

Flora Study – Mabopane

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1 EXECUTIVE SUMMARY

The University of Pretoria's Landscape Architecture Department appointed EkoInfo CC to assist with a floristic study an area to the north of Pretoria in Gauteng Province. The area is located within Mabopane.

Willem de Frey, a registered scientific professional in the fields of botanical – and ecological science with more than 25 years' experience facilitated the study. The areas were surveyed during January and February 2022, the optimal period for floristic studies in the summer rainfall area of South Africa.

The area covers 100 ha. Twenty-four plots were surveyed using the Braun-Blanquet approach. Three plant communities and four sub-communities were identified based on floristic composition and abiotic factors. The vegetation communities are:

- 1. *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
 - 1.1. *Acacia nilotica* - *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
 - 1.2. *Ozoroa paniculosa* - *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
- 2. *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
 - 2.1. *Carissa bispinosa* - *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
 - 2.2. *Grewia flava* - *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
- 3. *Imperata cylindrica* - *Persicaria lapathifolia* tall closed grassland on moderate deep, very coarse textured soils, mainly on valley bottoms in association with temporary - seasonal wetland soils such as Kroonstad

Overall, the study area represents mainly terrestrial ecosystems (Community one and two) with wetland restricted to community three along the watercourses transecting the study area. Humans have been influencing the study area since 1969, mainly with cultivation, but currently with commercial and sports infrastructure. The terrestrial ecosystems experienced the brunt of these human influences.

The species area curve confirmed that the 184 species recorded across the plots surveyed are representative of the study area. No national protected or threatened Red Data plants were recorded within the species surveyed. Provincially protected plants were recorded as well as declared alien invasive species. Medicinal as well as plant which present habitat for butterflies and birds had been recorded.

Based on the Beta-diversity between the three communities identified, the least sensitive is community three, associated with wetlands along the watercourses. Community two has the highest sensitivity, mainly due to the fact that it is a transitional community, community one and three, and represents a mosaic of terrestrial and wetland (inundated areas).

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2 INTRODUCTION

The University of Pretoria appointed Eco Info And Associates Environmental Services (Pty) Ltd to assist with a floristic study at a site north of Pretoria, Gauteng Province (Figure 1). The study formed part of a larger project which concerns remote sensing.

3 SCOPE OF WORK

To describe and map the vegetation within the study area the Braun-Blanquet approach was applied. Additional information was derived from aerial based remote sensing platforms (drones) with regards to vegetation cover and health.

To achieve this objective, EIAA's managing director and principal consultant, Willem de Frey, a registered scientific professional in the fields of ecological – and botanical science with more than 25 years' experience facilitated the study. The study occurred in the months of January and February 2022.

Each of the two areas will be treated as separate section, each with:

1. A general description of the study area
2. Phytosociological description and mapping

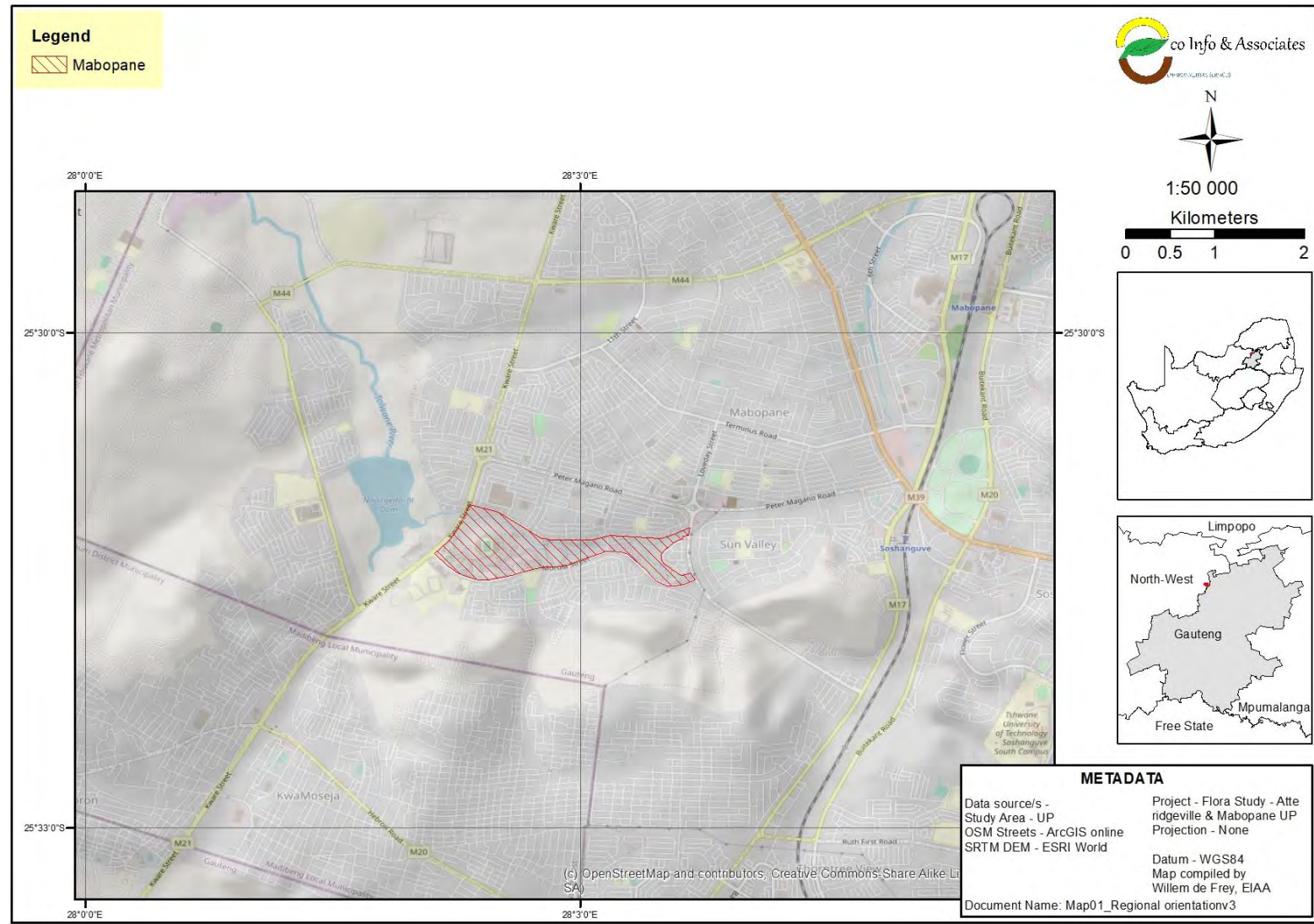


Figure 1: Regional orientation of the study area to the north of the city of Pretoria, Gauteng Province – South Africa

4 METHOD STATEMENT

The study consisted of a phytosociological study.

4.1 PHYTOSOCIOLOGICAL STUDY

The Braun-Blanquet approach was applied, which is basically the standard for phytosociological studies (plant description and mapping) in South Africa. The Braun-Blanquet sample plot method is the preferred sampling technique of the National Spatial Biodiversity Assessment team (Rouget *et al.* 2004).

Stratified randomly placed plots were targeted during January and February 2022 based on available soil – and landscape information and physiognomic differences observed on large-scale aerial photographs and satellite imagery. Twenty-four plots were surveyed in the Mabopane study (Figure 2). The National Spatial Biodiversity Assessment team indicated that twenty (20) sample plots are the minimum number of sample plots that can be included in the national biodiversity datasets (Rouget *et al.* 2004). Therefore, the study complies with the minimum number of sample plot samples recommended on a national level. The random, *pro rata* placement of the 24 sampling plots was facilitated with the aid of a Geographic Information System (GIS), namely ESRI's ArcView 10.1 and Idrisi Selva. The co-ordinates of the sample plots were exported to Mapsource and uploaded to a GARMIN Montana Global Positioning System (GPS) receiver for navigation in the field. Actual location in the field was recorded within a 5 m accuracy interval.

At each sample plot, the following abiotic attributes were documented:

1. Topography – altitude, terrain unit, percentage slope;
2. Soil – soil form, soil depth (mm), erosion, estimated percentage clay of A horizon and
3. Estimated percentage rock cover – gravel, small, medium, large.

The following overall vegetation characteristics were documented:

1. Vegetation cover – total, trees, shrubs, herbs, open water, rock; and
2. Estimated average height of trees, shrubs and herbs – highest and lowest categories.

A list of all species within an approximate 200 m² area was recorded in the following growth form categories: grasses, forbs and woody species (shrubs and trees). Cover abundance values was estimated for each species within the sample plot. Unknown species or potential red data species was identified using field guides (Van Oudtshoorn 1991, Van Wyk & Malan 1988, Van Rooyen 2001, Van der Walt 2009), the University of Pretoria's herbarium and specialists from the National Botanical Institute.

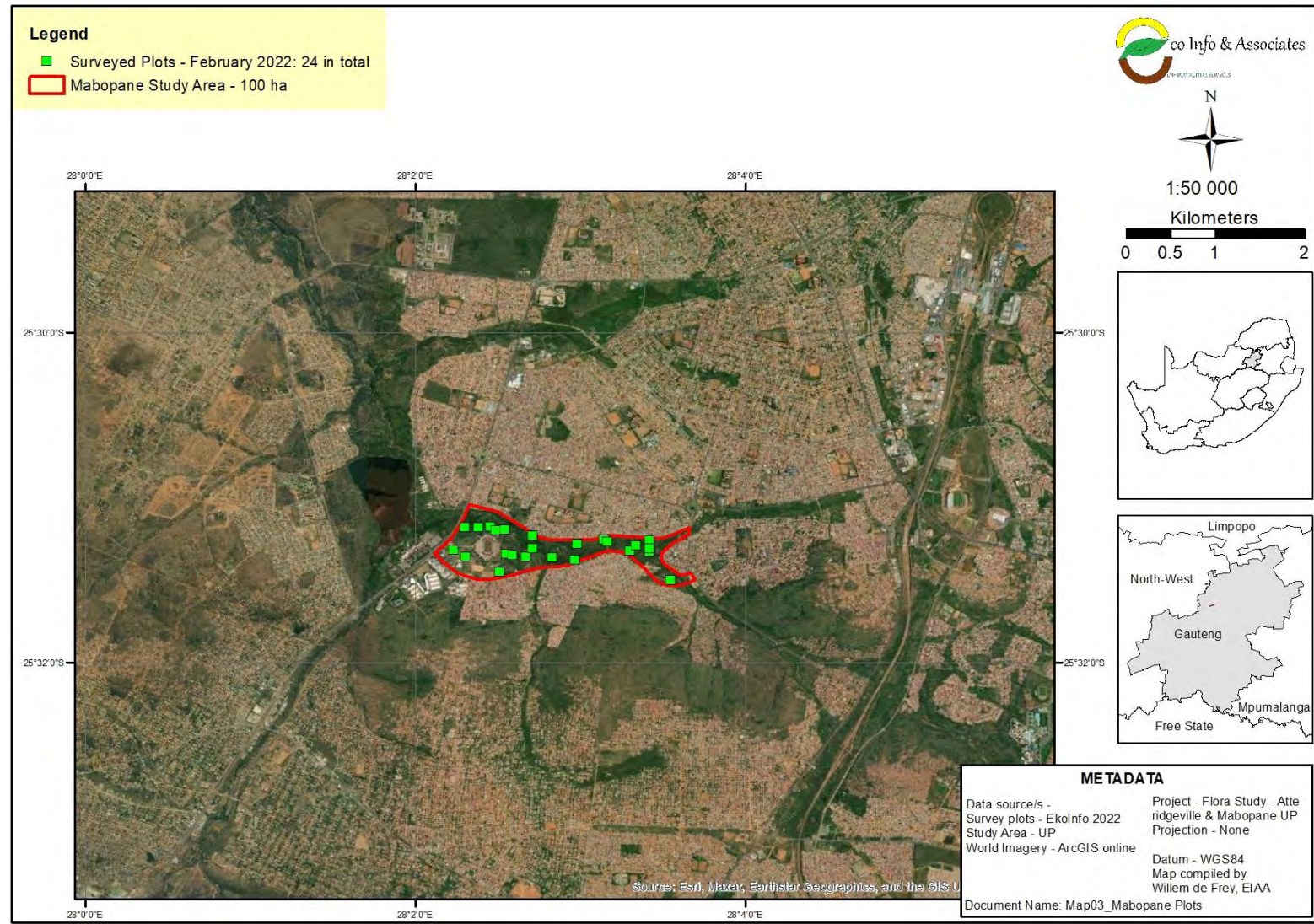


Figure 2: Distribution of the survey plots within the Mabopane study area

A single team consisting of a professionally registered scientist in the fields of ecological – and botanical science and a field assistant facilitated the fieldwork.

The survey results were entered into a relational database for record purposes and analysis of the abiotic and vegetation characteristics. The species data was entered into TURBOVEG (Hennekens 1996) and analysed with Juice1. A vegetation map was compiled and refined, based on the results of the phytosociological table and boundaries of the homogenous units.

This approach follows the guidelines recommended for phytosociological studies on a national level with regards to the classification and description of vegetation in southern Africa (Brown *et al.* 2013).

4.2 LIMITATIONS

1. The Braun-Blanquet approach was developed to collect 95% of the species present within a sample plot, therefore the more sample plots surveyed the more comprehensive the species lists will be and the more detailed the vegetation description and mapping will be;
2. This study only represents a summer survey based on national guidelines and criteria
3. The vegetation map was compiled using available remote sensing imagery and therefore is not absolute in its accuracy, confidence level estimated to be in the 80% to 85% range
4. The following confidence levels are attributed to the species recorded: Families – 95%, Genera – 85% and Species – 75%;
5. Available regional land cover information was based on third party sources, which is assumed to be accurate.
6. For many of the threatened plant species in South Africa no images are available to assist with field identification

1 <http://www.sci.muni.cz/botany/juice/>

5 RESULTS

5.1 STUDY AREA

The study area is located to the north of the City of Tshwane in Gauteng Province, it covers 100 ha. Dense residential developments occur on the northern, eastern - and southern boundary, with road on the western boundary that separate it from large open spaces (**Error! Reference source not found.**). The western open space is associated with a dam. An overview of the environmental factors which the vegetation is expected to reflect is provided.

5.1.1 Geological Attributes

A single stratigraphic unit underlay the study area, namely the Lebowa Granite Suite of the Bushveld Igneous Complex (Johnson **et al.** 2006) (Figure 3). Granite is a coarse textured igneous rock which developed deep inside the crust of the earth. Igneous rocks tend to weather faster in humid climates resulting in valleys with fine textured soils in the low-lying areas of the landscape (Read & Watson 1983, Strahler & Strahler 1987, White 1987). Quartz crystals are prominent in the soil, especially higher up in the landscape as the fine materials are removed from the soil profile.

5.1.2 Climatic Attributes

The study area is located within the Northern Transvaal climate zone, across two global climate zones, namely semi-arid and sub-humid (Figure 4). According to the climate graph² (Figure 5) for the Klipgat settlement west of the study area, with which the study area is associated, the mean annual precipitation is 604 mm, with the most rainfall occurring in the December and the least in July. February is the warmest month, and July the coldest. The mean annual temperature is 19.2 °C.

5.1.3 Topographic Attributes

The study area is associated with plains and hills, from an altitude of 1 190 m above mean sea level to 1 148 m in the west (Figure 6). A watercourse drains the area to the west.

