alteration of the natural environment into the built environment (e.g. agriculture, mining, plantation, and settlements) or the human preservation of the natural environment (e.g. conservation).
- **Land use planning and decision-making (LUPDM)** Land use planning and decision-making takes the form of both reactive decision-making and proactive planning. The former refers to decisions and recommendations made by authorities and professionals dealing with land use development applications (e.g. EIA and LUPO); whilst the latter refers to the compilation of forward planning documents and maps, such as SDFs, SEAs etc., which guide land use development. LUPDM is a multi-sectoral planning process.
- **Listed Threatened Ecosystems** are ecosystems that are threatened (CR, E and V - see ecosystem status) and have been listed in terms of Section 52 of the National Biodiversity Act (10 of 2004).
- **Mainstreaming biodiversity** means integrating biodiversity considerations and the sustainable use of biological resources into the policies, strategies and day-to-day operations of a range of sectors whose core business is not biodiversity conservation (e.g. into economic sectors and development models and programmes) and in so doing, integrating it into all human behaviour. Mainstreaming biodiversity is essential for overcoming the "conservation versus development" mindset, and for ensuring sustainable development.
- **Multi-sectoral planning procedures** consider all available sector plans (biodiversity, agricultural, mining, economic, social, etc.) in order to make informed decisions and promote sustainable development. IDPs and SDFs are examples of multi-sectoral planning tools.
- **National Equivalent** ecosystem status. See ecosystem status above.
- **National Biodiversity Threshold** See Biodiversity Threshold above.
- **Place-bound versus non-place-bound** Place bound is where a proposed development is dependent on a certain location, e.g. mining only occurs where minerals are located, versus non-place bound development which is not dependent on a certain location e.g. a paint ball centre or water park.
- **Planning Unit** The minimum unit of land used in the biodiversity (conservation) planning process to identify Critical Biodiversity Areas (and the other mapped categories of land).
- **Precautionary principle** In the face of uncertainty about the workings of ecosystems and the effects of human activities, we should always err on the side of caution. Incomplete or inadequate data are generally the norm in conservation and resource management activities; however, the lack of data should not be used to justify a delay in taking conservation actions.



Actions or refraining from potentially harmful actions should be based on the probable consequences to species, habitats and ecosystems, especially when long-term, or irreversible, consequences are more likely than not. Referred to in the NEMA.

- **Pristine** Unspoiled, used here to describe the natural environment in its undisturbed state.
- **Protected Areas** These are formally protected areas declared in terms of the National Environmental Management: Protected Areas Act.
- **Ramsar Convention and List:** Known as the ‘Convention on Wetlands of International Importance’, where certain wetlands have been listed and have acquired a new status at the national level and are recognised by the international community as being of significant value, not only for the country, but for humanity as a whole (see www.ramsar.org).
- **Red Data species:** Plant or animal species that have been assessed and classified according to their potential for extinction in the near future. These species are listed in the Red Data Book and classified as Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened or Least Concern. Red Data species are those species classified as Extinct, Critically Endangered, Endangered or Vulnerable. They are protected by law under provincial ordinances, the NEMA, and the Biodiversity Act.
- **Rehabilitate/rehabilitation - see also restore/restoration** Meaning (roughly) restoration, especially after mining activities or quarrying, but where the natural environment is not repaired to its original pristine state. Rehabilitation emphasizes the reparation of ecosystem processes, productivity and services.
- **Restore/restoration** (Ecological restoration) The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. It involves the repair of the natural environment to a state close to its original state. For example, this can be achieved through the removal of alien invasive plants, or the repair of eroded sites and the replanting of indigenous plants. Restoration involves, not only the reparation of ecosystem processes, productivity and services, but also the re-establishment of species composition and community structure.
- **Rezoning and Land Use Schemes** The general purpose of zoning is to determine land use rights, manage urban growth, develop and utilise land, as well as conservation of the natural and cultural environment.
- **Shapefile** Several GIS files that together produce a geographical/mapped feature e.g. dam, road, vegetation type, also known as a GIS layer or map (see above).
- **Species** Any living organism e.g. plant, animal, insect, bird, etc., of a particular kind and name.
- **Species of Special Concern (SSC)** in this handbook refers to red data species (see above). SSC are also referred to as Species of Conservation Concern or Taxa of Conservation Concern.
- **Sustainable development** Development that meets the needs of both present and future generations, equitably. In terms of the NEMA, (sustainable) development is the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.”
- **‘Sustainable Human Settlements’** Integrated and sustainable human settlements that redress the legacy of racial and social divisions, combat urban sprawl, ensure centrality for the poor and create empowered communities through social capital formation (PSDF, 2005). Encouraging nodal development and the protection of nature’s ecosystem services, to promote sustainable development.



