

TENBOSCH

BASELINE TERRESTRIAL ECOLOGY STUDY & BIODIVERSITY VALUE ASSESSMENT



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EIA REGULATIONS SPECIALISTS REPORT CHECKLIST

(1) A specialist report prepared in terms of the 2014 Environmental Impact Assessment Regulations must contain-

	(a) details of-	
✓	(i) the specialist who prepared the report; and	page 7
✓	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	page 68
✓	(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	page 69
✓	(c) an indication of the scope of, and the purpose for which, the report was prepared;	page 7
✓	(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	page 12
✓	(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	page 12
✓	(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	page 37
✓	(g) an identification of any areas to be avoided, including buffers;	page 40
✓	(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	page 38
✓	(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	page 17
✓	(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	page 39
✓	(k) any mitigation measures for inclusion in the EMPr;	page 40
✓	(l) any conditions for inclusion in the environmental authorisation;	page 40
✓	(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	page 40
	(n) a reasoned opinion-	
✓	(i) as to whether the proposed activity or portions thereof should be authorised; and	page 41
✓	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	page 40
X	(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	n/a
X	(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
✓	(q) any other information requested by the competent authority.	none

Abbreviations

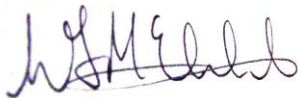
IUCN	International Union for Conservation of Nature
mamsl	Metres Above Mean Sea Level
MBSP	Mpumalanga Biodiversity Sector Plan
MNCA	Mpumalanga Nature Conservation Act (No. 10 of 1998)
MTPA	Mpumalanga Tourism and Parks Agency
NEMBA ToPS	National Environmental Management: Biodiversity Act Threatened or Protected Species (No. 10 of 2004)
NFA	National Forest Act (No. 30 of 1998)
PRECIS	National Herbarium Pretoria (PRE) Computerised Information System
QDS	Quarter Degree Square, for example 2531 BD
SANParks	South African National Parks

Terminology

Alien	Introduced from elsewhere: neither endemic nor indigenous.
Biodiversity	The structural, functional and compositional attributes of an area, ranging from genes to landscapes.
Degraded	An ecosystem that is a poor ecological state, usually through impacts such as invasion by alien plants, severe overgrazing, poor burning regimes, etc. These systems still contain a moderate proportion of indigenous flora.
Floating macrophyte	Floating aquatic macrophytes are defined as plants that float on the water surface, usually with submerged roots, that are not dependant on soil or water depth.
Geophyte	Plants that produce their growth points from organs stored below the ground, an adaption to survive frost, drought and / or fire.
Palearctic	Ecozone consisting of North Africa, Europe and Asia north of the Himalayan foothills.
Transformed	Transformed ecosystems are no longer natural and contain little or no indigenous flora. Examples include agricultural lands, plantations, urban areas, etc.

Declaration of Independence

We declare that we have been appointed as independent consulting ecologists with no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2010. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. Remuneration for our services by the proponent is not linked to approval by any decision-making authority responsible for authorising this development.



W.L. McClelland

07 June 2016



D.R. McKenzie

07 June 2016

1. INTRODUCTION

ECOREX Consulting Ecologists CC was appointed by Peter Velcich of NuLeaf Planning & Environmental to conduct the terrestrial ecology study for a Basic Assessment Report (BAR) on a portion of land north-west of Komatipoort that is earmarked for development (Figure 1). This study will provide a basis for assessing potential impacts of the proposed project on terrestrial ecology and guide the design and location of planned infrastructure. The study comprised flora and key vertebrate fauna (mammals, birds, reptiles, frogs). The two key deliverables for this study were a baseline terrestrial ecology survey and an integrated Biodiversity Value Assessment.

The land owner intends to develop a timeshare resort on the property consisting of the following:

- 60 -100 chalets
- Central complex with recreational facilities
- A third of the existing water rights from the river will be converted to be used for the development.

The study team was as follows:

Duncan McKenzie – Terrestrial Ecologist. He has been involved in biodiversity assessments for ECOREX for eight years and countries of work experience include Lesotho, Swaziland, Mali, Mozambique, Sierra Leone, South Africa, Tanzania and Democratic Republic of the Congo. Duncan has previously worked as a Regional Coordinator for the Mondi Wetlands Project and lectures on many aspects of conservation in Nelspruit and the Kruger National Park. He is currently the Regional Co-ordinator for the South African Bird Atlas Project, sits on the KZN Bird Rarities Committee and is a co-author on the Wildflowers of the Kruger National Park project.

Linda McKenzie (GIS Specialist). Linda is a GIS Specialist/GIS Analyst with over 12 years' experience in the industry. For the last 3 years she has operated her own GIS Consultancy called Digital Earth. She has extensive experience in both the private and public sector, as has worked on a wide variety of projects and GIS applications. These include, most recently, vegetation and sensitivity mapping, landcover data capture, municipal roads master planning, hydroelectric scheme and wind farm feasibility mapping and town planning, land surveyor and

engineering support services. Linda currently serves as treasurer for GISSA Mpumalanga and is a registered Professional GISc Practitioner (PGP0170).

2. TERMS OF REFERENCE

- A. Conduct an assessment of the terrestrial ecosystems within the project area (vertebrate fauna and flora), which will include the following:
- Description of vegetation communities;
 - Vegetation Map;
 - Description of faunal assemblages (mammals, birds, reptiles and frogs).
- B. Assessment of the Biodiversity Value of the vegetation units represented, which will comprise:
- Assessment of conservation importance and functional importance of each vegetation unit;
 - Biodiversity Value Map – including no-go and buffer areas.

Emphasis will be placed on locating species of conservation importance (Red Data, endemic, and / or protected).

3. STUDY AREA

The proposed development is situated on Portion 101 of the farm Tenbosch 162 JU, approximately 8 km north-west of the town of Komatipoort, Ehlanzeni District, Mpumalanga (Figure 1). The study area lies adjacent to the Kruger National Park boundary on the southern bank of the Crocodile River between the town of Marloth Park to the west and the Crocodile Bridge Gate to the east. Most of the study area is transformed through houses, sheds, a short golf course and orchards. The study area is approximately 40 hectares in size, of which 30 ha is transformed. The remaining 10 ha comprises natural vegetation in varying degrees of disturbance or degradation. Surrounding land uses include agricultural, commercial and residential developments to the west, south and east and conservation land to the north. The study area is situated within the quarter-degree grid 2531 BD at an altitude of approximately 170 mamsl.

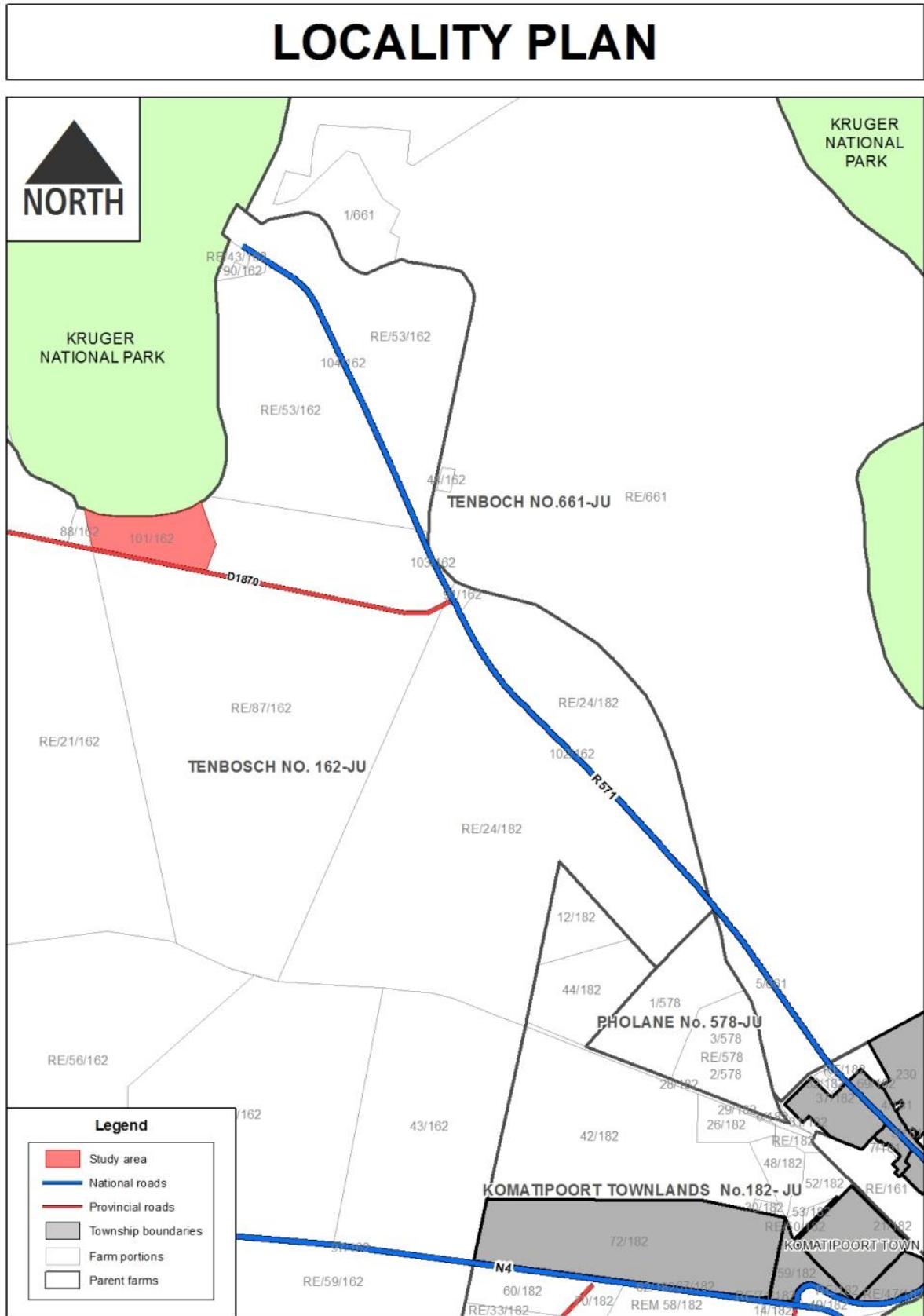


Figure 1. Location of Study Area

4. METHODS

4.1 Flora

Desktop

Vegetation communities were identified prior to fieldwork using satellite imagery supplied by Digital Earth. Red Data plant species listed for the quarter-degree grid 2531 BD in the Mpumalanga Tourism & Parks Agency's threatened species database, as well as PRECIS data from the South African National Biodiversity Institute (SANBI), were used to produce a list of the most likely threatened species, which were searched for during fieldwork.

Fieldwork

Vegetation communities identified in the desktop phase were ground-truthed during a single day field trip on the 19th May 2016. Representative meandering transects were surveyed on foot in each vegetation community and species lists compiled for each transect. Plants were listed according to each of the vegetation communities identified during the desktop phase. Plants not identified to species level were collected and dried in a plant press for identification at a later stage.

4.2 Fauna

Desktop

Lists of conservation-important mammals, birds, reptiles and frogs potentially occurring within the proposed agricultural development were prepared using data from the MTPA's threatened species database, Friedmann & Daly (2004), the Southern African Bird Atlas Project 2 <http://sabap2.adu.org.za/>, Barnes (2000), Minter *et al.* (2004) and Bates *et al.* (2014). The above data were captured mostly at a quarter-degree spatial resolution, but were refined by excluding species unlikely to occur within the study area, due to unsuitable habitat characteristics (e.g. altitude and land-use). Bat species thought to only forage over the study area (i.e. mostly cave-roosting species) were not included in the assessment due to the lack of suitable caves within the study area. Potential occurrence of fauna in the study area was predicted based on knowledge of known habitat requirements of local fauna species.

Fieldwork

Birds were identified audially and visually using Bushnell 10x42 binoculars. Observations were made incidentally during the time that the vegetation survey was conducted, and limited to birds seen and heard within the study area and immediate surrounds. Mammals, reptiles and frogs were recorded incidentally as they were encountered during the survey through direct evidence (sightings) and indirect evidence (spoor, dung).

4.3 Biodiversity Value Assessment

The biodiversity value of each vegetation community was based on a combination of Conservation Importance and Functional Importance, each of which were rated on a five-point scale, from Very Low to Very High, as indicated in Table 1. This method was based on Biodiversity Action Plan guidelines developed by Anglo American (Coombes, 2004).

Conservation Importance

The method of calculating conservation importance was based on six key parameters, which were each allocated a score that ranged between zero (Not Important) and twenty (Very Important) (Table 2). The overall conservation importance was based on the median value of the six parameters, namely:

1. *Protection Status*. The extent to which the vegetation community is currently formally protected (e.g. World Heritage Site; RAMSAR, National Park; Provincial Game Reserve; Private Conservancy etc.);
2. *Size*. The extent to which the larger vegetation type of which the defined area is a representative sample, still exists; this incorporates the conservation status of threatened vegetation types in that vegetation types with the highest threat status are assumed to have the lowest extent of habitat remaining;
3. *Species Diversity*. The extent to which the vegetation community supports a high diversity of plants or animals;
4. *Species of Conservation Concern*. The extent to which the vegetation community supports threatened species and other species of conservation concern;
5. *Unique Habitat or Taxa*. Presence of range-restricted plants or animals or unusual natural feature;

6. *Present Ecological State.* The extent to which the vegetation community is modified from natural conditions.