² <https://en.climate-data.org/africa/south-africa/gauteng/pretoria-154/>

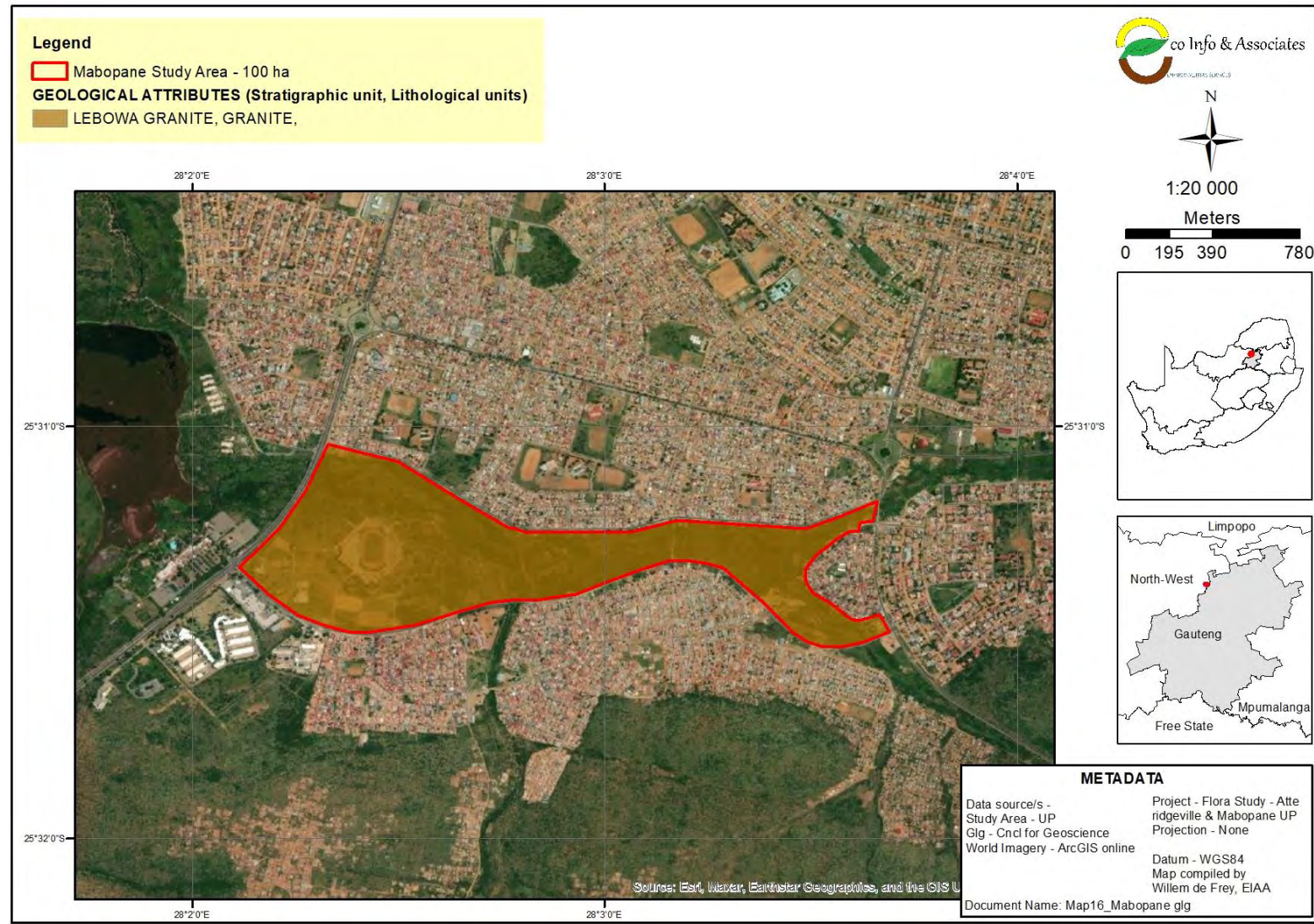


Figure 3: Geological attributes associated with the Mabopane study area

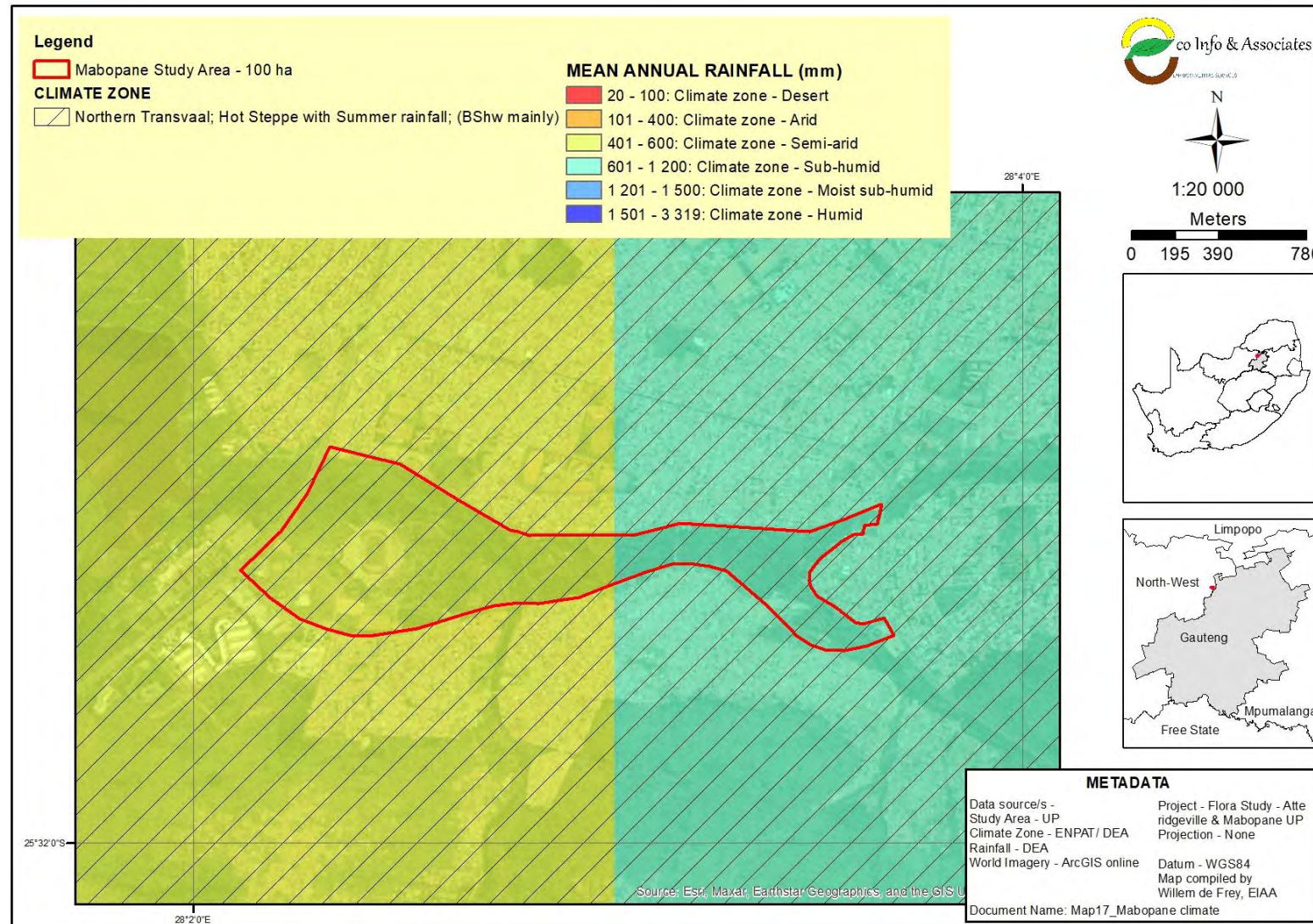
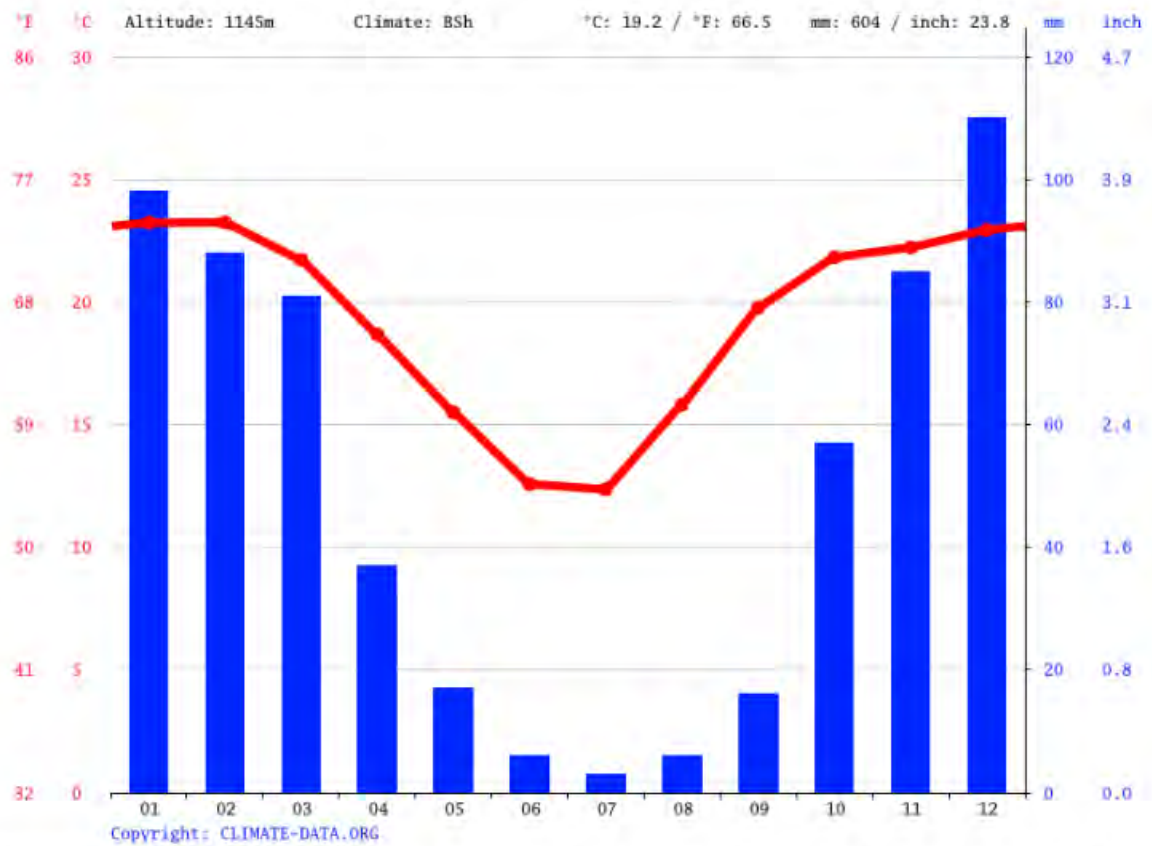


Figure 4: Climatic attributes associated with the Mabopane area



The least amount of rainfall occurs in July. The average in this month is 3 mm | 0.1 inch. Most precipitation falls in December, with an average of 110 mm | 4.3 inch.

Figure 5: Climate graph of Klipgat, a settlement near the Mabopane study area

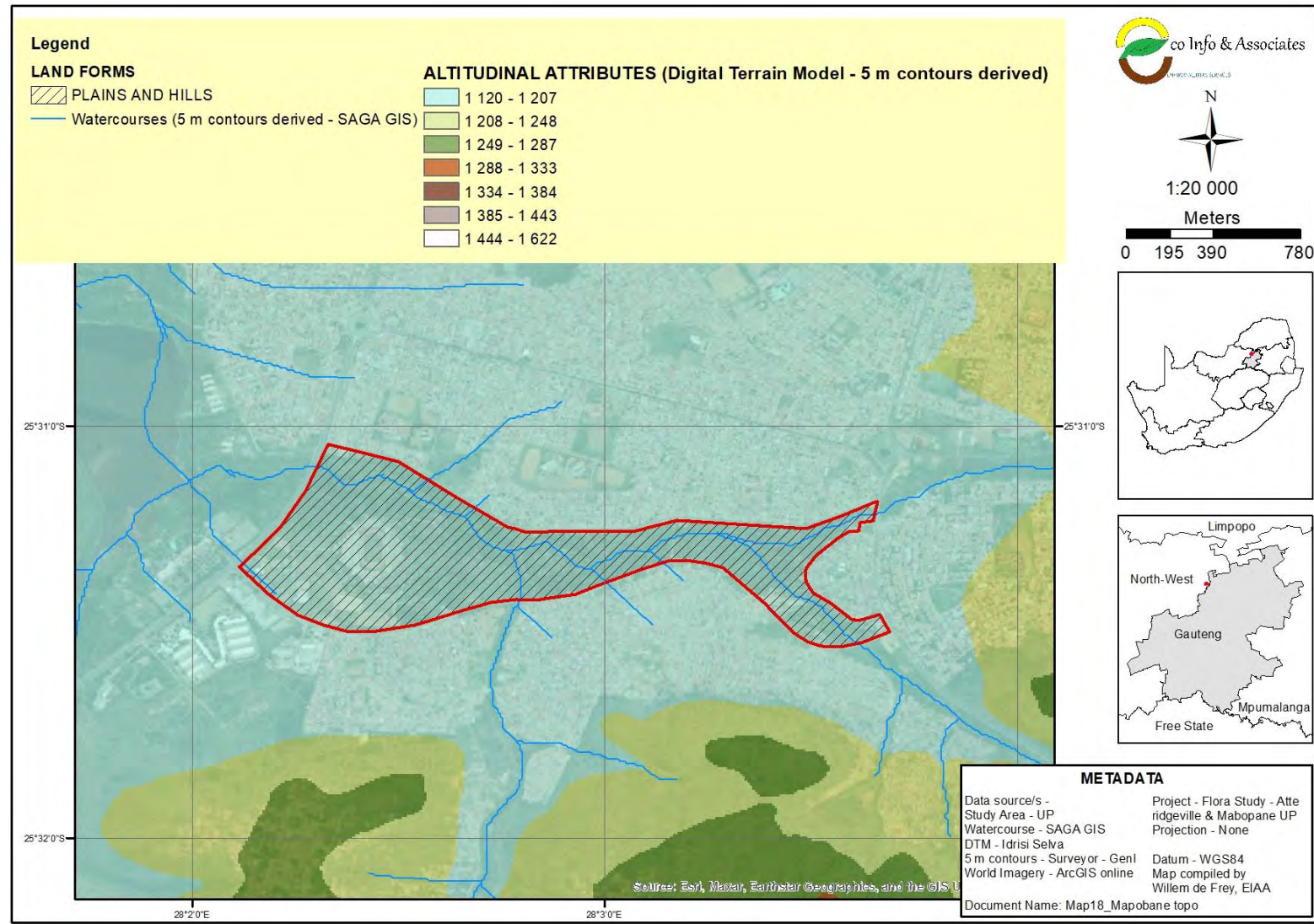


Figure 6: Topographic attributes associated with the Mabopane study area

Locally most of the study area is associated with slopes of less than 5°, slopes of 5 – 10° occur close to the drainage lines, with high to very high potential for wetlands to develop (Figure 7).

5.1.4 Soil Attributes

The study area is associated with a single land type unit, namely Fa4 (**Error! Reference source not found.**). Soils belonging to this land type units are associated with pedologically young landscape, consisting mainly of Mispah and Glenrosa soil forms, with limited lime in the profile (Land Type Survey Staff 1987, Soil Classification Workgroup 1991). These soils are not optimal for cultivation activities (White 1987, Fey 2010). Historical images from 1969 however do indicate that cultivation did occur in the area (Figure 9). The use of these areas for subsistence farming is evident within the study area (Photo plate 1Photo plate 1).

It is expected the vegetation will reflect the variation in coarse textured soils and presence of the shallow water table (Barbour **et al.** 1980, Strahler & Strahler 1987) on a local scale.

5.1.5 Vegetation Attributes

The study area is located within the least concern Central Sandy Bushveld (Figure 10) of the Savanna Biome of South Africa (Mucina & Rutherford 2006). The Central Sandy Bushveld is described as:

“Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea Africana* woodland on deep sandy soils (with the former often dominated on the lower slopes of sandy catenas) and low, broadleaved *Combretum* woodland on shallow rocky or gravelly soils. Species of *Acacia*, *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *A. tortilis* may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic soils.

Vulnerable. Target 19%. Less than 3% statutorily conserved spread thinly across many nature reserves including the Doorndraai Dam and Skuinsdraai Nature Reserves. An additional 2% conserved in other reserves including the Wallmansthal SANDF Property and a grouping of private reserves, which include most of the Nyilsvei freshwater wetlands. About 24% transformed, including about 19% cultivated and 4% urban and buildt-up areas. Much of the unit in the broad arc south of the Springbokvlakte is heavily populated by rural communities. Several alien plants are widely scattered but often at low densities, these include *Cereus jamacaru*, *Eucalyptus* species, *Lantana camara*, *Melia azedarach*, *Opuntia ficus-indica* and *Sesbania punicea*. Erosion very low to high, especially in some places northeast of Groblersdal.”

