Specialist Report: Ecological Assessment Of The Development Footprint For The Schoemanskloof Upgrade On The N4 Highway, Mpumalanga Province

Commissioned by

Prism Environmental Management Services

Compiled by

EkoInfo CC & Associates

July 2021

EkoInfo CC
P.O. Box 72847
Lynwood Ridge
0040
Pretoria
Gauteng
RSA
http://www.ekoinfo.co.za

Member: Willem de Frey
Registration no: CC1995/34111/23

Tel: 012-365-2546
Fax: 012-365-3217
Email: wdefrey@ekoinfo.co.za

EkoInfo CC
www.ekoinfo.co.za

20 Years

1995 - 2015

CONTRIBUTING ASSOCIATES

Company	EkoInfo CC				
Person	Willem de Frey				
Qualifications	MSc Wildlife Management –UP, 1999				
Field of expertise	Flora, Ecology, Soil, Wetlands, GIS				
Years experience	15 – Full time				
Professional Registration	Pr.Sci.Nat. - Botany & Ecology (400100/02)				
Component	Ecological Assessment				
Telephone	012 365 2546				
Fax	012 365 3217				
Cell phone	082 579 5049				
Email	wdefrey@ekoinfo.co.za				
Logo	EkoInfo CC www.ekoinfo.co.za				

Report Status	Version	File Route
Final	5	C:\02_Projects\01_EkoInfo\20190930Eko_EcologySchoemanskloof_PrismRyan\Reports\tx\EkoInfo CC Ecological Assessment N4_Schoemanskloof Upgrade ONLY Prism Jul2021v3.docx

1 EXECUTIVE SUMMARY

Prism Environmental Management Services appointed EkoInfo CC to do an ecological assessment of the remaining natural areas associated with the road upgrade sections along the Schoemanskloof road section of the N4 in Mpumalanga Province. Willem de Frey, a registered scientific professional in the fields of ecological – and botanical science with more than 20 years' experience facilitated the study.

The study consisted of a literature – and desktop review to provide regional context, while a site visit was done on the 12th and 13th of January 2020 to provide local context. During the site visit eleven plots were surveyed, and remote images captured of the area. During November 2020, an additional two sites associated with existing river crossing were assessed. In May 2021 an additional 15 surveys were done in areas where proposed access roads are to be constructed.

It was determined that the sections to be upgraded transects two threatened regional vegetation units, namely Lydenburg Montane Grassland within the Grassland Biome and Legogote Sour Bushveld within the Savanna Biome of South Africa, vulnerable and endangered respectively. The remaining natural vegetation contain national and provincial protected plants, for which permits are required for their destruction.

Due to the presence of existing road infrastructure and small footprint of the total upgrade sections (upgrade and access roads = 40 ha of which 20.2 ha represent pristine, primary vegetation), it is not expected that the development will have a significant impact on fauna in the area. However, the upgrade does provide an opportunity to improve the permeability of the road infrastructure to allow the movement of small to medium animals and herpetofauna to and from the Crocodile River, a source of water in the area. The proposed upgrade of the two existing river crossing will contribute significantly to improve the permeability of the landscape, especially for ground dwelling organisms during the time of flooding.

Due to the fact that the proposed upgrade will contribute less than 1% to transformation of the remaining natural vegetation and therefore habitat in the broader landscape (Table 19), this development cannot be considered a no-go.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS/ PHOTO PLATES

2 INTRODUCTION

Prism Environmental Management Services appointed EkoInfo CC to facilitate an ecological assessment of the proposed upgrade of sections of the Schoemanskloof road along the N4 Highway in Mpumalanga Province (Figure 1).

2.1 Scope of work/ Terms of reference

EkoInfo CC was appointed to do an ecological assessment of the area to be impacted upon by the proposed upgrade of sections of the Schoemanskloof road along the N4 in Mpumalanga Province. The appointment did not specify any criteria, and therefore the criteria/ guidelines provided in Appendix 6 of the NEMA EIA Regulations of 2014 was implemented. The principals in general requires the following:

1. Details of the specialist and CV (Appendix A).
2. Declaration of independence – page 2
3. Indication of the scope and purpose of the document
4. Date and season of the site visit
5. Method statement
6. Sensitive areas to be identified
7. Areas to be avoided to be identified
8. Map indicating the location of the site, its sensitivities, and associated buffers.
9. Limitations and assumptions
10. Impact assessment and mitigation measures
11. Conditions to be included in the environmental authorisation
12. Monitoring requirements to include in the EMPr
13. A reasoned opinion
14. Any consultation that had taken place or related correspondence
15. Additional information required by the competent authority

Willem de Frey, sole member, and principal consultant of EkoInfo CC facilitated the ecological assessment, he is a registered scientific professional in the fields of ecological – and botanical science with more than 20 years' experience.

Additional two river crossings were added to the project, and subsequent additional site investigations were done on the 12th of November 2020.

Due to safety concerns and accident hotspots, it was decided to improve access to existing road infrastructure, by combining access from various landowners. This will imply the transformation of additional areas to improve the access. The potential impact of these additional access roads were evaluated from the 11 – 13th of May 2021.

3 STUDY AREA

The upgrade of the road sections commences west of the town of Waterval Boven, where the N4 Highway provides the option to select between the Schoemanskloof route or Wateval Boven route (Figure 1). The Schoemskloof route alternative is 118 km long, and winds through an agricultural landscape (Figure 2), with the natural vegetation replaced by either forestry (

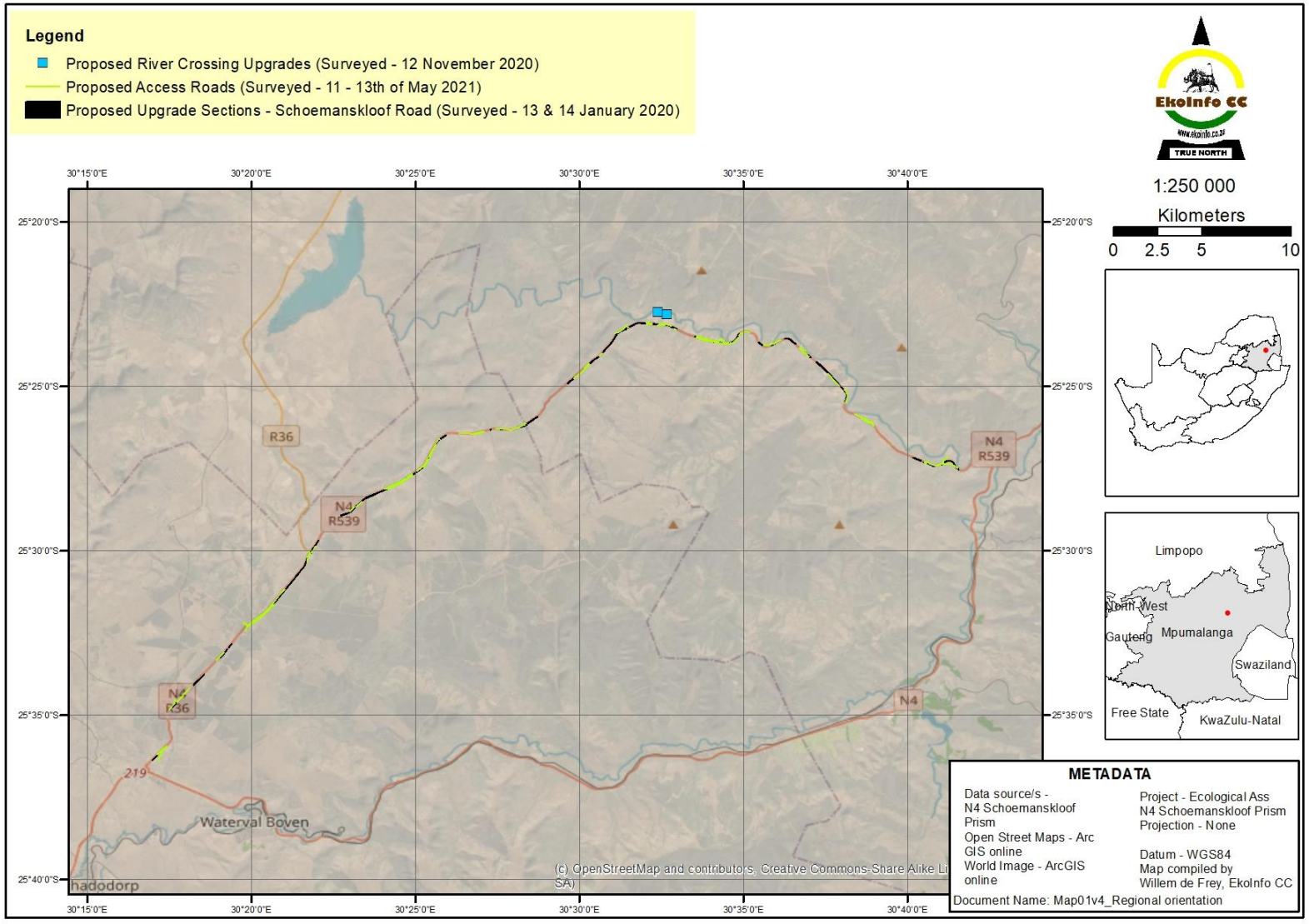


Figure 1: Regional orientation of the proposed road upgrade sections along the Schoemanskloof section of the N4, Mpumalanga Province

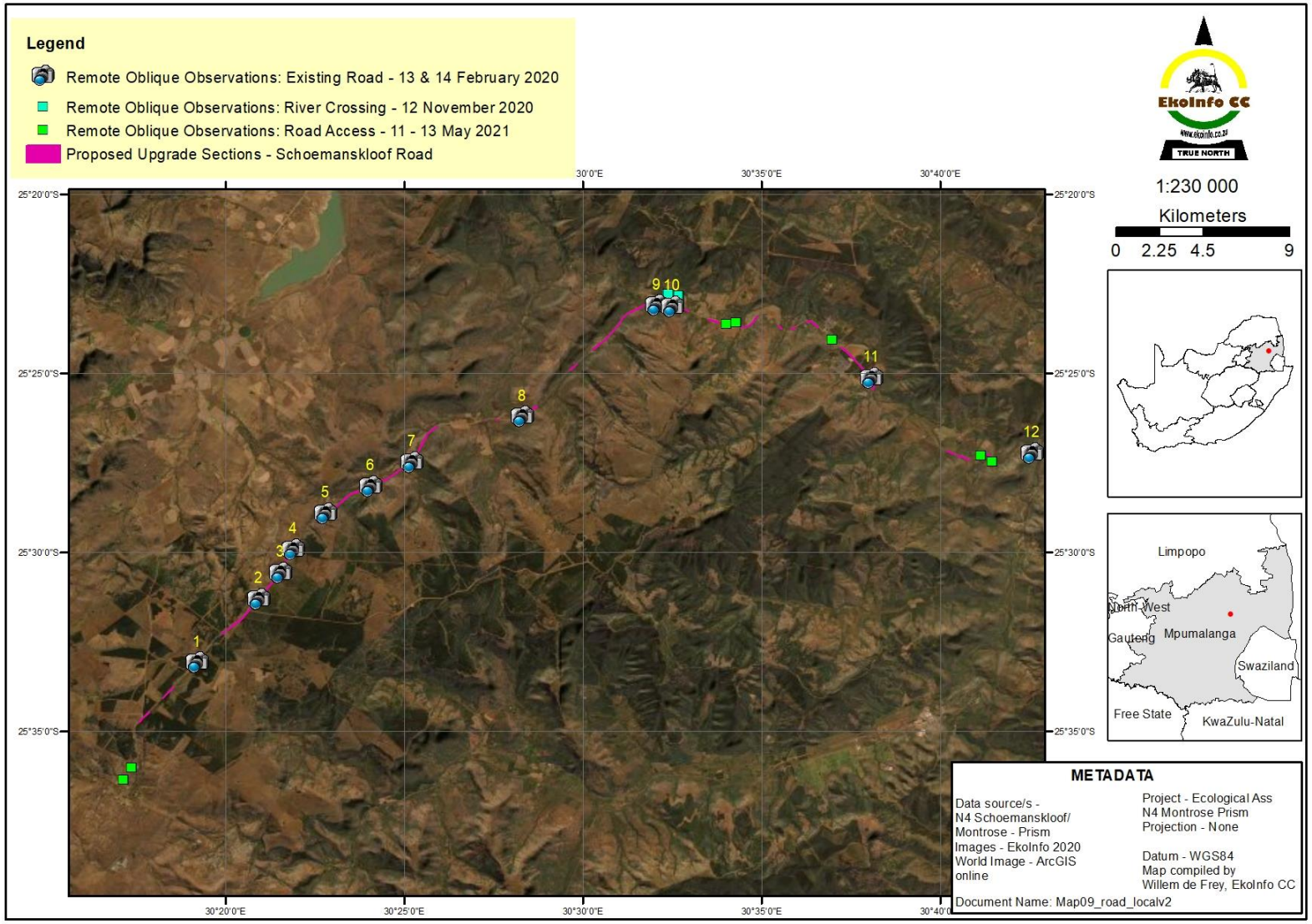


Figure 2: Local orientation of the proposed road upgrade sections along the Schoemanskloof road

Photo 1), cultivation (Photo 2) and orchards (Photo 3). The natural vegetation changes from high altitude Grassland (Photo 4) in the west to Savanna (Photo 5) in the low-lying valley to the east.

The extent of the area to be upgraded along the existing Schoemanskloof road is 12 ha, while the access road improvement involves an additional 27 ha.

4 METHOD STATEMENT

The assessment involved two components, a literature and desktop review, which provides regional context, and highlights potential issues of concern regarding the ecology in the area, and the actual fieldwork, which provides local context, and aims to verify the issues of concern identified during the literature and desktop review.

4.1 Literature – And Desktop Review

Available small-scale dataset available from government and academic institutions were reviewed. Most of the datasets are available on the Internet at the various institutions. A primary source of this information is SANBI's BGIS platform[1]

An additional small-scale data that was obtained was from international institutions such as USGS Earth Explorer[2], which provide satellite imagery and Digital Elevation Models.

4.2 Fieldwork

Fieldwork was done on the 13th and 14th of January 2020 and involved the use of the Braun-Blanquet approach, which is the national standard for vegetation description and mapping in South Africa (Brown **et al** 2013). Additional surveys for two river crossings were done on the 12th of November 2020, as well as for the proposed access roads from 11 to 13th of May 2021.

The Braun-Blanquet approach involves the use of plots, where in the floristic composition, vegetation characteristics and environmental data is recorded (Kent & Coker 1992, De Frey 1999). The plot size varies according to the dominant vegetation, whether Savanna or Grassland, within the Savanna Biome the standard plot size is 10 x 20 m. Eleven plots were surveyed within the upgrade sections of Schoemanskloof which exceeded 500 m^2. The number of plots increased to 28, due an additional plots completed:

1. River crossing – 2 plots (November 2020)
2. Access roads – 15 plots (May 2021)

[1] https://www.sanbi.org/link/bgis-biodiversity-gis/
[2] https://earthexplorer.usgs.gov

Photo 1: Example of the human influenced areas – forestry (Remote Oblique Observation Site 3, Direction Northeast)

Photo 2: Example of the human influenced areas – cultivated fields (active or abandoned) (Remote Oblique Observation Site 6, Direction Northeast)

Photo 3: Example of the human influenced areas – orchards (Remote Oblique Observation Site 11, Direction Northwest)

Photo 4: Example of the high-altitude grassland towards the west (Remote Oblique Observation Site 3, Direction Northeast)

Photo 5: Example of the Savanna in the valley towards the east (Remote Oblique Observation Site 5, Direction Northeast)

4.2.1 Limitations And Assumptions

1. The assessment represents a sample not a census, therefore not all of the area was covered, only plots were surveyed, no walkdown of the proposed road servitude was done.
2. The main objective was to verify the presence or absence of species of concern, specifically plants for which permits are required to remove
3. The optimal time for vegetation surveys in the summer rainfall area of South Africa is January/ February to April/ May in the Savanna Biome.
4. For the purpose of this ecological assessment, only those areas associated with remaining patches of natural vegetation were surveyed. However, the majority of these represented road servitude or secondary vegetation.
5. It is assumed that information from third parties are accurate and/ or correct.

5 RESULTS

5.1 Regional Context – Literature And Desktop Review

5.1.1 Ecosystem Diversity

Due to the length of the Schoemanskloof road, the sections to be upgraded transects three regional vegetation units (Figure 3), representing three biomes, namely:

1. Lydenburg Montane Grassland – Grassland Biome
2. Legogote Sour Bushveld – Savanna Biome
3. Northern Misbelt Forest – Forest Biome

Most of the upgrades along the existing road infrastructure occur within the Legogote Sour Bushveld unit at 6.6 ha or 54% (Table 1.A). The second area in which 45% or 5.5 ha (Table 1) of upgrade will occur is the Lydenburg Montane Grassland, with less than a hectare or 1% of the upgrade occurring in the Northern Mistbelt Forest. The potential influence of the upgrades on the Northern Misbelt Forest is considered insignificant, and therefore this unit will not be discussed in detail. Same applies to the proposed access roads (Table 1.B), with the majority of additional access roads to be develop, falling inside the Legogote Sour Bushveld of the Savanna Biome at 15.4 ha (57%).

5.1.1.1 Lydenburg Montane Grassland

The Lydenburg Montane Grassland vegetation unit is described as follows (Mucina & Rutherford 2006):

> "High-altitude plateaus, undulating plains, mountain peaks and slopes, hills and deep valleys of the Northern Escarpment region, supporting predominantly very low grasslands on the high-lying areas. Height of the grass sward increases on the lower slopes. The grassland is very rich in forbs species.
>
> Conservation Vulnerable. The conservation target is 27%, with 2.4% formally protected within reserves (Gustav Klingbiel, Makobulaan, Mt Anderson, Ohrigstad Dam, Sterkspruit and Verlorenvlei) as well as in a number of private conservation areas (Buffelskloof, Crane Creek, ETTC, In-de-Diepte, Kaalboom, Kalmoesfontein, Mbesan,

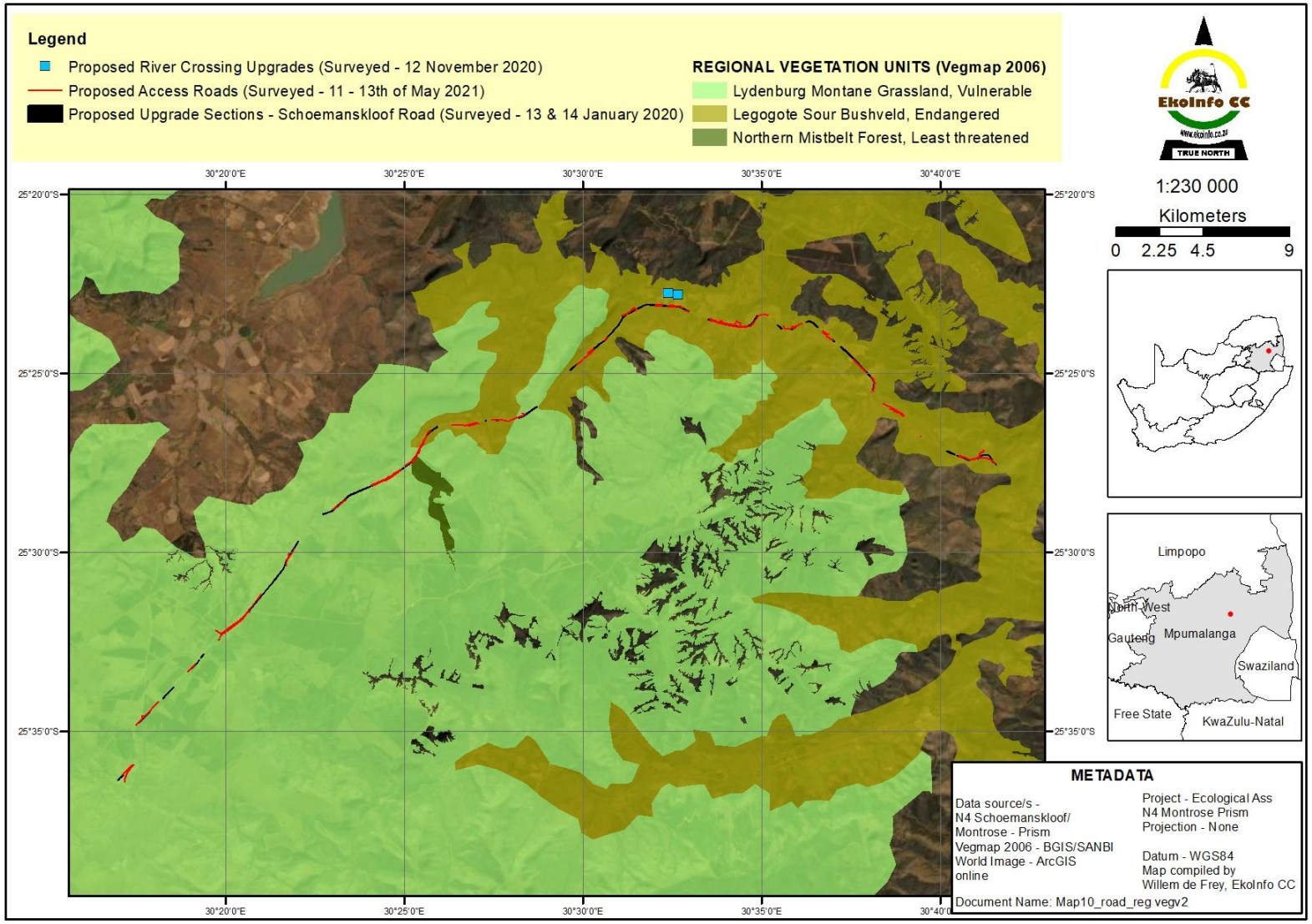


Figure 3: Regional vegetation units associated with the proposed road upgrade sections along the Schoemanskloof road

Table 1: Overview of the regional vegetation units and biomes associated with the road upgrade sections along the Schoemanskloof road

A. Existing road infrastructure

Regional Vegetation Units	Biomes			Surface Area (ha)	% Cover
	Grassland Biome	Savanna Biome	Forests		
Lydenburg Montane Grassland	5.5			5.5	45%
Legogote Sour Bushveld		6.6		6.6	54%
Northern Mistbelt Forest			0.1	0.1	1%
Grand Total	**5.5**	**6.6**	**0.1**	**12.2**	**100%**
	45%	54%	1%		

B. Access roads

Regional Vegetation Units	Biomes			Surface Area (ha)	% Cover
	Grassland Biome	Savanna Biome	Forests		
Lydenburg Montane Grassland	11.2			11.2	41%
Legogote Sour Bushveld		15.4		15.4	57%
Northern Mistbelt Forest			0.4	0.4	2%
Grand Total	**11.2**	**15.4**	**0.4**	**27.0**	**100%**
	41%	57%	2%		

Mondi Indigenous Forest, Mt Sheba, Waterval etc.). The level of transformation is relatively high at 23%, with mostly alien plantations (20%) and cultivated lands (2%). Erosion potential very low (74%) and low (12%)."

