

Flora Study – Atteridgeville

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1 EXECUTIVE SUMMARY

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

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.

This document concerns the Atteridgeville study area. The area covers 228 ha. Twenty-two 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. *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms
- 1.1. *Digitaria tricholaenoides* - *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland sub-community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms, to wet to plough, but used for forestry
- 1.2. *Ledebouria cooperi* - *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland sub-community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms, not ploughed due to surface rock, used for grazing
- 2. *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 2.1 *Sida rhombifolia* - *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 2.2. *Eragrostis chloromelas* - *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 3. *Berula erecta* - *Leersia hexandra* wet tall grassland community on very deep, coarse textured soils which are saturated/ over-saturated such as Katspruit

Overall, the study area represents mainly wetland (Community two and three) with patches of terrestrial habitat (Community 1) severely influenced by human activities both historic and current.

The species area curve confirmed that the 169 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.

Of the three communities identified, community three as the lowest flora sensitivity due to the difficult conditions associated with saturated to over saturated soils, while community one has the highest flora sensitivity. However on a regional scale the wetlands associated with community two and three is give a higher conservation priority in terms of environmental legislation.

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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.

The area was described as follows:

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

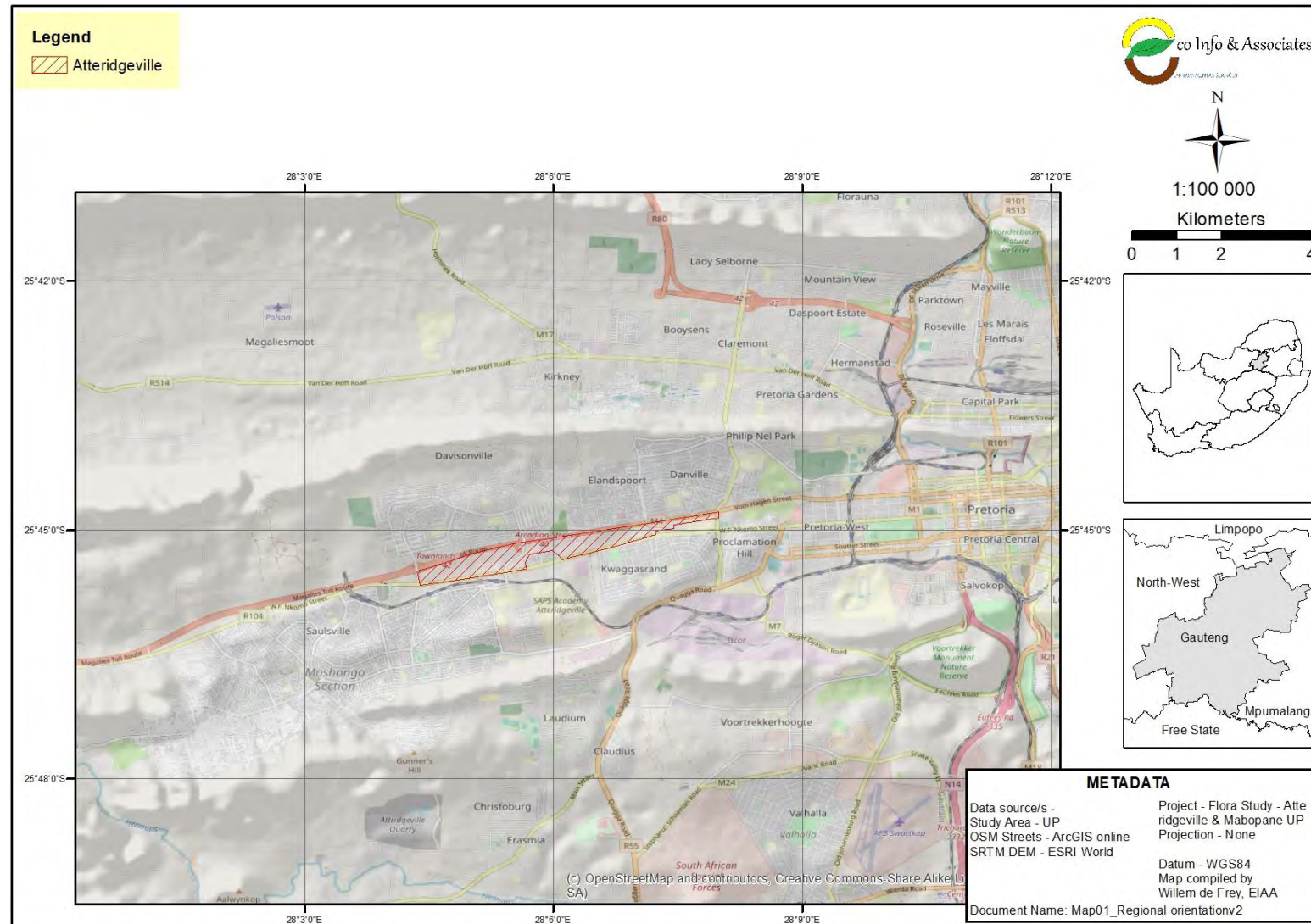


Figure 1: Regional orientation of the study area to the north of the city of Pretoria, Gauteng Province – South Africa

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-two plots were surveyed in the Atteridgeville 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 22 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.

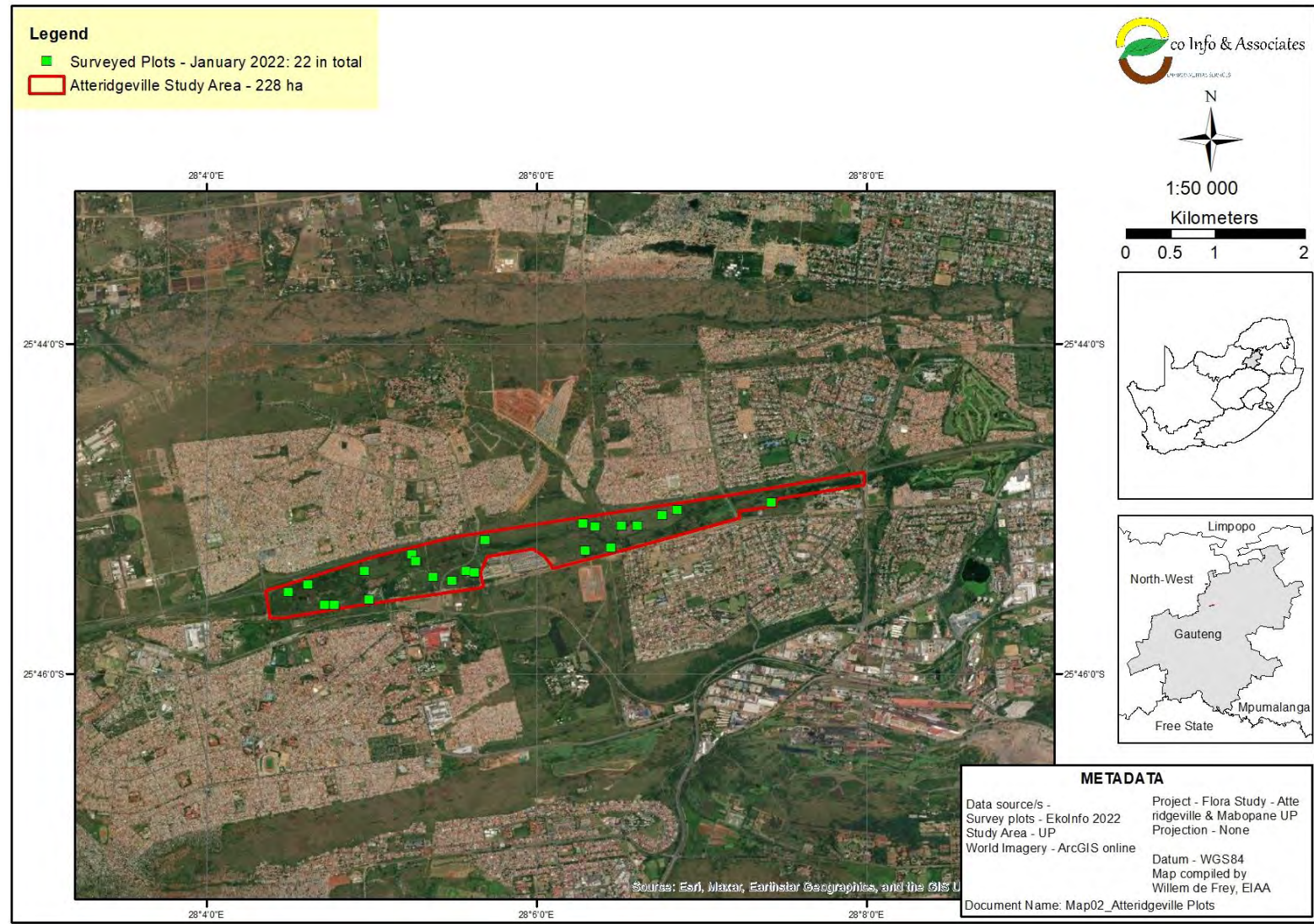


Figure 2: Distribution of the survey plots within the Atteridgeville study area

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 west of the City of Tshwane in Gauteng Province, it covers 228 ha. It is surrounded by residential developments with two main roads along the northern and southern boundaries. It is therefore overall isolated from other natural areas, with patches of natural areas towards the south and north mainly associated with drainage systems. An overview of the environmental factors which the vegetation is expected to reflect is provided.

5.1.1 Geological Attributes

The two stratigraphic units underlay the study area, namely Timeball Hill and Hekpoort formations of the Pretoria Group within the Transvaal Sequence (Johnson *et al.* 2006) (Figure 3). The Timeball Hill formation lithological units represent sedimentary rock namely: shale and arenite. The Hekpoort formation represents igneous rock consisting of andesite. It is expected that shale and arenite will contribute to the development of fine textured soils, while the arenite (coarse grained sandstone) will result in coarse textured soils (Read & Watson 1983, Strahler & Strahler 1987, White 1987).

5.1.2 Climatic Attributes

The study area is located within the Northern Transvaal climate zone, with mean annual rainfall ranging from 600 – 1 200 mm, which places it globally within the sub-humid climate zone (Figure 4). According to the climate graph² (Figure 5) for the city of Pretoria, with which the study area is associated, the mean annual precipitation is 661 mm, with the most rainfall occurring in the December and the least in July. January is the warmest month, and July the coldest. The mean annual temperature is 18.4 °C.

5.1.3 Topographic Attributes

The study area is associated with lowlands and hills, from an altitude of 1 384 m above mean sea level to 1 333 m in the east (Figure 6). A watercourse drains the area to the east.