Functional Importance

The method of calculating functional importance was based on four ecosystem service categories, which were each allocated a score that ranged between zero (Not Important) and twenty (Very Important) (Table 3). The overall functional importance was based on the median value of the four ecosystem service categories, namely:

1. *Provisioning Services*. The extent and frequency that the vegetation community provides consumable goods (e.g. food, freshwater, timber, fibre, medicinal plants, etc.);
2. *Regulating Services*. The extent to which the vegetation community provides regulating services (e.g. flood attenuation, water purification, storage, climate regulation, carbon sequestration, etc.);
3. *Cultural Services*. The extent to which the vegetation community provides cultural services (e.g. tourism attraction, spiritual attraction, aesthetic value, etc.), and;
4. *Supporting Services*. The extent to which the vegetation community provides supporting ecological services, either positive (e.g. migration corridor, refuge area, primary production, pollination, pest control, nutrient cycling, soil formation), or negative (e.g. disease sources, pest outbreaks).

By integrating assessments of the conservation importance and functional importance of the different vegetation communities, an assessment of Biodiversity Value was made. This is indicated spatially in Figure 8.

Table 1. Method of calculating Biodiversity Value of vegetation communities

Conservation Importance	Functional Importance				
	Very High	High	Moderate	Low	Very Low
Very High	Very High	Very High	High	High	Moderate
High	Very High	High	High	Moderate	Moderate
Moderate	High	High	Moderate	Moderate	Low
Low	High	Moderate	Moderate	Low	Low
Very Low	Moderate	Moderate	Low	Low	Very Low

Table 2. Method of calculating Conservation Importance of vegetation communities

Parameter	Very High	High	Moderate	Low	Very Low
Protection Status	International	National	Regional	Local	None
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Size / Length	Very small	Small	Moderate	Large	Very Large
	(<500km ²)	(500 to 1,000km ²)	(1,000 to 20,000km ²)	(20,000 to 50,000km ²)	(> 50,000km ²)
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species Diversity	Noticeably High		Moderate		Noticeably Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species of Conservation Concern	Noticeably High		Moderate		Noticeably Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Unique Habitat or Taxa	Noticeably High		Moderate		Noticeably Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Present Ecological State	Natural, largely Unmodified	Slightly modified	Moderately Modified	Considerably Modified	Severely Modified
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Table 3. Method of calculating Functional Importance of vegetation communities

Parameter	Very High	High	Moderate	Low	Very Low
Provisioning Services	Constant	Regular	Frequent	Occasional	Intermittent
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Regulating Services	Very High	High	Moderate	Low	Very Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Cultural Services	Very High	High	Moderate	Low	Very Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Supporting Services	Very High	High	Moderate	Low	Very Low
	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

4.4 Assumptions, Limitations And Knowledge Gaps

4.4.1 Seasonality

The assessment was based on a single field survey in the dry season only. It is possible that plants which flower at other times of the year are underrepresented, including most of the potentially occurring threatened plants such as *Adenium swazicum* (CR) and *Aloe komatiensis* (EN). Additional summer fieldwork is recommended to search for these and other species, particularly in the woodland vegetation community.

4.4.2 Overlooked Species

Certain plant species, particularly geophytes, will only flower in seasons when conditions are optimal and may thus remain undetected, even over a survey that encompasses several seasons. Other plant species may be overlooked because of very small size and / or extreme rarity. A sampling strategy will always represent merely a subset of the true diversity of the study area. However, the level of sampling effort for this study was appropriate for the objectives of the study.

4.4.3 Wetland Delineation

The wetland assessments in this report are based purely on conservation value and no wetland or riparian delineation, buffer determination or full functionality assessments were performed. The buffer width recommendations made are the standard distance as recommended in the Mpumalanga Biodiversity Sector Plan (MBSP) by the Mpumalanga Tourism and Parks Authority.

5. BIODIVERSITY BASELINE DESCRIPTION

5.1 Flora

5.1.1 Regional Context

According to Mucina & Rutherford (2006), the study area is situated in Tshokwane - Hlane Basalt Lowveld within the Lowveld Bioregion in the Savanna Biome. This vegetation type is restricted to a strip running parallel to the Lebombo Mountains from central Swaziland in the south to the Olifants River in the north. Tshokwane - Hlane Basalt Lowveld originally covered 281 929 ha in Mpumalanga, of which 12.1 % has been transformed, mostly through sugarcane and settlements. This vegetation type is considered well protected and has a conservation status of **Least Concern** (Lötter *et al.*, 2014). This is largely due to much of this community occurring within the Kruger National Park. It is not listed as a Threatened Ecosystem (Notice 1002 of Government Gazette 34809, 9 December 2011).

Most of the terrestrial ecosystems within the study area on Tenbosch is classified as **Heavily** or **Moderately Modified Areas** by the Mpumalanga Biodiversity Sector Plan (MBSP). The scattered untransformed sections are classified as **Other Natural Areas**¹. Other Natural Areas refer to areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character, while performing a range of biodiversity and ecological functions. Other Natural Areas offer much more flexibility in terms of permissible land uses, but the desired management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning.

The entire study area is also situated within the **Ecological Support Areas (ESA): Protected Area Buffers**. ESA's are "areas that are not essential for meeting (conservation) targets, but play an important role in supporting the functioning of CBA's and that deliver important ecosystem services" (Lötter *et al.*, 2014). Protected Area Buffers are areas that surround proclaimed protected areas that moderate the negative impacts of land-uses that may affect the ecological functioning of those protected areas².

The wetland vegetation around the dam is classified as **ESA: Wetlands** in the MBSP. These areas are not essential for meeting biodiversity conservation targets but play an important role in supporting the functioning of Critical Biodiversity Areas and deliver important ecosystem

¹ Lötter *et al.*, 2014

² Lötter *et al.*, 2014

services¹. Both drainage lines in the study area classified as **ESA: Important Subcatchments, Fish Support Areas**. These are areas that are important for supporting threatened and near threatened indigenous freshwater fish populations².

The study area is **not** situated in any of southern Africa's floristic centres of endemism, which are areas that have an unusually high number of plants unique to that area (Van Wyk & Smith, 2001).

5.1.2 Local Vegetation Communities

Three untransformed vegetation communities were identified within the study area on the basis of distinctive vegetation structure (grassland, woodland, thicket, etc.), floristic composition (dominant and diagnostic species) and position in the landscape (mid-slopes, terrace, crest, etc.). Transformed and degraded areas make up approximately 30 ha, or 75 % of the study area. Most of the transformed and degraded land is covered by citrus orchards, various buildings, a short golf course and old lands. The untransformed vegetation communities are described in detail below:

5.1.2.1 *Ficus sycomorus* - *Hypoestes forskalii* Disturbed Riparian Forest

This vegetation community occurs in two portions within the study area. The larger tract is located in the eastern section below the dam, running down along the small stream to the Crocodile River (Figure 7). Vegetation structure is mostly Low to Tall Forest (*sensu* Edwards, 1983; Figure 2). Riparian Forest covers approximately 3 ha which equates to 7.5 % of the study area. Evergreen trees and woody shrubs dominate this vegetation community, with the dominant canopy species being *Ficus sycomorus*, *Diospyros mespiliformis* and *Trichilia emetica*. Other common canopy species include *Bridelia micrantha*, *Rauvolfia caffra* and *Acacia xanthophloea*. Woody shrubs dominating the understory include *Grewia monticola*, *Bridelia cathartica*, *Phyllanthus reticulatus*, *Gymnosporia senegalensis*, *Pluchea dioscoridis* and *Gymnanthemum coloratum*. Much of the understory of Riparian Forest had been slashed, particularly west of the channel, but in less disturbed parts the common understory plants included the herbs *Hypoestes forskalii*, *Cucumis zeyheri* and *Jasminum fluminense* and the grasses *Setaria megaphylla* and *Panicum maximum*. A feature of this community is the high level of alien plant infestation with many species forming monospecific stands (such as *Hedychium gardnerianum*). Some are declared alien invasive plants but many are growing as garden escapes, and at least 21 species were recorded from this community.

¹ Lötter *et al.*, 2014

² Lötter *et al.*, 2014

A total of 62 species (44 % of the entire list) was recorded from Riparian Forest, the second highest of all the vegetation communities (Appendix 1). Species fidelity, which is closely linked to community uniqueness, is also high, with 34 species (55 % of the community list) occurring nowhere else in the study area.

Only two conservation-important species were recorded. *Philenoptera violacea* and *Sclerocarya birrea* subsp. *caffra* are protected under the National Forests Act (No. 30 of 1998) (Table 4).



Figure 2. Photographs of Riparian Forest

Riparian Forest was assessed as having High Biodiversity Value through integration of Moderate Conservation Importance and High Functional Importance scores (Table 5). It was rated as having High Functional Importance (Appendix 5) because of a high rating in the following components:

- Provisioning Services – fibres, medicinal plants;
- Regulating Services - flood attenuation, water purification;
- Supporting Services – nutrient cycling, migration corridors.

Riparian Forest was given a Moderate Conservation Importance rating because of moderate to low scores for Threatened Species and Present Ecological State (Appendix 5).

5.1.2.2 *Acacia nigrescens* – *Panicum maximum* Disturbed Closed Woodland

Acacia – *Panicum* Disturbed Closed Woodland covers 2.2 ha or 5.5 % of the study area (Figure 7). Vegetation structure can best be described as Short to Tall Closed Woodland (Figure 3) although some bush clearing has taken place in parts which has resulted in an Open Shrubland vegetation structure (Edwards, 1983).

A moderate variety of trees dominate the canopy with the most dominant including various legumes such as *Acacia nigrescens*, *Acacia nilotica* and *Peltophorum africanum*. Other common trees located include *Combretum hereroense* and *C. imberbe*, *Sclerocarya birrea* subsp. *caffra* and *Ziziphus mucronata*. Common shrubs found include *Grewia bicolor*, *G. flavescens*, *Dichrostachys cinerea* subsp. *africana* and *Gymnosporia senegalensis*. Dwarf shrubs were prominent, and include *Barleria elegans*, *Abutilon austro-africanum*, *Solanum campylacanthum* subsp. *panduriforme* and *Maerua parvifolia*. Forbs, bulbs and herbs recorded included *Kalanchoe rotundifolia*, *Acalypha villicaulis*, *Cucumis zeyheri* and *Justicia flava*. Scattered *Aloe marlothii* were also observed. The dominant grasses found include *Panicum maximum*, *Cenchrus ciliaris*, *Digitaria eriantha*, *Eragrostis superba*, *Heteropogon contortus* and *Urochloa mosambicensis*.

A total of 78 species was recorded in *Acacia* – *Panicum* Disturbed Closed Woodland, representing 56 % of the entire species list (Appendix 1) and the highest of the three vegetation communities. Species fidelity is high, with 39 species (50 % of the community list) occurring nowhere else in the study area. One Near Threatened tree species was recorded: *Dalbergia melanoxylon*, as well as three species protected under the National Forests Act (No. 30 of 1998): *Philenoptera violacea*, *Combretum imberbe* and *Sclerocarya birrea* subsp. *caffra*, and one by the Mpumalanga Nature Conservation Act (No.10 of 1998): *Aloe marlothii* (Table 4).



Figure 3. Photographs of Closed Woodland

Disturbed Closed Woodland was assessed as having Moderate Biodiversity Value through integration of Moderate Conservation Importance and Moderate Functional Importance scores (Table 5). It was rated as having Moderate Conservation Importance (Appendix 5) because of moderate ratings for almost all the assessment parameters. Closed Woodland was given a Moderate Functional Importance rating (Appendix 5) because of moderate scores in Provisioning and Supporting Services. However, if the recommended summer survey for *Aloe komatiensis* confirms the presence of this species in this vegetation community, then the Conservation Value and overall Biodiversity Value would be elevated to High.

5.1.2.3 *Phragmites australis* – *Typha capensis* Wetland

Tall and dense wetland vegetation surrounds the artificial dam in the eastern part of the study area (Figure 7). Vegetation structure is mostly Tall Closed Grassland (*sensu* Edwards, 1983,

). Wetland areas cover approximately 4.6 ha or 11.5 % of the entire study area. This figure, though, includes the unvegetated open water of the dam itself. The reed *Phragmites australis* and the rush *Typha capensis* strongly dominate this community. Other species located include the sedges *Cyperus dives* and *C. sexangularis*, the grass *Leersia hexandra*, the herbs *Persicaria decipiens* and *Commelina diffusa* subsp. *scandens*, the shrubs *Ludwigia octovalvis* and *Phyllanthus reticulatus*, and the fern *Thelypteris confluens*.

A total of 15 species (11 % of the entire list) was recorded from the Wetland community, the lowest species richness of the three untransformed vegetation communities in the study area (Appendix 1). Species fidelity, which is closely linked to community uniqueness, is high, with 8 species (53 % of the community list) occurring nowhere else in the study area.

No conservation-important species were recorded within this vegetation community.

Phragmites australis – *Typha capensis* Wetland was assessed as having Moderate Biodiversity Value through integration of Moderate Conservation Importance and Moderate Functional Importance scores (Table 5). This community was rated as having Moderate Conservation Importance (Appendix 5) in spite of high ratings for the Protection Status – a High score was allocated because of legislation and government policy preventing development of wetlands, including artificial ones. However, moderate scores in the other CI components reduced the overall CI score to Moderate. Despite the artificial status of the Wetland, most of the functional aspects of natural wetlands are taking place but it is still allocated a Moderate Functional Importance rating (Appendix 5) because of moderate scores in the following components:

- Provisioning Services – fibres, medicinal plants;
- Regulating Services - flood attenuation, water purification;
- Supporting Services – nutrient cycling, migration corridors.