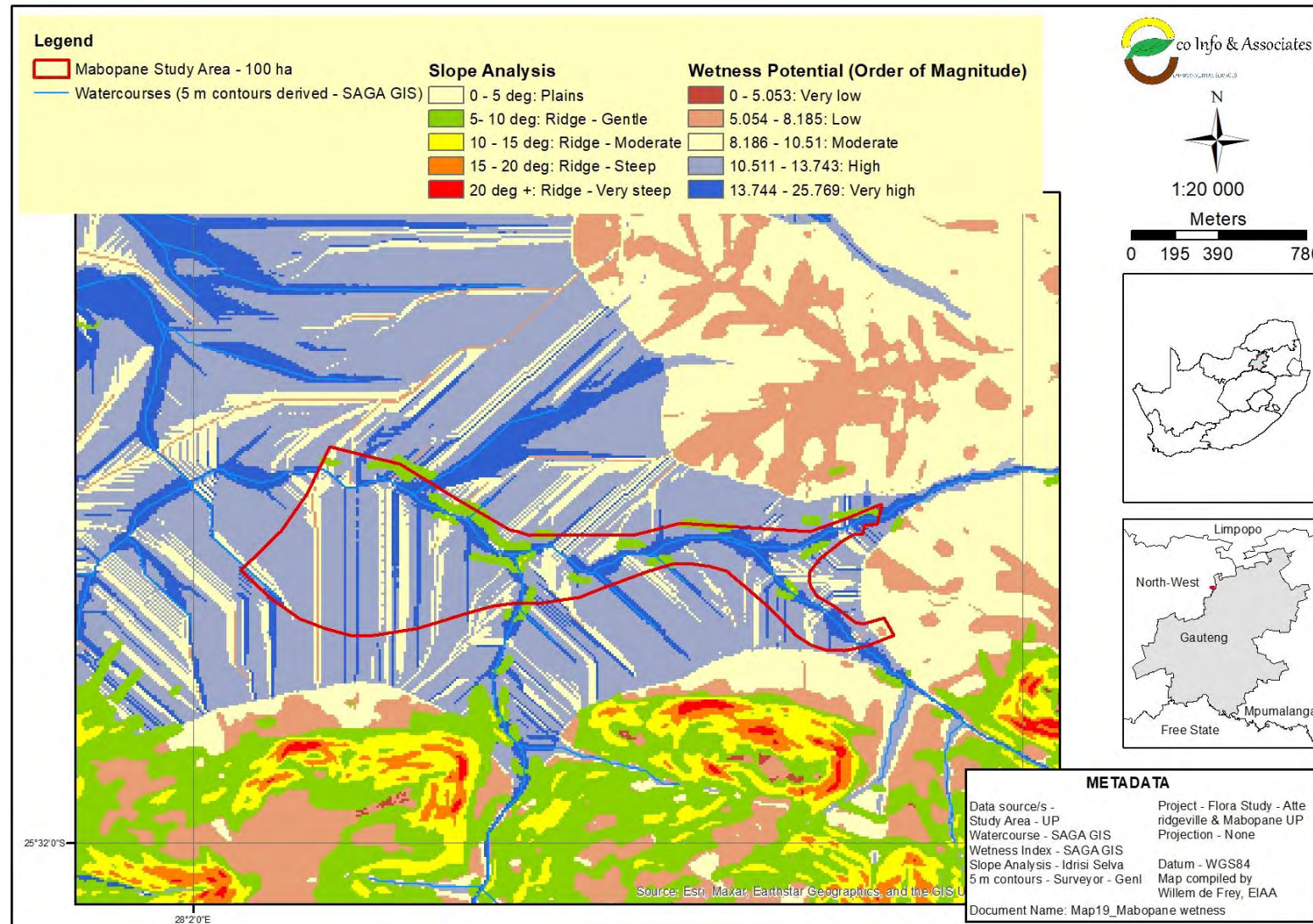


Figure 7: Local topographic attributes associated with the Mabopane study area

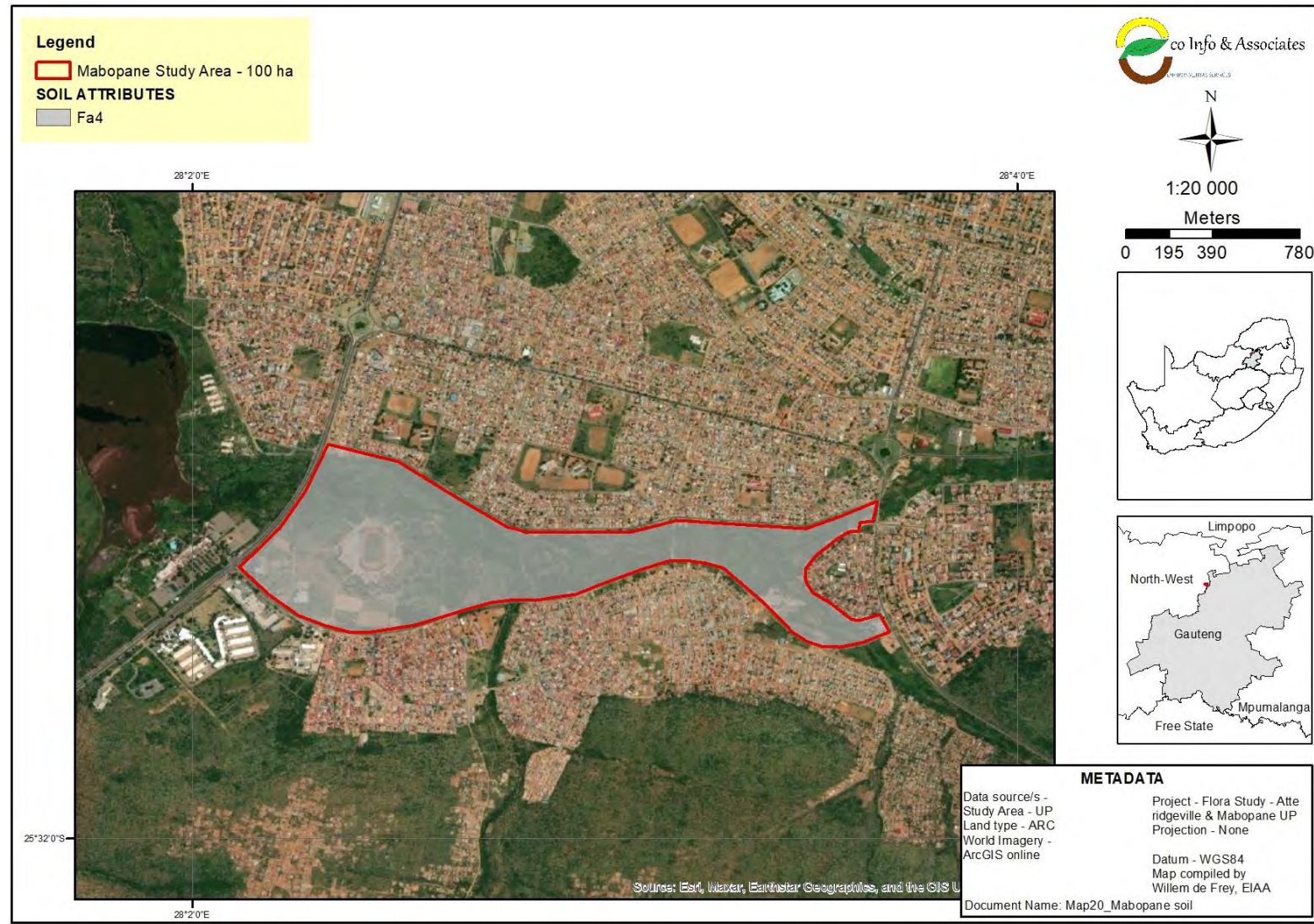


Figure 8: Soil attributes associated with the Mabopane study area

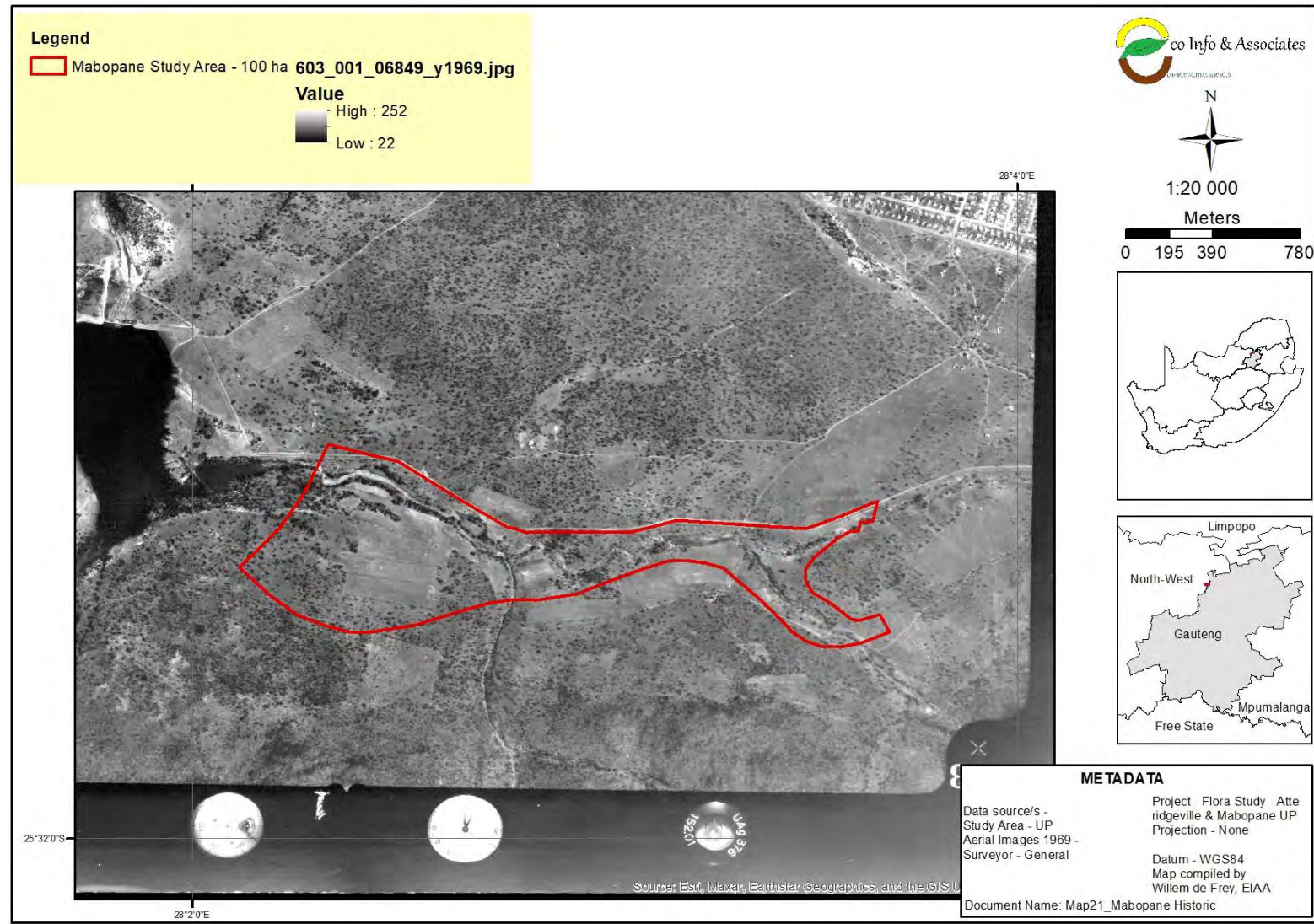


Figure 9: Historical images from 1969 showing the occurrence of cultivated fields in the study area



Photo plate 1: Oblique images showing subsistence farming on the soils associated with the study area

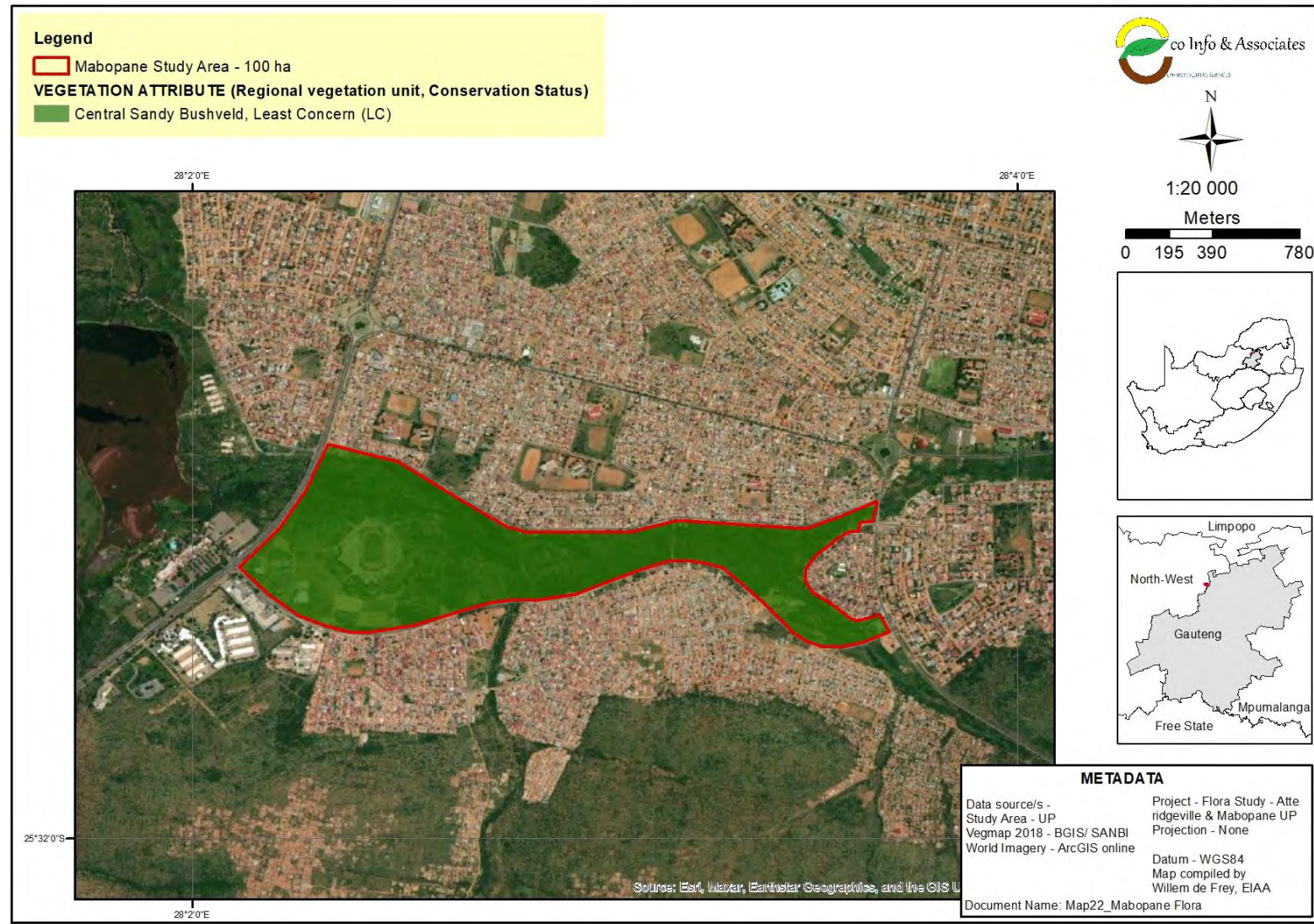


Figure 10: Flora attributes associated with the Mabopane study area

The following 50 plant species are listed as important for the vegetation unit:

*Acacia*³ *burkei*, *Acacia robusta* subsp. *robusta*, *Agathisanthemum bojeri* subsp. *bojeri*, *Aloe greatheadii* var. *davyana*, *Antheophora pubescens*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Asparagus buchananii*, *Barleria macrostegia*, *Blepharis integrifolia* var. *integrifolia*, *Brachiaria nigropedata*, *Brachiaria serrata*, *Burkea africana*, *Combretum apiculatum* subsp. *apiculatum*, *Combretum hereroense*, *Combretum zeyheri*, *Crabbea angustifolia*, *Dicerocaryum senecioides*, *Dichapetalum cymosum*, *Elionurus muticus*, *Eragrostis nindensis*, *Eragrostis pallens*, *Eragrostis rigidior*, *Evolvulus alsinoides*, *Felicia fascicularis*, *Geigeria burkei* subsp. *burkei* var. *burkei*, *Gnidia sericocephala*, *Grewia bicolor* var. *bicolor*, *Grewia monticola*, *Hermannia lancifolia*, *Hyperthelia dissoluta*, *Hypoxis hemerocallidea*, *Indigofera daleoides*, *Indigofera filipes*, *Justicia anagalloides*, *Kyphocarpa angustifolia*, *Lophiocarpus tenuissimus*, *Loudetia simplex*, *Ochna pulchra*, *Panicum maximum*, *Peltophorum africanum*, *Perotis patens*, *Rhus leptodictya*, *Schmidtia pappophoroides*, *Sclerocarya birrea* subsp. *caffra*, *Strychnos pungens*, *Terminalia sericea*, *Themeda triandra*, *Trachypogon spicatus*, *Waltheria indica*, *Xerophyta humilis*

Two additional species are listed as biogeographically important taxa, namely: *Mosdenia leptostachys*, *Oxygonum dregeanum* subsp. *canescens* var. *dissectum*.

It is expected that the majority of species recorded during the survey will be representative of these species.

5.1.6 Conservation Attributes

Based on the provincial scale biodiversity sector plan (Figure 11Error! Reference source not found.), 35 ha or 35% of the study area is associated with Ecological Support Area (Table 1Error! Reference source not found.), with the remaining area having no conservation priority assigned to it. The lack of Critical Biodiversity Area (CBA) can be attributed to past (Figure 9) and current human activities

5.1.7 Current Land use

According to the most recent land cover information from 2020 (Figure 12) 24 ha or 24% of the study area is untransformed (Table 2), consisting mainly of grasslands at 12 ha or 12%. Of concern is the fact that the land cover datasets classify the area as grassland while it is woodland!

³ The genus *Acacia* in South Africa had been divided into genera in 2011, namely *Vachellia* (round flower heads) and *Senegalia* (Spike flower heads) (Dyer 2014). However, for the purpose of this document, and ease of access in older field guides the genus *Acacia* will be used

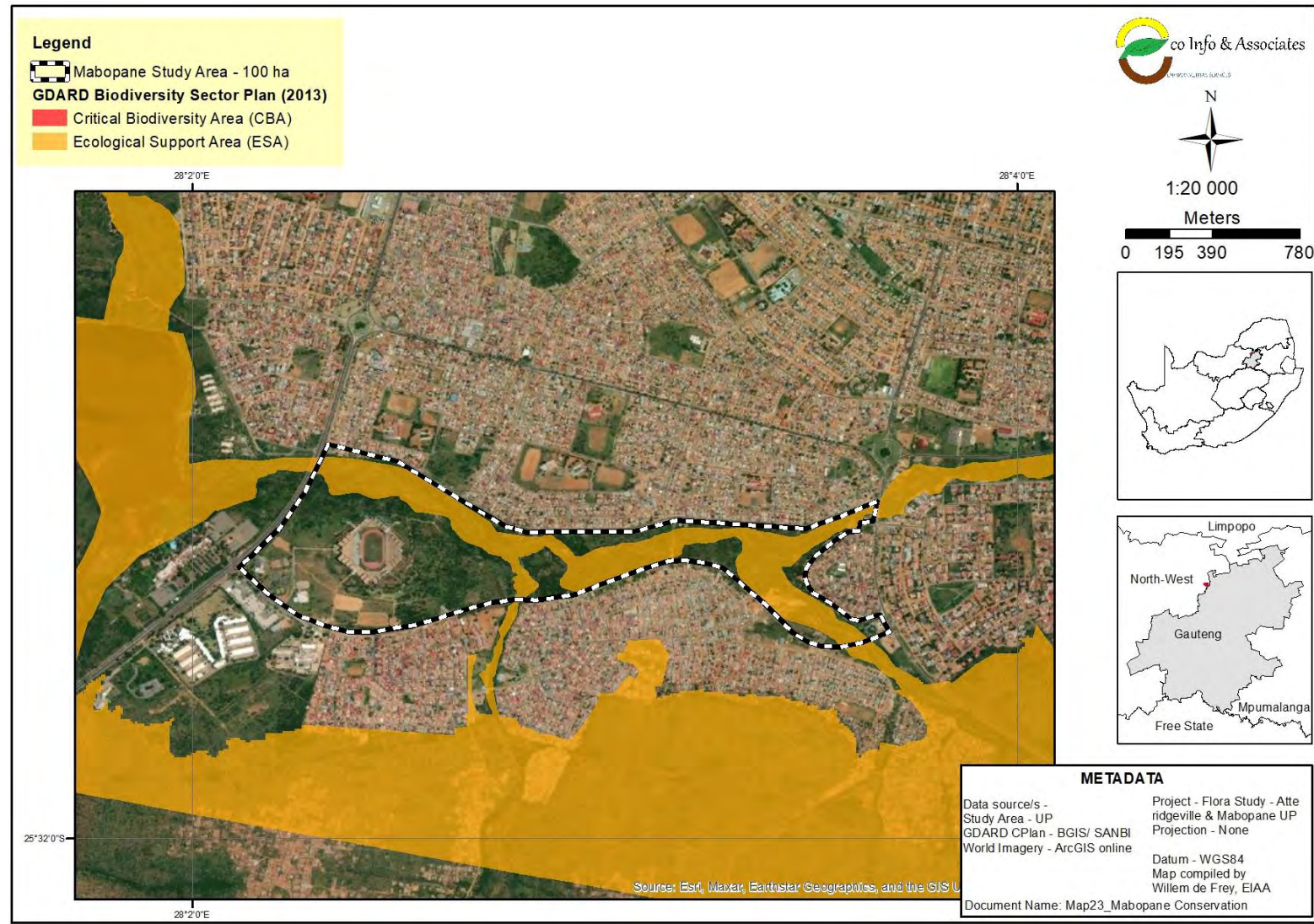


Figure 11: Conservation attributes associated with the Mabopane study area

Table 1: Overview of the extent and percentage cover of areas of conservation concern within the Mabopane study area