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

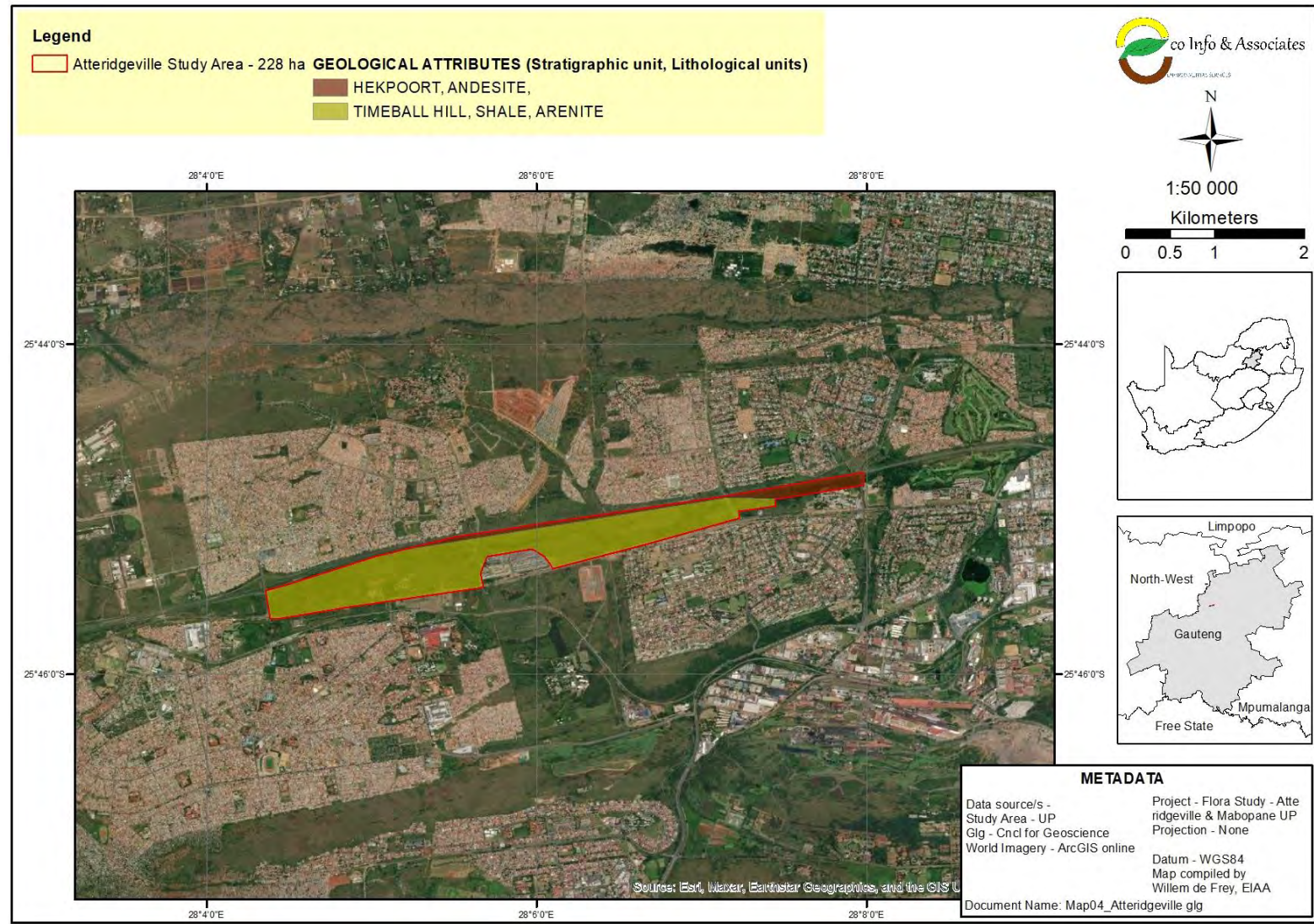


Figure 3: Geological attributes associated with the Atteridgeville study area

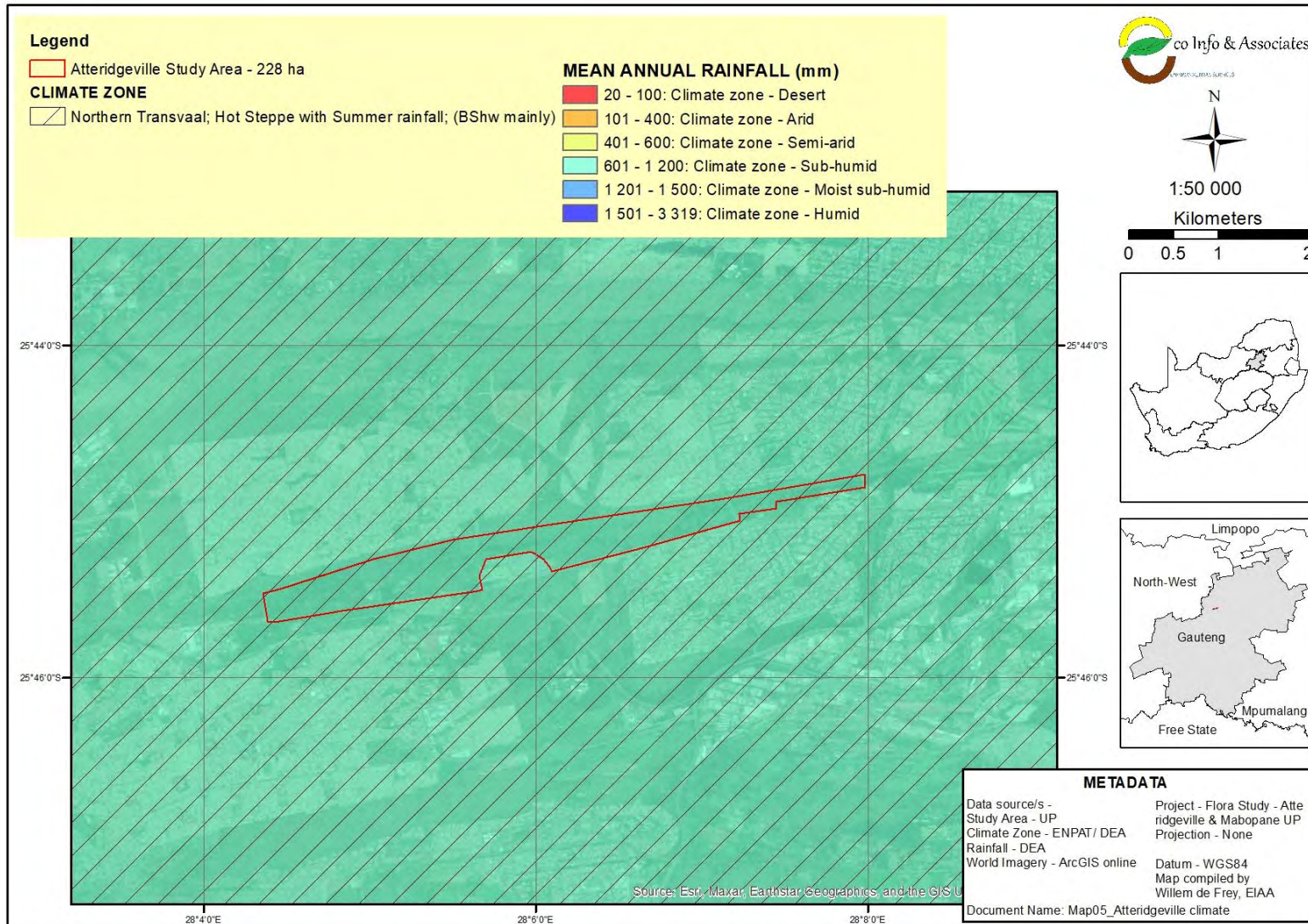
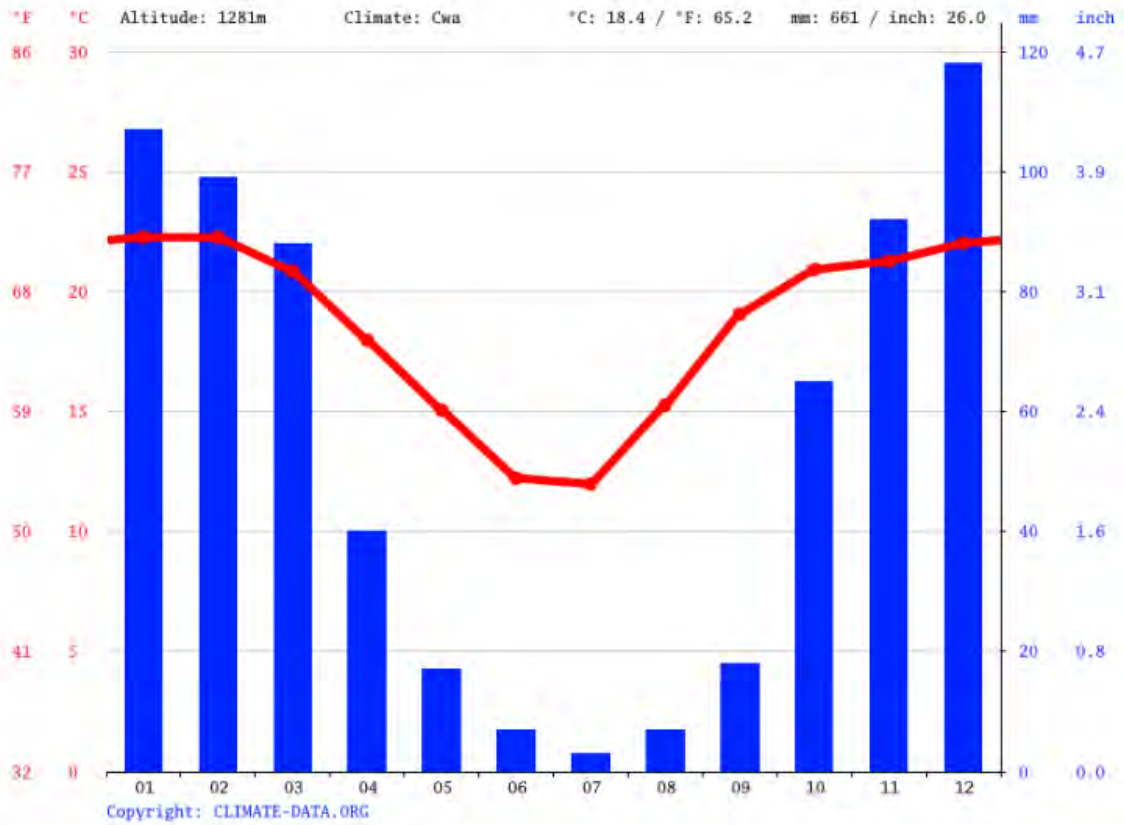


Figure 4: Climatic attributes associated with the Atteridgeville study area

CLIMATE GRAPH // WEATHER BY MONTH PRETORIA



The least amount of rainfall occurs in July. The average in this month is 3 mm | 0.1 inch. In December, the precipitation reaches its peak, with an average of 118 mm | 4.6 inch.

Figure 5: Climate graph of the city of Pretoria with which the Atteridgeville study area is associated with

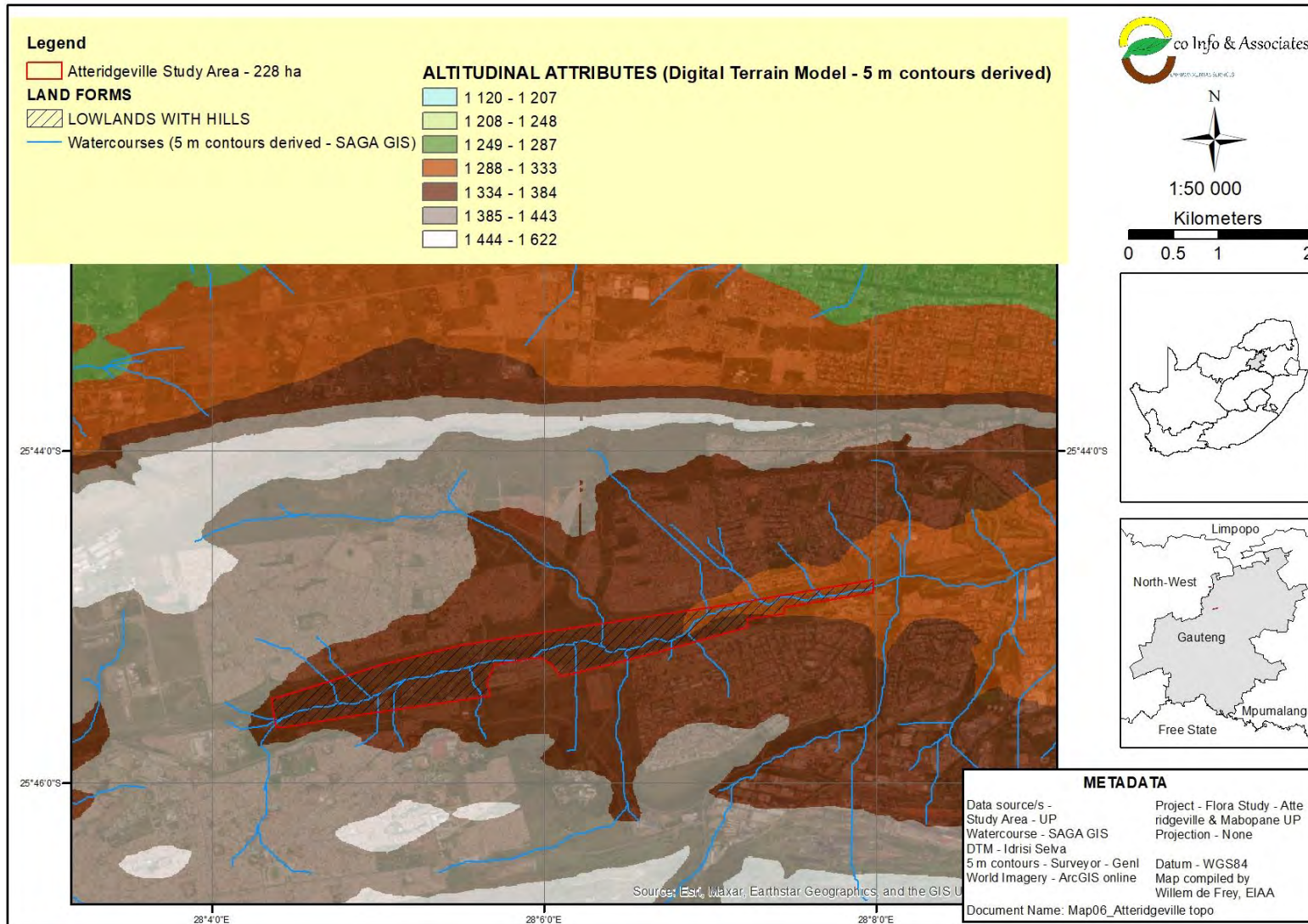


Figure 6: Topographic attributes associated with the Atteridgeville study area

Locally most of the study area is associated with slopes of less than 5°, with a moderate 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 Ba7 (Figure 8). Soils belonging to this land type units are associated with yellow-brown apedal subsoils and a fluctuating water table within 1.5m of the surface (Land Type Survey Staff 1987, Soil Classification Workgroup 1991). Yellow-brown apedal soils are often used for cultivation, as they are well drained and coarse textured (White 1987, Fey 2010). Historical images from 1969 supports this statement (Figure 9). The agricultural potential of these soils is still evident from the subsistence farming occurring within the study area (Photo 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 Endangered Marikana Thornveld (Figure 10) of the Savanna Biome of South Africa (Mucina & Rutherford 2006). The Marikana Thornveld is described as:

“Open Acacia karroo woodland, occurring in valleys and slightly undulating plains, and some lowland hills. Shrubs are more dense along drainage lines, on termitaria and rocky outcrops or in other habitat protected from fire.

Less than 1% statutorily conserved in, for example, Magaliesberg Nature Area. More conserved in addition in other reserves, mainly in De Onderstepoort Nature Reserve. Considerably impacted, with 48% transformed, mainly cultivated and urban or built-up areas. Most agricultural development of this unit is in the western regions towards Rustenburg, while in the east (near Pretoria) industrial development is a greater threat of land transformation. Erosion is very low to moderate. Alien invasive plants occur localised in high densities, especially along drainage lines.”

The following 49 plant species are listed as important for the vegetation unit:

*Acacia*³ *burkei*, *Acacia caffra*, *Acacia gerrardii* subsp. *gerrardii* var. *gerrardii*, *Acacia karroo*, *Acacia nilotica* subsp. *kraussiana*, *Acacia tortilis* subsp. *heteracantha*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Asparagus cooperi*, *Barleria macrostegia*, *Celtis africana*, *Clematis brachiata*,

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

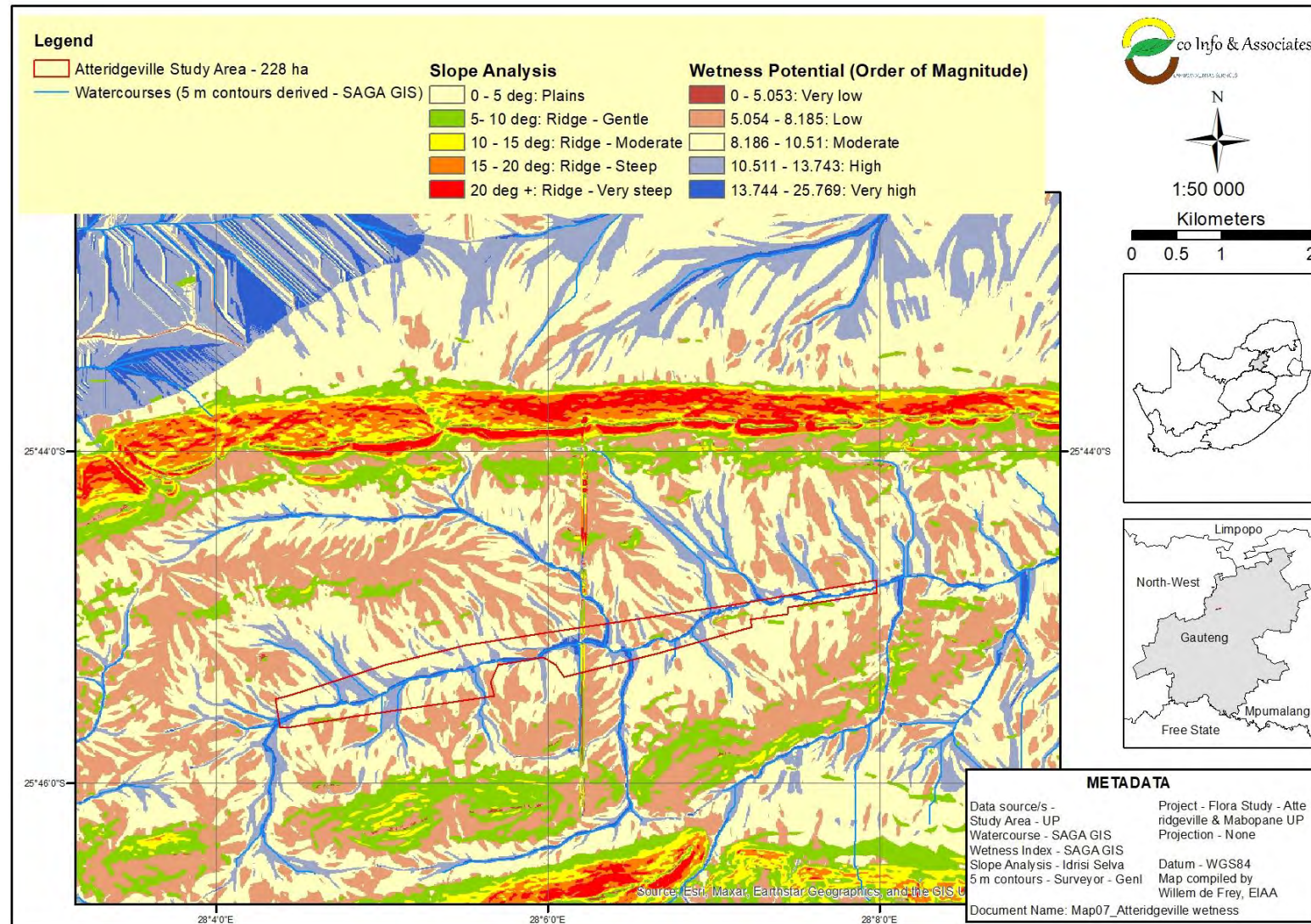


Figure 7: Local topographic attributes associated with the Atteridgeville study area