5.1.1.2 Legogote Sour Bushveld

The Legogote Sour Bushveld is within the Savanna Biome of South Africa (Figure 3). The vegetation unit is described as follows (Mucina & Rutherford 2006):

"Gently to moderately sloping upper pediment slopes with dense woodland including many medium to large shrubs often dominated by *Parinari curatellifolia* and *Bauhinia galpinii* with *Hyperthelia dissoluta* and *Panicum maximum* in the undergrowth. Short thicket dominated by *Acacia ataxacantha* occurs on less rocky sites. Exposed granite outcrops have low vegetation cover, typically with *Englerophytum magalismontanum*, *Aloe petricola* and *Myrothamnus flabellifolia*.

Conservation Endangered. Target 19%. About 2% statutorily conserved mainly in the Bosbokrand and Barberton Nature Reserves; at least a further 2% is conserved in private reserves including the Mbesan and Kaapsehoop Reserves and Mondi Cycad Reserve. It has been greatly transformed (50%), mainly by plantations and also by cultivated areas and urban development. Scattered alien plants include *Lantana camara*, *Psidium guajava* and *Solanum mauritianum*. Erosion is very low to moderate."

5.1.2 Species Diversity

5.1.2.1 Lydenburg Montane Grassland

In terms of known recorded species, 165 species are listed for the Lydenburg Montane Grassland (Appendix B), of which 24 species (15%) is endemic and 24 species (15%) is biogeographically important taxa.

Fourteen of the known 165 species recorded within the Lydenburg Montane Grassland are classified as threatened Red Data plants[3] (Table 2), of which one species is Critically Endangered (*Protea roupelliae* subsp *hamiltoni*), four species are Endangered, and nine species are Vulnerable. From the habitat description, it is evident that the species are associated with terrestrial ecosystems, mainly in high-lying, rocky areas. It should be noted that *Protea roupelliae* subsp *hamiltoni* is also a critical endangered species in terms of the National Environmental Management Biodiversity Act.

Twenty-four provincially protected species in terms of the Mpumalanga Nature Conservation Act (No 10 of 1998) had been recorded within the Lydenburg Montane Grassland (Table 3). Twelve species associated with the protected families Orchidaceae and Proteaceae, and twelve species with the protected genera *Aloe*, *Eucomis*, *Gladiolus*, *Kniphofia*, *Scilla* and *Watsonia*.

No nationally protected trees are expected to occur within the Lydenburg Montane Grassland.

[3] http://redlist.sanbi.org/

Table 2: List of threatened Red Data plants which is associated with the Lydenburg Montane Grassland

Scientific Name	Red Data Status – National	Major system	Major Habitats	Habitat Description
Graderia linearifolia Codd	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Sparse montane grassland on poor, gravely, quartzitic soil, 2255 m.
Crotalaria monophylla Germish.	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Rocky quartzitic ridges in montane grassland.
Cymbopappus piliferus (Thell.) B.Nord.	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Rocky quartzitic ridges in montane grassland.
Disa amoena H.P.Linder	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Well-drained gravely soil, gentle to moderate slopes, in fairly short grassland, and on mountain plateaus.
Disa clavicornis H.P.Linder	Endangered (EN)	Terrestrial	Lydenburg Montane Grassland	Grasslands above 2000 m, in well-drained soils between rocks and in marshy areas.
Eucomis vandermerwei I.Verd.	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland, Sekhukhune Montane Grassland, Rand Highveld Grassland	Short, sour montane grassland on sandy, low-pH soils derived from quartzitic rocky outcrops. In rock crevices or under overhanging rocks, confined to outcrops on slopes and plateaus of higher peaks, predominantly on north-facing slopes, 2200-2500 m.
Gladiolus cataractarum Oberm.	Endangered (EN)	Terrestrial	Lydenburg Montane Grassland	Moisture loving, growing on waterfalls, cliffs and steep rocky slopes on quartzite in sheltered, south-facing sites.

Scientific Name	Red Data Status – National	Major system	Major Habitats	Habitat Description
Gladiolus malvinus Goldblatt & J.C.Manning	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland, Eastern Highveld Grassland	Dolerite outcrops in grassland, around 2000 m.
Helichrysum lesliei Hilliard	Endangered (EN)	Terrestrial	Northern Escarpment Quartzite Sourveld, Lydenburg Montane Grassland	High altitude grassland, restricted to quartzite outcrops.
Helichrysum summo-montanum I.Verd.	Endangered (EN)	Terrestrial	Lydenburg Montane Grassland	Rocks on east-facing cliffs, 2000-2450 m.
Pearsonia hirsuta Germish.	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Low grassland between rocks, in humus-rich, sandy soil.
Streptocarpus cyaneus S.Moore subsp. longi-tommii Weigend & T.J.Edwards	Vulnerable (VU)	Terrestrial	Northern Mistbelt Forest, Lydenburg Montane Grassland, Barberton Montane Grassland	Afromontane forest margins and cliffs at very high altitudes, sometimes just below the snow line, in seepage areas.
Streptocarpus hilburtianus T.J.Edwards	Vulnerable (VU)	Terrestrial	Lydenburg Montane Grassland	Afromontane grassland on lithosols above cliffs, in very exposed positions, sparingly shaded by rock ledges and associated scrub, 2000 m and above.
Protea roupelliae Meisn. subsp. hamiltonii Beard ex Rourke	Critical Endangered (CR)	Terrestrial	Barberton Montane Grassland, Legogote Sour Bushveld	Confined to Barberton montane grassland.

Table 3: List of provincially protected species associated with the Lydenburg Montane Grassland

Count of Protected Genus	All species in		
Row Labels	**The family**	**The genus**	**Grand Total**
Aloe		**2**	**2**
Aloe affinis		1	1
Aloe dyeri		1	1
Eucomis		**1**	**1**
Eucomis vandermerwei		1	1
Gladiolus		**5**	**5**
Gladiolus calcaratus		1	1
Gladiolus cataractarum		1	1
Gladiolus ecklonii		1	1
Gladiolus exiguus		1	1
Gladiolus malvinus		1	1
Kniphofia		**1**	**1**
Kniphofia rigidifolia		1	1
ORCHIDACEAE	**11**		**11**
Corycium dracomontanum	1		1
Corycium nigrescens	1		1
Disa amoena	1		1
Disa clavicornis	1		1
Disa versicolor	1		1
Disperis renibractea	1		1
Habenaria dives	1		1
Habenaria dregeana	1		1
Habenaria lithophila	1		1
Holothrix scopularia	1		1
Schizochilus lilacinus	1		1
PROTEACEAE	**1**		**1**
Faurea galpinii	1		1
Scilla		**1**	**1**
Scilla natalensis		1	1
Watsonia		**2**	**2**
Watsonia occulta		1	1
Watsonia wilmsii		1	1
Grand Total	**12**	**12**	**24**

5.1.2.2 Legogote Sour Bushveld

Within the regional vegetation 68 plant species are listed, namely: *Acacia ataxacantha, Acacia caffra, Acacia davyi, Acacia sieberiana, Agathisanthemum bojeri, Aloe petricola, Aloe simii, Andropogon schirensis, Antidesma venosum, Bauhinia galpinii, Bothriochloa bladhii, Combretum zeyheri, Cymbopogon excavatus, Cymbopogon validus, Diospyros galpinii, Diospyros lycioides, Eriosema psoraleoides, Erythrina latissima, Erythroxylum delagoense, Erythroxylum emarginatum, Euphorbia ingens, Euphorbia vandermerwei, Faurea rochetiana, Faurea saligna, Ficus burkei, Ficus glumosa, Ficus ingens, Ficus petersii, Flemingia grahamiana, Gerbera ambigua, Gerbera viridifolia, Gladiolus hollandii, Gymnosporia heterophylla, Helinus integrifolius, Hemizygia persimilis, Hemizygia punctata, Heteropyxis natalensis, Hibiscus sidiformis, Huernia kirkii, Hyparrhenia cymbaria, Hyparrhenia poecilotricha, Hyperthelia dissoluta, Hypoxis rigidula, Indigofera filipes, Myrothamnus flabellifolius, Ocimum gratissimum, Olea europaea, Orbea carnosa, Pachystigma macrocalyx, Panicum maximum, Parinari curatellifolia, Paspalum scrobiculatum, Peltophorum africanum, Piliostigma thonningii, Pseudarthria hookeri, Pterocarpus angolensis, Pterocarpus rotundifolius, Rhus pentheri, Rhus rogersii, Schizachyrium sanguineum, Schotia brachypetala, Sclerocarya birrea, Sphedamnocarpus pruriens, Stapelia gigantea, Terminalia sericea, Trichilia emetica, Vernonia amygdalina, Waltheria indica*

Of the 68 species listed, one species is nationally protected and threatened in terms of the National Environmental Management Biodiversity Act, namely *Aloe simii* (Appendix C), this succulent is classified as Critically Endangered, and associated with wetland habitat.

Two nationally protected trees in terms of the National Forest Act (1998) occurs within the regional unit namely: *Pterocarpus angolensis* and *Sclerocarya birrea*.

The following species which are protected in terms of the Mpumalanga Nature Conservation Act (No 10 of 1998) occur in the regional vegetation unit, namely: *Pterocarpus angolensis*, all of the species within the following genera Aloe, Gladiolus, Olea, Huernia, Stapelia and Orbea and all of the species in the family Proteaceae (*Faurea rochetiana, Faurea saligna*).

Permits are required for the removal or destruction of nationally protected plants, while permits are only required for provincially protected plant's destruction if developer is not the owner of the land or if the plants would be sold or moved into other areas of the provinces.

5.1.3 Areas Of Conservation Concern

On a provincial scale, the Mpumalanga Biodiversity Sector Plan of 2014 (Figure 4), indicates that 48% or 6.4 ha of the existing road upgrade sections transect Critical Biodiversity Areas (CBA) (Table 4.A), with only 17% or 2.3 ha are associated with heavily or moderately modified areas. With regards the access roads, the same principal applies, with the highest percentage cover being the CBA's at 44%, but of significance is that the actual extent (hectares) is more than double (Table 4.B).

An Environmental Impact Assessment is required if more than 300 m^2 of Critical Biodiversity Areas is to be transformed.

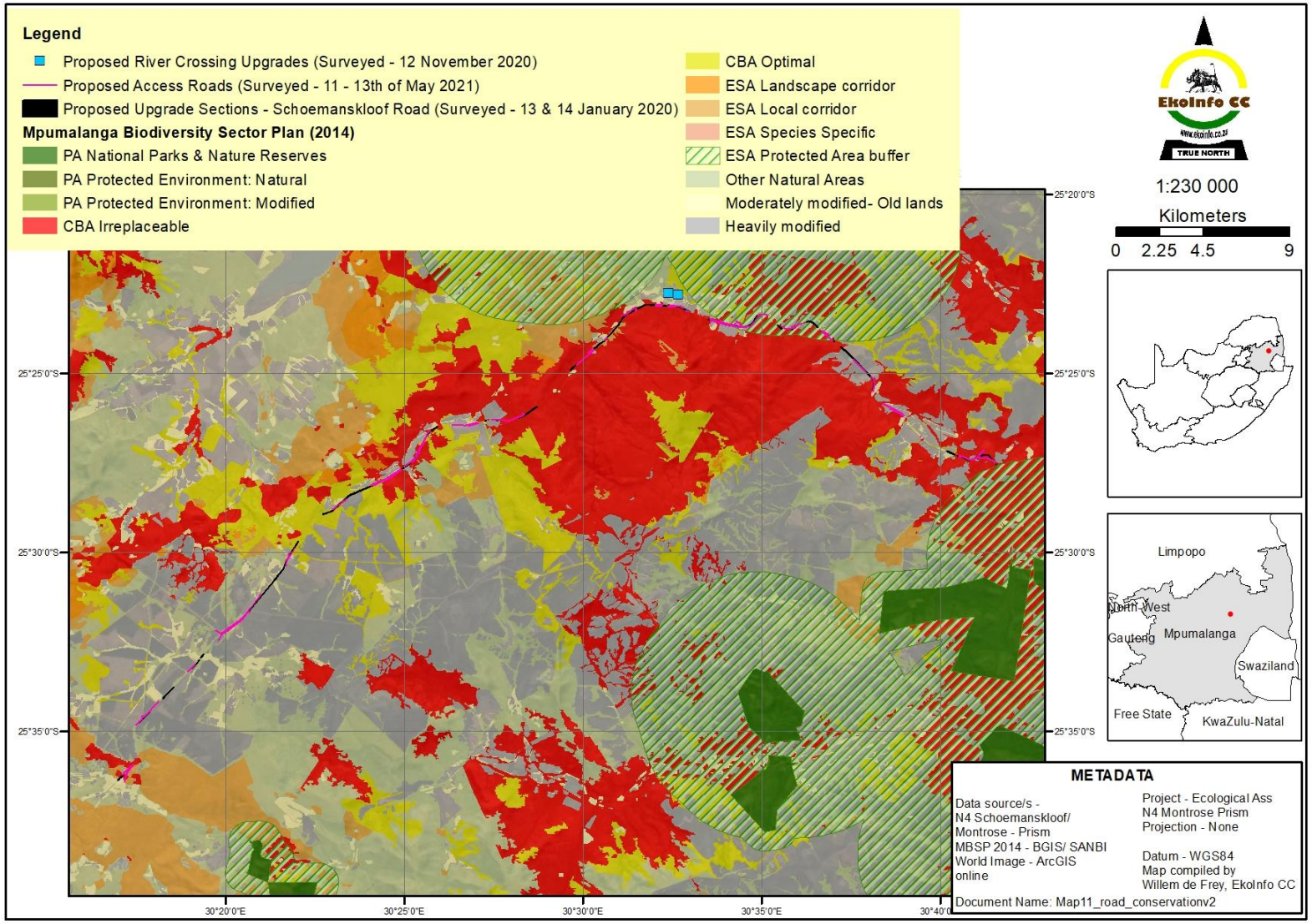


Figure 4: Distribution of Mpumalanga Biodiversity Sector Plan (2014) areas along the proposed upgrade sections.

Table 4: Overview of the extent and percentage cover of Mpumalanga Biodiversity Sector Plan categories associated with the upgrade sections along the Schoemanskloof road

A. Existing road infrastructure

Mpumalanga Biodiversity Sector Plan (2014)	Categories					
Sub-categories	**Critical Biodiversity Area**	**Ecological Support Area**	**Other Natural Areas**	**Heavily or moderately modified**	**Grand Total**	**% cover**
CBA Irreplaceable	4.5				4.5	34%
CBA Optimal	1.8				1.8	14%
ESA Local corridor		1.1			1.1	9%
ESA Protected Area buffer		1.1			1.1	8%
Heavily modified				1.4	1.4	11%
Moderately modified- Old lands				0.8	0.8	6%
Other Natural Areas			2.5		2.5	18%
Grand Total	**6.4**	**2.2**	**2.5**	**2.3**	**13.3**	**100%**
	48%	17%	18%	17%		

B. Access roads

Mpumalanga Biodiversity Sector Plan (2014)	Categories					
Sub-categories	**Critical Biodiversity Area**	**Ecological Support Area**	**Other Natural Areas**	**Heavily or moderately modified**	**Grand Total**	**% cover**
CBA Irreplaceable	11.6				11.6	38%
CBA Optimal	1.9				1.9	6%
ESA Local corridor		1.1			1.1	3%
ESA Protected Area buffer		3.7			3.7	12%
Heavily modified				6.6	6.6	21%
Moderately modified- Old lands				2.0	2.0	6%
Other Natural Areas			4.0		4.0	13%
Grand Total	**13.5**	**4.8**	**4.0**	**8.6**	**30.9**	**100%**
	44%	15%	13%	28%		

5.2 Local Context – Site Visit

5.2.1 Ecosystem Diversity

5.2.1.1 Existing Road Infrastructure

The remaining patches of natural vegetation within the upgrade sections were visited over the 13th and 14th of February 2020. Design information obtained from the engineers in Google Earth format was converted to ESRI shape files, making it possible to determine the location of natural vegetation patches larger than 500m^2 based on the landcover 2014 dataset (Figure 5). The mean patch size per natural vegetation for grasslands and woodlands was below 300 m^2 (Table 5.A), natural vegetation presenting 11.20 ha or 90% of the area to be upgraded. Eleven plots were sampled within the remaining terrestrial patches.

Of the eleven plots surveyed, seven plots were surveyed within the Grassland Biome (Figure 6) (Appendix D). Although classified as grassland, on a national scale, on a local scale, these patches of natural grassland, represents mainly secondary grassland within the existing road reserve or under the influence of the adjacent land use such as cultivation and forestry. The high percentage frequency of the following species supports this statement (Appendix D): *Digitaria eriantha* and *Eragrostis curvula*, both grass species frequently used in rehabilitation of roadside areas (Van Outdshoorn 1991, Tainton 1999). Other species present also associated with disturbance are: *Cenchrus ciliaris*, *Paspalum urvillei* and *Verbena bonariens*. Species associated with climax and sub-climax conditions are present, indicating that succession is occur over time, within these reserve - and disturbed areas, namely: *Themeda triandra*, *Acalypha angustrata*, *Andropogon chinensis* (Van Wyk & Malan 1988).

Three of the remaining four plots, were located within Savanna Biome (Figure 6), these areas is also mainly located within the road reserve. The presence of the following species confirms this statement (Appendix D): *Digitaria eriantha*, *Heteropogon contortus* and *Hyperthelia dissoluta*. Digitaria eriantha once again is associated with rehabilitated/ stabilised areas, while *Heteropogon contortus* and *Hyperthelia dissoluta* (Van Outdshoorn 1991) are pioneer species. Also, within these servitude areas, climax species are moving in overtime such as (Table 6): *Acacia sieberiana*, *Andropogon chinensis*, *Bauhinia galpinii* and *Eragrostis racemosa*. The presence of both alien invasive and disturbance species confirms the successional nature of these areas (Table 7). In natural or pristine areas, the percentage of alien invasive and disturbance species would be below 20%.

It should be noted on a local scale within the landscape, the vegetation communities form a mosaic, with patches of either grassland or savanna occurring within the regional biome classification, this is especially true on the ecotone between the high lying grassland and low-lying bushveld. As the terrain ruggedness increases the biodiversity increases, due to the micro-habitat present (Figure 7, Table 8, Figure 8). Rugged terrain is generally associated with surface rock and variation in altitude, slope and aspect over a short distance (Photo 6). It is evident that the proposed road upgrade sections avoid the high and very high terrain ruggedness areas, and influences less than 1% of the very low, low and moderate terrain ruggedness areas on a landscape level (Table 9).

