A classification and description of the shrubland vegetation on Platberg, Eastern Free State, South Africa

Authors:
Robert F. Brand[1]
Pieter J. du Preez[2]
Leslie R. Brown[1]

Affiliations:
[1]Applied Behavioural Ecology and Ecosystem Research Unit, Department of Environmental Sciences, University of South Africa, South Africa

[2]Department of Plant Sciences, University of the Free State, South Africa

Correspondence to:
Leslie R. Brown

e-mail:
lrbrown@unisa.ac.za

Postal address:
Department of Environmental Sciences, Unisa (Florida campus), P/Bag X6, Florida, 1710, South Africa

Keywords:
Drakensberg Alpine Centre (DAC); Braun–Blanquet; TWINSPAN; floristic links; inselberg

Dates:
Received: 12 Mar. 2009
Accepted: 17 Sept. 2009
Published: 22 Oct. 2009

How to cite this article:
Brand, R.F., Du Preez, P.J. & Brown, L.R., 2009, 'A classification and description of the shrubland vegetation on Platberg, Eastern Free State, South Africa', *Koedoe* 51(1), Art. #696, 11 pages. DOI: 10.4102/koedoe.v51i1.696

This article is available at:
http://www.koedoe.co.za

© 2009. The Authors. Licensee: OpenJournals Publishing. This work is licensed under the Creative Commons Attribution License.

ABSTRACT

The natural environment is constantly under threat from human-related activities. Platberg, overlooking the town of Harrismith in the Free State, is an inselberg that presents a refuge for indigenous plants and animals. The natural vegetation of the area is threatened by various farming and grazing practices, as well as by commercial development. In order to obtain baseline data and to obtain an improved understanding of the long-term ecological processes, the vegetation of Platberg was investigated to establish Afroalpine floristic links to the Drakensberg, as well as for the management of natural resources. From a Two-Way Indicator-Species Analysis (TWINSPAN) classification, refined by Braun–Blanquet methods, four major plant communities were identified, which were subdivided into fynbos, wetland, woody/shrub and grassland. A classification and description of the shrubland is presented in this article.

The analysis showed the shrubland divided into 20 different plant communities, which are grouped into eight major communities, 13 sub-communities and eight variants. A total of 450 species was recorded from 109 relevés. A total of 24 endemic, or near-endemic, and Red Data species belonging to the Drakensberg Alpine Centre (DAC) was collected, with 22 alien (introduced) species also being recorded. Numerous floristic links with the DAC, the Cape Floristic Region and the Grassland Bioregions to the north and west were found.

Conservation implications: The floristic composition and community analysis proves Platberg to be an important centre for plant diversity, with high species richness, a variety of habitats, and complex ecosystems. This description of the woodland communities can be used to assist with the setting of criteria for the management and protection of inselbergs in the province.

INTRODUCTION

The natural environment is continually under threat from development, pollution, alien species invasions, and other human-related actions (Millennium Ecosystem Assessment 2005). The increasing pressures imposed by such actions threaten to lead to a loss of plant and animal species, which could lead to the degradation of an area. The prevention of large-scale loss of biodiversity is a daunting challenge facing the world today (Huntley 1991). In order to conserve our natural resources, ecosystems must be studied to allow for the compilation of an inventory of our natural resources. Platberg, in the Eastern Free State, overlooking the town of Harrismith, is an inselberg that serves as a refuge for indigenous plants and animals.

Plant communities occurring on inselbergs form unique phytosociological associations (Parmentier *et al*. 2006; Porembski & Brown 1995; Sarthou & Villiers 1998). However, inselberg plant associations also feature numerous species that occur in the vegetation matrix surrounding the inselbergs (Mutke *et al.* 2001), in which the inselberg flora is embedded.

The unique, high-altitude conditions found above 2 000 m in the Drakensberg region of South Africa lead to high levels of endemism in plants and animals (Carbutt & Edwards 2006; Hillard & Burtt 1987; Mucina & Rutherford 2006; Van Wyk & Smith 2001). Such high levels of endemism are due to the compression of climatic life zones within a relatively small space, which makes mountains hotspots for biological diversity (Körner 2003). Mountains may be regarded as analogous with an archipelago of islands in an 'ocean' of low-level vegetation types which act as an isolation factor (MacArthur & Wilson 2001; Taylor 1996). This, in turn, precludes plant species with less mobile seed dispersal mechanisms from propagating over wide ranges, and allows for high levels of endemism to develop (Hilliard & Burtt 1987; Taylor 1996). High levels of endemism mean that a large proportion of the available gene pool is unique to a particular site, and inselbergs and mountains, therefore, have an important role to play in the maintenance of genetic diversity (Mucina & Rutherford 2006; Taylor 1996).

Prior to the current study, no extensive vegetation surveys had been undertaken on Platberg, with only limited opportunistic floristic collections being undertaken in the mid-1960s by Mrs M.L. Jacobs, with some 50 relevés being sampled by Professor H.J.T. Venter of the University of the Free State (UFS) between 1975 and 1977. (The vouchers from both collectors are housed at the Geo Potts Herbarium, UFS.) Due to the proposed commercial development by the Platberg Conservancy, as well as the aims of the Maloti–Drakensberg Transfrontier Project, it was considered necessary to undertake a more detailed and extensive ecological survey aimed at describing and classifying the vegetation of the Platberg.

Study area

Location

Platberg is the largest inselberg situated in the area approximately 60km north of the main massif of the Maluti/Drakensberg range (Geological Survey maps; 1:50 000 scale). It also has the highest peak in the area, Mtabazwe (2 394.5 m; Survey Beacon 44), as well as the largest inselberg capped by igneous rock (Du Toit 1956; King 1963; McCarthy & Rubidge 2005; Norman & Whitfield 1998). It forms a distinctive

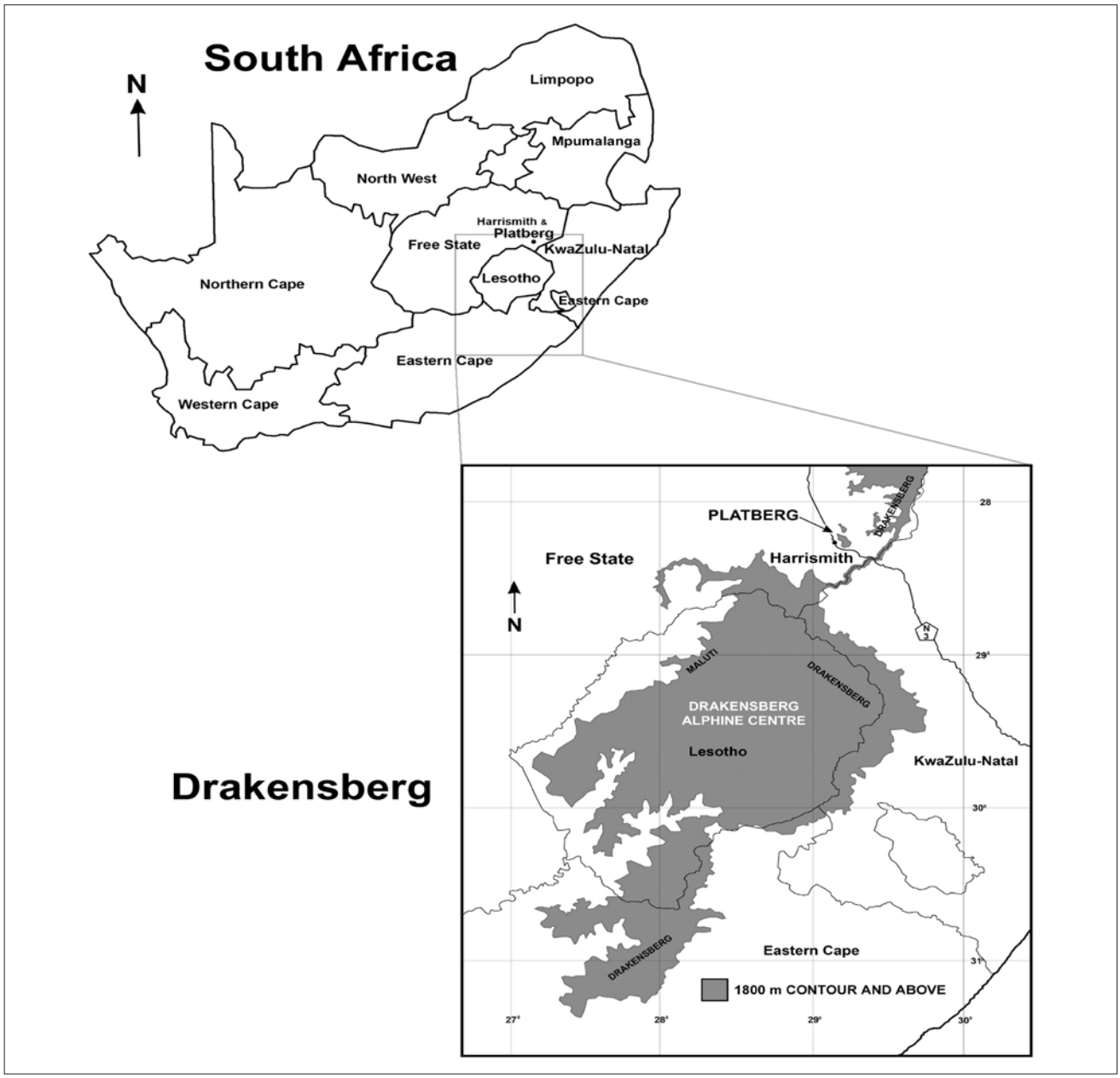


FIGURE 1
Location of the study area

flat-topped, L-shaped plateau with clear-cut contact between the Stormberg volcanism and the Cave Sandstone of the Clarens Formation.

Platberg is located at latitude S 29°–10′ and longitude E 28°–16′ on the N3 highway between Johannesburg and Durban (see Figure 1). The altitude ranges from 1 900 m to 2 394 m, with the surface area of the study site being approximately 3 000 ha. The slopes are steep, with numerous vegetated gullies and boulder scree slopes below the vertical cliffs, which are 20 m to 45 m high. Waterfalls cascade down the southern cliffs after rain.

Vegetation

Platberg falls within the Grassland Biome (or the Drakensberg Grassland Bioregion; Mucina & Rutherford 2006), with generally short to tall sour grasses (Acocks 1988; Low & Rebelo 1998). It also has elements of Fynbos and False Karoo (Acocks) or Succulent Karoo (Low & Rebelo 1998), as well as elements of Temperate and Transitional Forests, and specifically of the Highland Sourveld (Acocks) biomes.

The vegetation description presented by Mucina & Rutherford (2006) shows the study area located within the Northern Drakensberg Highland Grassland (Gm5) and Lesotho Highland Basalt Grassland (Gd8), both within the Drakensberg Grassland Bioregion.

Geology

Platberg consists of layers of the Karoo Supergroup which stratigraphically lie immediately below the volcanics of the Drakensberg Formation, which is the youngest (Jurassic, 65 million years) unit of the Stormberg Group (Brand, Du Preez & Brown 2008).