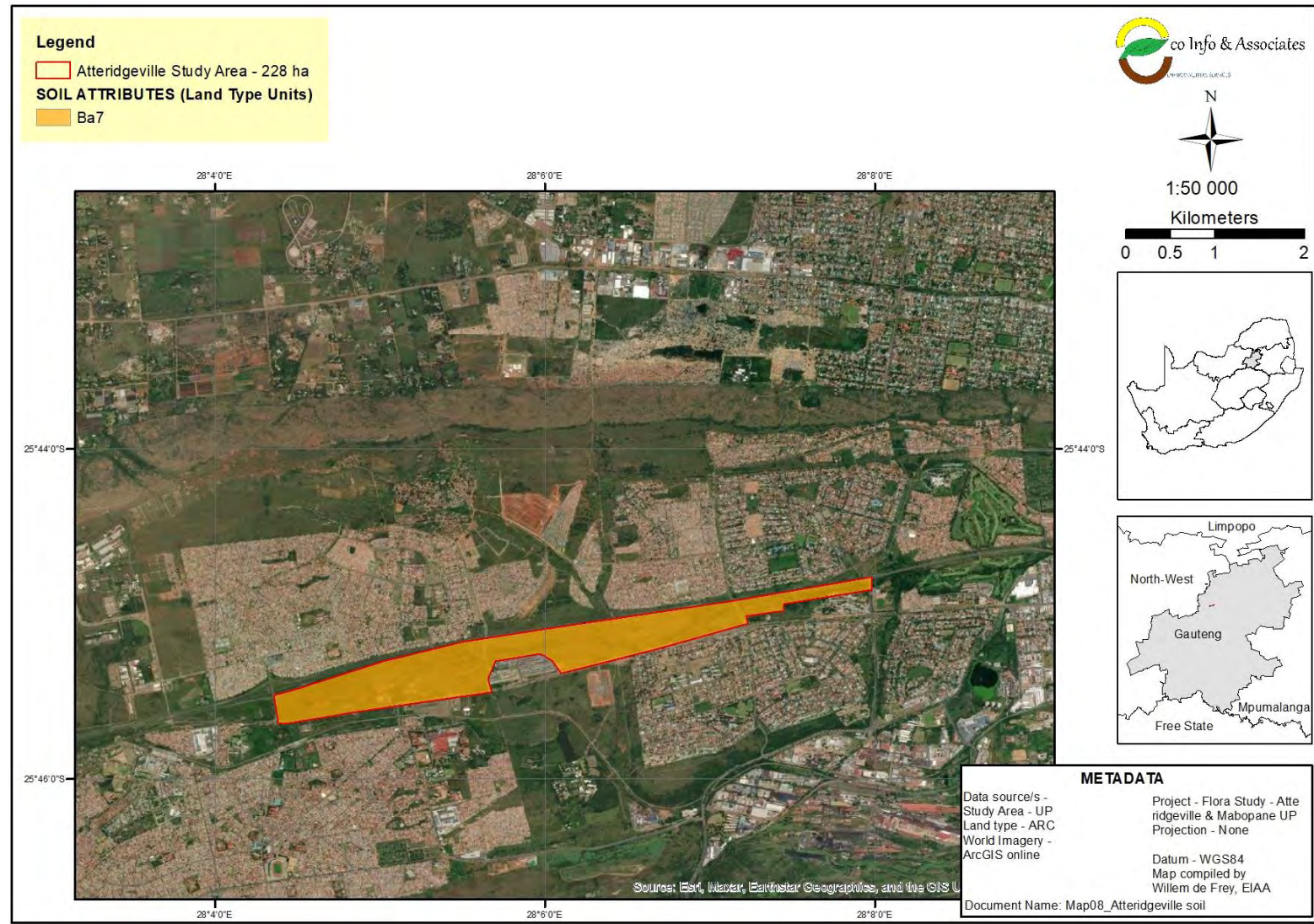


Figure 8: Soil attributes associated with the Atteridgeville study area

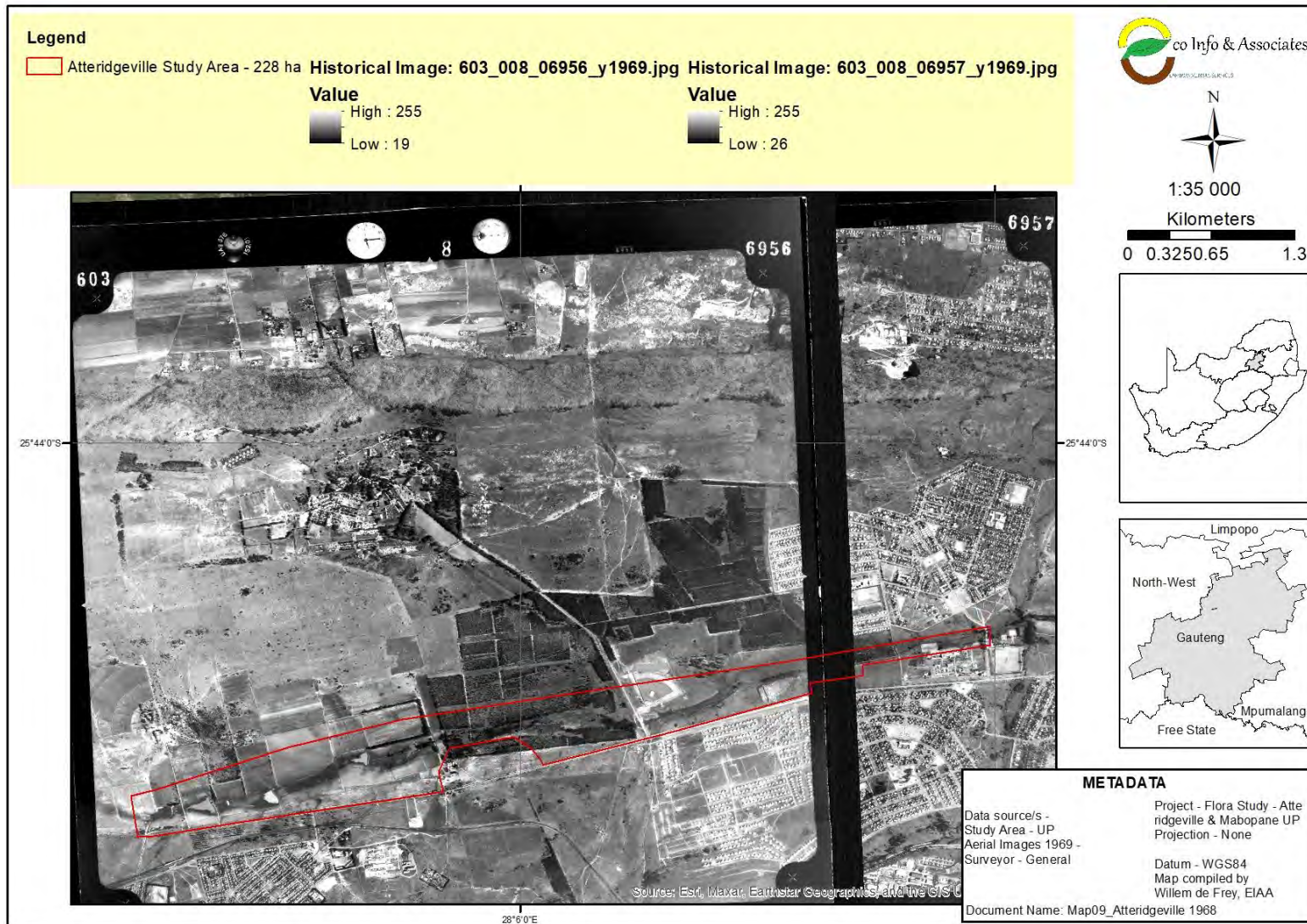


Figure 9: Historical images from 1969 showing the extensive use of the areas for agricultural purposes



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

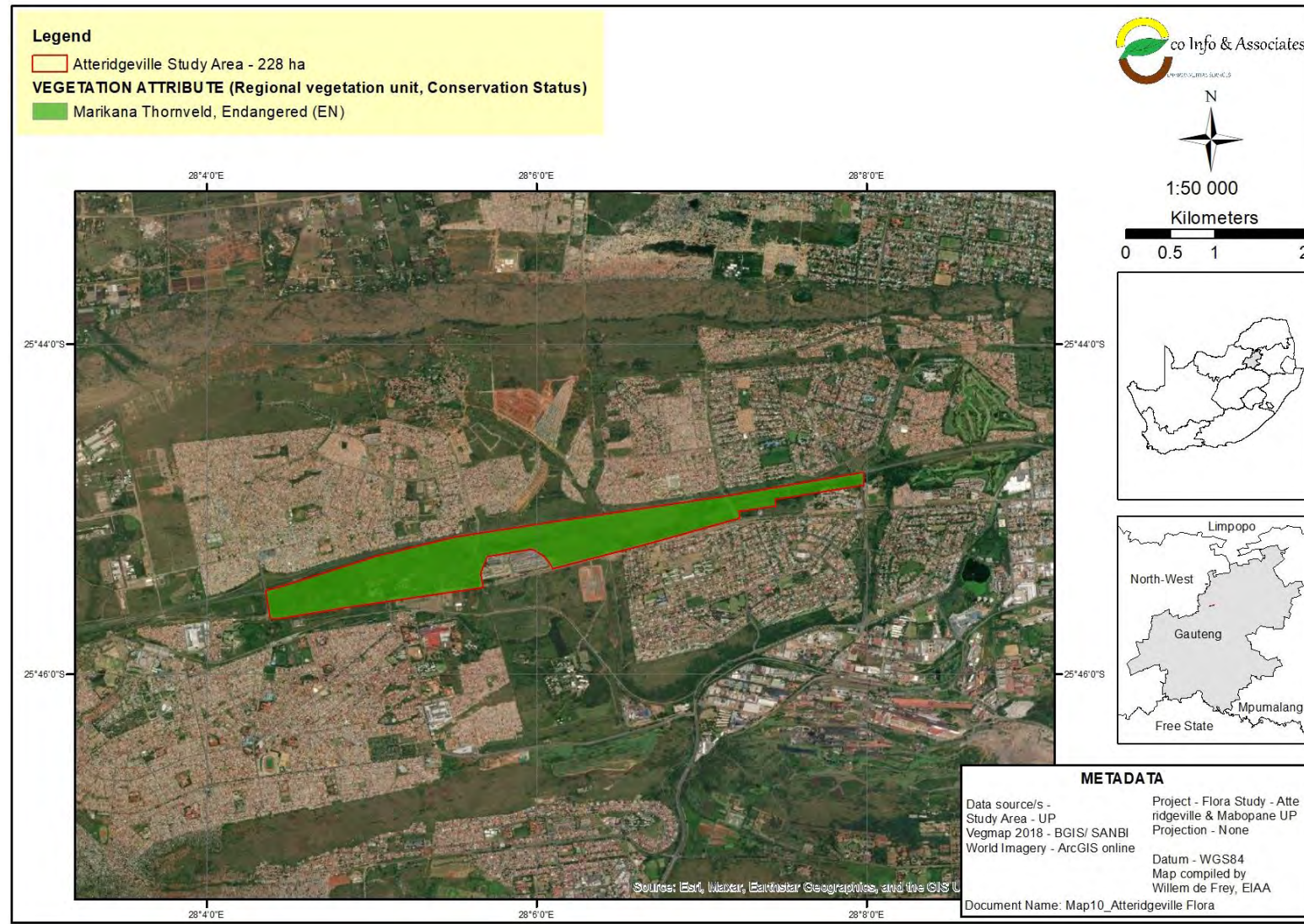


Figure 10: Flora attributes associated with the Atteridgeville study area

Combretum molle, *Cyphostemma cirrhosum* subsp. *cirrhosum*, *Dianthus mooiensis* subsp. *mooiensis* var. *mooiensis*, *Diospyros lycioides* subsp. *guerkei*, *Dombeya rotundifolia* var. *rotundifolia*, *Ehretia rigida* subsp. *rigida*, *Elionurus muticus*, *Eragrostis lehmanniana* var. *lehmanniana*, *Euclea crispa* subsp. *crispa*, *Euclea undulata*, *Fingerhuthia africana*, *Grewia flava*, *Helinus integrifolius*, *Hermannia depressa*, *Heteropogon contortus*, *Hyperthelia dissoluta*, *Indigofera zeyheri*, *Ipomoea oblongata*, *Ipomoea obscura* var. *obscura*, *Justicia flava*, *Ledebouria revoluta*, *Melinis nerviglumis*, *Olea europaea* subsp. *africana*, *Ornithogalum tenuifolium* subsp. *tenuifolium*, *Pappea capensis*, *Pavetta gardeniifolia* var. *gardeniifolia*, *Peltophorum africanum*, *Pentarrhinum insipidum*, *Pogonarthria squarrosa*, *Rhus lancea*, *Rhus pyroides* var. *pyroides*, *Rhynchosia nitens*, *Sansevieria aethiopica*, *Setaria sphacelata* var. *sphacelata*, *Terminalia sericea*, *Themeda triandra*, *Vernonia oligocephala*, *Ziziphus mucronata* subsp. *mucronata*

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 11), 177 ha or 86% of the study area is associated with Critical Biodiversity Area (CBA) (Table 1), with 29 ha or 14% associated with Ecological Support Area.

It is evident that most of the area is considered to be suitable habitat for Red Listed plants or mammals and is associated with areas considered to represent primary vegetation (Table 2). The current study will evaluate relevance of these assumptions, as it is evident from the 1969 historical image that a large part of the study areas used to be used for cultivation (Figure 9).

5.1.7 Current Land use

According to the most recent land cover information from 2020 (Figure 12), 149 ha or 66% of the study area is untransformed (Table 3), consisting mainly of wetlands at 94 ha or 41%.

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 and forestry.

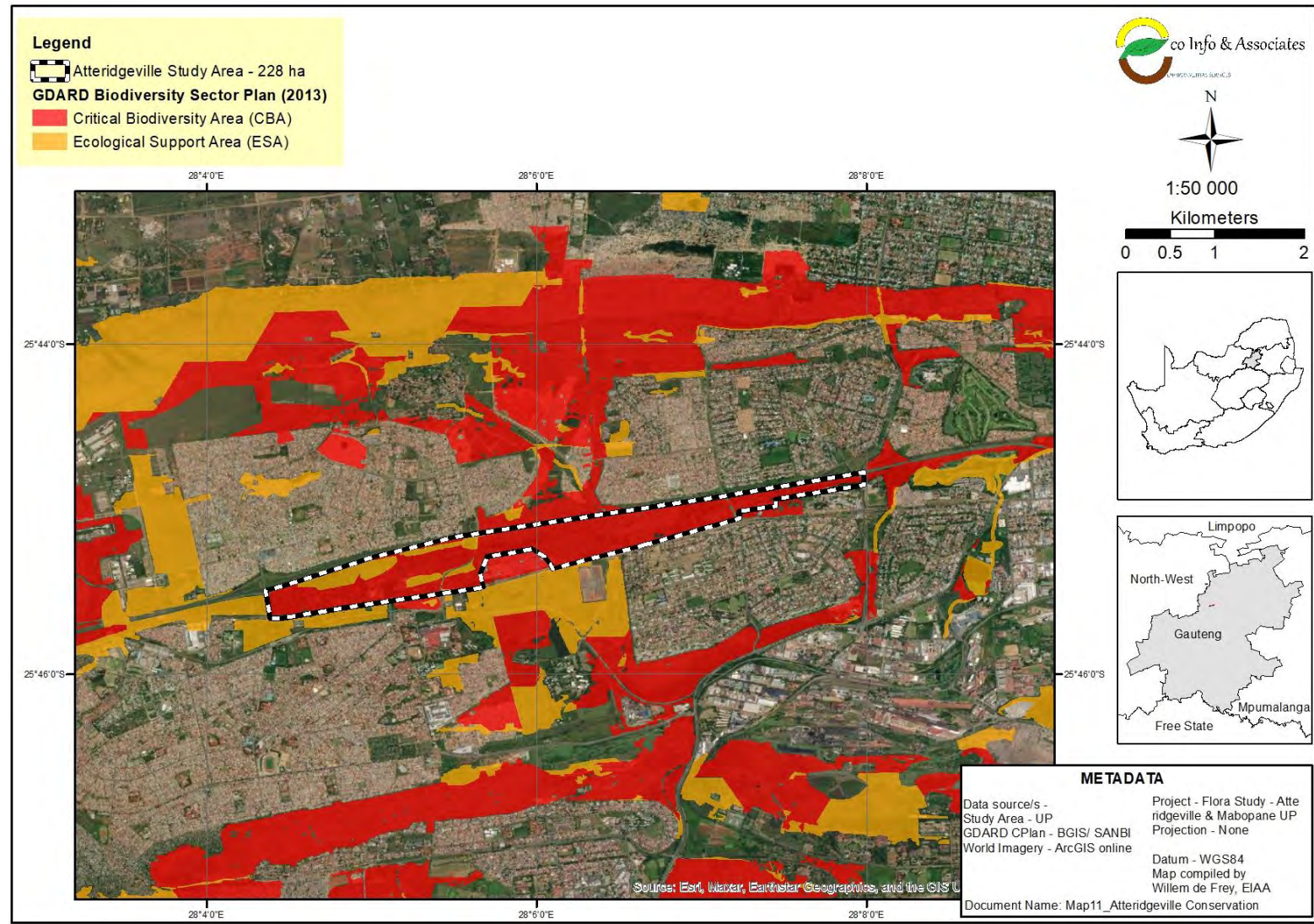


Figure 11: Conservation attributes associated with the Atteridgeville study area

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

GDARD Conservation Plan Categories	Biodiversity Sector Plan Categories		Grand Total	% Cover
	Critical Biodiversity Area (CBA)	Ecological Support Area (ESA)		
Ecological Support Area		29	29	14%
Important Area	177		177	86%
Grand Total	177	29	206	100%
	86%	14%	100%	

Table 2: Overview of the biodiversity parameters considered to evaluate the areas of concern

Biodiversity Sector Plan Category	
Biodiversity Parameters Considered	Surface (ha)
Critical Biodiversity Area (CBA)	177
RL plant hab, OL plant hab, RL mammal hab, Prim veg	163
RL plant hab, Prim veg	0
RL plant hab, RL mammal hab, Prim veg	14
Ecological Support Area (ESA)	29
	29
Grand Total	206

