

**AN ECOLOGICAL EVALUATION AND VEGETATION
ASSESSMENT ON PORTIONS 77, 169 AND RE 76 OF THE
FARM ZANDFONTEIN 317 JR, GAUTENG**

June 2018



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EXECUTIVE SUMMARY

Pachnoda Consulting CC was requested by Exigent Environmental to provide an ecological evaluation and vegetation assessment report on Portions 77, 169 and Re 76 of the Farm Zandfontein 317 JR, Gauteng. The floristic and faunal attributes of the study site was investigated on 18 April 2018.

The following key considerations were identified and noted:

- Five broad-scale habitat types were identified on the study site:
 - Untransformed *Themeda triandra* - *Cymbopogon caesius* grassland - **high** ecological sensitivity;
 - Secondary *Heteropogon contortus* - *Melinis repens* grassland - **medium** ecological sensitivity;
 - Secondary *Hyparrhenia hirta* - *Heteropogon contortus* grassland - **medium-low** ecological sensitivity;
 - Secondary *Hyparrhenia dregeana* grassland - **low** ecological sensitivity;
 - Degraded Moot Plains Bushveld - **low** ecological sensitivity.
- No threatened or near threatened plant species were observed, with one widespread provincially protected plant species (e.g. *Pellaea calomelanos*) observed from the degraded Moot plains Bushveld.
- Twenty-one (21) alien invasive alien plant taxa were observed on the study site, including noteworthy taxa such as *Campuloclinium macrocephalum*, *Melia azedarach*, *Lantana camara* and *Eucalyptus cf. camaldulensis*. The majority of these taxa were located on the degraded Moot plains Bushveld units.

Only 1.79 ha of the surface area on the study site was covered by untransformed grassland. These grassland units were fragmented and of small surface coverage (represented by two patches of ca. 0.03 ha and 1.5 ha), meaning that intensive, short-term crisis management procedures will be required to maintain the current ecological condition and integrity of the untransformed grassland units. Therefore, the long-term conservation value and preservation of these untransformed grassland units were regarded as questionable and probably not desirable.

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DECLARATION OF INDEPENDENCE

I, Lukas Niemand (Pachnoda Consulting CC) declare that:

- I act as the independent specialist in this application to Exigent Environmental or the applicant;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have no vested financial, personal or any other interest in the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; and
- All the particulars furnished by me in this form are true and correct.



Lukas Niemand (Pr.Sci.Nat)
24 June 2018

Lukas Niemand is registered with the South African Council for Natural Scientific Professionals (400095/06) with more than 15 years of experience in ecological-related assessments. He has conducted numerous ecological, botanical and avifaunal impact assessments including Eskom Transmission projects, hydro-electric schemes, mining related projects in South Africa and other African countries.

1. INTRODUCTION

1.1 Background

Pachnoda Consulting CC was requested by Exigent Environmental to provide an ecological evaluation and vegetation assessment report on Portions 77, 169 and Re 76 of the Farm Zandfontein 317 JR (herewith referred to as the 'study site'), Gauteng. The surface extent of the study site is approximately 90.2 ha.

1.2 Terms of Reference

The terms of reference are to:

- provide a description of *broad-scale habitat units* (based on floristic composition and structure) on the proposed study site, including the compilation of a preliminary species list of *observed* indigenous and naturalised plant species (to provide an indication of the floristic diversity) according to the latest taxonomic treatments;
- mapping of remaining areas of *untransformed* vegetation and *transformed* habitat units (c. land-cover types) and providing brief descriptions of the dominant and typical plant species identified within broad-scale habitat types;
- conduct a survey of *observed* and *expected* threatened, near-threatened plant species, including plant species of conservation concern (e.g. protected species) on the study site;
- provide an indication on the relative ecological importance and function of the habitat types and structures on the study site (to be incorporated into a sensitivity map); and
- provide recommendations regarding the proposed development, where ecologically viable.

2. BACKGROUND INFORMATION

2.1 Location

The study site is located west of the Andeon Agricultural Holdings on Portions 77, 169 and Re 76 of the Farm Zandfontein 317 JR, Gauteng. The site is located south of the corner between Kenneth Street and Hornsnek Road (M17) and north of the railway line that runs parallel to Van der Hoff Road (R514). The approximate centre position of the study site is S25° 42' 37.6" E28° 05' 13" while also corresponding to the quarter-degree grid (QDS) 2528CA (Figure 1).

2.2 Land use, existing infrastructure and important landscape features

Most of the study site is covered by secondary grassland dominated by *Heteropogon contortus* and *Hyparrhenia hirta* with scattered bush clumps containing both native and alien invasive tree and shrub species present. Existing infrastructure includes homesteads and houses which are located on the central and south-eastern parts of the study site (Figure 2). According to the 2013-2014 land cover dataset (Geoterraimage, 2015), the study site is dominated by open bush and urban/build-up land (Figure 3).

2.3 Biophysical Description

2.3.1 Climate

The climate is characterised by summer rainfall and dry winters. The mean annual rainfall is approximately 660 mm. The mean annual temperature is 15.6°C (Mucina and Rutherford, 2006). Frost is frequent in winter.

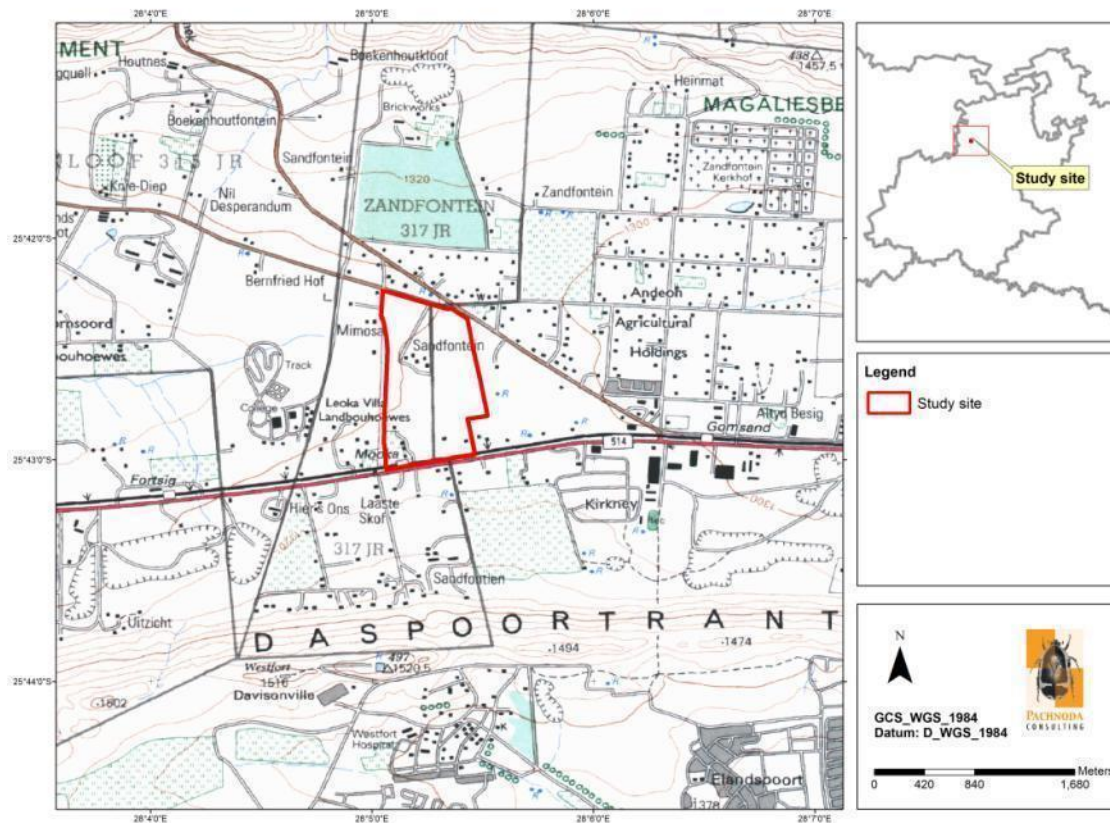


Figure 1: A topocadastral map illustrating the geographic position of the proposed study site.

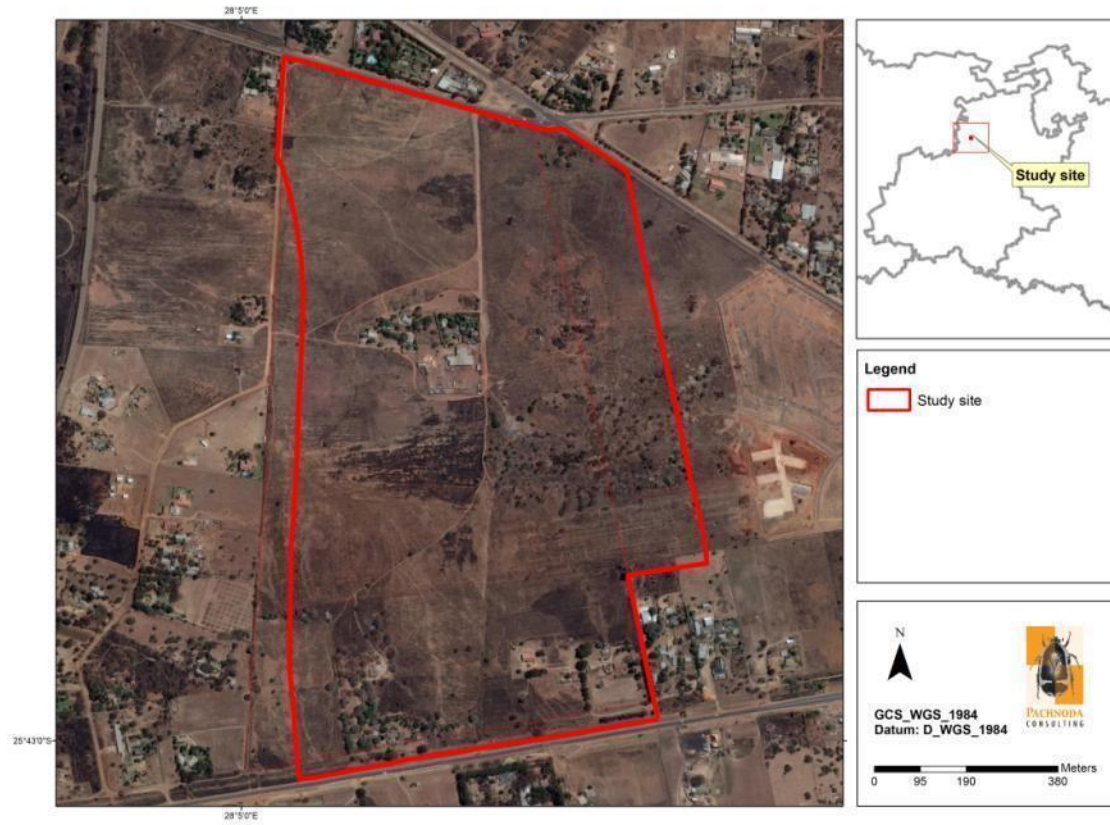


Figure 2: A satellite image illustrating the current land use and existing infrastructure on the study site.