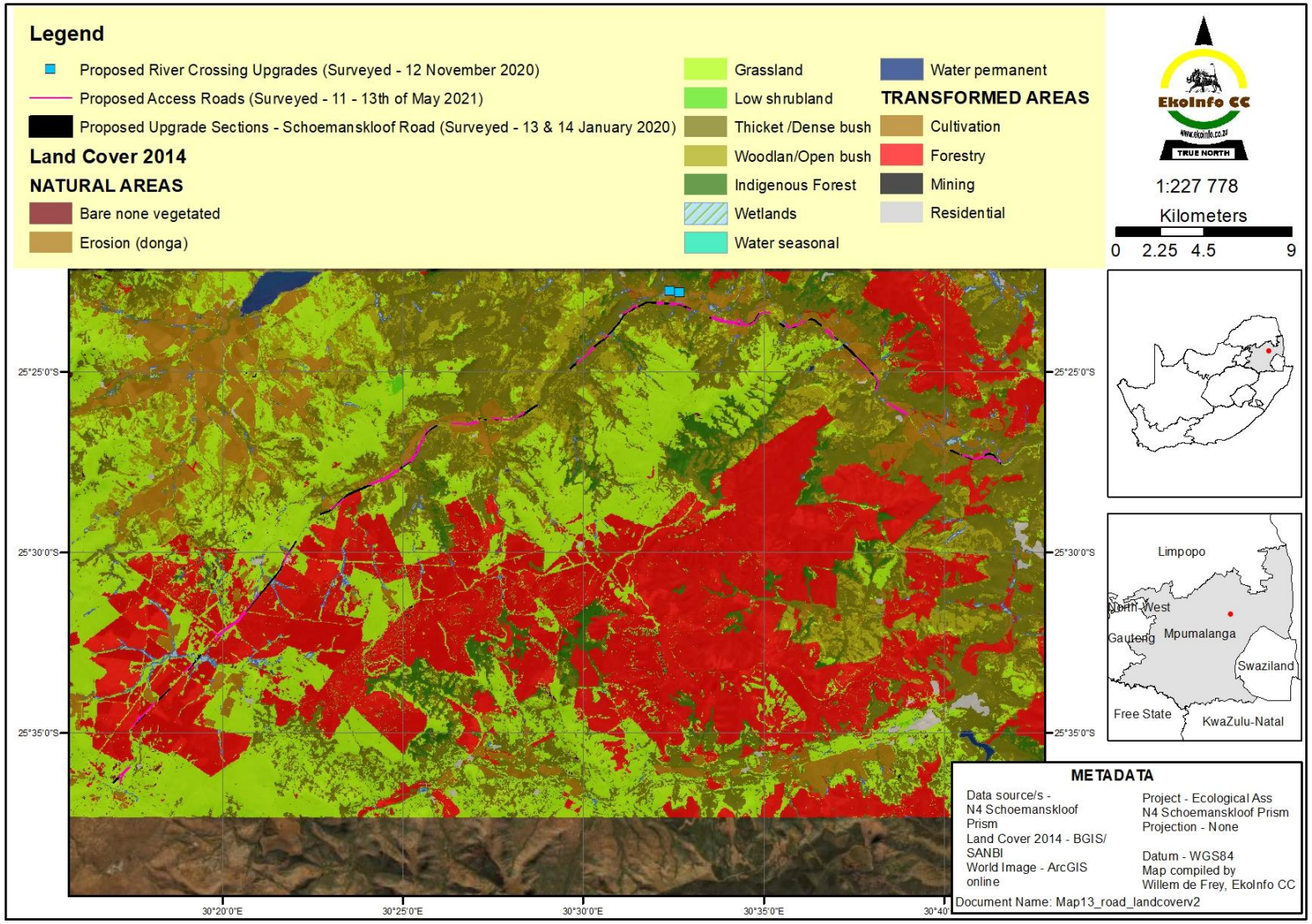


Figure 5: Overview of land cover 2014 categories along the proposed upgrade sections of the Schoemanskloof road

Table 5: Overview of the land cover 2014 categories within the upgraded sections along the Schoemanskloof road

A. Existing Road Infrastructure

Land Cover 2014 Categories	No of patches	Total Surface Area (ha)	Mean patch size (m^2)	% Cover	Derived Ecological Status	
					Natural	Transformed
Bare none vegetated	4	0.02	43	0%		0.02
Cultivated comm fields (high)	2	0.01	35	0%		0.01
Cultivated comm fields (low)	16	0.25	159	2%		0.25
Cultivated comm fields (med)	13	0.31	236	2%		0.31
Cultivated orchards (high)	9	0.04	44	0%		0.04
Cultivated orchards (low)	2	0.01	70	0%		0.01
Cultivated orchards (med)	21	0.14	67	1%		0.14
Grassland	162	3.55	219	29%	3.55	
Indigenous Forest	1	0.01	53	0%	0.01	
Low shrubland	40	0.31	77	2%	0.31	
Plantation / Woodlots young	1	0.00	9	0%		0.00
Plantations / Woodlots mature	35	0.42	121	3%		0.42
Thicket /Dense bush	161	3.63	225	29%	3.63	
Urban built-up (dense trees / bush)	2	0.00	25	0%		0.00
Wetlands	27	0.52	191	4%	0.52	
Woodland/Open bush	207	3.20	155	26%	3.20	
Grand Total	**703**	**12.41**		**100%**	**11.20**	**1.21**
					90%	10%

B. Proposed Access Roads

Land Cover 2014 Categories	No of patches	Total Surface Area (ha)	Mean patch size (m^2)	% Cover	Derived Ecological Status	
					Natural	Transformed
Bare none vegetated	8	0.21	264	1%		0.21
Cultivated comm fields (high)	9	0.52	576	2%		0.52
Cultivated comm fields (low)	35	1.07	305	4%		1.07
Cultivated comm fields (med)	48	1.51	315	5%		1.51
Cultivated comm pivots (high)	1	0.08	798	0%		0.08
Cultivated orchards (high)	31	0.78	250	3%		0.78
Cultivated orchards (low)	8	0.14	177	1%		0.14
Cultivated orchards (med)	24	0.65	271	2%		0.65
Grassland	160	6.71	419	24%	6.71	
Indigenous Forest	1	0.04	399	0%	0.04	
Low shrubland	42	0.73	174	3%	0.73	
Plantation / Woodlots young	1	0.02	154	0%		0.02
Plantations / Woodlots mature	35	2.33	666	8%		2.33
Thicket /Dense bush	155	7.30	471	26%	7.30	
Urban built-up (dense trees / bush)	1	0.01	83	0%		0.01
Wetlands	20	0.55	277	2%	0.55	
Woodland/Open bush	191	5.15	270	19%	5.15	
Grand Total	**770**	**27.80**		**100%**	**20.49**	**7.31**
					74%	26%

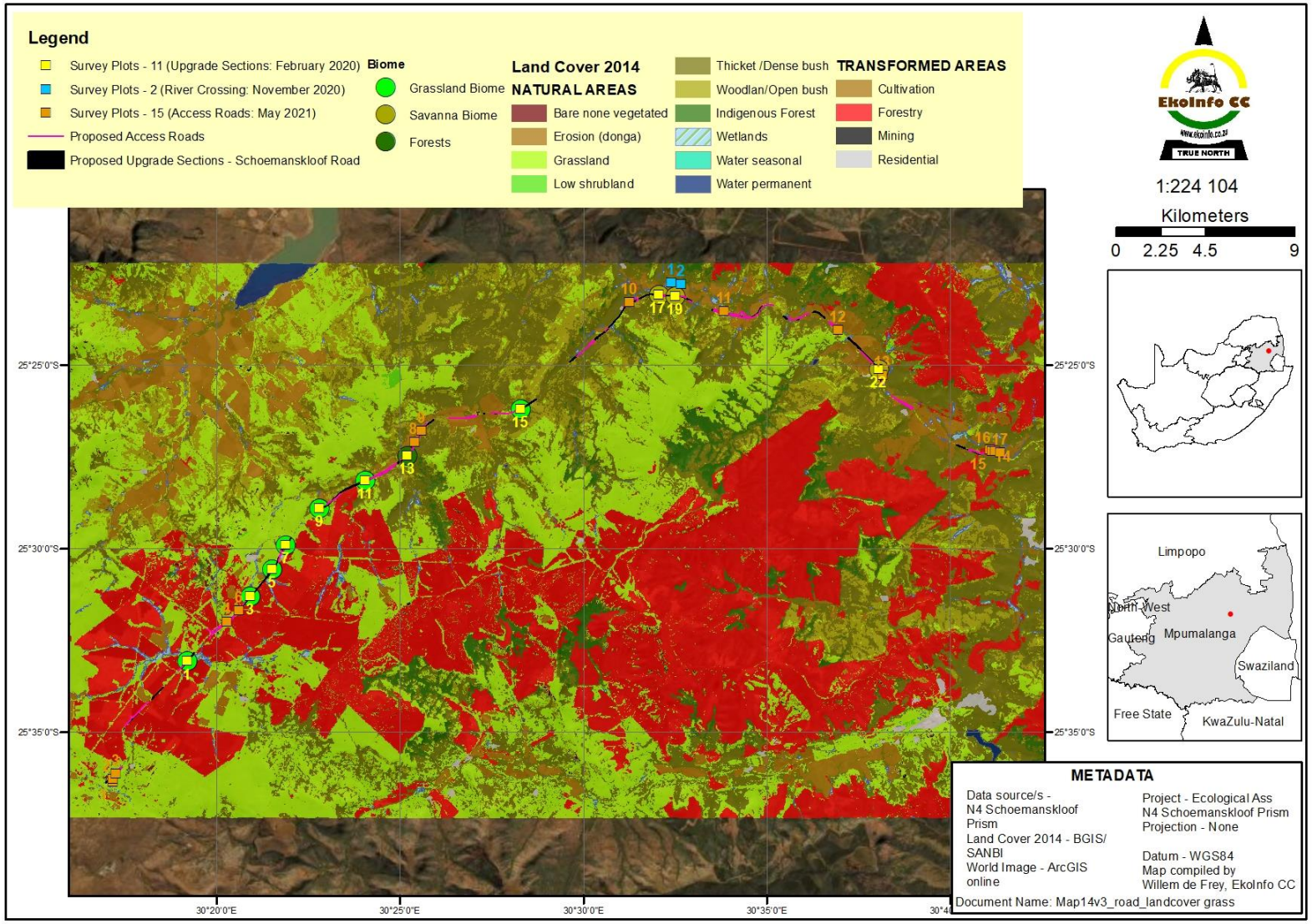


Figure 6: Distribution of the 26 survey plots (Feb 2020 & May 2021) where natural vegetation exceeds 500 m^2 and two aquatic survey plots (Nov 2020)

Table 6: Overview of the plant species recorded within the proposed upgrade sections and their associated ecological indicator

G	Grassland Associated Plots
S	Savanna Associated Plots

Ecological Indicator	Plots Surveyed									
Botanical Name	**1**	**3**	**5**	**7**	**9**	**11**	**15**	**17**	**19**	**22**
Alien invasive	**1**				**2**		**1**		**3**	
Araujia sericifera									1	
Eucalyptus camaldulensis	1									
Jacaranda mimosifolia					1				1	
Lantana camara							1			
Melia azedarach									1	
Opuntia ficus-indica					1					
Climax		**1**	**8**		**12**	**3**	**5**		**5**	**2**
Acacia caffra					1	1				
Acacia sieberiana						1			1	
Acalypha angustata			1							
Aloe species					1					
Andropogon chinensis							1			
Anthephora pubescens			1							
Bauhinia galpinii									1	
Brachiaria serrata			1							
Celtis africana					1					
Cussonia paniculata					1					
Cussonia spicata					1					
Diospyros whyteana					1					
Dombeya rotundifolia					1					
Eragrostis racemosa			1							1
Erica cerinthoides			1							1
Erythrina lysistemon									1	
Euclea natalensis							1			
Ficus species									1	
Geigeria burkei							1			
Grewia species									1	
Hypoxis obtusa		1								
Ipomoea oblongata			1							
Olea europaea					1					
Rhynchosia totta							1			
Senecio venosus					1					
Setaria sphacelata							1			

Ecological Indicator	Plots Surveyed									
Botanical Name	**1**	**3**	**5**	**7**	**9**	**11**	**15**	**17**	**19**	**22**
Themeda triandra			1			1				
Vangueria infausta					1					
Vernonia natalensis			1							
Zanthoxylum capense					1					
Ziziphus mucronata					1					
Disturbance	**2**	**5**	**2**	**4**	**1**	**1**	**7**	**2**	**3**	**8**
Acacia karroo							1			
Conyza bonariensis				1					1	
Digitaria eriantha	1	1	1	1	1	1	1	1	1	1
Eragrostis curvula	1	1	1				1			1
Eragrostis plana		1					1			1
Heteropogon contortus									1	1
Hyparrhenia filipendula							1			
Hyperthelia dissoluta								1		1
Melinis repens				1						1
Paspalum urvillei		1					1			1
Ruellia patula										1
Verbena bonariensis		1		1						
Verbena tenuisecta							1			
Sub climax					**1**	**1**			**1**	
Cenchrus ciliaris					1	1			1	
Grand Total	**3**	**6**	**10**	**4**	**16**	**5**	**13**	**2**	**12**	**10**

Table 7: Overview of the number of alien invasive species and disturbance species recorded per biome type

Species Status	Biome Type		Grand Total
	Grassland Biome	Savanna Biome	
Alien invasive	4	3	7
Climax	29	7	36
Disturbance	22	13	35
Sub climax	2	1	3
Grand Total	**57**	**24**	**81**
Species Status	**Biome Type**		**Grand Total**
	Grassland Biome	**Savanna Biome**	
Alien invasive	7%	13%	9%
Climax	51%	29%	44%
Disturbance	39%	54%	43%
Sub climax	4%	4%	4%
Grand Total	**100%**	**100%**	**100%**
Alien invasive & Disturbance	46%	67%	52%
Climax & Sub-climax	54%	33%	48%
Grand Total	**100%**	**100%**	**100%**

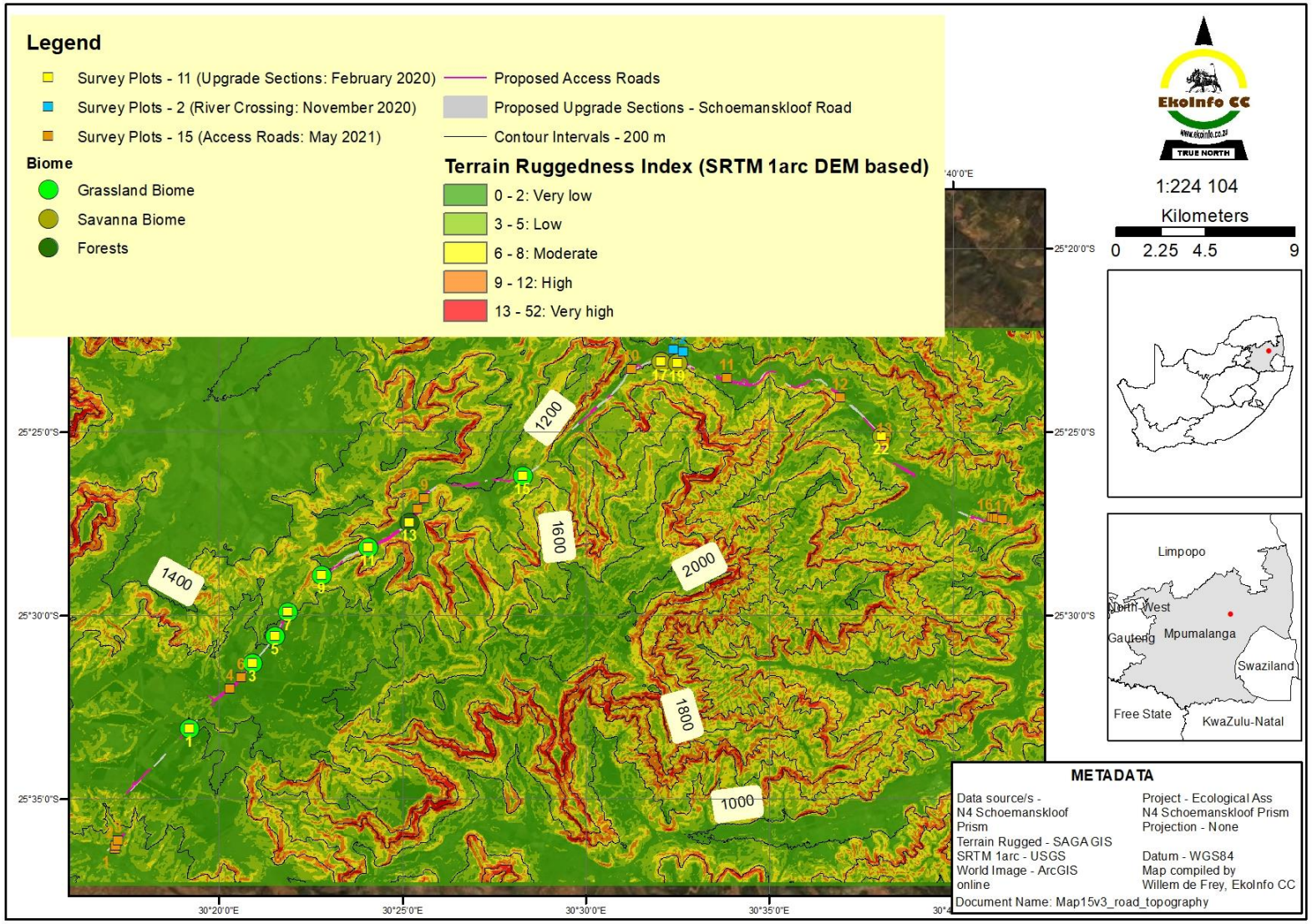


Figure 7: Terrain ruggedness index based on the SRTM 1arc DEM along the upgrade sections and the surrounding landscape

Table 8: Overview of the topographic attributes associated with the plots surveyed

Plot no	Topographic Attributes					No of species
	Altitude (m)	Slope (°)	Aspect	Terrain ruggedness index	Terrain ruggedness index class	
1	1599	6	West	1.9	Very low	3
3	1629	4	West	1.1	Very low	6
5	1630	4	West	1.2	Very low	10
7	1589	1	West	1.4	Very low	4
9	1436	12	North	3.5	Low	16
11	1310	3	North	0.8	Very low	5
13	1278	4	West	2.3	Low	
15	1266	7	North	2.3	Low	13
17	984	6	North	2.3	Low	2
19	976	8	North	3.4	Low	12
22	911	6	East	1.7	Very low	10

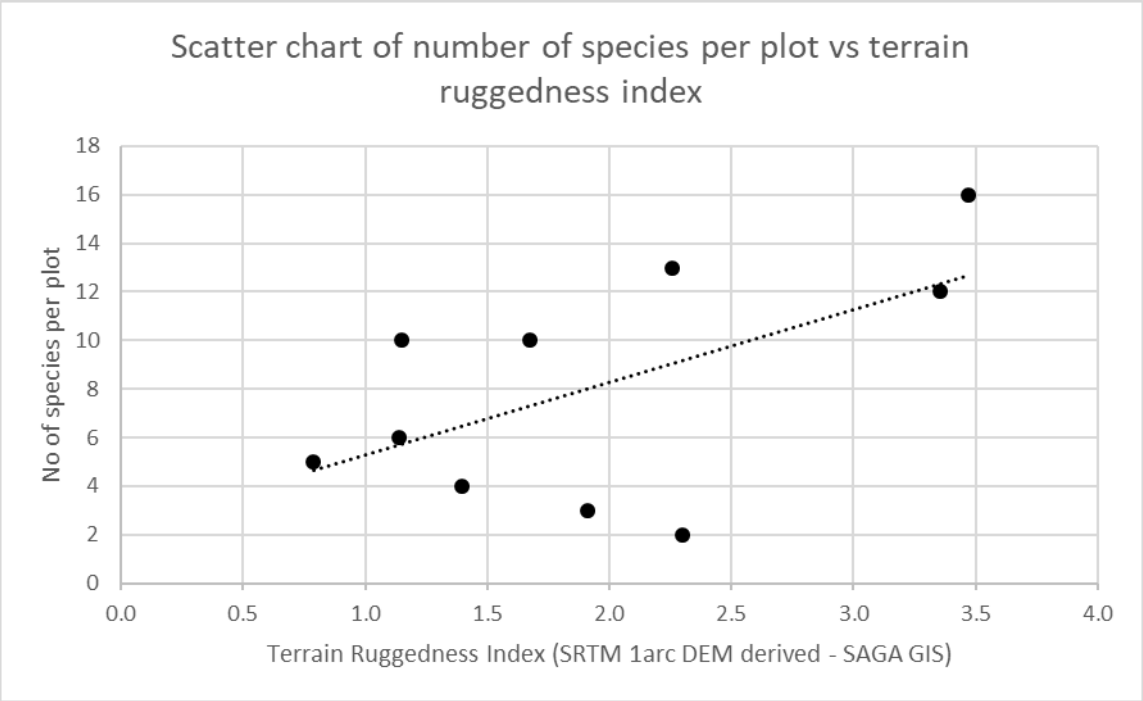


Figure 8: Scatter chart of number of species per plot vs terrain ruggedness index – Upgrade Sections

Photo 6: Example of rugged terrain with surface rock (In the vicinity of Plot 9)

Table 9: Overview of the surface area and percentage cover of rugged terrain within the road upgrade sections and surrounding landscape

Terrain Ruggedness Classes	Road upgrade sections	Surrounding landscape	Grand Total	Upgrade sections as % of total landscape
Very low	8.4	44 474	44 483	0.02%
Low	4.0	41 569	41 573	0.01%
Moderate	0.3	27 836	27 837	0.00%
High		14 788	14 788	0.00%
Very high		3 789	3 789	0.00%
Grand Total (ha)	**12.8**	**132 456**	**132 469**	**0.01%**
Terrain Ruggedness Classes	**Road upgrade sections**	**Surrounding landscape**	**Grand Total**	
Very low	66%	34%	34%	
Low	32%	31%	31%	
Moderate	2%	21%	21%	
High	0%	11%	11%	
Very high	0%	3%	3%	
Grand Total	**100%**	**100%**	**100%**	

5.2.1.2 River Crossings

On the 12th of November 2020, two additional sites where surveyed which concerns river crossings (Figure 6). These two plots are associated with the riparian fringe of the Crocodile River (Appendix G).