Figure 4. Photographs of Wetland

5.1.2.4 Transformed / Degraded

Approximately 30 ha, or 75 % of the study area, are transformed either through agriculture (mostly citrus), sheds, houses and a golf course (Figure 5). However, four conservation-important plant species were recorded from Transformed areas including *Crinum stuhlmannii* (Declining and protected under the MNCA), *Philenoptera violacea* and *Sclerocarya birrea* subsp. *caffra* (protected under the NFA) and *Aloe marlothii* (protected under the MNCA, (Table 5). Most of these plants grow around the homesteads or golf course.

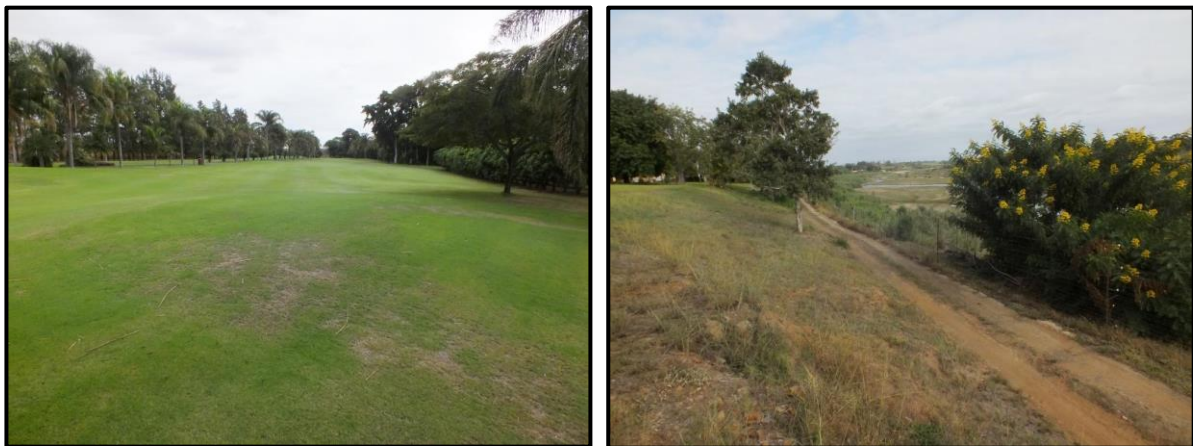


Figure 5. Photographs of Transformed Areas

5.1.3 Conservation-Important Flora

A total of 140 plant species was recorded within the study area during fieldwork (Appendix 1). Three of these are protected under the National Forests Act (No. 30 of 1998): *Philenoptera violacea*, *Combretum imberbe* and *Sclerocarya birrea* subsp. *caffra*, and two by the Mpumalanga Nature Conservation Act (No.10 of 1998): *Aloe marlothii* and *Crinum stuhlmannii* (Figure 6). *Dalbergia melanoxylon* is assessed as Near Threatened and *Crinum stuhlmannii* as Declining. The latter two species are discussed below:

***Dalbergia melanoxylon* Guill. & Perr.** Zebra Wood

This species usually grows as a small to medium-sized tree and is found throughout the Lowveld and as far north and west as Senegal. Although not locally listed, it is assessed by the IUCN as Near Threatened due to over-collection for the wood carving industry and in the manufacturing of musical instruments¹. A single small plant was found in the western portion of the study area (Figure 7).

***Crinum stuhlmannii* Baker** Candy-striped Crinum

A single large *Crinum* species, most likely *C. stuhlmannii*, was located within Transformed vegetation in a line of trees between the large lawn of the eastern building complex and the Kruger National Park fence (Figure 7). This large bulbous plant is listed as Declining due to the ongoing and uncontrolled harvesting of bulbs for the medicinal plant trade².

¹ World Conservation Monitoring Centre. 1998. *Dalbergia melanoxylon*. The IUCN Red List of Threatened Species 1998: e.T32504A9710439. <http://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32504A9710439.en>. Downloaded on 27 May 2016.

² Williams *et. al.*, 2008

*Crinum cf. stuhlmannii**Dalbergia melanoxylon* (from file)

Figure 6. Photographs of plants of Conservation Concern located during fieldwork

Twenty-two plant species with conservation concern have been recorded from similar habitat within the quarter-degree grid 2531 BD and surrounding grids with similar vegetation communities, of which seven species have a moderate chance of occurring (Appendix 2). Of these, two species are listed as **Endangered**: *Aloe komatiensis* and *Pavetta zeyheri* subsp. *microlancea*. Plants are known from Tenbosch farm or within 1 km of the site (*pers. obs.*) and due to their small size may have been overlooked.

***Aloe komatiensis* Komatipoort Aloe** is listed as Endangered due to significant habitat loss within its small distribution¹ and may occur within the Closed Woodland vegetation community. This species flowers in February and March and would have finished flowering at the time of the survey.

***Pavetta zeyheri* subsp. *microlancea* Narrow-leaved Brides Bush** is listed as Endangered due to the very low number of individuals known, as well as significant habitat loss², and may occur within the Closed Woodland community.

The remaining five species are widespread across north-eastern South Africa and listed as Declining due to over-collection for the medicinal plant trade: the geophytes *Crinum macowanii*, *Drimia altissima* and *D. sanguinea* and the orchids *Ansellia africana* and *Eulophia speciosa*. Although these species were not confirmed during fieldwork, they could have been overlooked because of tall and very dense vegetation as well as the timing of the survey as

¹ von Staden, L. & McKenzie, D. 2015

² von Staden, L., Lötter, M. & McClelland, W. 2013

all flower from spring to summer. All five species could potentially occur within the Closed Woodland vegetation community with *Crinum macowanii* and *Ansellia africana* potentially occurring within Riparian Forest as well.

Table 4. Conservation-important plant species confirmed during fieldwork

Taxa	Growth Form	Protected	Red Data	Vegetation Communities			
				Riparian Forest	Acacia Woodland	Wetland	Transformed
Family Amaryllidaceae							
<i>Crinum stuhlmannii</i> Baker	bulb	MNCA	Declining				r
Family Anacardiaceae							
<i>Sclerocarya birrea</i> (A.Rich.) Hochst. subsp. <i>caffra</i> (Sond.) Kokwaro	tree	NFA		r	f		r
Family Asphodelaceae							
<i>Aloe marlothii</i> A.Berger subsp. <i>marlothii</i>	succulent	MNCA			u		u
Family Combretaceae							
<i>Combretum imberbe</i> Wawra	tree	NFA			f		
Family Fabaceae							
<i>Dalbergia melanoxylon</i> Guill. & Perr.	tree		NT#		r		
<i>Philenoptera violacea</i> (Klotzsch) Schrire	tree	NFA		u	r		r
TOTAL	6	5	2	2	5	0	4

NFA = National Forests Act

MNCA = Mpumalanga Nature Conservation Act

NT = Near Threatened

= IUCN assessment

d = dominant

f = frequent

u = uncommon

r = rare

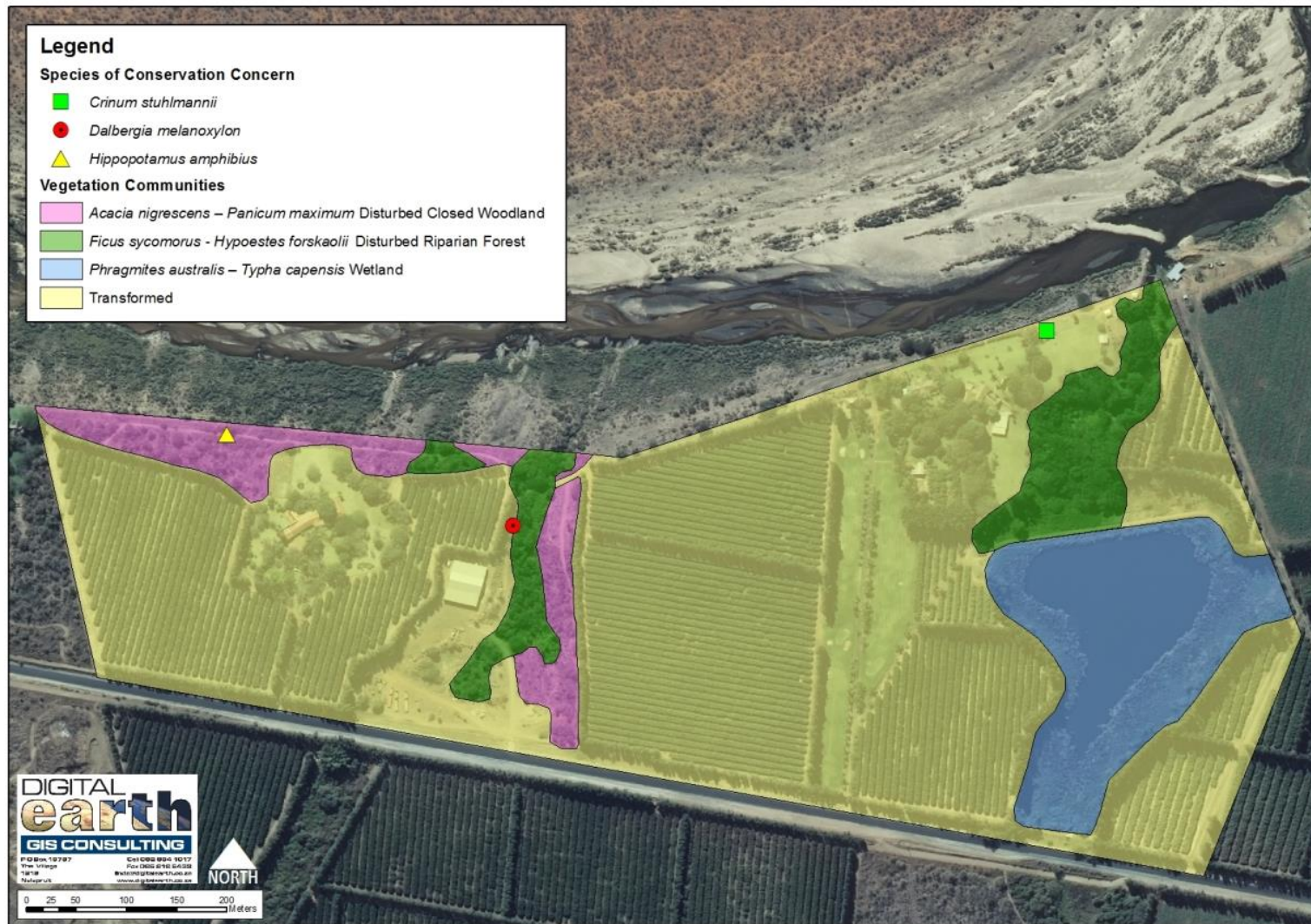


Figure 7. Vegetation communities identified within the Study Area

5.2 Terrestrial Fauna

5.2.1 Mammals

Situated in the savanna biome immediately south of the Kruger National Park (K.N.P.), the Komatipoort area has very high mammal diversity, relatively low numbers of endemics and a moderate number of Red Data species¹. Most of the area around Tenbosch has been transformed for agriculture (mainly citrus, sugarcane and bananas) but also lodge development and townships such as Marloth Park and Komatipoort. Large tracts of untransformed land are present to the north of the study area within the K.N.P. but scattered small patches are present on Tenbosch and surrounding farms, including the municipal reserve Lionspruit situated c. 8 km to the west of the study area. The study area is mostly transformed (75 %) and little habitat remains, especially for larger mammals. However, it is located on the boundary fence of the K.N.P. and animals can and do wander in through gates or the fence or via the stream channel in the east. Evidence of this was found in a small tract of woodland in the west where old Hippopotamus (*Hippopotamus amphibius*) faeces were located. Sixty-four mammal species are confirmed for 2531 BD in the Animal Demography Unit's Virtual Museum's database². An estimated 32 conservation-important mammals potentially occur within the project area (Appendix 4), although most of these are more likely in adjacent conservation land than in the project area. Several bat species are highly likely to occur overhead, such as Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), but these species are only likely to feed over the site because of the shortage of suitable roosting sites.

Of the 32 potentially occurring species, 26 are considered to be of conservation concern³ with only four considered threatened (Appendix 4). Hippopotamus (*Hippopotamus amphibius*), was **confirmed** in Closed Woodland during fieldwork and is discussed below:

Hippopotamus (*Hippopotamus amphibius*)

Desiccated faeces were located in the small tract of Closed Woodland in the western part of the study area (Figure 7). This large even-toed ungulate may also occasionally utilise the dam and stream in the east. However, due to human disturbance and access problems due to the fence, it would probably only frequent the study area occasionally. It is listed as Vulnerable

¹ Friedmann & Daly, 2004

² http://vmus.adu.org.za/vm_sp_list.php accessed 27/05/2016

³ The same approach as Raimondo *et al.* (2009) has been followed here regarding species of conservation concern (i.e. those with a status of Declining, Near Threatened and Data Deficient) and threatened species (Vulnerable, Endangered and Critically Endangered)

due to habitat loss, range contraction, conflict from farmers and a decline in water quality¹. This species is resident in the adjacent Crocodile River (*pers.obs.*).

The remaining three potentially occurring threatened species, namely **African Wild Dog (*Lycoan pictus*, Endangered)**, **Lion (*Panthera leo*, Vulnerable)** and **Ground Pangolin (*Smutsia temminckii*, Vulnerable)**, all have a low likelihood of occurrence due to disturbance, lack of prey or general scarcity. Both Lion and African Wild Dog regularly escape from the K.N.P. but tend to wander widely before being persecuted or returning to the Park and tend not to remain in any one area for long.