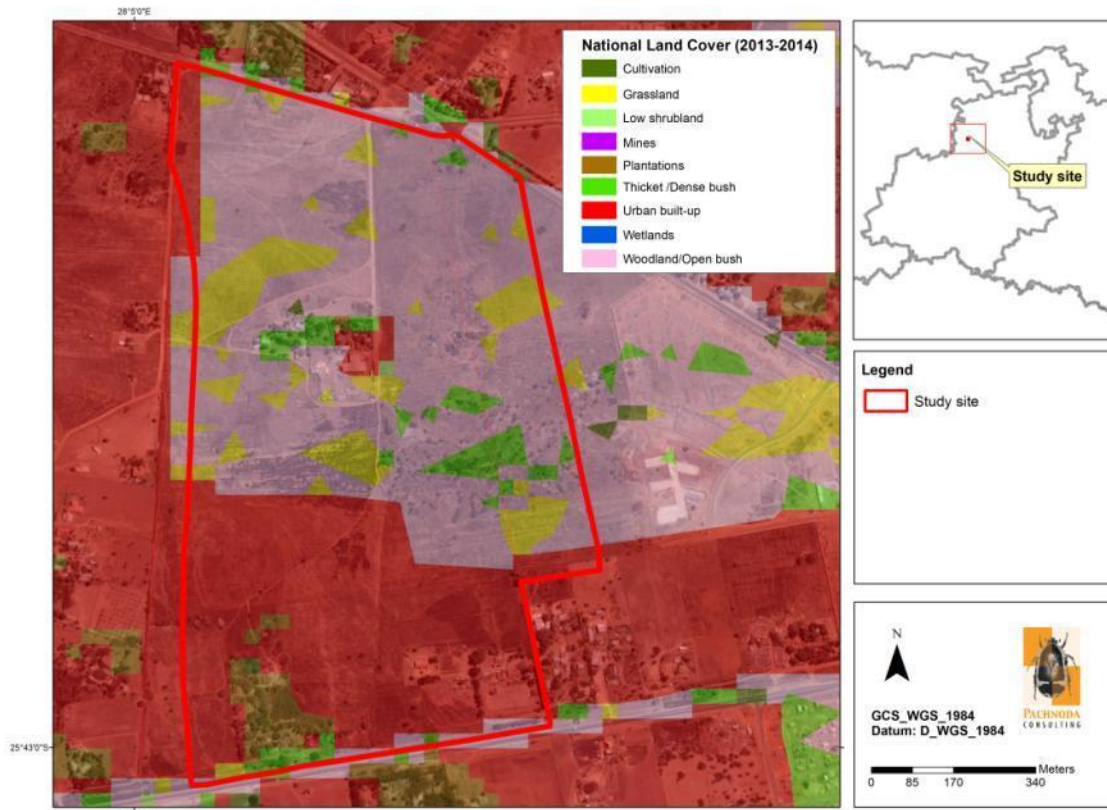


Figure 3: A map illustrating the national land cover classes (Geoterrimage, 2015) corresponding to the proposed study site.

2.3.2 Geology

The study site is underlain by shale of the Silverton Formation (Pretoria Group) which was deposited during the Vaalian Erathem.

2.3.3 Regional Vegetation Description & Threatened Ecosystems

The study site corresponds to the Savanna Biome and more particularly to the Central Bushveld Bioregion as defined by Mucina & Rutherford (2006). It comprehends an ecological type known as Moot Plain Bushveld (Mucina & Rutherford, 2006) (Figure 4). Moot Plain Bushveld is located in the North West and Gauteng Provinces where it occurs along an east-west belt immediately south of the Magaliesberg from the Selons River Valley in the west, proceeding eastwards where it occurs between the Magaliesberg and Daspoort Ridge mountain ranges north of Pretoria. It conforms to an open to closed microphyllous savanna dominated by various species pertaining to the genus *Vachellia* with mixed woodland on lower hillsides. The basal cover is dominated by grasses.

Moot Plains Bushveld is **Vulnerable** with approximately 13 % statutorily conserved within the Magaliesberg Nature Area. Approximately 28 % has been transformed by cultivation and urban development, and some areas are heavily invested by alien invader species such as *Melia azedarach*, *Lantana camara* and *Jacaranda mimosifolia*.

The study site does not appear to overlap with any threatened ecosystem as Section 52 of National Environmental Management Biodiversity Act, (Act No. 10 of 2004) (Figure 5).

Table 1 summarises a list of plant species characteristic of the Moot Plains Bushveld.

Table 1: A list of the characteristic plant species for each stratum (e.g. grass, forb & woody layer) representing Moot Plains Bushveld (Mucina & Rutherford, 2006).

Moot Plains Bushveld		
Grassy Layer	Forb Layer	Woody Layer
<i>Heteropogon contortus</i> , <i>Setaria sphacelata</i> , <i>Themeda triandra</i> , <i>Aristida congesta</i> , <i>Cynodon dactylon</i> , <i>Sporobolus nitens</i> , <i>Tragus racemosus</i>	Herbs: <i>Corchorus asplenifolius</i> , <i>Helichrysum nudifolium</i> , <i>Hermannia depressa</i> , <i>Osteospermum muricatum</i> , <i>Phyllanthus maderaspatensis</i> Herbaceous climber: <i>Lotononis bainsii</i>	Small trees: <i>Vachellia nilotica</i> , <i>V. tortilis</i> , <i>Searsia lancea</i> Tall shrubs: <i>Gymnosporia polyacantha</i> Low shrubs: <i>Lantana rugosa</i> , <i>Teucrium trifidum</i> Succulent shrub: <i>Kalanchoe paniculata</i>

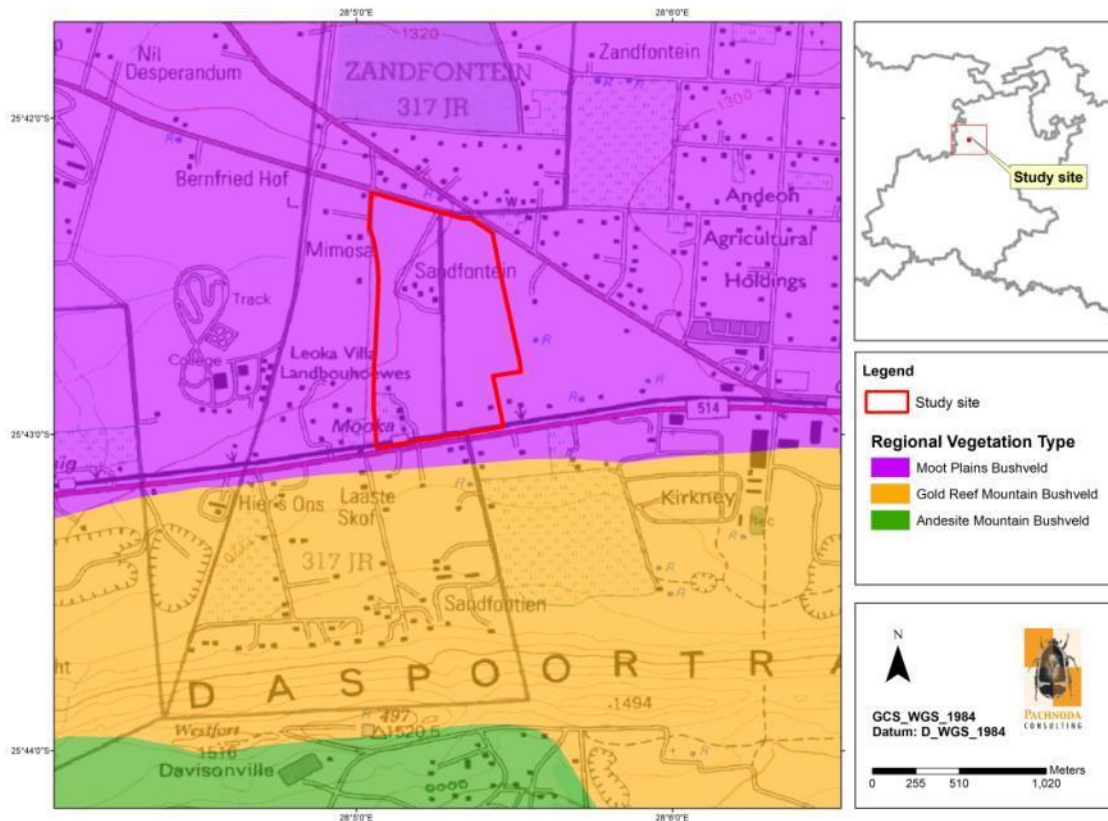


Figure 4: The spatial position of the proposed study site and the regional vegetation types as defined by Mucina & Rutherford (2006).

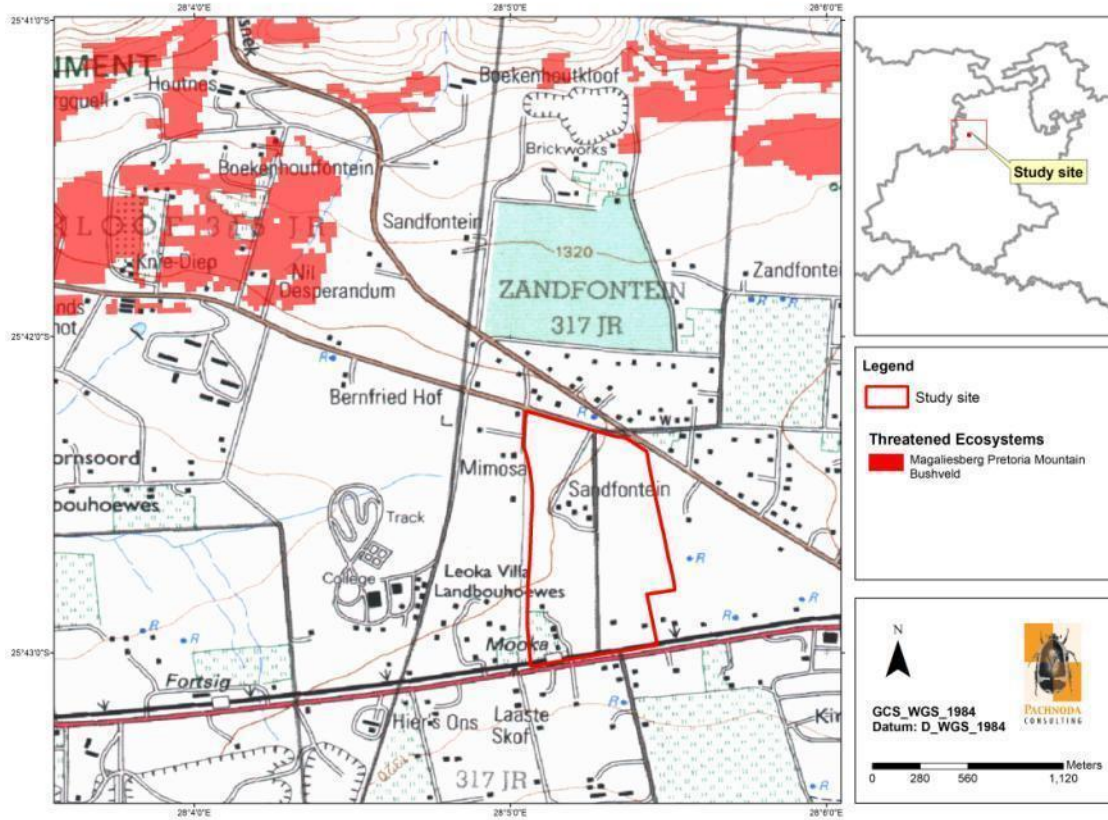


Figure 5: The spatial position of the proposed study site and the remaining extent of threatened ecosystems.

2.3.4 Gauteng Conservation Plan

The study site does not overlap with any critical or important biodiversity area or any ecological support area (Figure 6).

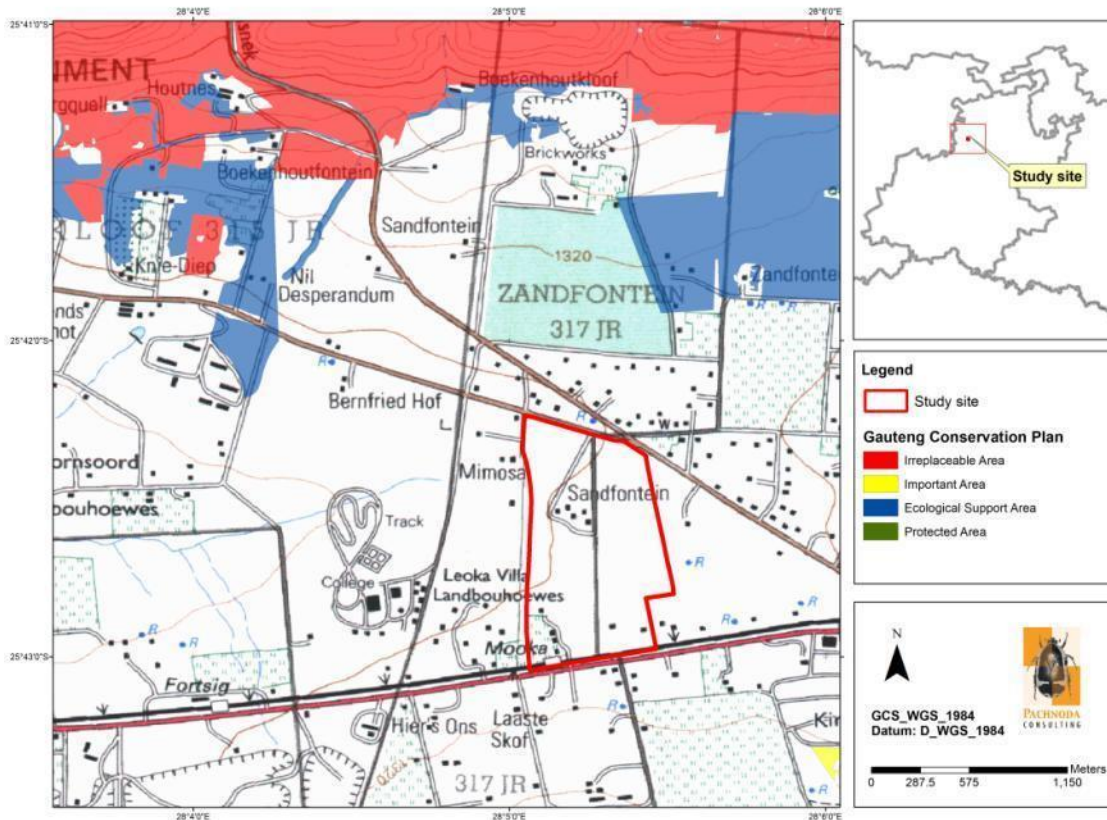


Figure 6: A map illustrating the Gauteng conservation plan for the study area.