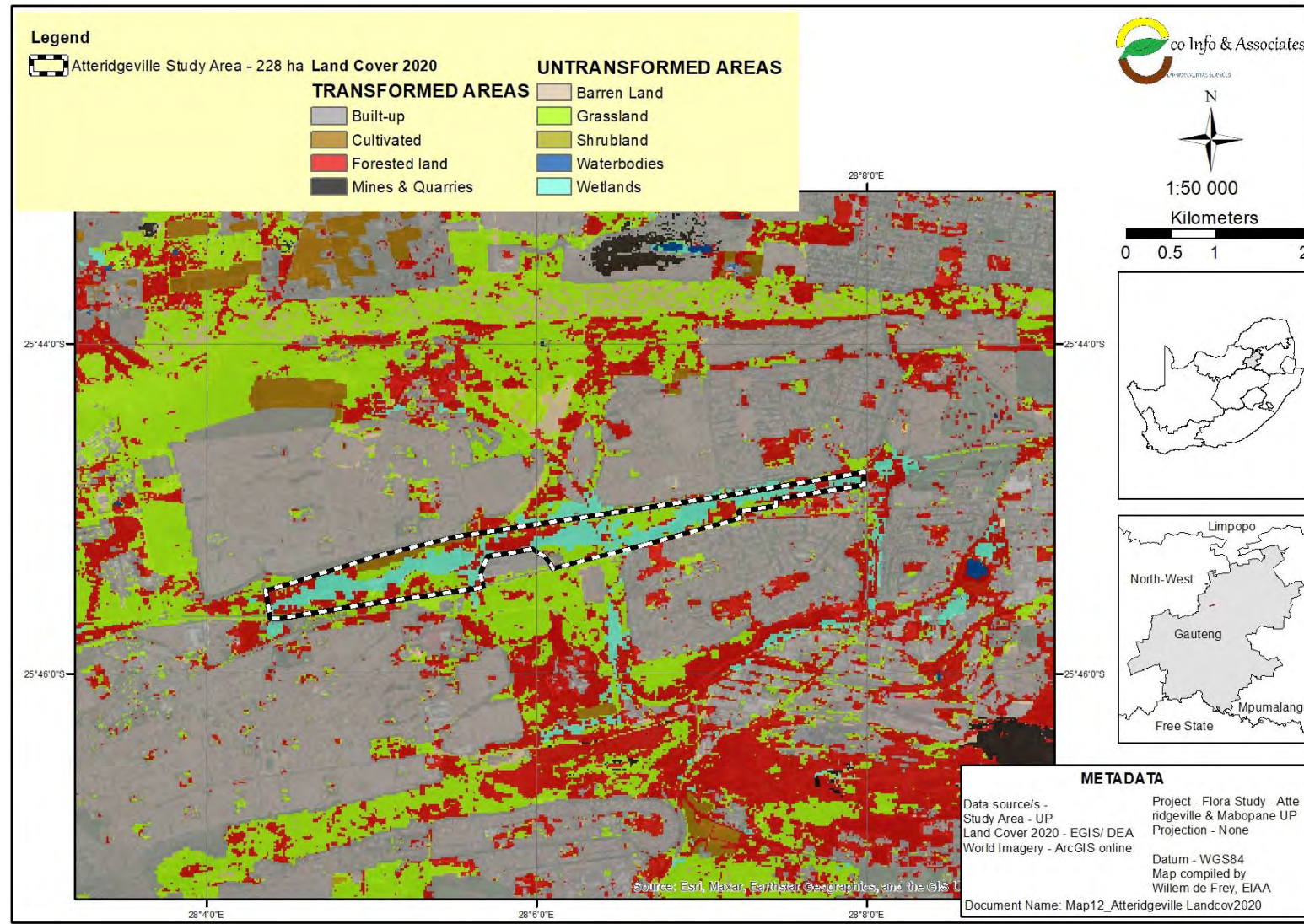


Figure 12: Land cover attributes from 2020 associated with the Atteridgeville study area

Table 3: Overview of the extent and percentage cover of the land cover 2020 categories within Atteridgeville study area

Land Cover 2020	Surface Area (ha)	% Cover	Derived Ecological Status	
			Untransformed	Transformed
Barren Land	0	0%	0	
Built-up	11	5%		11
Cultivated	11	5%		11
Forested land	56	24%		56
Grassland	55	24%	55	
Wetlands	94	41%	94	
Grand Total	228	100%	149	78
			66%	34%

5.2 PHYTOSOCIOLOGICAL STUDY

Twenty-eight 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). Twenty-nine 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 4). Due to localised transformation influences such as illegal rubble dumping and informal recycling (Photo plate 2) not all 28 plots could be surveyed, resulting in only 22 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. *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms
- 1.1. *Digitaria tricholaenoides* - *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland sub-community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms, to wet to plough, but used for forestry
- 1.2. *Ledebouria cooperi* - *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland sub-community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms, not ploughed due to surface rock, used for grazing
- 2. *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 2.1 *Sida rhombifolia* - *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 2.2. *Eragrostis chloromelas* - *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh
- 3. *Berula erecta* - *Leersia hexandra* wet tall grassland community on very deep, coarse textured soils which are saturated/ over-saturated such as Katspruit

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
- Surface rock

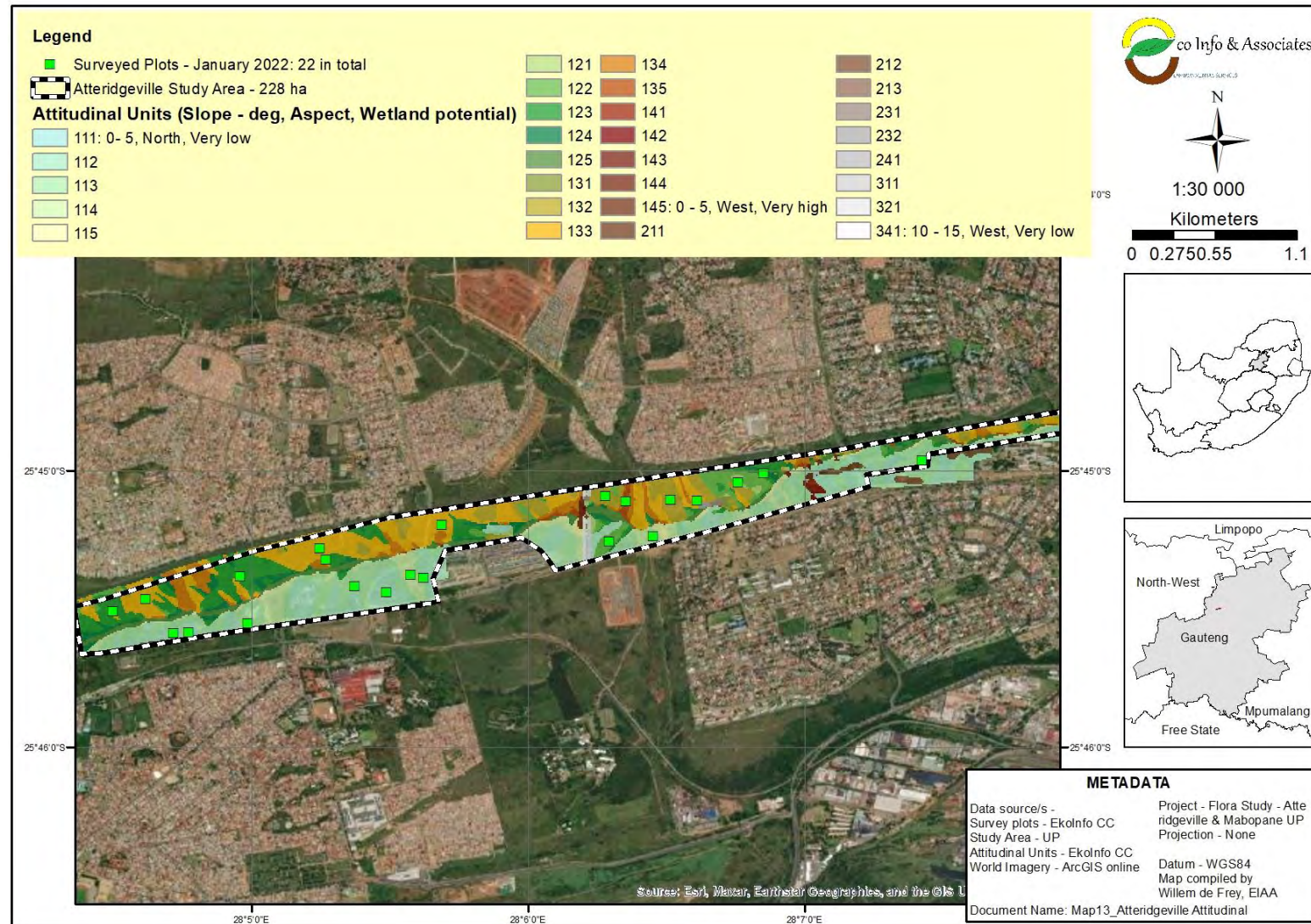


Figure 13: Attitudinal units associated with the Atteridgeville study area

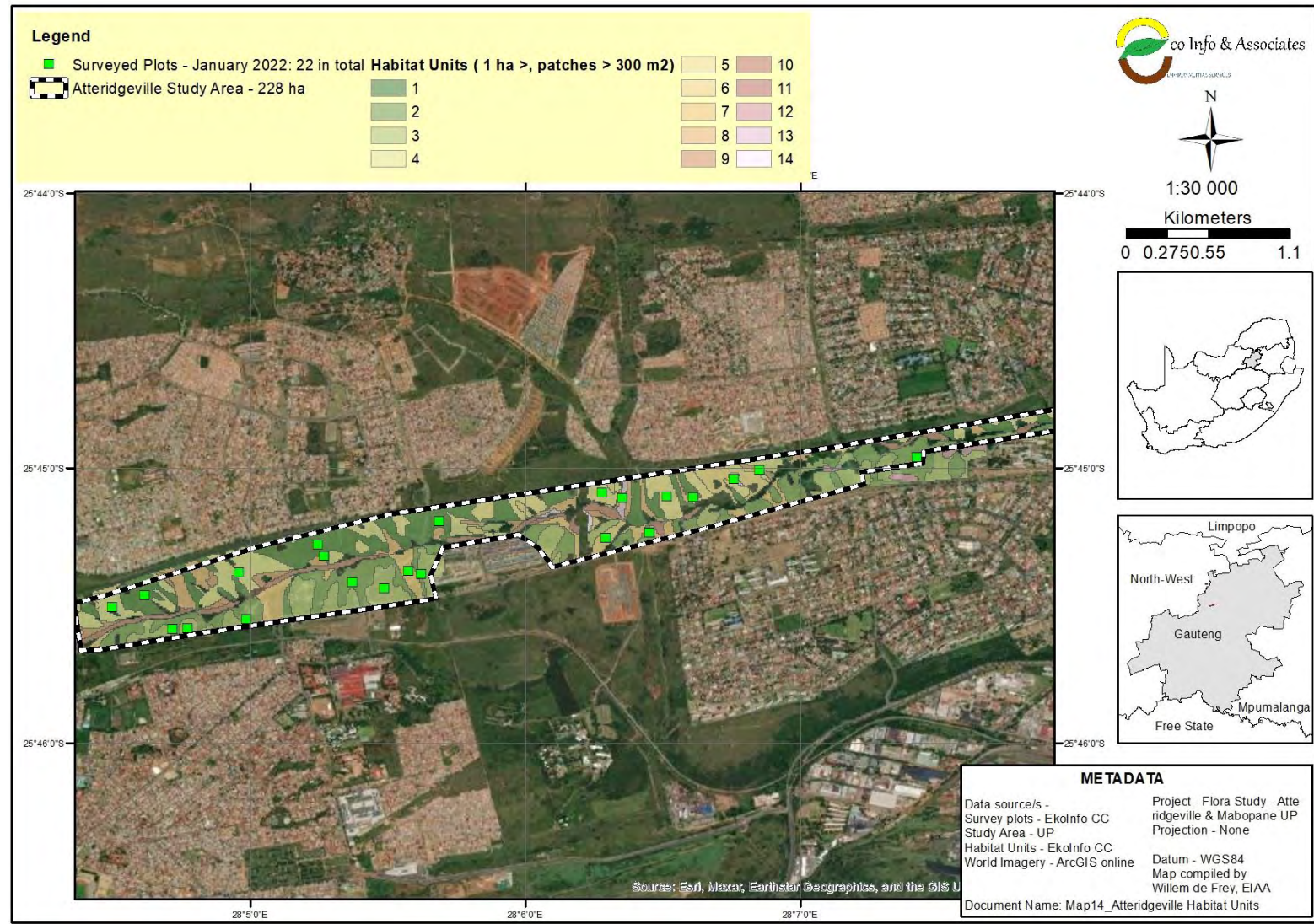


Figure 14: Distribution and extent of the 14 habitat units exceeding 1 ha in size, and consisting of patches of more than 300 m² in size

Table 4: Targeted samples based on the 14 habitat units exceeding 1 ha in size

Attitudinal Unit	Hectares	Attitudinal Unit – Attribute No			Attitudinal Unit - Description			% cover	Cum % Cover	Habitat Unit	Targeted Sample Count
		Slope	Aspect	Wetland Probability	Slope	Aspect	Terrain				
133	45.4279306	1	3	3	0 - 5 deg	South	Midslope - Lower	17%	17%	1	4
113	45.3178872	1	1	3	0 - 5 deg	North	Midslope - Lower	17%	34%	2	4
112	38.9453719	1	1	2	0 - 5 deg	North	Midslope - Upper	15%	49%	3	4
123	29.581676	1	2	3	0 - 5 deg	East	Midslope - Lower	11%	60%	4	3
132	22.0086869	1	3	2	0 - 5 deg	South	Midslope - Upper	8%	68%	5	2
122	17.3368429	1	2	2	0 - 5 deg	East	Midslope - Upper	7%	75%	6	2
114	13.2452279	1	1	4	0 - 5 deg	North	Footslope	5%	80%	7	2
134	12.3948923	1	3	4	0 - 5 deg	South	Footslope	5%	84%	8	1
124	12.3748844	1	2	4	0 - 5 deg	East	Footslope	5%	89%	9	1
125	12.1447936	1	2	5	0 - 5 deg	East	Valley bottom	5%	93%	10	1
115	4.1016189	1	1	5	0 - 5 deg	North	Valley bottom	2%	95%	11	1
212	2.6710543	2	1	2	5 - 10 deg	North	Midslope - Upper	1%	96%	12	1
135	2.4809793	1	3	5	0 - 5 deg	South	Valley bottom	1%	97%	13	1
121	1.6706594	1	2	1	0 - 5 deg	East	Crest	1%	98%	14	1
TOTALS											28



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

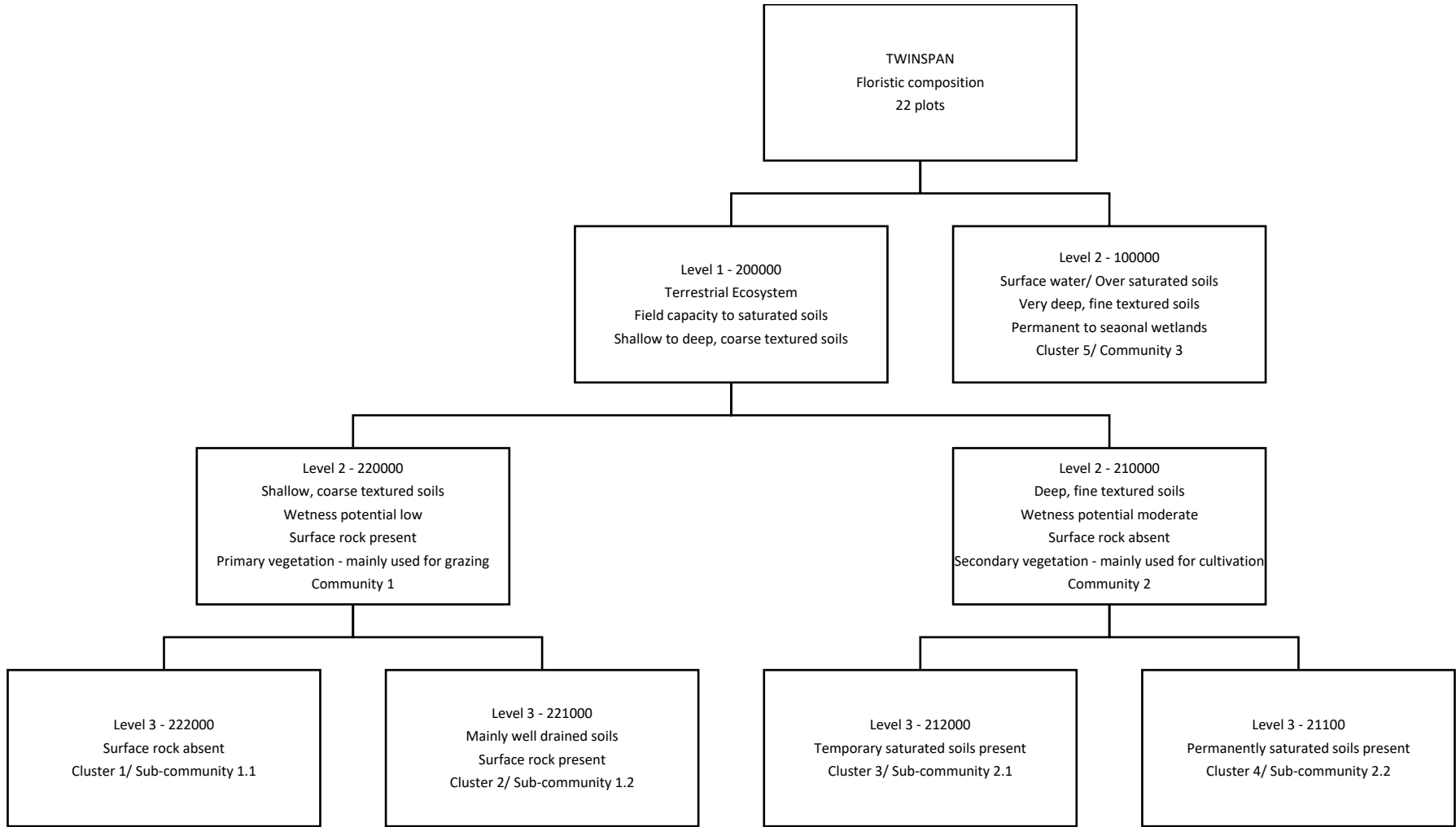


Figure 15: TWINSpan dendrogram based on floristic composition and environmental attributes