Topography and soils

Figure 2 shows a terrain-form sketch of the study area. The steep slopes are composed of shale and mostly sandstone of the Clarens Formation intersected by dolerite dykes, resulting in benches, deep ravines and terraces. Numerous sandstone and basalt boulders form scree and boulder slopes, resulting

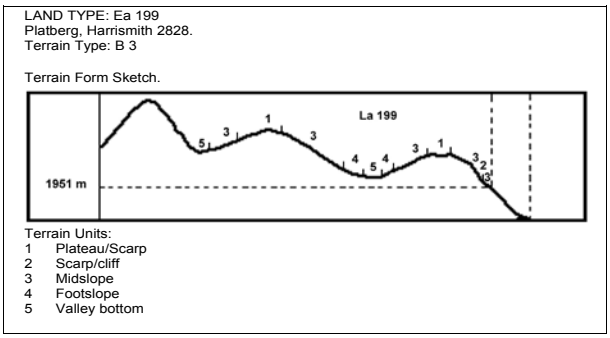


FIGURE 2
Landscape sketch showing the principal terrain units (Land Type Survey Staff 1991)

in miscellaneous soil forms, characteristic of Ib land type, specifically Mispah (Ms), and Glenrosa (Gs), soil forms (Du Preez 1991; MacVicar *et al.* 1991; Mucina & Rutherford 2006). There are affinities with Fa land types, with the undulating rocky landscape being dominated by shallow Ms and Gs soil forms (Land Type Survey Staff 1991; Smit *et al.* 1993).

The summit plateau is composed of igneous rock, specifically basalt and dolerite, established from thin section studies of Platberg rock samples (Brand *et al.* 2008). The soils are generally shallow (20–200 mm), with the deepest being < 500 mm. Derived from basalt and dolerite, they are shown to have even proportions of course sand, fine sand, clay, silt and moderate to high organic matter content. The main land type is Ea comprising clay vertic, melanic or red diagnostic horizons (MacVicar *et al.* 1991; Mucina & Rutherford 2006; Smit, Bredenkamp & Van Rooyen 1993), with a clay content of 8% to 60%, dependant on soil series (Land Type Survey Staff 1991).

Climate

The average annual precipitation for the study area ranges between 800 and 1 200 mm per annum, with the mean daily maximum temperatures fluctuating between 22°C to 24°C for January, and the lowest daily mean temperatures for June and July of –2°C to 0°C. The daily mean relative humidity for the most humid month, March, varies between 68% and 72%, with the daily minimum relative humidity for July and August varying between 32% and 38% (Mucina & Rutherford 2006; Schulze 1997; South African Weather Services 2007; Van Zinderen Bakker 1973).

Snow, which is recorded at the top of Platberg during most winters, can remain on the ground for up to two weeks (D. Weaver, G. Weaver, S. Falanga & C. Gobbles pers. comm. 2008). Water in south-facing gullies may stay frozen for several weeks at a time (Mucina & Rutherford 2006; Van Zinderen Bakker 1973). Possible heave soils are present on Mtabazwe (the highest point on Platberg; personal observation c.p.w. Hilliard & Burtt 1987) and might be a significant factor in controlling vegetation at high altitudes (Hilliard & Burtt 1987; Mucina & Rutherford 2006).

METHODS

A total of 109 sample plots was placed within the shrubland communities of Platberg. The aim of the study was to sample above the 1 900 m contour, in order to work within the limits set by Killick (1963, 1978a, 1978b), who regarded the region in the Drakensberg above the 1 800 m as a distinct floristic region, namely the Afroalpine Region. Plot sizes were fixed at 100 m² (Du Preez 1991, 1992; Du Preez & Bredenkamp 1991a; Malan 1998; Westhoff & Van der Maarel 1980; Whitaker 1980,). In all sample plots, each species was recorded, with all woody plants being counted and the cover abundance being estimated using the Braun–Blanquet cover scale (Mueller-Dombois & Ellenberg 1974; Whitaker 1980).

Fieldwork was undertaken in February/March 2005, and again at the start of the summer growing season from October to December 2005, continuing until the end of March 2006. Final follow-up field work was conducted during January 2007.

Over 1 500 floristic collections were made and identified at the UFS Herbarium and the National Herbarium, Pretoria. All taxa names conform to Germishuizen & Meyer (2003). In the structural assessment of the woody vegetation, all woody species were divided into three groups based on height, namely shrubs (> 0–2 m), trees (> 2–6 m) and tall trees (> 6 m) (Brand 2007).

Habitat, as well as floristic data, was processed using TURBOVEG (Hennekens 1996a). A first approximation was undertaken using the two-way indicator-species analysis classification (TWINSPAN) algorithm (Hill 1979). The result was refined with the aid of the MEGATAB table editing program (Hennekens 1996b), in order to obtain a phytosociological table indicating the classification of the vegetation types, with their species composition. Further refinement of the classification was undertaken through the application of Braun–Blanquet procedures (Barbour, Burk & Pitts 1987; Kent & Coker 1992).

Numerous phytosociological studies have shown this to be a suitable numerical classification system to use (for example Barrett *et al.* 2006; Bredenkamp & Brown 2003; Du Preez 1991; Du Preez & Bredenkamp 1991a; Grobler, Bredenkamp & Brown 2002; Malan 1998; Pond *et al.* 2002). MEGATAB (Hennekens 1996b) was used to generate a phytosociological table, with further refinements being undertaken in Excel (Kent & Coker 1992).

Erosion was estimated using the three-scale numerical system, where 1 = no erosion, 2 = moderate and 3 = high (Brand 2007). Slope was estimated using the following scale in degrees: Flat – 0° to 3°; Gradual – 3° to 8°; Moderate – 8° to 16°; Steep – 16° to 26°; Very Steep – 26° to 45°; Greater than – 45°. Soil depths were measured with a probe graded for 5 cm intervals to a maximum of 30 cm.

RESULTS

Vegetation classification

A total of 450 species was recorded for the woody shrub vegetation. The floristic analysis identified 20 plant communities, which are grouped into eight major communities (see Table 1) (online appendix)

1. *Themeda triandra–Watsonia lepida* community
   - 1.1 *Themeda triandra–Watsonia lepida–Harpochloa falx* sub-community
     - 1.1.1 *Cyphia elata* variant
     - 1.1.2 *Cliffortia ramosissima* variant
   - 1. 2 *Themedatriandra–Watsonialepida–Andropogon appendiculatus* sub-community
     - 1.2.1 *Helictotrichon longifolium* variant
     - 1.2.2 *Lotononis lotononoides* variant
   - 1.3 *Themeda triandra–Watsonia lepida–Ficinia stolonifera* sub-community
   - 1.4 *Themeda triandra–Watsonia lepida–Printzia pyrifolia* sub-community
   - 1.5 *Themeda triandra–Watsonia lepida–Tristachya leucothrix* sub-community
2. *Leucosidea sericea–Hyparrhenia hirta* community
3. *Rhus pyroides–Pteridium aquilinum* community
4. *Diospyros whyteana–Euclea crispa* community
   - 4.1 *Diospyros whyteana–Euclea crispa–Bowiea volubilis* sub-community
     - 4.1.1 *Maytenus undata* variant
     - 4.1.2 *Bidens pilosa* variant
   - 4.2 *Diospyros whyteana–Euclea crispa–Themeda triandra* sub-community

African Protected Area Conservation and Science
Article #696

5. *Kiggelaria africana–Crassula lanceolata* community
   5.1 *Kiggelaria africana–Crassula lanceolata–Senecio isatideus* sub-community
   5.2 *Kiggelaria africana–Crassula lanceolata–Zehneria scabra* sub-community
6. *Buddleja loricata–Rhus divaricata* community
   6.1 *Buddleja loricata–Rhus divaricata–Gallium scabrelloides* sub-community
   6.2 *Buddleja loricata–Rhus divaricata–Stachys grandifolia* sub-community
      6.2.1 *Clutia hirsuta* variant
      6.2.2 *Stachys grandifolia* variant
7. *Asparagus ramosissimus–Leucosidea sericea* community
   7.1 *Asparagus ramosissimus–Leucosidea sericea–Fraxinus angustifolia* sub-community
   7.2 *Asparagus ramosissimus–Leucosidea sericea–Plectranthus grallatus* sub-community
8. *Senecio inornatus–Thamnocalamus tessellatus* community

The shrubland vegetation is found on the steep slopes; in gullies, ravines and along water courses; on the boulder scree slopes; on the cliffs at their bases, and on the rock ridges and outcrops of the summit plateau area. On the cool south and east side of Platberg, dense continuous woody stands of shrubs occur.

The general vegetation of the Shrubland Community is characterised by plants from Species Group AL (Table 1), particularly *Leucosidea sericea*, while species from Species Groups AA and W are also prominent locally. *Buddleja salviifolia* (Species Group X) is present in most communities. *Stachys grandifolia* (Species Group AE) has a strong, but more limited and widely scattered, presence. The climber, *Clematis brachiata* (Species Group AG), too, has a strong, though scattered, presence in the mountain bamboo *Thamnocalamus tessellatus* community.

1. *Themeda triandra–Watsonia lepida* community

The *Themeda triandra–Watsonia lepida* community is found on all aspects of the summit plateau and the steep footslopes. The altitude varies between 1 920 and 2 340 m, with the soil being shallow (40 mm) to deep (300 mm). The summit soils are well drained and composed of degraded igneous rocks. The footslopes are composed of a mix of igneous and sandstone of the Clarens Formation of Ib soil type. Rock cover varies from 5% to 45%, with erosion and levels of trampling varying from zero to moderate or high. For small trees, the total canopy cover varies between 5% and 30%, while tall trees had a cover ranging between 5% and 10%. The total canopy cover varied from 5% to 80% for shrubs. Herbaceous cover varied between 5% and 50%.

Species belonging to Species Group M are characteristic of the community and include the perennial bunch grasses *Themeda triandra, Tristachya leucothrix, Eragrostis racemosa*; the shrubs *Indigofera hedyantha* and *Athrixia phylicoides*; the bulb *Watsonia lepida*; the forbs *Ajuga ophyrdis, Aster bakeranus, Anthspermum herbaceum, Euphorbia striata, Helichrysum dasycephalum Helichrysum nudifolium, Heliophila rigidiuscula, Lotononis procumbens, Rhynchosia totta, Senecio glaberrimus, Schistostephium crataegifolium, Senecio rhomboideus, Vernonia natalensis,* and the grass root parasite *Thesium pallidum.*

The community is dominated by the shrub *Leucosidea sericea* (Species Group AL); the perennial grasses *Themeda triandra, Tristachya leucothrix*; and the bulb *Watsonia lepida* (Species Group M). Prominent species include the grasses *Cymbopogon dieterlenii* (Species Group T), and *Eragrostis curvula* (Species Group Y), and the forb *Senecio inornatus* (Species Group AL). An average of 32.22 species per 100 m² was recorded for the community under review.

1.1 *Themeda triandra–Watsonia lepida–Harpochloa falx* sub-community

The small geophyte sub-community is located on all aspects of Platberg, including on the flat, rocky summit outcrops and on the very steep slopes > 45°. Soils are derived from either igneous summit rocks or sedimentary Cave Sandstone. Soils are shallow, being between 10 and 60 mm, or > 300 mm deep, and seasonally damp. Moderate surface erosion was recorded, with no evidence of trampling. Rock cover was found to vary between 20% and 50%.

The sub-community is characterised by the presence of the small geophyte *Albuca humilis* and the forb *Wahlenbergia cuspidata* (Species Group C). Prominent species include the grass *Harpochloa falx* (Species Group I), and *Eragrostis curvula* (Species Group Y); the sedge *Ficinia gracillis* (Species Group I); and the geophyte *Watsonia lepida* (Species Group M). The average number of species recorded per 100 m² was 40.5.