Eight potentially occurring species are Near Threatened, which are species close to or likely to soon qualify for the status of Vulnerable. Four of these have a moderate likelihood of occurring due to the presence of suitable habitat:

Honey Badger (*Mellivora capensis*) is a small carnivore in the Mustelidae family which includes otters, badgers and weasels. It is assessed as Near Threatened due to direct persecution from farmers and for the muthi trade, indirect poisoning, poor recruitment and habitat loss². Animals could regularly forage anywhere in natural habitat in the study area but are unlikely to be resident.

Side-striped Jackal (*Canis adustus*) is another small carnivore but in the Canidae family which includes dogs and wolves. A habitat specialist found primarily in deciduous broad-leaved woodland but also utilises other woodland types. This species could forage anywhere in natural habitat in the study area but is unlikely to be resident.

Welwitsch's Hairy Bat (*Myotis welwitschii*) and **Rusty Bat (*Pipistrellus rusticus*)** are both tree roosting bats found in savanna habitats. Both are listed as Near Threatened due to ongoing clearing of larger trees used for roosting. They both have a moderate chance of roosting in tree cavities within the study area as suitable trees are present.

The rest of the potentially occurring species are classified as Data Deficient, meaning that not enough data were available in order to assess their Red Data status³. It is probable that at least a few Data-Deficient species do occur, particularly shrews in the genera *Crocidura* and

¹ Friedmann & Daly, 2004

² Friedman & Daly, 2004

³ Friedman & Daly, 2004

Suncus. Fourteen potentially occurring species are protected under either the Mpumalanga Nature Conservation Act (No. 10 of 1998) or the National Environmental Management: Biodiversity Act Threatened or Protected Species (No. 10 of 2004). Only two mammal species were confirmed to occur during fieldwork: Hippopotamus (*Hippopotamus amphibius*) and Vervet Monkey (*Chlorocebus pygerythrus*) (Appendix 3).

5.2.2 Birds

The savanna biome supports the highest diversity of bird species within the Southern African sub-region and the K.N.P. supports the largest birdlist of all conservation areas in South Africa with an estimated 57 % of the birds found within the entire southern African sub-region recorded¹. The study area, situated within the quarter degree square (QDS) 2531 BD, is especially diverse with a total of 366 species recorded during the second Southern African Bird Atlas Project (SABAP2)², which is currently in progress. This is the highest total for a QDS in Mpumalanga. At a finer scale, data from SABAP2 indicate that 346 bird species have already been recorded from the pentad (mapping unit) in which the study area is situated (2520_3150)³, also the highest of all the 1015 pentads situated within Mpumalanga. A pentad covers an area of approximately 77 km², which is considerably smaller than a quarter-degree grid and thus a better indication of which species occur in the study area. Eighty-eight bird species were confirmed to occur within the actual habitats represented in the study area during fieldwork, all of which are listed in Appendix 3.

Twenty-nine of the bird species potentially occurring within the study area (confirmed to occur in 2531 BD during SABAP2 or potentially occur due to presence of suitable habitat) have Red Data status (Appendix 4). One of these was **confirmed** to occur during fieldwork:

Martial Eagle (*Polemaetus bellicosus*)

Africa's largest eagle is listed as Endangered due to many factors including habitat loss, direct persecution from small-stock farmers and indirect persecution from electrocution and reservoir drownings⁴. A pair of eagles was observed flying over Closed Woodland in the study area and not actually utilising the habitat within, although it may occasionally hunt over the study area. No suitable breeding habitat is present on Tenbosch.

¹ Taylor *et. al.*, 2015

² http://sabap2.adu.org.za/pentad_info.php?pentad=2555_3030#menu_top accessed 27/05/2016

³ Data accessed from http://sabap2.adu.org.za/pentad_info.php?pentad=2555_3030#menu_top on 27/05/2016

⁴ Taylor *et. al.*, 2015

Twenty-one additional species of conservation-concern¹ have a low likelihood of foraging over the study area (Appendix 4). This is primarily due to a lack of suitable prey such as small antelope and gamebirds, human disturbance from farming and recreational activities and insufficient habitat area available due to habitat transformation. Many of these species, though, will be visible from the study area in the adjacent K.N.P. including vultures, eagles and storks. Some breeding habitat (tall trees) for larger birds is present in the eastern portion of the Riparian Forest vegetation community but the disturbance levels there are high and probably only suitable for species with high tolerance for humans such as the raptors Yellow-billed Kite (*Milvus aegyptius*) or Wahlberg's Eagle (*Hieraaetus wahlbergi*), or Egyptian Goose (*Alopochen aegyptiaca*).

Seven potentially occurring species are listed as Near Threatened (Appendix 4) with three having a moderate likelihood of occurring within the study area. These three species are discussed below:

Half-collared Kingfisher (*Alcedo semitorquata*)

This small piscivorous kingfisher favours quiet rivers and streams with overhanging vegetation and this habitat is present along the small stream in the Riparian Forest vegetation community in the eastern portion of the study area. It is threatened by habitat loss and water quality deterioration². The SABAP2 reporting rate in the QDS is very low which results in a moderate likelihood of occurrence. Breeding habitat is present but this bird can be elusive and hard to find (*pers.obs.*).

European Roller (*Coracias garrulous*)

This Palaearctic migrant prefers open, grassy areas within savanna and could potentially occur in any of the more open areas within the study area, including transformed areas. It is listed as Near Threatened due to habitat loss over some of its breeding grounds, particularly in Europe³.

Marabou Stork (*Leptoptilos crumeniferus*)

The largest of all Africa's storks, the Marabou favours a wide diversity of habitats and will readily scavenge around humans. It has a moderate likelihood of occasionally foraging within

¹ The same approach as Raimondo et al. (2009) has been followed here regarding species of conservation concern (i.e. those with a status of Declining, Near Threatened and Data Deficient) and threatened species (Vulnerable, Endangered and Critically Endangered)

² Taylor et. al., 2015

³ Taylor et. al., 2015

refuse or dump sites within the study area, as it does in nearby Marloth Park (*pers.obs.*). This species does not regularly breed in South Africa but a few pairs breed in central Swaziland¹.

Ten potentially occurring species are protected under the National Environmental Management: Biodiversity Act (No.10 of 2004, Appendix 3).

Eighty-eight bird species were confirmed to occur in the study area during fieldwork. Thirty-six species were recorded from Riparian Forest, 26 from the Wetland and 13 from Transformed (Appendix 3). Sufficient sampling was undertaken for assessing habitat suitability for potentially occurring threatened species, the primary objective of the ornithological component of this study, and to describe broad bird assemblages. Further fieldwork is likely to increase the species richness of each assemblage but is unlikely to identify additional assemblages.

Three broad assemblages or species-habitat associations were identified, each of which is briefly described below:

I. Forest Assemblage

This assemblage occurs in the tall evergreen forest patches, best represented in the eastern portion of the study area. Although some overlap occurs with the Woodland assemblage, the composition of species differs sufficiently to justify the inclusion of this assemblage. Bird species found include those species not commonly found in the adjacent K.N.P. due to habitat transformation through large herbivores. These include Scaly-throated Honeyguide, Red-backed Mannikin, African Goshawk, Tambourine Dove, Yellow-rumped Tinkerbird and Black-throated Wattle-eye. Thirty-six species (41 %) were recorded from the Forest assemblage, the highest of the three assemblages (Appendix 3).

II. Woodland Assemblage

The drier woodlands across the study area provide refuge for a number of generalist species that will occasionally forage in any type of wooded habitat including the Riparian Forest. These include Black-backed Puffback, White-bellied Sunbird and Yellow-breasted Apalis. Some species, though, are restricted to this assemblage and include Jameson's Firefinch, White-browed Scrub Robin, Brown-crowned Tchagra and Southern Yellow-billed Hornbill. Due to the small size of the woodland patches, many woodland species will probably only visit the study area to forage or include the patches as part of larger territories extending into the K.N.P.

¹ Taylor *et. al.*, 2015

Thirty-one species (35 % of the entire species list) were recorded from the Woodland assemblage, the second highest of the three.

III. Wetland Assemblage

The artificial dam and associated reed and rush beds in the eastern portion of the study area provide habitat for a number of wetland-dependant species not found in the other assemblages. These include shy reedbed skulkers such as Little Rush and Lesser Swamp Warblers, Black Crake and African Swamphen, open water species such as African Darter, Pied and Giant Kingfishers and African Fish Eagle and the floating macrophyte specialist African Jacana. Twenty-six species were recorded in this assemblage, representing 30 % of the total species list (Appendix 3).

5.2.3 Reptiles & Frogs

The Lowveld and foothills of far eastern Mpumalanga support a high diversity of reptile species with 102 species already recorded from the degree grid 2531¹. Forty-seven species of reptiles have been recorded from the QDS 2531 BD, in which Tenbosch is situated, as listed on the Reptile Atlas of Southern Africa website (<http://vmus.adu.org.za/>) and in Bates *et al.* (2014). Of the potentially occurring species, only two conservation-important reptiles potentially occur (Appendix 4). One of these has been assessed as Vulnerable: Nile Crocodile (*Crocodylus niloticus*), which is also protected under NEMBA ToPS. This species was **confirmed** during fieldwork and is discussed below:

Nile Crocodile (*Crocodylus niloticus*)

Africa's largest reptile is listed as Vulnerable due to a number of factors including habitat transformation, water pollution, direct persecution from landowners and harvesting for the medicinal market (Bates *et al.*, 2014). The Kruger National Park supports an estimated 3000 individuals which constitutes the largest population in South Africa (Thorbjarnarson, 1992). The adjacent Crocodile River supports a resident population of crocodiles (*pers.obs.*) and smaller individuals are able to enter the study area at the junction of the Crocodile River and the small stream in the eastern portion (*pers.obs.*). In communication with a number of farm labourers, the presence of a few juvenile Nile Crocodiles was **confirmed** to occur in the dam on the stream but larger specimens potentially occur. No breeding habitat (sandy river banks) is available around the dam though.

¹ http://vmus.adu.org.za/vm_sp_list.php accessed 30/05/2016

Southern African Python (*Python natalensis*) is protected under the National Environmental Management: Biodiversity Act (No.10 of 2004) and was **confirmed** during fieldwork from Riparian Forest immediately north of the dam. Two additional reptile species were recorded during fieldwork: Rainbow Skink (*Trachylepis margaritifera*) and Common Giant Plated Lizard (*Matobosaurus validus*, Appendix 3).

Thirty species of frogs have been recorded in 2531 BD, as listed on the Frogs of Southern Africa website (<http://vmus.adu.org.za/>) as well as in the frog atlas project (Minter *et al.*, 2004), only one of which has Red Data or protected status. Whistling Rain Frog (*Breviceps sopranus*), is listed as Data Deficient due to a lack of data of this little-known forest species. This frog has a low likelihood of occurrence due to the small size and disturbed nature of the Riparian Forest vegetation type present within the study area. No frogs were recorded during the assessment although summer fieldwork with nocturnal surveys will result in a fair number of species.

6. BIODIVERSITY VALUE ASSESSMENT

A qualitative integration of conservation importance and functional importance values for the three untransformed vegetation communities and the transformed areas represented in the study area provides an indication of the biodiversity values of these communities. The data sheets for conservation importance and functional importance calculations for each community are presented in Appendix 5, and are dealt with in more detail under each vegetation community description. The integrated biodiversity values are summarised in Table 5 and presented spatially in Figure 8.

The Riparian Forest vegetation community has a High Biodiversity Value (Table 5) due to a High Functional Value score. This highlights the value of keeping this system intact and out of the impact zone of development. Closed Woodland and Wetland have Moderate Biodiversity Value resulting from Moderate Conservation Value and Functional Value scores.