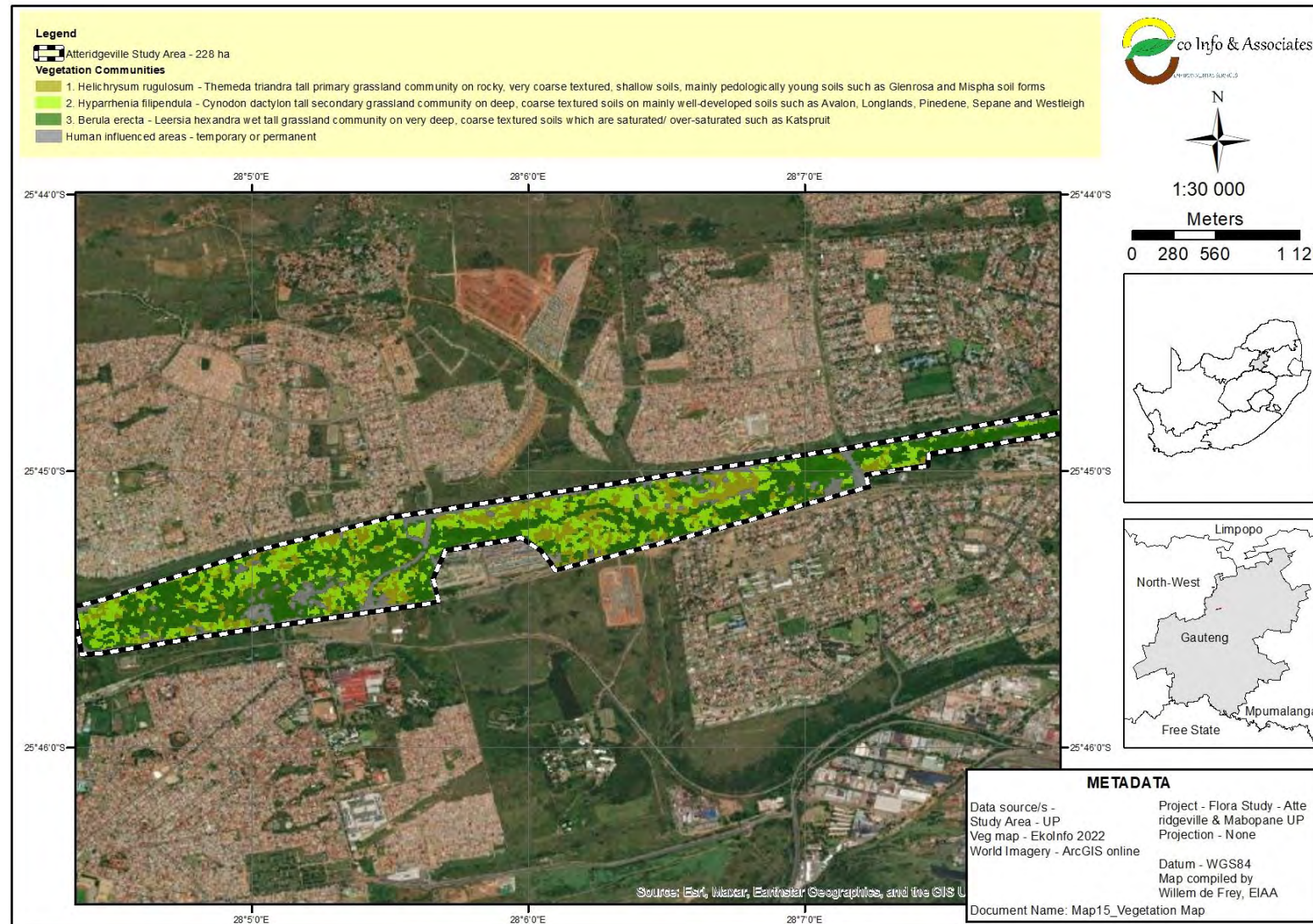


Figure 16: Vegetation map of the Atteridgeville study area based on the floristic survey completed in January 2022

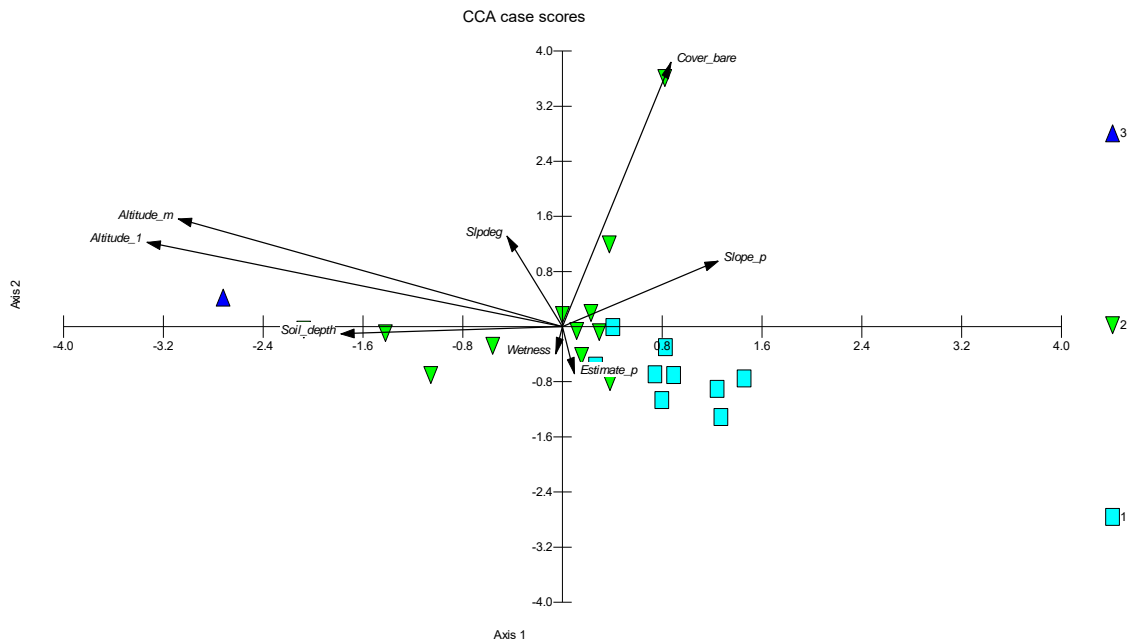


Figure 17: Canonical correspondence analysis based on all the quantitative abiotic factors

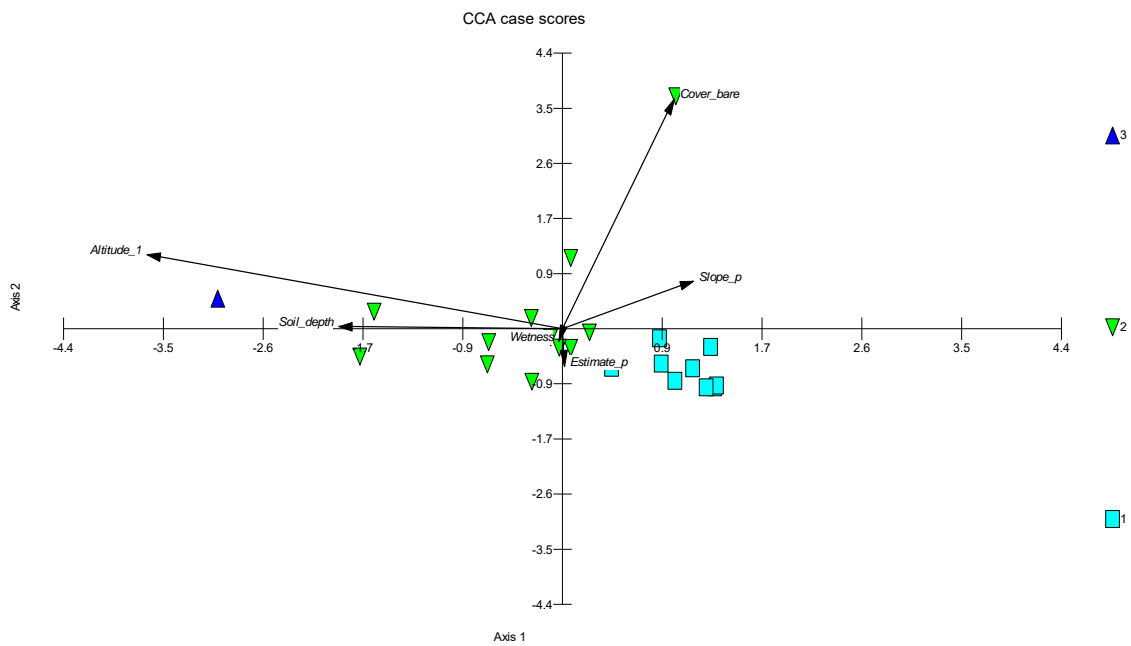
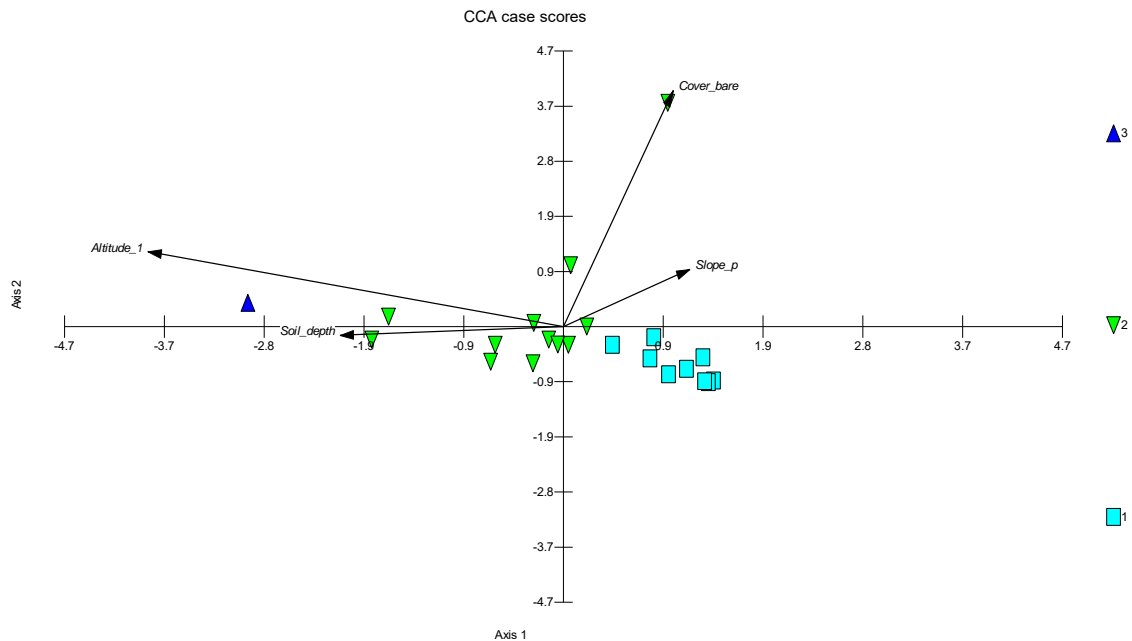


Figure 18: Canonical correspondence analysis with duplicate environmental factors removed



Legend

1 = Community 1

2 = Community 2

3 = Community 3

Altitude_1 = GPS recorded altitude measurements

Cover_bare = Estimated percentage surface rocks

Soil_depth = measured soil depth

Slope_P = estimated percentage slope

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

- Soil depth
- Percentage slope

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: *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispah soil forms

Community one is located at a mean altitude of between 1 348 m and 1354 m (Table 5), mainly associated with crests and midslopes (Table 6). The community is slightly steeper than the adjacent communities, with a mean value of 2.1° (Mode – 2.5°) (Table 7). Surface rock is present at an estimated mean value of 2% (Table 5), the soils are shallow at a mean measured value of 422 mm, with an estimated mean percentage of clay in the A-horizon of 9%. These soils are representative of pedological young soils, namely the Glenrosa and Mispah soil forms (Table 8). This community has the lowest overall vegetation cover of all three of the vegetation communities at a mean estimated value of 80% (Table 9). The mean woody cover (estimated tree and shrub cover) is less than 10%, therefore the community represents grassland (Photo plate 3). The estimated herbaceous cover is the lowest of the three communities at 64% (Table 9), and the forb cover is the lowest at 10%. Community one has the second highest estimated mean herb height at 48 cm, and the highest mean high herb height at 142 cm. Therefore, the grass community is classified as tall. The extent of this community is 36 ha or 16% of the study area (Table 10).

This community is represented by 120 plant species, consisting of the following species within the three major growth forms:

Forbs: *Acalypha angustata*, *Aloe greatheadii* var. *davyana*, *Amaranthus hybridus* subsp. *hybridus*, *Anthericum cooperi*, *Anthericum trichophlebium*, *Anthospermum rigidum* subsp. *rigidum*, *Asclepias fruticosa*, *Becium obovatum* subsp. *obovatum*, *Berkheya radula*, *Bidens pilosa*, *Campuloclinium macrocephalum*, *Chaetacanthus costatus*, *Chamaecrista comosa* var. *comosa*, *Chamaecrista mimosoides*, *Conyza bonariensis*, *Conyza podocephala*, *Crotalaria species (122_2357)*, *Crotalaria agatiflora* subsp. *agatiflora*, *Eriosema cordatum*, *Eriosema salignum*, *Euphorbia heterophylla*, *Felicia muricata* subsp. *muricata*, *Gazania krebsiana* subsp. *krebsiana*, *Gladiolus pretoriensis*, *Hebenstretia angolensis*, *Helichrysum nudifolium* var. *nudifolium*, *Helichrysum rugulosum*, *Hermannia depressa*, *Hermannia grandistipula*, *Hibiscus trionum*, *Hypoxis argentea* var. *argentea*, *Hypoxis hemerocallidea*, *Hypoxis iridifolia*, *Hypoxis rigidula* var. *rigidula*, *Indigofera adenoides*, *Indigofera heterotricha*, *Ipomoea bathycolpos*, *Ipomoea obscura* var. *obscura*, *Ipomoea purpurea*, *Justicia anagalloides*, *Kohautia virgata*, *Lactuca inermis*, *Lantana rugosa*, *Ledebouria cooperi*, *Melilotus albus*, *Mirabilis jalapa*, *Nidorella anomala*, *Pentarrhinum insipidum*, *Pentas angustifolia*, *Physalis viscosa*, *Polygala hottentotta*, *Pseudognaphalium luteo-album*, *Raphionacme hirsuta*, *Rubia horrida*, *Scabiosa columbaria*, *Schkuhria pinnata*, *Senecio glanduloso-lanosus*, *Senecio venosus*, *Sida rhombifolia* subsp. *rhombifolia*, *Solanum panduriforme*, *Sonchus wilmsii*, *Sphenostylis angustifolia*, *Tagetes minuta*, *Tephrosia capensis* var. *capensis*, *Teucrium trifidum*, *Thesium utile*

Table 5: Overview of the quantitative abiotic factors associated with the Atteridgeville vegetation communities

Community No	1	2	3
No of plots	9	12	1
Mean value - Altitude (m): GPS receiver	1354	1363	1368
Mean value – Altitude (m): 5m Digital Terrain Model	1348	1359	1360
Mean value - Slope (%): Estimated during survey	2	2	1
Mean value – Slope (°): 5m Digital Terrain Model	2	2	1
Mean value – Wetness Index (Order of magnitude): 5 m DTM	9	10	11
Mean value - % Clay (A-horizon): Estimated during survey	9	12	12
Mean value – Soil depth (mm): Measured during survey	422	975	1200
Mean value - Cover bare rock (%): Estimated during survey	2	0	0

Table 6: Overview of the terrain units associated with the Atteridgeville vegetation communities

Estimated Terrain Units	Community no			Grand Total
	1	2	3	
Crest	11%	0%	0%	5%
Midslope	67%	42%	0%	50%
Footslope	22%	58%	0%	41%
Valley bottom	0%	0%	100%	5%
Grand Total	100%	100%	100%	100%
Wetness Index Derived Terrain Units	1	2	3	Grand Total
Crest - No or very low	11%	0%	0%	5%
Midslope - Upper: Low	44%	17%	0%	27%
Midslope - Lower: Moderate	44%	58%	100%	55%
Footslope - High	0%	17%	0%	9%
Valley bottom - Very high	0%	8%	0%	5%
Grand Total	100%	100%	100%	100%