Two variants of the sub-community are recognised:

1.1.1 ***Cyphia elata*** **variant:** The variant is characterised by species from Species Group A, being dominated by the shrub *Buddleja salviifolia* (Species Group X) and the climber *Clematis brachiata* (Species Group AG).

1.1.2 ***Cliffortia ramosissima*** **variant:** The variant is characterised by species from Species Group B. The vegetation is dominated by the fynbos shrub *Cliffortia ramosissima* (Species Group B); the grasses *Heteropogon contortus* (Species Group H), *Themeda triandra,* and *Tristachya leucothrix* (Species Group M); and the geophyte *Watsonia lepida* (Species Group M).

1.2 *Themeda triandra–Watsonia lepida–Andropogon appendiculatus* sub-community

The *Themeda triandra–Watsonia lepida–Andropogon appendiculatus* sub-community is located on the cool southern aspects, on terrain with gradients ranging from 8° to > 45°. It has two altitudinal locations, a lower one at 1 976 to 2 150 m on the sandstones of the Clarens Formation, and a higher one at 2 287 m, on the rolling summit plateau. Rock cover varies between 5% and 35%. Soils are 300 mm deep and seasonally moist, with no signs of erosion or trampling. The canopy cover, which varies between 5% and 40%, is provided by shrubs.

The sub-community, which is characterised by species from Species Group E (Table 1), includes the tall bunch grass *Andropogon appendiculatus* and the forbs *Monsonia attenuata* and *Silene bellidioides.*

The vegetation is dominated by two bunch grasses, *Andropogon appendiculatus* (Species Group E) and *Themeda triandra* (Species Group M), and the shrub *Leucosidea sericea* (Species Group AL). Grasses and sedges that are prominent include *Aristida monticola* and *Carex zuluensis,* (Species Group K). Other species also present include the bulb *Watsonia lepida* (Species Group M); the alien bramble *Rubus ludwigii* (Species Group T); the forb *Senecio inornatus*; and the geophyte *Agapanthus campanulatus* (Species Group AL). An average of 24.6 species was recorded per 100 m².

1.2.1 ***Helictotrichon longifolium*** **variant:** The variant is characterised by the absence of species from Species Groups C, D and F. The vegetation is dominated by the shrub *Leucosidea sericea* (Species Group AL), and the bunch grasses *Andropogon appendiculatus* (Species Group E) and *Themeda triandra* (Species Group M).

1.2.2 ***Lotononis lotononoides*** **variant:** The variant is characterised by species from Species Group D. Species that dominate this variant include the shrubs *Lotononis lotononoides* (Species Group D) and *Leucosidea sericea* (Species Group AL); the grass *Themeda triandra*; and the bulb *Watsonia lepida* (Species Group M).

1.3 *Themeda triandra–Watsonia lepida–Ficinia stolonifera* sub-community

The sub-community is located at 1 925 to 2 218 m altitudes, on

the southern and south-western aspects with moderately steep to very steep slopes. Rock size varies from gravel < 10mm to boulders > 200mm. The geology is the Cave Sandstone of the Clarens Formation, plateau basalt and dolerite dykes. Rock exposure varies from 0% to 25%. Soil erosion and trampling are zero to moderate. The soils range from shallow (60 to 180 mm) to deep > 300 mm. Several relevés had a canopy cover of 15% to 50% for shrubs.

The sub-community, which is characterised by species from Species Group F, includes the sedge *Ficinia stolonifera* and the forbs *Haplocarpha scaposa, Linum thunbergii* and *Sebaea exigua.*

Plants that dominate the sub-community include the shrub *Leucosidea sericea* (Species Group AL), and the grasses *Heteropogon contortus* (Species Group H); *Themeda triandra* (Species Group M), and *Eragrostis curvula* (Species Group Y). Other important species include the shrub *Rhus discolor* (Species Group P); the grasses *Harpochloa falx* (Species Group I), *Aristida monticola, Helictotrichon longifolium* (Species Group K), *Tristachya leucothrix* (Species Group M), *Cymbopogon dieterlenii* (Species Group T), and *Eragrostis curvula* (Species Group Y); and the forb *Senecio inornatus* (Species Group AL), which is found in moist locations. The average number of species recorded per 100 m² was 41.2. The species composition of tall and short perennial bunch grasses indicates the grassland on rocky terrain in dynamic transition with colonisation by low woody species (Mucina & Rutherford 2006).

1.4 *Themeda triandra–Watsonia lepida–Printzia pyrifolia* sub-community

The small sub-community is located on the southern and south-western aspects, between 1 940 m and 2 057 m on the very steep slopes below the basalt cliffs on rocky ridges and outcrops of sandstone and dolerite. Rock size is > 500mm, with rock cover ranging between 10% and 40%. No trampling or erosion was noted. Soils are shallow (60 to 1200 mm) and > 300 mm deep. Canopy cover for shrubs varies between 15% and 60%.

Species from Species Group J, namely the shrubs *Printzia pyrifolia* and *Indigofera hewittii* and the perennial bunch grass *Helictotrichon turgidulum* are diagnostic for this variant.

The small tree *Leucosidea sericea* and the shrubs *Myrsine africana* (Species Group AL) *Printzia pyrifolia* (Species Group J), and *Calpurnia sericea* (Species Group T) dominate the vegetation. A well-developed grass layer includes *Aristida monticola* (Species Group K), *Themeda triandra* (Species Group M), *Cymbopogon dieterlenii* (Species Group T), and *Ehrharta erecta* (Species Group AL). In this small community, an average of 37.3 species per 100 m² was recorded.

1.5 *Themeda triandra–Watsonia lepida–Tristachya leucothrix* sub-community

The sub-community is located at altitudes ranging between 2 027 m and 2 047 m, on various aspects, with gradual to steep slopes on the mid-slopes below the basalt cliffs. Rock size is > 200 mm. Rock exposure ranges from 0% to 35%. Levels of trampling and erosion are zero to moderate. Soils are well drained and 40 mm to 200 mm deep. The sub-community has shrubs, which provide canopy cover between 5% and 50%.

The sub-community is characterised by species from Species Group L, including the forb *Gerbera piloselloides,* the tuberous *Pentanisia prunelloides* and the geophyte *Cyanotis speciosa*. The vegetation is dominated by the grasses *Themeda triandra* and *Tristachya leucothrix* (Species Group M). The shrub *Leucosidea sericea* and forb *Senecio inornatus* (Species Group AL) are prominent. The grasses *Eragrostis racemosa* (Species Group M) and *E. curvula* (Species Group Y) are prominent in dense patches scattered throughout the area.

The sub-community occurs on rocky, grassed terrain on the Farm Platberg. Evidence of the impact of grazing by cattle and other smaller livestock, as well as their paths, is widespread. An average of 28 species per 100 m² was recorded for the degraded community.

2. *Leucosidea sericea–Hyparrhenia hirta* community

The *Leucosidea sericea–Hyparrhenia hirta c*ommunity is located on the warm northern and north-western aspect, at 1 930 to 2 052 m above sea level, on steep to very steep slopes (16° to 45°). Rock size varies from < 1 mm, 10 to 50 mm, with boulders > 200 m. The community is located on Cave Sandstone with < 5% rock exposure on seasonally damp soils with depths ranging from 60 to 100 mm and > 300 mm. Though no surface erosion was recorded, levels of trampling varied from none to heavy. The total percentage canopy cover for small trees was 5% to 10%, and 5% for shrubs, while herbaceous cover ranged from 7% to 50%.

The perennial grass *Hyparrhenia hirta* (Species Group N) was found to be characteristic for the community. The vegetation is dominated by the small tree *Leucosidea sericea* (Species Group AL) and the grass *Hyparrhenia hirta* (Species Group N). The shrubs *Calpurnia sericea* (Species Group T) and *Rhus discolor* (Species Group P); the grass *Eragrostis curvula* (Species Group Y); and the forbs *Senecio inornatus* (Species Group AL) and *Clutia affinis* (Species Group AF) are prominent locally. An average of 28.7 species per 100 m² was recorded in the six relevés.

3. *Rhus pyroides–Pteridium aquilinum* community

The shrub community occurs at low altitudes of between 1 996 and 2 034m on the footslopes of the Platberg, on the southern and south-western aspects. The slope was found to vary from gradual to very steep. Soils are a mix of Cave Sandstone and igneous rocks. Rock cover ranges from 0% to 25%, with no erosion or trampling seen. Soils are seasonally damp and 180 to > 300 mm deep. Canopy cover ranges between 70% and 95%, and is dominated by the 1.8 m tall fern, *Pteridium aquilinum*.

The fern, *Pteridium aquilinum* (Species Group O), is diagnostic and dominant for this community. Prominent species include *Calpurnia sericea* (Species Group T) and *Buddleja salviifolia* (Species Group X); the perennial grass *Eragrostis curvula*; the shrub *Rhus pyroides* (Species Group Y); and the forb *Senecio inornatus* (Species Group AL).

Stands of the dense and distinct community, which show the invasion of the bracken into the grassland are indicative of disturbance (Du Preez 1991). Four relevés, with an average of 25.1 species per 100 m² relevé, were recorded for the community.

4. *Diospyros whyteana–Euclea crispa* community

The community is located at altitudes between 1 944 m and 2 088 m, on the north and north-eastern aspects, on moderately angled footslopes. Rock cover is 0% to 10% with stones > 200 mm. Soils are generally > 300 mm deep, with some medium depth (100 to 120 mm) sections. The geology is Cave Sandstone with scree rubble (a mixture of dolerite and basalt). Moderate to high levels of trampling and soil erosion were recorded. The canopy cover was found to be 20% to 70% for small trees and 10% to 40% for shrubs. The herbaceous cover is poor, and was found to vary between 0% and 5%.

The community has a well-developed shrub layer, which is characterised by species from Species Group S, namely the shrubs *Diospyros whyteana, Maytenus heterophylla, Euclea crispa, Rhus dentata,* and *Osyris lanceolata,* and the weedy forbs *Bidens pilosa* and *Achyranthus aspera* var. *sicula.*

The vegetation is dominated by the shrubs *Diospyros whyteana, Maytenus heterophylla, Euclea crispa* (Species Group S), and *Leucosidea sericea* (Species Group AL). Prominent species include the shrubs *Rhus dentata, Osyris lanceolata* (Species Group S), *Buddleja salviifolia* (Species Group X), *Heteromorpha arborescens*,

and *Rhus pyroides,* and the climber *Dioscorea sylvatica* (Species Group Y). The herbaceous layer is not well developed with the grass *Eragrostis curvula* (Species Group Y), as well as the under-story grass *Ehrharta erecta* (Species Group AL), present. An average of 29.44 species per 100 m² was recorded in 16 relevés.

Two sub-communities, including one with two variants, were identified:

4.1 *Diospyros whyteana–Euclea crispa–Bowiea volubilis* sub-community

The sub-community is located on mid-slopes at approximately 2 100 m on the north, north-eastern and south-western aspects, with gradual to steep (8° to 26°) slopes. The geology is Cave Sandstone, with scree derived from the higher igneous rocks. Rock cover varies between 0% and 10% on medium to deep (100 to > 300 mm) soils. The surface erosion and levels of trampling are moderate to high. Total canopy cover for small trees ranges from 20% to 80%, and that for shrubs from 0% to 40%.