GDARD Biodiversity Sector Plan (2013)	Surface (ha)	% Cover
Ecological Support Area	35	35%
No Conservation Priority Area	65	65%
Total	100	100%

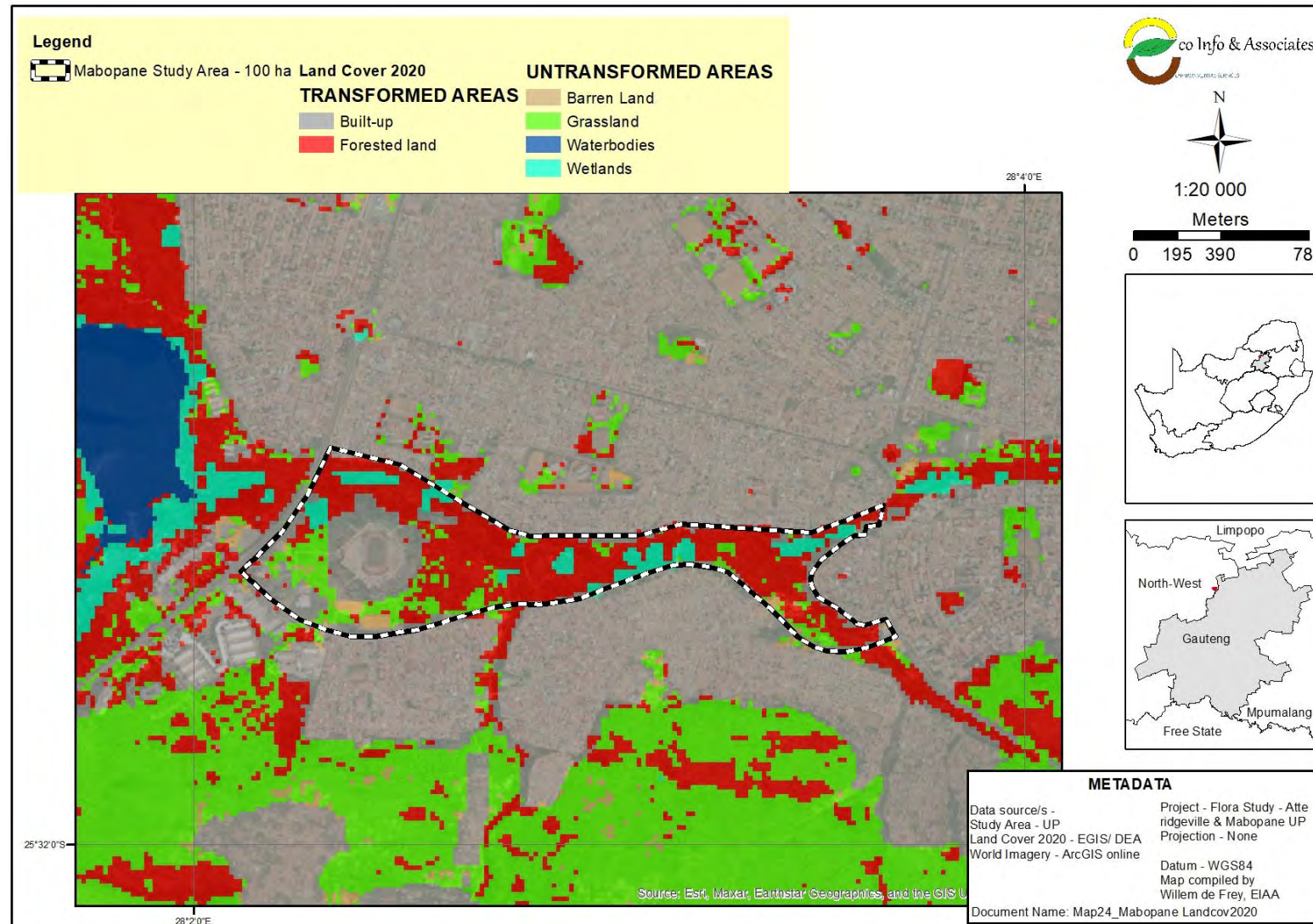


Figure 12: Land cover attributes from 2020 associated with the Mabopane study area

Table 2: Overview of the extent and percentage cover of the land cover 2020 categories within Mabopane study area

Land Cover 2020 Categories	Surface Area (ha)	% Cover	Derived Ecological Status	
			Untransformed	Transformed
Barren Land	2	2%	2	
Built-up	30	30%		30
Forested land	47	47%		47
Grassland	12	12%	12	
Wetlands	9	9%	9	
Grand Total	100	100%	24	77
			24%	76%

It should be noted that the land cover data does not distinguish between primary or secondary vegetation or persistent primary vegetation. Based on the historical image from 1969 (Figure 9), it is evident that a large part of the study area had been used for cultivation.

5.2 PHYTOSOCIOLOGICAL STUDY

Twenty-seven randomly stratified plots were placed across the study area, based on altitudinal units derived from slope, aspect and potential accumulation of water in the landscape (Figure 13). Thirty altitudinal units are present within the study area, of which of which 14 exceed 1 ha in size (Figure 14). These 14 units representing stands/ patches of 300 m² or more were targeted for the survey (Table 3). Due to localised transformation influences such as illegal rubble dumping and informal recycling (Photo plate 2) not all 27 plots could be surveyed, resulting in only 24 plots being surveyed.

5.2.1 Vegetation Communities

Implementing the TWINSpan hierarchical algorithm (Kent & Coker 1992) (Figure 15), five clusters were identified, representing three communities (Figure 16) and four sub-communities:

- 1. *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
 - 1.1. *Acacia nilotica* - *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
 - 1.2. *Ozoroa paniculosa* - *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah
- 2. *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
 - 2.1. *Carissa bispinosa* - *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
 - 2.2. *Grewia flava* - *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly
- 3. *Imperata cylindrica* - *Panicum capense* tall closed grassland on moderate deep, very coarse textured soils, mainly on valley bottoms in association with temporary - seasonal wetland soils such as Kroonstad

Canonical correspondence analysis (CCA) (Kent & Coker 1992) (Figure 17, Figure 18, Figure 19) based on the floristic data and quantitative abiotic data indicates that the main factors which influence the vegetation distribution within the study area are:

- Altitude

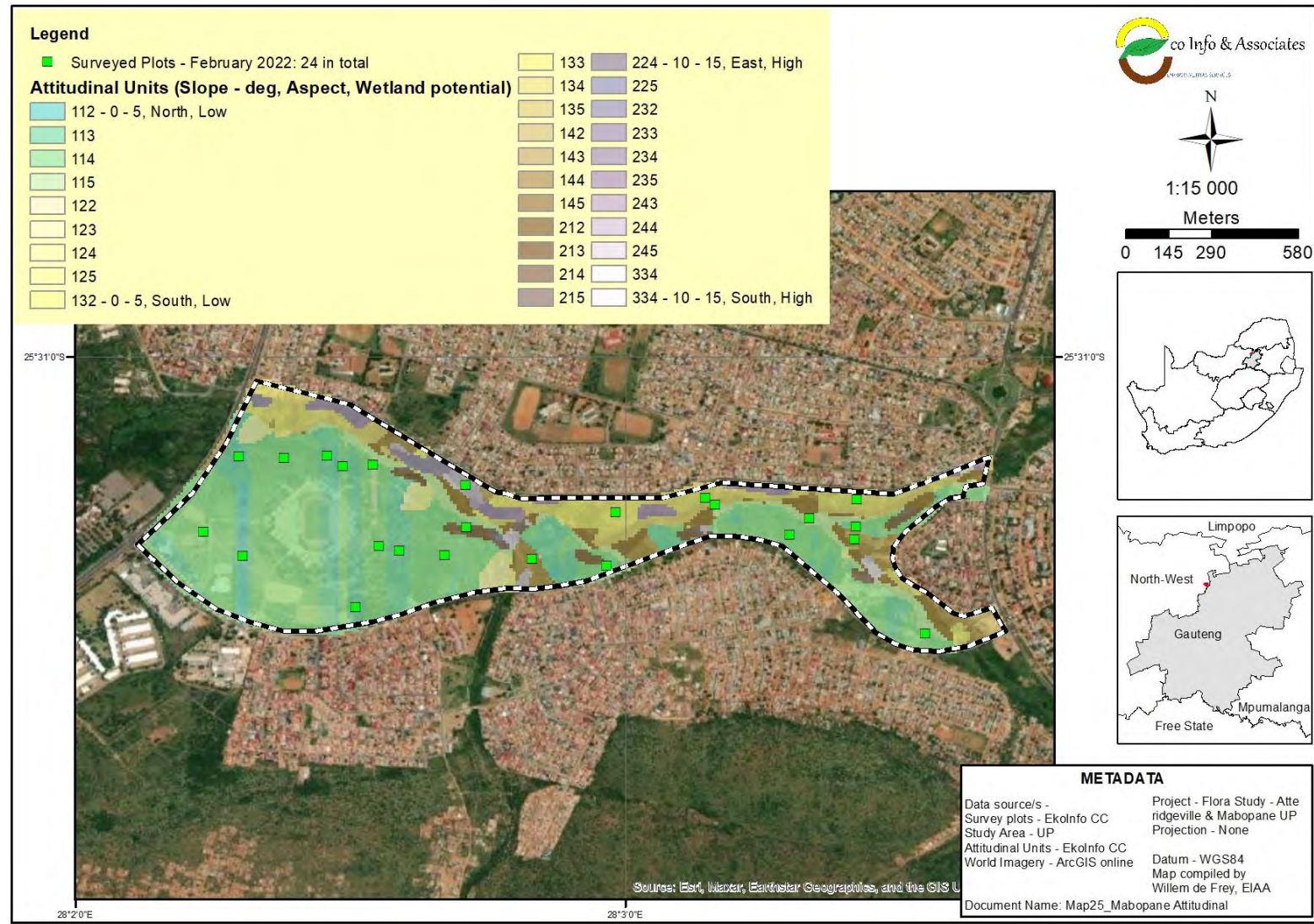


Figure 13: Attitudinal units associated with the Mabopane study area



Figure 14: Distribution and extent of the 14 habitat units exceeding 1 ha in size, and consisting of patches of more than 300 m² in size

Table 3: Targeted samples based on the 14 habitat units exceeding 1 ha in size

Attitudinal Units	Hectares	Attitudinal Unit – Attribute No			Attitudinal Unit - Description			% cover	Cum % Cover	Habitat Unit	Target Sample Count
		Slope	Aspect	Wetland Probability	Slope	Aspect	Terrain				
114	44.2674726	1	1	4	0 - 5 deg	North	Footslope	41%	41%	1	9
113	18.0071075	1	1	3	0 - 5 deg	North	Midslope - Lower	17%	58%	2	4
134	8.0131628	1	3	4	0 - 5 deg	South	Footslope	7%	65%	3	2
115	5.3421086	1	1	5	0 - 5 deg	North	Valley bottom	5%	70%	4	2
145	4.3817295	1	4	5	0 - 5 deg	West	Valley bottom	4%	75%	5	1
144	4.2516782	1	4	4	0 - 5 deg	West	Footslope	4%	79%	6	1
135	3.9815715	1	3	5	0 - 5 deg	South	Valley bottom	4%	82%	7	1
234	3.1312359	2	3	4	5 - 10 deg	South	Footslope	3%	85%	8	1
133	2.921153	1	3	3	0 - 5 deg	South	Midslope - Lower	3%	88%	9	1
112	2.0608134	1	1	2	0 - 5 deg	North	Midslope - Upper	2%	90%	10	1
214	1.560616	2	1	4	5 - 10 deg	North	Footslope	1%	91%	11	1
123	1.4605765	1	2	3	0 - 5 deg	East	Midslope - Lower	1%	93%	12	1
143	1.370541	1	4	3	0 - 5 deg	West	Midslope - Lower	1%	94%	13	1
244	1.170462	2	4	4	5 - 10 deg	West	Footslope	1%	95%	14	1
Total											27



Photo plate 2: Oblique images of the illegal rubble dumping and informal recycling occurring within the Mabopane study area

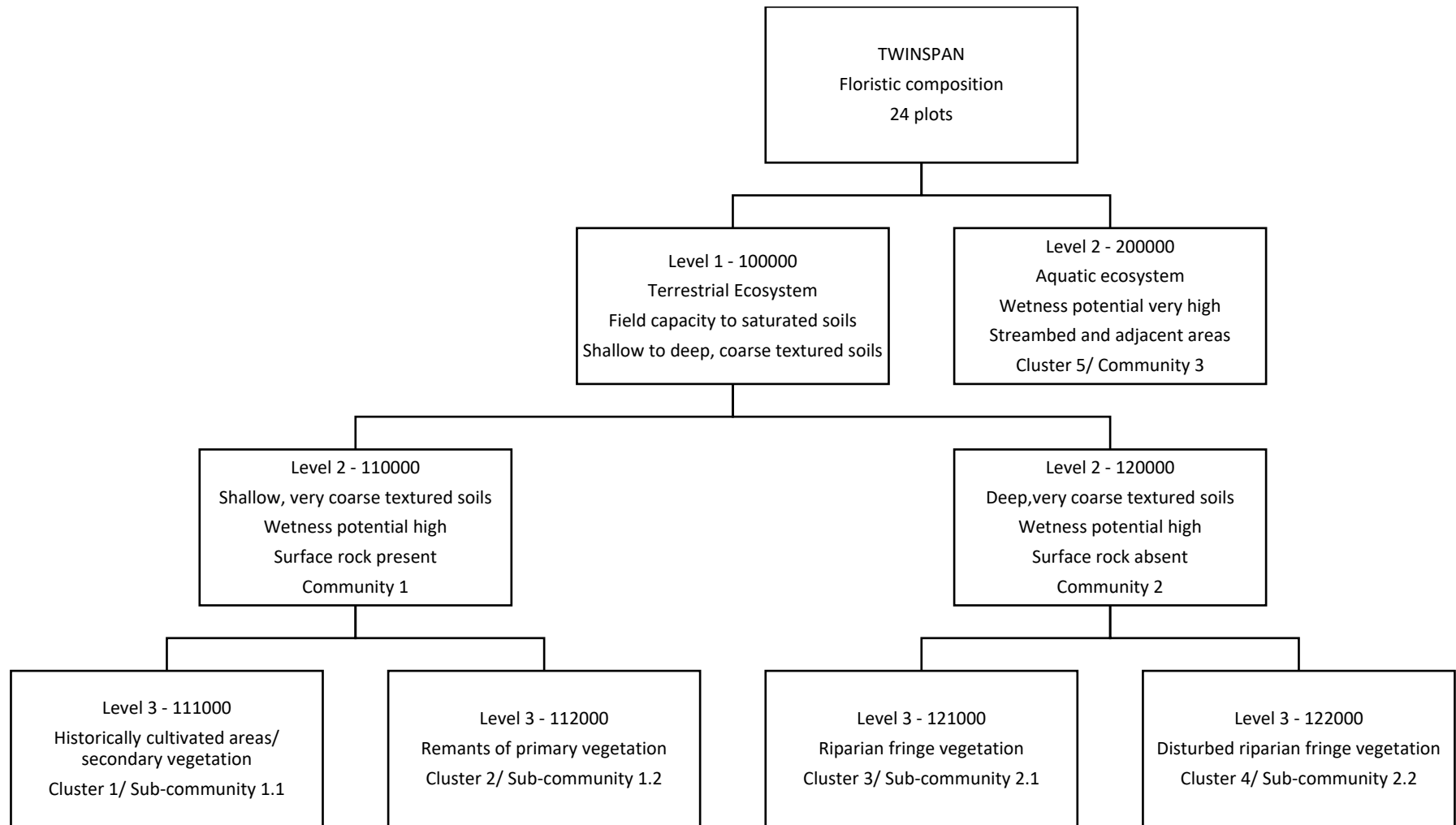


Figure 15: TWINSpan dendrogram based on floristic composition and environmental attributes

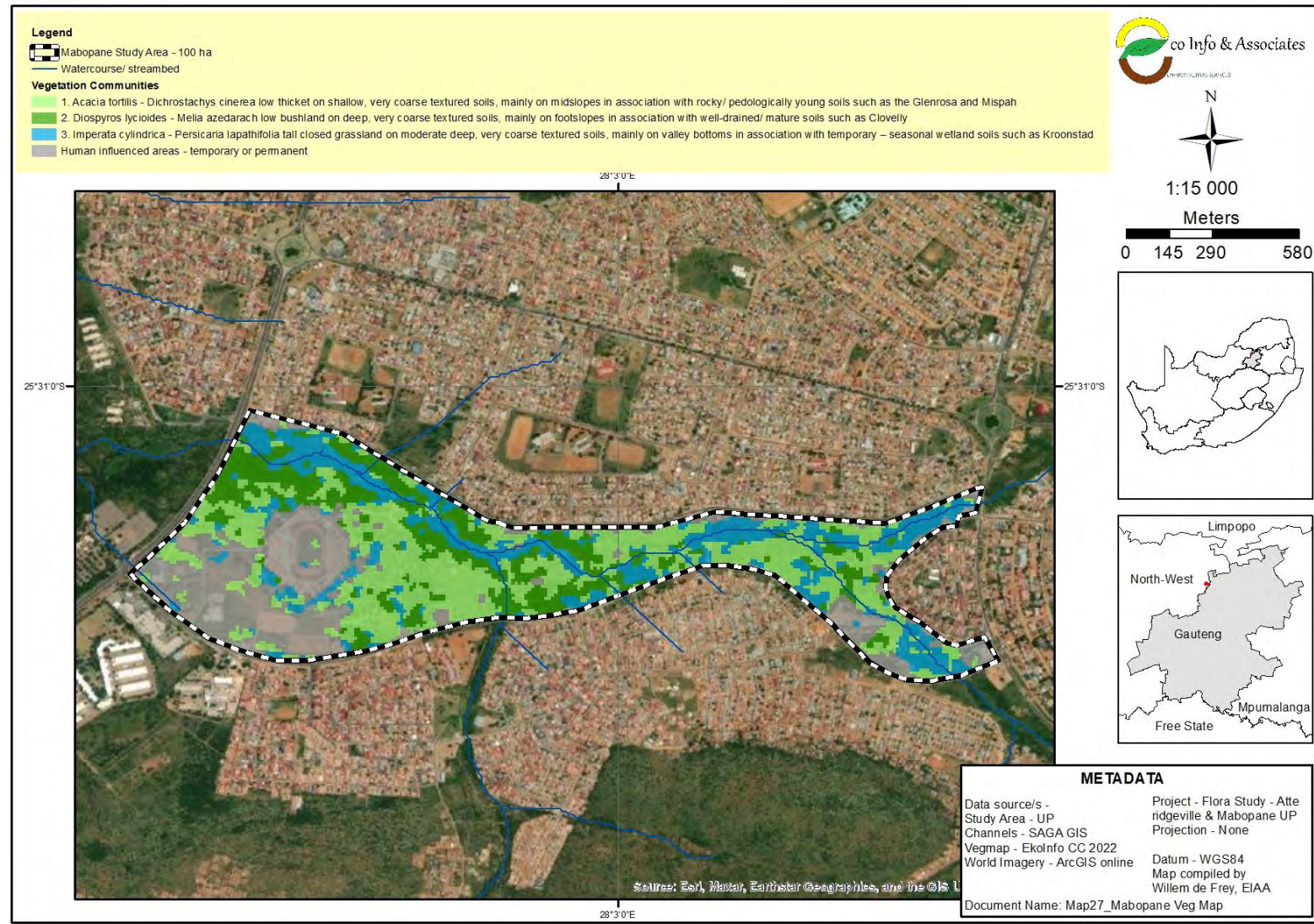


Figure 16: Vegetation map of the Mabopane study area based on the floristic survey completed in February 2022