Table 5. Conservation Importance, Functional Importance and Biodiversity Values for vegetation communities in the Study Area

Vegetation Communities	Conservation Importance	Functional Importance	Biodiversity Value
Riparian Forest	Moderate	High	High
Closed Woodland	Moderate	Moderate	Moderate
Wetland	Moderate	Moderate	Moderate
Transformed	Low	Low	Low

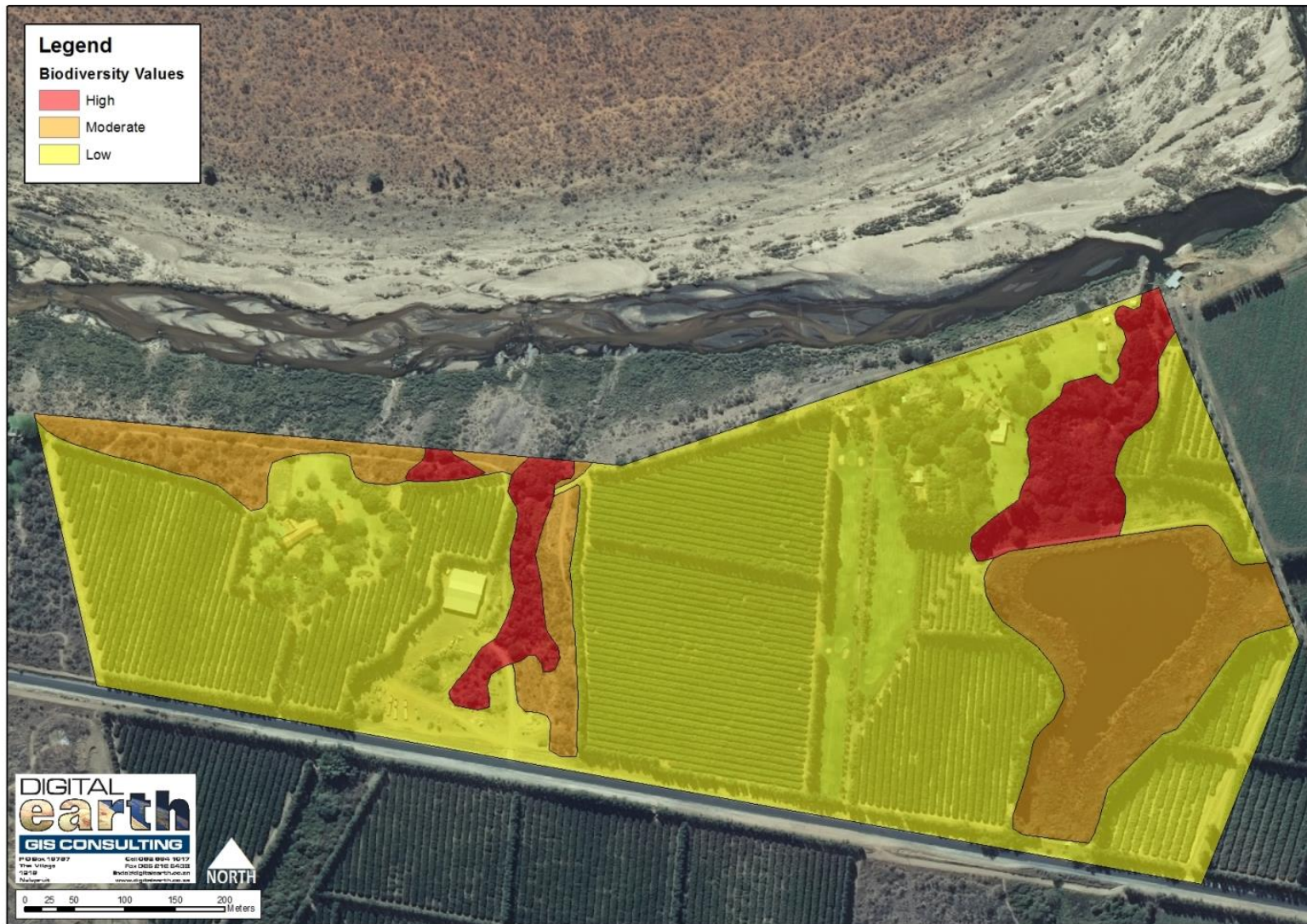


Figure 8. Biodiversity Values of Vegetation Communities in the Study Area

7. KEY POTENTIAL IMPACTS

While a detailed impact assessment is not required for this report, key potential impacts associated with the proposed development can be described. The following are potentially significant impacts on untransformed vegetation communities:

- **Loss of plant species of conservation importance** – six species could be impacted during the construction phase. The trees *Sclerocarya birrea* subsp. *caffra*, *Combretum imberbe* and *Philenoptera violacea* are nationally protected and *Aloe marlothii* and *Crinum stuhlmannii* are protected under provincial legislation. *Dalbergia melanoxylon* is listed as Near Threatened;
- **Degradation of riparian habitat** – construction activities could result in degradation of these habitats if not carefully managed, e.g. dumping of soil, building rubble, etc.; long-term changes in surface and subsurface runoff could negatively affect riparian structure and function, particularly with respect to channel erosion caused by increased stormwater runoff;
- **Invasion of natural habitat by alien plants** – a large seed-base of invasive alien species is already present, and invasion by these species could increase as bare soil is exposed; if well managed, this is likely to only have moderate significance;
- **Loss of habitat for conservation-important fauna** – all three untransformed vegetation communities are potentially key habitats and migration corridors for fauna that would be sensitive to impacts. Vegetation along the Crocodile River and along the two small streams in the study area is most sensitive.

8. RECOMMENDATIONS

While this is not a detailed impact assessment, some preliminary recommendations and mitigation measures are listed below. Table 6 summarises the potential Biodiversity / Development Conflict within the identified vegetation communities.

- According to the Government Gazette No 32805 dated 18 December 2009 a Water Use License may have to be applied for by the developer due to water use within a 500 m radius from the boundary of any wetland in terms of section 21 (c) and (i) of the National Water Act (NWA).
- According to the MBSP, a conservation buffer of 100 m is recommended around the Crocodile River and both drainage lines, including the Wetland and Riparian Forest vegetation communities, as measured from the edge of the watercourse. This buffer can be refined using the Water Research Commissions wetland buffer determination guidelines (Macfarlane *et. al.*, 2014).
- Buffers, once established, should be revegetated with locally sourced indigenous plants and managed as conservation land.
- According to the MBSP (2014) any development on untransformed land within a Protected Areas Buffer will need
 - i) consultation with the Protected Area (in this case SANParks) and
 - ii) undertake a viewshed analysis of the potential visual impact of the proposed development on the Protected Area.
- Where possible, all future development to take place over existing Transformed areas to preserve the remaining natural vegetation on the site.
- New infrastructure should not impact any large indigenous trees, wherever possible.
- The trees *Sclerocarya birrea* subsp. *caffra*, *Combretum imberbe* and *Philenoptera violacea* are nationally protected and a permit would be required to destroy them. *Aloe marlothii* and *Crinum stuhlmannii* are protected under provincial legislation and need to be rescued and relocated to adjacent suitable habitat if they are found to be within the development footprint. A permit to move these plants would also be required. If infrastructure is planned within any natural vegetation, the areas should be checked by a suitably experienced botanist to locate all conservation-important species. These plants should be marked and the relevant permits applied for before removal and translocated to nearby suitable habitat prior to vegetation being cleared.
- A follow-up survey in late summer (February / March) should take place to search for the succulent *Aloe komatiensis*. This species is listed as Endangered and is confirmed

from just outside the study area. This is a small aloe which may have been overlooked during fieldwork and a search during its flowering period will make it far more visible.

- According to the National Environmental Management: Biodiversity Act 2004 (Act 10 of 2004) Alien and Invasive Species Lists, 2014 all declared alien invasive plant species need to be removed from wetland areas. It is therefore recommended that the developers implement an alien plant control program to combat the infestation present. This program should include regular inspections and follow-ups.
- All existing and proposed roads to contain adequate stormwater drainage and erosion control measures.

Provided the recommendations suggested in this report are followed, there is no objection to the proposed development in terms of the terrestrial ecosystems of the study area.

Table 6. Potential Biodiversity / Development Conflict within the identified vegetation communities

Vegetation Communities	Biodiversity / Development Conflict	Development Recommendations
Riparian Forest	High	Exclude from development footprint
Closed Woodland	Moderate	Develop with mitigation
Wetland	Moderate	Exclude from development footprint
Transformed	Low	Can be included within development footprint

9. REFERENCES

- Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M.S. (eds). 2014. *Atlas and Red Data List of the Reptiles of South Africa, Lesotho and Swaziland*. Suricata 1. South African National Biodiversity Institute, Pretoria.
- Coombes, P. 2004. Anglo American Best Practice Environmental Guideline Series 01: Guideline for preparing Biodiversity Action Plans (BAP) Draft Document 03. Anglo American. Johannesburg.
- DEA. 2014. National Environmental Management: Biodiversity Act 2004 (Act 10 of 2004) Alien and Invasive Species Lists. Government Gazette.
- DEAT. 2011. *National List of Threatened Terrestrial Ecosystems in South Africa*. National Environmental Management: Biodiversity Act (Act 10 of 2004). Government Gazette.
- Edwards, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 14:705-712.
- Friedmann, Y. & Daly, B. (editors). 2004. *Red Data Book of the Mammals of South Africa: A Conservation Assessment*. CBSG Southern Africa, Conservation Breeding Specialist Group (SSC / IUCN), Endangered Wildlife Trust. South Africa.
- Lötter, M.C., Cadman, M.J. and Lechmere-Oertel, R.G. 2014. *Mpumalanga Biodiversity Sector Plan*. Mpumalanga Tourism & Parks Agency, Nelspruit.
- Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. *Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report*. WRC Report No TT 610/14, Water Research Commission, Pretoria.
- Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. & Kloepfer, D. 2004. *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series No.9. Smithsonian Institution, Washington, DC.
- Mucina, L. and Rutherford, M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama, P.A. (eds) 2009. *Red List of South African Plants 2009*. Strelitzia 25. South African National Biodiversity Institute, Pretoria.
- Taylor, M.R., Peacock, F., Wanless, R.W. (eds). 2015. *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. Birdlife South Africa, Johannesburg.
- Thorbjarnarson, J. 1992. *Crocodiles, an Action Plan for their Conservation*. IUCN, Switzerland.
- Van Wyk, A. E. & Smith, G. F. 2001. *Regions of floristic endemism in southern Africa: A review with emphasis on succulents*. Umdaus Press, Pretoria.

- von Staden, L., Lötter, M. & McClelland, W. 2013. *Pavetta zeyheri* Sond. subsp. *microlancea* (K.Schum.) P.P.J.Herman. National Assessment: Red List of South African Plants version 2015.1. Accessed on 2016/05/27.
- von Staden, L. & McKenzie, D. 2015. *Aloe komatiensis* Reynolds. National Assessment: Red List of South African Plants version 2015.1. Accessed on 2016/05/27.
- Williams, V.L., Raimondo, D., Crouch, N.R., Cunningham, A.B., Scott-Shaw, C.R., Lötter, M., Ngwenya, A.M. & Brueton, V.J. 2008. *Crinum stuhlmannii* Baker. National Assessment: Red List of South African Plants version 2015.1. Accessed on 2016/05/27.
- World Conservation Monitoring Centre. 1998. *Dalbergia melanoxylon*. The IUCN Red List of Threatened Species 1998: e.T32504A9710439. <http://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32504A9710439.en>. Downloaded on 27 May 2016.

10. APPENDICES

Appendix 1. Checklist of Flora recorded during fieldwork

Taxa	Growth Form	Protected	Red Data	Vegetation Communities			
				Riparian Forest	Acacia Woodland	Wetland	Transformed
Family Acanthaceae							
<i>Barleria elegans</i> S.Moore ex C.B.Clarke	dwarf shrub			f	d		
<i>Hypoestes forskalii</i> (Vahl) R.Br.	herb			d			
<i>Justicia flava</i> (Vahl) Vahl	herb				f		
Family Amaranthaceae							
* <i>Achyranthes aspera</i> L. var. <i>aspera</i>	herb			u	u		r
* <i>Alternanthera pungens</i> Kunth	herb				r		f
* <i>Gomphrena celosioides</i> Mart.	herb						r
Family Amaryllidaceae							
<i>Crinum stuhlmannii</i> Baker	bulb	MNCA	Declining				r
Family Anacardiaceae							
<i>Ozoroa engleri</i> R.Fern. & A.Fern.	tree				r		
<i>Sclerocarya birrea</i> (A.Rich.) Hochst. subsp. <i>caffra</i> (Sond.) Kokwaro	tree	NFA		r	f		r
Family Apocynaceae							
<i>Gomphocarpus physocarpus</i> E.Mey.	dwarf shrub					r	
* <i>Nerium oleander</i> L.	tree			r			
<i>Rauvolfia caffra</i> Sond.	tree			f			
<i>Sarcostemma viminale</i> (L.) R.Br. subsp. <i>viminale</i>	succulent				r		
<i>Tabernaemontana elegans</i> Stapf	tree			r			
Family Araceae							
<i>Stylochaeton natalensis</i> Schott	herb				r		
Family Asparagaceae							
<i>Asparagus cooperi</i> Baker	shrub				r		

Family Asphodelaceae						
<i>Aloe marlothii</i> A.Berger subsp. <i>marlothii</i>	succulent	MNCA		u		u
Family Asteraceae						
* <i>Ageratum houstonianum</i> Mill.	herb			r		
* <i>Bidens pilosa</i> L.	herb			r		r
* <i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	herb			f	u	r
* <i>Conyza sumatrensis</i> (Retz.) E.Walker var. <i>sumatrensis</i>	herb					r
<i>Gymnanthemum coloratum</i> (Willd.) H.Rob. & B.Kahn sens.lat.	shrub			f		
<i>Mikania capensis</i> DC.	climber			r		
* <i>Parthenium hysterophorus</i> L.	herb			r	r	f
<i>Pluchea dioscoridis</i> (L.) DC.	dwarf shrub			f		
* <i>Tridax procumbens</i> L.	herb					f
<i>Vernonia fastigiata</i> Oliv. & Hiern	herb				r	
Family Bignoniaceae						
<i>Kigelia africana</i> (Lam.) Benth.	tree			r		
* <i>Spathodea campanulata</i> P.Beauv.	tree			r		
Family Cactaceae						
* <i>Opuntia ficus-indica</i> (L.) Mill.	succulent				r	r
Family Capparaceae						
<i>Cleome angustifolia</i> Forssk. subsp. <i>petersiana</i> (Klotzsch ex Sond.) Kers	herb				r	
<i>Cleome monophylla</i> L.	herb				r	
<i>Maerua parvifolia</i> Pax	dwarf shrub				r	
Family Casuarinaceae						
* <i>Casuarina cunninghamiana</i> Miq.	tree			f	r	r
Family Celastraceae						
<i>Gymnosporia senegalensis</i> (Lam.) Loes.	shrub			f	r	
Family Combretaceae						
<i>Combretum apiculatum</i> Sond. subsp. <i>apiculatum</i>	tree				r	
<i>Combretum hereroense</i> Schinz	tree				f	
<i>Combretum imberbe</i> Wawra	tree	NFA			f	
<i>Combretum microphyllum</i> Klotzsch	climber			f	u	
<i>Combretum mossambicense</i> (Klotzsch) Engl.	climber				f	
<i>Terminalia sericea</i> Burch. ex DC.	tree				r	
Family Commelinaceae						
<i>Commelina diffusa</i> Burm.f. subsp. <i>scandens</i> (Welw. ex C.B.Clarke) Oberm.	herb			r		u