The rare Red Data geophytic climber *Bowiea volubilis* (Species Group Q) is characteristic of this community. The vegetation is dominated by three shrubs: *Diospyros whyteana, Maytenus heterophylla,* and *Euclea crispa* (Species Group S). Other prominent species include *Rhus dentata* (Species Group S), *Buddleja salviifolia* (Species Group X), *Heteromorpha arborescens,* and *Rhus pyroides* (Species Group Y). Forbs include the weedy *Bidens pilosa* and *Achyranthus aspera sp sicula* (Species Group S). The average number of species recorded per 100 m² was 28.1.

The *Diospyros whyteana–Euclea crispa–Bowiea volubilis* sub-community has two variants:

4.1.1 ***Maytenus undata* variant:** The shrub variant is characterised by species from Species Group R. The vegetation is dominated by the small trees *Euclea crispa, Maytenus heterophylla* and *Diospyros whyteana* (Species Group S). The shrubs *Maytenus undata* (Species Group R), *Buddleja salviifolia* (Species Group X), *Heteromorpha arborescens* (Species Group Y), *Rhamnus prinoides* (Species Group AF), and *Leucosidea sericea* (Species Group AL) are prominent locally.

4.1.2 ***Bidens pilosa* variant:** The absence of species from Species Group R is characteristic. The vegetation is dominated by the shrubs *Diospyros whyteana,* (Species Group S), *Buddleja salviifolia* (Species Group X), *Heteromorpha arborescens,* and *Rhus pyroides* (Species Group Y) and the weed *Bidens pilosa* (Species Group S). Other prominent species include the shrubs *Euclea crispa, Rhus dentata*, and *Maytenus heterophylla* (Species Group S), and the weed *Achyranthus aspera* var. *sicula* (Species Group S).

4.2 *Diospyros whyteana–Euclea crispa–Themeda triandra* sub-community

The sub-community is located at relatively low altitudes of between 1 940 m and 2 084 m on the eastern, south-eastern and northern aspects. The slopes are moderate to steep. The bedrock geology is sandstone and shale of the Clarens Formation. The community is located on the foot or mid-slopes, with moderate to high levels of erosion and trampling. Rock exposure ranges between 0% and 10%, with an exception of 25% for one relevé. The soils are damp, with black humus > 300 mm deep. Woody species dominate the sub-community with the canopy cover for small trees ranging between 20% and 70%, while shrubs have between 10% to 80% cover.

The sub-community is characterised by the absence of Species Groups Q and R and is dominated by the small trees and shrubs *Diospyros whyteana, Maytenus heterophylla*, *Rhus dentata* (Species Group S) and *Leucosidea sericea* (Species Group AL). Other prominent species include *Buddleja salviifolia* (Species Group X), *Heteromorpha arborescens, Eragrostis curvula,* and *Rhus pyroides,* and the climbers *Dioscorea sylvatica* (Species Group Y), *Clematis brachiata* (Species Group AG), and *Myrsine africana* (Species Group AL). Within eight sample plots an average number of 30.75 species per 100 m² was recorded.

5. *Kiggelaria africana–Crassula lanceolata* community

The *Kiggelaria africana–Crassula lanceolata* community is composed of tall to small trees and comprises a significant proportion (27%) of the shrub/woody vegetation. It has two sub-communities, which are located on rocky ridges and scree slopes, predominantly on the south and south-west aspects, with scattered components on the south-eastern and northern slopes. The gradients are steep to very steep. The bedrock geology is sandstone and shale from the Clarens Formation, with the presence of igneous scree boulders > 500 mm. Rock exposure ranges from 0% to 40%. Altitudes range between 2 006 m and 2 238 m. The soils are seasonally damp, shallow (10 to 100 mm), or over 300 mm deep. Little or no trampling or erosion was found to be present. The canopy cover for small trees is between 5% and 15%, and for tall trees is 25% to 80%. There is a well-developed under-story layer of forbs and succulents, with cover varying between 15% and 75%.

The community is characterised by species from Species Group V and comprises the tall tree *Kiggelaria africana*, the climber *Zehneria scabra,* and the succulent *Crassula lanceolata sp. transvaalensis.*

The vegetation has a well-developed tree and shrub layer, and is dominated by the tall tree *Kiggelaria africana* (Species Group V); the small tree *Buddleja salviifolia* (Species Group X); the shrub *Rhus pyroides* (Species Group Y); the tall, under-story forb *Stachys grandifolia* (Species Group AE); and the ubiquitous shrub *Leucosidea sericea* (Species Group AL). Other woody species with significant presence are *Heteromorpha arborescens, Dioscorea sylvatica* (Species Group Y), and the small shrub *Myrsine africana* (Species Group AL). The tall forb *Senecio inornatus* (Species Group AL) is locally prominent. The grass layer is poorly developed, represented by only two grasses: *Eragrostis curvula* (Species Group Y) and *Ehrharta erecta* (Species Group AL). A total species count of 596 in 22 relevés averages 27.1 species per 100 m².

5.1 *Kiggelaria africana–Crassula lanceolata–Senecio isatideus* sub-community

The *Kiggelaria africana–Crassula lanceolata–Senecio isatideus* sub-community is located on the south and southwestern mid-slopes, with altitude ranging between 2 006 m and 2 219 m. The slopes are steep to very steep. The bedrock geology is sandstone of the Clarens Formation and basalt at the contact of the summit volcanics. Rock exposure varies between 5% and 35%. Surface erosion and trampling vary from zero to moderate. Soils are seasonally damp, shallow (20 to 200 mm), or over 300 mm deep. The canopy cover for tall trees is 10%, and for small trees is between 5% and 15%. For shrubs, cover is between 20% and 75%.

The sub-community is characterised by the absence of species from Species Groups U, Z and AC. The vegetation is dominated by the small tree *Leucosidea sericea* (Species Group AL), and the shrubs *Buddleja salviifolia* (Species Group X) and *Stachys grandifolia* (Species Group AE). The tree *Kiggelaria africana* (Species Group V) and the two grasses *Eragrostis curvula* (Species Group Y) and *Ehrharta erecta* (Species Group AL) have significant presence. Other species of importance include the tree *Heteromorpha arborescens*, the climber *Dioscorea sylvatica* (Species Group Y), and the tall forb *Senecio inornatus* (Species Group AL). An average of 31.29 different species per 100 m² was recorded for the sub-community.

5.2 *Kiggelaria africana–Crassula lanceolata–Zehneria scabra* sub-community

The sub-community is located on the extensive, mobile scree

Article #696 African Protected Area Conservation and Science

beds visible on the mid-slope at altitudes of between 2 055 m and 2 280 m, on the cool south side of Platberg. The incline is steep to very steep. Very large boulders are common, with rock exposure ranging from 10% to 40%. Soils are damp and generally shallow, with depths varying widely as a result of boulder packing. The geology is the contact between the Clarens Formation sandstone and the summit volcanics. No trampling or erosion is evident. Canopy cover for small trees varies between 5% and 15%, and for shrubs between 30% and 90%.

The sub-community is characterised by the presence of species from species Group U and includes *Chrysocoma ciliate, Zantedeschia albomaculata, Polystichum monticola, Aeollanthus buchnerian,* and *Myosotis semiamplexicaulis.* The vegetation is dominated by the trees *Buddleja salviifolia* (Species Group X), *Kiggelaria africana* (Species Group V), *Rhus pyroides* (Species Group Y), *Stachys grandifolia* (Species Group AE), and *Leucosidea sericea* (Species Group AL). Other species prominent in the sub-community include the shrubs *Myrsine africana* (Species Group AL), *Rhus divaricata* (Species Group AD), and *Clematis brachiata* (Species Group AG); and the forbs *Senecio inornatus, Asparagus asparagoides*, and A. *microraphis* (Species Group AL). The grass layer is poorly represented, with only *Ehrharta erecta* (Species Group AL) being present throughout.

The sub-community is a dense, shrub community, mostly located on the cool, moist south slopes of the Platberg. Individuals of the tree *Kiggelaria africana* are all below 6 m in height. The unstable substrate of igneous boulders has recently been colonised by plants. An average of 25.13 species per 100 m² was recorded for the sub-community.

6. *Buddleja loricata–Rhus divaricata* community

The community is located on the southern side of the Platberg, at altitudes ranging between 2 094 m and 2 119 m, on the extensive boulder scree slopes located on the steep to very steep shoulder below the summit basalt. The geology is sandstone bedrock, with the scree boulders composed of summit volcanics. Estimation of rockiness is difficult, as the communities are located almost exclusively on the vegetation growing on the accumulated, unstable boulders. Levels of trampling and erosion within the constraints of these communities range from zero to moderate. Soil depths vary greatly, depending on the location of the accumulated humus trapped by the boulders, from very shallow (10 mm) to > 300 mm deep. Canopy cover for tall trees ranges from 5% to 10%, for small trees from 5% to 50% and for shrubs from 20% to 100%. Herbaceous cover ranges from 1% to 50%, with some relevés having up to 75% cover.

The community is defined by species from Species Group AD, including the shrubs *Buddleja loricata* and *Rhus divaricata.*

The community is dominated by the tree *Leucosidea sericea* (Species Group AL), the shrub *Buddleja loricata* (Species Group AD), the tall under-story labiate forb *Stachys grandifolia* (Species Group AE), and the common climber *Clematis brachiata* (Species Group AG). The shrub *Rhus divaricata* (Species Group AG) is locally abundant. The paucity of grasses, forbs and geophytes for the community is a feature of the substrate, which is characterised by large, mobile boulders, which have very shallow, poorly developed soils. An average of 18.2 species per 100 m² was recorded for the community.

6.1 *Buddleja loricata–Rhus divaricata–Gallium scabrelloides* sub-community

The sub-community is located at altitudes of between 2 095 m and 2 225 m on the cool, moist south slopes of the Platberg, below the vertical igneous rocks on the steep to very steep slopes. Very large packed boulders comprise the scree community. Soils are damp, very shallow (10 mm) or > 300 mm deep. Canopy cover varies from 10% to 20% for tall trees, 5% to 60% for small trees and 20% to 80% for shrubs.

The sub-community is characterised by two species from Species Group AA: the soft, lax forb *Galium scabrelloides* and the fern *Polystichum pungens.*

The dominant species include the tree *Leucosidea sericea* (Species Group AL), the shrub *Buddleja loricata* (Species Group AD), the forb *Stachys grandiflora* (Species Group AE), and the climber *Clematis brachiata* (Species Group AG). There is poor representation of grasses, geophytes and forbs. The sub-community is regarded as species poor, with an average of 18.1 species per 100 m², which is the second lowest average for the woody shrub vegetation. The loose packing and precarious nature of the boulders, with very shallow soils, partially explains the paucity.

6.2 *Buddleja loricata–Rhus divaricata–Stachys grandifolia* sub-community

The sub-community is located on the mid-slope, at approximately 2 200 m on the southern aspect, with steep to very steep slopes. The geology is sandstone of the Clarens Formation and scree boulders of the Stormberg Volcanics. Scree boulders give rock exposure of between 10% and 20%, with soil depths ranging from shallow (10 mm) to > 300 m deep. Moderate trampling and erosion was recorded. Canopy cover ranges between 50% and 95% for shrubs. Evidence of fire is apparent, with the remains of burned tree stumps and shrubs.

The sub-community is characterised by the single species *Asparagus plumosus* (Species Group AC) and is dominated by the shrub *Buddleja loricata* (Species Group AD), and the under-story forb *Stachys grandifolia* (Species Group AE). Other prominent species include the tree *Leucosidea sericea* (Species Group AL), the shrubs *Rhus divericata* (Species Group AD) and *Polygala virgata* (Species Group AF), and the climber *Clematis brachiata* (Species Group AG). No grasses or geophytes are present, indicating a depaupered species community. Such depauperisation is also reflected in the low average of 17.5 species recorded per 100m².