Both sites are regionally associated with the Savanna Biome, and specifically with the endangered Legogote Sour Bushveld. However, these sites differ from the terrestrial vegetation described above, in that typical species associated with riparian fringes in the Savanna Biome had been recorded during the site visit namely: *Acacia ataxacantha, Acacia karroo, Celtis africana, Combretum erythrophyllum, Dalbergia armata, Dombeya burgessiae, Grewia occidentalis* var. *occidentalis, Phragmites australis, Rhoicissus tomentosa, Syzygium cordatum* subsp. *cordatum*.

5.2.1.3 Proposed Access Roads

Similar to the areas earmarked for upgrading along the existing road infrastructure, areas larger than 500 m^2 were targeted for surveys (Figure 6). Design information obtained from the engineers in Google Earth format was converted to ESRI shape files, making it possible to determine the location of natural vegetation patches larger than 500m^2 based on the landcover 2014 dataset (Figure 5). The mean patch size per natural vegetation for grasslands was 419 m^2 and for woodlands was below 270 m^2 (Table 5.B), natural vegetation presenting 20.49 ha or 74 % of the area to be used for improving access. Fifteen (15) plots were sampled in total during May 2021.

Of the fifteen plots surveyed, six (6) plots were surveyed within the Grassland Biome (Figure 6) (Appendix I). The following 34 species were only recorded within the Grassland Biome plots, of which those in **bold** are climax species: *Acacia mearnsii, Acacia robusta, Acanthospermum australe, **Alloteropsis semialata**, Aristida junciformis, **Becium obovatum**, Berchemia zeyheri, Berkheya radula, **Brachiaria serrata**, **Cliffortia species** (101_2015), Conyza podocephala, **Dianthus mooiensis**, Ehretia rigida, Eragrostis capensis, Eragrostis gummiflua, Eragrostis racemosa, Felicia muricata, Geigeria burkei, Grewia occidentalis, **Helichrysum aureonitens, Helichrysum pilosellum, Helichrysum rugulosum, Hermannia linearifolia**, Indigofera melanadenia, Leonotis leonurus, Oenothera rosea, **Panicum natalense, Pentanisia angustifolia, Peucedanum magalismontanum, Pollichia campestris**, Protasparagus laricinus, Rubus rigidus, Solanum sisymbriifolium, Striga bilabiate* (Van Wyk & Malan 1988). The presence of woody species among these 34 species shows the transitional nature of this area from proper Grassland in the west to Savanna in the east.

The remaining nine (9) were located within Savanna Biome (Figure 6), it is evident from the mean number of species recorded per plot (Appendix I - 24) in the proposed access areas compared to the upgrade sections (Appendix D - 8), that these areas cover more natural areas. The following 54 species support this statement, with the species in **bold** typical Savanna woodies: *Acacia ataxacantha, **Acacia sieberiana**, Ageratum houstonianum, Bauhinia galpinii, Berkheya seminivea, Berkheya setifera, Bowkeria cymosa, Brachylaena huillensis, **Breonadia salicina**, Bridelia micrantha, Cheilanthes viridis, Clematis brachiata, **Combretum collinum, Combretum erythrophyllum, Combretum molle, Cussonia natalensis, Cussonia spicata, Dalbergia armata**, Dicliptera clinopodia, Dombeya pulchra, Englerophytum magalismontanum,*

Eucalyptus species (115_2092), ***Euclea divinorum***, *Eustachys paspaloides*, ***Faurea saligna***, *Heteropyxis natalensis*, ***Hippobromus pauciflorus***, *Hyparrhenia hirta*, ***Hyperthelia dissoluta***, *Ilex mitis, Imperata cylindrica, Jacaranda mimosifolia, Lantana camara, Melia azedarach, Nidorella hottentotica*, ***Olea europaea***, *Parinari capensis, Paspalum urvillei*, ***Pavetta edentula, Peltophorum africanum***, *Phymaspermum athanasioides, Pogonarthria squarrosa, Protasparagus virgatus, Protea caffra, Psidium guajava*, ***Pterocarpus angolensis***, *Pterocarpus rotundifolius, Rhamnus prinoides, Rhoicissus tridentata, Rhus lancea, Setaria lindenbergiana*, ***Strychnos madagascariensis***, *Syzygium cordatum, Tagetes minuta* (Van Wyk & Van Wyk 1997, Van Wyk & Malan 1988).

The following 38 species were recorded within both the plots associated with either Grassland or Savanna, and highligths the transitional nature of the landscape along the existing road: *Acacia caffra, Aloe greatheadii, Athrixia elata, Bewsia biflora, Bidens pilosa, Celtis africana, Clerodendrum glabrum, Crabbea hirsuta, Cymbopogon excavatus, Cymbopogon validus, Dichrostachys cinerea, Diospyros lycioides, Diospyros whyteana, Dombeya rotundifolia, Dovyalis caffra, Eragrostis curvula, Euclea crispa, Euclea undulata, Gladiolus crassifolius, Helichrysum nudifolium, Heteropogon contortus, Hypoxis rigidula, Lippia javanica, Loudetia flavida, Melinis repens, Panicum maximum, Rhus chirindensis, Rhus dentata, Rhus rehmanniana, Senecio polyanthemoides, Senecio venosus, Setaria sphacelata, Sporobolus pyramidalis, Themeda triandra, Trachypogon spicatus, Vernonia natalensis, Zanthoxylum capense, Ziziphus mucronate*.

Duplicating the terrain ruggedness analysis (Figure 7), it is evident from Table 10 that the access roads are planned in areas of very low to low ruggedness, as would be expected, as it would simplify construction activities and improve overall visibility. There is a slight increase in species with an increase in ruggedness (Figure 9), but not significantly, which is attributed to the closer spacing of the plots, which makes the trend less pronounced.

Overall, it can be concluded that the proposed access roads avoid the high and very high ruggedness areas (Table 11), with 74% or 20 ha being associated with very low ruggedness areas. Due to the lower habitat complexity associated with very low and low ruggedness areas, it is expected that less species would occur there, and fewer species adapted to specific habitats (Barbour **et al.** 1980, Wiens **et al.** 2006), thereby lowering the risk of impacting on species with narrow distribution ranges or small populations. Rare and/ or threatened species[4] are often associated with narrow distribution ranges or localised populations (Van Wyk & Smith 2001, Golding 2002).

[4] https://www.britannica.com/science/conservation-ecology/Preventing-the-loss-of-biodiversity

Table 10: Overview of the topographic attributes at the plots surveyed within the areas earmarked for the proposed access roads

Plot no	Topographic Attributes			Species per plot
	altitude	Terrain Ruggedness Index	Terrain Ruggedness Index Class	
1	1527.84	4.040798	Low	24
2	1533.81	3.347046	Low	21
3	1544.67	2.312464	Low	21
4	1674.38	1.460128	Very low	16
6	1659.66	1.182398	Very low	13
8	1278.9	1.886067	Very low	30
9	1242.35	0.925269	Very low	28
10	996.61	2.018787	Very low	26
11	936.21	1.392277	Very low	25
12	897.63	3.314774	Low	26
13	897.96	2.831732	Low	28
14	884.03	3.500748	Low	19
15	880.41	3.789778	Low	26
16	855.72	2.517505	Low	18
17	824.79	2.657186	Low	21

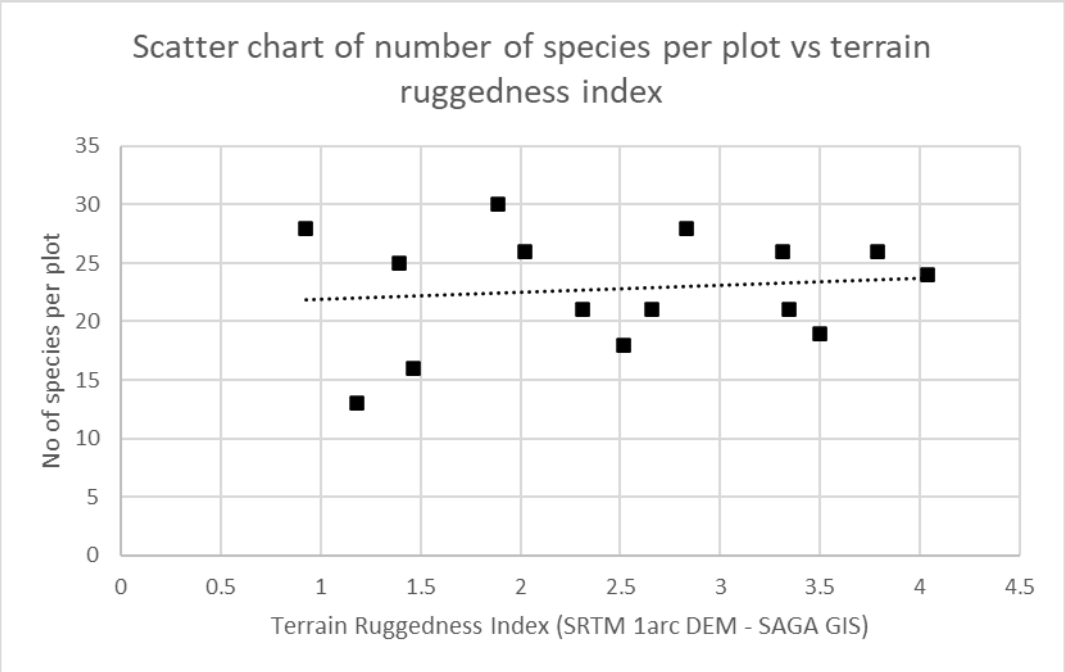


Figure 9: Scatter chart of number of species per plot vs terrain ruggedness index – Access Roads

Table 11: Overview of the surface area and percentage cover of rugged terrain within the proposed access roads and surrounding landscape

Terrain Ruggedness Classes	Access roads	Surrounding landscape	Grand Total	Upgrade sections as % of total landscape
Very low	20	43 263	43 283	0.05%
Low	6	41 541	41 547	0.01%
Moderate	1	27 816	27 817	0.00%
High		14 789	14 789	0.00%
Very high		3 791	3 791	0.00%
Grand Total	**27**	**131 201**	**131 227**	**0.02%**
Terrain Ruggedness Classes	**Access roads**	**Surrounding landscape**	**Grand Total**	
Very low	74%	33%	33%	
Low	23%	32%	32%	
Moderate	3%	21%	21%	
High	0%	11%	11%	
Very high	0%	3%	3%	
Grand Total	**100%**	**100%**	**100%**	

5.2.2 Species Diversity

5.2.2.1 Existing Road Infrastructure

During the survey 51 species were recorded of which the majority were woody species (trees and shrubs) at 44% or 22 species (Table 12), followed by grasses 29% (15 species) and then forbs at 27% or 14 species. The 51 species recorded is below the 68 species listed for the Legogote Sour Bushveld and 165 species listed for the Lydenburg Montane Grassland, highlighting the non-climax status of the vegetation within the proposed road upgrade sections.

Within the grassland associated plots, 42 species were recorded, with woody species representing 40% of the species recorded, which highlights once again the transitional nature of the area between grassland and savanna (Table 12). Within the savanna associated plots, 20 species were recorded, with grasses representing 45%.

5.2.2.2 River Crossings

At the two riparian fringe associated sites within the Legotote Sour Bushveld, the dominant growth form was woody species (Appendix H), representing 69% of the 32 species recorded.

5.2.2.3 Proposed Access Roads

During the survey 126 species were recorded of which the majority were woody species (trees and shrubs) at 49% or 62 species (Table 13), followed by grasses 21% (26 species) and then forbs at 30% or 38 species. The 126 species recorded is above the 68 species listed for the Legogote Sour Bushveld and below 165 species listed for the Lydenburg Montane Grassland, highlighting the climax status of the vegetation within the proposed access roads.

Within the grassland associated plots, 72 species were recorded, with woody species representing 33% of the species recorded, which highlights once again the transitional nature of the area between grassland and savanna (Table 13). Within the savanna associated plots, 92 species were recorded, with grasses representing 21%.

5.2.3 Species Of Concern

5.2.3.1 Existing Road Infrastructure

No threatened Red Data plants were recorded within the plots surveyed, the majority of the species were least concern or not evaluated.

No protected species in terms of the National Environmental Management Biodiversity Act (No 10 of 2004) were recorded within the plots surveyed.

No nationally protected trees in terms of the National Forest Act (No 84 of 1998), had been recorded within the plots surveyed, however individuals of *Pterocarpus angolensis* and *Sclerocarya birrea*, were noted within the Savanna biome area towards the east. These species have a wide distribution in the area, and individuals were noted higher up in the landscape, away from the road. Neither of these two species are threatened Red Data plants, there Red Data status

Table 12: Overview of the major growth forms associated with the species recorded during the site visit – Upgrade Sections

Major Growth Form	Physiognomic Unit		Count	No of species	% of all species
Botanical Name	Grassland Plots	Savanna Plots			
Forbs				14	27%
Acalypha angustata	1	0	1		
Aloe species	1	0	1		
Araujia sericifera	0	1	1		
Conyza bonariensis	1	1	1		
Erica cerinthoides	1	1	1		
Geigeria burkei	1	0	1		
Hypoxis obtusa	1	0	1		
Ipomoea oblongata	1	0	1		
Rhynchosia totta	1	0	1		
Ruellia patula	0	1	1		
Senecio venosus	1	0	1		
Verbena bonariensis	1	0	1		
Verbena tenuisecta	1	0	1		
Vernonia natalensis	1	0	1		
Grasses				15	29%
Andropogon chinensis	1	0	1		
Anthephora pubescens	1	0	1		
Brachiaria serrata	1	0	1		
Cenchrus ciliaris	1	1	1		
Digitaria eriantha	1	1	1		
Eragrostis curvula	1	1	1		
Eragrostis plana	1	1	1		
Eragrostis racemosa	1	1	1		
Heteropogon contortus	0	1	1		
Hyparrhenia filipendula	1	0	1		
Hyperthelia dissoluta	0	1	1		
Melinis repens	1	1	1		
Paspalum urvillei	1	1	1		
Setaria sphacelata	1	0	1		
Themeda triandra	1	0	1		
Woody				22	43%
Acacia caffra	1	0	1		
Acacia karroo	1	0	1		
Acacia sieberiana	1	1	1		
Bauhinia galpinii	0	1	1		

Major Growth Form	Physiognomic Unit		Count	No of species	% of all species
Botanical Name	Grassland Plots	Savanna Plots			
Celtis africana	1	0	1		
Cussonia paniculata	1	0	1		
Cussonia spicata	1	0	1		
Diospyros whyteana	1	0	1		
Dombeya rotundifolia	1	0	1		
Erythrina lysistemon	0	1	1		
Eucalyptus camaldulensis	1	0	1		
Euclea natalensis	1	0	1		
Ficus species	0	1	1		
Grewia species	0	1	1		
Jacaranda mimosifolia	1	1	1		
Lantana camara	1	0	1		
Melia azedarach	0	1	1		
Olea europaea	1	0	1		
Opuntia ficus-indica	1	0	1		
Vangueria infausta	1	0	1		
Zanthoxylum capense	1	0	1		
Ziziphus mucronata	1	0	1		
Grand Total	**42**	**20**	**51**	**51**	**100%**
Forbs	12	4			
Grasses	13	9			
Woody species	17	7			
Forbs	29%	20%			
Grasses	31%	45%			
Woody species	40%	35%			

Table 13: Overview of the major growth forms associated with the species recorded during the site visit – Access roads

Major Growth Forms	Physiognomic Units		Count	No of species	% of all species
Botanical Names	Grassland	Savanna			
Forbs				38	30%
Acanthospermum australe	1	0	1		
Ageratum houstonianum	0	1	1		
Aloe greatheadii	1	1	1		
Athrixia elata	1	1	1		
Becium obovatum	1	0	1		
Berkheya radula	1	0	1		
Berkheya seminivea	0	1	1		
Berkheya setifera	0	1	1		
Bidens pilosa	1	1	1		
Cheilanthes viridis	0	1	1		
Clematis brachiata	0	1	1		
Conyza podocephala	1	0	1		
Crabbea hirsuta	1	1	1		
Dianthus mooiensis	1	0	1		
Dicliptera clinopodia	0	1	1		
Felicia muricata	1	0	1		
Geigeria burkei	1	0	1		
Gladiolus crassifolius	1	1	1		
Helichrysum aureonitens	1	0	1		
Helichrysum nudifolium	1	1	1		
Helichrysum pilosellum	1	0	1		
Helichrysum rugulosum	1	0	1		
Hermannia linearifolia	1	0	1		
Hypoxis rigidula	1	1	1		
Indigofera melanadenia	1	0	1		
Leonotis leonurus	1	0	1		
Nidorella hottentotica	0	1	1		
Oenothera rosea	1	0	1		
Parinari capensis	0	1	1		
Pentanisia angustifolia	1	0	1		
Peucedanum magalismontanum	1	0	1		
Pollichia campestris	1	0	1		
Senecio polyanthemoides	1	1	1		
Senecio venosus	1	1	1		
Solanum sisymbriifolium	1	0	1		
Striga bilabiata	1	0	1		
Tagetes minuta	0	1	1		
Vernonia natalensis	1	1	1		

Major Growth Forms	Physiognomic Units		Count	No of species	% of all species
Botanical Names	Grassland	Savanna			
Grasses				26	21%
Alloteropsis semialata	1	0	1		
Aristida junciformis	1	0	1		
Bewsia biflora	1	1	1		
Brachiaria serrata	1	0	1		
Cymbopogon excavatus	1	1	1		
Cymbopogon validus	1	1	1		
Eragrostis capensis	1	0	1		
Eragrostis curvula	1	1	1		
Eragrostis gummiflua	1	0	1		
Eragrostis racemosa	1	0	1		
Eustachys paspaloides	0	1	1		
Heteropogon contortus	1	1	1		
Hyparrhenia hirta	0	1	1		
Hyperthelia dissoluta	0	1	1		
Imperata cylindrica	0	1	1		
Loudetia flavida	1	1	1		
Melinis repens	1	1	1		
Panicum maximum	1	1	1		
Panicum natalense	1	0	1		
Paspalum urvillei	0	1	1		
Pogonarthria squarrosa	0	1	1		
Setaria lindenbergiana	0	1	1		
Setaria sphacelata	1	1	1		
Sporobolus pyramidalis	1	1	1		
Themeda triandra	1	1	1		
Trachypogon spicatus	1	1	1		
Woodies				62	49%
Acacia ataxacantha	0	1	1		
Acacia caffra	1	1	1		
Acacia mearnsii	1	0	1		
Acacia robusta	1	0	1		
Acacia sieberiana	0	1	1		
Bauhinia galpinii	0	1	1		
Berchemia zeyheri	1	0	1		
Bowkeria cymosa	0	1	1		
Brachylaena huillensis	0	1	1		
Breonadia salicina	0	1	1		
Bridelia micrantha	0	1	1		
Celtis africana	1	1	1		
Clerodendrum glabrum	1	1	1		
Cliffortia species (101_2015)	1	0	1		

Major Growth Forms	Physiognomic Units		Count	No of species	% of all species
Botanical Names	Grassland	Savanna			
Combretum collinum	0	1	1		
Combretum erythrophyllum	0	1	1		
Combretum molle	0	1	1		
Cussonia natalensis	0	1	1		
Cussonia spicata	0	1	1		
Dalbergia armata	0	1	1		
Dichrostachys cinerea	1	1	1		
Diospyros lycioides	1	1	1		
Diospyros whyteana	1	1	1		
Dombeya pulchra	0	1	1		
Dombeya rotundifolia	1	1	1		
Dovyalis caffra	1	1	1		
Ehretia rigida	1	0	1		
Englerophytum magalismontanum	0	1	1		
Eucalyptus species (115_2092)	0	1	1		
Euclea crispa	1	1	1		
Euclea divinorum	0	1	1		
Euclea undulata	1	1	1		
Faurea saligna	0	1	1		
Grewia occidentalis	1	0	1		
Heteropyxis natalensis	0	1	1		
Hippobromus pauciflorus	0	1	1		
Ilex mitis	0	1	1		
Jacaranda mimosifolia	0	1	1		
Lantana camara	0	1	1		
Lippia javanica	1	1	1		
Melia azedarach	0	1	1		
Olea europaea	0	1	1		
Pavetta edentula	0	1	1		
Peltophorum africanum	0	1	1		
Phymaspermum athanasioides	0	1	1		
Protasparagus laricinus	1	0	1		
Protasparagus virgatus	0	1	1		
Protea caffra	0	1	1		
Psidium guajava	0	1	1		
Pterocarpus angolensis	0	1	1		
Pterocarpus rotundifolius	0	1	1		
Rhamnus prinoides	0	1	1		
Rhoicissus tridentata	0	1	1		
Rhus chirindensis	1	1	1		
Rhus dentata	1	1	1		
Rhus lancea	0	1	1		

Major Growth Forms	Physiognomic Units		Count	No of species	% of all species
Botanical Names	Grassland	Savanna			
Rhus rehmanniana	1	1	1		
Rubus rigidus	1	0	1		
Strychnos madagascariensis	0	1	1		
Syzygium cordatum	0	1	1		
Zanthoxylum capense	1	1	1		
Ziziphus mucronata	1	1	1		
Grand Total	**72**	**92**	**126**	**126**	**100%**
Forbs	29	19			
Grasses	19	19			
Woody species	24	54			
Forbs	40%	21%			
Grasses	26%	21%			
Woody species	33%	59%			

is Least Concern[5]. A permit is required to remove/ destroy nationally protected trees. *Sclerocarya birrea* were recorded at the river crossing two.