- **Systematic biodiversity plan (technically known as a systematic conservation plan)** A map which indicates priority areas for conservation and sustainable management to ensure the continued existence of biodiversity. Systematic biodiversity planning is an approach to conservation that prioritises actions by setting quantitative targets (thresholds) for biodiversity features (e.g. vegetation types). It is premised on conserving a representative sample of biodiversity pattern, including species and habitats (the principle of representation), as well as the ecological and evolutionary processes that maintain biodiversity over time (the principle of persistence). The configuration of priority areas identified in the plan is designed to be spatially efficient (i.e. to meet biodiversity targets as efficiently as possible in terms of the amount of land required) and where possible to avoid conflict with other land uses where these are known to exist (principles of efficiency and conflict avoidance). It recognizes that the whole landscape must be planned and managed strategically to ensure sustainable development. (It is the technical term for the CBA Map - see Critical Biodiversity Areas Map above).
- **Thresholds** See biodiversity threshold above.
- **Modification / Modified Land [habitat loss]** Clearing an area of its indigenous vegetation. These modified parts of the landscape no longer contain indigenous habitat. In many areas, this has led to the breakdown of natural ecological processes.
- **Urban Edge** An urban edge is ‘a defined line drawn around an urban node as a growth boundary i.e. the outer limit of urban areas’. It is intended to protect the rural environment from urban sprawl and to encourage efficient settlement patterns. Refer to the DEADP Guideline Document ‘Urban Edge Guidelines in the Western Cape’.
- **Vegetation** The collective term for plants in an area. Often referred to as “bush” or “veld”.
- **Water Management Area** South Africa is divided into Water Management Areas (WMAs), according to the National Water Act (36 of 1998). A WMA is an area established as a management unit in the national water resource strategy within which a catchment management agency will conduct the protection, use, development, conservation, management and control of water resources.



A close-up photograph of an elephant's skin, showing the characteristic wrinkled and textured surface. The skin is a mix of brown and grey tones, with deep creases and ridges. A small, light-colored, irregularly shaped object is visible on the lower left side of the frame.

Section 8

List of abbreviations



BGIS	Biodiversity Geographical Information Systems
BSP	Biodiversity Sector Plan
BRP	Bioregional Plan
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs (National)
DEAT	former Department of Environmental Affairs and Tourism (National)
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIP	Environmental Implementation Plan
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ESA	Ecological Support Area
GEF	Global Environment Facility
GIS	Geographic Information System
ha	Hectares
K2C	Kruger to Canyon Biosphere Reserve
LCPv2	Limpopo Conservation Plan Version 2
LEDET	Limpopo Department of Economic Development, Environment and Tourism
IBA	Important Bird Area
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
LED	Local Economic Development
LUMS	Land Use Management System
NBA	National Biodiversity Assessment 2011
NEMA	National Environmental Management Act (107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Act (57 of 2003)
NFEPA	National Freshwater Ecosystem Priority Areas (or FEPA)
NGO	Non-Governmental Organization
NNR	No Natural Remaining
NPAES	National Protected Area Expansion Strategy
NSBA	National Spatial Biodiversity Assessment (2011)
NWA	National Water Act (36 of 1998)
ONA	Other Natural Areas
PA	Protected area
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act (16 of 2013)
UNESCO	United Nations Educational, Scientific and Cultural Organisation