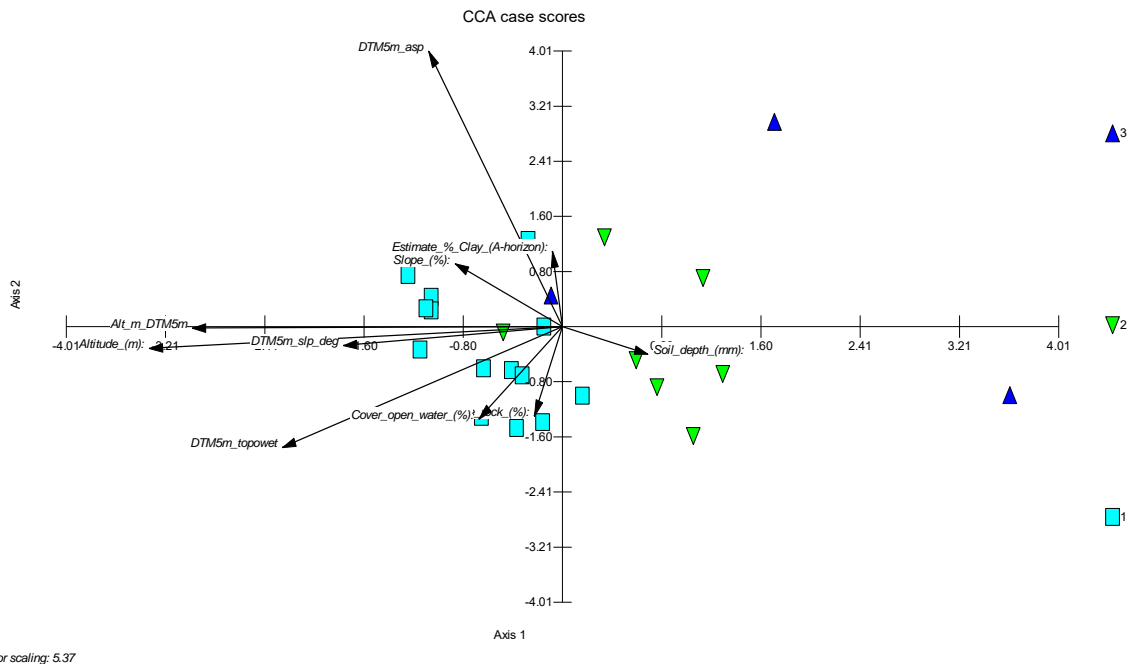


Figure 17: Canonical correspondence analysis based on all the quantitative abiotic factors

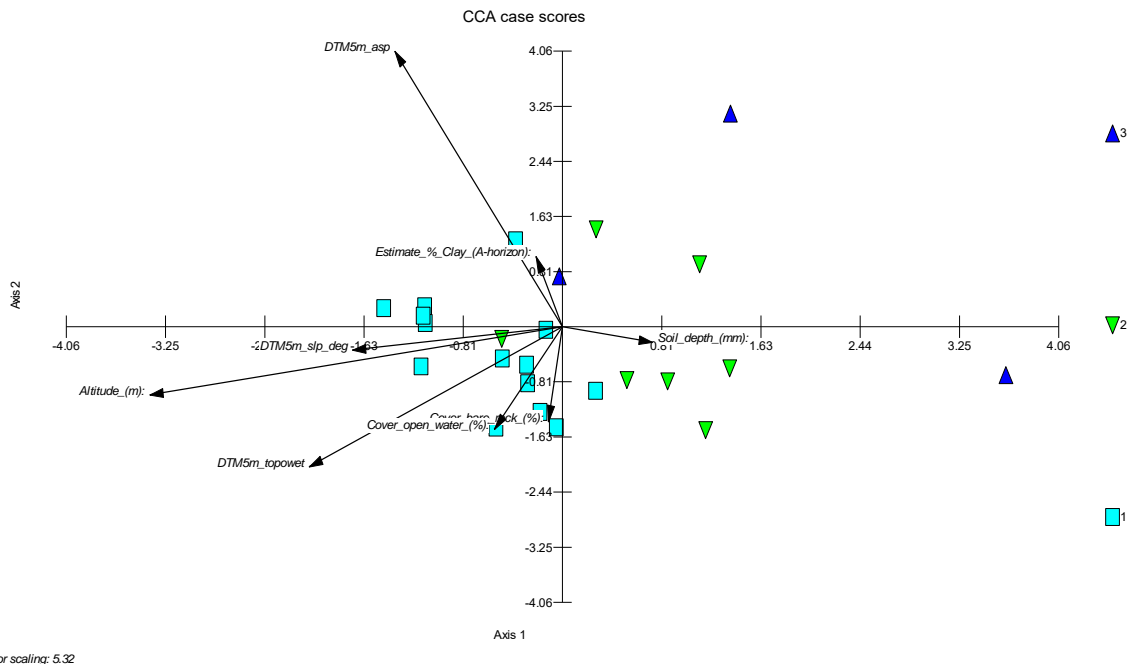
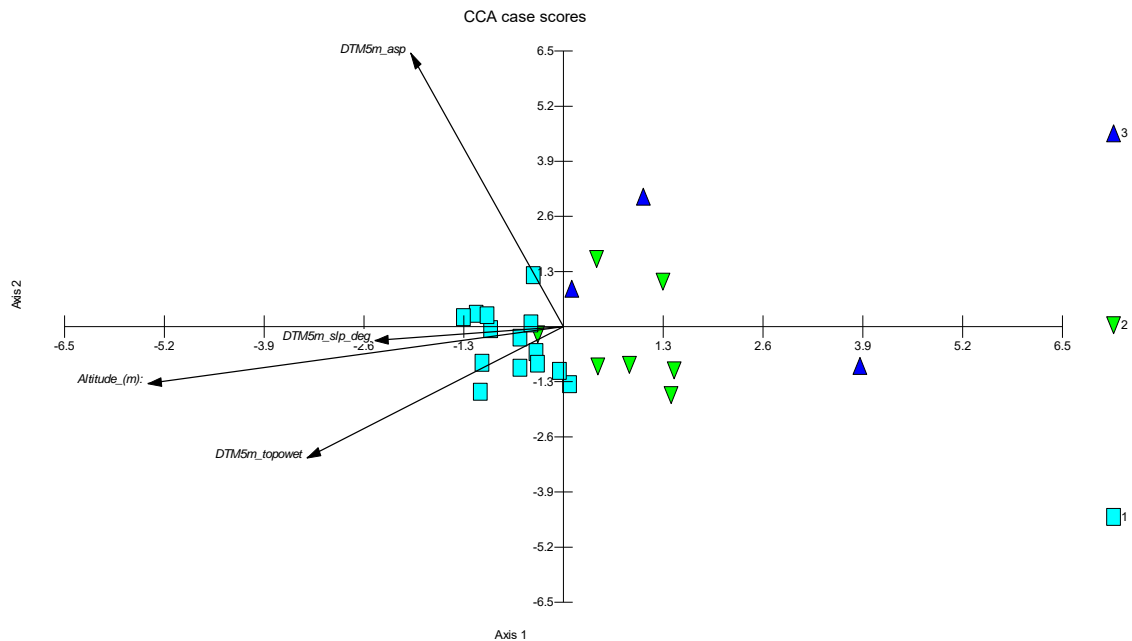


Figure 18: Canonical correspondence analysis with duplicate environmental factors removed



Legend

1 = Community 1

2 = Community 2

3 = Community 3

Altitude_(m) = GPS recorded altitude measurements

DTMSm_asp = Azimuth values extracted from 5 m contour Digital Elevation Model

DTMSm_topowet = Order of magnitude potential for water to accumulate derived from 5 m contour Digital Elevation Model

DTMSm_slp_deg = Slope values in degrees extracted from 5 m contour Digital Elevation Model

Figure 19: Canonical correspondence analysis with only the main environmental drivers

- The probability that water will accumulate (wetness index)
- Aspect
- Slope degrees

Figure 20 shows the CCA results based only on the environmental factors derived from the 5 m contour Digital Terrain Model, which clearly indicates that the potential for water to accumulate being a significant influence on vegetation distribution, with a strong negative correlation. This implies that wetness values increase from community one to community three.

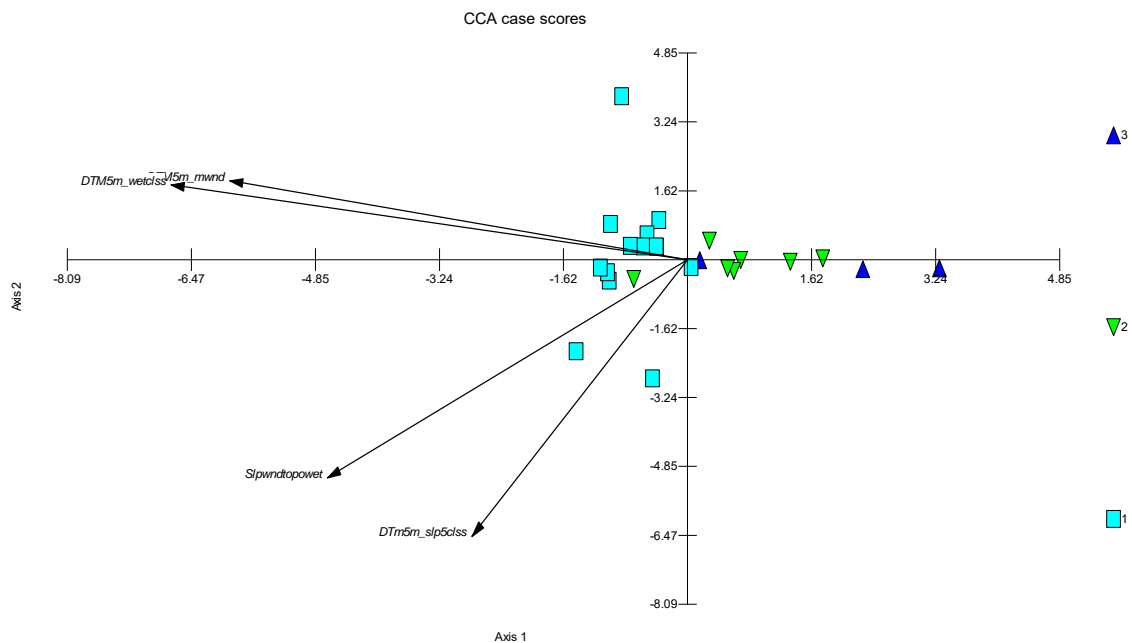
The cluster results were refined using the Braun-Blanquet table (Appendix A). Each of the communities are described in the following sections in terms of the main environmental attributes associated with them, and their diagnostic and characteristic species and their current status.

5.2.1.1 *Community 1: Acacia tortilis - Dichrostachys cinerea low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah*

Community one is located at a mean altitude of between 1 167 m and 1 170 m (Table 4), mainly associated with midslopes (Table 5). This community and community two have the same mean order of wetness at a value of 12 (Table 6), which is drier than community three. Surface rock is present at an estimated mean value of 3% (Table 4), the soils are shallow at a mean measured value of 582 mm, with an estimated mean percentage of clay in the A-horizon of 7%. These rocky soils are representative of pedological young soils, namely the Glenrosa and Mispah soil forms (Table 7). This community has the second highest overall vegetation cover of all three of the vegetation communities at a mean estimated value of 68% (Table 8). The mean woody cover (estimated tree and shrub cover) is more than 10%, therefore the community represents thicket (Photo plate 3). The estimated herbaceous cover is the second highest of the three communities at 45% (Table 8), and the forb cover is the lowest at 7%. Community one has the second highest estimated mean herb height at 44 cm, and the lowest mean high herb height at 129 cm. The extent of this community is 34 ha or 34% of the study area (Table 9).

This community is represented by 132 plant species, consisting of the following species within the three major growth forms:

Forbs: *Acalypha villicaulis*, *Aloe greatheadii* var. *davyana*, *Amaranthus hybridus* subsp. *hybridus* var. *hybridus*, *Aptosimum procumbens*, *Barleria macrostegia*, *Bidens pilosa*, *Bulbine species (217_2490)*, *Chamaecrista mimosoides*, *Clematis brachiata*, *Cleome monophylla*, *Coccinia sessilifolia*, *Commelina erecta*, *Convolvulus sagittatus*, *Conyza bonariensis*, *Corchorus asplenifolius*, *Crotalaria sphaerocarpa* subsp. *sphaerocarpa*, *Cyphostemma sandersonii*, *Datura stramonium*, *Eriosema burkei* var. *burkei*, *Euphorbia heterophylla*, *Euphorbia neopolycnemoides*, *Felicia mossamedensis*, *Flaveria bidentis*, *Geigeria burkei* subsp. *burkei* var. *burkei*, *Gomphrena celosioides*, *Gossypium herbaceum* subsp. *africanum*, *Hermannia boraginiflora*, *Hibiscus engleri*, *Indigofera adenoides*, *Indigofera daleoides* var. *daleoides*, *Indigofera hedyantha*, *Indigofera hilaris* var. *hilaris*, *Ipomoea magnusiana*, *Ipomoea purpurea*, *Kedrostis foetidissima*, *Kohautia amatymbica*, *Kyphocarpa angustifolia*, *Lantana rugosa*,



Legend

1 = Community 1

2 = Community 2

3 = Community 3

DTM5m_wetclss = Natural break grouped magnitude of wetness values 1 = low, 5 = high

DTM5m_mwnd = Aspect: 1 = North, 2 = East, 3 = South, 4 = West

Slpwndtopowet = Combined slope, aspect and wetness class: 111 -555

DTM5m_slp5clss = 5° interval slope classes: 1 = 0 – 5°, 5 = 20° >

Figure 20: Canonical correspondence analysis with only the main environmental drivers

Table 4: Overview of the quantitative abiotic factors associated with the Mabopane vegetation communities

Community No	1	2	3
No of plots	14	7	3
Mean value - Altitude (m): GPS receiver	1170	1161	1179
Mean value – Altitude (m): 5m Digital Terrain Model	1167	1157	1172
Mean value – Slope (°): 5m Digital Terrain Model	3	3	2
Mean value - Slope (%): Estimated during survey	2	1	1
Mean value – Soil depth (mm): Measured during survey	582	929	734
Mean value - % Clay (A-horizon): Estimated during survey	7	8	9
Mean value - Cover bare rock (%): Estimated during survey	3	0	0
Mean value – Wetness Index (Order of magnitude): 5 m DTM	12	12	15
Mean value - Cover open water (%): Estimated during survey	0	0	17

Table 5: Overview of the terrain units associated with the Mabopane vegetation communities

Estimated Terrain Units	Community no			Grand Total
	1	2	3	
Midslope	64%	14%	0%	42%
Footslope	36%	71%	33%	46%
Valley bottom	0%	14%	67%	13%
Grand Total	100%	100%	100%	100%
Wetness Index Derived Terrain Units	1	2	3	Grand Total
Midslope - Upper: Low	7%	0%	0%	4%
Midslope - Lower: Moderate	14%	43%	0%	21%
Footslope - High	71%	29%	67%	58%
Valley bottom - Very high	7%	29%	33%	17%
Grand Total	100%	100%	100%	100%

Table 6: Overview of extracted wetness index values (order of magnitude) per Mabopane vegetation community

Community no	No of plots	Extracted Wetness Index Values		
		Minimum	Mean	Maximum
1	14	9	12	18
2	7	9	12	15
3	3	12	15	20

Table 7: Overview of the soil forms associated with the Mabopane vegetation communities

Main Ecosystems/ Soil Moisture Content	Community no			Grand Total
	1	2	3	
Soil forms recorded				
Human influenced soils	7%	14%	33%	13%
Witbank	7%	14%	33%	13%
Terrestrial - rocky	29%	14%	0%	21%
Glenrosa	21%	14%	0%	17%
Mispah	7%	0%	0%	4%
Terrestrial - well drained	29%	71%	0%	38%
Augrabies	0%	14%	0%	4%
Clovelly	29%	57%	0%	33%
Wetland - temporary/ seasonal	36%	0%	67%	29%
Avalon	7%	0%	0%	4%
Glencoe	14%	0%	0%	8%
Kroonstad	0%	0%	67%	8%
Pinedene	7%	0%	0%	4%
Westleigh	7%	0%	0%	4%
Grand Total	100%	100%	100%	100%

Table 8: Overview of the estimated vegetation characteristic per vegetation community within the Mabopane study area

Community no	1	2	3
No of plots	14	7	3
Mean estimated values			
Cover total (%)	68	74	60
Cover tree layer (%)	6	11	3
Cover shrub layer (%)	22	20	7
Cover herb layer (%)	45	43	50
Cover grass layer (%)	38	33	38
Cover forbs layer (%)	7	10	12
Height (highest) trees (m)	6	9	6
Height lowest trees (m)	3	5	2
Height (highest) shrubs (m)	4	5	3
Height lowest shrubs (m)	1	1	1
Height (high) herbs (cm)	44	43	83
Height lowest herbs (cm)	19	8	43
Maximum height herbs (cm)	129	149	183