6.2.1 ***Clutia hirsuta* variant:** While characterised by species from Species Group AB, the vegetation is dominated by the shrub *Buddleja loricata* (Species Group AD), and the two labiate forbs *Stachys grandifloria* (Species Group AE) and *Plectranthus grallatus* (Species Group AG).

6.2.2 **Stachys *grandifolia* variant:** The variant is differentiated from the *Clutia hirsuta* variant by the absence of species from Species Group AB. The vegetation is poorly developed, but dominated by the shrub *Buddleja loricata* (Species Group AD), and the labiate forb *Stachys grandifolia* (Species Group AE).

7. *Leucosidea sericia–Asparagus ramosissimus* community

The community is located on a north-western and south-eastern aspect, at altitudes ranging between 2 015 m and 2 236 m. The community is located on the footslope leading to the locally named 'Monkey Point', and on the south-eastern section of the promontory. The slope varies from gradual for the *Leucosidea sericia* woodland to very steep for the south-east community. Soils are a mix of damp, black turf and humus > 500 mm deep. Levels of trampling are moderate, with little erosion. Large boulders cover the forest floor, with some sandstone sheet rock on the south-eastern side giving exposure up to 10%. Geology is sedimentary Cave Sandstone of the Clarens Formation. Canopy cover for tall trees is between 5% and 25%, for small trees between 20% and 80%, and for shrubs between 15% and 80%. The herbaceous cover ranges from 20% to 70%.

The community is characterised by species from Species Group AI, including the lithophytic fern *Pleopeltis macrocarpha*; the forbs *Asparagus ramosissimus, Parietaria debilis,* and *Streptocarpus polyantha*; and the climber *Riocreuxia torulosa.*

The tree species *Kiggelaria africana* (Species Group V) and *Leucosidea sericea* (Species Group AL) dominate the vegetation. Other species present include *Plectranthus grallatus* (Species

Group AG), and *Parietaria debilis* (Species Group AI); the small shrub *Myrsine Africana*; and the under-story grass *Ehrharta erecta* (Species Group AL). An average of 25.8 species per 100 m² was recorded for the community, which is significantly lower than has been recorded for similar communities by Bredenkamp and Brown (2003), Grobler *et al.* (2002) and Robbeson (1998).

The community has two sub-communities:

7.1 *Asparagus ramosissimus–Leucosidea sericea–Fraxinus angustifolia* sub-community

The sub-community is located on the footslope below the Cave Sandstone of the Clarens Formation, on the north-western and south-eastern aspects. Soils are deep, black and damp, with depths greater than 500 mm. Igneous boulders cover less than 5% of the area. The sub-community is a forest stand with a 25% cover provided by tall trees, 60% for small trees, and 10% for shrubs. Slopes vary from 0° to 8°, with moderate levels of erosion and trampling evident. The forest floor is transsected by numerous trails, indicating significant use by wildlife. The trees form a community with poorly developed stratification. The forest patch is mostly open below the tall trees, with limited tree and shrub growth. Low, caespitose forbs cover the ground. Speciation is low, with > 50% bare soil.

The sub-community is characterised by species from Species Group AH, including the alien tree *Fraxinus angustifolia*; the forbs *Solaum macrocarpon* and *Cerastium indicum*; the grass *Bromus leptocladus*; and the sedge *Schoenoxphium lehmannii*.

The vegetation is dominated by the tall tree *Fraxinus angustifolia* (Species Group AH); the small tree *Leucosidea sericea* (Species Group AL); the shrubs *Rhus divaricata* (Species Group AD) and *Myrsine africana* (Species Group AL); and the forb *Stachys grandifolia* (Species Group AE). Prominent species include the tree *Kiggelaria africana* (Species Group V); the weedy forb *Achyranthus aspera* var. *sicula* (Species Group S); and the two grasses *Bromus leptocladus* (Species Group AH) and *Ehrharta erecta* (Species Group AL). The average number of species recorded per 100 m² was 16.7, which was the lowest count for all the communities.

Fraxinus angustifolia an alien emergent tree, which, along with *Leucosidea sericea*, forms the major component of the forest. Some of the *Leucosidea sericea* individuals are more than 6 m tall, with DBH of 500 mm forming an unusually tall and dense stand of *Leucosidea* trees. Lithophytes and ferns cover numerous large igneous boulders. The forest has a 90% to 100% canopy cover. Sunlight penetrates gaps in the canopy with numerous thick-stemmed (20 to 50 mm) climbers, mostly *Clematis brachiata*, festooning the trees.

7.2 *Asparagus ramosissimus–Leucosidea sericea Plectranthus grallatus* sub-community

The sub-community is located on the cool and very cool south-eastern aspects of the Platberg on private farms. The sub-community extends from the footslopes, on gradual to very steep slopes on the mid-slope below the cliffs. Soils are deeper than 500 mm, and are damp, composed of black humus-rich soil, which shows moderate erosion and trampling. Altitudes vary from 2 030 m to 2 250 m. Rockiness is less than 5%. The geology is a mix of Cave Sandstone of the Clarens Formation and the igneous rock capping Platberg. The canopy cover for tall trees is 25%. For small trees cover it is 60%, and for shrubs it is 10%. The dense forest patch covers the very steep eastern slope of the Platberg. It forms a well-stratified forest community with a mix of emigrants (> 6 m), small trees and shrubs, with numerous ferns, forbs, soft grasses and lichens abundant on boulders and dead trees. Browsing and other animal utilisation is evident. Though three *Podocarpus latifolius* individuals have been recorded in the community (M. Cunningham, pers comm., 2005), none were found in the current study.

The species from Species Group AJ characterise the community, including the forb *Cineraria dieterlenii*; the large fern *Polystichum wilsonii*; and the geophyte *Kniphofia caulescens.*

The sub-community is dominated by the tall tree *Rhamnus prinoides* (Species Group AF); the small tree *Leucosidea sericea* (Species Group AL); the shrub *Buddleja salviifolia* (Species Group X); the under-story forb *Plectranthus grallatus* (Species Group AG); the soft prostrate herb *Parietaria debillis*; and the spiny forb *Asparagus ramosissimus* (Species Group AI). An average of 23 species per 100 m² was recorded for the community.

8. *Senecio inornatus–Thamnocalamus tessellatus* community

The community is located exclusively on the cool, southern side of the Platberg, between altitudes of 2 220 m and 2 316 m. It occurs in steep ravines and watercourses, along the base of the cliffs and growing along the only perennial stream in Donkey Pass. The lowest altitude at which *Thamnocalamus tessellatus* has been recorded is 1 980 m, in a south-facing gully. The community is in semi-shade, on gradual to steep inclines with black, damp soils, ranging from 100 mm to > 300 mm deep. Rock exposure is mostly zero, although certain sections have 20% to 30% cover. Canopy cover for shrubs and bamboo 2 m to 3.5 m tall ranges between 20% and 50%. Such cover shades out most other species and, with its dense, tight rhizomal packing, inhibits the root growth of other species. The result is a low herbaceous cover, ranging between 1% and 30%.

The community is characterised by species from Species Group AK, being composed of the monotypic genus of mountain bamboo *Thamnocalamus tessellates*; the endemic shrub *Euryops evansii*; and the forbs *Alepedia amatymbica* and *Helichrysum hypoleucum*.

The community is dominated by *Thamnocalamus tessellatus* (Species Group AK). Other prominent species include the tree *Leucosidea sericea* (Species Group AL), the shrubs *Euyrops evansii* (Species Group AK) and *Myrsine africana* (Species Group AL); and the forbs *Alepidea amatymbica* (Species Group AK) and *Senecio inornatus* (Species Group AL).

Thamnocalamus tessellatus forms stands, with poor representation from other species. An average of 23 species per 100 m² was recorded. Shading out by the bamboo, as well as dense rhizome development, which outcompetes other species, may explain the limited development of other vegetation in the community (Gibbs-Russell *et al.* 1991; Moffett 1997). Such development is the second lowest after the *Buddleja loricata–Rhus divericata* community 6.2, which is located on large, loose, poorly packed boulders with shallow, thin soils.

DISCUSSION

The results from the phytosociological analysis indicate the woody shrub vegetation to have a variety of plant communities, which are dominated by i) tall and short perennial bunch grasses, in full sun, on moderate slopes, on rocky terrain, with shallow, well-drained soils, which comprise either grassland in transition or established woody/shrub communities (Communities 1, 2 and 3); and ii) trees and shrubs in well-developed shaded stands,

TABLE 2
Average number of species for each of the major communities

COMMUNITY NAME	COMMUNITY NUMBER	AVERAGE SPECIES PER 100 M²
Themeda triandra–Watsonia lepida	1	32.2
Diospyros whyteana–Euclea crispa	4	29.4
Leucosidea sericea–Hyparrhenia hirta	2	28.7
Kiggelaria africana–Crassula lanceolata	5	27.1
Asparagus ramosissimus–Leucosidea sericia	7	25.8
Rhus pyroides–Pteridium aquilinum	3	25.1
Senecio inornatus–Thamnocalamus tessellatus	8	23
Buddleja loricata–Rhus divericata	6	18.2

on steep slopes, mainly on the southern and eastern aspects, with specialist under-story forbs and grass species (Communities 4 to 8) on deep, damp organic-rich soil.

The *Themeda triandra–Watsonia lepida* community (Community 1), which constitutes the largest component of the Shrubland vegetation, was found to have the greatest average number of species (32 per 100 m^2) (see Table 2). The woody shrub vegetation of the community is possibly an extension of the Western Lesotho Basalt Shrubland (Gd 9; Mucina & Rutherford 2006), which has a similar species composition, with typical species, such as *Leucosidea sericea, Rhamnus prunoides* and *Buddleja salfolia*, which are indicative of forest precursors. However, the woody vegetation on Platberg may be more complex than the Western Lesotho Basalt Shrubland described by Mucina & Rutherford. The former represents a biogeographic relictual situation, starting in the Miocene, with climate cooling and the rise and dominance of Grassland (Retallack 1992, 2001), with the Western Lesotho Basalt Shrubland unit (Gd 9; Mucina & Rutherford) showing the transition of woody shrubland to grassland. Such a finding is supported by the presence of the C4 grass *Themeda triandra,* which is adapted to warmer drier conditions (Gibbs-Russell *et al.* 1991), dominating the northern and western slopes with the shrub *Leucosidea sericea* dominant/prominent on all slopes throughout Platberg (Table 1). Thus, the zone may be one of tension between the grassland and woody shrubland habitats, in accordance with which the zone or gradient allows for high species diversity patterns (Cowling 1992; Linder 2003). Such may also be the case for the *Diospyros whyteana–Euclea crispa* community (See Community 4, as represented in Table 1), which is closely related to the Basotho Montane Shrubland vegetation unit (Gm 5; Mucina & Rutherford). The vegetation unit is embedded, or at least closely related to, the Western Lesotho Basalt Shrubland. The rainfall, altitude, and temperature recorded for the study area closely resemble those of the Western Lesotho Basalt Shrubland (Gd 9; Mucina & Rutherford), with the latter shrubland being confined to the Maseru and Mafekeng Districts. The community studied might therefore be regarded as an extension of the vegetation on Platberg.