Section 9

References



- Alexander, G. and Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature. Cape Town.
- Apps. P. 2000. Smithers' Mammals of Southern Africa: A Field Guide. Struik Publishers. Cape Town.
- Bates, M.F., Branch, W.R., Bauer, A.M., Burger M., Marais, J., Alexander, G.J. and de Villiers, M.S. 2014. (Eds.) Atlas and Red List of the Reptiles of South Africa, Lesotho & Swaziland. Suricata 1. South African National Biodiversity Institute.
- Maruleng IDP. 2016. Maruleng Municipality Integrated Development Plan Draft Reviewed (2016-2017/21). Province of Limpopo. Hoedspruit.
- Cowling, R.M. 2002. New perspectives on the tree richness of South Africa's forests. *Veld and Flora* 88: 48-49.
- CSIR. 2012. Background Report Lower Olifants Community Health: Risks and Opportunities Project. Authors: J. John, R. Garland, B. Genthe, D. Govender, W. Le Roux, V. Macandza, J. Manhique, K. Nortje, M.A. Oosthuizen, C. Pauw, M. Steyn, L. Swemmer, C. Wright.
- Davis, D., Stevens, N., Sinden, L. and Nkambule, C. Engaging stakeholders in global change risk and vulnerability planning: a case study of the Kruger to Canyons Biosphere Region. Science Real and Relevant Conference. Prepared by CSIR, Natural Resources and the Environment, Climate Change. Auckland Park.
- DEA. 2015. Climate Support Programme - Climate Change Adaption Strategies. Adaption Strategies for Limpopo Province. Department of Environmental Affairs.
- Desmet, P. Holness, S.H., Skowno, A., Mphaphuli, D. and Ramatsae, M.C. 2014. Limpopo Protected Area Expansion Strategy. Technical Report. (Contract number: EDET/QUT/2371/13). Prepared for Limpopo Department of Economic Development, Environment and Tourism (LEDET) by ECOSOL GIS.
- Department of Environmental Affairs and Economic Development. 2003. Bioregional Planning Manual. Bioregional Planning in the Western Cape. Prepared by Dennis Moss Partnership.
- Department of Environmental Affairs and Development Planning. 2004. Western Cape Provincial Zoning Scheme Model By-Law. Prepared by Planning Partners in association with Du Plessis and Hofmeyr Attorneys Dr. P.E. Claassen.
- Department of Environmental Affairs and Development Planning. 2007. Provincial Guideline on Biodiversity Offsets. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
- Department of Environmental Affairs and Tourism. 2008. Guideline regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans.
- Department of Environmental Affairs and Development Planning. 2009. DRAFT Western Cape Provincial Rural Land Use Planning and Management Guidelines (May 2009). Prepared by Setplan (Cape Town).
- Department of Environmental Affairs and Tourism. 2009. National Biodiversity Framework. Government Gazette, 3 August 2009. No 32474.
- Department of Water Affairs and Forestry. 2007. Policy principles and guidelines for control of development affecting natural forests.
- Department of Water Affairs and Forestry. 2007. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.
- Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J., Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Report to the Water Research Commission.



- Ferrar, A.A. and Lötter, M.C. 2007. Mpumalanga Biodiversity Conservation Handbook. Mpumalanga Tourism and Parks Agency, Nelspruit.
- Henning, G.A., Terblanche, R.F. and Ball, J.B. (eds) 2009. South African Red Data Book: butterflies. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria.
- Hewitson, B.C. and Crane, R.G. 2006. Consensus between GCM climate change projections with empirical downscaling: Precipitation downscaling over South Africa. *International Journal of Climatology*. 26: 1315-1337.
- Holness, S.D., Bradshaw, P. and Brown, A.E. 2010. Critical Biodiversity Areas of the Garden Route. Conservation Planning Report. Garden Route Initiative. South African National Parks. Knysna.
- Hosking, S.G. and du Preez, M. 2004. A cost-benefit analysis of the Working for Water Programme on selected sites in South Africa. *Water SA* Vol. 30 (2): 143 - 152.
- Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Summary for Policymakers. Synthesis Report of the IPCC Fourth Assessment Report.
- Jackelman, J., Holness, S.D. and Lechmere-Oertel, R. 2008. The National Protected Area Expansion Strategy (NPAES): A Framework for Implementation. Report compiled for South African National Biodiversity Institute and National Department of Environment Affairs and Tourism, Pretoria.
- Job, N. and Driver, A. 2006. Biodiversity Priority Areas: Supporting land use planning and decision-making in threatened ecosystems and special habitats. Botanical Society of South Africa: Conservation Unit. Kirstenbosch, Cape Town. Booklets compiled for the Drakenstein, Swartland and Cape Agulhas Municipalities in the Western Cape.
- Job, N. and Driver, A. 2006(2). Putting Biodiversity Plans to Work: Project Report and Recommendations (Draft). Botanical Society of South Africa: Conservation Unit. Kirstenbosch, Cape Town.
- Job, N., Snaddon, K., Day, L., Nel, J., Smith-Adoo, L. and Kotze, I. 2008. The Freshwater Consulting Group and CSIR. C.A.P.E. fine-scale biodiversity planning project: Aquatic Ecosystems of the Sandveld - Saldanha Planning Domain.
- LEDET. 2013. Limpopo Green Economy Plan Including the Provincial Climate Change Response. Prepared by Dr Antoaneta Letsoalo. Department of Economic Development, Environment and Tourism. Limpopo.
- LEDET. Limpopo Climate Change Response Strategy 2016-2020. Department of Economic Development, Environment and Tourism. Limpopo.
- LEDET. 2016a. The Mopani District Bioregional Plan. Prepared for the Limpopo Department of Economic Development, Environment and Tourism (LEDET) by NuLeaf Planning and Environmental (Pty) Ltd) in collaboration with the LEDET, the South African National Biodiversity Institute (SANBI), South African National Parks (SANParks) and various stakeholders within the Mopani District.
- LEDET. 2016b. The Waterberg District Bioregional Plan. Prepared for the Limpopo Department of Economic Development, Environment and Tourism (LEDET) by ECOSOL GIS (Pty) Ltd) in collaboration with the LEDET, the South African National Biodiversity Institute (SANBI), and various stakeholders within the Waterberg District.
- Macfarlane, D.M., Kotze, D.C., Ellery W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2008. Wetland Management Series: WET-Health - A technique for rapidly assessing wetland health. WRC Report TT 340/08.
- Macfarlane, D., Holness, S.D., von Hase, A., Brownlie, S. and Dini, J., 2014. Wetland offsets: a best-practice guideline for South Africa. South African National Biodiversity Institute and the Department of Water Affairs. Pretoria.
- Macfarlane, D.M. and Bredin, I.P. 2016. Buffer zone guidelines for rivers, wetlands and estuaries. Part 1: Technical Manual. WRC Report No. TT 715-1-17. Water Research Commission, Pretoria.
- Macfarlane, D.M. and Bredin, I.P. 2017. Buffer zone guidelines for rivers, wetlands and estuaries. Part 2: Practical Guide. WRC Report No. TT 715/2/17. Water Research Commission, Pretoria.