3. METHODS AND APPROACH

The floristic attributes of the study site was investigated on 18 April 2018 with the objective to evaluate the structure, composition and conservation value of the prevalent broad-scale habitat units, which occurred historically on the study site prior to recent development activities. A total of eight hours were spent on the study site during the site visit.

3.1 Vegetation & Flora of Conservation Concern

3.1.1 Description and dominance estimation

- 1: 50 000 topographical maps and Google Earth and BirdsEye satellite imagery were used to subjectively stratify specific areas of uniform vegetation, structure and land cover (including highly localised and spatially restricted habitats). By using a stratified sampling approach, it is possible to obtain a more accurate species inventory and description of the vegetation, rather than using other site selection methods (e.g. random sampling).

- The dominant and typical floristic species were based on visual estimates of cover/abundance values. It entails the compilation of a list of plant taxa, whereby each taxon was assigned an abundance estimate based on its relative cover within a predefined quadrat of 100 m² (see Figure 7). The following abundance classes were used based on estimated canopy cover (after Kent & Coker, 1992):

<u>Value</u>	<u>Braun-Blanquet cover</u>
r	1-2 individuals
+	< 1%
1	1 – 5%
2a	6-12.5%
2b	12.6 – 25%
3	26 – 50 %
4	51 – 75%
5	76 – 100%

- To assist with the vegetation description and to determine the subtle gradients in the species composition, "floristic samples" were taken by modifying Braun-Blanquet cover abundance values (only on untransformed grassland). The following modified abundance values will be used for the "floristic samples" (adapted and modified from Kent and Coker, 1993):

<u>Abundance estimate</u>	<u>Relative cover (%)</u>
1	75-100
2	50-75
3	25-50
Common (c)	10-25
Uncommon (u)	<10

- In order to facilitate the search for plant taxa of conservation concern, a 'timed random search' method was used. The 'timed random search' method is a semi-quantitative survey procedure that focuses on the detection of rare vascular plant species or taxa occurring naturally at low densities (Goff *et al.*, 1982; Huebner, 2007). This method is highly effective and time efficient when describing the α -diversity of a particular area (Huebner, 2007).
- Where possible, all plant taxa were positively identified in the field. Plant names follow Germishuizen *et al.* (2006) with the relevant updates included in the Plants of South Arica web-based database (<http://posa.sanbi.org>).

3.1.2 Literature review and database acquisition

In addition, the following parameters were also documented to aid the vegetation survey:

- The occurrence of threatened taxa, including near threatened, declining and rare taxa was provided by Raimondo *et al.* (2009). Prior to the conduction of the field

survey, historical records of plant 'species of conservation concern' within the quarter degree grid corresponding to the study site (2528CA) was obtained from the National Herbarium's PRECIS database (<http://posa.sanbi.org>) including the new botanical database of southern Africa using the BRAHMS Online distributes Botanical Research and Herbarium Management Software (newposa.sanbi.org); and

- The prominence of declared weeds and invader species (as amended under Notice 3 during 29 July 2016 in the Government Gazette, No. 40166) as promulgated under the Alien and Invasive species regulations of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004 was included.
- An indication of the provincial and national protected plant species was also provided (*sensu* Notice 389 of 2013 of the Biodiversity Act of 2004 and Schedule 11 of the Transvaal Nature Conservation Ordinance (No.12 of 1983)).

3.2 Ecological Sensitivity

The ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity. In addition, the sensitivity of any piece of land is a key consideration when identifying impacts.

3.2.1 Ecological Function & Connectivity

The extent to which a site is ecologically connected to surrounding areas is an important determinant of its sensitivity. Systems with a high degree of landscape connectivity amongst one another were perceived to be more sensitive and will be those contributing to better ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

3.2.2 Biodiversity Importance

Biodiversity importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

3.2.3 Sensitivity Scale

- *High* – Sensitive and untransformed ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened, near threatened or rare species.

- *Medium* – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species.
- *Low* – Degraded and highly transformed systems with little ecological function and are generally very poor in species diversity (many species are exotic or weeds).
- *Negligible* – Permanently transformed systems with no natural habitat remaining (mainly infrastructure, mining activities or build-up areas).

3.3 Limitations

In order to obtain a comprehensive understanding of the dynamics of the floristic and faunal communities on the study site, as well as the status of endemic, rare or threatened species in any area, ecological surveys should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies were not feasible.

Please note that the inventories and the number of taxa listed in this document is by no means complete, and is merely a reflection of the dominant taxa on the study site obtained during a single (“snapshot”) instantaneous sampling session. In addition, focus was placed on the occurrence or potential occurrence of threatened and near threatened plant taxa, instead of providing a long list of species that could be present. Therefore, a comprehensive inventory, irrespective of the taxon or group of taxa could only be achieved during long-term temporal sampling. Therefore, a comprehensive species list of the untransformed parts of the study site cannot be compiled based on a brief, once-off field survey. In addition, the report provides a broad ecological investigation of the habitat units on the study site based on dominant floristic characters. Quantitative methods (*sensu stricto*) and phytosociological sampling techniques were excluded owing to the small surface area of the study site.

The information as presented in this document only has reference to the *investigated study site boundaries* and the immediate surroundings (ca. 500 m radius) and cannot be applied to any other area without prior investigation. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

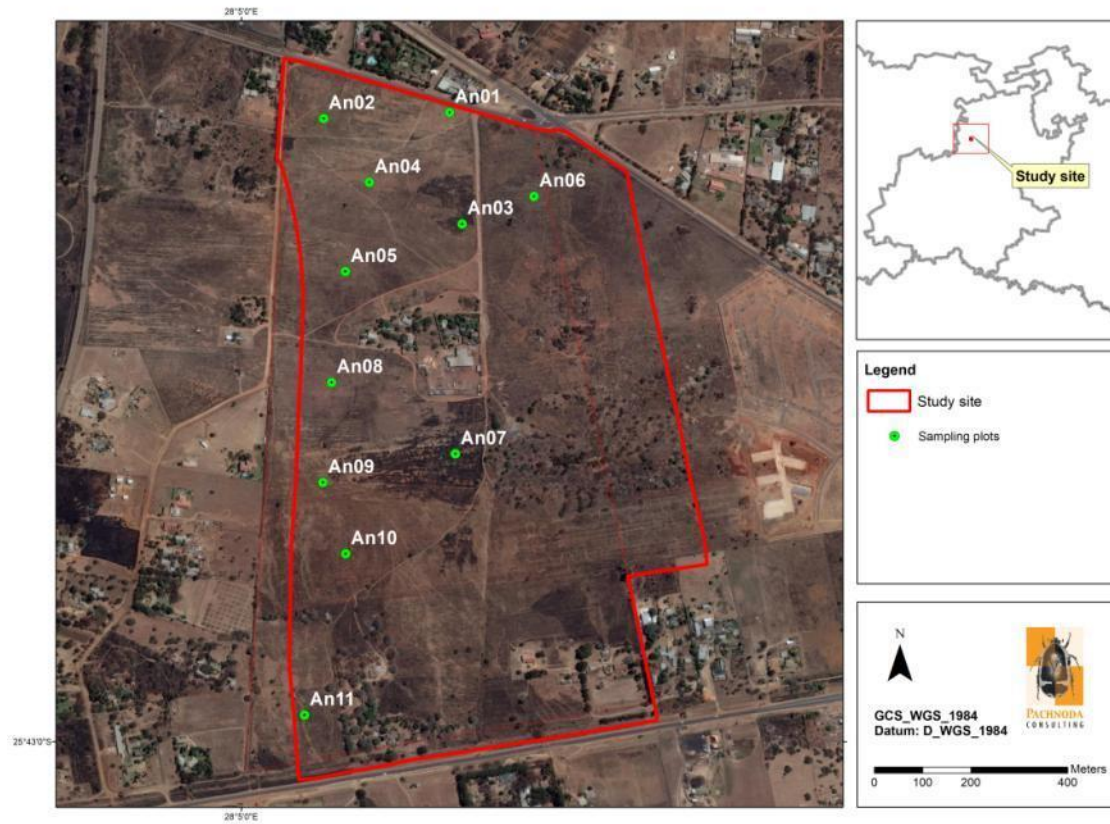


Figure 7: A satellite image of the study area illustrating the geographic placement of quantitative sampling plots on the study site (image courtesy of GoogleEarth).

4. RESULTS AND DISCUSSION

4.1 Broad-scale habitat units (vegetation associations)

Five broad-scale habitat types occur on the study site, which range from untransformed to secondary grassland and also include degraded Moot Plains Bushveld (Figure 8 and Figure 9). The spatial extent of each habitat unit is given in Table 2. A shortlist of the plant composition and abundance of each species in each broad-scale habitat type (or vegetation association) is provided in Appendix 1 - 3.

The most important grassland portions representing untransformed and "late-successional" grassland (dominated by *Themeda triandra* and *Cymbopogon caesius*) are uncommon and represent approximately 1.79 % of the total surface area. The dominant habitat unit is represented by secondary *Hyparrhenia hirta* - *Heteropogon contortus* grassland that covers approximately 44.53 % of the study site. It was evident that former untransformed Moot Plains Bushveld was converted to secondary grassland through agricultural activities, which include baling of the grass cover to be used as livestock fodder.

A total of 182 plant species (132 dicotyledons, 49 monocotyledons and one pteridophyte) represented by 49 families were recorded during the site visit.

The dominant plant species on the study site consists of secondary and subclimax taxa that are commonly encountered on grassland where disturbances are persistent or frequent (e.g. in this case mowing and baling) such as *Hyparrhenia hirta*, *Heteropogon contortus*, *Aristida congesta*, *Eragrostis chloromelas* and *Felicia muricata*. Most of these taxa produce large quantities of viable seed and quickly establish on recently disturbed or open exposed soils, whereby they tend to outcompete "late-successional" species.