<i>Commelina</i> sp. (no flowers)	herb			u	
Family Convolvulaceae					
<i>Cuscuta</i> sp.	climber			r	r
* <i>Ipomoea alba</i> L.	climber		u		
* <i>Ipomoea purpurea</i> (L.) Roth	climber		r	r	
Family Crassulaceae					
<i>Kalanchoe paniculata</i> Harv.	succulent			r	
<i>Kalanchoe rotundifolia</i> (Haw.) Haw.	succulent			u	
Family Cucurbitaceae					
<i>Cucumis zeyheri</i> Sond.	creeper		f	f	
Family Cyperaceae					
<i>Cyperus dives</i> Delile	sedge				u
<i>Cyperus sexangularis</i> Nees	sedge				f
Family Dracenaceae					
<i>Sansevieria hyacinthoides</i> (L.) Druce	herb			u	
Family Ebenaceae					
<i>Diospyros mespiliformis</i> Hochst. ex A.DC.	tree		f	r	
Family Euphorbiaceae					
* <i>Euphorbia cyathophora</i> Murray	herb		u		u
* <i>Euphorbia hirta</i> L.	herb				r
Family Fabaceae					
<i>Acacia nigrescens</i> Oliv.	tree			d	
<i>Acacia nilotica</i> (L.) Willd. ex Delile subsp. <i>kraussiana</i> (Benth.) Brenan	tree			d	r
<i>Acacia robusta</i> Burch. subsp. <i>clavigera</i> (E.Mey.) Brenan	tree		r		
<i>Acacia schweinfurthii</i> Brenan & Exell var. <i>schweinfurthii</i>	climber		r		
<i>Acacia tortilis</i> (Forssk.) Hayne subsp. <i>heteracantha</i> (Burch.) Brenan	tree			r	
<i>Acacia xanthophloea</i> Benth.	tree		f	r	r
* <i>Bauhinia purpurea</i> L.	tree		r		
<i>Dalbergia melanoxylon</i> Guill. & Perr.	tree	NT#		r	
<i>Dichrostachys cinerea</i> (L.) Wight & Arn. subsp. <i>africana</i> Brenan & Brummitt	tree			f	
<i>Erythrina lysistemon</i> Hutch.	tree		r		
<i>Peltophorum africanum</i> Sond.	tree			f	
<i>Philenoptera violacea</i> (Klotzsch) Schrire	tree	NFA	u	r	r
<i>Rhynchosia minima</i> (L.) DC. var. <i>minima</i>	climber		r	u	
<i>Schotia brachypetala</i> Sond.	tree		u		

* <i>Senna cf. multijuga</i>	tree	r		
Family Lamiaceae				
<i>Leucas sexdentata</i> Skan	herb		r	
<i>Ocimum americanum</i> L. var. <i>americanum</i>	herb		u	u
Family Loranthaceae				
<i>Erianthemum dregei</i> (Eckl. & Zeyh.) Tiegh.	parasite		r	
Family Malvaceae				
<i>Abutilon austro-africanum</i> Hochr.	dwarf shrub		r	
<i>Grewia bicolor</i> Juss. var. <i>bicolor</i>	shrub		u	
<i>Grewia flavescens</i> Juss.	shrub		u	
<i>Grewia monticola</i> Sond.	shrub	f		
<i>Sida cordifolia</i> L. subsp. <i>cordifolia</i>	dwarf shrub		r	f
Family Meliaceae				
* <i>Melia azedarach</i> L.	tree		u	
<i>Trichilia emetica</i> Vahl subsp. <i>emetica</i>	tree		f	
Family Menispermaceae				
<i>Cissampelos torulosa</i> E.Mey. ex Harv.	climber		r	
* <i>Cocculus hirsutus</i> (L.) Diels	climber		u	u
Family Moraceae				
<i>Ficus burkei</i> (Miq.) Miq.	tree			r
<i>Ficus sycomorus</i> L. subsp. <i>sycomorus</i>	tree		d	
* <i>Morus alba</i> L. var. <i>alba</i>	tree		r	
Family Nyctaginaceae				
* <i>Boerhavia diffusa</i> L. var. <i>diffusa</i>	herb			r
<i>Commicarpus plumbagineus</i> (Cav.) Standl. var. <i>plumbagineus</i>	herb		r	
Family Olacaceae				
<i>Ximenia americana</i> L. var. <i>microphylla</i> Welw. ex Oliv.	shrub		r	
Family Oleaceae				
<i>Jasminum fluminense</i> Vell. subsp. <i>fluminense</i>	climber		f	u
Family Onagraceae				
<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	dwarf shrub			u
Family Oxalidaceae				
* <i>Oxalis corniculata</i> L.	herb		r	u
Family Passifloraceae				
* <i>Passiflora subpeltata</i> Ortega	climber		r	

Family Pedaliaceae					
<i>Ceratotheca triloba</i> (Bernh.) Hook.f.	herb				u
Family Phyllanthaceae					
<i>Bridelia cathartica</i> G.Bertol. subsp. <i>melanthesoides</i> (Baill.) J.Leonard	tree			f	
<i>Bridelia micrantha</i> (Hochst.) Baill.	tree			r	
<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt subsp. <i>virosa</i>	shrub			r	
<i>Phyllanthus reticulatus</i> Poir. var. <i>reticulatus</i>	shrub			f	r r
Family Plumbaginaceae					
<i>Plumbago zeylanica</i> L.	shrub			r	r
Family Poaceae					
<i>Aristida adscensionis</i> L.	grass				r
<i>Bothriochloa insculpta</i> (Hochst. ex A.Rich.) A.Camus	grass				r
<i>Brachiaria serrata</i> (Thunb.) Stapf	grass			f	
<i>Cenchrus ciliaris</i> L.	grass			u	
<i>Cynodon dactylon</i> (L.) Pers.	grass			r	u r f
<i>Digitaria eriantha</i> Steud.	grass			f	
<i>Eleusine coracana</i> (L.) Gaertn. subsp. <i>africana</i> (Kenn.-O'Byrne) Hilu & de Wet	grass				r
<i>Eragrostis curvula</i> (Schrad.) Nees	grass				u
<i>Eragrostis plana</i> Nees	grass				u
<i>Eragrostis superba</i> Peyr.	grass			f	r
<i>Heteropogon contortus</i> (L.) Roem. & Schult.	grass			f	u
<i>Leersia hexandra</i> Sw.	grass				r
<i>Melinis repens</i> (Willd.) Zizka subsp. <i>repens</i>	grass			u	f
<i>Panicum maximum</i> Jacq.	grass			f	d r
<i>Phragmites australis</i> (Cav.) Steud.	reed				d
<i>Pogonarthria squarrosa</i> (Roem. & Schult.) Pilg.	grass			u	
<i>Setaria megaphylla</i> (Steud.) T.Durand & Schinz	grass			u	
<i>Setaria sphacelata</i> (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	grass				r
<i>Setaria verticillata</i> (L.) P.Beauv.	grass				r
<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	grass				u
<i>Sporobolus pyramidalis</i> P.Beauv.	grass			r	u
<i>Urochloa mosambicensis</i> (Hack.) Dandy	grass			r	f
Family Polygonaceae					
<i>Persicaria decipiens</i> (R.Br.) K.L.Wilson	herb				r
Family Rhamnaceae					

<i>Berchemia discolor</i> (Klotzsch) Hemsl.	tree			r			
<i>Ziziphus mucronata</i> Willd. subsp. <i>mucronata</i>	tree			r	f		
Family Rubiaceae							
<i>Gardenia volkensii</i> K.Schum. subsp. <i>volkensii</i> var. <i>volkensii</i>	tree				r		
* <i>Richardia brasiliensis</i> Gomes	herb						u
<i>Vangueria infausta</i> Burch. subsp. <i>infausta</i>	tree				r		
Family Rutaceae							
<i>Citrus x sinensis</i> L. (Osbeck)	tree						d
Family Sapindaceae							
* <i>Cardiospermum grandiflorum</i> Sw.	climber			r			
* <i>Litchi chinensis</i> Sonn.	tree						r
Family Sinopteridaceae							
<i>Cheilanthes viridis</i> (Forssk.) Sw. var. <i>viridis</i>	fern				r		
Family Solanaceae							
<i>Solanum campylacanthum</i> A. Rich. subsp. <i>panduriforme</i>	herb					u	u
* <i>Solanum mauritianum</i> Scop.	shrub			r			
* <i>Solanum seaforthianum</i> Andrews var. <i>disjunctum</i> O.E.Schulz	climber			r			
Family Strelitziaceae							
<i>Strelitzia reginae</i> Banks subsp. <i>reginae</i>	herb			r			
Family Thelypteridaceae							
<i>Thelypteris confluens</i> (Thunb.) C.V.Morton	fern			r			r
Family Typhaceae							
<i>Typha capensis</i> (Rohrb.) N.E.Br.	rush						d
Family Verbenaceae							
* <i>Lantana camara</i> L.	shrub			u	r		r
<i>Lippia javanica</i> (Burm.f.) Spreng.	dwarf shrub				r		r
* <i>Verbena bonariensis</i> L.	herb						r
Family Zingiberaceae							
* <i>Hedychium gardnerianum</i> Ker Gawl.	herb			f			
TOTAL	140	5	2	62	78	15	41

NFA = National Forests Act

MNCA = Mpumalanga Nature Conservation Act

* = exotic species

NT = Near Threatened

d = dominant

f = frequent

u = uncommon

r = rare

= IUCN assessment

Appendix 2. Potentially occurring plant species of conservation concern

Species	Family	Red Data Status	Habitat	Likelihood	Reason
<i>Adenia gummifera</i> var. <i>gummifera</i>	Passifloraceae	Declining	Forests and thickets	Low	All suitable habitat searched
<i>Adenium swazicum</i>	Apocynaceae	CR	Lowveld savanna, often on sodic soils	Low	All suitable habitat searched
<i>Aloe komatiensis</i>	Asphodelaceae	EN	Lowveld savanna	Moderate	All suitable habitat searched but plants could have been overlooked. This species is confirmed to occur within 1 km of the study area (<i>pers. obs.</i>)
<i>Ansellia africana</i>	Orchidaceae	Declining	Low altitude savanna and riparian forest	Moderate	Suitable habitat present
<i>Barleria oxyphylla</i>	Acanthaceae	Rare	Savanna, thickets	Low	All suitable habitat searched
<i>Blepharis laevifolia</i>	Acanthaceae	DD	Low altitude savanna, including sodic areas	Low	Only known from within the KNP
<i>Boophone disticha</i>	Amaryllidaceae	Declining	Dry grassland and rocky areas	Low	All suitable habitat searched
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Hyacinthaceae	VU	Thickets with rock scree	Low	Unsuitable habitat
<i>Caesalpinia rostrata</i>	Fabaceae	VU	Drainage lines in savanna	Low	All suitable habitat searched
<i>Cleome schlechteri</i>	Capparaceae	DD	Heavy clay soils in savanna	Low	Unsuitable habitat
<i>Crinum macowanii</i>	Amaryllidaceae	Declining	Grassland and savanna	Moderate	Suitable habitat present
<i>Crinum stuhlmannii</i>	Amaryllidaceae	Declining	Low altitude sandy savanna	Confirmed	
<i>Dalbergia melanoxylon</i>	Fabaceae	NT#	Savanna	Confirmed	
<i>Drimia altissima</i>	Hyacinthaceae	Declining	Hot, dry bushveld and thicket.	Moderate	Suitable habitat present
<i>Drimia sanguinea</i>	Hyacinthaceae	Declining	Open savanna and scrubby woodland	Moderate	Suitable habitat present
<i>Elaeodendron transvaalense</i>	Celastraceae	NT	Savanna	Low	All suitable habitat searched
<i>Eulophia speciosa</i>	Orchidaceae	Declining	Sand dunes, bushveld, thornveld and grasslands	Moderate	All suitable habitat searched but plants could have been overlooked. This species is confirmed to occur within 2 km of the study area (<i>pers. obs.</i>)
<i>Gunnera perpensa</i>	Gunneraceae	Declining	Wetland	Low	All suitable habitat searched

<i>Hypoxis hemerocallidea</i>	Hypoxidaceae	Declining	Wide range of habitats including grassland and savanna	Low	Study area possibly too dry for this species
<i>Nesaea alata</i>	Lythraceae	Rare	Edges of shallow pans in low-lying areas	Low	Unsuitable habitat
<i>Pavetta zeyheri</i> subsp. <i>microlancea</i>	Rubiaceae	EN	Rocky slopes or loamy flats	Moderate	Suitable habitat present, small plant that may have been overlooked
<i>Woodia singularis</i>	Apocynaceae	Rare	Grassland, Savanna	Low	Only known from three small, disjunct subpopulations