The lowest species richness is seen in the *Buddleja loricata–Rhus divericata* community (Community 6) with 18.2 species per 100 m^2 (see Table 2). Such paucity might reflect the shallowness of the soils occurring on the mobile boulder beds, as well as the high incidence of fire observed in the field.

Though no *Protea* shrubs grow on Platberg, some have been recorded in the proximity of the Golden Gate National Park (Roberts 1969) and 60 km to the south, in Qwa-Qwa (Moffett *et al.* 2001), KwaZulu-Natal (Robbeson 1998), the northern Drakensberg (Matthews 1991; Matthews, Bredenkamp & Van Rooyen 1994; Matthews *et al.* 2001), and the southern Drakensberg (Bester 1998; Hill 1996; Smit *et al.* 1993, 1997; Smit, Bredenkamp & Van Rooyen 1995). Specimens of *Protea caffra, P. subvestita* and *P. roupelliae* were also collected near Sterkfontein Dam, approximately 25 km to the south of Platberg in 2003, 2004, and 2005 (Brand 2007).

Affinities with Platberg

Numerous phytosociological and floristic studies of the vegetation of the grassland biome in the Free State (Du Preez 1991; Du Preez & Bredenkamp 1991a, 1991b; Fuls 1993; Kay, Bredenkamp & Theron 1993; Malan 1998; Matthews *et al.* 1994; Moffett *et al.* 2001; Perkins 1997; Perkins *et al.* 1999a; Roberts 1969; Van Zinderen Bakker 1973), KwaZulu-Natal (Hill 1996; Killick 1978a, 1978b; Robbeson 1998; Smit *et al.* 1993, 1995, 1997), the Eastern Cape (Bester 1998; Hoare & Bredenkamp 2001; Pond *et al.* 2002), Gauteng (Bredenkamp & Brown 2003; Grobler *et al.* 2002; Grobler, Bredenkamp & Brown 2006), Limpopo (Barrett *et al.* 2006), and Mpumalanga (Brown *et al.* 2005; Matthews 1991: Matthews *et al.* 1994) demonstrate floristic relationships.

Studies conducted by Bester (1998), Fuls (1993) and Matthews (1991) also show floristic relationships with Platberg. As discussed by White (1983) and Bester (1998), the high-altitude Afromontane, Altimontane regions of Africa can be regarded as an archipelago-like string of islands. The theoretical model of Macarthur & Wilson (2001) and Hubbell (2001) predicts that the closer the islands are, the greater the alpha diversity. Thus, it might be expected that the studies of high-altitude vegetation for Qwa-Qwa (Moffett *et al.* 2001) and the Golden Gate National Park (Kay *et al.* 1993; Roberts 1969) would show a similar species composition and diversity. The species lists for the cool eastern portions of the areas in question show a high degree of similarity with taxa from Platberg. Such a high degree of similarity might have been established before the fragmentation of the Afromontane *Podocarpus* forests (Mucina & Rutherford 2006).

Other close floristic associations exist with the Korannaberg (Du Preez 1992; Du Preez & Bredenkamp 1991b), which is the only other inselberg on which a similar study has been conducted. The Korannaberg is approximately 300 km west of Platberg, in the drier interior of the Eastern Free State. It is also at the lower altitude of 1 881 m (Du Preez & Bredenkamp 1991a, 1991b), and has no basaltic cap. Precipitation is lower, at approximately 550 mm per annum or more (Du Preez & Bredenkamp 1991a, 1991b). The Korannaberg falls outside the defined Afromontane zone (Hilliard & Burtt 1987; Mucina & Rutherford 2006; Van Wyk & Smith 2001 2003; White 1983); however, an examination of the species list and phytosociological vegetation tables shows many similarities with Platberg (Brand 2007).

In addition, *Leucosidea sericea*, which is a significant woody/shrub component on Platberg, is found commonly along streams in the Mountain Zebra National Park (MZNP). The two woody shrubs, *Maytenus heterophylla* and *Diospyros whyteana*, are also found in association with the Renosterveld (Pond *et al*. 2002).

CONCLUSION

No previous vegetation description has been completed for Platberg. The description of the shrubland is part of a larger study that has been conducted into the entire vegetation of Platberg, which has been identified as one of four distinct major communities (i.e. Wetlands, Shrubland, Grassland and Fynbos) occurring on the inselberg (Brand 2007).

The study resulted in the identification of 20 plant communities, which can be grouped into eight major communities, 13 sub-communities and eight variants. A total of 450 species, belonging to 304 genera and 95 families, was identified for the Shrubland. A total of 24 endemic or near-endemic and Red Data species belonging to the Drakensberg Alpine Centre (DAC) and the broader Eastern Mountain Region (EMR) (Carbutt & Edwards 2004, 2006) was collected, along with 22 invasive, or potentially invasive, alien species. A species to hectare ratio of 4.37 (43.67 per km^2) was calculated, indicating a moderately rich floristic composition.

The shrub community on Platberg is located on the rocky ridgeline or boulder outcrops on the summit, as well as along the benches on the vertical cliffs, at their bases and in gullies, drainage lines and on scree slopes on all aspects of the inselberg. Generally, the woody shrub community is low to medium in height (2 to 6 m), with a predominance of *Leucosidea sericea* occurring throughout and dominating in communities 1, 2, 6 and 7. Although *L. sericea* is generally found as a small tree or shrub in the study area, it does reach heights over 6 m in some areas. Though the taller *Podocarpus latifolius* (M. Cunningham, pers. comm., June 2007) has been reported as growing on the cool eastern slopes of Platberg, none was found during the study.

The presence of the endemic bamboo, *Thamnocalamus tessellates*, in South Africa shows the phytogeographic link with this genus and the other five related species, which occur in the Himalayas

African Protected Area Conservation and Science Article #696

(Pooley 2003). The mountain bamboo, *Thamnocalamus tessellates*, occurs as a disjunct population on the Drakensberg in South Africa, as well as on the mountains, including especially Mount Kilimanjaro, in East Africa. Four species of such mountain bamboo exist, of which there are three genera in east Africa. One genus, *Arundinaria tessellate*, is synonymous with *Thanmocalamus tessellatus*. The nearest member of the genus occurs in the Himalayas, suggesting that it evolved there during the formation of Gondwanaland (White 1983). According to Gibbs-Russell *et al*. (1991), the Himalayan synonym genus is *Himalayacalamus*.

The Basotho Montane Shrubland (Gm 5) unit is regarded as vulnerable, with the conservation target of 28% being regarded as desirable. Currently, it is only 2% conserved in the Qwa-Qwa National Park section of the Golden Gate Highlands National Park, as well as in the Sterkfontein Dam Nature Reserve (Mucina & Rutherford 2006). The Gd 9 Western Lesotho Basalt Shrubland (Gd 9) is currently not conserved in any reserve, with 16% having probably already been transformed by agriculture (Mucina & Rutherford). On Platberg, where both units are found growing in an interpenetrated union, there is ample opportunity for conservation of such co-joined vegetation units.

The floristic collections and the plant community analysis shows Platberg to be an important centre for plant diversity, with high species richness, and a variety of habitats and complex ecosystems. Accordingly, conservation of the site should be prioritised, with a management plan being developed for such express purpose.

The study described in the present article will provide valuable baseline data on the ecosystems of Platberg. Such data will be incorporated into the management plan for the Platberg Conservancy, as well as be used to augment the larger Maloti–Drakensberg Transfrontier Park Project, the surveys of which are currently being concluded. The data will form part of the biodiversity surveys of the Free State Department for Economic, Tourism, and Environmental Affairs. Such data will assist the Department in setting criteria for protecting and managing unique flora and inselbergs in the province.

ACKNOWLEDGEMENT

Without the generous funding granted by the *National Geographic* (grant number 7920-05), the current fieldwork and study would not have been possible.

NOTE

Supplementary information for this paper is available from www.koedoe.co.za article #696: Table 1.

REFERENCES

Acocks, J.P.H., 1988, 'Veld types of South Africa', *Memoirs of the Botanical Survey of South Africa* 57, 1–146.

Barbour, M.G., Burk, J.H. & Pitts, W.D., 1987, *Terrestrial plant ecology*, 2nd edn., Benjamin/Cummings Publishing Company, Inc., San Francisco.

Barrett, A.S., Brown, L.R., Barrett, L. & Henzi, S.P., 2006, 'Phytosociological and plant community utilisation by vervet monkeys of the Blydeberg Conservancy, Limpopo Province', *Koedoe* 49(1), 49–68.

Bester, S.P., 1998, 'Vegetation and flora of the Southern Drakensberg Escarpment and adjacent areas', MSc thesis, Department of Botany, University of Pretoria.

Brand, R.F., 2007, 'Phytosociology of Platberg Mountain, eastern Free State, South Africa', PhD thesis, Department of Plant Sciences, University of the Free State.

Brand, R.F., Du Preez, P.J. & Brown, L.R., 2008, 'A floristic description of the Afromontane fynbos communities on Platberg, Eastern Free State, South Africa', *Koedoe* 50(1), 202–213.

Bredenkamp, G.J. & Brown, L.R., 2003, 'A reappraisal of Acocks' Bankenveld: Origin and diversity of vegetation types', *South African Journal of Botany* 69(1), 7–26.

Brown, L.R., Marais, H., Henzi, S.P. & Barrett, L., 2005, 'Vegetation classification as the basis for baboon management in the Bourke's Luck Section of the Blyde Canyon Nature Reserve, Mpumalanga', *Koedoe* 48(2), 71–92.

Carbutt, C. & Edwards, T.J., 2006, 'The endemic and near-endemic angiosperms of the Drakensberg Alpine Centre', *South African Journal of Botany* 72, 105–132.

Carbutt, C. & Edwards, T.J., 2004, 'The flora of the Drakensberg Alpine Centre', *Edinburgh Journal of Botany* 60(3), 581–607.

Cowling, R.M. (ed.), 1992, *The ecology of fynbos: Nutrients, fire and diversity*, Oxford University Press, Cape Town.

Du Preez, P.J. & Bredenkamp, G.J., 1991a, 'The syntaxonomy and synecology of the forests in the eastern Orange Free State, South Africa ll: The *Pittosporetatea viridiflorum*', *South African Journal of Botany* 57, 198–206.

Du Preez, P.J. & Bredenkamp, G.J., 1991b, 'Vegetation classes of the southern and eastern Orange Free State, (Republic of South Africa) and the highlands of Lesotho', *Navors. Nas. Mus. Bloemfontein* 7, 477–526.

Du Preez, P.J., 1991, 'A syntaxonomical and synecological Study of the vegetation of the South-Eastern Orange Free State and related areas with special reference to Korannaberg', PhD thesis, Department of Plant Sciences, University of the Orange Free State.

Du Preez, P.J., 1992, 'The classification of the vegetation of Korannaberg, eastern Orange Free State. I. Afromontane fynbos communities', *South African Journal of Botany* 58(3), 165–172.

Du Toit, A.L., 1956, *The geology of South Africa*, Oliver and Boyd, Edinburgh.

Fuls, E.R., 1993, 'Vegetation ecology of the northern Orange Free State', PhD thesis, Department of Botany, University of Pretoria.

Germishuizen, G. & Meyer, N.L. (eds.), 2003, 'Plants of southern Africa: An annotated checklist', *Strelitzia* 14, n.p.