Table 7: Overview of extracted slope in degrees per Atteridgeville vegetation community

Community no	Extracted Slope Values (°)			
	Minimum	Mean	Maximum	Mode
1	0.1	2.1	14.6	2.5
2	0.1	1.8	14.5	1.3
3	0.0	1.6	15.4	1.3

Table 8: Overview of the soil forms associated with the Atteridgeville vegetation communities

Soil forms recorded	Community no			Grand Total
	1	2	3	
Avalon	11%	17%	0%	14%
Glenrosa	22%	17%	0%	18%
Katspruit	0%	0%	100%	5%
Longlands	0%	8%	0%	5%
Mispah	44%	0%	0%	18%
Pinedene	0%	8%	0%	5%
Rensburg	0%	17%	0%	9%
Sepane	11%	8%	0%	9%
Westleigh	11%	25%	0%	18%
Grand Total	100%	100%	100%	100%
<i>Young soils</i>	67%	17%	0%	
Well developed/ mature soils	33%	67%	0%	
Waterlogged soils	0%	17%	100%	
Grand Total	100%	100%	100%	

Table 9: Overview of the estimated vegetation characteristic per vegetation community within the Atteridgeville study area

Community no	1	2	3
No of plots	9	12	1
Mean estimated values			
Cover total (%)	80	81	95
Cover tree layer (%)	6	3	0
Cover shrub layer (%)	10	10	0
Cover herb layer (%)	64	68	95
Cover grass layer (%)	54	48	65
Cover forbs layer (%)	10	20	30
Height (highest) trees (m)	5	4	0
Height lowest trees (m)	2	1	0
Height (highest) shrubs (m)	1	1	0
Height lowest shrubs (m)	1	1	0
Height (high) herbs (cm)	48	35	50
Height lowest herbs (cm)	18	25	25
Maximum height herbs (cm)	142	121	100



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Photo plate 3: Georeferenced digital images of community one: *Helichrysum rugulosum* - *Themeda triandra* tall primary grassland community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispaha soil forms (Photo direction – North, East, South, West & Soil Profile)

Table 10: Overview of the surface area and percentage extent of the main vegetation communities within the Atteridgeville study area

Atteridgeville main vegetation communities	Surface (ha)	% cover
1. <i>Helichrysum rugulosum</i> - <i>Themeda triandra</i> tall primary grassland community on rocky, very coarse textured, shallow soils, mainly pedologically young soils such as Glenrosa and Mispha soil forms	36	16%
2. <i>Hyparrhenia filipendula</i> - <i>Cynodon dactylon</i> tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh	55	25%
3. <i>Berula erecta</i> - <i>Leersia hexandra</i> wet tall grassland community on very deep, coarse textured soils which are saturated/ over-saturated such as Katspruit	93	42%
Human influenced areas - temporary or permanent	37	17%
Grand Total	221	100%

Tithonia rotundifolia, *Tulbaghia acutiloba*, *Verbena brasiliensis*, *Verbena tenuisecta*, *Vernonia oligocephala*, *Vigna vexillata* var. *vexillata*, *Wahlenbergia undulata*, *Xysmalobium undulatum* var. *undulatum*, *Zinnia peruviana*

Graminoids (Grasses and sedges): *Aristida congesta* subsp. *barbicollis*, *Bothriochloa insculpta*, *Cymbopogon excavatus*, *Cynodon dactylon*, *Cyperus rupestris* var. *rupestris*, *Digitaria tricholaenoides*, *Eragrostis curvula*, *Eragrostis gummiflua*, *Eragrostis racemosa*, *Eragrostis superba*, *Heteropogon contortus*, *Hyparrhenia filipendula* var. *filipendula*, *Hyparrhenia hirta*, *Melinis repens* subsp. *repens*, *Microchloa caffra*, *Panicum maximum*, *Paspalum scrobiculatum*, *Pennisetum setaceum*, *Schizachyrium sanguineum*, *Setaria sphacelata* var. *sphacelata*, *Themeda triandra*, *Trichoneura grandiglumis*, *Urochloa mosambicensis*

Woody species (Trees and shrubs): *Acacia*⁴ *karroo*, *Yucca glorisa*, *Carpinus betulus*, *Celtis africana*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida* subsp. *rigida*, *Elephantorrhiza elephantina*, *Eucalyptus* species (119_2320), *Tipuana tipu*, *Gymnosporia heterophylla*, *Jacaranda mimosifolia*, *Melia azedarach*, *Morus alba* var. *alba*, *Pinus radiata*, *Protasparagus cooperi*, *Protasparagus laricinus*, *Rhus lancea*, *Rhus leptodictya*, *Rhus pyroides* var. *pyroides*, *Tecoma stans* var. *stans*, *Ziziphus mucronata* subsp. *mucronata*, *Ziziphus zeyheriana*

This community represent most probably remnants of the primary vegetation that occurred in the landscape prior to human influences such as cultivation and forestry (Figure 9). It was not used for cultivation because of the presence of surface rock. The presence and dominance of climax grass species such as *Themeda triandra*, *Eragrostis superba*, *Digitaria tricholaenoides* and *Schizachyrium sanguineum* (Van Oudtshoorn 1991). The presence of geophytes (bulbs) from the genera *Gladiolus* and *Hypoxis* provides further evidence that this community had not been historically transformed as bulbs struggle to re-colonise areas once removed. Community one is the community with the lowest potential for water to accumulate at a mean value of 9 (Table 5), and therefore present the transition from terrestrial ecosystem higher up in the landscape to the aquatic or wetland system lower in the landscape. The presence of the following species indicates past over utilisation by livestock: *Aristida congesta*, *Heteropogon contortus* (Van Oudtshoorn 1991), *Helichrysum nudifolium* and *Ziziphus zeyheriana* (Van Wyk & Malan 1988).

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): *Amaranthus hybridus* subsp. *hybridus*, *Cyperus rupestris* var. *rupestris*, *Digitaria tricholaenoides*, *Ehretia rigida* subsp. *rigida*, *Helichrysum nudifolium* var. *nudifolium*, *Hypoxis argentea* var. *argentea*, *Hypoxis rigidula* var. *rigidula*, *Indigofera heterotricha*, *Ipomoea purpurea*, *Paspalum scrobiculatum*, *Rubia horrida*, *Schkuhria pinnata*, *Tecoma stans* var. *stans*, *Teucrium trifidum*. The following species are absent from sub-community 1.2 and are diagnostic of sub-community 1.2 (Appendix A – Species Group C): *Anthericum cooperi*, *Cymbopogon excavatus*, *Justicia anagalloides*, *Ledebouria cooperi*, *Verbena tenuisecta*, *Anthericum trichophlebium*,

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.

Chaetacanthus costatus, *Tipuana tipu*, *Scabiosa columbaria*, *Vernonia oligocephala*, *Ziziphus zeyheriana*. Sub-community 1.1 contains more disturbance species than sub-community 1.2.

5.2.1.2 *Community 2: Hyparrhenia filipendula - Cynodon dactylon tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh*

Community two is located at a mean altitude of between 1 359 m and 1363 m (Table 5), mainly associated with midslopes and footslopes (Table 6). The community has a gentler slope than community one, but is slightly steeper than community three, with a mean value of 1.8° (Mode – 1.3°) (Table 7). This community has no surface rock (Table 5), the soils are deep at a mean measured value of 975 mm, with an estimated mean percentage of clay in the A-horizon of 12%. These soils are representative of well-developed/ mature soils, namely the Avalon, Longlands, Pinedene, Sepane and Westleigh soil forms (Table 8). This community has the second highest overall vegetation cover of all three of the vegetation communities at a mean estimated value of 81% (Table 9). The mean woody cover (estimated tree and shrub cover) remains less than 10%, therefore the community represents grassland (Photo plate 4). The estimated herbaceous cover is the second highest of the three communities at 68% (Table 9), and the forb cover is also the second lowest at 20%. Community two has the lowest estimated mean herb height at 35 cm, and the second highest mean high herb height at 121 cm. Therefore, community two is also classified as a tall grass community. The extent of this community is 55 ha or 25% of the study area (Table 10).

This community is represented by 109 plant species, consisting of the following species within the three major growth forms:

Forbs: *Agapanthus campanulatus* subsp. *campanulatus*, *Agrimonia procera*, *Arundo donax*, *Asclepias fruticosa*, *Berkheya radula*, *Bidens pilosa*, *Campuloclinium macrocephalum*, *Chamaecrista comosa* var. *comosa*, *Chamaecrista mimosoides*, *Cirsium vulgare*, *Clematis brachiata*, *Conyza bonariensis*, *Conyza podocephala*, *Dipcadi rigidifolium*, *Epilobium hirsutum*, *Euphorbia heterophylla*, *Felicia muricata* subsp. *muricata*, *Gladiolus crassifolius*, *Gomphrena celosioides*, *Helichrysum cooperi*, *Helichrysum nudifolium* var. *nudifolium*, *Hermannia depressa*, *Hibiscus aethiopicus* var. *aethiopicus*, *Hibiscus trionum*, *Indigofera* species (126_2353), *Indigofera adenoides*, *Indigofera comosa*, *Indigofera cryptantha* var. *cryptantha*, *Ipomoea purpurea*, *Justicia anagalloides*, *Lantana rugosa*, *Ledebouria ovatifolia*, *Melilotus albus*, *Mirabilis jalapa*, *Nidorella anomala*, *Nidorella hottentotica*, *Oenothera tetraptera*, *Pentarrhinum inspidum*, *Persicaria lapathifolia*, *Physalis viscosa*, *Plantago lanceolata*, *Polygala hottentotta*, *Pseudognaphalium luteo-album*, *Rumex crispus*, *Schkuhria pinnata*, *Scilla nervosa*, *Senecio glanduloso-lanosus*, *Senecio othonniflorus*, *Sida rhombifolia* subsp. *rhombifolia*, *Solanum elaeagnifolium*, *Solanum panduriforme*, *Solanum retroflexum*, *Sonchus wilmsii*, *Sphenostylis angustifolia*, *Tagetes minuta*, *Tithonia rotundifolia*, *Verbena brasiliensis*, *Verbena tenuisecta*, *Vernonia oligocephala*, *Vigna vexillata* var. *vexillata*, *Wahlenbergia undulata*, *Xanthium strumarium*, *Xysmalobium undulatum* var. *undulatum*, *Zinnia peruviana*

Graminoids (Grasses and sedges): *Aristida bipartita*, *aristida congesta* subsp. *barbicollis*, *Aristida congesta* subsp. *congesta*, *Cymbopogon excavatus*, *Cynodon dactylon*, *Cyperus eragrostis*, *Cyperus rupestris* var. *rupestris*, *Cyperus sexangularis*, *Digitaria eriantha*, *Eragrostis chloromelas*, *Eragrostis*



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DSC02802



DSC02803



DSC02804



DSC02805

Photo plate 4: Georeferenced digital images of community two: *Hyparrhenia filipendula* - *Cynodon dactylon* tall secondary grassland community on deep, coarse textured soils on mainly well-developed soils such as Avalon, Longlands, Pinedene, Sepane and Westleigh (Photo direction – North, East, South, West & Soil Profile)

curvula, *Eragrostis gummiflua*, *Heteropogon contortus*, *Hyparrhenia filipendula* var. *filipendula*, *Hyparrhenia hirta*, *Imperata cylindrica*, *Kyllinga alba*, *Leersia hexandra*, *Melinis repens* subsp. *repens*, *Miscanthus junceus*, *Panicum maximum*, *Paspalum urvillei*, *Pennisetum clandestinum*, *Setaria sphacelata* var. *sphacelata*, *Sorghum bicolor* subsp. *arundinaceum*, *Sporobolus africanus*, *Themeda triandra*, *Typha capensis*, *Urochloa mosambicensis*

Woody species (Trees and shrubs): *Acacia caffra*, *Acacia karroo*, *Celtis africana*, *Dichrostachys cinerea* subsp. *africana*, *Diospyros lycioides* subsp. *lycioides*, *Eucalyptus* species (119_2320), *Gymnosporia heterophylla*, *Lantana camara*, *Melia azedarach*, *Morus alba* var. *alba*, *Protasparagus cooperi*, *Protasparagus laricinus*, *Rhus lancea*, *Rhus leptodictya*, *Rhus pyroides* var. *pyroides*, *Solanum mauritianum*

Community two represents the temporary to seasonal zone of the wetland system located through the centre of the study area (Figure 6, Figure 7). The presence of the following plant species supports this statement: *Nidorella anomala*, *Persicaria lapathifolia*, *Rumex crispus*, *Wahlenbergia undulata* (Van Wyk & Malan 1988), *Cyperus sexangularis*, *Imperata cylindrica*, *Leersia hexandra*, *Miscanthus junceus* and *Typha capensis* (Van Oudtshoorn 1991). Further support for this observation is the presence of the following soils associated with temporary to seasonal wetlands (DWAF 2005): Avalon, Longlands, Pinedene, Sepane and Westleigh (Table 8). The wetness index as a magnitude of order also indicates that the probability for water to accumulate in this community is higher than for community one, at mean value of 10 (Table 5). Due to its position in the landscape further down the slope towards the valley floor, it also has a higher clay content (mean value – 12% A-horizon: Table 5), since finer minerals move down slope (White 1987) or further away from the channel during flooding (Read & Watson 1983, Strahler & Strahler 1987). The presence of plants associated with finer textured soils confirm this statement: *Berkheya radula* (Van Wyk & Malan 1988) and *Acacia caffra* (Van Wyk & Van Wyk 1997, Smit 2008).

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 F): *Sida rhombifolia* subsp. *rhombifolia*, *Hibiscus trionum*, *Oenothera tetraptera*. The following species are absent from sub-community 2.1 and are diagnostic of sub-community 2.2 (Appendix A – Species Group G): *Aristida bipartita*, *Eragrostis chloromelas*, *Polygala hottentotta*, *Agrimonia procera*, *Celtis africana*, *Clematis brachiata*, *Diospyros lycioides* subsp. *lycioides*, *Gladiolus crassifolius*, *Imperata cylindrica*, *Lantana camara*, *Pentarrhinum insipidum*, *Rhus leptodictya*, *Senecio glanduloso-lanosus*. Sub-community 2.2 represents the riparian fringe that develops along section of the drainage system (Photo plate 5). The woody fringe consists of the following woody species: *Celtis africana*, *Diospyros lycioides* subsp. *lycioides* and *Rhus leptodictya*. These patches of riparian fringe develop in areas along the drainage system, where there is sufficient soil moisture to sustain woody species to the extent that a closed canopy can develop (Barbour et al 1980, Strahler & Strahler 1987, Mucina & Rutherford 2006).

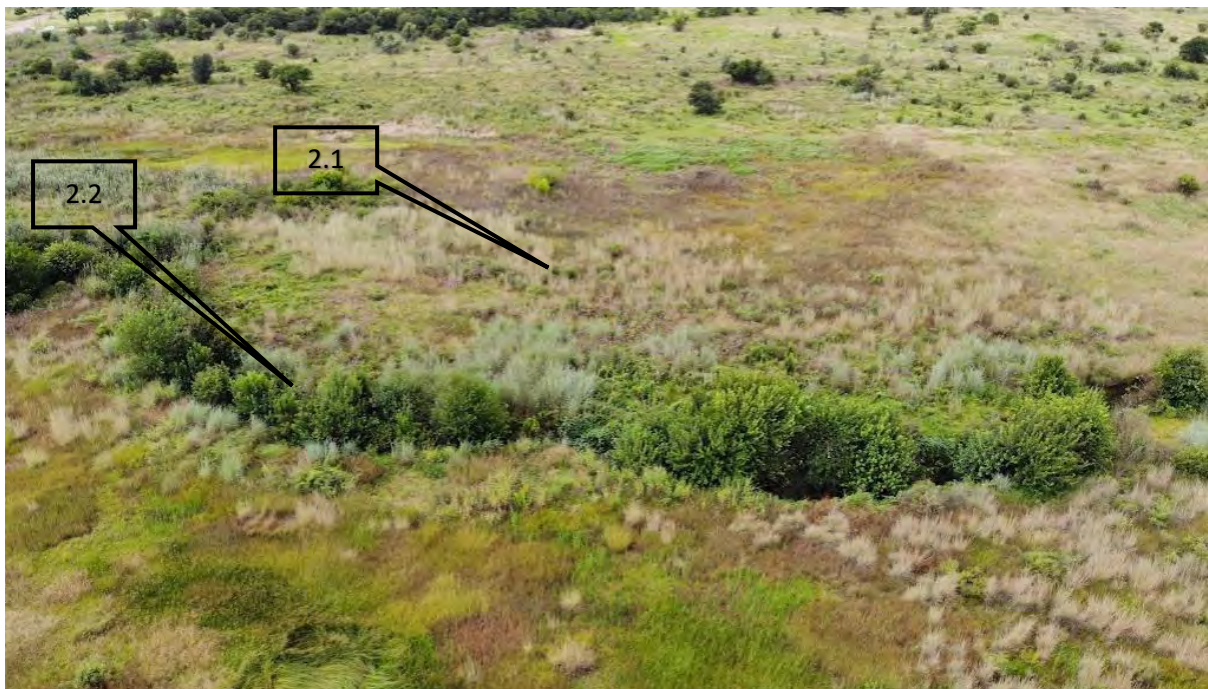


Photo plate 5: Oblique images indicating the position of sub-communities 2.1 and 2.2 within the Atteridgeville study area

5.2.1.3 Community 3: *Berula erecta* - *Leersia hexandra* wet tall grassland community on very deep, coarse textured soils which are saturated/ over-saturated such as Katspruit

Community three was recorded at 1 360 m (DTM extracted) or 1 368 m (GPS receiver) above mean sea level (Table 5), mainly associated with lower midslopes (Table 6). The community has a very gentle slope with a mean value of 1.6° (Mode – 1.3°) (Table 7). This community is similar to community two has no surface rock (Table 5), the soils are very deep at a measured value of 1200 mm, with 12% clay in the A-horizon. It is associated with waterlogged soils, namely Katspruit (Table 8) (Soil Classification Workgroup 1991). This community has the highest overall vegetation cover of all three of the vegetation communities at an estimated value of 95% (Table 9). There is no woody species in this community (Photo plate 5, Photo plate 6). The estimated herbaceous cover is the highest of the three communities at 95% (Table 9), and both the estimated forb and grass cover is the highest, at 65% and 30% respectively. Community three has the highest estimated herb height at 50 cm, and but the lowest estimated high herb height at 100 cm. Therefore, community three also qualify as a tall grass community. The extent of this community is 93 ha or 42% of the study area (Table 10).