Appendix 3. Checklist of fauna recorded during fieldwork

Common Name	Scientific Name	Red Data	Endemic	Protected	Assemblages				
					Riparian Forest	Acacia Woodland	Wetland	Degraded	
Mammals									
ORDER: PRIMATES									
Family Cercopithecidae (Old World monkeys)									
Vervet Monkey	<i>Chlorocebus pygerythrus</i>				x	x			x
ORDER: CETARTIODACTYLA									
Family Hippopotamidae (hippopotamus)									
Hippopotamus	<i>Hippopotamus amphibius</i>	VU		MNCA		x			
Subtotal	2	1	0	1	1	2	0		1
Birds									
ORDER: ANSERIFORMES									
Family Anatidae (ducks, geese and swans)									
Egyptian Goose	<i>Alopochen aegyptiaca</i>								x
ORDER: GALLIFORMES									
Family Numididae (guineafowl)									
Helmeted Guineafowl	<i>Numida meleagris</i>					x			
Family Phasianidae (pheasants, fowl and allies)									
Natal Spurfowl	<i>Pternistis natalensis</i>				x	x			
ORDER: PELECANIFORMES									
Family Threskiornithidae (ibises and spoonbills)									
Hadeda Ibis	<i>Bostrychia hagedash</i>							x	x
Family Ardeidae (herons and bitterns)									
Western Cattle Egret	<i>Bubulcus ibis</i>							x	
ORDER: SULIFORMES									
Family Phalacrocoracidae (cormorants and shags)									
Reed Cormorant	<i>Microcarbo africanus</i>							x	
Family Anhingidae (anhingas and darters)									

African Darter	<i>Anhinga rufa</i>							x
ORDER: ACCIPITRIFORMES								
Family Accipitridae (kites, hawks and eagles)								
Martial Eagle	<i>Polemaetus bellicosus</i>	EN	NEMBA (EN)				x	
African Goshawk	<i>Accipiter tachiro</i>			x				
African Fish Eagle	<i>Haliaeetus vocifer</i>							x
ORDER: GRUIFORMES								
Family Rallidae (rails, crakes and coots)								
Black Crake	<i>Amauornis flavirostra</i>							x
African Swamphen	<i>Porphyrio madagascariensis</i>							x
ORDER: CHARADRIIFORMES								
Family Charadriidae (plovers)								
Blacksmith Lapwing	<i>Vanellus armatus</i>							x
Family Jacanidae (jacanas)								
African Jacana	<i>Actophilornis africanus</i>							x
ORDER: COLUMBIFORMES								
Family Columbidae (pigeons and doves)								
Red-eyed Dove	<i>Streptopelia semitorquata</i>					x		
Cape Turtle Dove	<i>Streptopelia capicola</i>						x	x
Laughing Dove	<i>Spilopelia senegalensis</i>							x
Emerald-spotted Wood Dove	<i>Turtur chalcospilos</i>						x	
Tambourine Dove	<i>Turtur tympanistria</i>					x		
African Green Pigeon	<i>Treron calvus</i>					x		
ORDER: MUSOPHAGIFORMES								
Family Musophagidae (turacos)								
Purple-crested Turaco	<i>Tauraco porphyreolophus</i>					x		
Grey Go-away-bird	<i>Corythaixoides concolor</i>						x	
ORDER: CUCULIFORMES								
Family Cuculidae (cuckoos)								
Burchell's Coucal	<i>Centropus burchelli</i>							x
ORDER: APODIFORMES								
Family Apodidae (swifts)								
African Palm Swift	<i>Cypsiurus parvus</i>							x
ORDER: COLIIFORMES								

Family Coliidae (mousebirds)			
Speckled Mousebird	<i>Colius striatus</i>	x	x
Red-faced Mousebird	<i>Urocolius indicus</i>		x
ORDER: CORACIIFORMES			
Family Alcedinidae (kingfishers)			
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>		x
Giant Kingfisher	<i>Megaceryle maxima</i>		x
Pied Kingfisher	<i>Ceryle rudis</i>		x
Family Meropidae (bee-eaters)			
White-fronted Bee-eater	<i>Merops bullockoides</i>		x
ORDER: BUCEROTIFORMES			
Family Bucerotidae (hornbills)			
Southern Yellow-billed Hornbill	<i>Tockus leucomelas</i>		x
ORDER: PICIFORMES			
Family Lybiidae (African barbets)			
Yellow-rumped Tinkerbird	<i>Pogoniulus bilineatus</i>	x	
Black-collared Barbet	<i>Lybius torquatus</i>	x	
Family Indicatoridae (honeyguides)			
Scaly-throated Honeyguide	<i>Indicator variegatus</i>	x	
Family Picidae (woodpeckers)			
Golden-tailed Woodpecker	<i>Campethera abingoni</i>	x	
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>		x
ORDER: PASSERIFORMES			
Family Platysteiridae (wattle-eyes and batises)			
Chinspot Batis	<i>Batis molitor</i>		x
Black-throated Wattle-eye	<i>Platysteira peltata</i>	x	
Family Malaconotidae (bushshrikes)			
Orange-breasted Bushshrike	<i>Chlorophoneus sulfureopectus</i>		x
Brown-crowned Tchagra	<i>Tchagra australis</i>		x
Black-backed Puffback	<i>Dryoscopus cubla</i>	x	x
Southern Boubou	<i>Laniarius ferrugineus</i>	x	
Family Oriolidae (figbirds and orioles)			
Black-headed Oriole	<i>Oriolus larvatus</i>	x	
Family Dicruridae (drongos)			
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>		x
		x	x

Family Monarchidae (monarchs)					
African Paradise Flycatcher	<i>Terpsiphone viridis</i>	x			
Family Paridae (tits and chickadees)					
Southern Black Tit	<i>Parus niger</i>		x		
Family Pycnonotidae (bulbuls)					
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>	x	x		x
Sombre Greenbul	<i>Andropadus importunus</i>	x			
Yellow-bellied Greenbul	<i>Chlorocichla flaviventris</i>	x			
Terrestrial Brownbul	<i>Phyllastrephus terrestris</i>	x			
Family Hirundinidae (swallows and martins)					
Wire-tailed Swallow	<i>Hirundo smithii</i>				x
Family Macrosphenidae (crombecs and African warblers)					
Long-billed Crombec	<i>Sylvietta rufescens</i>		x		
Family Acrocephalidae (reed warblers and allies)					
Lesser Swamp Warbler	<i>Acrocephalus gracilirostris</i>				x
Family Locustellidae (grassbirds and allies)					
Little Rush Warbler	<i>Bradypterus baboecala</i>				x
Family Cisticolidae (cisticolas and allies)					
Red-faced Cisticola	<i>Cisticola erythrops</i>				x
Rattling Cisticola	<i>Cisticola chiniana</i>		x		x
Tawny-flanked Prinia	<i>Prinia subflava</i>	x	x	x	x
Yellow-breasted Apalis	<i>Apalis flavida</i>	x	x		
Green-backed Camaroptera	<i>Camaroptera brachyura</i>	x			
Family Leiothrichidae (laughingthrushes)					
Arrow-marked Babbler	<i>Turdoides jardineii</i>		x		
Family Zosteropidae (white-eyes)					
Cape White-eye	<i>Zosterops virens</i>	x			
Family Sturnidae (starlings)					
Cape Glossy Starling	<i>Lamprotornis nitens</i>		x		
Family Turdidae (thrushes)					
Kurrichane Thrush	<i>Turdus libonyanus</i>	x			
Family Muscicapidae (chats and Old World flycatchers)					
White-browed Scrub Robin	<i>Erythropygia leucophrys</i>		x		
Southern Black Flycatcher	<i>Melaenornis pammelaina</i>	x			

Ashy Flycatcher	<i>Muscicapa caerulescens</i>					x			
African Dusky Flycatcher	<i>Muscicapa adusta</i>					x			
White-throated Robin-Chat	<i>Cossypha humeralis</i>					x	x		
White-browed Robin-Chat	<i>Cossypha heuglini</i>					x			
Family Nectariniidae (sunbirds)									
Collared Sunbird	<i>Hedydipna collaris</i>					x			
Scarlet-chested Sunbird	<i>Chalcomitra senegalensis</i>							x	
Purple-banded Sunbird	<i>Cinnyris bifasciatus</i>					x			
White-bellied Sunbird	<i>Cinnyris talatala</i>					x	x		x
Family Passeridae (Old World sparrows)									
Southern Grey-headed Sparrow	<i>Passer diffusus</i>								x
Family Ploceidae (weavers and widowbirds)									
Thick-billed Weaver	<i>Amblyospiza albifrons</i>								x
Spectacled Weaver	<i>Ploceus ocularis</i>					x			
Village Weaver	<i>Ploceus cucullatus</i>					x		x	
Southern Red Bishop	<i>Euplectes orix</i>								x
Family Estrildidae (waxbills, munias and allies)									
Red-billed Firefinch	<i>Lagonosticta senegala</i>						x		x
Jameson's Firefinch	<i>Lagonosticta rhodopareia</i>						x		
Blue Waxbill	<i>Uraeginthus angolensis</i>						x		x
Common Waxbill	<i>Estrilda astrild</i>								x
Bronze Mannikin	<i>Lonchura cucullata</i>								x
Red-backed Mannikin	<i>Lonchura nigriceps</i>					x			
Family Viduidae (indigobirds and whydahs)									
Village Indigobird	<i>Vidua chalybeata</i>						x		
Pin-tailed Whydah	<i>Vidua macroura</i>								x
Family Motacillidae (wagtails and pipits)									
African Pied Wagtail	<i>Motacilla aguimp</i>								x
Family Fringillidae (finches and canaries)									
Yellow-fronted Canary	<i>Crithagra mozambica</i>					x	x	x	x
Subtotal		88	1	0	1	36	31	26	13
Reptiles									
ORDER: SQUAMATA									
Family Crocodylidae (crocodiles)									

Nile Crocodile *	<i>Crocodylus niloticus</i>	VU		NEMBA (VU)				x	
Family Pythonidae									
Southern African Python	<i>Python natalensis</i>			NEMBA (PR)		x			
Family Scincidae (skinks)									
Rainbow Skink	<i>Trachylepis margaritifer</i>							x	
Family: Gerrhosauridae (plated lizards)									
Common Giant Plated Lizard	<i>Matobosaurus validus</i>							x	
Subtotal		4	3	1	4	38	32	27	13
TOTAL		94	5	1	6	75	65	53	27

PR - Protected

VU - Vulnerable

EN - Endangered

NEMBA - National Environmental Management: Biodiversity Act

MNCA - Mpumalanga Nature Conservation Act

* - small crocodiles present in the dam, as reported by farm staff

Appendix 4. Potentially occurring fauna of conservation concern

Common Name	Scientific Name	Red Data	Protected	Habitat	SABAP2 Reporting Rate for 2531 BD	Likelihood	Reason
Mammals							
African Clawless Otter	<i>Aonyx capensis</i>		MNCA	Rivers and streams		Moderate	Suitable habitat present
Side-striped Jackal	<i>Canis adustus</i>	NT		Sour bushveld		Moderate	Suitable habitat present
Reddish-grey Musk Shrew	<i>Crocidura cyanea</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Greater Musk Shrew	<i>Crocidura flavescens</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Tiny Musk Shrew	<i>Crocidura fuscomurina</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Lesser Red Musk Shrew	<i>Crocidura hirta</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Swamp Musk Shrew	<i>Crocidura mariquensis</i>	DD		Wetlands in savanna		Moderate	Suitable habitat present
Peters' Musk Shrew	<i>Crocidura silacea</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Spotted Hyaena	<i>Crocuta crocuta</i>	NT	NEMBA (PR)	Wide variety of habitats		Low	Disturbance, lack of prey
African Marsh Rat	<i>Dasymys incomtus</i>	NT		Wetlands		Low	Limited suitable habitat present
Gambian Epauletted Fruit Bat	<i>Epomophorus gambianus</i>	DD		Savanna, tree roosting		Moderate	Suitable habitat present
Southern Lesser Galago	<i>Galago moholi</i>		MNCA	Savanna		Confirmed	
Woodland Thicket Rat	<i>Grammomys dolichurus</i>	DD		Thickets and woodland		Low	Edge of distribution range
Hippopotamus	<i>Hippopotamus amphibius</i>	VU	MNCA	Wetlands		Confirmed	
Single-striped Grass-Mouse	<i>Lemniscomys rosalia</i>	DD		Woodland with tall grass		Moderate	Suitable habitat present
Serval	<i>Leptailurus serval</i>	NT	NEMBA (PR)	Grassland, wetlands		Low	Limited suitable habitat present
African Wild Dog	<i>Lycaon pictus</i>	EN	NEMBA (EN)	Wide variety of habitats		Low	Disturbance, lack of prey
Honey Badger	<i>Mellivora capensis</i>	NT	MNCA	Wide variety of habitats		Moderate	Suitable habitat present
Welwitsch's Hairy Bat	<i>Myotis welwitschii</i>	NT		Savanna, tree roosting		Moderate	Suitable habitat present
Aardvark	<i>Orycteropus afer</i>		NEMBA (PR)	Wide variety of habitats		Moderate	Suitable habitat present
Thick-tailed Greater Galago	<i>Otolemur crassicaudatus</i>		MNCA	Moist woodland and forest		High	Suitable habitat present, common riparian species