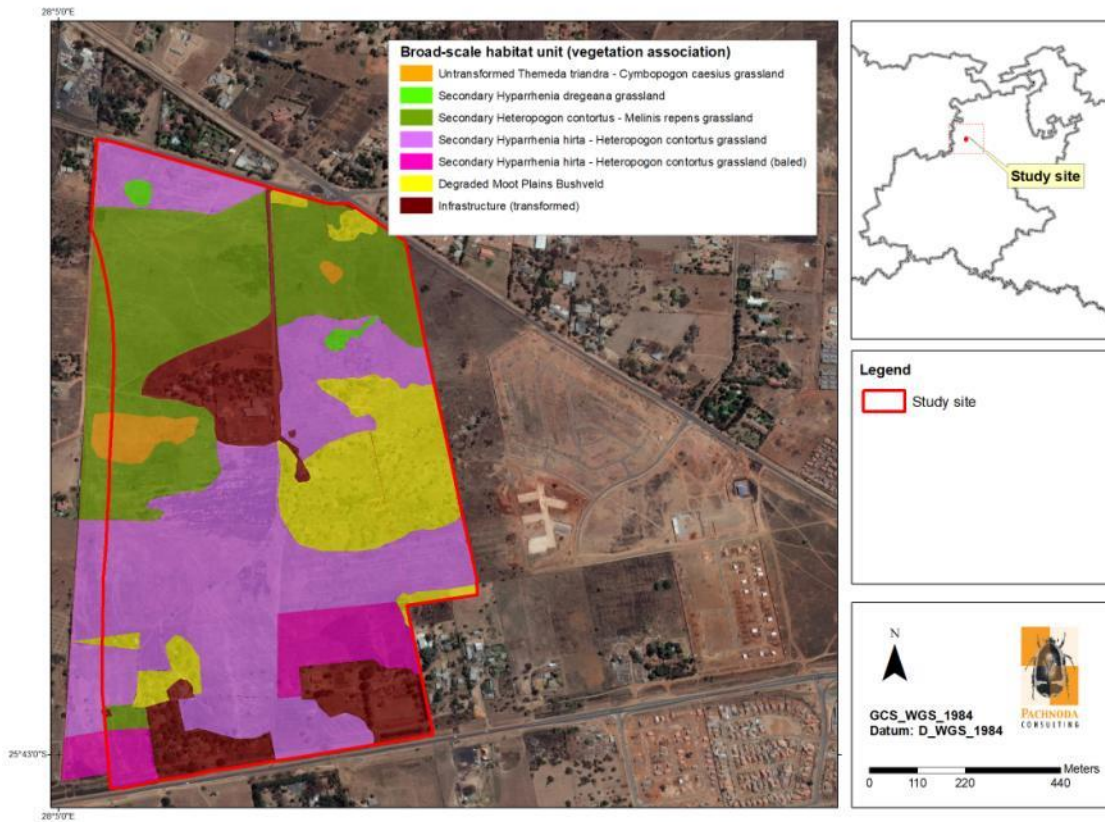


Figure 8: A map illustrating the current broad-scale habitat units (vegetation associations) on the study site.

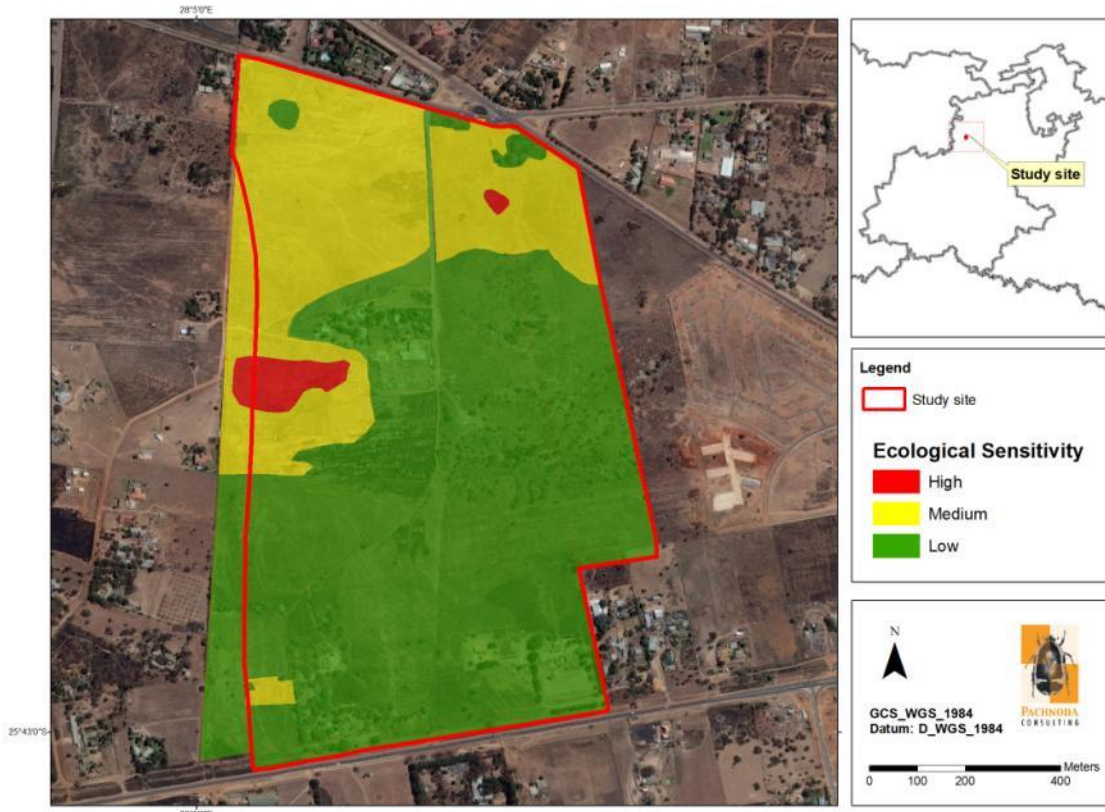


Figure 9: A sensitivity map of extant habitat units on the study site.

Table 2: Nature, transformation status and size of the vegetation associations on the study site.

Vegetation association	Transformation Status	Area (ha)	% of total
Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Untransformed	1.62	1.79
Secondary <i>Hyparrhenia dregeana</i> grassland	Secondary	0.57	0.64
Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Secondary	40.18	44.53
Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary	22.49	24.93
Degraded Moot Plains Bushveld	Degraded/Transformed	13.24	14.68
Infrastructure (transformed)	Transformed	12.12	13.44
Total		90.23	100.00

4.1.1 Untransformed *Themeda triandra* - *Cymbopogon caesius* grassland

This vegetation association is rare on the study site and is represented by two small disjointed grassland patches. It covers only 1.62 ha of the study site, which equates to

1.79 % of the entire study site (Figure 8 and Figure 10). It represents a species rich grassland composition that is typical of untransformed or "late-successional" grassland where it occurs on gravelly soils to rocky shale. Total graminoid cover is approximately 70-75 % and herbaceous cover is approximately 10-20 %, while the shrubs were rare (1%) and trees being absent. The average height of the graminoid layer is 1.2-1.3 m tall, while the forb layer is 10-35 cm tall and shrubs up to 1.5 m tall.

The association can be described as a species rich mixed grassland dominated by grass species such as *Themeda triandra*, *Cymbopogon caesius* and *Eragrostis racemosa*. Other co-dominants include *Heteropogon contortus* and *Senecio inornatus*. The graminoid layer include many "late-successional" and "decreaser" grass species that was absent or uncommon from the secondary units. Typical "late-successional" taxa include *Melinis nerviglumis*, *Digitaria monodactyla* and *Brachiaria serrata*. Herbaceous species richness is high and include prominent taxa such as *Helichrysum nudifolium*, *Hilliardiella oligocephala*, *Acalypha angustata*, *Crabbea angustifolia*, *Hermannia depressa*, *Chamaecrista comosa* and *Gnidia capitata*. Geophytes are represented by *Hypoxis acuminata*, *H. rigidula*, *H. hemerocallidea* and *H. obtusa*. *Cynodon dactylon* forms conspicuous dominant patches.

A total of 59 plant species were observed (see Appendix 1), with an average of 35.5 plant species/100m² (range: 29-40 species). The highest number of plant species per sampling unit was recorded from the untransformed grassland unit (c. 40 species). No species of conservation concern was observed.

This grassland unit is considered to be of **high** ecological sensitivity (Figure 9) and is regarded as being sensitive for the following reasons:

- It represents untransformed grassland.
- Floristic species richness per sampling unit is high and the species composition includes many "late-successional" species, especially forb taxa and "decreaser" graminoid species.
- The prevalence of alien or introduced species is low with only three species recorded (c. *Physalis viscosa*, *Melia azedarach* and *Lepidium bonariense*).
- The floristic composition contains a number of geophytes, mainly members of the Hypoxidaceae.



Figure 10: An example of untransformed *Themeda triandra* - *Cymbopogon caesius* grassland.

4.1.2 Secondary *Hyparrhenia dregeana* grassland

This vegetation association is confined to two small fragmented grassland patches located on the northern and eastern parts of the study site. It covers 0.57 ha of the study site, which equates to 0.64 % of the entire study site (Figure 8 and Figure 11). It represents a tall, coarse grassland on dark red to brown-black clay soils with a relative high moisture content. Total graminoid cover is approximately 98 % and herbaceous cover is approximately 2 %, while the shrubs were rare (<1%) and trees being absent. The average height of the graminoid layer is 2.2 m tall, while the forb layer is 20 cm tall and shrubs up to 1.5 m tall.

The association can be described as species poor secondary grassland dominated by *Hyparrhenia hirta*. Co-dominants include *Eragrostis chloromelas*, *Hyparrhenia hirta* and *Oxalis obliquifolia*. Other noteworthy graminoids include *Cynodon dactylon*, *Aristida congesta*, *Heteropogon contortus* and *Paspalum notatum*. The graminoid layer consists mainly of secondary grass species, although *Themeda triandra* occur as localised patches along the edges where soil moisture is prevalent. Typical forb species include *Alysicarpus rugosus*, *Conyza podocephala*, *Hermannia depressa*, *Oenothera rosea*, *Physalis viscosa*, *Plantago lanceolata*, *Verbena aristigera* and *V. officinalis*. Geophytes were absent or rare.

A total of 34 plant species were observed (see Appendix 1), with an average of 30 plant species/100m². No species of conservation concern was observed.

This grassland unit is considered to be of **low** ecological sensitivity (Figure 9) for the following reasons:

- It represents secondary grassland.
- Floristic species richness per sampling unit is low when compared to the other vegetation associations and represented by secondary taxa.

- It is highly fragmented, thereby considered to be of low conservation value.
- The tall dense structure of the grassland will preclude (shade-out) forb richness and floristic diversification, as well as the dispersal of terrestrial animal species.



Figure 11: An example of secondary *Hyparrhenia dregeana* grassland.

4.1.3 Secondary *Heteropogon contortus* - *Melinis repens* grassland

This vegetation association is the second largest grassland unit on the study site, which occurs prominently on the northern parts of the study site. It covers 22.49 ha of the study site, which equates to 24.93 % of the entire study site (Figure 8 and Figure 12). It represents a secondary grassland that has been regularly baled and occurs on shallow gravelly shale. The total graminoid cover is approximately 83-93 % and herbaceous cover is approximately 8 %, while shrubs and trees being absent. The average height of the graminoid layer is 1-1.2 m tall, while the forb layer is 10-20 cm tall.

The association can be described as a secondary "plagioclimax" grassland dominated by *Heteropogon contortus* and *Melinis repens*. Co-dominants include *Cymbopogon caesius*, *Hyparrhenia hirta* and *Senecio inornatus*. Other noteworthy graminoids include *Eragrostis chloromelas*, *Aristida congesta*, *Cynodon dactylon*, *Themeda triandra* and *Eragrostis curvula*. Typical forb species include *Felicia muricata*, *Hilliardiella oligocephala*, *Nidorella hottentota*, *Helichrysum rugulosum*, *Hermannia depressa*, *Conyza podocephala*, *Cucumis zeyheri*, *Pentarrhinum insipidum*, *Sonchus oleraceus*, *Rhynchosia totta*, *Convolvulus sagittatus*, *Solanum delagoense* and *Alysicarpus rugosus*. Geophytes were rare and consist of *Hypoxis acuminata* and *Ornithogalum tenuifolium*.

Plant species richness was high with a total of 90 plant species observed (see Appendix 1), although the floristic richness per sampling unit was low (Beta diversity) with an average of 22 plant species/100m² (range = 16-26 species). No species of conservation concern was observed.

This grassland unit is considered to be of **medium** ecological sensitivity (Figure 9) for the following reasons:

- It represents secondary grassland of large surface area, which provide ephemeral foraging habitat for larger-bodied animal species.
- Floristic species richness is high although Beta-diversity is low when compared to the other vegetation associations and is represented by secondary taxa.
- The ecological connectivity was moderate to high, which will support animal dispersal across the landscape.



Figure 12: An example of secondary *Heteropogon contortus* - *Melinis repens* grassland.