Photo plate 3: Georeferenced digital images of community one: *Acacia tortilis* - *Dichrostachys cinerea* low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah (Photo direction – North, East, South, West & Soil Profile)

Table 9: Overview of the surface area and percentage extent of the main vegetation communities within the Mabopane study area

Mabopane main vegetation communities	Surface (ha)	% cover
1. <i>Acacia tortilis</i> - <i>Dichrostachys cinerea</i> low thicket on shallow, very coarse textured soils, mainly on midslopes in association with rocky/ pedologically young soils such as the Glenrosa and Mispah	34	34%
2. <i>Diospyros lycioides</i> - <i>Melia azedarach</i> low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly	18	18%
3. <i>Imperata cylindrica</i> - <i>Persicaria lapathifolia</i> tall closed grassland on moderate deep, very coarse textured soils, mainly on valley bottoms in association with temporary – seasonal wetland soils such as Kroonstad	21	21%
Human influenced areas - temporary or permanent	27	27%
Grand Total	100	100%

Ledebouria cooperi, *Leonotis ocymifolia*, *Lotononis laxa*, *Monsonia angustifolia*, *Nidorella hottentotica*, *Pavonia burchellii*, *Pentarrhinum insipidum*, *Pergularia daemia* subsp. *daemia*, *Phyllanthus parvulus* var. *parvulus*, *Pollichia campestris*, *Polygala hottentotta*, *Richardia brasiliensis*, *Schkuhria pinnata*, *Senna italica* subsp. *arachoides*, *Sesamum triphyllum* var. *triphyllum*, *Solanum elaeagnifolium*, *Solanum panduriforme*, *Stylosanthes fruticosa*, *Tagetes minuta*, *Tephrosia multijuga*, *Waltheria indica*, *Yucca gloriosa*, *Zinnia peruviana*, *Zornia linearis*

Graminoids (Grasses and sedges): *Aristida congesta* subsp. *congesta*, *Cenchrus ciliaris*, *Chloris virgata*, *Cymbopogon excavatus*, *Cynodon dactylon*, *Dactyloctenium giganteum*, *Digitaria eriantha*, *Digitaria ternata*, *Diheteropogon amplexans* var. *amplexans*, *Enneapogon cenchroides*, *Eragrostis lehmanniana* var. *lehmanniana*, *Eragrostis rigidior*, *Eragrostis superba*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Hyperthelia dissoluta*, *Kyllinga alba*, *Melinis repens* subsp. *repens*, *Panicum maximum*, *Perotis patens*, *Phragmites australis*, *Pogonarthria squarrosa*, *Schmidtia pappophoroides*, *Sporobolus festivus*, *Tragus berteronianus*, *Tricholaena monachne*, *Typha capensis*, *Urochloa mosambicensis*

Woody species (Trees and shrubs): *Acacia*⁴ *caffra*, *Acacia karroo*, *Acacia nilotica* subsp. *kraussiana*, *Acacia tortilis* subsp. *heteracantha*, *Boscia albitrunca*, *Celtis africana*, *Combretum apiculatum* subsp. *apiculatum*, *Combretum hereroense*, *Combretum molle*, *Combretum zeyheri*, *Dichrostachys cinerea* subsp. *africana* var. *africana*, *Dodonaea angustifolia*, *Dombeya rotundifolia* var. *rotundifolia*, *Ehretia amoena*, *Ehretia rigida* subsp. *rigida*, *Elephantorrhiza burkei*, *Elephantorrhiza elephantina*, *Euclea crispa* subsp. *crispa*, *Euclea undulata* var. *myrtina*, *Faurea saligna*, *Grewia bicolor* var. *bicolor*, *Gymnosporia heterophylla*, *Gymnosporia senegalensis*, *Lantana camara*, *Leucaena leucocephala* subsp. *leucocephala*, *Lippia javanica*, *Melia azedarach*, *Morus alba* var. *alba*, *Ozoroa paniculosa* var. *paniculosa*, *Pappea capensis*, *Peltophorum africanum*, *Protasparagus laricinus*, *Rhus lancea*, *Rhus leptodictya*, *Rhus pyroides* var. *pyroides*, *Sclerocarya birrea* subsp. *caffra*, *Syzygium cordatum* subsp. *cordatum*, *Tecoma stans* var. *stans*, *Terminalia sericea*, *Vangueria infausta* subsp. *infausta*, *Vitex zeyheri*, *Ziziphus mucronata* subsp. *mucronata*

This community represent most probably remnants of the primary vegetation that occurred in the landscape prior to human influences such as cultivation (**Error! Reference source not found.**). It was not used for cultivation because of the presence of surface rock. The presence and dominance of the following woody species support this observation: *Ozoroa paniculosa*, *Combretum zeyheri*, *Peltophorum africanum* and *Sclerocarya birrea* subsp. *caffra* (Van Wyk & Van Wyk 1997). The presence of the following species indicates past over utilistation by livestock: *Aristida congesta*, *Chloris virgata*, *Heteropogon contortus*, *Melinis repens* (Van Oudtshoorn 1991), *Felicia mossamedensis*, *Cleome monophylla* and *Schkuhria pinnata* (Van Wyk & Malan 1988). The following woody species also gives a strong indication of past human influences: *Acacia tortilis*, *Acacia nilotica* and *Dichrostachys cinerea* (Bothma 1995, Tainton 1999).

⁴ The genus *Acacia* in South Africa had been divided into two genera in 2011, namely *Vachellia* (round flower heads) and *Senegalia* (Spike flower heads) (Dyer 2014). However, for the purpose of this document, and ease of access in older field guides the genus *Acacia* will be used.

Two sub-communities are associated with this community but could not be mapped at the current scale of information. The following species are diagnostic of sub-community 1.1 (Appendix A – Species Group B): *Felicia mossamedensis*, *Dactyloctenium giganteum*, *Geigeria burkei* subsp. *burkei* var. *burkei*, *Chloris virgata*, *Acacia nilotica* subsp. *kraussiana*, *Elephantorrhiza burkei*, *Kyphocarpa angustifolia*, *Cleome monophylla*, *Ledebouria cooperi*. The following species are mainly absent from sub-community 1.2 and are diagnostic of sub-community 1.2 (Appendix A – Species Group C): *Schkuhria pinnata*, *Melinis repens* subsp. *repens*, *Tricholaena monachne*, *Enneapogon cenchroides*, *Indigofera daleoides* var. *daleoides*, *Ozoroa paniculosa* var. *paniculosa*, *Combretum zeyheri*. Sub-community 1.1 most probably represent a successional stage from historic cultivated fields, sub-community 1.2 represent the remnants of the original vegetation, which was not cultivated. The uniting species for this community and its sub-communities is the dominance of the following encroacher species *Acacia tortilis* (Appendix A – Species Group A) and *Dichrostachys cinerea* (Appendix A – Species Group K) (Van Wyk & Van Wyk 1997, Bromilow 2010).

5.2.1.2 Community 2: *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly

Community two is located at a mean altitude of between 1 157 m and 1 161 m (Table 4), mainly associated with footslopes (Table 5). This community and community one has the same mean order of wetness at a value of 12 (Table 6), which is drier than community three. Surface rock is absent (Table 4), the soils are deep at a mean measured value of 929 mm, with an estimated mean percentage of clay in the A-horizon of 8%. These deeper soils are representative of mature or well-developed soil forms, such as the Clovelly soil form (Table 7). This community has the highest overall vegetation cover of all three of the vegetation communities at a mean estimated value of 74% (Table 8). The mean woody cover (estimated tree and shrub cover) is more than 10%, therefore the community represents bushland (Photo plate 4). The estimated herbaceous cover is the lowest of the three communities at 43% (Table 8), and the forb cover is the second highest at 10%. Community two has the lowest estimated mean herb height at 43 cm, and the second highest mean high herb height at 149 cm. The extent of this community is 18 ha or 18% of the study area (Table 9).

This community is represented by 105 plant species, consisting of the following species within the three major growth forms:

Forbs: *Acalypha villicaulis*, *Agapanthus campanulatus* subsp. *campanulatus*, *Aloe greatheadii* var. *davyana*, *Bidens pilosa*, *Campuloclinium macrocephalum*, *Chamaecrista mimosoides*, *Clematis brachiata*, *Cleome monophylla*, *Commelina erecta*, *Conyza bonariensis*, *Crotalaria distans*, *Cyphostemma sandersonii*, *Cyphostemma simulans*, *Eriosema burkei* var. *burkei*, *Eulophia streptopetala*, *Euphorbia heterophylla*, *Euphorbia neopolycnemoides*, *Hibiscus engleri*, *Ipomoea magnusiana*, *Ipomoea purpurea*, *Justicia betonica*, *Justicia flava*, *Kedrostis foetidissima*, *Kedrostis leloja*, *Lablab purpureus* subsp. *purpureus*, *Lantana rugosa*, *Ledebouria cooperi*, *Nidorella hottentotica*, *Pavonia burchellii*, *Pellaea calomelanos* var. *calomelanos*, *Pentarrhinum insipidum*, *Pergularia daemia* subsp. *daemia*, *Persicaria lapathifolia*, *Phyllanthus parvulus* var. *parvulus*, *Pseudognaphalium luteo-album*, *Scadoxus puniceus*, *Sida rhombifolia* subsp. *rhombifolia*, *Tagetes minuta*, *Tritonia* (213_2480), *Verbena brasiliensis*, *Vigna vexillata* var. *vexillata*, *Zinnia peruviana*



Photo plate 4: Georeferenced digital images of community two: *Diospyros lycioides* - *Melia azedarach* low bushland on deep, very coarse textured soils, mainly on footslopes in association with well-drained/ mature soils such as Clovelly (Photo direction – North, East, South, West & Soil Profile)

Graminoids (Grasses and sedges): *Aristida bipartita*, *Brachiaria brizantha*, *Cenchrus ciliaris*, *Cynodon dactylon*, *Cyperus rotundus* subsp. *rotundus* var. *platystachys*, *Dactyloctenium giganteum*, *Digitaria eriantha*, *Eragrostis lehmanniana* var. *lehmanniana*, *Eragrostis rigidior*, *Eustachys paspaloides*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Hyperthelia dissoluta*, *Kyllinga alba*, *Mariscus macrocarpus*, *Melinis repens* subsp. *repens*, *Panicum maximum*, *Phragmites australis*, *Schmidtia pappophoroides*, *Typha capensis*, *Urochloa mosambicensis*

Woody species (Trees and shrubs): *Acacia caffra*, *Acacia galpinii*, *Acacia karroo*, *Acacia nilotica* subsp. *kraussiana*, *Acacia robusta* subsp. *robusta*, *Ailanthus altissima*, *Boscia albitrunca*, *Burkea africana*, *Carissa bispinosa*, *Celastraceae* species (213_2482), *Celtis africana*, *Cereus jamacaru*, *Citrus x sinensis*, *Combretum apiculatum* subsp. *apiculatum*, *Combretum zeyheri*, *Dichrostachys cinerea* subsp. *africana* var. *africana*, *Diospyros lycioides* subsp. *lycioides*, *Dombeya rotundifolia* var. *rotundifolia*, *Ehretia amoena*, *Ehretia rigida* subsp. *rigida*, *Elephantorrhiza elephantina*, *Euclea crispa* subsp. *crispa*, *Euclea undulata* var. *myrtina*, *Grewia flava*, *Gymnosporia heterophylla*, *Lantana camara*, *Melia azedarach*, *Morus alba* var. *alba*, *Opuntia ficus-indica*, *Pappea capensis*, *Pavetta* species (213_2481), *Peltophorum africanum*, *Protasparagus cooperi*, *Protasparagus setaceus*, *Rhus lancea*, *Rhus leptodictya*, *Rhus pyroides* var. *pyroides*, *Sclerocarya birrea* subsp. *caffra*, *Solanum mauritanium*, *Tecoma stans* var. *stans*, *Zanthoxylum capense*, *Ziziphus mucronata* subsp. *mucronata*

Community two represents the transitional vegetation from community one to community three (Table 10). It has a mean distance of 74 m from the watercourses with which community three is associated with (Figure 10). Due to its location, it can experience flooding during high rainfall events, which would explain the slightly higher clay content, as the finer materials will move further away from the channels (Strahler & Strahler 1987, White 1987).

Two sub-communities are associated with this community but could not be mapped at the current scale of information. The following species are diagnostic of sub-community 2.1 (Appendix A – Species Group E): *Eulophia streptopetala*, *Scadoxus puniceus*, *Carissa bispinosa*, *Pergularia daemia* subsp. *daemia*, *Cyphostemma simulans*, *Clematis brachiata*, *Combretum apiculatum* subsp. *apiculatum*. The following species are absent from sub-community 2.1 and are diagnostic of sub-community 2.2 (Appendix A – Species Group H): *Kedrostis leloja*, *Justicia betonica*, *Grewia flava*, *Pseudognaphalium luteo-album*, *Mariscus* species (202_2422), *Aristida bipartita*, *Cenchrus ciliaris*, *Ipomoea magnusiana*, *Eragrostis lehmanniana* var. *lehmanniana*, *Cyphostemma sandersonii*, *Vigna vexillata* var. *vexillata*, *Protasparagus cooperi*, *Justicia flava*, *Kedrostis foetidissima*. Sub-community 2.1 represents the riparian fringe (Photo plate 5), while sub-community 2.2 represents those areas which are temporary inundated during extreme rainfall events, whether due to flooding or localised depressions.

Table 10: Mean distance of survey plots associated with the three communities from the watercourses present in the study area

Community no	No of plots	Distance from watercourse		
		Minimum	Mean	Maximum
1	14	13	133	416
2	7	40	74	135
3	3	4	33	48



Photo plate 5: Location of sub-community 2.1 and 2.2 in relation to the watercourse channels (Community 3)

5.2.1.3 *Community 3: Imperata cylindrica - Persicaria lapathifolia tall closed grassland on moderate deep, very coarse textured soils, mainly on valley bottoms in association with temporary - seasonal wetland soils such as Kroonstad*

Community three is located at a mean altitude of between 1 172 m and 1 179 m (Table 4), mainly associated with footslopes and valley bottoms (Table 5). This community has the highest mean order of wetness at a value of 15 (Table 6), mainly due to the fact that it is associated with the streambed. Surface rock is absent (Table 4), the soils are moderate at a mean measured value of 734 mm, with an estimated mean percentage of clay in the A-horizon of 9%. These deeper soils are associated with areas which becomes temporarily or seasonal saturated, such as Kroonstad (Table 7). This community has the lowest overall vegetation cover of all three of the vegetation communities at a mean estimated value of 60% (Table 8). The mean woody cover (estimated tree and shrub cover) is less than 10%, therefore the community represents grassland (Photo plate 6). The estimated herbaceous cover is the highest of the three communities at 50% (Table 8), and the forb cover is the highest at 12%. Community three has the highest estimated mean herb height at 83 cm, and the highest mean high herb height at 183 cm. The extent of this community is 21 ha or 21% of the study area (Table 9).

This community is represented by 49 plant species, consisting of the following species within the three major growth forms:

Forbs: *Amaranthus hybridus* subsp. *hybridus* var. *hybridus*, *Campuloclinium macrocephalum*, *Chamaecrista mimosoides*, *Conyza bonariensis*, *Conyza podocephala*, *Datura stramonium*, *Eriosema burkei* var. *burkei*, *Euphorbia heterophylla*, *Flaveria bidentis*, *Gomphrena celosioides*, *Ipomoea purpurea*, *Leonotis ocymifolia*, *Persicaria lapathifolia*, *Rhynchosia totta* var. *totta*, *Ricinus communis* var. *communis*, *Rumex crispus*, *Sida rhombifolia* subsp. *rhombifolia*, *Solanum panduriforme*, *Tagetes minuta*, *Verbena brasiliensis*, *Xanthium strumarium*, *Zinnia peruviana*

Graminoids (Grasses and sedges): *Brachiaria brizantha*, *Cladium mariscus* subsp. *jamaicense*, *Cynodon dactylon*, *Cyperus eragrostis*, *Cyperus rotundus* subsp. *rotundus* var. *platystachys*, *Eragrostis curvula*, *Hyparrhenia hirta*, *Imperata cylindrica*, *Kyllinga alba*, *Panicum maximum*, *Paspalum urvillei*, *Pennisetum clandestinum*, *Phragmites australis*, *Pogonarthria squarrosa*, *Pycreus polystachyos* var. *polystachyos*, *Themeda triandra*, *Typha capensis*

Woody species (Trees and shrubs): *Acacia caffra*, *Acacia karroo*, *Elephantorrhiza elephantina*, *Lippia javanica*, *Melia azedarach*, *Morus alba* var. *alba*, *Rhus pyroides* var. *pyroides*, *Salix babylonica* var. *babylonica*, *Sclerocarya birrea* subsp. *caffra*, *Tecoma stans* var. *stans*

Community three is associated with the permanently wet areas within the study area along the channel/ streambed of the drainage line (Photo plate 5), the highest wetness value (15 - Table 4) of the three plant communities present, support this statement. The graminoids recorded in this community, grows in over saturated/ waterlogged soils, and is classified as obligate hydrophytes (DWAF 2005, Gerber *et al.* 2004). The Kroonstad soil form associated with this community consist of an orthic A horizon on an E-horizon on a G-horizon (Soil Classification Workgroup 1991).



Photo direction – North, East, South, West, if soil profile is absent it is due to the presence of surface water

Photo plate 6: Georeferenced digital images of community three: Imperata cylindrica - Persicaria lapathifolia tall closed grassland on moderate deep, very coarse textured soils, mainly on valley bottoms in association with temporary – seasonal wetland soils such as Kroonstad

The G-horizon indicates the presence of permanently saturated soils (DWAF 2005, Fey 2010). It should be noted that all of the other soil forms associated with this community (Table 7Table 1) are classified as wetland soils (DWAF 2005). From the oblique images recorded during the survey, it is evident that this community floods (Photo plate 7), during high rainfall events, most probably due to additional runoff from the adjacent residential areas being channelled towards the watercourses present in the area. The energy moving through this system during flooding is evident in the damage to the bridge (Photo plate 8).