Lion	<i>Panthera leo</i>	VU	NEMBA (VU)	Wide variety of habitats		Low	Disturbance, lack of prey
Leopard	<i>Panthera pardus</i>	NT	NEMBA (PR)	Wide variety of habitats		Low	Disturbance, lack of prey
Rusty Bat	<i>Pipistrellus rusticus</i>	NT		Savanna, riparian forest, tree roosting		Moderate	Suitable habitat present
African Weasel	<i>Poecilogale albinucha</i>	DD		Wide variety of habitats		Low	Disturbance, lack of prey
Aardwolf	<i>Proteles cristatus</i>		MNCA	Wide variety of habitats		Low	Disturbance, lack of prey
Steenbok	<i>Raphicerus campestris</i>		MNCA	Wide variety of habitats		Low	Disturbance, lack of suitable habitat
Meller's Mongoose	<i>Rhynchogale melleri</i>	DD		Savanna and grasslands		Low	Disturbance, lack of suitable habitat
Ground Pangolin	<i>Smutsia temminckii</i>	VU	NEMBA (VU)	Wide variety of habitats		Low	Disturbance, increasingly rare species
Least Dwarf Shrew	<i>Suncus infinitesimus</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Greater Dwarf Shrew	<i>Suncus lixus</i>	DD		Wide variety of habitats		Moderate	Suitable habitat present
Bushveld Gerbil	<i>Tatera leucogaster</i>	DD		Woodland, thicket		Moderate	Suitable habitat present
Subtotal	32	26	14				
Birds							
Half-collared Kingfisher	<i>Alcedo semitorquata</i>	NT		Streams with overhanging vegetation	0.63	Moderate	Some suitable habitat present
Tawny Eagle	<i>Aquila rapax</i>	EN	NEMBA (EN)	Savanna	27.31	Low	Disturbance, lack of prey
Kori Bustard	<i>Ardeotis kori</i>	NT	NEMBA (PR)	Open savanna, semi-desert	4.62	Low	Disturbance, lack of suitable habitat
Southern Ground-Hornbill	<i>Bucorvus leadbeateri</i>	EN	NEMBA (EN)	Savanna	9.03	Low	Disturbance, lack of prey
Abdim's Stork	<i>Ciconia abdimii</i>	NT		Open arid woodland and grassland	-	Low	No suitable habitat present
Black Stork	<i>Ciconia nigra</i>	VU		Forages in wetlands and breeds on cliffs	5.88	Low	Limited suitable habitat present
Pallid Harrier	<i>Circus macrourus</i>	NT		Open grassland and semi-desert	0.21	Low	No suitable habitat present
African Marsh Harrier	<i>Circus ranivorus</i>	EN		Moist grassland and wetland	0.42	Low	Limited suitable habitat present, very rare in the Lowveld

European Roller	<i>Coracias garrulus</i>	NT		Savanna	17.44	Moderate	Limited suitable habitat present
Saddle-billed Stork	<i>Ephippiorhynchus senegalensis</i>	EN		Large rivers, dams and pans	25.42	Low	Disturbance, lack of suitable habitat
Lanner Falcon	<i>Falco biarmicus</i>	VU		Wide variety of habitats	-	Low	Limited suitable habitat present, very rare in the Lowveld
White-backed Night-Heron	<i>Gorsachius leuconotus</i>	VU		Streams with overhanging vegetation	0.21	Low	Disturbance, very low reporting rate from grid
White-backed Vulture	<i>Gyps africanus</i>	CR	NEMBA (EN)	Savanna	58.61	Low	Disturbance, lack of prey
Cape Vulture	<i>Gyps coprotheres</i>	EN	NEMBA (EN)	Mountains and surrounding vegetation, savanna	3.57	Low	Disturbance, lack of prey
Marabou Stork	<i>Leptoptilos crumeniferus</i>	NT		Wide variety of habitats	13.66	Moderate	May occasionally forage within study area
Bat Hawk	<i>Macheiramphus alcinus</i>	EN		Tall woodland along rivers	0.21	Low	Disturbance, lack of suitable habitat
Lesser Jacana	<i>Microparra capensis</i>	VU		Floating vegetation on tropical wetlands	-	Low	Unrecorded from grid, very rare in Mpumalanga
Yellow-billed Stork	<i>Mycteria ibis</i>	EN		Wide variety of wetlands	14.5	Low	Disturbance, lack of suitable habitat
Hooded Vulture	<i>Necrosyrtes monachus</i>	CR	NEMBA (EN)	Wide variety of wetlands	15.97	Low	Disturbance, lack of prey
African Pygmy Goose	<i>Nettapus auritus</i>	VU		Tropical wetlands with floating vegetation	-	Low	Unrecorded from grid, very rare in Mpumalanga
African Finfoot	<i>Podica senegalensis</i>	VU		Rivers and streams with overhanging vegetation	1.47	Low	Disturbance, limited suitable habitat present
Martial Eagle	<i>Polemaetus bellicosus</i>	EN	NEMBA (EN)	Wide variety of habitats	20.17	Confirmed overhead	
Greater Painted-snipe	<i>Rostratula benghalensis</i>	NT		Wetlands	1.68	Low	Lack of suitable habitat
Secretarybird	<i>Sagittarius serpentarius</i>	VU		Open savanna and grassland	1.26	Low	Disturbance, limited suitable habitat present
Pel's Fishing Owl	<i>Scotopelia peli</i>	EN		Rivers and streams with overhanging vegetation	-	Low	Unrecorded from grid, very rare in Mpumalanga
Crowned Eagle	<i>Stephanoaetus coronatus</i>	VU		Forest	-	Low	Disturbance, unrecorded from grid

Bateleur	<i>Terathopius ecaudatus</i>	EN	NEMBA (EN)	Savanna	53.78	Low	Disturbance, lack of prey
Lappet-faced Vulture	<i>Torgos tracheliotos</i>	EN	NEMBA (EN)	Savanna	19.96	Low	Disturbance, lack of prey
White-headed Vulture	<i>Trigonoceps occipitalis</i>	CR	NEMBA (EN)		12.18	Low	Disturbance, lack of prey
Subtotal	29	29	10				
Reptiles							
Nile Crocodile	<i>Crocodylus niloticus</i>	VU	NEMBA (VU)	Wetlands		Confirmed	
Common File Snake	<i>Gonionotophis capensis</i>		LEMA	Savanna		Moderate	Suitable habitat present
Black File Snake	<i>Gonionotophis nyassae</i>		LEMA	Savanna		Moderate	Suitable habitat present
FitzSimons' Flat Lizard	<i>Platysaurus orientalis fitzsimonsi</i>	NT		Rocky ridges in bushveld		High	Suitable habitat present
Northern Crag Lizard	<i>Pseudocordylus transvaalensis</i>	NT		High altitude rocky grasslands		Low	Unsuitable altitude and habitat
Southern African Python	<i>Python natalensis</i>		NEMBA (PR)	Wide variety of habitats, but usually near water or rocky outcrops		High	Suitable habitat present
Breyer's Long-tailed Seps	<i>Tetradactylus breyeri</i>	VU		Montane grasslands		Low	Unsuitable altitude and habitat
Subtotal	27	24	12				
Frogs							
Whistling Rain Frog	<i>Breviceps sopranus</i>	DD		Forest with dense understory		Low	Small size and poor state of habitat
Subtotal	1	1	0				
TOTAL	89	80	36				

CR = Critically Endangered

EN = Endangered

VU = Vulnerable

NT = Near-threatened

DD = Data Deficient

PR = Protected

NEMBA = National Environmental Management: Biodiversity Act

LEMA = Limpopo Environmental Management Act

* = confirmed on adjacent properties or landowner record for study area

Appendix 5. Biodiversity Values of Vegetation Communities

Riparian Forest

Conservation Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Protection Status		International	National	Regional	Local	None
	14	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Size / Length		Very small (<500km ²)	Small (500 to 1,000km ²)	Moderate (1,000 to 20,000km ²)	Large (20,000 to 50,000km ²)	Very Large (> 50,000km ²)
	14	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species Diversity		Noticeably High		Moderate		Noticeably Low
	11	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Threatened Species		Noticeably High		Moderate		Noticeably Low
	8	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Unique Habitat or Taxa		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Present Ecological State		Natural, largely Unmodified	Slightly modified	Moderately Modified	Considerably Modified	Severely Modified
	9	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	11.5	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Functional Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Provisioning Services		Constant	Regular	Frequent	Occasional	Intermittent
	13	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Regulating Services		Very High	High	Moderate	Low	Very Low
	13	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Cultural Services		Very High	High	Moderate	Low	Very Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Supporting Services		Very High	High	Moderate	Low	Very Low
	14	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	13.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Closed Woodland

Conservation Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Protection Status		International	National	Regional	Local	None
	8	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Size / Length		Very small (<500km ²)	Small (500 to 1,000km ²)	Moderate (1,000 to 20,000km ²)	Large (20,000 to 50,000km ²)	Very Large (> 50,000km ²)
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species Diversity		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Threatened Species		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Unique Habitat or Taxa		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Present Ecological State		Natural, largely Unmodified	Slightly modified	Moderately Modified	Considerably Modified	Severely Modified
	11	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	12.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Functional Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Provisioning Services		Constant	Regular	Frequent	Occassional	Intermittent
	13	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Regulating Services		Very High	High	Moderate	Low	Very Low
	8	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Cultural Services		Very High	High	Moderate	Low	Very Low
	9	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Supporting Services		Very High	High	Moderate	Low	Very Low
	13	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	11.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Wetland

Conservation Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Protection Status		International	National	Regional	Local	None
	14	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Size / Length		Very small (<500km ²)	Small (500 to 1,000km ²)	Moderate (1,000 to 20,000km ²)	Large (20,000 to 50,000km ²)	Very Large (> 50,000km ²)
	14	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species Diversity		Noticeably High		Moderate		Noticeably Low
	10	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Threatened Species		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Unique Habitat or Taxa		Noticeably High		Moderate		Noticeably Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Present Ecological State		Natural, largely Unmodified	Slightly modified	Moderately Modified	Considerably Modified	Severely Modified
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	12.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Functional Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Provisioning Services		Constant	Regular	Frequent	Occassional	Intermittent
	13	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Regulating Services		Very High	High	Moderate	Low	Very Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Cultural Services		Very High	High	Moderate	Low	Very Low
	10	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Supporting Services		Very High	High	Moderate	Low	Very Low
	12	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	12.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Transformed Areas

Conservation Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Protection Status		International	National	Regional	Local	None
	4	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Size / Length		Very small (<500km ²)	Small (500 to 1,000km ²)	Moderate (1,000 to 20,000km ²)	Large (20,000 to 50,000km ²)	Very Large (> 50,000km ²)
	10	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Species Diversity		Noticeably High		Moderate		Noticeably Low
	7	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Threatened Species		Noticeably High		Moderate		Noticeably Low
	6	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Unique Habitat or Taxa		Noticeably High		Moderate		Noticeably Low
	4	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Present Ecological State		Natural, largely Unmodified	Slightly modified	Moderately Modified	Considerably Modified	Severely Modified
	4	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	5.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Functional Importance

Parameter	Score	Very High	High	Moderate	Low	Very Low
Provisioning Services		Constant	Regular	Frequent	Occassional	Intermittent
	15	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Regulating Services		Very High	High	Moderate	Low	Very Low
	4	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Cultural Services		Very High	High	Moderate	Low	Very Low
	5	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
Supporting Services		Very High	High	Moderate	Low	Very Low
	5	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0
MEDIAN Score	5.0	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6 5	4 3 2 1 0

Appendix 6. Curriculum Vitae of Duncan McKenzie

Name: Duncan Robert McKenzie
Profession: Terrestrial Ecologist
Date of Birth: 9 Nov 1977
Name of Firm: ECOREX Consulting Ecologists cc
Position in Firm: Ecologist
Years with firm: 8
Nationality: South African
Qualifications :



- | | | |
|--------------------------------|-----------------------|------|
| • N.Dip. [Nature Conservation] | UNISA, RSA | 2007 |
| • N.Cert. [Nature Guiding] | Drumbeat Academy, RSA | 2004 |

Membership in Professional Societies:

- BirdLife South Africa
- Animal Demography Unit, University of Cape Town
- Botanical Society of South Africa

Languages :

	<u>Speaking</u>	<u>Reading</u>	<u>Writing</u>
English (home):	Excellent	Excellent	Excellent
Afrikaans:	Good	Good	Good
isiZulu:	Good	Fair	Fair
Spanish:	Fair	Fair	Fair

Countries of Work Experience : Botswana, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Zimbabwe (Guiding). South Africa, Mozambique, DRC, Mali, Lesotho, Tanzania, Swaziland, Sierra Leone (Consulting Ecologist)

OVERVIEW OF EXPERIENCE

- 8 years' experience in specialist species identification, conducting baseline surveys, data analysis and report writing in various biomes in southern Africa, particularly savannah, forest and grassland biomes
- 2 years' experience game reserve management (KwaZulu-Natal)
- 5 years' experience (part time) of wetland delineation and management
- 2 years' experience of plant propagation and use for rehabilitation
- Specialist knowledge of identification of vascular plants
- Specialist knowledge of identification of mammals, birds, reptiles and amphibians
- SABAP2 Regional Co-ordinator: Mpumalanga
- Member of the Kwa-Zulu-Natal Bird Rarities Committee

Employment Record:

2007 - present	ECOREX	Ecologist
2005 - 2006	Iglu (London, UK)	Specialist Travel Agent
1997 - 2005	Duncan McKenzie Bird Tours	Owner, Specialist Guide
2001	KZN Wildlife	District Conservation Officer, Reserve Manager
1999 - 2001	Institute of Natural Resources	Part-time Horticulturalist and Rehabilitation Officer
1997-2001	Mondi Wetlands Project	Part-time Field Assistant and Regional Co-ordinator
1996-1997	Natal Parks Board	Ranger

Appendix 7. Specialists Declaration

10.4 The Specialist

Note: Duplicate this section where there is more than one specialist.

I ...Duncan McKenzie..., as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and that I:

- in terms of the general requirement to be independent (tick which is applicable):

X	other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
---	---

	am not independent, but another EAP that is independent and meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
--	--

- have expertise in conducting specialist work as required, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- will ensure compliance with the EIA Regulations 2014;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- will take into account, to the extent possible, the matters listed in regulation 18 of the regulations when preparing the application and any report, plan or document relating to the application;
- will disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- declare that all the particulars furnished by me in this form are true and correct;
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).



Signature of the specialist

ECOREX Consulting Ecologists CC

Name of company

07/08/2018

Date