This community is represented by 12 plant species, consisting of the following species within the three major growth forms:

Forbs: *Berula erecta* subsp. *erecta*, *Epilobium hirsutum*, *Melilotus albus*, *Mentha aquatica*, *Persicaria lapathifolia*, *Ranunculus multifidus*, *Rumex crispus*

Graminoids (Grasses and sedges): *Leersia hexandra*, *Miscanthus junceus*, *Phragmites australis*, *Schoenoplectus brachyceras*, *Typha capensis*

Community three is associated with the permanently wet areas within the study area along the channel/ streambed of the drainage line, the highest wetness value (11 - Table 5) 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 Katspruit soil form associated with this community consist of an orthic A horizon on a G-horizon (Soil Classification Workgroup 1991). The G-horizon occurs in areas in the landscape where the soil is permanently saturated for long periods of the year (Soil Classification Workgroup 1991, Fey 2010). The water available within this system has most probably increased due stormwater channels from the surrounding build-up landscape (Photo plate 7), resulting in deeper channels being present than would have occurred historically in this landscape.

It should be noted that *Acacia karroo* (Appendix A – Species Group F) occurs extensively throughout the study area (Photo plate 8), this is due to past and current human influences such as over grazing (Van Wyk & Van Wyk 1997). The presence of other plants associated with disturbance such as over utilisation, in species group F supports this statement: *Heteropogon contortus*, *Pseudognaphalium luteo-album*, *Xysmalobium undulatum* var. *undulatum*, *Zinnia peruviana* (Bromilow 2010, Van Oudtshoorn 1991).



DSC02797



DSC02798



DSC02799



DSC02800

Photo direction – North, East, South, West, No soil profile due to over saturated soil conditions

Photo plate 6: Georeferenced digital images of community three: Berula erecta - Leersia hexandra wet tall grassland community on very deep, coarse textured soils which are saturated/ over-saturated such as Katspruit



Photo plate 7: Examples of stormwater channels directing excess water to the Atteridgeville study area



Photo plate 8: Oblique remote image showing the frequent occurrence of Acacia karroo within the Atteridgeville study area

It is highly probable that woody species would have been restricted to the rocky areas associated with community one, and the riparian fringes of major drainage systems (sub-community 2.2) in the area prior to the arrival of excess human influences such as over grazing and fire control.

In essence, the study area represents predominantly wetland (Communities two and three) with patches of terrestrial vegetation (Community one).

5.2.2 Vegetation Diversity

5.2.2.1 Species richness

During the survey consisting of 22 plots, 169 plant species were recorded (Appendix A). From the species – area curve (Figure 20), it is evident this is representative of the species present within the study area as the curve started to level out.

The 169 plant species represent 47 plant families and 124 genera (Appendix B). Of the 169 plant species, 103 species are forbs (61%), 40 species are graminoids (grasses and sedges) (24%) and 26 species are woody species (trees and shrubs) (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*, *Gladiolus crassifolius* and *Gladiolus pretoriensis*. It should be noted that all species in these two genera are protected.

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

No national protected trees in terms of the National Forest Act had been recorded in the plots surveyed.

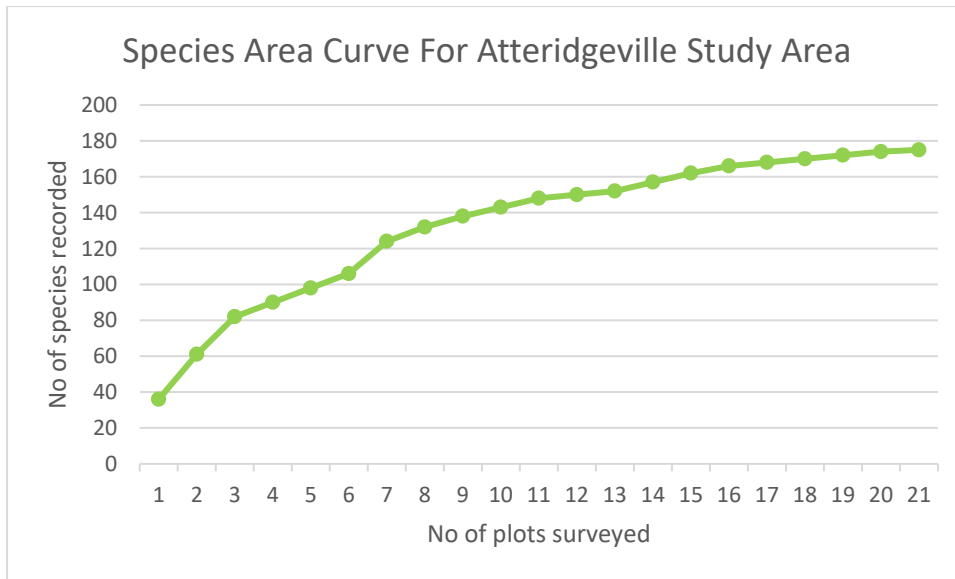


Figure 20: Species – area curve for the Atteridgeville study area

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

Major Growth Forms	No of species	% Frequency
Forbs	103	61%
Graminoids (grasses and sedges)	40	24%
Woody species (trees and shrubs)	26	15%
Grand Total	169	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: *Arundo donax*, *Campuloclinium macrocephalum*, *Cirsium vulgare*, *Ipomoea purpurea*, *Jacaranda mimosifolia*, *Lantana camara*, *Melia azedarach*, *Morus alba*, *Pennisetum setaceum*, *Pinus radiata*, *Solanum elaeagnifolium*, *Solanum mauritianum*, *Tecoma stans*, *Tithonia rotundifolia*, *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 9% 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, as well as the species *Tipuana tipu*. 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).

5.2.2.4 Plants With Medicinal Properties

Nine species with medicinal properties were recorded within the study area: *Acacia karroo*, *Berula erecta*, *Elephantorrhiza elephantina*, *Hypoxis hemerocallidea*, *Scabiosa columbaria*, *Typha capensis*, *Vernonia oligocephala*, *Xysmalobium undulatum* and *Ziziphus mucronate* (Van Wyk *et al.* 2000).

5.2.2.5 Plants Beneficial To Specific Fauna

Five species were recorded within the study area that presents habitat for butterflies, they are: *Acacia caffra*, *Acacia karroo*, *Celtis africana*, *Dichrostachys cinerea*, *Diospyros lycioides* and *Ziziphus mucronate* (Venter 2002).

Six species were recorded within the study area that presents habitat for birds, they are: *Acacia caffra*, *Acacia karroo*, *Celtis africana*, *Ehretia rigida*, *Typha capensis* and *Ziziphus mucronate* (Oberprieler & Cillie 2001)

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

Conservation of Agricultural Resources Act – Alien Invasive Categories	Community no		Grand Total
	1	2	
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.	4	7	11
Campuloclinium macrocephalum	1	1	2
Cirsium vulgare		1	1
Lantana camara		1	1
Pennisetum setaceum	1		1
Solanum elaeagnifolium		1	1
Solanum mauritianum		1	1
Tecoma stans	1		1
Tithonia rotundifolia	1	1	2
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
Pinus radiata	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.	4	4	8
Arundo donax		1	1
Ipomoea purpurea	1	1	2
Jacaranda mimosifolia	1		1
Melia azedarach	1	1	2
Morus alba	1	1	2
Grand Total	9	11	20

5.2.3 Vegetation Sensitivity

The area with the lowest vegetation sensitivity is the human influenced areas (Figure 21), 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 one, 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.

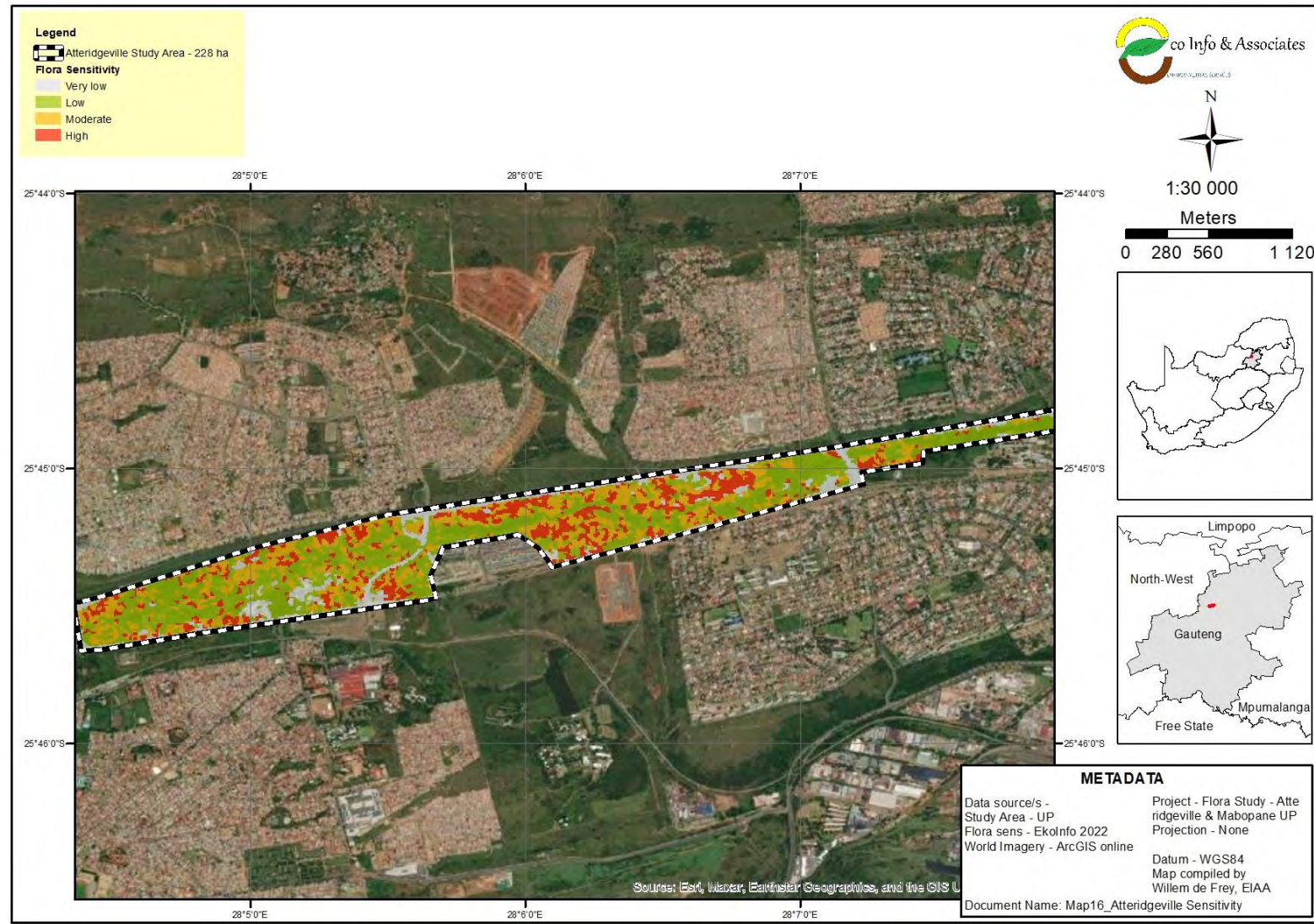


Figure 21: Flora sensitivity of the Atteridgeville study area

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% = 169) (A)	Surface Area (ha) - Natural	% Cover - Natural (B)	Beta - diversity index (B)	Flora Sensitivity
1	120	71%	36	20%	3.6	High
2	109	64%	55	30%	2.2	Moderate
3	12	7%	93	51%	0.1	Low

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7 APPENDIX A – BRAUN – BLANQUET TABLE: ATTERIDGEVILLE

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
TWINSpan02		22000		22000	22000	22000	22000	22000	22000	22000	22000		21000	21000	21000	21000	21000	21000	21000	21000	21000	21000		21000	21000		10000	
TWINSpan03		22200		22100	22100	22100	22100	22100	22100	22100	22100		21200	21200	21200	21200	21200	21200	21200	21200	21200	21200		21100	21100		10000	
TWINSpan04		22200		22120	22120	22120	22120	22110	22110	22110	22110		21220	21220	21220	21220	21220	21220	21220	21220	21210	21210		21100	21100		10000	
Table Number/ Plot number		15		10	4	19	6	20	22	18	17		13	3	2	7	1	5	21	9	14	11		16	12		8	
SPECIES GROUP A																												
Helichrysum rugulosum		+				+	+		+	+																		
Aloe greatheadii var. davyana		+		+		+	+																					
Elephantorrhiza elephantina		+							+	+	+																	
Ipomoea obscura var. obscura		+							+	+	+																	
SPECIES GROUP B																												
Amaranthus hybridus subsp. hybridus var. hybridus		+																										
Cyperus rupestris var. rupestris		+															+	+										
Digitaria tricholaenoides		+																										
ehretia rigida subsp. Rigida		+				r																						
Helichrysum nudifolium var. nudifolium		+							+	+										+								
Hypoxis argentea var. argentea		+																										
Hypoxis rigidula var. rigidula		+								+																		
Indigofera heterotricha		+				+			+																			
Ipomoea purpurea		+			+								+	1														
Paspalum scrobiculatum		+																										
Rubia horrida		+								+																		
Schkuhria pinnata		+		+									+	+	+													
Tecoma stans var. stans		+																										
Teucrium trifidum		+																										
SPECIES GROUP C																												
Anthericum cooperi				+	+	+	+	+	+																			
Cymbopogon excavatus				1	+	+		+	+	1				+														
Justicia anagalloides					+	+	+	+		+										+								
Ledebouria cooperi				+	+	+	+	+				+																
Verbena tenuisecta				+	+		+	+	+						+	+	+											
Anthericum trichophlebium						+	r	+																				
Chaetacanthus costatus					+	+	2																					
Tipuana tipu					+	+			+																			
Scabiosa columbaria					+		+			+																		

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
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Vernonia oligocephala							+	1	+										+	+								
Ziziphus zeyheriana				+			+		+	+																		
SPECIES GROUP D																												
Hyparrhenia filipendula var. filipendula									+		1				1	+	+	+							1	+		1
Paspalum urvillei													+	1			+											+
Berkheya radula								+			+			+						1	+	1				+	+	
Chamaecrista comosa var. comosa									+								+	+	+	+								+
SPECIES GROUP E																												
Sida rhombifolia subsp. rhombifolia				+									+		+	+	+	+										+
Hibiscus trionum									+								+	+	+									+
Oenothera tetraptera															+		+		+	1								+
SPECIES GROUP F																												
Acacia karroo				1	2	r	+			3	3	2	2	3	3	r	2											1
Heteropogon contortus				1	1	+	+			1	1			+			+	+			+							+
Pseudognaphalium luteo-album				1	+					+	+					+	+			+	+	+						+
Xysmalobium undulatum var. undulatum								+	+		+					+				+	+							+
Zinnia peruviana							1			+	+		1			+				+	+							+
SPECIES GROUP G																												
Aristida bipartita																												+
Eragrostis chloromelas																												+
Polygala hottentotta								+	+							+												+
Agrimonia procera																												+
Celtis africana										+												r						1
Clematis brachiata																												+
Diospyros lycioides subsp. lycioides																												+
Gladiolus crassifolius																												2
Imperata cylindrica																												+
Lantana camara														+		+												+
Pentarrhinum insipidum							+									+												+
Rhus leptodictya					+																							+
Senecio glanduloso-lanosus									+		+									+	+							+
SPECIES GROUP H																												
Berula erecta subsp. erecta																												3
Epilobium hirsutum														+														+
Mentha aquatica																												4
Miscanthus junceus																												3

