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

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 Afrotropical floristic links to the Drakensberg, as well as for 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 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 2006; Porembski & Brown 1995; Sarthou & Villiers 1998).

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; Hilliard & 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 biodiversity (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). 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 60 km 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
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
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Original Research

1974; Whitaker 1980). Being counted and the cover abundance being estimated using sample plots, each species was recorded, with all woody plants 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 Barnett 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 falc sub-community
      1.1.1 Cypria clau variant
      1.1.2 Cliffordia ramosissima variant
   1.2 Themeda triandra–Watsonia lepida–Andropogon appendiculatus sub-community
      1.2.1 Helicotherian longiflorum variant
      1.2.2 Lomonia lomonoides 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 serico–Hyparrhenia hirta community

3. Rhus pyriforme–Pteridium aquilinum community

4. Diospyros whyteana–Euclea crispa community
   4.1 Diospyros whyteana–Euclea crispa–Bowenia volubilis sub-community
      4.1.1 Mayetidus undata variant
      4.1.2 Balans pilosa variant
   4.2 Diospyros whyteana–Euclea crispa–Themeda triandra sub-community

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 four classes based on diameter, namely shrubs (> 0–2 m), trees (> 2–6 m) and tall trees (> 6 m) (Brand 2007).

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).

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5. Kiggelaria africana–Crassula lanccolata community
6. Buddleja loricata–Rhus diversicata community
7. Asparagus ramosissimus–Leucosidea sericea community
8. Senecio inornatus–Thamnochalamus tessellatus community
9. Themeda triandra–Watsonia lepida community
10. Cyphila elata variant
11. Cliftoria ramosissima variant
12. Themeda triandra–Watsonia lepida–Andropogon appendiculatus sub-community
13. Themeda triandra–Watsonia lepida–Ficinia stolonifera sub-community

5.1 Kiggelaria africana–Crassula lanccolata–Senecio isatidus sub-community
5.2 Kiggelaria africana–Crassula lanccolata–Zehneria scabra sub-community
6.1 Buddleja loricata–Rhus diversicata–Gallium scabreloides sub-community
6.2 Buddleja loricata–Rhus diversicata–Stachys grandifolia sub-community
6.2.1 Clutia hirsuta variant
6.2.2 Stachys grandifolia variant
7.1 Asparagus ramosissimus–Leucosidea sericea–Frazinus angustifolia sub-community
7.2 Asparagus ramosissimus–Leucosidea sericea–Plectranthus grallatus sub-community
8. Senecio inornatus–Thamnochalamus tessellatus community
9. Themeda triandra–Watsonia lepida community
10. Cyphila elata variant
11. Cliftoria ramosissima variant
12. Themeda triandra–Watsonia lepida–Andropogon appendiculatus sub-community
13. Themeda triandra–Watsonia lepida–Ficinia stolonifera sub-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 Thamnochalamus tessellatus community.

The shrubland vegetation is dominated by two bunch grasses Themeda triandra, Tristachya leucothrix, Eragrostis racemosa; the shrubs Indigofera hedgyantha and Athrixia phyllicoides; the bulb Watsonia lepida; the forbs Ajuga ophyrdis, Aster hakeranus, Antirrhinum herbaceum, Euphorbia striata, Helichrysum dancephalum, Helichrysum nudifolium, Helichrysum rigidiuscula, Lotononis procumbens, Rhyynchosa totia, 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 deep, 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 humidis and the forb Wahlenbergia cucodes (Species Group C). Prominent species include the grass Harpochloa falx (Species Group I), and Eragrostis curvula (Species Group Y); the sedge Ficinia gracilis (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 Cyphila 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 Cliftoria ramosissima variant: The variant is characterised by species from Species Group B. The vegetation is dominated by the fynbos shrub Cliftoria ramosissima (Species Group B); the grasses Hesperospartum 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 belliioides.

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 ludoviigii (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 size 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 Scebea 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 fals (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 includes 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 Eleharta 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 Clutia canosia. 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 community 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 Cluita 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 2 043 m 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 < 5% 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 invasiveness of the shrub 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 tree 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 heterophyllata, Euclea crispa, Rhus dentata, and Osyris lanceolata, and the weedy forbs Bidens pilosa and Aegyptis aspera var. sicula.

The vegetation is dominated by the shrubs Diospyros whyteana, Maytenus heterophyllata, 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 arborecens,
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 V), 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 Acanthopanax dentata (Species Group G), Buddleja salviifolia (Species Group X), Heteromorpha arborescens, and Rhus pyroides (Species Group Y). Forbs include the weedy Bidens pilosa and Achyranthis aspera sp. sica (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 Euclea crispa, Rhus dentata, and Maytenus heterophylla (Species Group S), and the weed Achyranthis aspera var. sica (Species Group S).