Photo plate 7: Oblique images showing the extent of flooding within community three



Photo plate 8: Oblique image of the damage to the bridge crossing the watercourse associated with community three

5.2.2 Vegetation Diversity

5.2.2.1 Species richness

During the survey consisting of 24 plots, 184 plant species were recorded (Appendix A). From the species – area curve (Figure 21), it is evident this is representative of the species present within the study area as the curve started to level out.

The 184 plant species represent 52 plant families and 148 genera (Appendix B). Of the 184 plant species, 84 species are forbs (46%), 41 species are graminoids (grasses and sedges) (22%) and 59 species are woody species (trees and shrubs – 32%) (Table 11).

5.2.2.2 Protected Species

No threatened (Vulnerable, Endangered, Critical Endangered) Red Data listed species were recorded in the plots surveyed.

A single Orange Listed plant from Gauteng Department of Agricultural and Rural Development's Directorate Nature Conservation had been recorded, namely *Hypoxis hemerocallidea*, its population is declining.

Three protected species in terms of the Gauteng Conservation Ordinance had been recorded, namely: *Agapanthus campanulatus subsp. campanulatus*, *Scadoxus puniceus*, *Eulophia streptopetala* (Orchidaceae). It should be noted that all species in the genera *Agapanthus* and *Scadoxus* are protected, as well as all the species in the family Orchidaceae.

No species protected in terms of the National Environmental Management Biodiversity Act had been recorded in the plots surveyed.

Two national protected trees in terms of the National Forest Act had been recorded in the plots surveyed, namely: *Boscia albitrunca* and *Sclerocarya birrea subsp. caffra*.

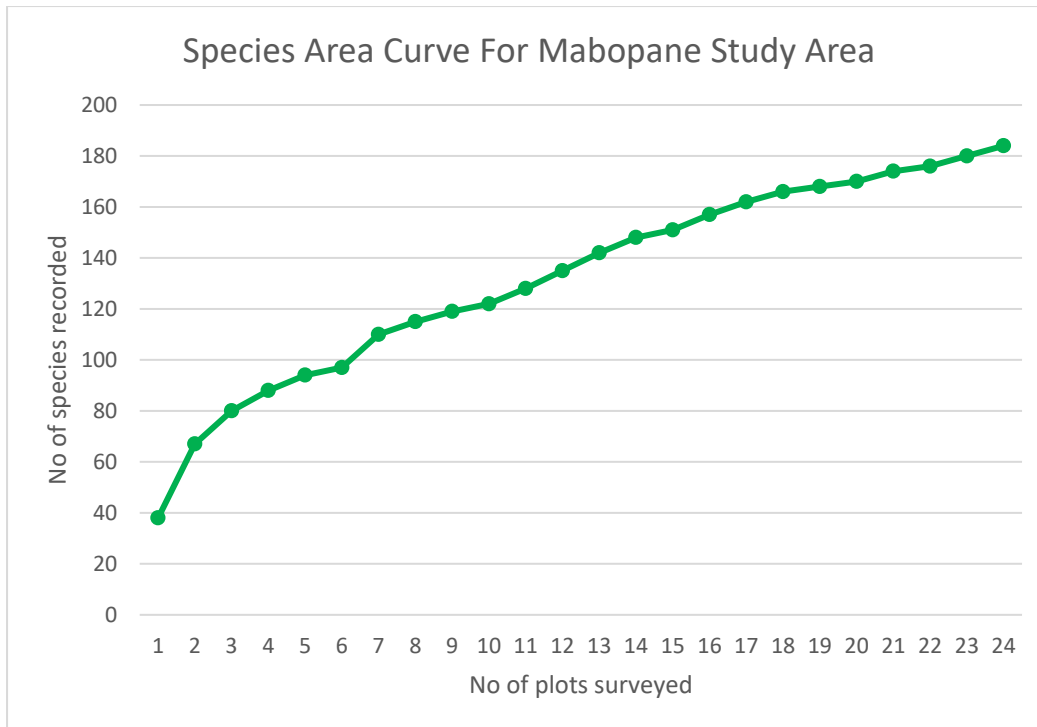


Figure 21: Species – area curve for the Mabopane study area

Table 11: Overview of the number of species per major growth form recorded within the Mabopane study area

Major Growth Forms	No of species	% Frequency
Forbs	84	46%
Graminoids (grasses and sedges)	41	22%
Woody species (trees and shrubs)	59	32%
Grand Total	184	100%

5.2.2.3 Alien Invasive Species

Fifteen declared alien invasive species in terms of the Conservation of Agricultural Resources Act had been recorded with the study area. They are: *Campuloclinium macrocephalum*, *Cereus jamacaru*, *Datura stramonium*, *Ipomoea purpurea*, *Lantana camara*, *Leucaena leucocephala*, *Melia azedarach*, *Morus alba*, *Opuntia ficus-indica*, *Ricinus communis*, *Salix babylonica*, *Solanum elaeagnifolium*, *Solanum mauritianum*, *Tecoma stans*, *Xanthium strumarium*. Nine of the fifteen alien invasive species recorded are Category 1, which implies that they must be controlled and eradicated (Table 12). It should be noted that these 15 declared alien invasive species represent 8% of all of the species recorded.

All of these species are also listed in term of the National Environmental Management Act's Alien Invasive Species Regulation, with the exemption of *Salix babylonica*. It is most probable that the list of alien invasive species is not comprehensive, and that it would be prudent to develop an alien invasive management plan for the area. The area functions as a source area for the dispersal of alien invasive species due to its location along a drainage line and roads (Lindenmayer & Fischer 2006, Van Andel & Aronson 2006). Table 12 confirms this observation with the majority of alien invasive species recorded in community three in association with the watercourses.

5.2.2.4 Plants With Medicinal Properties

Sixteen species with medicinal properties were recorded within the study area: *Acacia karroo*, *Datura stramonium*, *Dodonaea angustifolia*, *Dombeya rotundifolia*, *Elephantorrhiza elephantina*, *Euclea undulata*, *Lippia javanica*, *Pellaea calomelanos*, *Ricinus communis*, *Scadoxus puniceus*, *Sclerocarya birrea*, *Syzygium cordatum*, *Terminalia sericea*, *Typha capensis*, *Zanthoxylum capense*, *Ziziphus mucronata* (Van Wyk *et al.* 2000).

5.2.2.5 Plants Beneficial To Specific Fauna

Sixteen species were recorded within the study area that presents habitat for butterflies, they are: *Acacia caffra*, *Acacia karroo*, *Boscia albitrunca*, *Celtis africana*, *Combretum apiculatum*, *Combretum hereroense*, *Combretum zeyheri*, *Dichrostachys cinerea*, *Diospyros lycioides*, *Dombeya rotundifolia*, *Grewia flava*, *Pappea capensis*, *Peltophorum africanum*, *Syzygium cordatum*, *Zanthoxylum capense*, *Ziziphus mucronata* (Venter 2002).

Twelve species were recorded within the study area that presents habitat for birds, they are: *Acacia caffra*, *Acacia galpinii*, *Acacia karroo*, *Acacia tortilis*, *Boscia albitrunca*, *Celtis africana*, *Ehretia rigida*, *Pappea capensis*, *Syzygium cordatum*, *Typha capensis*, *Vangueria infausta*, *Ziziphus mucronata* (Oberprieler & Cillie 2001).

Table 12: Overview of the declared alien invasive species in terms of the Conservation of Agricultural Resources Act recorded in the Mabopane study area

Conservation of Agricultural Resources Act – Alien Invasive Categories	Community no			Grand Total
	1	2	3	
Botanical Name				
Category 1 plants are weeds and serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment.	5	7	6	18
Campuloclinium macrocephalum		1	1	2
Cereus jamacaru		1		1
Datura stramonium	1		1	2
Lantana camara	1	1		2
Opuntia ficus-indica		1		1
Solanum elaeagnifolium	1	1	1	3
Solanum mauritianum	1	1	1	3
Tecoma stans	1	1	1	3
Xanthium strumarium			1	1
Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.	1		1	2
Leucaena leucocephala	1			1
Ricinus communis			1	1
Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.	3	3	4	10
Ipomoea purpurea	1	1	1	3
Melia azedarach	1	1	1	3
Morus alba	1	1	1	3
Salix babylonica			1	1
Grand Total	9	10	11	30

5.2.3 Vegetation Sensitivity

The area with the lowest vegetation sensitivity is the human influenced areas (Figure 22), as most of the natural vegetation had been removed and replaced with hard surfaces. The community with the lowest flora sensitivity is community 3 (Table 13), as it has the lowest number of species in relation to the area it covers. This is what would be expected for wetland areas, because in terms of vegetation, few species are adapted to the saturated to over-saturated conditions. This area is also highly infested by alien invasive species, as many of the alien invasive species migrate along the stream bed. The community with the highest flora sensitivity is community two, this is due to it high percentage of species in relation to the area it covers.

However, on a regional scale, the wetlands will have a higher conservation priority than the terrestrial areas, as they are provided additional protection or priority in terms of environmental legislation, such as the National Environmental Management Act and the National Water Act.

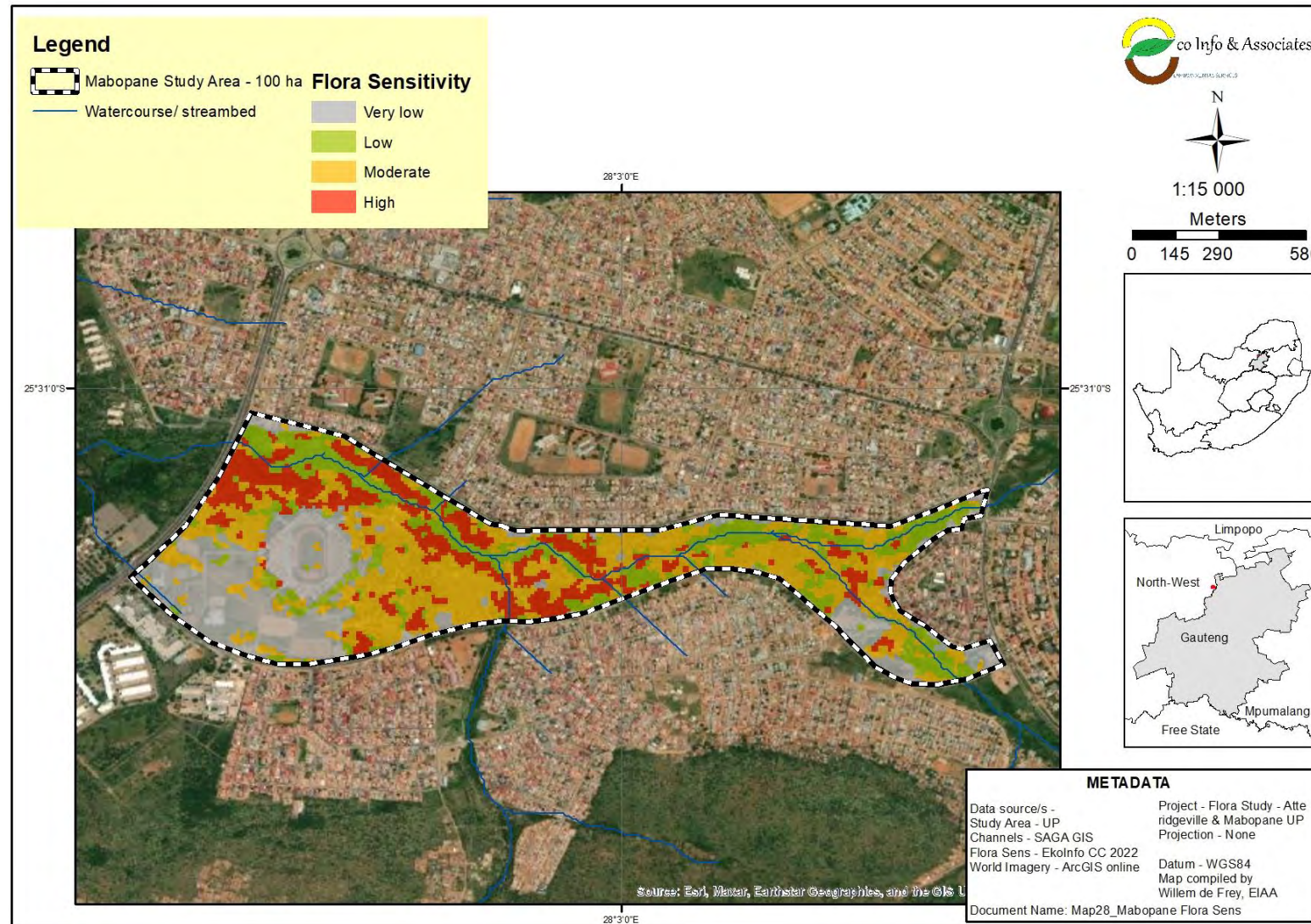


Figure 22: Flora sensitivity of the Mabopane study area

Table 13: Overview of the Beta diversity between the communities on which the flora sensitivity is based.

Community no	No of species per community	% of total (100% = 184) (A)	Surface Area (ha) – Natural	% Cover – Natural (B)	Beta - diversity index (A/B)	Flora Sensitivity
1	132	72%	34	46%	1.5	Moderate
2	105	57%	18	24%	2.3	High
3	49	27%	21	29%	0.9	Low

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7 APPENDIX A – BRAUN – BLANQUET TABLE: MABOPANE

Cluster no	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	5	5	5
TWINSpan level 1	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	20000	20000	20000
TWINSpan level 2	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	12000	12000	12000	12000	12000	12000	12000	20000	20000	20000
TWINSpan level 3	11100	11100	11100	11100	11100	11200	11200	11200	11200	11200	11200	11200	11200	11200	12100	12100	12100	12100	12100	12100	12200	20000	20000	20000
Table no	11	4	7	10	9	14	17	16	20	1	19	23	22	3	13	8	12	21	6	5	2	18	24	15
SPECIES GROUP A																								
Acacia tortilis subsp. heteracantha	+	+		+	+	+	+	2		+	+													
Crotalaria sphaerocarpa subsp. sphaerocarpa	+		+	+	+		+		+	2	+													
Eragrostis superba				+	1	+	1			1	+	+		1										
Aristida congesta subsp. congesta		+		+				+	+	+	+		+											
SPECIES GROUP B																								
Felicia mossamedensis	+	+		+	+					1														
Dactyloctenium giganteum	+		+	+	+		+										+							
Geigeria burkei subsp. burkei var. burkei	+		+		+			+					+											
Chloris virgata	+		+	+																				
Acacia nilotica subsp. kraussiana		1		+	+				+			2							+					
Elephantorrhiza burkei				+	r																			
Kyphocarpa angustifolia	+			+																				
Cleome monophylla	+			+														+						
Ledebouria cooperi		+		+							+								+					
SPECIES GROUP C																								
Schkuhria pinnata	+					+		+	+	+	+	+	2											
Melinis repens subsp. repens		+						+	+	+	+	+	+								+			
Tricholaena monachne	+							+	+	+	+	+	+											
Enneapogon cenchroides	+					2	+					+	1											
Indigofera daleoides var. daleoides					+			+		+			+											
Ozoroa paniculosa var. paniculosa						+	+	+																
Combretum zeyheri						+	+			+								+						
SPECIES GROUP D																								
Protasparagus setaceus															+	+	+	+	+	+	1			
Lablab purpureus subsp. purpureus															+		+				+			
Euclea crispa subsp. crispa		+													+			+			1			
Diospyros lycioides subsp. lycioides															+	+					+			
SPECIES GROUP E																								
Eulophia streptopetala															+			r	+	r				
Scadoxus puniceus																+			+	r				
Carissa bispinosa															2	+		+						
Pergularia daemia subsp. daemia			+				+					+					+	+	+					
Cyphostemma simulans															+	+								
Clematis brachiata									+						+	+					+			
Combretum apiculatum subsp. apiculatum	1					+		1							+			+						
SPECIES GROUP F																								
Heteropogon contortus				+	+	+	+		+	+	+	+	+	+		+			+					
Hyperthelia dissoluta				+			+			+	+	+	+				+		+					
SPECIES GROUP G																								
Eragrostis rigidior	+	2	3	+	2	+		+	2	+		+							1		+			
Schmidtia pappophoroides	1	+	+	+	+		1	1			+								1		+			
Lantana camara		+	+	+	+	+			+	1			1		+	+	+	+	+					
Peltophorum africanum		+		1	2	1	+			+			3	1	+	+	+	2	+	+				
Gymnosporia heterophylla	+	1				+		+	+			1			+	+	+	+	+					
Bidens pilosa	+		+			+	+	+	+						4		+		+					

Cluster no	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	5	5	5
TWINSpan level 1	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	20000	20000	20000
TWINSpan level 2	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	12000	12000	12000	12000	12000	12000	12000	20000	20000	20000
TWINSpan level 3	11100	11100	11100	11100	11100	11200	11200	11200	11200	11200	11200	11200	11200	11200	12100	12100	12100	12100	12100	12100	12200	20000	20000	20000
Table no	11	4	7	10	9	14	17	16	20	1	19	23	22	3	13	8	12	21	6	5	2	18	24	15
Aloe greatheadii var. davyana	+	+				+		+				+			+		+	+	+					
Ziziphus mucronata subsp. mucronata		+			+				+	+		+			+	+								
SPECIES GROUP H																								
Kedrostis leloja																					+			
Justicia betonica																					+			
Grewia flava																					1			
Pseudognaphalium luteo-album																					+			
Mariscus macrocarpus																					+			
Aristida bipartita																					+			
Cenchrus ciliaris														+							2			
Ipomoea magnusiana				+			+														+			
Eragrostis lehmanniana var. lehmanniana					+																+			
Cyphostemma sandersonii		+																			+			
Vigna vexillata var. vexillata																				+	+			
Protasparagus cooperi																	+				+			
Justicia flava															+						+			
Kedrostis foetidissima	+														+						+			
SPECIES GROUP I																								
Ricinus communis var. communis																						1	r	+
Imperata cylindrica																							r	3
Paspalum urvillei																							+	1
Flaveria bidentis			+								+	+										+	1	
Eriosema burkei var. burkei									1												+		2	1
Typha capensis									r						r								r	1
Gomphrena celosioides													1										+	
Eragrostis curvula																							+	
Salix babylonica var. babylonica																						+		
Pycnus polystachyos var. polystachyos																								1
Cladium mariscus subsp. jamaicense																								+
Pennisetum clandestinum																						+		
Conyza podocephala																							+	
Themeda triandra																							+	
Xanthium strumarium																						+		
Rhynchosia totta var. totta																							+	
Rumex crispus																						+		
Cyperus eragrostis																						+		
Datura stramonium													+										+	
Lippia javanica									+	+													+	
Amaranthus hybridus subsp. hybridus				+						+												+		
Phragmites australis									r								r					3		
Cyperus rotundus subsp. rotundus																						+		
Sida rhombifolia subsp. rhombifolia															+								+	
Elephantorrhiza elephantina									+														1	
Brachiaria brizantha																							3	
SPECIES GROUP J																								
Verbena brasiliensis																						+		+
Campuloclinium macrocephalum																						+		+
SPECIES GROUP K - GENERAL SPECIES																								
Tagetes minuta		+	+	+		+	1	+	+	+	+	+	+			+	+	+		+			+	+
Sclerocarya birrea subsp. caffra	2			+	+	+	+	3	+	2	2			1			2			1	1		1	
Melia azedarach		+		+					+	+	+			+	1	4	1	+	3	3	+	2	+	
Dichrostachys cinerea subsp. africana var. african	3	3	4	4	4	+	2	1	+	1	+	4	2	+	+		+	3	1	+	2			
Digitaria eriantha	1	2	+	2	2	+	+	1	2	+	+	+	+	2						1	3			