Gibbs-Russell, G.E., Watson, L., Koekemoer, M., Smook, L., Barker, N.P., Anderson, H.M. & Dallwitz, M.J., 1991, 'Grasses of Southern Africa', *Memoirs of the Botanical Survey of South Africa* 58, n.p.

Grobler, C.H., Bredenkamp, G.J. & Brown, L.R., 2002, 'Natural woodland vegetation and plant species richness of the urban open spaces in Gauteng, South Africa', *Koedoe* 45(1), n.p.

Grobler, C.H., Bredenkamp, G.J. & Brown, L.R., 2006, 'Primary grassland communities of the urban open spaces in Gauteng, South Africa', *South African Journal of Botany* 72, 367–377.

Hennekens, S.M., 1996a, *TURBOVEG: A software package for input, processing, and presentation of phytosociological data, User's guide, version 2001*, University of Lancaster, IBN-DLO.

Hennekens, S.M., 1996b, *MEGATAB: A visual editor for phytosociological tables*, Giesen & Geurts, Ulft.

Hill, M.O., 1979, TWINSPAN – *a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes*, Cornell University, Ithaca.

Hill, T.R., 1996, 'Description, classification and ordination of the dominant vegetation communities, Cathedral Peak, KwaZulu-Natal Drakensberg', *South African Journal of Botany* 62, 263–269.

Hilliard, O.M. & Burtt, B.L., 1987, *The botany of Southern Natal Drakensberg*, National Botanical Gardens, Cape Town.

Hoare, D.B. & Bredenkamp, G.J., 2001, 'Syntaxonomy and environmental gradients of the grasslands of the Stormberg/Drakensberg mountain region of the Eastern Cape, South Africa', *South African Journal of Botany* 67, 595–608.

Hubbell, S.P., 2001, *The unified neutral theory of biodiversity and biogeography*, Princeton University Press, Princeton.

Huntley, B.J., 1991, 'Challenges to maintaining biotic diversity in a changing world', in B.J. Huntley (ed.), *Biotic Diversity in Southern Africa*, pp. xii–xix, Oxford University Press, Cape Town.

Kay, C., Bredenkamp, G.J. & Theron, G.K., 1993, 'The plant communities of the Golden Gate Highlands National Park in the north-eastern Orange Free State', *South African Journal of Botany* 59(4), 442–449.

Kent, M. & Coker, P., 1992, *Vegetation description and analysis: A practical approach*, John Wiley & Sons, Chichester.
Killick, D.J.B., 1963, 'An account of the plant ecology of the Cathedral Peak area of the Natal Drakensberg', *Memoirs of the Botanical Survey of South Africa* 34, n.p.
Killick, D.J.B., 1978a, 'The Afro-alpine Region', in M.J.A. Werger (ed.), *Biogeography and Ecology of Southern Africa*, pp. 515–560, Junk, The Hague.
Killick, D.J.B., 1978b, 'Notes on the Vegetation of the Sani Pass Area of the Southern Drakensberg', *Bothalia* 12, 537–542.
King, L.C., 1963, *South African scenery: A textbook of geomorphology*, 3rd edn., Oliver and Boyd, Edinburgh.
Körner, C., 2003, *Alpine plant life: Functional plant ecology of high mountain ecosystems*, Springer-Verlag, Berlin.
Land Type Survey Staff, 1991, *Land types of the map 2828 Harrismith*, Soil and Irrigation Research Institute, Department of Agriculture, Pretoria.
Linder, H.P., 2003, The radiation of the Cape flora, southern Africa, *Biological Review* 78, 597–638.
Low, A.B. & Rebelo, A.G. (eds.), 1998, *Vegetation of South Africa, Lesotho and Swaziland*, Department of Environmental Affairs & Tourism, Pretoria.
Macarthur, R.H. & Wilson, E.O., 2001, *The theory of island biogeography*, Princeton University Press, Princeton.
MacVicar, C.N., Loxton, R.F., Lambrechts, J.J.N., Le Roux, J., De Villiers, J.M., Verster, E., Merrweather, F.R., Van Rooyen, T.H. & Von M., H.J., 1991, *Soil Classification: A taxonomic system for South Africa*, Department of Agricultural Development, Soil and Irrigation Research Institute, Pretoria.
Malan, P.W., 1998, 'Vegetation ecology of the Southern Free State', PhD thesis, University of the Orange Free State.
Matthews, W.S., 1991, 'Phytosociology of the North-eastern Mountain Sourveld', MSc thesis, University of Pretoria.
Matthews, W.S., Van Wyk, A.E., Van Rooyen, N. & Botha, G.A., 2001, 'Vegetation of the Tembe Elephant Park, Maputoland, South Africa', *South African Journal of Botany* 67, L 573–594.
Matthews, W.S., Bredenkamp, G.J. & Van Rooyen, N., 1994, 'The phytosociology and syntaxonomy of relatively low-altitude areas in the North-Eastern Mountain Sourveld, in the eastern Transvaal escarpment region', *Koedoe* 37(2), 73–87.
McCarthy, T. & Rubidge, B., 2005, *The story of Earth & life*, Struik Publishing, Cape Town.
Millennium Ecosystem Assessment, 2005, *Ecosystems and human well-being: Biodiversity synthesis,* World Resources Institute, Washington, DC.
Moffett, R., 1997, *Grasses of the Eastern Free State*, UNIQUA, Qwa-Qwa Campus of the University of the North, Phuthaditjhaba.
Moffett, R.O., Daemane, M.E., Pitso, T.R., Lentsoane, R. & Taoana, T.R.N., 2001, 'A checklist of the vascular plants of Qwa-Qwa and notes on the flora and vegetation of the area', *UNIQWA Research Chronicles* 3(2), 32–83.
Mucina, L. & Rutherford, M.C., 2006, 'The vegetation of South Africa, Lesotho and Swaziland', *Strelitzia* 19, n.p.
Mueller-Dombois, D. & Ellenberg, H., 1974, *Aims and methods of vegetation ecology*, J. Wiley & Sons, New York.
Mutke, J., Kier, G., Braun, G., Schultz, C.H.R. & Barhlott, W., 2001, 'Patterns of African vascular plant diversity – a GIS based analysis', *Systematics and Geography of Plants* 71, 1125–1136.
Norman, N. & Whitfield, G., 1998, *Geological journeys: A traveller's guide to South Africa's rocks and landforms*, De Beers, s.l.
Parmentier, I., Oumorou, M., Porembski, M., Lejoly, S. & Decocq, G.J., 2006, 'Ecology, distribution, and classification of *xeric monocotyledonous* mats on inselbergs in West Africa and Atlantic central Africa', *Phytocoenology* 36(4), 547–564.
Perkins, L., 1997, 'Aspects of the syntaxonomy and synecology of the grasslands of southern KwaZulu-Natal', MSc thesis, Department of Botany, University of Pretoria.
Perkins, L., Bredenkamp, G.J. & Granger, J.E., 1999a, 'The phytosociology of the incised river valleys and dry upland savannah of the southern KwaZulu-Natal', *South African Journal of Botany* 65(5&6), 321–330.
Pond, U., Beesley, B.B., Brown, L.R. & Bredenkamp, H., 2002, 'Floristic analysis of the Mountain Zebra National Park, Eastern Cape', *Koedoe* 45(1), n.p.
Pooley, E., 2003, *Mountain flowers: A field guide to the flora of the Drakensberg and Lesotho*, Flora Publishing Trust, Durban.
Porembski, S. & Brown G., 1995, 'The vegetation of inselbergs in the Comoé National Park (Ivory Park)', *Conservatoire et Jardin Botanicues de Geneve* 50(2), 351–365.
Retallack, G.J., 1992, 'Middle Miocene fossil plants from Fort Ternan (Kenya) and evolution of African grassland', *Paleobiology* 18(4), 383–400.
Retallack, G.J., 2001, 'Cenozoic expansion of grasslands and climate cooling', *The Journal of Geology* 109, 407–426.
Robbeson, R.A.J., 1998, 'Phytosociology of northwestern KwaZulu-Natal', MSc thesis, Department of Botany, University of Pretoria.
Roberts, B.R., 1969, 'The vegetation of the Golden Gate Highlands National Park', *Koedoe* 12, 15–28.
Sarthou, C. & Villiers, J-F., 1998, 'Epilithic plant communities on inselbergs in French Guiana', *Journal of Vegetation Science* 9, 847–860.
Schulze, R.E., 1997, *South African atlas of agro hydrology and climatology,* Water Research Commission, Pretoria. (Report TT 82/96.)
Smit, C.M., Bredenkamp, G.J. & Van Rooyen, N., 1993, 'Phytosociology of the Ac land type in the foothills of the low Drakensberg in north-western Natal', *South African Journal of Botany* 59, 203–214.
Smit, C.M., Bredenkamp, G.J. & Van Rooyen, N., 1995, 'The grassland vegetation of the low Drakensberg Escarpment in the north-western KwaZulu-Natal and north-eastern Orange Free State Border Area', *South African Journal of Botany* 61, 9–17.
Smit, C.M., Bredenkamp, G.J., Van Rooyen, N., Van Wyk, A.E. & Combrink, J.M., 1997, 'Vegetation of the Witbank Nature Reserve and its importance for conservation of threatened Rocky Highveld Grassland', *Koedoe* 40(2), n.p.
South African Weather Services, 2007, *Climate of South Africa: Climate statistics for Bethlehem from 1961-1990,* WB 40, Government Printer, Pretoria.
Taylor, D., 1996, 'Mountains', in W.M. Adams, A.S. Goudie & A.R. Orme (eds.), *The Physical Geography of Africa*, pp. 287–306, s.l., Oxford University Press.
Van Wyk, A.E. & Smith, G.F., 2001, *Regions of floristic endemism in Southern Africa: A review with emphasis on succulents*, Umdaus Press, Pretoria.
Van Zinderen Bakker Jr., E.M., 1973, 'Ecological investigation of forest communities in the Eastern Orange Free State and the adjacent Natal Drakensberg', *Vegetatio* 28, 299–334.
Westhoff, V. & Van der Maarel, E., 1980, '20 The Braun–Blanquet approach', in R.H. Whitaker (ed.), *Classification of Plant Communities*, pp. 287–378, Junk, The Hague.
Whitaker, R.H. (ed.), 1980, *Classification of plant communities,* Kluwer Academic Publisher, The Hague.
White, F., 1983, *The vegetation of Africa. Volume XX, A descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa*, UNESCO, Paris.