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
TWINSpan02		22000		22000	22000	22000	22000	22000	22000	22000	22000		21000	21000	21000	21000	21000	21000	21000	21000	21000	21000		21000	21000		10000	
TWINSpan03		22200		22100	22100	22100	22100	22100	22100	22100	22100		21200	21200	21200	21200	21200	21200	21200	21200	21200	21200		21100	21100		10000	
TWINSpan04		22200		22120	22120	22120	22120	22110	22110	22110	22110		21220	21220	21220	21220	21220	21220	21220	21220	21210	21210		21100	21100		10000	
Table Number/ Plot number		15		10	4	19	6	20	22	18	17		13	3	2	7	1	5	21	9	14	11		16	12		8	
Persicaria lapathifolia																												
Phragmites australis																												
Ranunculus multifidus																												
Rumex crispus													r															
Schoenoplectus brachyceras																												
Typha capensis													r															
SPECIES GROUP I																												
Leersia hexandra																												
SPECIES GROUP J – GENERAL SPECIES																												
Hyparrhenia hirta		3		2	3	2	2	2	+	1	+		+	+														
Themeda triandra		+		2	1	3	2	2	2	3	1		+															
Tagetes minuta		+		+	+		+		+	+	+		2	+	+	+	+	2	+	1								
Aristida congesta subsp. barbicollis		+		+	+			+	+	+	+		+	+														
Melinis repens subsp. repens		+		1	+		+	+		1	+		2			2	2	2										
Setaria sphacelata var. sphacelata		1		+		+	+			+	+		+															
Campuloclinium macrocephalum		3		+	+			+	+	2			+	+	+	2	+	2	1	3	+	1						
Eragrostis curvula		3		1	+	+	+		+				+	+	4	+	4	1	2									
Physalis viscosa		+				+	+		+	+	+		+		+	+		+	+	+								
Protasparagus laricinus		+		+	+	+	+			+																		
Rhus pyroides var. pyroides		1			+	+			+		+		1															
Cynodon dactylon		+				+		+			+		2	1	3		3	4	+	1	2	1						
Panicum maximum		+		+			+				+		1	2					+									
Protasparagus cooperi		+			+	+					+																	
Vigna vexillata var. vexillata		+			+		+			+																		
Verbena brasiliensis		+		+	+								+		+		1		+	+	3							
Wahlenbergia undulata		+		+						+								+	+	+	+							
Eucalyptus species (119_2320)		3							r		+																	
Conyza bonariensis		+			+								+	+	+	+												
Euphorbia heterophylla		+							1				1		1		+		+									
Rhus lancea		+							+				+		r		+											
Sonchus wilmsii		+			+												+	+										
Gymnosporia heterophylla		+										+																
Nidorella anomala		+															+	1	+	+								
Urochloa mosambicensis		+											3	+		1			+									
Conyza podocephala				+	+			r		+	+		+						1	+	+							
Bidens pilosa					+				+		+		+	+	+													
Sphenostylis angustifolia							+			+	+				+	+												

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
TWINSpan02		22000		22000	22000	22000	22000	22000	22000	22000	22000		21000	21000	21000	21000	21000	21000	21000	21000	21000	21000		21000	21000		10000	
TWINSpan03		22200		22100	22100	22100	22100	22100	22100	22100	22100		21200	21200	21200	21200	21200	21200	21200	21200	21200	21200		21100	21100		10000	
TWINSpan04		22200		22120	22120	22120	22120	22110	22110	22110	22110		21220	21220	21220	21220	21220	21220	21220	21220	21210	21210		21100	21100		10000	
Table Number/ Plot number		15		10	4	19	6	20	22	18	17		13	3	2	7	1	5	21	9	14	11		16	12		8	
Felicia muricata subsp. muricata					+	+		+						+												+		
Lantana rugosa							+			+	+									+						+		
Melilotus albus										+						+			+		4	+		+			+	
SPECIES GROUP K – SPECIES WITH LOW FREQUENCY																												
Acacia caffra																					+							
Acalypha angustata							+			+																		
Agapanthus campanulatus subsp. campanulatus																					+							
Anthospermum rigidum subsp. rigidum					+			+																				
Aristida congesta subsp. congesta																3												
Arundo donax													r															
Asclepias fruticosa					+												+											
Yucca glorisa					+																							
Becium obovatum subsp. obovatum							+																					
Bothriochloa insculpta									+	+																		
Carpinus betulus										+	+																	
Chamaecrista mimosoides					+									+							+							
Cirsium vulgare																							+					
Crotalaria species (122_2357)										+																		
Crotalaria agatiflora subsp. agatiflora									+	2																		
Cyperus eragrostis														+														
Cyperus sexangularis														+							+							
Dichrostachys cinerea subsp. africana														3														
Digitaria eriantha															1		+	+										
Dipcadi rigidifolium															+							r						
Eragrostis gummiflua				+	+									+														
Eragrostis racemosa				+																								
Eragrostis superba							+																					
Eriosema cordatum										+																		
Eriosema salignum					+																							
Gazania krebsiana subsp. krebsiana							+																					
Gladiolus pretoriensis				1																								
Gomphrena celosioides																+		+										
Hebenstretia angolensis				+																								
Helichrysum cooperi																						+						
Hermannia depressa							+	+									+			+								
Hermannia grandistipula				r					+																			
Hibiscus aethiopicus var. aethiopicus																				+								

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

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
TWINSpan02		22000		22000	22000	22000	22000	22000	22000	22000	22000		21000	21000	21000	21000	21000	21000	21000	21000	21000	21000		21000	21000		10000	
TWINSpan03		22200		22100	22100	22100	22100	22100	22100	22100	22100		21200	21200	21200	21200	21200	21200	21200	21200	21200	21200		21100	21100		10000	
TWINSpan04		22200		22120	22120	22120	22120	22110	22110	22110	22110		21220	21220	21220	21220	21220	21220	21220	21220	21210	21210		21100	21100		10000	
Table Number/ Plot number		15		10	4	19	6	20	22	18	17		13	3	2	7	1	5	21	9	14	11		16	12		8	
Hypoxis hemerocallidea									r																			
Hypoxis iridifolia							r																					
Indigofera species (126_2353)																			+									
Indigofera adenoides								+	+										+									
Indigofera comosa													+							+								
Indigofera cryptantha var. cryptantha																		+										
Ipomoea bathycolpos					+		+																					
Jacaranda mimosifolia							r																					
Kohautia virgata				+																								
Kyllinga alba																					+							
Lactuca inermis					+																							
Ledebouria ovatifolia																			+									
Melia azedarach										+	1										+							
Microchloa caffra				+		+																						
Mirabilis jalapa											+			1														
Morus alba var. alba							+														+	+						
Nidorella hottentotica															+	+	+											
Pennisetum clandestinum													3															
Pennisetum setaceum							r																					
Pentas angustifolia					+																							
Pinus radiata					+		r																					
Plantago lanceolata															+		+					+						
Raphionacme hirsuta								+		+																		
Schizachyrium sanguineum				+																								
Scilla nervosa																	+											
Senecio othonniflorus																					1							
Senecio venosus						+			+																			
Solanum elaeagnifolium																	+											
Solanum mauritianum													+	+						+								
Solanum panduriforme								+					+	+														
Solanum retroflexum																	+											
Sorghum bicolor subsp. arundinaceum																+												
Sporobolus africanus														1														
Tephrosia capensis var. capensis										+																		
Thesium utile					+																							
Tithonia rotundifolia								+					1	+						+								
Trichoneura grandiglumis				+																								

Releve_seq	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cluster no		1		2	2	2	2	2	2	2	2		3	3	3	3	3	3	3	3	3	3		4	4		5	
TWINSpan01		20000		20000	20000	20000	20000	20000	20000	20000	20000		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000		20000	20000		10000	
TWINSpan02		22000		22000	22000	22000	22000	22000	22000	22000	22000		21000	21000	21000	21000	21000	21000	21000	21000	21000	21000		21000	21000		10000	
TWINSpan03		22200		22100	22100	22100	22100	22100	22100	22100	22100		21200	21200	21200	21200	21200	21200	21200	21200	21200	21200		21100	21100		10000	
TWINSpan04		22200		22120	22120	22120	22120	22110	22110	22110	22110		21220	21220	21220	21220	21220	21220	21220	21220	21210	21210		21100	21100		10000	
Table Number/ Plot number		15		10	4	19	6	20	22	18	17		13	3	2	7	1	5	21	9	14	11		16	12		8	
Tulbaghia acutiloba							+																					
Xanthium strumarium														+														
Ziziphus mucronata subsp. mucronata									+																			

8 APPENDIX B – ATTERIDGEVILLE PLANT LIST

FAMILY, Genus, Species

ACANTHACEAE

Chaetacanthus

Chaetacanthus costatus

Justicia

Justicia anagalloides

AGAPANTHACEAE

Agapanthus

Agapanthus campanulatus

ALLIACEAE

Tulbaghia

Tulbaghia acutiloba

AMARANTHACEAE

Amaranthus

Amaranthus hybridus

Gomphrena

Gomphrena celosioides

ANACARDIACEAE

Rhus

Rhus lancea

Rhus leptodictya

Rhus pyroides

ANTHERICACEAE

Anthericum

Anthericum cooperi

Anthericum trichophlebium

APIACEAE

Berula

Berula erecta

APOCYNACEAE

Asclepias

Asclepias fruticosa

Pentarrhinum

Pentarrhinum insipidum

Raphionacme

Raphionacme hirsuta

Xysmalobium

Xysmalobium undulatum

ASPARAGACEAE

Protasparagus

Protasparagus cooperi

FAMILY, Genus, Species

Protasparagus laricinus

Yucca

Yucca glorisa

ASPHODELACEAE**Aloe**

Aloe greatheadii

ASTERACEAE**Berkheya**

Berkheya radula

Bidens

Bidens pilosa

Campuloclinium

Campuloclinium macrocephalum

Cirsium

Cirsium vulgare

Conyza

Conyza bonariensis

Conyza podocephala

Felicia

Felicia muricata

Gazania

Gazania krebsiana

Helichrysum

Helichrysum cooperi

Helichrysum nudifolium

Helichrysum rugulosum

Lactuca

Lactuca inermis

Nidorella

Nidorella anomala

Nidorella hottentotica

Pseudognaphalium

Pseudognaphalium luteo-album

Schkuhria

Schkuhria pinnata

Senecio

Senecio glanduloso-lanosus

Senecio othonniflorus

Senecio venosus

Sonchus

Sonchus wilmsii

Tagetes

Tagetes minuta

Tithonia

Tithonia rotundifolia

FAMILY, Genus, Species

Vernonia

Vernonia oligocephala

Xanthium

Xanthium strumarium

Zinnia

Zinnia peruviana

BETULACEAE

Carpinus

Carpinus betulus

BIGNONIACEAE

Jacaranda

Jacaranda mimosifolia

Tecoma

Tecoma stans

BORAGINACEAE

ehretia

ehretia rigida

CAMPANULACEAE

Wahlenbergia

Wahlenbergia undulata

CELASTRACEAE

Gymnosporia

Gymnosporia heterophylla

CELTIDACEAE

Celtis

Celtis africana

CONVOLVULACEAE

Ipomoea

Ipomoea bathycolpos

Ipomoea obscura

Ipomoea purpurea

CYPERACEAE

Cyperus

Cyperus eragrostis

Cyperus rupestris

Cyperus sexangularis

Kyllinga

Kyllinga alba

Schoenoplectus

Schoenoplectus brachyceras

DIPSACACEAE

Scabiosa

Scabiosa columbaria

EBENACEAE

FAMILY, Genus, Species**Diospyros**

Diospyros lycioides

EUPHORBIACEAE**Acalypha**

Acalypha angustata

Euphorbia

Euphorbia heterophylla

FABACEAE**Acacia**

Acacia caffra

Acacia karroo

Chamaecrista

Chamaecrista comosa

Chamaecrista mimosoides

Crotalaria

Crotalaria 122_2357

Crotalaria agatiflora

Dichrostachys

Dichrostachys cinerea

Elephantorrhiza

Elephantorrhiza elephantina

Eriosema

Eriosema cordatum

Eriosema salignum

Indigofera

Indigofera 126_2353

Indigofera adenoides

Indigofera comosa

Indigofera cryptantha

Indigofera heterotricha

Melilotus

Melilotus albus

Sphenostylis

Sphenostylis angustifolia

Tephrosia

Tephrosia capensis

Tipuana

Tipuana tipu

Vigna

Vigna vexillata

HYACINTHACEAE**Dipcadi**

Dipcadi rigidifolium

Ledebouria

Ledebouria cooperi

FAMILY, Genus, Species

Ledebouria ovatifolia

Scilla

Scilla nervosa

HYPOXIDACEAE**Hypoxis**

Hypoxis argentea

Hypoxis hemerocallidea

Hypoxis iridifolia

Hypoxis rigidula

IRIDACEAE**Gladiolus**

Gladiolus crassifolius

Gladiolus pretoriensis

LAMIACEAE**Becium**

Becium obovatum

Mentha

Mentha aquatica

Teucrium

Teucrium trifidum

MALVACEAE**Hermannia**

Hermannia depressa

Hermannia grandistipula

Hibiscus

Hibiscus aethiopicus

Hibiscus trionum

sida

sida rhombifolia

MELIACEAE**Melia**

Melia azedarach

MORACEAE**Morus**

Morus alba

MYRTACEAE**Eucalyptus**

Eucalyptus 119_2320

NYCTAGINACEAE**Mirabilis**

Mirabilis jalapa

ONAGRACEAE**Epilobium**

Epilobium hirsutum

FAMILY, Genus, Species**Oenothera**

Oenothera tetraptera

PINACEAE**Pinus**

Pinus radiata

PLANTAGINACEAE**Plantago**

Plantago lanceolata

POACEAE**Aristida**

Aristida bipartita

Aristida congesta

Arundo

Arundo donax

Bothriochloa

Bothriochloa insculpta

Cymbopogon

Cymbopogon excavatus

Cynodon

Cynodon dactylon

Digitaria

Digitaria eriantha

Digitaria tricholaenoides

Eragrostis

Eragrostis chloromelas

Eragrostis curvula

Eragrostis gummiflua

Eragrostis racemosa

Eragrostis superba

Heteropogon

Heteropogon contortus

Hyparrhenia

Hyparrhenia filipendula

Hyparrhenia hirta

Imperata

Imperata cylindrica

Leersia

Leersia hexandra

Melinis

Melinis repens

Microchloa

Microchloa caffra

Miscanthus

Miscanthus junceus

Panicum

FAMILY, Genus, Species

Panicum maximum

Paspalum

Paspalum scrobiculatum

Paspalum urvillei

Pennisetum

Pennisetum clandestinum

Pennisetum setaceum

Phragmites

Phragmites australis

Schizachyrium

Schizachyrium sanguineum

Setaria

Setaria sphacelata

sorghum

sorghum bicolor

Sporobolus

Sporobolus africanus

Themeda

Themeda triandra

Trichoneura

Trichoneura grandiglumis

Urochloa

Urochloa mosambicensis

POLYGALACEAE**Polygala**

Polygala hottentotta

POLYGONACEAE**Persicaria**

Persicaria lapathifolia

Rumex

Rumex crispus

RANUNCULACEAE**Clematis**

Clematis brachiata

Ranunculus

Ranunculus multifidus

RHAMNACEAE**ziziphus**

ziziphus mucronata

Ziziphus zeyheriana

ROSACEAE**Agrimonia**

Agrimonia procera

RUBIACEAE**Anthospermum**

FAMILY, Genus, Species

Anthospermum rigidum

Kohautia

Kohautia virgata

Pentas

Pentas angustifolia

Rubia

Rubia horrida

SANTALACEAE

Thesium

Thesium utile

SCROPHULARIACEAE

Hebenstretia

Hebenstretia angolensis

SOLANACEAE

Physalis

Physalis viscosa

Solanum

Solanum elaeagnifolium

Solanum mauritianum

Solanum panduriforme

Solanum retroflexum

TYPHACEAE

Typha

Typha capensis

VERBENACEAE

Lantana

Lantana camara

Lantana rugosa

Verbena

Verbena brasiliensis

Verbena tenuisecta