4.1.4 Secondary *Hyparrhenia hirta* - *Heteropogon contortus* grassland

This vegetation association is the largest grassland unit on the study site, which occurs predominantly on the southern portion of the study site. It covers 40.18 ha of the study site, which equates to 44.53 % of the entire study site (Figure 8 and Figure 13). It represents a secondary "plagioclimax" grassland with portions that have either been baled or mowed, and occurs on moderately deep red structured soils. The total graminoid cover is approximately 78.75 % and herbaceous cover is approximately 16.25 %, while the shrub and tree cover is respectively 4.75 % and 0.25 %. The average height of the graminoid layer is 1-1.4 m tall, while the forb layer is 17.5 cm tall. The shrub and tree layer is respectively 0.5 m and 1.5 m tall.

The association can be described as a secondary "plagioclimax" grassland dominated by *Heteropogon contortus* and *Hyparrhenia hirta*. Other noteworthy graminoids include *Melinis repens*, *Aristida congesta*, *Cynodon dactylon*, *Eragrostis chloromelas*, *E. pseudosclerantha* and *Eragrostis racemosa*. Typical forb species include *Felicia muricata*, *Helichrysum rugulosum*, *Nidorella hottentota*, *N. resedifolia*, *Crepis hypochaeridea* and *Pentarrhinum inspidum*. Geophytes were rare with only *Hypoxis hemerocallidea* observed.

Plant species richness was moderate with a total of 71 plant species observed (see Appendix 1), with an average of 24.8 plant species/100m² (range = 16-35 species). No species of conservation concern was observed.

This grassland unit is considered to be of **low** ecological sensitivity (Figure 9) for the following reasons:

- It represents secondary grassland with a low propensity to revert to its original floristic structure.
- Floristic species richness is moderate and is represented by secondary taxa.
- It is a tall "plagioclimax" grassland dominated by *Hyparrhenia hirta*, which is regionally widespread.

In addition, a small section of this grassland on the extreme northern section of the study site was considered to be of **medium** ecological sensitivity due to the high Beta-diversity recorded from the grassland sere (Figure 9).



Figure 13: An example of secondary *Hyparrhenia hirta* - *Heteropogon contortus* grassland.

4.1.5 Degraded Moot Plains Bushveld

This vegetation association is confined to bush clumps and represents degraded secondary Moot Plains Bushveld, with the largest portion observed on the eastern section of the study site. It covers 13.24 ha of the study site, which equates to 14.68 % of the entire study site (Figure 8 and Figure 14). It represents secondary Moot Plains Bushveld which is structurally dominated by tree and shrub species. However, most of the native tree and shrub species were subsequently replaced or invaded by declared invader taxa, most notably *Eucalyptus cf. camaldulensis*, *Tipuana tipu*, *Melia azedarach* and *Lantana camara*.

The association can be described as secondary bush clumps dominated by indigenous woody species such as *Vachellia tortilis*, *V. karoo*, *Senegalia caffra*, *Searsia lancea*, *S. leptodictya*, *S. pyroides*, *Ehretia rigida*, *Diospyros lycioides* and *Gymnosporia buxifolia*. Noteworthy graminoids include *Hyparrhenia hirta*, *Heteropogon contortus*, *Sporobolus pyramidalis*, *Pennisetum clandestinum*, *P. setaceum* and *Panicum maximum*. Typical forb species include *Asparagus larcinus*, *A. suaveolens*, *Aloe davyana*, *Teucrium trifidum*, along with many alien ruderal weed species such as *Bidens pilosa*, *B. biternata*, *Tagetes minuta*, *Conyza albida* and *Schkuhria pinnata*.

Plant species richness was moderate to high with a total of 81 plant species observed (see Appendix 1). No species of conservation concern was observed.

This unit is considered to be of **low** ecological sensitivity (Figure 9) for the following reasons:

- It represents degraded and disturbed Moot Plains Bushveld.
- A large proportion of the floristic richness consists of alien and declared invader species.



Figure 14: An example of degraded Moot Plains Bushveld.

4.2 Occurrence of plant 'species of conservation concern'

4.2.1 Plant species of conservation concern

South Africa has been recognised globally as having a remarkable plant diversity with high levels of endemism. Almost ten percent of the earth's plants are found within South Africa approximating 23 420 species (Golding, 2002). Of the 948 taxa assessed, 414 species are threatened with extinction, while 270 of these have populations with extremely localised geographic distributions (Golding, 2002).

In terms of conserving biodiversity, there has been a shift towards focussing on ecosystems and landscapes (habitats) rather than efforts in conserving specific species. This is the case due to the variety of living organisms, which make up ecosystems relying on suitable habitats to which they have become adapted over an extended temporal scale. Habitat degradation is one of the main reasons for species becoming extinct in a particular area. However, it can be viewed that threatened species are seen as indicators of the overall health of an ecosystem and serve, with varying degrees of success, as ‘umbrellas’ for the protection of other organisms as well as ecosystems (Hilton-Taylor, 1996; 2000). According to Hilton-Taylor (1996), threatened species can be seen as “biodiversity attention grabbers”. In addition, Victor & Keith (2004) introduced the concept of an Orange List for plant taxa that warrant conservation measures but do not meet the IUCN criteria. These taxa include those species at risk of becoming threatened (all taxa currently considered “Near threatened” or “Data Deficient”) or represent rare or declining populations. These categories were developed to highlight species that are not threatened with extinction, but require some conservation effort and monitoring.

Table 3 provides a list of 19 threatened and near-threatened species (including one Data Deficient species) with a distribution pattern sympatric (QDS: 2528CA) to the study area, and an indication of its probability of occurrence. Although none of these species were observed during the site visit, the untransformed grassland units provide a moderate probability for the occurrence of four of these species (c. *Argyrobium campicola*, *A. megarrhizum*, *Habenaria bicolor* and *Pearsonia bracteata*). These species, with *Habenaria bicolor* being the exception (which flowers between March and April), have flowering seasons corresponding to December and February, and may therefore been overlooked during the site visit. Although these species are likely to be absent from the untransformed grassland units, it is recommended that a second follow-up site visit be conducted during January/February to confirm the presence/absence of *Argyrobium campicola*, *A. megarrhizum* and *Pearsonia bracteata*.

4.2.2 Protected plant species

The following legislation provides protected status to selected indigenous plant species and is of relevance to the study area:

- National Forests Act (Act 84 of 1998),
- NEMA Biodiversity Act (Act 10 of 2004, as amended in 2015 by Notice 255 of the Government Gazette, 31 March 2015, No. 38600), and
- Transvaal Nature Conservation Ordinance (to be replaced by the Gauteng Nature Conservation Ordinance) (No.12 of 1983).

Schedule A of the National Forests Act (Act 84 of 1998) lists 47 tree species that are protected in South Africa. In terms of the National Forests Act, a licence should be granted by the Department of Agriculture, Forestry and Fisheries (or a delegated authority) prior

to the removal, damage or destruction of any individual tree. Therefore, such activities (as mentioned above) should be directed to the responsible Forestry official in each province or area. However, it was evident from the site visit that *none* of the 47 tree species listed in Schedule A of the National Forests Act occurs on the study site.

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended in 2013) is intended to protect plant and animal species that are directly threatened by utilisation or illegal trade. The Act assigns four categories (namely Critically Endangered, Endangered, Vulnerable and Protected) to species threatened by utilisation which appears to be similar to those used by the IUCN, although it should be emphasised that these categories are not as rigorously defined as per the IUCN Ver. 3.1 categories (IUCN, 2015). The destruction, collection or trading of any species listed in the Act requires a permit which must be obtained from the relevant authority. However, it was evident from the site visit that *none* of these taxa occurs on the study site.

A number of plant species occurring in Gauteng are not considered to be threatened or near-threatened (*sensu* Raimondo *et al.*, 2009), but are protected under Schedule 11 of the Transvaal Nature Conservation Ordinance (No.12 of 1983). Although old, the Act is still applicable to the province. A permit is required to remove or disturb a protected plant. However, during the site visit, only one fern species, *Pellaea calomelanos* was observed on the study site from the degraded Moot Plains Bushveld habitat. However, this species is relatively widespread in the region.

Table 3: List of all plant 'species of conservation concern' (*sensu* Raimondo *et al.*, 2009) historically recorded from the quarter degree grid square within which the vast majority of the study area is situated (2528CA) and the SANBI PRECIS database (<http://posa.sanbi.org>, accessed in April 2018).

Taxon	Latest (IUCN version 3.1) Conservation Status Category*	Habitat	Flowering Time	Probability of occurrence on the study site
ACANTHACEAE				
<i>Dicliptera magaliesbergensis</i> K.Balkwill	Vulnerable B1ab(iii)+2ab(iii)	Forest, savanna (Riverine forest and bush). Only known from Less than 10 remaining locations continue to decline due to ongoing destruction and degradation of riparian habitat.	February - April	Low , not observed
APOCYNACEAE				
<i>Stenostelma umbelliferum</i> (Schltr.) S.P.Bester & Nicholas	Near Threatened B1ab(ii,iii,iv,v)	Deep black turf in open woodland mainly in the vicinity of drainage lines.	September-March	Low , soil texture not optimal.
<i>Ceropegia decida</i> E.A.Bruce subsp. <i>pretoriensis</i> R.A.Dyer	Vulnerable D1+2	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.	November-April	Low , habitat absent.
<i>Ceropegia turricula</i> E.A.Bruce	Near Threatened A2c	Hills or grassland slopes.	December-February	Low
ANACARDIACEAE				
<i>Searsia gracillima</i> (Engl.) Moffett var. <i>gracillima</i>	Near Threatened D2	Rocky quartzitic outcrops in bushveld.	January-April	Low or unlikely to be present owing to the absence of suitable habitat.
ASPHODELACEAE				
<i>Aloe peglerae</i> Schönland	Critically Endangered A4abd	Grassland, in shallow, gravelly quartzitic soils on rocky north-facing slopes or summits of ridges.	July-August	Low
ASTERACEAE				
<i>Gnaphalium nelsonii</i> Burt Davy	Near Threatened B1ab(iii)	Seasonally wet grasslands.	October-December	Low
CRASSULACEAE				
<i>Adromischus umbraticola</i> C.A.Sm. subsp. <i>umbraticola</i>	Near Threatened B1ab(ii,iii,v)	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south.	September-January	Low
CUCURBITACEAE				
<i>Cucumis humifructus</i> Stent	Vulnerable B1ab(ii,v)	Woodland and grassland, on deep sand.	January-April	Low , soil texture absent
FABACEAE				
<i>Argyrolobium campicola</i> Harms	Near Threatened A2c	Highveld grassland	November-February	Moderate , may occur on untransformed grassland units (not observed during site visit).

Taxon	Latest (IUCN version 3.1) Conservation Status Category*	Habitat	Flowering Time	Probability of occurrence on the study site
<i>Argyrobium megarrhizum</i> Bolus	Near Threatened B1ab(ii,iii,v)	Mixed bushveld	September-January	Moderate , may occur on untransformed grassland units (not observed during site visit).
<i>Melolobium subspicatum</i> Conrath	Vulnerable D2	Open grassland, mainly on dolomite	October - February	Low , probably absent.
<i>Pearsonia bracteata</i> (Benth.) Polhill	Near threatened B1ab(i,ii,iii,iv,v)	On plateau grassland.	December - March	Moderate , may occur on untransformed grassland units (not observed during site visit)
HYACINTHACEAE				
<i>Bowiea volubilis</i> Harv. ex Hook.f. <i>subsp. volubilis</i>	Vulnerable A2ad	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	September-April	Low
<i>Drimia sanguinea</i> (Schinz) Jessop	Near Threatened A2d	Open veld and scrubby woodland in a variety of soil types.	August-December	Low
POACEAE				
<i>Festuca dracomontana</i> H.P.Linder	Data Deficient - Insufficient Information	Montane grassland	October-December	Low
ORCHIDACEAE				
<i>Habenaria kraenzliniana</i> Schltr.	Near Threatened B1ab	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	February-April	Low
<i>Habenaria bicolor</i> Conrath & Kraenzl.	Near Threatened B1ab(iii)+2ab(iii)	It occurs on well-drained grassland at 1 600m.a.s.l. It is only known from 10-20 localities confined primarily to Gauteng.	January - April (peak March - April)	Moderate . An extremely difficult species to detect when not in flower - it was not observed during the site survey, may occur on the untransformed grassland units.
<i>Holothrix randii</i> Rendle.	Near threatened B1ab(iii)+2ab(iii); C2a(i)	Grassy slopes and rock ledges, usually southern aspects	September - October	Low

* Status follows the latest Red Data Plant Book of South African Plants (Raimondo *et al.*, 2009), and the continuously updated online Red List of SANBI (<http://redlist.sanbi.org>, accessed in April 2018). Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001).