Eco Info And Associates (Pty) Ltd **Flora –Mabopane**

Cluster no	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	5	5	5
TWINSpan level 1	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWINSpan level 2	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	12000	12000	12000	12000	12000	12000	12000	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWINSpan level 3	11100	11100	11100	11100	11100	11200	11200	11200	11200	11200	11200	11200	11200	11200	12100	12100	12100	12100	12100	12100	12200	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Table no	11	4	7	10	9	14	17	16	20	1	19	23	22	3	13	8	12	21	6	5	2	18	24	15
<i>Ehretia rigida</i> subsp. <i>rigida</i>	+	1	+			+			+	+		+		+				+	+	+				
<i>Commelina erecta</i>		+	+	+			+	+	+										+	+	+			
<i>Panicum maximum</i>				+	+	+	+	+	1	+		1	2		+	+		2	2	+		+	+	
<i>Zinnia peruviana</i>	+			+		+			+		+		+			+	+	+	+				+	
<i>Acacia karroo</i>		4		+		1										+	+		2	4			3	
<i>Rhus pyroides</i> var. <i>pyroides</i>		+			+						+						+		+	+			+	
<i>Urochloa mosambicensis</i>	+	+	+	+	+	+	+	+	+	+		+	+	+					+	+			+	
<i>Pogonarthria squarrosa</i>	+				+				+	+	+	+											+	
<i>Lantana rugosa</i>		+			+					+		+	+						+	+				
<i>Pavonia burchellii</i>		+	+															+	+	+				
<i>Acacia caffra</i>	+					2		1	2		2		+		+			+	2	1			+	
<i>Cynodon dactylon</i>		+					+		+				+			+	+			2			+	
<i>Tecoma stans</i> var. <i>stans</i>						+	+		+	1	2		+		+	+	1	+			+	+	+	
<i>Pappea capensis</i>												+	+		+	+			+	+			2	
<i>Conyza bonariensis</i>							+		+							+	+			+	+			
<i>Dombeya rotundifolia</i> var. <i>rotundifolia</i>	+	+				+			3							+	+	2		+				
<i>Rhus lancea</i>		+		+		2									+		+							
<i>Euclea undulata</i> var. <i>myrtina</i>	+	+										+								+				
<i>Nidorella hottentotica</i>					+			+	+		+		+	+						+				
<i>Pentarrhinum insipidum</i>	+								+		+	+	+							+	+			
<i>Chamaecrista mimosoides</i>									+		+	+	+							+			+	
<i>Leonotis ocyimifolia</i>							+		+	+		+											+	
<i>Solanum panduriforme</i>						+	+				+												+	
<i>Ipomoea purpurea</i>												+	+		+	+	+				+	+	+	
<i>Hyparrhenia hirta</i>										3	3					+				+			4	
<i>Euphorbia heterophylla</i>						+										+	+	+		+			+	
<i>Kyllinga alba</i>												+			+			+	+	+			1	
<i>Morus alba</i> var. <i>alba</i>											+				+		+		+				+	
<i>Persicaria lapathifolia</i>															r		r				1		+	
SPECIES GROUP L																								
<i>Acacia galpinii</i>																		+						
<i>Acacia robusta</i> subsp. <i>robusta</i>															1									
<i>Acalypha villicaulis</i>									+									+						
<i>Agapanthus campanulatus</i> subsp. <i>campanulatus</i>															r									
<i>Aptosimum procumbens</i>					1																			
<i>Yucca gloriosa</i>												+												
<i>Barleria macrostegia</i>	+																							
<i>Ailanthus altissima</i>																		1						
<i>Boscia albitrunca</i>				+										r		r								
<i>Bulbine species</i> (217_2490)											+													
<i>Burkea africana</i>																			+					
<i>Celastraceae species</i> (213_2482)															+									
<i>Celtis africana</i>											+					+								
<i>Cereus jamacaru</i>																			+					
<i>Coccinia sessilifolia</i>						+																		
<i>Combretum hereroense</i>												r												
<i>Combretum molle</i>											+													
<i>Convolvulus sagittatus</i>											+													
<i>Corchorus asplenifolius</i>													+											
<i>Crotalaria distans</i>																			+					
<i>Cymbopogon excavatus</i>						+			+															
<i>Digitaria ternata</i>										+				+										
<i>Diheteropogon amplexans</i> var. <i>amplexans</i>													+											
<i>Dodonaea angustifolia</i>					2																			

Eco Info And Associates (Pty) Ltd **Flora –Mabopane**

Cluster no	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	5	5	5
TWINSpan level 1	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWINSpan level 2	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	12000	12000	12000	12000	12000	12000	12000	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWINSpan level 3	11100	11100	11100	11100	11100	11200	11200	11200	11200	11200	11200	11200	11200	11200	12100	12100	12100	12100	12100	12100	12200	20000	20000	20000
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Table no	11	4	7	10	9	14	17	16	20	1	19	23	22	3	13	8	12	21	6	5	2	18	24	15
<i>Ehretia amoena</i>									+										r					
<i>Euphorbia neopolycnemoides</i>							+						+				+							
<i>Eustachys paspaloides</i>																				+				
<i>Faurea saligna</i>									r															
<i>Gossypium herbaceum subsp. africanum</i>													+											
<i>Grewia bicolor var. bicolor</i>									+					+										
<i>Gymnosporia senegalensis</i>							+	+																
<i>Hermannia boraginiflora</i>			+								+													
<i>Hibiscus engleri</i>							+												+					
<i>Indigofera adenoides</i>													+	+										
<i>Indigofera hedyantha</i>														+										
<i>Indigofera hilaris var. hilaris</i>													+											
<i>Kohautia amatymbica</i>														+										
<i>Leucaena leucocephala subsp. leucocephala</i>						+																		
<i>Lotononis laxa</i>										+														
<i>Monsonia angustifolia</i>											+		+											
<i>Opuntia ficus-indica</i>																			+					
<i>Pavetta species (213_2481)</i>															+									
<i>Pellaea calomelanos var. calomelanos</i>																			+					
<i>Perotis patens</i>														+										
<i>Phyllanthus parvulus var. parvulus</i>											+									+				
<i>Pollichia campestris</i>					+	+					+													
<i>Polygala hottentotta</i>														+										
<i>Protasparagus laricinus</i>		+																						
<i>Rhus leptodictya</i>	+										+								+					
<i>Richardia brasiliensis</i>											+		+											
<i>Citrus x sinensis</i>																				+				
<i>Senna italica subsp. arachoides</i>	+																							
<i>Sesamum triphyllum var. triphyllum</i>								+					+											
<i>Solanum elaeagnifolium</i>			+																					
<i>Solanum mauritianum</i>																		+						
<i>Sporobolus festivus</i>	+																							
<i>Stylosanthes fruticosa</i>														+										
<i>Syzygium cordatum subsp. cordatum</i>						+																		
<i>Tephrosia multijuga</i>											+													
<i>Terminalia sericea</i>						r																		
<i>Tragus berteronianus</i>											+													
<i>Tritonia species (213_2480)</i>															+									
<i>vangueria infausta subsp. Infausta</i>								+																
<i>Vitex zeyheri</i>	+																							
<i>Waltheria indica</i>						+								+										
<i>Zanthoxylum capense</i>																+								
<i>Zornia linearis</i>					+									+										

8 APPENDIX B – MABOPANE PLANT LIST

FAMILY, Genus, Botanical Name

ACANTHACEAE

Barleria

Barleria macrostegia

Justicia

Justicia betonica

Justicia flava

AGAPANTHACEAE

Agapanthus

Agapanthus campanulatus subsp. campanulatus

AMARANTHACEAE

Amaranthus

Amaranthus hybridus subsp. hybridus var. hybridus

Gomphrena

Gomphrena celosioides

Kyphocarpa

Kyphocarpa angustifolia

AMARYLLIDACEAE

Scadoxus

Scadoxus puniceus

ANACARDIACEAE

Ozoroa

Ozoroa paniculosa var. paniculosa

Rhus

Rhus lancea

Rhus leptodictya

Rhus pyroides var. pyroides

Sclerocarya

Sclerocarya birrea subsp. caffra

APOCYNACEAE

Carissa

Carissa bispinosa

Pentarrhinum

Pentarrhinum insipidum

Pergularia

Pergularia daemia subsp. daemia

ASPARAGACEAE

Protasparagus

Protasparagus cooperi

Protasparagus laricinus

Protasparagus setaceus

Yucca

Yucca gloriosa

FAMILY, Genus, Botanical Name

ASPHODELACEAE

Aloe

Aloe greatheadii var. *davyana*

Bulbine

Bulbine species (217_2490)

ASTERACEAE

Bidens

Bidens pilosa

Campuloclinium

Campuloclinium macrocephalum

Conyza

Conyza bonariensis

Conyza podocephala

Felicia

Felicia mossamedensis

Flaveria

Flaveria bidentis

Geigeria

Geigeria burkei subsp. *burkei* var. *burkei*

Nidorella

Nidorella hottentotica

Pseudognaphalium

Pseudognaphalium luteo-album

Schkuhria

Schkuhria pinnata

Tagetes

Tagetes minuta

Xanthium

Xanthium strumarium

Zinnia

Zinnia peruviana

BIGNONIACEAE

Tecoma

Tecoma stans var. *stans*

BORAGINACEAE

Ehretia

Ehretia amoena

Ehretia rigida subsp. *rigida*

CACTACEAE

Cereus

Cereus jamacaru

Opuntia

Opuntia ficus-indica

CAPPARACEAE

Boscia

FAMILY, Genus, Botanical Name

Boscia albitrunca

Cleome

Cleome monophylla

CARYOPHYLLACEAE**Pollichia**

Pollichia campestris

CELASTRACEAE**CELASTRACEAE**

Celastraceae species (213_2482)

Gymnosporia

Gymnosporia heterophylla

Gymnosporia senegalensis

CELTIDACEAE**Celtis**

Celtis africana

COMBRETACEAE**combretum**

Combretum apiculatum subsp. apiculatum

Combretum hereroense

Combretum molle

Combretum zeyheri

Terminalia

Terminalia sericea

COMMELINACEAE**Commelina**

Commelina erecta

CONVOLVULACEAE**Convolvulus**

Convolvulus sagittatus

Ipomoea

Ipomoea magnusiana

Ipomoea purpurea

CUCURBITACEAE**Coccinia**

Coccinia sessilifolia

Kedrostis

Kedrostis foetidissima

Kedrostis leloja

CYPERACEAE**Cladium**

Cladium mariscus subsp. jamaicense

Cyperus

Cyperus eragrostis

Cyperus rotundus subsp. rotundus var. platystachys

Kyllinga

FAMILY, Genus, Botanical Name

Kyllinga alba

Mariscus

Mariscus macrocarpus

Pycreus

Pycreus polystachyos var. polystachyos

EBENACEAE**Diospyros**

Diospyros lycioides subsp. lycioides

Euclea

Euclea crispa subsp. crispa

Euclea undulata var. myrtina

EUPHORBIACEAE**Acalypha**

Acalypha villicaulis

Euphorbia

Euphorbia heterophylla

Euphorbia neopolycnemoides

Ricinus

Ricinus communis var. communis

FABACEAE**Acacia**

Acacia caffra

Acacia galpinii

Acacia karroo

Acacia nilotica subsp. kraussiana

Acacia robusta subsp. robusta

Acacia tortilis subsp. heteracantha

Burkea

Burkea africana

Chamaecrista

Chamaecrista mimosoides

Crotalaria

Crotalaria distans

Crotalaria sphaerocarpa subsp. sphaerocarpa

Dichrostachys

Dichrostachys cinerea subsp. africana var. africana

Elephantorrhiza

Elephantorrhiza burkei

Elephantorrhiza elephantina

Eriosema

Eriosema burkei var. burkei

Indigofera

Indigofera adenoides

Indigofera daleoides var. daleoides

Indigofera hedyantha

FAMILY, Genus, Botanical Name

Indigofera hiliaris var. hiliaris

Lablab

Lablab purpureus subsp. purpureus

Leucaena

Leucaena leucocephala subsp. leucocephala

Lotononis

Lotononis laxa

Peltophorum

Peltophorum africanum

Rhynchosia

Rhynchosia totta var. totta

Senna

Senna italica subsp. arachoides

Stylosanthes

Stylosanthes fruticosa

Tephrosia

Tephrosia multijuga

Vigna

Vigna vexillata var. vexillata

Zornia

Zornia linearis

GERANIACEAE**Monsonia**

Monsonia angustifolia

HYACINTHACEAE**Ledebouria**

Ledebouria cooperi

IRIDACEAE**Tritonia**

Tritonia species (213_2480)

LAMIACEAE**Leonotis**

Leonotis ocymifolia

Vitex

Vitex zeyheri

MALVACEAE**Corchorus**

Corchorus asplenifolius

Dombeya

Dombeya rotundifolia var. rotundifolia

Gossypium

Gossypium herbaceum subsp. africanum

Grewia

Grewia bicolor var. bicolor

Grewia flava

FAMILY, Genus, Botanical Name**Hermannia**

Hermannia boraginiflora

Hibiscus

Hibiscus engleri

Pavonia

Pavonia burchellii

Sida

Sida rhombifolia subsp. rhombifolia

Waltheria

Waltheria indica

MELIACEAE**Melia**

Melia azedarach

MORACEAE**Morus**

Morus alba var. alba

MYRTACEAE**Syzygium**

Syzygium cordatum subsp. cordatum

ORCHIDACEAE**Eulophia**

Eulophia streptopetala

PEDALIACEAE**Sesamum**

Sesamum triphyllum var. triphyllum

PHYLLANTHACEAE**Phyllanthus**

Phyllanthus parvulus var. parvulus

POACEAE**Aristida**

Aristida bipartita

Aristida congesta subsp. congesta

Brachiaria

Brachiaria brizantha

Cenchrus

Cenchrus ciliaris

Chloris

Chloris virgata

Cymbopogon

Cymbopogon excavatus

Cynodon

Cynodon dactylon

Dactyloctenium

Dactyloctenium giganteum

Digitaria

FAMILY, Genus, Botanical Name

Digitaria eriantha

Digitaria ternata

Diheteropogon

Diheteropogon amplexans var. *amplexans*

Enneapogon

Enneapogon cenchroides

Eragrostis

Eragrostis curvula

Eragrostis lehmanniana var. *lehmanniana*

Eragrostis rigidior

Eragrostis superba

Eustachys

Eustachys paspaloides

Heteropogon

Heteropogon contortus

Hyparrhenia

Hyparrhenia hirta

Hyperthelia

Hyperthelia dissoluta

Imperata

Imperata cylindrica

Melinis

Melinis repens subsp. *repens*

Panicum

Panicum maximum

Paspalum

Paspalum urvillei

Pennisetum

Pennisetum clandestinum

Perotis

Perotis patens

Phragmites

Phragmites australis

Pogonarthria

Pogonarthria squarrosa

Schmidtia

Schmidtia pappophoroides

Sporobolus

Sporobolus festivus

Themeda

Themeda triandra

Tragus

Tragus berteronianus

Tricholaena

Tricholaena monachne

FAMILY, Genus, Botanical Name**Urochloa**

Urochloa mosambicensis

POLYGALACEAE**Polygala**

Polygala hottentotta

POLYGONACEAE**Persicaria**

Persicaria lapathifolia

Rumex

Rumex crispus

PROTEACEAE**Faurea**

Faurea saligna

PTERIDACEAE**Pellaea**

Pellaea calomelanos var. calomelanos

RANUNCULACEAE**Clematis**

Clematis brachiata

RHAMNACEAE**Ziziphus**

Ziziphus mucronata subsp. mucronata

RUBIACEAE**Kohautia**

Kohautia amatymbica

Pavetta

Pavetta species (213_2481)

Richardia

Richardia brasiliensis

Vangueria

Vangueria infausta subsp. infausta

RUTACEAE**Citrus**

Citrus x sinensis

Zanthoxylum

Zanthoxylum capense

SALICACEAE**Salix**

Salix babylonica var. babylonica

SAPINDACEAE**Dodonaea**

Dodonaea angustifolia

Pappea

Pappea capensis

SCROPHULARIACEAE

FAMILY, Genus, Botanical Name**Aptosimum**

Aptosimum procumbens

SIMAROUBACEAE**Ailanthus**

Ailanthus altissima

SOLANACEAE**Datura**

Datura stramonium

Solanum

Solanum elaeagnifolium

Solanum mauritianum

Solanum panduriforme

TYPHACEAE**Typha**

Typha capensis

VERBENACEAE**Lantana**

Lantana camara

Lantana rugosa

Lippia

Lippia javanica

Verbena

Verbena brasiliensis

VITACEAE**Cyphostemma**

Cyphostemma sandersonii

Cyphostemma simulans