Two provincially protected species in terms of the Mpumalanga Nature Conservation Act (No 10 of 1998) had been recorded within the plots surveyed, namely *Olea europaea* and *Aloe* species, it should be noted that all species in the genus *Olea* is protected, as well as all the *Aloe* species restricted to Mpumalanga Province, except the following species: *A. aculeata, A. ammophilla; A. arborescens A. barbertoniae, A. castanae, A. davyana, A. globuligemma, A. grandidentata, A. lutescens, A. marlothii, A. mutans, A. parvibracteata, A. transvaalensis* and *A. wickensii*. It should be noted that a permit is only required if the species are going to be sold or relocated, the Act (Section 70) makes provision for the removal/ destruction of protected species for development by the landowner. It is highly likely that more provincially protected species could occur in the proposed upgrade sections consisting of persistent, primary or secondary vegetation (Figure 10). The proposed road upgrade sections transect approximately 6 ha (54%) of persistent, primary vegetation (Table 15.A).

On landscape scale, the proposed road upgrade sections have the potential to influence less than 1% of persistent, primary vegetation (Table 16.A). To contribute to 1% or more loss of habitat for species of concern, 678 ha or more of persistent, primary vegetation needs to be transformed. It should be evident, that the potential influence of the road upgrade sections on species of concern would be insignificant.

Six declared alien invasive species in terms of the National Environmental Management Biodiversity Act, Alien Invasive Species (AIS) Regulations and the Conservation of Agricultural Resource Act was recorded within the plots surveyed. They are: *Araujia sericifera, Eucalyptus camaldulensis. Jacaranda mimosifolia, Lantana camara, Melia azedarach* and *Opuntia ficus-indica*. The majority of the species are category 1b in terms of the NEMBA AIS Regulations (Table 17), and needs to be controlled, which imply that post-construction their establishment within the servitude should be prevented.

5.2.3.2 River Crossings

Additional declared alien invasive species recorded at the riparian fringe crossing sites are *Datura stramonium*, *Populus species* and *Psidium guajava*.

5.2.3.3 Proposed Access Roads

No threatened Red Data plants were recorded within the plots surveyed, the majority of the species were least concern or not evaluated.

No protected species in terms of the National Environmental Management Biodiversity Act (No 10 of 2004) were recorded within the plots surveyed.
Two nationally protected trees in terms of the National Forest Act (No 84 of 1998), had been recorded within the plots surveyed, namely individuals of *Pterocarpus angolensis* and

[5] http://redlist.sanbi.org/redcat.php (Least Concern A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above threatened categories. Species classified as Least Concern are considered at low risk of extinction. **Widespread and abundant species are typically classified in this category**)

Breonadia salicina, were noted within the Savanna biome area towards the east. These species have a wide distribution in the area. Neither of these two species are threatened Red Data plants, there Red Data status is Least Concern[6]. A permit is required to remove/ destroy nationally protected trees. *Sclerocarya birrea* were recorded at the river crossing two and observed elsewhere in the landscape associated with proposed access road in the Savanna Biome.

Seven provincially protected species (Table 14) in terms of the Mpumalanga Nature Conservation Act (No 10 of 1998) had been recorded within the plots surveyed, namely: *Aloe* species, *Berchemia zeyheri, Faurea saligna, Gladiolus crassifolius, Olea europaea, Protea caffra, Pterocarpus angolensis*

It should be noted that all species in the genus *Olea* and *Gladiolus* are protected, as well as all the *Aloe* species restricted to Mpumalanga Province, except the following species: *A. aculeata, A. ammophilla; A. arborescens A. barbertoniae, A. castanae, A. davyana, A. globuligemma, A. grandidentata, A. lutescens, A. marlothii, A. mutans, A. parvibracteata, A. transvaalensis* and *A. wickensii*. Two species within the Proteacea family, had been recorded, namely Protea caffra and Faurea saligna, all species in the Protea family is protected. It should be noted that a permit is only required if the species are going to be sold or relocated, the Act (Section 70) makes provision for the removal/ destruction of protected species for development by the landowner.

It is highly likely that more provincially protected species could occur in the proposed access road sections consisting of persistent, primary or secondary vegetation (Figure 10). The proposed access road sections transect approximately 13 ha (49%) of persistent, primary vegetation (Table 15.B).

On landscape scale, the proposed access road sections have the potential to influence less than 1% of persistent, primary vegetation (Table 16.B). To contribute to 1% or more loss of habitat for species of concern, 678 ha or more of persistent, primary vegetation needs to be transformed. It should be evident, that the potential influence of the access road sections on species of concern would be insignificant.

Six declared alien invasive species in terms of the National Environmental Management Biodiversity Act, Alien Invasive Species (AIS) Regulations and the Conservation of Agricultural Resource Act was recorded within the plots surveyed. They are: *Araujia sericifera, Eucalyptus camaldulensis, Jacaranda mimosifolia, Lantana camara, Melia azedarach* and *Opuntia ficus-indica*. The majority of the species are category 1b in terms of the NEMBA AIS Regulations (Table 17), and needs to be controlled, which imply that post-construction their establishment within the servitude should be prevented.

Individuals of *Eucalyptus* species are prominent within Poplar Creek area (Photo plate 1).

[6] http://redlist.sanbi.org/redcat.php (Least Concern A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above threatened categories. Species classified as Least Concern are considered at low risk of extinction. **Widespread and abundant species are typically classified in this category**)

Table 14: List of provincially protected plant species recorded within the proposed access road areas

Botanical Name	Taxon	Conservation Status
Berchemia zeyheri		Species only
Pterocarpus angolensis		Species only
Faurea saligna	Proteaceae	All species in family
Protea caffra	Proteaceae	All species in family
	Aloe	All species in genus, with exceptions
Gladiolus crassifolius	Gladiolus	All species in genus
Olea europaea	Olea	All species in genus

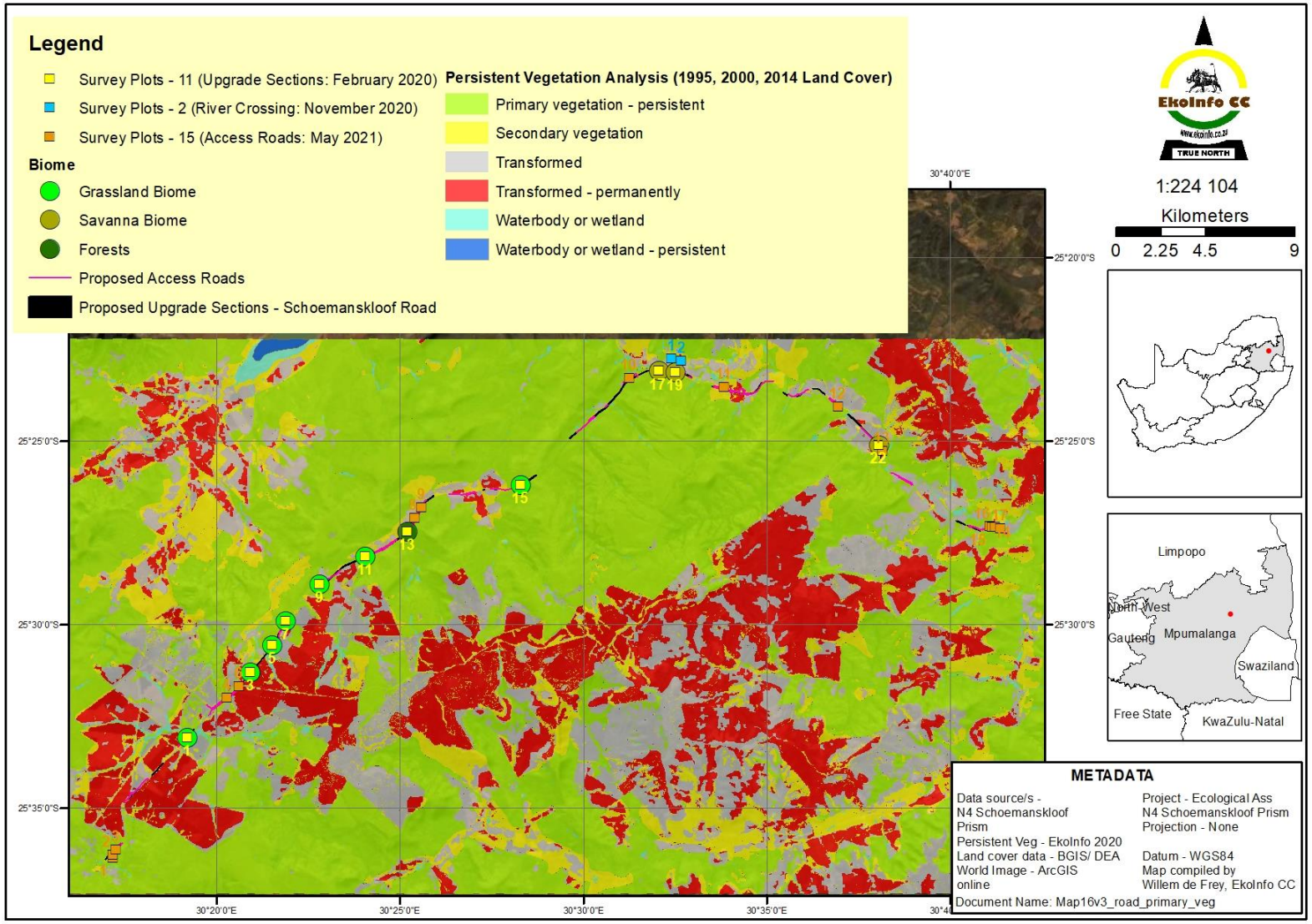


Figure 10: Distribution and extent of persistent, primary vegetation along the proposed road upgrade sections and surrounding landscape

Table 15: Overview of the surface area and percentage cover of persistent, primary vegetation associated with the proposed road upgrade sections

A. Existing Road Infrastructure

Persistent Vegetation Analysis	Surface (ha)	% cover	Species of concern habitat	Transformed habitat
Primary vegetation - persistent	6.6	54%	6.6	
Secondary vegetation	3.9	32%		3.9
Transformed	1.1	9%		1.1
Transformed - permanently	0.1	1%		0.1
Waterbody or wetland	0.5	4%		0.5
Grand Total	**12.3**	**100%**	**6.6**	**5.7**
			54%	46%

B. Proposed Access Roads

Persistent Vegetation Analysis	Surface (ha)	% cover	Species of concern habitat	Transformed Habitat
Primary vegetation - persistent	13.4	49%	13.4	
Secondary vegetation	6.4	23%		6.4
Transformed	6.1	22%		6.1
Transformed - permanently	1.0	4%		1.0
Waterbody or wetland	0.5	2%		0.5
Grand Total	**27.4**	**100%**	**13.4**	**14.0**
			49%	51%

Table 16: Overview of the potential habitat loss for species of concern along the proposed road upgrade section on landscape scale

A. Existing Road Infrastructure

Persistent Vegetation Analysis	Landscape Scale		Upgrade Sections	% of total landscape
	Surface Area (ha)	% Cover	Surface Area (ha)	
Primary vegetation - persistent	67 797	51%	6.6	0.01%
Secondary vegetation	15 676	12%	3.9	0.03%
Transformed	24 008	18%	1.1	0.00%
Transformed - permanently	22 948	17%	0.1	0.00%
Waterbody or wetland	1 510	1%	0.5	0.03%
Waterbody or wetland - persistent	177	0%		0.00%
Total	**132 115**	**100%**	**12.3**	**0.01%**

A. Proposed Access Roads

Persistent Vegetation Analysis	Landscape Scale		Access Roads	% of total landscape
	Surface Area (ha)	% Cover	Surface Area (ha)	
Primary vegetation - persistent	67 797	51%	13.6	0.02%
Secondary vegetation	15 676	12%	6.5	0.04%
Transformed	24 008	18%	6.1	0.03%
Transformed - permanently	22 948	17%	1.0	0.00%
Waterbody or wetland	1 510	1%	0.6	0.04%
Waterbody or wetland - persistent	177	0%		0.00%
Total	**132 115**	**100%**	**27.8**	**0.02%**

Table 17: List of declared alien invasive species recorded within the survey plots

Botanical Names	Conservation of Agricultural Resources Act		NEMBA Alien Invasive Species
	Category	Description	
Araujia sericifera	1	Category 1 plants are weeds and serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment.	1b
Eucalyptus camaldulensis	2	Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.	1b with exceptions
Jacaranda mimosifolia	3	Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.	1b with exceptions
Lantana camara	1	Category 1 plants are weeds and serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment.	1b
Melia azedarach	3	Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.	1b - outside urban areas
Opuntia ficus-indica	1	Category 1 plants are weeds and serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment.	1b

Oblique Image (EkoInfo CC Drone – May 2021)

Photo plate 1: Remote images of the Poplar Creek area highlighting the presence of *Eucalyptus* individuals

5.3 Fauna Component

From the persistent, primary vegetation analysis (Table 16), it is evident that the proposed road section upgrades plus access roads will have limited impact on primary vegetation, and therefore habitat for fauna. Although the upgrades could impact on habitat utilised by fauna, especially ground dwelling fauna, the animals are highly mobile in contrast to the plants. During the site visit limited signs of fauna activity were noted, and it was beyond the scope of the project to install motion cameras to detect animal activities.

Appendix E lists 135 mammal species which had been recorded within the 1-degree grid 2530[7] (Figure 11). The surrounding landscape represents a potential source for these species, especially the conservation areas present, while the drainage lines and ridges providing corridors for their movement (Hilty **et al** 2006). Some of the larger animals (antelope, jackal, baboons, leopard and hippopotamus) could collide with vehicles on the road, while the smaller animals' habitat (burrows) could be destroyed by the construction activities, however very few of these species are threatened (Table 18). Signs warning against the presence of hippopotamus were noted along the Crocodile River.

Appendix F lists 41 reptile species which had been recorded in the quarter degree grid 2530BC[8] (Figure 11). The search was restricted to the quarter degree grid instead of the 1-degree grid, because it is expected that the lizards and geckos will move over shorter distance than mammals and will therefore be more habitat specific, especially those species associated with outcrops/ surface rock. None of these species are threatened. It is obvious, that it is unlikely that the road sections upgrade will affect flying animals such as the birds, bats and most of the invertebrate species. No nests of birds of prey were observed during the site visit, and it is most probably due to human activity already present in the area.

The bridges to be constructed at the two river crossings will improve connectivity for ground dwelling species, especially during times of flooding, as these animals will be able to cross the river, this is especially relevant for medium to large size mammals.

6 ENVIRONMENTAL IMPACT ASSESSMENT

The upgrade of the road sections plus access roads will result in the removal of natural vegetation, associated with a threatened vegetation units on a regional scale and Critical Biodiversity Area on a provincial scale, however taking in consideration the extent of the area involved, namely 40 ha (Table 19), of which 20.2 ha represent persistent, primary vegetation, it cannot be considered that it would contribute significantly to habitat loss, whether for plants or animals within the immediate landscape. The extent of transformation does not exceed 1% of the persistent vegetation within the landscape (Table 19).

Therefore, the impact can be classified as negative, permanent, localised and of very low significance.

[7] FitzPatrick Institute of African Ornithology (2019). MammalMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2019-11-10

[8] FitzPatrick Institute of African Ornithology (2019). ReptileMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=ReptileMAP on 2019-11-10

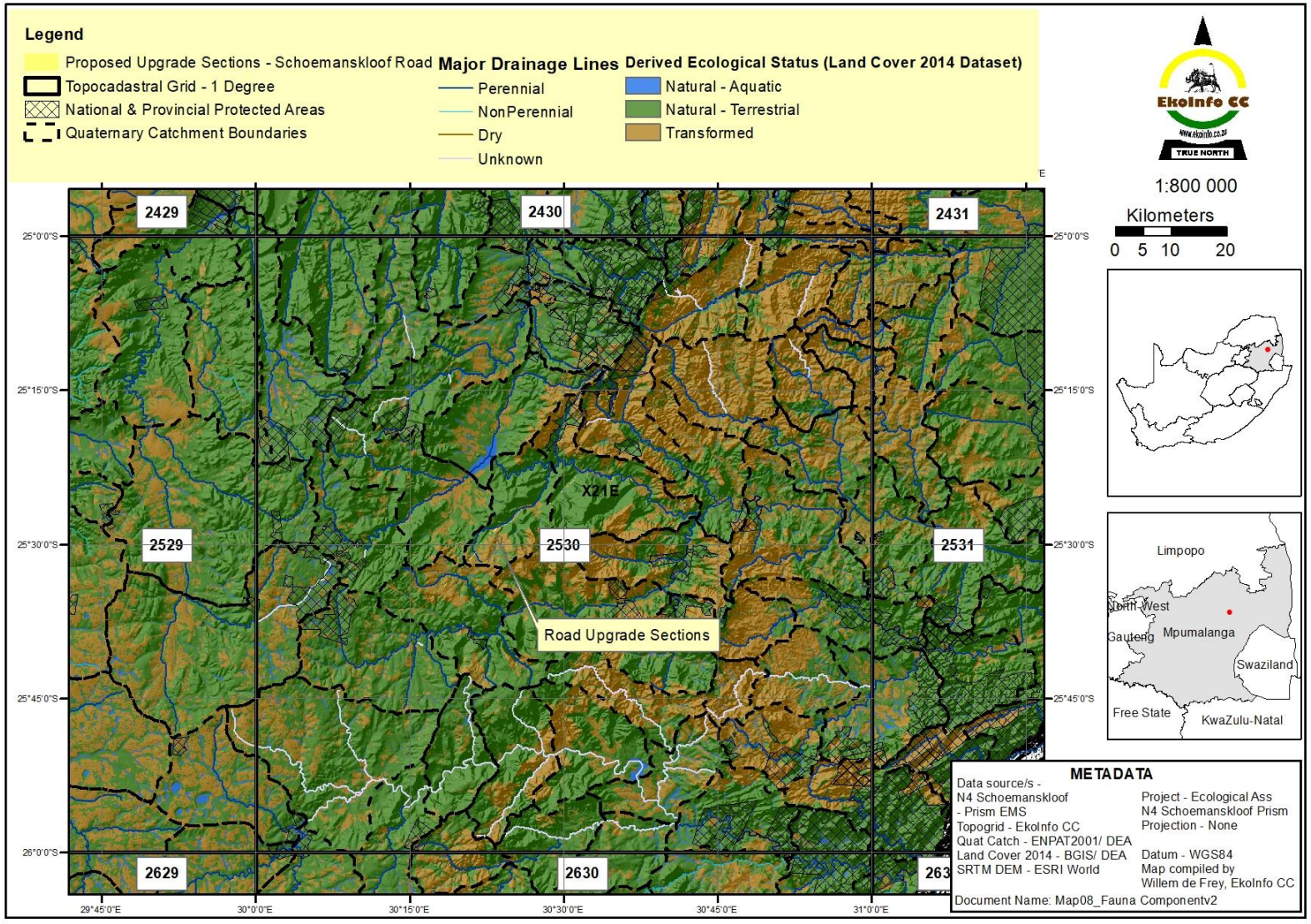


Figure 11: Overview of the ecological status of the surrounding landscape which could be a source of ground dwelling animals

Table 18: Overview of the Red Data status, collision risk and habitat loss risk for the mammals that could occur potentially in the landscape

Family	Family Overview	Status Unknown	Introduced	Red Data Categories				Grand Total	Collision Risk	Habitat Loss Risk
				Least Concern	Near Threatened	Vulnerable	Endangered			
Bathyergidae	Mole rats			1				1	Low	High
Bovidae	Antelope			12	2		1	15	High	Low
Canidae	Jackals, Wilddogs, Foxes			3			1	4	High	Moderate
Cercopithecidae	Monkeys, Baboons	1		4	1			6	High	Low
Chrysochloridae	Golden Moles					1		1	Low	High
Emballonuridae	Bats			1				1	Low	Low
Equidae	Zebra		1	1				2	High	Low
Erinaceidae	Hedgehog				1			1	Low	Moderate
Felidae	Lion, Leopard, Cerval, Cats		1	3	1	1		6	High	Low
Galagidae	Bush baby			1				1	Low	Low
Gliridae	Mouse	1		1				2	Low	High
Herpestidae	Mongoose, Meerkat			8				8	Moderate	High
Hippopotamidae	Hippopotamus			1				1	High	Low
Hipposideridae	Bats			1			1	2	Low	Low
Hyaenidae	Hyaena, Aardwolf			1	1			2	Moderate	Moderate
Hystricidae	Porcupine			1				1	Moderate	High
Leporidae	Hares			3				3	Low	Moderate
Molossidae	Bats			3				3	Low	Low
Muridae	Rats, Mouses	6		12	1			19	Low	High
Mustelidae	Otters, Polecat, Honey badger			3	2			5	Moderate	Low
Nesomyidae	Mouses			3				3	Low	High
Nycteridae	Bats			1				1	Low	Low

Family	Family Overview	Status Unknown	Introduced	Red Data Categories				Grand Total	Collision Risk	Habitat Loss Risk
				Least Concern	Near Threatened	Vulnerable	Endangered			
Orycteropodidae	Aardvark			1				1	Moderate	Low
Procaviidae	Hyrax			1				1	Low	Moderate
Pteropodidae	Bats	1		2				3	Low	Low
Rhinolophidae	Bats	1		3	2	2		8	Low	Low
Soricidae	Shrews	2		7	1	2		12	Low	High
Suidae	Bush pig	1		2				3	Moderate	Moderate
Vespertilionidae	Bats	4		9	1			14	Low	Low
Viveridae				1				1		
Viverridae	Genets	1		3				4	Low	High
Grand Total		18	2	93	13	6	3	135		
% Frequency		13%	1%	69%	10%	4%	2%	100%		

Table 19: Overview of total transformation impact on persistent vegetation within the landscape along the existing N4 freeway

Persistent Vegetation Analysis	Surrounding Landscape		Total Road Upgrade And Improvements					
	Landscape Scale		Upgrade Sections	% of total landscape	Access Roads	% of total landscape	Total Upgrades	% of total landscape
	Surface Area (ha)	% Cover	Surface Area (ha)		Surface Area (ha)		Surface Area (ha)	
Primary vegetation - persistent	67 797	51%	6.6	0.01%	13.6	0.02%	20.2	0.03%
Secondary vegetation	15 676	12%	3.9	0.03%	6.5	0.04%	10.4	0.07%
Transformed	24 008	18%	1.1	0.00%	6.1	0.03%	7.2	0.03%
Transformed - permanently	22 948	17%	0.1	0.00%	1	0.00%	1.1	0.00%
Waterbody or wetland	1 510	1%	0.5	0.03%	0.6	0.04%	1.1	0.07%
Waterbody or wetland - persistent	177	0%		0.00%		0.00%	0	0.00%
Total	**132 115**	**100%**	**12.3**	**0.01%**	**27.8**	**0.02%**	40	**0.03%**

Note:

- 1% of persistent, primary vegetation = 678 ha
- The actual surface area varies with +/- 1 ha, due the pixel resolution of the images being 30 m x 30 m
- To transform 1% of the primary vegetation – persistent, 33.3 times more area than the current 20 ha needs to be transformed

Due to the existing road infrastructure, it is highly unlikely that the upgrade of the road sections would significantly contribute to incidents of roadkill as the animals present in the landscape is used to the existing road infrastructure and traffic volumes.