#Probability of occurrence, as follows: LOW – no suitable habitats occur within the study site based on available habitat descriptions for the species and authors personal observations; MODERATE – habitats on site match available general habitat description for the species, but based on authors experience available microhabitat does not meet the requirements for the species (e.g. rocky grassland on shallow, moist soils overlying dolomite) OR, seemingly suitable microhabitat present but species is conspicuous and most available microhabitats searched and species not found and therefore probability of occurrence not considered high, HIGH – habitats on site strongly match the general and microhabitat description for the species, RECORDED – species found within study area.

4.3 Declared invader plant species

Twenty-one (21) Declared Weeds and Invader species (Table 4) were observed on the study site, with the majority confined to the degraded Moot Plains Bushveld.

Invaders and weed species are plants that invade natural or semi-natural habitats, especially areas disturbed by humans, and are commonly known as environmental weeds. Weeds that invade severely disturbed areas are known as ruderal and agrestal weeds. Most of these weeds are annuals colonising waste sites and cultivated fields. These weeds only persist on recently disturbed areas and seldom invade established areas (Henderson, 2001).

Declared weeds and invaders have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems.

The Alien and Invasive Species Regulations were published on 1 August 2014 in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004. The Act provides a list of prohibited invasive plant species under section 71(A) (as amended on 29 July 2016) and identifies four categories:

- Category 1a listed invasive species: Species which must be combatted or eradicated. It basically instructs a person to comply with section 73(2) of the Act. In addition, an authorised official from the Department (DEA) must be allowed to assist with the eradication of these species.
- Category 1b invasive species: Species that should be controlled as listed by the notice in terms of section 70(1)(a). Any person in control of these species must control these species, and must allow an authorised official from the Department to assist with the control of these species.
- Category 2 invasive species: Species that requires a permit to carry out a restricted activity (e.g. afforestation) on a specified area. A person in possession of a permit or who owns land with Category 2 species must also ensure that these species will not spread outside the land. Unless otherwise specified, if any Category 2 species occur outside any specified area, they should be treated as Category 1b species and must be managed accordingly.
- Category 3 invasive species: A species that is subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the Act. If any of these species occur in a riparian area, they should be treated as Category 1b species, and must be managed accordingly.

Table 4: A list of weeds and invader plant species identified on the study site

Species	Vernacular Name	Type	Control Measure	NEMBA Category	Locality
<i>Arundo donax</i>	Spanish Reed	Weed	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Campuloclinium macrocephalum</i> (Pompom Weed	Weed	Eradicate	1b	All units
<i>Crotalaria agatiflora</i>	Bird Flower	Weed	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Datura ferox</i>	Large Thorn Apple	Weed	Control	1b	Degraded Moot Plains Bushveld
<i>Eucalyptus cf. camaldulensis</i>	Red River Gum	Invader	Remove when within 32 m from edge of river or stream. No removal is required if the tree trunks are >400mm in diameter (at 1000mm height) when these occur within 50m of a derelict homestead or when within urban area.	1b	Scattered on study site.
<i>Flaveria bidentis</i>	Smelter's Bush	Weed	Control	1b	Degraded Moot Plains Bushveld
<i>Jac aranda mimosifolia</i>	Jacaranda	Invader	Control	1b	Degraded Moot Plains Bushveld
<i>Lantana camara</i>	Tickberry	Invader	eradicate	1b	Degraded Moot Plains Bushveld
<i>Melia azedarach</i>	Seringa	Invader	Control	3	Most habitat units, although concentrated on Degraded Moot Plains Bushveld
<i>Morus alba</i>	Common Mulberry	Invader	Control	3	Degraded Moot Plains Bushveld
<i>Nicotiana glauca</i>	Wild Tobacco	Invader	Control	1b	Degraded Moot Plains Bushveld
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Invader	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Pennisetum setaceum</i>	Fountain Grass	Invader	Control	1b	Degraded Moot Plains Bushveld
<i>Ricinus communis</i>	Caster oil Plan	Invader	Control	2	Degraded Moot Plains Bushveld
<i>Robinia pseudoacacia</i>	Black Locust	Invader	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Rumex usambarensis</i>	East African docl	Invader	Control	1b	Degraded Moot Plains Bushveld
<i>Sesbania punicea</i>	Red Sesbania	Invader	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Solanum mauritianum</i>	Bugweed	Weed	Eradicate	1b	Degraded Moot Plains Bushveld
<i>Solanum sisymbriifolium</i>	Wild tomato	Weed	Control	1b	Degraded Moot Plains Bushveld 7

Species	Vernacular Name	Type	Control Measure	NEMBA Category	Locality
					secondary grassland
<i>Te coma stans</i>	Yellow Bels	Weed	Eradicate	1b	Singe individual observed from secondary <i>Hyparrhenia hirta</i> grassland
<i>Tithonia rotundifolia</i>	Red Sunflower	Weed	Eradicate	1b	Degraded Moot Plains Bushveld

As a priority, all individuals of *Campuloclinium macrocephalum* (Category 1a) should be removed since these species are highly noxious within natural grassland.

4.4 A reasoned opinion regarding authorisation and General Recommendations

As per Appendix 6 of the Environmental Impact Regulations of 2014 (No. R. 982) of the National Environmental Management Act (Act No. 107 of 1998) a reasoned opinion should be provided as to whether the proposed activity or portions thereof should be authorised.

The broad-scale vegetation types on the study site are represented by a secondary grassland unit dominated by secondary grasses such as *Heteropogon contortus*, *Melinis repens*, *Hyparrhenia hirta* and *H. dregeana* of medium to low conservation value. In addition, 14.68 % of the study site is also represented by degraded Moot Plains Bushveld, which was identified with a low ecological sensitivity. The latter was highly degraded and a large proportion of its floristic composition consists of alien plant species (c. 20 species being alien declared invader species). Only 1.79 % of the study site comprised of two grassland patches that were regarded as untransformed grassland with a high ecological value. However, based on the isolated nature of the untransformed grassland patches and their respective small surface areas (c. 0.03 ha and 1.5 ha) considerable effort in terms of short-term crises conservation management (e.g. grazing and fire regimes) will be required to control deleterious edge effects imposed onto the grassland units, and to procure the long-term conservation value of these units.

However, the following recommendations/mitigation measures are proposed:

- Where possible, development should focus on habitat of low ecological sensitivity.
- Appropriate storm water management features should be installed to prevent excessive run-off of storm water (and potential erosion) into the surrounding grassland habitat (this could result in compositional floristic changes).
- An overspill of construction activities into adjacent areas that are not part of the development layout should be prohibited.

- Landscaping should make use of indigenous species, and preferably of species native to the study area and immediate surroundings. The species selected should strive to represent habitat types typical of the ecological landscape prior to construction.
- Implement an alien eradication plant programme to systematically control/eradicate the declared invasive plant species. Priority should be given to the eradication (as per the Act) of *Campuloclinium macrocephalum*.
- As a precautionary measure, it is recommended that a second follow-up site visit be conducted during January/February to confirm the potential presence/absence of *Argyrobolium campicola*, *A. megarrhizum* and *Pearsonia bracteata* from the untransformed grassland units.

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6. APPENDICES

Appendix 1: A shortlist of plant species recorded during a survey on the study site. *-denotes alien/exotic taxa and **-denotes indigenous species that was artificially planted.

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary Hyparrhenia dregeana grassland	Untransformed Themeda triandra - Cymbopogon caesius grassland	Secondary Heteropogon contortus - Melinis repens grassland	Secondary Hyparrhenia hirta - Heteropogon contortus grassland	Degraded Moot Pains Bushveld (bush clumps)
Ferns								
Sinopteridaceae	<i>Pellaea calomelanos</i>							1
Subtotal	1	0	1	0	0	0	0	1
Dicotyledons								
Acanthaceae	<i>Chaetacanthus setiger</i>				1	1	1	
Acanthaceae	<i>Crabbea angustifolia</i>				1			
Amaranthaceae	<i>Amaranthus hybridus</i> *							1
Amaranthaceae	<i>Alternanthera pungens</i> *							1
Amaranthaceae	<i>Gomphrena celosioides</i> *					1	1	
Amaranthaceae	<i>Guilleminea densa</i> *							1
Anacardiaceae	<i>Schinus molle</i> *							1
Anacardiaceae	<i>Searsia lancea</i>					1		1
Anacardiaceae	<i>Searsia leptodictya</i>							1
Anacardiaceae	<i>Searsia pyroides</i>							1
Apocynaceae	<i>Landolphia capensis</i>						1	
Apocynaceae	<i>Pentarrhinum insipidum</i>					1	1	1
Apocynaceae	<i>Raphionacme hirsuta</i>						1	
Apocynaceae	<i>Xysmalobium undulatum</i>					1		
Asteraceae	<i>Bidens biternata</i> *							1
Asteraceae	<i>Bidens pilosa</i> *							1
Asteraceae	<i>Campuloclinium macrocephalum</i> *			1		1	1	1
Asteraceae	<i>Conyza albida</i> *					1		1
Asteraceae	<i>Conyza podocephala</i>			1	1	1	1	1
Asteraceae	<i>Crepis hypochaeridea</i> *						1	
Asteraceae	<i>Dicoma anomala</i>					1		
Asteraceae	<i>Felicia muricata</i>			1	1	1	1	1

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyparrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Asteraceae	<i>Flaveria bidentis</i> *							1
Asteraceae	<i>Helichrysum nudifolium</i>				1	1		
Asteraceae	<i>Helichrysum rugulosum</i>				1	1	1	1
Asteraceae	<i>Hilliardiella oligocephala</i>				1	1	1	
Asteraceae	<i>Lactuca inermis</i>					1	1	
Asteraceae	<i>Macleodium zeyheri</i>						1	
Asteraceae	<i>Nidorella anomala</i>				1	1		
Asteraceae	<i>Nidorella hottentota</i>				1	1	1	
Asteraceae	<i>Nidorella resedifolia</i>			1	1	1	1	1
Asteraceae	<i>Osteospermum scariosum</i>					1	1	
Asteraceae	<i>Pseudognaphalium luteo-album</i>						1	1
Asteraceae	<i>Schkuhria pinnata</i> *			1		1	1	1
Asteraceae	<i>Senecio cf. affinis</i>						1	
Asteraceae	<i>Senecio erubescens</i>					1		
Asteraceae	<i>Senecio inomatus</i>				1	1		
Asteraceae	<i>Seriphium plumosum</i>					1		
Asteraceae	<i>Sonchus oleraceus</i> *					1	1	
Asteraceae	<i>Tagetes minuta</i> *			1		1	1	1
Asteraceae	<i>Tithonia rotundifolia</i> *							1
Asteraceae	<i>Ursinia nana</i>				1			
Asteraceae	<i>Zinnia peruviana</i> *			1		1		1
Bignoniaceae	<i>Jacaranda mimosifolia</i> *							1
Bignoniaceae	<i>Tecoma stans</i> *						1	
Boraginaceae	<i>Ehretia rigida</i>							1
Boraginaceae	<i>Ehretia amoena</i>					1		1
Brassicaceae	<i>Lepidium bonariense</i> *				1			1
Cactaceae	<i>Opuntia ficus-indica</i> *							1
Campanulaceae	<i>Wahlenbergia undulata</i>					1		
Celastraceae	<i>Gymnosporia buxifolia</i>							1
Chenopodiaceae	<i>Chenopodium album</i> *							1