4.2 Diospyros whyteana–Euclea crispa–Themedia 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 brachitata (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 AF); 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 isatidens sub-community

The Kiggelaria africana–Crassula lanceolata–Senecio isatidens sub-community is located on the south and south-western 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 AF). 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
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 Clarins 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, Acantholirion buchenerianum, and Myosotis semiamplexicaulis. The vegetation is dominated by the trees Buddleja salviifolia (Species Group X), Rhus pyroides (Species Group Y), Stachys grandifolia (Species Group AE), and Leucosidea serica (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 asperagoides, and A. microphthalmus (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 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 sub-community is characterised by the single species Asparagus plumosus (Species Group AC) and is dominated by the shrubs Buddleja loricata (Species Group AD), and the labiate forb Clutia hirsuta (Species Group AD). Other species included are Asparagus plumosus, Polystichum monticola, Acantholirion buchenerianum, Myosotis semiamplexicaulis, and Myosotis sericea. The vegetation is dominated by the shrubs Buddleja loricata (Species Group AD), and the labiate forb Clutia hirsuta (Species Group AD). 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 Clarins 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 mm deep. Canopy cover ranges between 30% and 90% 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 shrubs Buddleja loricata (Species Group AD), and the two labiate forbs Stachys grandifolia (Species Group AE) and Plectranthus glutatus (Species Group AG). There is poor development 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.

7. Leucosidea serica–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 serica woodland to very steep for the south-east aspect. 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 Clarins 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 macrocarpa; the forbs Asparagus ramosissimus, Paratropaeolum digonum, and Streptocarpus polyantha; and the climber Ricracxia torulosa. The tree species Kiggelaria africana (Species Group V) and Leucosidea serica (Species Group AL) dominate the vegetation. Other species present include Plectranthus glutatus (Species Group AG), and Plectranthus cordatum (Species Group AG).
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 *Paritaria deblis*; 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 2 280 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 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 tessellatus*; the endemc shrub *Europs evansi*; and the forbs *Alepedia amattyntica* and *Helichrysum hypoleucum*.

The community is dominated by *Thamnocalamus tessellatus* (Species Group AK). Other prominent species include the tree *Leucosidea sericea* (Species Group AG), the shrubs *Europs evansi* (Species Group AK) and *Myrsine africana* (Species Group AL); and the forbs *Alepedia amattyntica* (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, loosely, 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>
<thead>
<tr>
<th>COMMUNITY NAME</th>
<th>COMMUNITY NUMBER</th>
<th>AVERAGE SPECIES PER 100 M²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thembesa biandra–Matsonia lepida</td>
<td>1</td>
<td>32.2</td>
</tr>
<tr>
<td>Diospyros whyteana–Europs crispa</td>
<td>4</td>
<td>26.4</td>
</tr>
<tr>
<td>Leucosidea sericosa–Hypericium hirta</td>
<td>2</td>
<td>28.7</td>
</tr>
<tr>
<td>Kiggelaria africana–Crassula lanceolata</td>
<td>5</td>
<td>27.1</td>
</tr>
<tr>
<td>Asparagus ramosissimus–Leucosidea sericosa</td>
<td>7</td>
<td>25.8</td>
</tr>
<tr>
<td>Rhus pyroides–Pteridium aquilinum</td>
<td>3</td>
<td>25.1</td>
</tr>
<tr>
<td>Senecio inornatus–Thamnocalamus tessellatus</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Buddleja loricata–Rhus divericata</td>
<td>6</td>
<td>18.2</td>
</tr>
</tbody>
</table>
A classification and description of the shrubland vegetation on Platberg, Eastern Free State, South Africa

The Themeda triandra-Watsonia lepida community (Community 1), which constitutes the largest component of the Shrubland vegetation, was found to have the highest average number of species (32 per 100 m²) (see Table 2). The woody shrub vegetation of the community is possibly an extension of the Western Lesotho Basalt Shrubland unit (Gd 9; Mucina & Rutherford 2006), which has a similar species composition, with typical species, such as Leucosidea sericea, Rhamnus pinnoides and Buddleja sellofia, 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 whitneyae–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 Masero and Mafefeng 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 divaricata community (Community 6) with 18.2 species per 100 m² (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 Sirkfontein Dam, approximately 25 km to the south of Platberg in 2003, 2004, and 2005 (Brand 2007).

Affinities with Platberg


In addition, Leucosidea sericea, which is a significant woody/shrub component on Platberg, is found commonly along streams in the Mountain Zebra National Park (MZN). The two woody shrubs, Magonius heterophyllus and Diospyros whitneyae, 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 km²) 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 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.

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. 1991; 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).
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.

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