The two proposed river crossings involve the actual upgrade of low water bridges or drifts (Photo 7, Photo 8, Photo 9, Photo 10), therefore does not represent green fields projects, but the actual upgrading of existing infrastructure, therefore the contribution to the transformation of natural vegetation will be insignificant, should the new infrastructure be kept within the same footprint.

7 ENVIRONMENTAL MANAGEMENT PLAN

A vegetation scientist specialising in vegetation ecology should do a walkthrough prior construction commencing during the summer season, optimally January/ February to identify and mark protected plants for which permits are required. Those plants small enough to translocate could be temporarily stored in a nursery for re-introduction post construction.

It is strongly recommended that the topsoil from the natural areas be stored and used in the subsequent rehabilitation of the road reserve once construction had ended. The topsoil should be stored in low (1 m high), levelled stockpiles which would reduce the establishment of alien invasive species, as well as facilitate the control alien invasive species which could establish.

The upgrade of the road sections allows for an opportunity to increase the permeability of the road infrastructure to facilitate animal movement in the landscape (Forman, Sperling et al 2003). Therefore, culverts should be designed to allow movement for small to medium size mammals to and from a water source such as the Crocodile River. The proposed upgrade of the two existing low water river crossings will contribute significantly to the facilitation of animal movement, during time of flooding, especially for ground dwelling species.

8 SPECIALIST OPINION

Due to the fact that the upgrade of the road sections is not a green fields project, but involves the improvement of existing road infrastructure, it is the opinion of the specialist that the proposed activity will not significantly add to the habitat loss and – fragmentation in the landscape. It contributes less than 1% to transformation within the broader landscape (Figure 10, Table 16). For a development to stimulate or result in one percent (1%) land use change within the broader landscape it would require 678 ha (Table 19).

However, it does provide an opportunity to improve the permeability of the road in terms of animal movement, by improving the design of culverts and storm water drains to facilitate the movement of small to medium size animals and herpetofauna.

Therefore, the proposed activity cannot be considered a no-go.

Photo 7: River crossing one showing the existing roads to and from the river

Photo 8: River crossing one clearly showing the low water crossing (rocky drift)

Photo 9: River crossing two showing the low water crossing (rocky drift) and associated infrastructure

Photo 10: River crossing two being used by farm employees to cross the Crocodile River

9 REFERENCES

BARBOUR, M.G.BURK, J.H. & PITTS, W.D. 1980. Terrestrial Plant Ecology. Benjamin/Cummings Publishing Company, California.

BROMILOW. C. 2010. Probleemplante en Indringeronkruide van Suid - Afrika. Briza Publikasies BK

BROWN, L.R., DU PREEZ, P.J., BEZUIDENHOUT, H., BREDENKAMP, G.J., MOSTERT, T.H.C. & COLLINS, N.B., 2013, 'Guidelines for phytosociological classifications and descriptions of vegetation in southern Africa', *Koedoe* 55(1), Art. #1103, 10 pages. http://dx.doi.org/10.4102/ koedoe.v55i1.1103

BOTHMA, J du P. 1995. Wildsplaasbestuur Nuwe uitgebreide uitgawe. 2de Uit. Struik Uitgewers

COATES-PALGRAVE, M. 2002. Keith Coates-Palgrave Trees of Southern Africa, 3 rd edn, 2nd imp. Struik Publishers, Cape Town

COWAN, G.I. (ed) 1995. Wetlands of South Africa. Department of Environmental Affairs and Tourism, Pretoria

DE FREY, W.H. 1999. PHYTOSOCIOLOGY OF SOUTHEASTERN MPUMALANGA HIGH ALTITUDE GRASSLANDS. MSc. Thesis, University of Pretoria.

DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Department of Water Affairs and Forestry

EDWARDS, D. 1983. A broad-scale structural classification of vegetation for practical purposes. Bothalia 14, 3 & 4: 705 - 712.

EWART-SMITH, J., OLLIS, D., DAY, J & MALAN, H 2006. NATIONAL WETLAND INVENTORY: Development of a Wetland Classification System for South Africa. The Water Research Commission (WRC)

FEY, M. 2010. Soils of South Africa. Cambridge

FORMAN, R.T.T., SPERLING, D., BISSONETTE, J.A., CLEVENGER, A.P., CUTSHALL, C.D., DALE, V.H., FAHRIG, L., FRANCE, R., GOLDMAN, C.R., HEANUE, K., JONES, J.A., SWANSON, F.J., TURRENTINE, T., WINTER, T.C. 2003. ROAD ECOLOGY Science and Solutions. Island Press.

GERMISHUIZEN, G & MEYER, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. *Strelitzia 14*. National Botanical Institute, Pretoria.

GEO 5 2012.Global Environment Outlook. UNEP http://www.unep.org/geo/sites/unep.org.geo/files/documents/geo5_report_full_en_0.pdf

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L. BARKER, N.P., ANDERSON, H.M. & DALWITZ, M.J. 1990. GRASSES OF SOUTHERN AFRICA. National Botanical Gardens, South Africa

GOLDING, J (Ed.s), 2002. Southern African Plant Red Data Lists. Sabonet Report no. 14. Southern African Botanical Diversity Network. Pretoria

HENNEKENS, S.M. 1996. TURBO(VEG) Software package for input, processing, and presentation of phytosociological data. User's guide. University of Lancaster.

HILTY, J.A., LIDICKER JR., W.Z. & MERENLENDER, A.M. 2006. CORRIDOR ECOLOGY The Science and Practice of Linking Landscapes for Biodiversity Conservation. Island Press

JOHNSON, M.R., ANHAEUSSER, C.R. & THOMAS, R.J. (Eds) 2006. The Geology of South Africa. Geological Society of South Africa, Johannesburg/ Council of Geoscience, Pretoria, 691 pp

KENT, M. & COKER, P. 1992. Vegetation Description and Analysis: A practical Approach. John Wiley & Sons, Chichester

KOVACH, W.L., 2007. MVSP - A MultiVariate Statistical Package for Windows, ver. 3.1. Kovach Computing Services, Pentraeth, Wales, U.K.

KRUGER, G.P. 1983. 1: 2 500 000 scale. Terrain morphological map of southern Africa Soil & Irrigation Institute. Dept. of Agriculture.

LAND TYPE SURVEY STAFF. 1985. Land types of the maps 2628 East Rand, 2630 Mbabane. Mem. agric. nat. Resour. S. Afr. No. 5

LAND TYPE SURVEY STAFF. 1987. Land types of the maps 2526 Rustenburg, 2528 Pretoria. Mem. agric. nat. Resour. S. Afr. No. 8

LE ROUX, J. 2002. The Biodiversity of South Africa 2002 Indicators, Trends and Human Impacts. Endangered Wildlife Trust

LEISTNER, O.A. (ed) 2000. Seed plants of southern Africa: families and genera. Strelitzia 10. National Botanical Institute, Pretoria

LINDENMAYER, D.B. & FISCHER, J. 2006. Habitat Fragmentation And Landscape Change An Ecological And Conservation Synthesis. Island Press, USA

MC MURTY, D., GROBLER, L, GROBLER, J. & BURNS, S. 2008. Field Guide to the ORCHIDS of Northern South Africa and Swaziland. Umdaus Press, Hatfield

McCARTHY, T. & RUBIDGE, B. 2005. The Story Of EARTH & LIFE A southern African perspective on a 4.6-billion-year journey. Struik Publishers

MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

NEL, J., MAREE, G., ROUX, D., MOOLMAN, J., KLEYNHANS, N., SILBERBAUER, M. & DRIVER, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific

NEL, J.L., DRIVER, A., STRYDOM, W.F., MAHERRY, A., PETERSEN, C., HILL, L., ROUX, D.J., NIENABER, S., VAN DEVENTER, H., SWARTZ, E., & SMITH-ADAO, L.B. 2011. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources.* WRC Report No. TT 500/11

READ, H.H. & WATSON, J. 1983. Introduction to Geology Volume 1 PRINCIPLES. Macmillan Press Ltd, Hong Kong

NORMAN, N. & WHITFIELD, G. 2006. A traveller's guide to South Africa's rocks and landforms Geological Journeys. Struik Publishers

RETIEF, E. & HERMAN, P.P.J. 1997. Plants of the northern provinces of South Africa: keys and diagnostic characters. Strelitzia 6: 1 – 681.

ROUGET, M., REYERS, B., JONAS, Z., DESMET, P., DRIVER, A., MAZE, K., EGOH, B. & COWLING, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.

SMIT, N. 2008. Field Guide to the Acacias of South Africa. Briza Publications

SOIL CLASSIFICATION WORKGROUP 1991. Soil classification a taxonomic system for South Africa. Memiors oor die Natuurlike Landbouhulpbronne van Suid-Afrika Nr. 15.

STRAHLER, A.N. & STRAHLER, A.H. 1987. Modern Physical Geography Third Edition. Wiley & Sons, New York

STRAHLER, A.N. 1962. Physical Geography. John Wiley & Sons, New York

TAINTON, N. 1999. Veld Management in South Africa. University of Natal Press

TURNER, M.G., GARDNER, R.H., & O'NEILL, R.V. 2001. Landscape Ecology In Theory And Practice Pattern And Process. Springer, USA

VAN ANDEL, J & ARONSON, J (Eds). 2006. RESTORATION ECOLOGY - The New Frontier. Blackwell Publishing

VAN OUDTSHOORN, F.P. 1991. Gids tot grasse van Suid-Afrika. Briza Publikasies Bk. Arcadia.

VAN WYK, A.E. & SMITH, G.F. 2001. Regions of Floristic Endemism in Southern Africa. Umdaus Press, Hatfield

VAN WYK, B. & MALAN, S. 1988. Veldgids tot die veldblomme van die Witwatersrand-&Pretoria- gebied. Struik Uitgewers, Kaapstad.

VAN WYK, B-E., VAN OUDTSHOORN, B. & GERICKE, N. 2000. Medicinal Plants of South Africa. Briza

VAN WYK, B. & VAN WYK, P. 1997. Field Guide to Trees of Southern Africa. Struik Nature, Cape Town

VAN WYK, B., VAN WYK, P. & VAN WYK, B-E. 2000. Photo Guide to Trees of Southern Africa. Briza Publications

VILJOEN, M.J. & REIMOLD, W.U. 1999. An Introduction to South Africa's Geological and Mining Heritage. Mintek

WHITE, R.E. 1987. Introduction to the Principles and Practice of Soil Science. Blackwell Scientific Publications, Australia

WIENS, J.A., MOSS, M.R., TURNER, M.G. & MLADENOFF, D.J. 2006. Foundation Papers In Landscape Ecology. Columbia University Press, New York

10 APPENDIX A – ABRIDGE CV, PRINCIPLE CONSULTANT

Name of firm: EkoInfo cc Environmental and Wildlife Management Consultancy
Name of staff: WILLEM HENDRIK DE FREY
Profession: Environmental and Wildlife Management consultant
Years with firm: Since 1995
Nationality: RSA
Membership of professional societies:
The South African Council for Natural Scientific Professions (Reg no 400100/02)
Categories: Botanical Science and Ecological Science
Currently in the process of affiliating to:
South African Association of Botanist (SAAB)
Grassland Society of Southern Africa
South African Institute of Ecologist and Environmental Scientists (SAIE)

KEY QUALIFICATIONS:

Mr W de Frey has been involved in the discipline of ecology since 1989. During this period he prepared himself for a profession in environmental and wildlife management, by attending courses in chemistry, geology, pedology and statistics, while majoring in Botany and Zoology. His working knowledge was obtained while completing projects for his post-graduate studies in wildlife management in both the Savanna and Grassland Biomes. In addition to his academic publications, he has contributed to numerous reports regarding EMPR's, EIA's, vegetation - and soil surveys and monitoring since the registration of his own consultation close corporation in 1995. He is actively involved in the management and marketing of his close corporation while completing tasks in his field of expertise namely soil, vegetation science and Geographical Information Systems. Mr W de Frey is task orientated with consideration of people's needs and safety. He beliefs in a holistic approach to environmental and wildlife management and has therefore established a network with individuals in related fields. He is also assisting previously disadvantaged persons in establishing a presence in the environmental industry, namely Lordwick Makhura of Baagi Environmental Consultancy CC and a joint venture company Bonolo Biodiversity And Environmental Management consisting of Baagi Environmental Consultancy CC and Disa Mphago Community Helpers CC.

EDUCATION:

1992 BSc Botany & Zoology, University of Pretoria

Course	Content	Level
Chemistry	Organic and Inorganic chemistry	1st year
Geology	Introduction/ Geomorphology, Stratigraphy, Structural, Sedimentology Palaeontology, Crystallography	1st and 2nd year
Pedology	Introduction, soil classification, soil fertility, soil ecology, soil physics	1st and 2nd year
Botany	Morphology, Anatomy, Physiology, Taxonomy, Mycology, Ecology, Reproductive biology	1st, 2nd and 3rd year
Zoology	Taxonomy (Vertebrates and Invertebrates), Physiology (mainly vertebrates), Ecology (mainly	1st, 2nd and 3rd year

	vertebrates), Animal behaviour (mainly vertebrates)	
Statistics	Sampling methods, Statistical Analysis, Probabilities	1st year

1993 BSc (Hons) (Cum laude) Wildlife Management, University of Pretoria
Dissertation: 'N HOLISTIESE EKOLOGIESE BENADERING TOT DIE DRAKRAGBEPALING
VAN 'N GEMENGDE WILD- EN BEESBOERDERY IN DIE UBOMBO DISTRIK, MET ENKELE BESTUURS AANBEVELINGS, 1993
1999 MSc (Cum laude) Wildlife Management, University of Pretoria
Thesis: PHYTOSOCIOLOGY OF THE MPUMALANGA HIGH ALTITUDE GRASSLANDS, 1999

COURSES/ WORKSHOPS ATTENDED

1. Red List And Threatened Species Assessment Training Workshop, Hosted by the Conservation Breeding Specialist Group Southern Africa & Endangered Wildlife Trust, December 2003
2. National State of the Environment Workshop, Hosted by DEAT and SRK, ESKOM Convention Centre – November 2004
3. Gauteng Red Data Flora Workshop, Hosted by SANBI and GDACE – November 2005
4. Gauteng Flora Minimum Requirement Workshop, Hosted by GDACE Nature Conservation – August 2007

EMPLOYMENT RECORD:

1986 – 1987
5 Signals Regiment, SADF

1998 – 1993 – Partime
Council of Geoscience, Palaeontology Section
University of Pretoria, Botany Department
Academy of Marksmanship, Range Officer
U Huisoppasser, Own enterprise
1994 – 1995
University of Pretoria, Botany Department, Assistant researcher

1995 – present

EkoInfo cc Environmental and Wildlife Management Consultancy, Founding member and consultant

Overall EkoInfo CC's principal consultant completed or administrated more than 58 vegetation studies as part of Environmental Impact Assessments within all of South Africa's nine provinces and adjacent countries such as Botswana and Mozambique with a focus on either terrestrial vegetation and/ or wetlands. Some projects were on provincial level such as the Mpumalanga and Gauteng Degradation Projects coordinated by the Institute for Soil, Climate and Water and sponsored by National Department of Agriculture. The majority of projects were on local scale from 5 ha to 50 000 ha or more for local developers and corporate institutions (SASOL, Anglo Coal, BHP Billington, Ingwe Coal, Deneys Rietz Attorneys, ESKOM) facilitated independently or as a subcontractor/ specialist for the following institutions: Oryx Environmental CC, African EPA, Arcuss Gibb, Digby Wells and Associates, Nature and Business Alliance and Eyethu Engineers, Strategic Environmental Focus.

COMMUNITY SERVICE

1. Substitute lecture – 2nd & 3rd year Botany Practical (Vegetation Survey Methods), University of Pretoria -1994 & 1995
2. Guest lecture – Wetland Vegetation Communities (2nd year students), Department of Landscape Architecture, University of Pretoria – 1996 & 1997

3. Guest lecture – Principles of Ecology (1st year students), Department of Landscape Architecture, University of Pretoria – 2002
4. Guest lecture – Principles of vegetation survey and mapping for EIA's (3rd year students), Department of Landscape Architecture, University of Pretoria – 2003
5. Referee – ILASA Merits Awards (Environmental Planning), Institute for Landscape Architects of South Africa - 2003

LANGUAGES:

Language	Capability
English & Afrikaans	Speak, Read, Write - sufficient
Sepedi (Northern Sotho)	Speak, Read, Write – insufficient