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyparrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Combretaceae	<i>Combretum molle</i>					1		
Convolvulaceae	<i>Convolvulus sagittatus</i>					1	1	
Convolvulaceae	<i>Ipomoea obscura</i>			1		1		
Cucurbitaceae	<i>Cucumis zeyheri</i>					1	1	
Ebenaceae	<i>Diospyros lycioides</i>					1		1
Euphorbiaceae	<i>Acalypha angustata</i>				1	1		
Euphorbiaceae	<i>Euphorbia heterophylla</i> *							1
Euphorbiaceae	<i>Euphorbia inaequilatera</i>					1	1	
Euphorbiaceae	<i>Euphorbia hirta</i> *					1		
Solanaceae	<i>Physalis viscosa</i> *			1	1	1	1	1
Euphorbiaceae	<i>Ricinus communis</i> *							1
Fabaceae	<i>Alysicarpus rugosus</i>			1	1	1	1	
Fabaceae	<i>Chamaecrista comosa</i>			1	1	1	1	
Fabaceae	<i>Chamaecrista mimosoides</i>			1				
Fabaceae	<i>Crotalaria sp.</i>						1	
Fabaceae	<i>Crotalaria agatiflora</i> *							1
Fabaceae	<i>Eriosema cf. burkei</i>					1	1	
Fabaceae	<i>Indigofera melanadenia</i>				1	1	1	
Fabaceae	<i>Indigofera filipes</i>				1	1		
Fabaceae	<i>Indigofera sp</i>				1			
Fabaceae	<i>Lotononis eriantha</i>							1
Fabaceae	<i>Rhynchosia totta</i>			1	1	1	1	
Fabaceae	<i>Robinia pseudoacacia</i> *							1
Fabaceae	<i>Sesbania punicea</i> *							1
Fabaceae	<i>Tephrosia capensis</i>				1	1	1	
Fabaceae	<i>Tipuana tipu</i> *							1
Fabaceae	<i>Vigna unguiculata</i>					1		
Fabaceae	<i>Zornia milneana</i>				1	1		
Geraniaceae	<i>Monsonia angustifolia</i>					1		
Lamiaceae	<i>Ocimum obovatum</i>				1			

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyparrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Lamiaceae	<i>Plectranthus</i> sp.							1
Lamiaceae	<i>Teucrium trifidum</i>							1
Lauraceae	<i>Cinnamomum camphora</i> *							1
Malvaceae	<i>Hermannia depressa</i>			1	1	1	1	
Malvaceae	<i>Hermannia grandistipula</i>					1	1	
Malvaceae	<i>Hermannia lancifolia</i>				1			
Malvaceae	<i>Hibiscus microcarpus</i>				1			
Malvaceae	<i>Sida dregei</i>				1	1	1	
Meliaceae	<i>Melia azedarach</i> *			1	1		1	1
Mimosaceae	<i>Dichrostachys cinerea</i>				1	1	1	
Mimosaceae	<i>Senegalia caffra</i>				1		1	
Mimosaceae	<i>Vachellia karoo</i>					1	1	1
Mimosaceae	<i>Vachellia nilotica</i>			1				
Mimosaceae	<i>Vachellia robusta</i>							1
Mimosaceae	<i>Vachellia sieberiana</i> **					1		1
Mimosaceae	<i>Vachellia tortilis</i>				1	1	1	1
Moraceae	<i>Morus alba</i> *							1
Myrtaceae	<i>Eucalyptus cf. camaldulensis</i> *					1		
Nyctaginaceae	<i>Boerhavia erecta</i> *							1
Onagraceae	<i>Oenothera rosea</i> *			1		1		
Oxalidaceae	<i>Oxalis corniculata</i> *					1		
Oxalidaceae	<i>Oxalis obliquifolia</i>			1		1	1	1
Plantaginaceae	<i>Plantago lanceolata</i>			1				
Polygalaceae	<i>Polygala amatymbica</i>				1			
Polygalaceae	<i>Polygala hottentota</i>				1	1		
Polygonaceae	<i>Rumex cf. usambarensis</i> *							1
Rhamnaceae	<i>Ziziphus zeyheriana</i>				1		1	
Rubiaceae	<i>Anthospermum rigidum</i>			1	1	1	1	
Rubiaceae	<i>Kohautia virgata</i>						1	
Rubiaceae	<i>Kohautia amatymbica</i>					1	1	

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyparrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Santalaceae	<i>Thesium sp.</i>				1	1	1	
Santalaceae	<i>Viscum cf. subserratum</i>							1
Scrophulariaceae	<i>Jamesbrittenia aurantiaca</i>					1	1	
Solanaceae	<i>Datura ferox*</i>							1
Solanaceae	<i>Nicotiana glauca*</i>							1
Solanaceae	<i>Solanum delagoense</i>			1		1	1	
Solanaceae	<i>Solanum lichtensteinii</i>					1	1	
Solanaceae	<i>Solanum mauritianum*</i>							1
Solanaceae	<i>Solanum sisymbriifolium*</i>					1	1	
Thymelaeaceae	<i>Gnidia capitata</i>				1			
Tiliaceae	<i>Corchorus asplenifolius</i>					1		
Ulmaceae	<i>Celtis africana</i>							1
Verbenaceae	<i>Chascanum hederaceum</i>						1	
Verbenaceae	<i>Lantana camara*</i>							1
Verbenaceae	<i>Lantana rugosa</i>			1	1	1	1	1
Verbenaceae	<i>Lippia cf. rehmannii</i>				1	1		
Verbenaceae	<i>Lippia javanica</i>						1	
Verbenaceae	<i>Verbena aristigera*</i>			1				
Verbenaceae	<i>Verbena officinalis*</i>			1		1		1
Zygophyllaceae	<i>Tribulus terrestris*</i>							1
Subtotal	132	0	0	24	40	69	54	59
Monocotyledons								
Agavaceae	<i>Agave americana*</i>							1
Asparagaceae	<i>Asparagus cf. cooperi</i>					1		
Asparagaceae	<i>Asparagus laricinus</i>							1
Asparagaceae	<i>Asparagus suaveolens</i>							1
Asphodelaceae	<i>Aloe davyana</i>					1		1
Commelinaceae	<i>Commelina africana</i>						1	
Commelinaceae	<i>Commelina benghalensis*</i>							1
Hyacinthaceae	<i>Ornithogalum tenuifolium</i>					1		

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyparrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Hypoxidaceae	<i>Hypoxis acuminata</i>				1	1		
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>			1	1		1	
Hypoxidaceae	<i>Hypoxis obtusa</i>				1			
Hypoxidaceae	<i>Hypoxis rigidula</i>				1			
Poaceae	<i>Aristida ascensionis</i>							1
Poaceae	<i>Aristida canescens</i>				1			
Poaceae	<i>Aristida congesta</i> subsp. <i>barbicollis</i>			1	1	1	1	
Poaceae	<i>Aristida congesta</i> subsp. <i>congesta</i>						1	
Poaceae	<i>Arundo donax</i> *							1
Poaceae	<i>Bothriochloa insculpta</i>						1	
Poaceae	<i>Bracharia serrata</i>				1			
Poaceae	<i>Cenchrus ciliaris</i>							1
Poaceae	<i>Chloris gayana</i>							1
Poaceae	<i>Cymbopogon caesius</i>				1	1	1	
Poaceae	<i>Cynodon dactylon</i>			1		1	1	1
Poaceae	<i>Digitaria eriantha</i>					1		
Poaceae	<i>Digitaria monodactyla</i>				1			
Poaceae	<i>Eleusine coracana</i> *							1
Poaceae	<i>Enneapogon cenchroides</i>							1
Poaceae	<i>Eragrostis chloromelas</i>			1	1	1	1	1
Poaceae	<i>Eragrostis curvula</i>					1		
Poaceae	<i>Eragrostis gummiflua</i>				1	1		
Poaceae	<i>Eragrostis pseudosclerantha</i>			1		1	1	
Poaceae	<i>Eragrostis racemosa</i>				1	1	1	
Poaceae	<i>Eragrostis rigidior</i>						1	
Poaceae	<i>Eragrostis superba</i>					1		
Poaceae	<i>Heteropogon contortus</i>			1	1	1	1	1
Poaceae	<i>Hyparrhenia dregeana</i>			1				
Poaceae	<i>Hyparrhenia hirta</i>			1	1	1	1	1
Poaceae	<i>Melinis nerviglumis</i>				1	1		

Family	Species	Red Data	Protected	Vegetation Association				
				Secondary <i>Hyarrhenia dregeana</i> grassland	Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	Secondary <i>Hyarrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	Degraded Moot Pains Bushveld (bush clumps)
Poaceae	<i>Melinis repens</i>				1	1	1	
Poaceae	<i>Panicum maximum</i>							1
Poaceae	<i>Panicum schinzii</i>							1
Poaceae	<i>Paspalum notatum</i> *			1				
Poaceae	<i>Pennisetum clandestinum</i> *							1
Poaceae	<i>Pennisetum setaceum</i> *							1
Poaceae	<i>Pogonarthria squarrosa</i>				1	1	1	
Poaceae	<i>Sporobolus pyramidalis</i>							1
Poaceae	<i>Themeda triandra</i>			1	1	1	1	
Poaceae	<i>Trichoneura grandiglumis</i>				1	1		
Poaceae	<i>Urochloa mossambicensis</i>						1	1
Subtotal	49	0	0	10	19	21	17	21
Total	182	0	1	34	59	90	71	81

Appendix 2: Flora quadrat data representing grassland units on the study site. *-denotes alien/exotic taxa.

Species	1	2	4	3	6	5	8	9	10	11	7	Frequency of occurrence
<i>Chaetacanthus setiger</i>	+			+	+		+	+				5
<i>Gomphrena celosioides*</i>										r		1
<i>Pentarrhinum inspidum</i>	+							+			+	3
<i>Raphionacme hirsuta</i>	r											1
<i>Campuloclinium macrocephalum*</i>		+	+					+	r			4
<i>Conyza podocephala</i>	2a	1					+	+	+	+	+	7
<i>Crepis hypochoeridea*</i>								+				1
<i>Felicia muricata</i>	+	+	+	+	+	2a	+	2a	+	+	+	11
<i>Helichrysum nudifolium</i>				+	+		+					3
<i>Helichrysum rugulosum</i>				+	+		+	+	r	+		6
<i>Hilliardiella oligocephala</i>				+	1		+					3
<i>Lactuca capensis</i>	+		r									2
<i>Macleodium zeyheri</i>								r				1
<i>Nidorella hottentota</i>			+	1	+	+	+	+	+		r	8
<i>Nidorella resedifolia</i>			+	r	+	+	+	+	+			7
<i>Osteospermum scariosum</i>										+		1
<i>Schkuhria pinnata*</i>	+	r	+									3
<i>Senecio inomatus</i>			+	+	2a							3
<i>Seriphium plumosum</i>				r								1
<i>Sonchus oleraceus*</i>	+								+			2
<i>Tagetes minuta*</i>	r	r		r								3
<i>Zinnia peruviana*</i>		r										1
<i>Wahlenbergia undulata</i>			+									1
<i>Commelina africana</i>										+		1
<i>Convolvulus sagittatus</i>	+											1
<i>Ipomoea obscura</i>		+										1
<i>Cucumis zeyheri</i>								+	r	+	+	4
<i>Acalypha angustata</i>							+					1
<i>Euphorbia inaequilatera</i>	+							+				2
<i>Euphorbia hirta*</i>			+									1
<i>Physalis viscosa*</i>	1	+					+	+	1	+	1	7
<i>Alysicarpus rugosus</i>		2a	+	r	+	r	r	r		+		8
<i>Chamaecrista comosa</i>	+	+	+	+			+	+				6
<i>Crotalaria sp.</i>								+				1
<i>Eriosema cf. burkei</i>	+											1
<i>Indigofera melanadenia</i>	+			+	+							3
<i>Indigofera filipes</i>							1					1
<i>Indigofera sp.</i>					+							1
<i>Rhynchosia totta</i>	+	+					+				r	4
<i>Tephrosia capensis</i>						+	+					2
<i>Zomia milneana</i>			r				r					2
<i>Hypoxis hemerocallidea</i>		+										1
<i>Ocimum obovatum</i>							+					1
<i>Hermannia depressa</i>	+		+	+	+	+	+	+	+			8