- Matthews, W.S., van Wyk, A.E. and Breedenkamp G.J. 1993. Endemic flora of the north-eastern Transvaal Escarpment, South Africa. *Biological Conservation* 63(1):83-94.
- MTPA. 2014. Mpumalanga Biodiversity Sector Plan Handbook. Compiled by Lötter M.C., Cadman, M.J. and Lechmere-Oertel R.G. Mpumalanga Tourism & Parks Agency, Mbombela (Nelspruit).
- Mucina, L., Rutherford, C. and Powries, I.W. EDITORS. 2005. The Vegetation of South Africa, Lesotho and Swaziland. 1 000 000 SCALE SHEET MAPS. South African National Biodiversity Institute. Pretoria.
- Mucina, L. and Rutherford, M.C. (Eds). 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute. Pretoria.
- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. And Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. Report to the Water Research Commission. WRC Report No. K5/1801.
- Nel J.L. and Driver A. 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater Component. CSIR Report Number CSIR/NRE/ECO/IR/2012/0022/A, Council for Scientific and Industrial Research, Stellenbosch.
- Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.
- Paterson, A.R. 2006. Pruning the money-tree to ensure sustainable growth: Facilitating sustainable development through market-based instruments. University of Cape Town.
- Pierce, S.M. and Mader, A.D. 2006. The STEP Handbook. Integrating the natural environment into land use decisions at the municipal level: towards sustainable development. Centre for African Conservation Ecology (ACE). Report Number 47 (Second Edition). Nelson Mandela Metropolitan University, South Africa.
- Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Tuner, R.C., Kamundi, D.A. and Manyama, P.A. (Eds). 2009. Red List of South African Plants. *Strelitzia* 25. South African National Biodiversity Institute. Pretoria.
- Roets, W. and Duffell-Canham, A. 2009. Implementing Setback Lines: Development Planning for Climate Change. Conference proceedings IAIA. Wilderness.
- SANBI. 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).
- Sinclair, I., Hockey, P. And Tarboton, W. 2002. Birds of Southern Africa. Struik Publishers. Cape Town.
- Skowno, A.L. and Holness, S.D. 2012. SANParks Addo Mainstreaming Biodiversity Project - Mapping Component. Technical Report. Port Elizabeth.
- Turpie J.K., Heydenrych, B.J. and Lamberth, S.J. 2003. Economic value of terrestrial and marine biodiversity in the Cape Floristic Region: implications for defining effective and socially optimal conservation strategies. *Biological Conservation* 112:233-273.
- van der Merwe, W. and du Toit, D. (Ed). 2016. Maruleng Municipality Draft. A profile of the municipal area. Prepared by Association for Water and Rural Development (AWARD). Prepared for the USAID: RESILIM O project. Hoedspruit.
- Vromans, D.C., Maree, K.S., Holness, S.D., Job, N. and Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the George, Knysna and Bitou Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Addo Elephant National Park Mainstreaming Biodiversity Project. South African National Parks. ISBN978-0-9869776-1-9.





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