11 APPENDIX B – RECORDED SPECIES: LYDENBURG MONTANE GRASSLAND

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Acalypha angustata	1			1
Acalypha depressinerva	1			1
Agapanthus inapertus subsp. hollandii		1		1
Agapanthus inapertus subsp. inapertus	1			1
Agapanthus inapertus subsp. intermedius	1			1
Agapanthus inapertus subsp. parviflorus		1		1
Agapanthus inapertus subsp. pendulus		1		1
Alepidea longifolia var. longifolia	1			1
Alloteropsis semialata subsp. eckloniana	1			1
Aloe affinis		1		1
Aloe dyeri	1			1
Aloe graciliflora	1			1
Aloe greatheadii var. davyana	1			1
Andropogon schirensis	1			1
Anthospermum rigidum subsp. rigidum	1			1
Aristida junciformis subsp. junciformis	1			1
Aristida sciurus	1			1
Brachiaria serrata	1			1
Bulbostylis oritrephes	1			1
Chlorophytum haygarthii	1			1
Cliffortia repens	1			1
Corycium dracomontanum	1			1
Corycium nigrescens	1			1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Crassula setulosa var. deminuta			1	1
Crassula vaginata subsp. vaginata	1			1
Crotalaria monophylla			1	1
Ctenium concinnum	1			1
Cymbopappus piliferus			1	1
Cymbopogon excavatus	1			1
Delosperma lydenburgense	1			1
Dicoma anomala subsp. anomala	1			1
Digitaria monodactyla	1			1
Digitaria tricholaenoides	1			1
Diheteropogon amplectens var. amplectens	1			1
Diheteropogon filifolius	1			1
Dimorphotheca jucunda	1			1
Dimorphotheca spectabilis	1			1
Disa amoena			1	1
Disa clavicornis			1	1
Disa fragrans subsp. fragrans	1			1
Disa versicolor	1			1
Disperis renibractea	1			1
Elionurus muticus	1			1
Eragrostis capensis	1			1
Eragrostis chloromelas	1			1
Eragrostis curvula	1			1
Eragrostis gummiflua	1			1
Eragrostis plana	1			1
Eragrostis racemosa	1			1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Eragrostis sclerantha subsp. sclerantha	1			1
Erica atherstonei			1	1
Erica cerinthoides var. cerinthoides	1			1
Erica holtii			1	1
Erica woodii var. woodii	1			1
Eriosema kraussianum	1			1
Eucomis vandermerwei			1	1
Eulalia villosa	1			1
Faurea galpinii	1			1
Felicia filifolia subsp. filifolia	1			1
Gerbera ambigua	1			1
Gladiolus calcaratus		1		1
Gladiolus cataractarum			1	1
Gladiolus ecklonii	1			1
Gladiolus exiguus		1	1	1
Gladiolus longicollis subsp. platypetalus	1			1
Gladiolus malvinus			1	1
Gnidia caffra	1			1
Graderia linearifolia		1		1
Habenaria dives	1			1
Habenaria dregeana	1			1
Habenaria lithophila	1			1
Haemanthus humilis subsp. hirsutus	1			1
Haplocarpha scaposa	1			1
Harpochloa falx	1			1
Helichrysum albilanatum		1		1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Helichrysum caespititium	1			1
Helichrysum chionosphaerum	1			1
Helichrysum lesliei			1	1
Helichrysum mariepscopicum		1		1
Helichrysum milleri		1		1
Helichrysum nudifolium var. nudifolium	1			1
Helichrysum odoratissimum	1			1
Helichrysum reflexum		1		1
Helichrysum rudolfii		1		1
Helichrysum rugulosum	1			1
Helichrysum spiralepis	1			1
Helichrysum subglomeratum	1			1
Helichrysum summo-montanum			1	1
Helichrysum swynnertonii	1			1
Helichrysum truncatum		1		1
Helichrysum umbraculigerum	1			1
Hemizygia albiflora		1		1
Hemizygia foliosa		1		1
Hemizygia subvelutina		1		1
Heteromorpha involucrata	1			1
Heteropogon contortus	1			1
Holothrix scopularia	1			1
Hyparrhenia hirta	1			1
Hypoxis costata	1			1
Hypoxis galpinii	1			1
Hypoxis rigidula var. pilosissima	1			1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Inezia integrifolia		1		1
Ischyrolepis schoenoides	1			1
Khadia alticola			1	1
Kniphofia rigidifolia			1	1
Knowltonia transvaalensis var. pottiana			1	1
Koeleria capensis	1			1
Lopholaena disticha	1			1
Loudetia simplex	1			1
Microchloa caffra	1			1
Monocymbium ceresiiforme	1			1
Monopsis decipiens	1			1
Monsonia transvaalensis		1		1
Myosotis afropalustris	1			1
Pachycarpus transvaalensis	1			1
Panicum ecklonii	1			1
Panicum natalense	1			1
Pearsonia hirsuta			1	1
Pelargonium luridum	1			1
Pentanisia prunelloides subsp. latifolia	1			1
Pentaschistis natalensis	1			1
Phymaspermum acerosum	1			1
Polygala amatymbica	1			1
Polygala uncinata	1			1
Protea roupelliae subsp. roupelliae	1			1
Psammotropha myriantha	1			1
Raphionacme galpinii	1			1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Rendlia altera	1			1
Rhynchosia monophylla	1			1
Rhynchosia totta var. totta	1			1
Riocreuxia aberrans			1	1
Satyrium longicauda var. longicauda	1			1
Schistostephium crataegifolium	1			1
Schizachyrium sanguineum	1			1
Schizochilus cecilii subsp. transvaalensis			1	1
Schizochilus lilacinus			1	1
Scilla natalensis	1			1
Sebaea erosa	1			1
Sebaea sedoides var. confertiflora	1			1
Selago compacta		1		1
Selago procera	1			1
Selago villosa		1		1
Senecio gerrardii	1			1
Senecio laevigatus var. laevigatus	1			1
Setaria nigrirostris	1			1
Sporobolus centrifugus	1			1
Sporobolus pectinatus	1			1
Streptocarpus cyaneus subsp. longi-tommii			1	1
Streptocarpus galpinii		1		1
Streptocarpus hilburtianus			1	1
Sutera polelensis subsp. fraterna		1		1
Tenrhynea phylicifolia	1			1
Tetraselago wilmsii		1		1

Botanical Name	Species Significance Rating			Frequency
	Important Taxa	Biogeographically Important Taxa	Endemic Taxa	
Themeda triandra	1			1
Trachypogon spicatus	1			1
Tristachya leucothrix	1			1
Tristachya rehmannii	1			1
Vernonia hirsuta	1			1
Vernonia natalensis	1			1
Vernonia oligocephala	1			1
Wahlenbergia undulata	1			1
Watsonia occulta		1	1	1
Watsonia wilmsii			1	1
Zantedeschia albomaculata subsp. albomaculata	1			1
Zornia capensis subsp. capensis	1			1
Grand Total	**119**	**24**	**24**	**165**
	72%	15%	15%	

12 APPENDIX C – NATIONALLY PROTECTED AND THREATENED PLANTS

SANBI Biodiversity for Life
South African National Biodiversity Institute

Red List of South African Plants

Search the Red List
Search

Red List statistics | Summary of recent changes | National Red List categories | Assessment methodology | Glossary | Guidelines for EIAs

Browse
- Genera: A
- Genera: B
- Genera: C
- Genera: D
- Genera: E
- Genera: F
- Genera: G
- Genera: H
- Genera: I
- Genera: J
- Genera: K
- Genera: L
- Genera: M
- Genera: N
- Genera: O
- Genera: P
- Genera: Q
- Genera: R
- Genera: S
- Genera: T
- Genera: U
- Genera: V
- Genera: W
- Genera: X
- Genera: Y
- Genera: Z

Home >> Genera: A >> Genus: Aloe

Aloe simii

Taxonomy

Scientific Name	**Aloe simii Pole-Evans**
Higher Classification	Monocotyledons
Family	ASPHODELACEAE

National Status

Status and Criteria	**Critically Endangered B2ab(ii,iii,iv,v)**
Assessment Date	2006/11/15
Assessor(s)	M. Lötter, J.E. Burrows, S. Krynauw & D. Raimondo
Justification	A narrow habitat specialist (AOO 10 km²) and known from five severely fragmented subpopulations. Declining due to afforestation, drying up of its wetland habitat as a result of adjacent plantations and water extraction, alien plant invasion, urban expansion and rural development.

Distribution

Endemism	South African endemic
Provincial distribution	Mpumalanga
Range	Sabie southwards to White River and around Nelspruit.

Habitat and Ecology

Major system	Terrestrial
Major habitats	Legogote Sour Bushveld
Description	Open woodland and grassland, along drainage lines and wetlands, 600-1100 m.

Threats

Habitat loss, Invasive Alien Species (direct effects), Habitat degradation

© D.R. McKenzie

http://redlist.sanbi.org/species.php?species=2206-235

13 APPENDIX D – LIST OF SPECIES RECORDED WITHIN THE SURVEY PLOTS

Plot no	1	3	5	7	9	11	13	15	17	19	22			
Biome - Regional Context	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Forests	Grassland Biome	Savanna Biome	Savanna Biome	Savanna Biome			
Regional Vegetation Unit - Regional Context	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Northern Mistbelt Forest	Lydenburg Montane Grassland	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld			
Conservation Status - Regional Context	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Least threatened	Vulnerable	Endangered	Endangered	Endangered			
Land cover 2014 category - Local Context	Grassland	Grassland	Grassland	Wetlands	Thicket /Dense bush	Grassland	Woodland/Open bush	Woodland/Open bush	Woodland/Open bush	Thicket /Dense bush	Grassland			
Derived Ecological Status - Local Context	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Aquatic	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Total % Frequency (11 = 100%)	Grassland % Frequency	Savanna % Frequency
Acacia caffra					1	1						18%	29%	0%
Acacia karroo								1				9%	14%	0%
Acacia robusta							1					9%	0%	0%
Acacia sieberiana						1				1		18%	14%	33%
Acalypha angustata			1				1					18%	14%	0%
Agave americana							1					9%	0%	0%
Agave sisalana							1					9%	0%	0%
Aloe greatheadii							1					9%	0%	0%
Aloe marlothii							1					9%	0%	0%
Aloe species					1		1					18%	14%	0%
Andropogon chinensis								1				9%	14%	0%
Anthephora pubescens			1									9%	14%	0%
Araujia sericifera										1		9%	0%	33%
Bauhinia galpinii										1		9%	0%	33%
Brachiaria serrata			1									9%	14%	0%
Celtis africana					1		1					18%	14%	0%
Cenchrus ciliaris					1	1	1			1		36%	29%	33%
Conyza bonariensis				1						1		18%	14%	33%
Cussonia paniculata					1							9%	14%	0%
Cussonia spicata					1		1					18%	14%	0%
Digitaria eriantha	1	1	1	1	1	1		1	1	1	1	91%	100%	100%
Diospyros whyteana					1							9%	14%	0%
Dodonaea viscosa							1					9%	0%	0%
Dombeya rotundifolia					1		1					18%	14%	0%
Eragrostis curvula	1	1	1					1			1	45%	57%	33%
Eragrostis nindensis							1					9%	0%	0%
Eragrostis plana		1					1	1			1	36%	29%	33%
Eragrostis racemosa			1								1	18%	14%	33%
Erica cerinthoides			1								1	18%	14%	33%
Erythrina lysistemon										1		9%	0%	33%
Eucalyptus camaldulensis	1											9%	14%	0%
Euclea natalensis								1				9%	14%	0%
Ficus species										1		9%	0%	33%
Fingerhuthia africana							1					9%	0%	0%
Geigeria burkei							1	1				18%	14%	0%
Grewia species										1		9%	0%	33%
Heteropogon contortus							1			1	1	27%	0%	67%
Hyparrhenia filipendula								1				9%	14%	0%
Hyperthelia dissoluta							1		1		1	27%	0%	67%
Hypoxis obtusa		1										9%	14%	0%
Ipomoea oblongata			1									9%	14%	0%
Jacaranda mimosifolia					1					1		18%	14%	33%
Lantana camara								1				9%	14%	0%
Melia azedarach										1		9%	0%	33%
Melinis repens				1							1	18%	14%	33%

Plot no	1	3	5	7	9	11	13	15	17	19	22			
Biome - Regional Context	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Forests	Grassland Biome	Savanna Biome	Savanna Biome	Savanna Biome			
Regional Vegetation Unit - Regional Context	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Northern Mistbelt Forest	Lydenburg Montane Grassland	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld			
Conservation Status - Regional Context	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Least threatened	Vulnerable	Endangered	Endangered	Endangered			
Land cover 2014 category - Local Context	Grassland	Grassland	Grassland	Wetlands	Thicket /Dense bush	Grassland	Woodland/Open bush	Woodland/Open bush	Woodland/Open bush	Thicket /Dense bush	Grassland			
Derived Ecological Status - Local Context	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Aquatic	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Total % Frequency (11 = 100%)	Grassland % Frequency	Savanna % Frequency
Olea europaea					1							9%	14%	0%
Opuntia ficus-indica					1		1					18%	14%	0%
Paspalum urvillei		1						1			1	27%	29%	33%
Pelargonium luridum							1					9%	0%	0%
Pentanisia prunelloides							1					9%	0%	0%
Rhynchosia totta								1				9%	14%	0%
Ruellia patula											1	9%	0%	33%
Senecio venosus					1							9%	14%	0%
Setaria sphacelata								1				9%	14%	0%
Themeda triandra			1			1	1					27%	29%	0%
Vangueria infausta					1							9%	14%	0%
Verbena bonariensis		1		1								18%	29%	0%
Verbena tenuisecta								1				9%	14%	0%
Vernonia natalensis			1									9%	14%	0%
Zanthoxylum capense					1							9%	14%	0%
Ziziphus mucronata					1							9%	14%	0%
Grand Total	**3**	**6**	**10**	**4**	**16**	**5**	**22**	**13**	**2**	**12**	**10**			
											Mean species/plot	9	8	8

14 APPENDIX E – LIST OF POTENTIAL MAMMALS

Family	Scientific name	Common name	Red list category
Bathyergidae	Cryptomys hottentotus	Southern African Mole-rat	Least Concern (2016)
Bovidae	Alcelaphus buselaphus caama	Red Hartebeest	Least Concern (2008)
Bovidae	Cephalophus natalensis	Red Duiker	Near Threatened (2016)
Bovidae	Connochaetes gnou	Black Wildebeest	Least Concern (2016)
Bovidae	Damaliscus pygargus phillipsi	Blesbok	Least Concern (2016)
Bovidae	Kobus ellipsiprymnus	Waterbuck	Least Concern (ver 3.1, 2016)
Bovidae	Oreotragus oreotragus	Klipspringer	Least Concern (2016)
Bovidae	Ourebia ourebi	Oribi	Endangered
Bovidae	Pelea capreolus	Vaal Rhebok	Near Threatened (2016)
Bovidae	Raphicerus campestris	Steenbok	Least Concern (2016)
Bovidae	Redunca arundinum	Southern Reedbuck	Least Concern (2016)
Bovidae	Redunca fulvorufula	Mountain Reedbuck	Least Concern
Bovidae	Sylvicapra grimmia	Bush Duiker	Least Concern (2016)
Bovidae	Taurotragus oryx	Common Eland	Least Concern (2016)
Bovidae	Tragelaphus scriptus	Bushbuck	Least Concern
Bovidae	Tragelaphus strepsiceros	Greater Kudu	Least Concern (2016)
Canidae	Canis adustus	Side-striped Jackal	Least Concern (2016)
Canidae	Canis mesomelas	Black-backed Jackal	Least Concern (2016)
Canidae	Lycaon pictus	African wild dog	Endangered (2016)
Canidae	Vulpes chama	Cape Fox	Least Concern (2016)
Cercopithecidae	Cercopithecus albogularis	Samango Monkey	Least Concern (2008)
Cercopithecidae	Cercopithecus albogularis erythrarchus	Samango Monkey (subsp. erythrarchus)	Near Threatened (2016)
Cercopithecidae	Chlorocebus pygerythrus	Vervet Monkey	Least Concern (2016)

Family	Scientific name	Common name	Red list category
Cercopithecidae	Chlorocebus pygerythrus pygerythrus	Vervet Monkey (subspecies pygerythrus)	Least Concern (2008)
Cercopithecidae	Papio hamadryas	Hamadryas Baboon	
Cercopithecidae	Papio ursinus	Chacma Baboon	Least Concern (2016)
Chrysochloridae	Amblysomus robustus	Robust Golden Mole	Vulnerable (2016)
Emballonuridae	Taphozous (Taphozous) mauritianus	Mauritian Tomb Bat	Least Concern
Equidae	Equus caballus ferus		Introduced
Equidae	Equus quagga	Plains Zebra	Least Concern (2016)
Erinaceidae	Atelerix frontalis	Southern African Hedgehog	Near Threatened (2016)
Felidae	Caracal caracal	Caracal	Least Concern (2016)
Felidae	Felis catus	Domestic Cat	Introduced
Felidae	Felis silvestris	Wildcat	Least Concern (2016)
Felidae	Leptailurus serval	Serval	Near Threatened (2016)
Felidae	Panthera leo	Lion	Least Concern (2016)
Felidae	Panthera pardus	Leopard	Vulnerable (2016)
Galagidae	Otolemur crassicaudatus	Brown Greater Galago	Least Concern (2016)
Gliridae	Graphiurus (Graphiurus) kelleni	Kellen's African Dormouse	
Gliridae	Graphiurus (Graphiurus) murinus	Forest African Dormouse	Least Concern
Herpestidae	Atilax paludinosus	Marsh Mongoose	Least Concern (2016)
Herpestidae	Cynictis penicillata	Yellow Mongoose	Least Concern (2016)
Herpestidae	Helogale parvula	Common Dwarf Mongoose	Least Concern (2016)
Herpestidae	Herpestes sanguineus	Slender Mongoose	Least Concern (2016)
Herpestidae	Ichneumia albicauda	White-tailed Mongoose	Least Concern (2016)
Herpestidae	Mungos mungo	Banded Mongoose	Least Concern (2016)
Herpestidae	Rhynchogale melleri	Meller's Mongoose	Least Concern (2016)
Herpestidae	Suricata suricatta	Meerkat	Least Concern (2016)
Hippopotamidae	Hippopotamus amphibius	Common Hippopotamus	Least Concern (2016)

Family	Scientific name	Common name	Red list category
Hipposideridae	Cloeotis percivali	Percival's Short-eared Trident Bat	Endangered (2016)
Hipposideridae	Hipposideros caffer	Sundevall's Leaf-nosed Bat	Least Concern (2016)
Hyaenidae	Hyaena brunnea	Brown Hyena	Near Threatened (2015)
Hyaenidae	Proteles cristata	Aardwolf	Least Concern (2016)
Hystricidae	Hystrix africaeaustralis	Cape Porcupine	Least Concern
Leporidae	Lepus capensis	Cape Hare	Least Concern
Leporidae	Lepus saxatilis	Scrub Hare	Least Concern
Leporidae	Pronolagus rupestris	Smith's Red Rock Hare	Least Concern (2016)
Molossidae	Chaerephon pumilus	Little Free-tailed Bat	Least Concern (2016)
Molossidae	Mops (Mops) condylurus	Angolan Free-tailed Bat	Least Concern
Molossidae	Tadarida aegyptiaca	Egyptian Free-tailed Bat	Least Concern (2016)
Muridae	Acomys sp.	Spiny Mice	
Muridae	Aethomys sp.	Veld rats	
Muridae	Aethomys ineptus	Tete Veld Aethomys	Least Concern (2016)
Muridae	Aethomys namaquensis	Namaqua Rock Mouse	Least Concern
Muridae	Gerbilliscus brantsii	Highveld Gerbil	Least Concern (2016)
Muridae	Grammomys dolichurus	Common Grammomys	Least Concern (2016)
Muridae	Lemniscomys sp.	Grass Mice	
Muridae	Lemniscomys rosalia	Single-Striped Lemniscomys	Least Concern (2016)
Muridae	Mastomys sp.	Multimammate Mice	
Muridae	Mastomys coucha	Southern African Mastomys	Least Concern (2016)
Muridae	Mastomys natalensis	Natal Mastomys	Least Concern (2016)
Muridae	Mus (Nannomys) minutoides	Southern African Pygmy Mouse	Least Concern
Muridae	Mus musculus musculus		Least concern
Muridae	Otomys sp.	Vlei Rats	
Muridae	Otomys angoniensis	Angoni Vlei Rat	Least Concern (2016)

Family	Scientific name	Common name	Red list category
Muridae	Otomys auratus	Southern African Vlei Rat	Near Threatened (2016)
Muridae	Rattus sp.	Genus Rattus	
Muridae	Rattus rattus	Roof Rat	Least Concern
Muridae	Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern (2016)
Mustelidae	Aonyx capensis	African Clawless Otter	Near Threatened (2016)
Mustelidae	Hydrictis maculicollis	Spotted-necked Otter	Least Concern (IUCN 2008)
Mustelidae	Ictonyx striatus	Striped Polecat	Least Concern (2016)
Mustelidae	Mellivora capensis	Honey Badger	Least Concern (2016)
Mustelidae	Poecilogale albinucha	African Striped Weasel	Near Threatened (2016)
Nesomyidae	Dendromus melanotis	Gray African Climbing Mouse	Least Concern (2016)
Nesomyidae	Dendromus mystacalis	Chestnut African Climbing Mouse	Least Concern (2016)
Nesomyidae	Saccostomus campestris	Southern African Pouched Mouse	Least Concern (2016)
Nycteridae	Nycteris thebaica	Egyptian Slit-faced Bat	Least Concern (2016)
Orycteropodidae	Orycteropus afer	Aardvark	Least Concern (2016)
Procaviidae	Procavia capensis	Cape Rock Hyrax	Least Concern (2016)
Pteropodidae	Epomophorus sp.	Epauletted Fruit Bats	
Pteropodidae	Epomophorus wahlbergi	Epomophorus wahlbergi	Least Concern (2016)
Pteropodidae	Rousettus (Rousettus) aegyptiacus	Egyptian Rousette	Least Concern
Rhinolophidae	Rhinolophus sp.	Horseshoe Bats	
Rhinolophidae	Rhinolophus blasii	Blasius's Horseshoe Bat	Near Threatened (2016)
Rhinolophidae	Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Least Concern (2016)
Rhinolophidae	Rhinolophus cohenae	Cohen's Horseshoe Bat	Vulnerable (2016)
Rhinolophidae	Rhinolophus darlingi	Darling's Horseshoe Bat	Least Concern (2016)
Rhinolophidae	Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	Near Threatened
Rhinolophidae	Rhinolophus simulator	Bushveld Horseshoe Bat	Least Concern (2016)
Rhinolophidae	Rhinolophus swinnyi	Swinny's Horseshoe Bat	Vulnerable (2016)

Family	Scientific name	Common name	Red list category
Soricidae	Crocidura sp.	Shrews	
Soricidae	Crocidura cyanea	Reddish-gray Musk Shrew	Least Concern (2016)
Soricidae	Crocidura flavescens	Greater Red Musk Shrew	Least Concern (2016)
Soricidae	Crocidura hirta	Lesser Red Musk Shrew	Least Concern (2016)
Soricidae	Crocidura maquassiensis	Makwassie Musk Shrew	Vulnerable (2016)
Soricidae	Crocidura mariquensis	Swamp Musk Shrew	Near Threatened (2016)
Soricidae	Crocidura silacea	Lesser Gray-brown Musk Shrew	Least Concern (2016)
Soricidae	Myosorex sp.	Mouse Shrews	
Soricidae	Myosorex cafer	Dark-footed Mouse Shrew	Vulnerable (2016)
Soricidae	Myosorex varius	Forest Shrew	Least Concern (2016)
Soricidae	Suncus infinitesimus	Least Dwarf Shrew	Least Concern (2016)
Soricidae	Suncus varilla	Lesser Dwarf Shrew	Least Concern (2016)
Suidae	Potamochoerus larvatus	Bush-pig	Least Concern (2016)
Suidae	Potamochoerus larvatus koiropotamus	Bush-pig (subspecies koiropotamus)	Least Concern (2016)
Suidae	Potamochoerus porcus	Red River Hog	
Vespertilionidae	Eptesicus (Eptesicus) hottentotus	Long-tailed Serotine	Least Concern
Vespertilionidae	Kerivoula lanosa	Lesser Woolly Bat	Least Concern (2016)
Vespertilionidae	Miniopterus sp.	Long-fingered Bats	
Vespertilionidae	Miniopterus fraterculus	Lesser Long-fingered Bat	Least Concern (2016)
Vespertilionidae	Miniopterus natalensis	Natal Long-fingered Bat	Least Concern (2016)
Vespertilionidae	Miniopterus schreibersii	Schreibers's Long-fingered Bat	Near Threatened
Vespertilionidae	Myotis sp.	Myotises (Mouse-eared Bats, Hairy Bats)	
Vespertilionidae	Myotis tricolor	Temminck's Myotis	Least Concern (2016)
Vespertilionidae	Neoromicia sp.		
Vespertilionidae	Neoromicia capensis	Cape Serotine	Least Concern (2016)
Vespertilionidae	Neoromicia nana	Banana Pipistrelle	Least Concern