Species	1	2	4	3	6	5	8	9	10	11	7	Frequency of occurrence
<i>Hermannia grandistipula</i>	r					r					r	3
<i>Hermannia lancifolia</i>							+					1
<i>Sida dregei</i>	r				+	r	+	r				5
<i>Vachellia nilotica</i>		r										1
<i>Vachellia tortilis</i>					r						+	2
<i>Oenothera rosea*</i>		+	+									2
<i>Oxalis obliquifolia</i>	1	2a	1						+		+	5
<i>Plantago lanceolata</i>		+										1
<i>Aristida canescens</i>					+							1
<i>Aristida congesta subsp. barbicollis</i>	2a	+	2b	+	1	1	+	2a	+		+	10
<i>Aristida congesta subsp. congesta</i>									+		+	2
<i>Bothriochloa insculpta</i>	1											1
<i>Brachiaria serrata</i>							+					1
<i>Cymbopogon caesius</i>	2b		+	+	3	+	2b	+				7
<i>Cynodon dactylon</i>	+	+						1	+		1	5
<i>Eragrostis chloromelas</i>	2a	3	1	r	+	+	3	3	+	+	+	11
<i>Eragrostis gummiflua</i>					+		+					2
<i>Eragrostis pseudosclerantha</i>	+	+								+		3
<i>Eragrostis racemosa</i>					3		+		+			3
<i>Eragrostis rigidior</i>								1				1
<i>Heteropogon contortus</i>	4	2a	5	5	2b	5	+	4	2b	4	5	11
<i>Hyparrhenia dregeana</i>		4										1
<i>Hyparrhenia hirta</i>	4	2b	+	2a	+	+	+	2a	4	2b	2b	11
<i>Melinis nerviglumis</i>					+		+					2
<i>Melinis repens</i>			3	2b	2a	+	+	+				6
<i>Paspalum notatum*</i>		2b										1
<i>Pogonarthria squarrosa</i>			+	+	+		+	r				5
<i>Themeda triandra</i>	+	2b	+		+		3					5
<i>Trichoneura grandiglumis</i>			r		+		+					3
<i>Urochloa mossambicensis</i>	r											1
<i>Polygala amatymbica</i>							+					1
<i>Polygala hottentota</i>							+					1
<i>Ziziphus zeyheriana</i>							+					1
<i>Anthospermum rigidum</i>	r	+	+	+	+	+	+		r			8
<i>Kohautia virgata</i>								+		+		2
<i>Kohautia amatymbica</i>				+				+	r			3
<i>Thesium sp.</i>	r			r	+		+					4
<i>Jamesbrittenia aurantiaca</i>			r			r						2
<i>Solanum delagoense</i>	+	r						r				3
<i>Solanum lichtensteinii</i>								r	r	r		3
<i>Solanum sisymbriifolium</i>	+							r				2
<i>Chascanum hederaceum</i>										r		1
<i>Lantana rugosa</i>	+	+					+			+	+	5
<i>Lippia cf. rehmannii</i>							+					1
<i>Lippia javanica</i>								+			r	2
<i>Verbena aristigera*</i>		+										1
<i>Verbena officinalis</i>		+										1

Species	1	2	4	3	6	5	8	9	10	11	7	Frequency of occurrence
Number of species	35	30	26	24	29	16	40	35	20	16	18	

Appendix 3: Summarised floristic data representing the abundance values of plant species on each grassland unit. *-denotes alien/exotic taxa and **-denotes indigenous species that was artificially planted.

Species	Abundance
Untransformed <i>Themeda triandra</i> - <i>Cymbopogon caesius</i> grassland	
<i>Cymbopogon caesius</i>	1
<i>Eragrostis racemosa</i>	1
<i>Themeda triandra</i>	1
<i>Heteropogon contortus</i>	2
<i>Senecio inornatus</i>	3
<i>Chamaecrista comosa</i>	c
<i>Conyza podocephala</i>	c
<i>Felicia muricata</i>	c
<i>Helichrysum nudifolium</i>	c
<i>Helichrysum rugulosum</i>	c
<i>Hermannia depressa</i>	c
<i>Hilliardiella oligocephala</i>	c
<i>Indigofera filipes</i>	c
<i>Indigofera melanadenia</i>	c
<i>Indigofera</i> sp.	c
<i>Nidorella resedifolia</i>	c
<i>Nidorella hottentota</i>	c
<i>Physalis viscosa</i> *	c
<i>Pogonarthria squarrosa</i>	c
<i>Tephrosia capensis</i>	c
<i>Ziziphus zeyheriana</i>	c
<i>Eragrostis gummiflua</i>	c
<i>Eragrostis chloromelas</i>	c
<i>Hyparrhenia hirta</i>	c
<i>Trichoneura grandiglumis</i>	c
<i>Melinis repens</i>	c
<i>Cynodon dactylon</i>	lc
<i>Senegalia caffra</i>	r
<i>Seriphium plumosum</i>	r
<i>Melia azedarach</i> *	r
<i>Hypoxis acuminata</i>	r
<i>Hypoxis rigidula</i>	r
<i>Acalypha angustata</i>	u
<i>Crabbea angustifolia</i>	u
<i>Dichrostachys cinerea</i>	u
<i>Gnidia capitata</i>	u
<i>Hibiscus microcarpus</i>	u
<i>Lepidium bonariense</i> *	u
<i>Nidorella anomala</i>	u
<i>Thesium</i> sp.	u
<i>Ursinia nana</i>	u
<i>Aristida canescens</i>	u

Species	Abundance
<i>Digitaria monodactyla</i>	u
<i>Hypoxis obtusa</i>	u
<i>Melinis nerviglumis</i>	u
<i>Vachellia tortilis</i>	u
Secondary <i>Hyparrhenia dregeana</i> grassland	
<i>Hyparrhenia dregeana</i>	1
<i>Eragrostis chloromelas</i>	2
<i>Hyparrhenia hirta</i>	2
<i>Oxalis obliquifolia</i>	3
<i>Alysicarpus rugosus</i>	c
<i>Aristida congesta barbicollis</i>	c
<i>Conyza podocephala</i>	c
<i>Cynodon dactylon</i>	c
<i>Hermannia depressa</i>	c
<i>Heteropogon contortus</i>	c
<i>Oenothera rosea</i> *	c
<i>Paspalum notatum</i> *	c
<i>Physalis viscosa</i> *	c
<i>Plantago lanceolata</i>	c
<i>Verbena aristigera</i> *	c
<i>Verbena officinalis</i> *	c
<i>Themeda triandra</i>	lc
<i>Melia azedarach</i> *	r
<i>Vachellia nilotica</i>	r
<i>Wahlenbergia undulata</i>	r
<i>Campuloclinium macrocephalum</i> *	u
<i>Chamaecrista mimosoides</i>	u
<i>Hypoxis hemerocallidea</i>	u
<i>Ipomoea obscura</i>	u
<i>Nidorella resedifolia</i>	u
<i>Zinnia peruviana</i> *	u
Secondary <i>Heteropogon contortus</i> - <i>Melinis repens</i> grassland	
<i>Heteropogon contortus</i>	1
<i>Cymbopogon caesius</i>	2
<i>Senecio inomatus</i>	3
<i>Hyparrhenia hirta</i>	3
<i>Felicia muricata</i>	c
<i>Hilliardiella oligocephala</i>	c
<i>Nidorella hottentota</i>	c
<i>Helichrysum rugulosum</i>	c
<i>Hermannia depressa</i>	c
<i>Conyza podocephala</i>	c
<i>Cucumis zeyheri</i>	c
<i>Oxalis obliquifolia</i>	c
<i>Physalis viscosa</i> *	c
<i>Sonchus oleraceus</i> *	c
<i>Pentarrhinum inspidum</i>	c

Species	Abundance
<i>Euphorbia inaequilatera</i>	c
<i>Rhynchosia totta</i>	c
<i>Convolvulus sagittatus</i>	c
<i>Eriosema cf. burkei</i>	c
<i>Solanum delagoense</i>	c
<i>Alysicarpus rugosus</i>	c
<i>Wahlenbergia undulata</i>	c
<i>Indigofera filipes</i>	c
<i>Melinis repens</i>	1
<i>Verbena officinalis*</i>	lc
<i>Eragrostis chloromelas</i>	lc
<i>Aristida congesta barbicollis</i>	lc
<i>Cynodon dactylon</i>	lc
<i>Themeda triandra</i>	lc
<i>Eragrostis curvula</i>	lc
<i>Vachellia tortilis</i>	r
<i>Eucalyptus cf. camaldulensis*</i>	r
<i>Dichrostachys cinerea</i>	r
<i>Ehretia amoena</i>	r
<i>Combretum molle</i>	r
<i>Searsia lancea</i>	r
<i>Vachellia karoo</i>	r
<i>Vachellia sieberiana**</i>	r
<i>Hypoxis acuminata</i>	r
<i>Melinis nervigulumis</i>	r
<i>Aloe davyana</i>	r
<i>Digitaria eriantha</i>	r
<i>Asparagus cf. cooperi</i>	r
<i>Conyza albida*</i>	u
<i>Lippia rehmannii</i>	u
<i>Kohautia amatymbica</i>	u
<i>Lantana rugosa</i>	u
<i>Hermannia grandistipula</i>	u
<i>Senecio erubescens</i>	u
<i>Tagetes minuta*</i>	u
<i>Lactuca inermis</i>	u
<i>Raphionacme hirsuta</i>	u
<i>Corchorus asplenifolius</i>	u
<i>Solanum sisymbriifolium*</i>	u
<i>Vigna unguiculata</i>	u
<i>Campuloclinium macrocephalum*</i>	u
<i>Senecio erubescens</i>	u
<i>Zinnia peruviana*</i>	u
<i>Solanum lichtensteinii</i>	u
<i>Monsonia angustifolia</i>	u
<i>Nidorella resedifolia</i>	u
<i>Nidorella anomala</i>	u

Species	Abundance
<i>Helichrysum nudifolium</i>	u
<i>Zomia milneana</i>	u
<i>Jamesbrittenia aurantiaca</i>	u
<i>Seriphium plumosum</i>	u
<i>Xysmalobium undulatum</i>	u
<i>Diospyros lycioides</i>	u
<i>Gomphrena celosioides*</i>	u
<i>Oxalis corniculata*</i>	u
<i>Ipomoea obscura</i>	u
<i>Osteospermum scariosum</i>	u
<i>Dicoma anomala</i>	u
<i>Ornithogalum tenuifolium</i>	u
<i>Eragrostis pseudosclerantha</i>	u
<i>Pogonarthria squarrosa</i>	u
<i>Trichoneura grandiglumis</i>	u
<i>Eragrostis racemosa</i>	u
<i>Eragrostis gummiflua</i>	u
<i>Eragrostis superba</i>	u
Secondary <i>Hyparrhenia hirta</i> - <i>Heteropogon contortus</i> grassland	
<i>Hyparrhenia hirta</i>	1
<i>Heteropogon contortus</i>	2
<i>Physalis viscosa*</i>	c
<i>Felicia muricata</i>	c
<i>Helichrysum rugulosum</i>	c
<i>Nidorella hottentota</i>	c
<i>Nidorella resedifolia</i>	c
<i>Crepis hypochaeridea*</i>	c
<i>Pentarrhinum inspidum</i>	c
<i>Aristida congesta congesta</i>	c
<i>Melinis repens</i>	c
<i>Eragrostis chloromelas</i>	c
<i>Eragrostis racemosa</i>	c
<i>Cynodon dactylon</i>	c
<i>Eragrostis pseudosclerantha</i>	c
<i>Aristida congesta barbicollis</i>	c
<i>Melia azedarach*</i>	r
<i>Senegalia caffra</i>	r
<i>Ziziphus zeyheriana</i>	r
<i>Landolphia capensis</i>	r
<i>Jamesbrittenia aurantiaca</i>	r
<i>Tecoma stans*</i>	r
<i>Campuloclinium macrocephalum*</i>	u
<i>Cucumis zeyheri</i>	u
<i>Senecio cf. affinis</i>	u
<i>Dichrostachys cinerea</i>	u
<i>Osteospermum scariosum</i>	u
<i>Pseudognaphalium luteo-album</i>	u

Species	Abundance
<i>Vachellia karoo</i>	u
<i>Hilliardiella oligocephala</i>	u
<i>Tephrosia capensis</i>	u
<i>Eragrostis rigidior</i>	u
<i>Hypoxis hemerocallidea</i>	u
<i>Anthospermum rigidum</i>	u
<i>Sonchus oleraceus*</i>	u

lc - locally dominant
r - 1-2 individuals
u - uncommon
c - common (10-25% cover)
3 - 25-50% cover
2 - 50-75% cover
1- 75 - 100% cover