TABLE 1
Phytosociological table for the shrubland communities of Platberg

Relevé number	1 1 | 3 5 | 7 1	3 3 1 2 | 4 3 8 9 | 9 6 1 8	3 3 1 1 2 2 1 1 2 | 5 5 8 4 1 2 6 9 1 | 0 1 4 5 2 4 9 7 8	1 1 2 | 1 2 2 8 | 8 0 1 3	3 3 3 3 3 3 2 | 5 0 5 4 5 6 5 | 9 8 6 6 8 1 7	1 3 3 | 2 5 4 | 8 7 2	2 | 3 3 6 2 2 2 3 | 7 6 0 3 0 1 4	2 2 | 6 3 6 7 4 4 | 9 2 2 0 7 1	3 2 3 2 | 3 5 1 5 | 5 5 2 4	2 3 2 2 | 3 5 3 3 | 1 4 6 9	2 2 2 2 | 4 4 4 4 | 0 1 4 7	2 2 2 4 3 2 2 2 | 5 6 4 1 2 3 3 6 | 8 1 9 9 7 7 3 8	1 3 1 1 1 3 | 8 5 4 8 8 9 4 | 6 6 4 2 8 9 1 3	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | 0 0 0 2 1 4 2 0 0 0 2 3 3 9 4 | 9 1 4 4 5 8 5 5 5 7 2 6 7 9 6 1	1 1 1 1 1 1 1 | 3 2 4 7 5 6 7 6 8	1 | 5 1	1 | 4 0	4 4 | 6 3 3 | 3 0 1	4 4 | 6 6 | 5 6	3 3 3 2 | 1 1 3 | 9 7 4 1 3 9 1
Number of species per relevé	3 3 | 7 4	4 4 5 3 | 2 2 0 8	4 3 4 2 3 3 4 3 2 | 1 6 5 9 0 9 0 2 6	4 4 2 5 | 1 1 8 1	3 4 3 5 5 3 3 | 6 5 1 0 6 6 1	3 4 2 | 8 7 7	2 2 3 2 2 3 2 | 7 5 6 3 7 0 8	2 1 3 3 2 2 | 6 8 5 5 3 2	2 2 3 2 | 8 2 0 5	4 2 4 3 | 4 4 0 2	2 1 2 2 | 4 3 5 3	3 2 2 4 2 3 3 3 | 5 4 7 4 3 1 0 2	2 2 4x | 2 5 2	4 2 3 3 | 1 4 0 5	3 3 1 1 2 2 1 3 3 2 2 2 2 2 2 | 8 1 6 8 6 0 8 0 2 4 9 5 1 5 4	1 1 2 1 1 1 2x x | 3 8 0 9 9 7 1	x 2 | 4	x 1 | 3	2 2 3 | 4 7 2	2 2 | 6 0	2 2 3 2x 1 4 | 0 3 9 8 | 1 4
Community	1							2	3	4			5			6			7		8	
Subcommunity	1.1		1.2		1.3	1.4	1.5			4.1	4.2		5.1	5.2		6.1	6.2		7.1	7.2		
Variant	1.1.1	1.1.2	1.2.1	1.2.2						4.1.1	4.1.2						6.2.1	6.2.2				
Species Group A																						
Sporobolus africanus	b . | . .	. . . . | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . . | . .	. . . + |	. . . . |	. . | . .	. . . . . |	. . | . .	. . . . . |	. . | . .	. . | . .	. . | . .	. . | . .	. . | . .	. . | . .
Asparagus cooperi	b . | . .	. . . . | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . 1 . . + |	. . . . |	. . | . .	1 . . . . . |	. . | . .	. . | . .	. | +	. . | . .	. . | . .	. . | . .
Eragrostis capensis	1 . | . .	+ . . . | . .	. . . . . |	+ . . . | 1 .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . | . . . . +	. . | . .
Cyperus schlechteri	1 . | . .	. . . . | . .	. . . . . | . . . . +	. . . . | . .	. . . . . |	. . . | . .	. . . . . |	1 . . . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Helichrysum aureonitens	1 . | . .	. . . . | . .	. . . . . | 1	. . . . | . .	. . . . . |	. . . | . .	. . . . + 1 . |	. . . . |	. . . . |	. . + ... |	. . | . .	. . | . .	. | .	. . | . .	. . + + . . . |	. . | . .
Cyphia elata	+ + | . .	. . + . | . .	. . . . . |	. . . . | . .	. . . . . |	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . | . . . . r	. . | . .
Silene burchellii	. + | . .	. . . . | . .	. . . . . |	. . . . | . .	. . . . . |	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Galtonia candicans	+ . | . .	. . . . | . .	. . . . . |	. . . . | . .	. . . . . |	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . | r r . .	. . | . .	. . | . .	. | .	. . | . .	. . . . . | . . . . +	. . | . .
Schizocarphus nervosa	r r | . .	. . + . | . .	. . . . . |	. . r . | . .	. . . . . |	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Species Group B																						
Cliffortia ramosissima	. . | . .	. b b b | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . . . |	. . . + |	. . . . |	. . . . |	. . . . . |	1 . . . . . 1 . . b . |	. . | . .	. . | . .	. | .	. . | . .	. . . 1 . . 1 |	. . | . .
Crassula dependens	. . | . .	+ + + . | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . + . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . . . . | r . . .	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Crassula sarcocaulis	. . | . .	. + + + | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . + . |	. . . . . |	. . . + ... + |	. . | . .	. . | . .	. | .	. . | . .	. + ... |	. . | . .
Passerina montana	. . | . .	. b . b | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Panicum ecklonii	. . | . .	1 b . . | . .	. . . . . + . | . .	. . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . + ... |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Muraltia saxicola	. . | . .	. . 1 1 | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Trachyandra saltii	r + r . | . .	. . . . | . .	. . . . . |	. . . r . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Moraea brevistyla	r r r . | . r	. . . . | . .	+ . . . |	. . . . | . .	. . . . . | . . .	r . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Aristea abyssinica	+ + r . | . .	. . . r . | . .	. . . . . |	. . . r + . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Senecio othonniflorus	. + | + .	+ . . . | . .	. . . . . + |	. . . . | . .	. . . . . + | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Crassula brachypetala	. . | . .	. . + + | . .	. . . . . |	. + . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	+ . . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Helichrysum sutherlandii	. . | . .	. . + + | . .	. . . . . |	. . . . | . .	. . . . . | . . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Species Group C																						
Albuca humilis	r r | . .	r . r r | . .	. . . . . |	. + . . | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . . r . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Wahlenbergia cuspidata	+ . | . .	. . + + | . .	. . . . . |	. + + . + | . .	. . . . . + | . . .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . + ... |	. . . + . + . |	. . | . .	. . | . .	. | .	. . | . .	. + ... |	. . | . .
Species Group D																						
Lotononis lotononoides	. . | . .	. . . . | . .	. . . . . |	1 b . 1 1 | . .	. . . . . + | . . .	. . + ... |	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Ranunculus multifidus	. . | . .	. . . . | . .	. . . . . |	+ + . . | . .	. . . . . | . . .	. . . . . |	. . + . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Species Group E																						
Andropogon appendiculatus	. 1 | . .	. . . . | . .	b + 1 1 a 1 1 1 1 | . .	+ 1 1 + | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Monsonia attenuata	. . | . .	. . . . | . .	. . . + . + r | . .	. + + . | . .	. . . . + . . | . . .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Silene bellidioides	. . | . r	. . . . | . .	. . . . . + + | . .	r . . + | . .	. . . . . | . . .	. . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Species Group F																						
Ficinia stolonifera	. . | . .	. . . . | . .	. . . . . |	. . . 1 | . .	+ + . + + . . | + .	. + ... | + . .	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Haplocarpha scaposa	. . | . .	. . . . | . .	. . . . . |	. . . . | . .	+ + . . + . . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Linum thunbergii	. . | . .	. . . . | . .	. . . . . |	. . . . | . .	+ . . . + + . | . .	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .
Sebaea exigua	. . | . .	. . . . | . .	. . . . . |	. . . . | . .	r . . . r r | . .	. . r . . . |	. . . . . |	. . . . |	. . . . |	. . . . |	. . . . . |	. . | . .	. . | . .	. | .	. . | . .	. . . . . |	. . | . .

Article #696 African Protected Area Conservation and Science

TABLE 1 (Continues.....)
Phytosociological table for the shrubland communities of Platberg

| | | |

TABLE 1 (Continues.....)
Phytosociological table for the shrubland communities of Platberg

Species Group P
Acalypha punctata
Rhus discolor
Leonotis ocymifolia
Rhynchosia pentheri

Species Group Q
Bowiea volubilis

Species Group R
Maytenus undata
Halleria lucida
Bidens bipinnata

Species Group S
Diospyros whyteana
Maytenus heterophylla
Euclea crispa
Rhus dentata
Osyris lanceolata
Bidens pilosa
Achyra aspera v. sicula

Species Group T
Commelina africana
Calpurnia sericea
Cymbopogon dieterlenii
Oxalis obliquifolia
Helichrysum odoratissimum
Clutia monticola
Vernonia hirsuta
Rumex sagittatus
Eucomis autumnalis
Berkheya setifera
Cheilanthes eckloniana
Merwilla natalensis
Felicia filifolia
Pelargonium luridum
Diospyros austro-africana
Senecio isatideus
Rubus ludwigii
Cineraria erodioides

Species Group U
Chrysocoma ciliata
Zantedeschia albomaculata
Polystichum monticola
Aeollanthus buchnerian
Myosotis semiamplexicaulis

Species Group V
Kiggelaria africana
Zehneria scabra
Crassula lanceolata s. transvaalensis

Species Group W
Asplenium aethiopicum

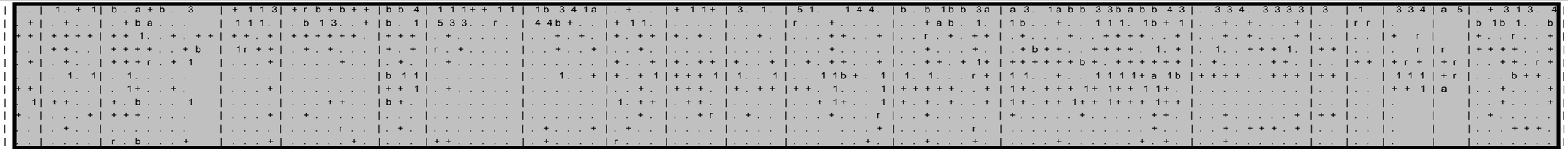
Species Group X
Buddleja salviifolia

African Protected Area Conservation and Science
Article #696

TABLE 1 (Continues.....)
Phytosociological table for the shrubland communities of Platberg

Species Group Y	
Heteromorpha arborescens	
Eragrostis curvula	
Rhus pyroides	
Dioscorea sylvatica	
Senecio subrubriflorus	
Galium capense	
Species Group Z	
Cineraria burkei	
Eucomis bicolor	
Nemesia silvatica	
Clutia natalensis	
Species Group AA	
Galium scabrelloides	
Polystichum pungens	
Species Group AB	
Clutia hirsuta	
Festuca caprina	
Galium thunbergianum	
Geranium wakkerstroomensis	
Stipa capensis	
Species Group AC	
Asparagus plumosus	
Species Group AD	
Buddleja loricata	
Rhus divaricata	
Species Group AE	
Stachys grandifolia	
Species Group AF	
Clutia affinis	
Polygala virgata	
Rhamnus prinoides	
Species Group AG	
Clematis brachiata	
Plectranthus grallatus	
Solanum retroflexum	
Species Group AH	
Fraxinus angustifolia	
Bromus leptoclados	
Cerastium indicum	
Schoenoxiphium lehmannii	
Solanum macrocarpon	
Species Group AI	
Parietaria debilis	
Asparagus ramosissimus	
Pleopeltis macrocarpa	
Riocreuxia torulosa	
Streptocarpus polyanthus	
Speicies Group AJ	
Cineraria dieterlenii	
Polystichum wilsonii	
Knipofhia caulescens	
Species Group AK	
Thamnocalamus tessellatus	
Alepidea amatymbica	
Helichrysum hypoleucum	
Euryops evansii	

TABLE 1 (Continues.....)
Phytosociological table for the shrubland communities of Platberg



Species Group AL
Leucosidea sericea
Senecio inornatus
Cheilanthes quadripinnata
Agapanthus campanulatus
Asparagus asparagoides
Myrsine africana
Ehrharta erecta
Asparagus microraphis
Sutera floribunda
Polemannia montana
Euclea coriacea