Family	Scientific name	Common name	Red list category
Vespertilionidae	Pipistrellus sp.	Pipistrelles	
Vespertilionidae	Pipistrellus (Pipistrellus) hesperidus	Dusky Pipistrelle	Least Concern
Vespertilionidae	Scotophilus dinganii	Yellow-bellied House Bat	Least Concern (2016)
Viveridae	Genetta maculata	Common Large-spotted Genet	Least Concern
Viverridae	Civettictis civetta	African Civet	Least Concern (2016)
Viverridae	Genetta sp.	Genets	
Viverridae	Genetta maculata	Rusty-spotted Genet (Common Large-spotted Genet)	Least Concern (2016)
Viverridae	Genetta tigrina	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)

15 APPENDIX F – LIST OF POTENTIAL REPTILES

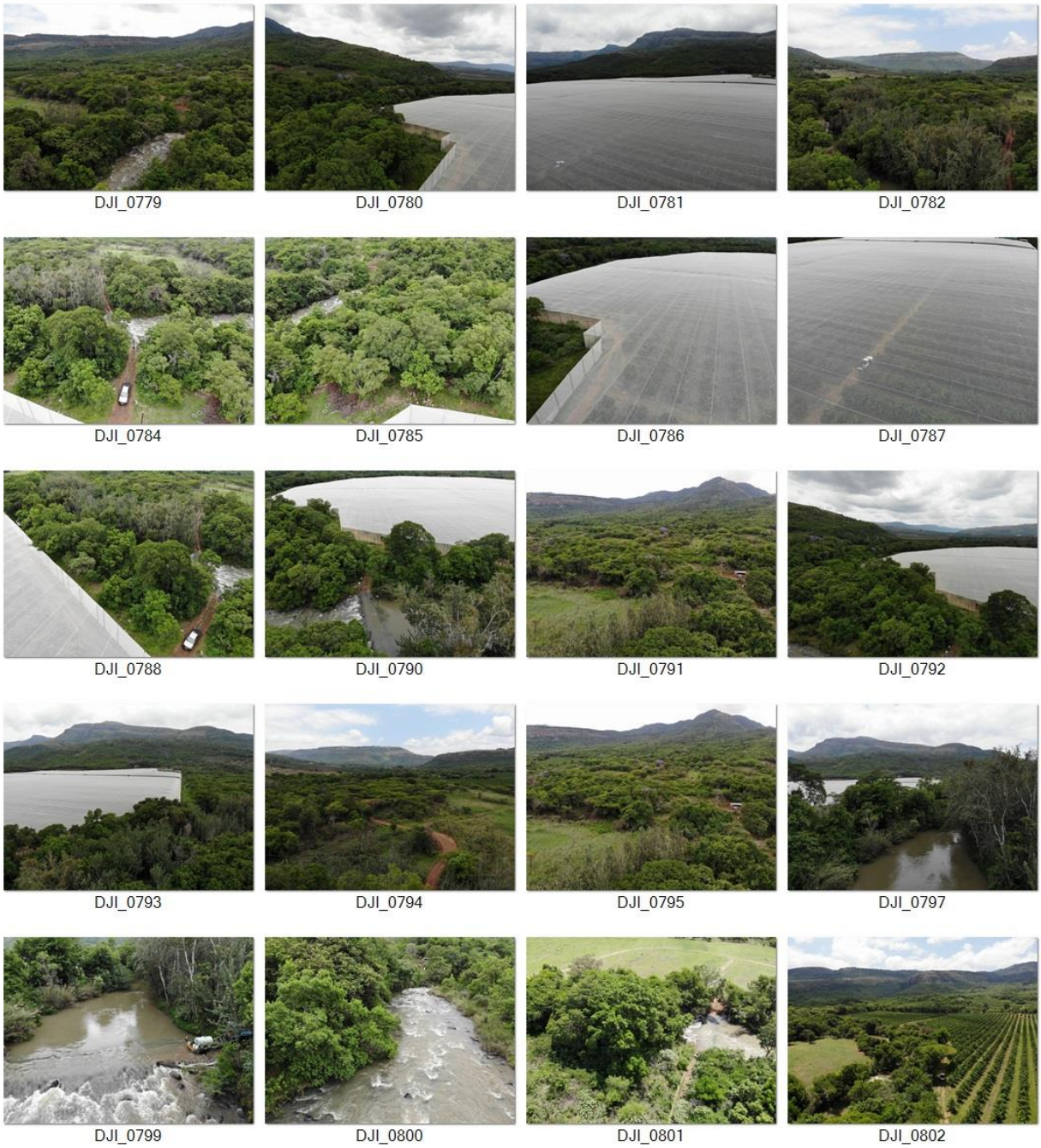
Family	Scientific name	Common name	Red list category
Agamidae	Acanthocercus atricollis	Southern Tree Agama	Least Concern (SARCA 2014)
Agamidae	Agama aculeata distanti	Distant's Ground Agama	Least Concern (SARCA 2014)
Chamaeleonidae	Bradypodion transvaalense	Wolkberg Dwarf Chameleon	Least Concern (SARCA 2014)
Colubridae	Crotaphopeltis hotamboeia	Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	Dasypeltis inornata	Southern Brown Egg-eater	Least Concern (SARCA 2014)
Colubridae	Dispholidus typus viridis	Northern Boomslang	Not evaluated
Colubridae	Philothamnus semivariegatus	Spotted Bush Snake	Least Concern (SARCA 2014)
Colubridae	Thelotornis capensis capensis	Southern Twig Snake	Least Concern (SARCA 2014)
Cordylidae	Cordylus vittifer	Common Girdled Lizard	Least Concern (SARCA 2014)
Cordylidae	Platysaurus intermedius wilhelmi	Wilhelm's Flat Lizard	Least Concern (SARCA 2014)
Cordylidae	Pseudocordylus melanotus melanotus	Common Crag Lizard	Least Concern (SARCA 2014)
Elapidae	Dendroaspis polylepis	Black Mamba	Least Concern (SARCA 2014)
Elapidae	Naja mossambica	Mozambique Spitting Cobra	Least Concern (SARCA 2014)
Gekkonidae	Homopholis wahlbergii	Wahlberg's Velvet Gecko	Least Concern (SARCA 2014)
Gekkonidae	Lygodactylus capensis capensis	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	Lygodactylus ocellatus	Spotted Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	Pachydactylus vansoni	Van Son's Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)
Lacertidae	Nucras ornata	Ornate Sandveld Lizard	Least Concern (SARCA 2014)
Lamprophiidae	Aparallactus capensis	Black-headed Centipede-eater	Least Concern (SARCA 2014)
Lamprophiidae	Boaedon capensis	Brown House Snake	Least Concern (SARCA 2014)
Lamprophiidae	Lycophidion capense capense	Cape Wolf Snake	Least Concern (SARCA 2014)
Lamprophiidae	Psammophis brevirostris	Short-snouted Grass Snake	Least Concern (SARCA 2014)

Family	Scientific name	Common name	Red list category
Lamprophiidae	Psammophis crucifer	Cross-marked Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	Psammophylax rhombeatus	Spotted Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	Pseudaspis cana	Mole Snake	Least Concern (SARCA 2014)
Leptotyphlopidae	Leptotyphlops sp.		
Leptotyphlopidae	Leptotyphlops jacobseni	Jacobsen's Thread Snake	Least Concern (SARCA 2014)
Pythonidae	Python natalensis	Southern African Python	Least Concern (SARCA 2014)
Scincidae	Acontias plumbeus	Giant Legless Skink	Least Concern (SARCA 2014)
Scincidae	Mochlus sundevallii	Sundevall's Writhing Skink	Least Concern (SARCA 2014)
Scincidae	Panaspis wahlbergi	Wahlberg's Snake-eyed Skink	Least Concern (SARCA 2014)
Scincidae	Scelotes mirus	Montane Dwarf Burrowing Skink	Least Concern (SARCA 2014)
Scincidae	Trachylepis margaritifera	Rainbow Skink	Least Concern (SARCA 2014)
Scincidae	Trachylepis punctatissima	Speckled Rock Skink	Least Concern (SARCA 2014)
Scincidae	Trachylepis striata	Striped Skink	Least Concern (SARCA 2014)
Scincidae	Trachylepis varia sensu lato	Common Variable Skink Complex	Least Concern (SARCA 2014)
Typhlopidae	Afrotyphlops bibronii	Bibron's Blind Snake	Least Concern (SARCA 2014)
Typhlopidae	Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)
Viperidae	Bitis arietans arietans	Puff Adder	Least Concern (SARCA 2014)
Viperidae	Causus rhombeatus	Rhombic Night Adder	Least Concern (SARCA 2014)

16 APPENDIX G – REMOTE IMAGES TAKEN AT THE TWO RIVER CROSSINGS

Note:

1. Oblique images 779 – 800 associated with plot 2 (Bridge 2)
2. Oblique images 801 – 819 associated with plot 1 (Bridge 1)




DJI_0803


DJI_0804


DJI_0805


DJI_0807


DJI_0808


DJI_0809


DJI_0810


DJI_0811


DJI_0812


DJI_0816


DJI_0817


DJI_0818


DJI_0819

17 APPENDIX H – OVERVIEW OF RIPARIAN SPECIES

Botanical Names	Major Growth Forms			Grand Total
	FORBS	GRASSES	WOODIES	
Acacia ataxacantha	0	0	1	1
Acacia karroo	0	0	1	1
Bidens pilosa	1	0	0	1
Celtis africana	0	0	1	1
Combretum erythrophyllum	0	0	1	1
Conyza bonariensis	1	0	0	1
Cyperus 13_2020	1	0	0	1
Dalbergia armata	0	0	1	1
Datura stramonium	1	0	0	1
Diospyros lycioides subsp. lycioides	0	0	1	1
Diospyros mespiliformis	0	0	1	1
Diospyros whyteana	0	0	1	1
Dombeya burgessiae	0	0	1	1
Dombeya rotundifolia var. rotundifolia	0	0	1	1
Grewia occidentalis var. occidentalis	0	0	1	1
Juncus effusus	1	0	0	1
Lantana camara	0	0	1	1
Lippia javanica	0	0	1	1
Morus alba var. alba	0	0	1	1
Panicum maximum	0	1	0	1
Phragmites australis	0	1	0	1
Populus 13_2024	0	0	1	1
Psidium guajava	0	0	1	1
Rhoicissus tomentosa	0	0	1	1
Rhus chirindensis	0	0	1	1
Rhus pyroides var. pyroides	0	0	1	1
sclerocarya birrea subsp. caffra	0	0	1	1
Setaria lindenbergiana	0	1	0	1
Setaria megaphylla	0	1	0	1
Setaria verticillata	0	1	0	1
Solanum giganteum	0	0	1	1
Syzygium cordatum subsp. cordatum	0	0	1	1
Grand Total	**5**	**5**	**22**	**32**
	16%	16%	69%	100%

18 APPENDIX I – LIST OF SPECIES RECORDED WITHIN THE PROPOSED ACCESS ROADS

Plot no	1	2	3	4	6	8	9	10	11	12	13	14	15	16	17			
Biome - Regional Context	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome			
Regional Vegetation Unit - Regional Context	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld			
Conservation Status - Regional Context	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered			
Land cover 2014 category - Local Context	Grassland	Grassland	Bare none vegetated	Grassland	Grassland	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush			
Derived Ecological Status - Local Context	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Total % Frequency (15 = 100%)	Grassland % Frequency	Savanna % Frequency
Acacia ataxacantha							1	1		1	1	1				33%	0%	56%
Acacia caffra						1	1			1		1				27%	17%	33%
Acacia mearnsii	1	1			1											20%	50%	0%
Acacia robusta						1										7%	17%	0%
Acacia sieberiana								1	1	1				1	1	33%	0%	56%
Acanthospermum australe		1														7%	17%	0%
Ageratum houstonianum										1						7%	0%	11%
Alloteropsis semialata				1	1											13%	33%	0%
Aloe greatheadii						1			1		1					20%	17%	22%
Aristida junciformis	1	1	1	1	1											33%	83%	0%
Athrixia elata		1	1								1					20%	33%	11%
Bauhinia galpinii								1	1	1		1	1	1		40%	0%	67%
Becium obovatum	1															7%	17%	0%
Berchemia zeyheri						1										7%	17%	0%
Berkheya radula		1	1													13%	33%	0%
Berkheya seminivea													1			7%	0%	11%
Berkheya setifera															1	7%	0%	11%
Bewsia biflora	1					1			1							20%	33%	11%
Bidens pilosa		1						1	1							20%	17%	22%
Bowkeria cymosa										1						7%	0%	11%
Brachiaria serrata	1	1	1	1												27%	67%	0%
Brachylaena huillensis												1	1			13%	0%	22%
Breonadia salicina										1						7%	0%	11%
Bridelia micrantha										1	1					13%	0%	22%
Celtis africana						1	1	1								20%	17%	22%
Cheilanthes viridis								1			1	1	1			27%	0%	44%
Clematis brachiata							1									7%	0%	11%
Clerodendrum glabrum						1	1							1		20%	17%	22%
Cliffortia species (101_2015)	1															7%	17%	0%
Combretum collinum													1			7%	0%	11%
Combretum erythrophyllum											1					7%	0%	11%
Combretum molle										1		1				13%	0%	22%
Conyza podocephala					1											7%	17%	0%
Crabbea hirsuta				1			1									13%	17%	11%
Cussonia natalensis															1	7%	0%	11%
Cussonia spicata							1									7%	0%	11%
Cymbopogon excavatus	1		1	1		1			1	1						40%	67%	22%
Cymbopogon validus		1	1		1		1		1		1					40%	50%	33%
Dalbergia armata												1		1		13%	0%	22%
Dianthus mooiensis	1															7%	17%	0%
Dichrostachys cinerea						1	1		1	1	1		1	1	1	53%	17%	78%

Plot no	1	2	3	4	6	8	9	10	11	12	13	14	15	16	17			
Biome - Regional Context	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome			
Regional Vegetation Unit - Regional Context	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld			
Conservation Status - Regional Context	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered			
Land cover 2014 category - Local Context	Grassland	Grassland	Bare none vegetated	Grassland	Grassland	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush			
Derived Ecological Status - Local Context	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Total % Frequency (15 = 100%)	Grassland % Frequency	Savanna % Frequency
Dicliptera clinopodia								1								7%	0%	11%
Diospyros lycioides	1	1				1				1	1			1	1	47%	50%	44%
Diospyros whyteana						1	1	1								20%	17%	22%
Dombeya pulchra							1	1								13%	0%	22%
Dombeya rotundifolia						1		1		1						20%	17%	22%
Dovyalis caffra						1									1	13%	17%	11%
Ehretia rigida						1										7%	17%	0%
Englerophytum magalismontanum											1		1			13%	0%	22%
Eragrostis capensis	1				1											13%	33%	0%
Eragrostis curvula	1	1		1	1	1		1						1		47%	83%	22%
Eragrostis gummiflua				1												7%	17%	0%
Eragrostis racemosa			1	1	1											20%	50%	0%
Eucalyptus species (115_2092)													1		1	13%	0%	22%
Euclea crispa						1					1					13%	17%	11%
Euclea divinorum												1				7%	0%	11%
Euclea undulata						1	1	1			1			1	1	40%	17%	56%
Eustachys paspaloides										1						7%	0%	11%
Faurea saligna											1	1	1			20%	0%	33%
Felicia muricata				1												7%	17%	0%
Geigeria burkei						1										7%	17%	0%
Gladiolus crassifolius			1	1	1										1	27%	50%	11%
Grewia occidentalis						1										7%	17%	0%
Helichrysum aureonitens				1	1											13%	33%	0%
Helichrysum nudifolium			1	1					1		1				1	33%	33%	33%
Helichrysum pilosellum		1														7%	17%	0%
Helichrysum rugulosum	1		1	1	1											27%	67%	0%
Hermannia linearifolia	1		1													13%	33%	0%
Heteropogon contortus				1							1			1		20%	17%	22%
Heteropyxis natalensis										1						7%	0%	11%
Hippobromus pauciflorus							1	1								13%	0%	22%
Hyparrhenia hirta									1		1	1	1			27%	0%	44%
Hyperthelia dissoluta													1		1	13%	0%	22%
Hypoxis rigidula			1	1	1				1							27%	50%	11%
Ilex mitis												1	1	1		20%	0%	33%
Imperata cylindrica							1									7%	0%	11%
Indigofera melanadenia	1															7%	17%	0%
Jacaranda mimosifolia								1		1		1			1	27%	0%	44%
Lantana camara								1	1	1	1	1	1	1	1	53%	0%	89%
Leonotis leonurus	1															7%	17%	0%
Lippia javanica						1	1		1	1				1	1	40%	17%	56%
Loudetia flavida	1	1	1			1			1	1	1		1			53%	67%	44%
Melia azedarach								1		1	1					20%	0%	33%
Melinis repens	1	1				1	1	1	1	1				1	1	60%	50%	67%
Nidorella hottentotica							1								1	13%	0%	22%
Oenothera rosea					1											7%	17%	0%
Olea europaea							1									7%	0%	11%
Panicum maximum						1		1	1	1	1			1	1	47%	17%	67%

Plot no	1	2	3	4	6	8	9	10	11	12	13	14	15	16	17			
Biome - Regional Context	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Grassland Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome	Savanna Biome			
Regional Vegetation Unit - Regional Context	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Lydenburg Montane Grassland	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld	Legogote Sour Bushveld			
Conservation Status - Regional Context	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered	Endangered			
Land cover 2014 category - Local Context	Grassland	Grassland	Bare none vegetated	Grassland	Grassland	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Woodland/Open bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush	Thicket /Dense bush			
Derived Ecological Status - Local Context	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Natural - Terrestrial	Total % Frequency (15 = 100%)	Grassland % Frequency	Savanna % Frequency
Panicum natalense			1													7%	17%	0%
Parinari capensis													1			7%	0%	11%
Paspalum urvillei							1									7%	0%	11%
Pavetta edentula													1	1		13%	0%	22%
Peltophorum africanum								1	1	1			1			27%	0%	44%
Pentanisia angustifolia			1													7%	17%	0%
Peucedanum magalismontanum		1														7%	17%	0%
Phymaspermum athanasioides													1			7%	0%	11%
Pogonarthria squarrosa												1				7%	0%	11%
Pollichia campestris	1	1														13%	33%	0%
Protasparagus laricinus						1										7%	17%	0%
Protasparagus virgatus								1								7%	0%	11%
Protea caffra													1			7%	0%	11%
Psidium guajava									1	1	1	1	1			33%	0%	56%
Pterocarpus angolensis									1		1	1	1			27%	0%	44%
Pterocarpus rotundifolius									1		1	1	1		1	33%	0%	56%
Rhamnus prinoides							1									7%	0%	11%
Rhoicissus tridentata							1	1								13%	0%	22%
Rhus chirindensis						1		1			1				1	27%	17%	33%
Rhus dentata	1	1					2									27%	33%	22%
Rhus lancea								1								7%	0%	11%
Rhus rehmanniana						1				1		1		1		27%	17%	33%
Rubus rigidus		1														7%	17%	0%
Senecio polyanthemoides			1			1	1		1			1				33%	33%	33%
Senecio venosus	1	1	1				1									27%	50%	11%
Setaria lindenbergiana								1								7%	0%	11%
Setaria sphacelata		1	1				1		1		1		1			40%	33%	44%
Solanum sisymbriifolium	1	1														13%	33%	0%
Sporobolus pyramidalis						1		1	1	1	1			1		40%	17%	56%
Striga bilabiata	1															7%	17%	0%
Strychnos madagascariensis													1			7%	0%	11%
Syzygium cordatum											1					7%	0%	11%
Tagetes minuta														1		7%	0%	11%
Themeda triandra	1		1	1			1		1				1		1	47%	50%	44%
Trachypogon spicatus	1	1	1						1				1			33%	50%	22%
Vernonia natalensis			1												1	13%	17%	11%
Zanthoxylum capense						1	1									13%	17%	11%
Ziziphus mucronata						1		1			1					20%	17%	22%
Grand Total	**24**	**21**	**21**	**16**	**13**	**30**	**28**	**26**	**25**	**26**	**28**	**19**	**26**	**18**	**21**			
															Mean species/ plot	23	21	24