

Major plant communities of the Marakele National Park

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To manage and conserve any national park efficiently, a profound knowledge of the ecology is a prerequisite, and to achieve that an inventory of the biotic and abiotic components must be undertaken. As a contribution to such a program this information was collected for Marakele National Park. The study area covers 290.51 km² in the southwestern part of the Limpopo Province. The underlying parent rock of the study area is sandstone, shale and mudstone with several diabase dykes. The soils range from shallow to deep sandy soils on sandstone and clayey soils on diabase and mudstone. The rainfall varies from 556 mm to 630 mm per annum, mainly during the summer months. The study area experiences warm summers with temperatures of up to 32 °C and cool, dry winters with frost in the low-lying areas. The vegetation of the study area was classified in a hierarchical, plant sociological system by using TWINSPLAN and the Braun-Blanquet technique. The floristic data from 130 relevés were classified to identify five major plant communities, namely one forest community, three savanna/grassland communities and one wetland community. These plant communities were ecologically interpreted by habitat. The phytosociological table was condensed to a synoptic table to describe the major plant communities.

Key words: Braun-Blanquet, classification, major plant communities, phytosociology, synoptic table.

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Introduction

The primary objective when proclaiming a national park is to conserve parts of pristine natural ecosystems for future generations (Gertenbach 1987). Marakele National Park (MNP) covers an area of 290.51 km² in the southwestern part of the Limpopo Province and is managed as a national park since 1988, but was officially proclaimed a national park on 11 February 1994.

In order to manage and conserve any conservation area, a profound knowledge of the ecology is a prerequisite, and to achieve that prerequisite, an inventory of the biotic and the abiotic components of that national park must be undertaken (Edwards 1972). The “natural systems” as they occur today cannot be viewed and conserved as “natural” any more, because of the influence of man. Thus, management recommendations can only be made on the basis of interpreted ecological

knowledge to restore the balance of the original natural system. The influence of management recommendations on the system must also be regularly monitored to determine if the aims that were set have been achieved satisfactorily. Efficient monitoring systems also depend upon an inventory of the biotic and abiotic components (Gertenbach 1987).

The primary aim of this study was to classify and describe the vegetation of the Marakele National Park in the Waterberg of the Limpopo Province (Van Staden 2003). The purpose of the classification can be described as to form an inventory as a basis of management.

Study area

The study area covers 29051 ha in the southwestern part of the Limpopo Province of

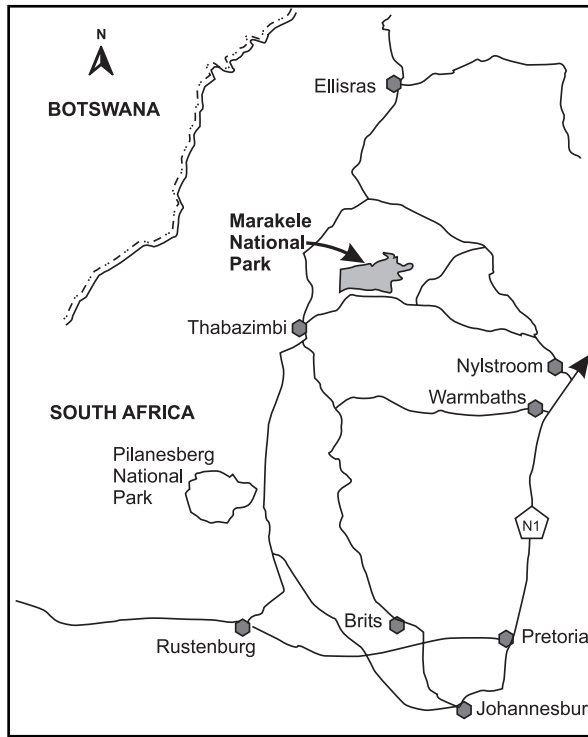


Fig. 1. A map indicating the location of the study area in relation to towns.

South Africa, between 27°30'E–27°45'E and 24°15'–24°30'S. The position of the park in relation to towns is shown in Fig. 1 (Van Staden 2003).

The underlying parent rock of the study area (SACS 1980) is sandstone of the Matlabas Subgroup, Aasvoëlkop Formation in the south-western and southern parts; with shale and mudstone of the Matlabas Subgroup, Aasvoëlkop Formation, Groothoek Mudstone Member; a conglomerate outcrop of the Matlabas Subgroup, Aasvoëlkop Formation in the west; and with the biggest part of the study area consisting of sandstone of the Kransberg Subgroup, Sandriviersberg Formation.

The soils that have developed on the parent materials range from shallow to deep sandy

soils on sandstone and clayey soils on diabase and mudstone (Van Staden 2003).

The rainfall varies from 556–630 mm per annum and occurs mainly during the summer months. The study area experiences warm, wet summers with average daily temperatures of 32 °C and cool, dry winters with frost in the low-lying areas (Van Staden 2003).

MNP is situated mainly in the Waterberg Moist Mountain Bushveld (Low & Rebelo 1996) in the Savanna Biome (Rutherford & Westfall 1994). The vegetation of the study area includes Acocks' (1988) Sour Bushveld (Veld Type 20), Mixed Bushveld (Veld Type 18), Sourish Mixed Bushveld (Veld Type 19) and North-Eastern Mountain Sourveld (Veld Type 8). This Sour Bushveld is listed by Edwards (1972) as one of 52 of South

African Veld Types that is extremely lacking in conservation. The Sour Bushveld covers 18306 km², occurring in mountainous areas in the previous Transvaal Province (Coetzee 1975; Coetzee *et al.* 1981). Previous plant ecological studies in the Sour Bushveld (Acocks 1988) include those by Van Vuuren & Van der Schijff (1970), Coetzee (1975); Coetzee *et al.* (1981), Westfall (1981) and Westfall *et al.* 1985. Other plant ecological work of interest in related vegetation types include those of Theron (1973) who described the vegetation of the Loskopdam Nature Reserve; Van der Meulen (1979) who described the vegetation of the bushveld south of the Waterberg; Van Rooyen (1983) who described the vegetation of Roodeplaat Dam Nature Reserve; and Brown (1997) who described the vegetation of Borakalalo Game Reserve.

Methods

Analysis

Methods applied are described in detail by Van Staden (2003) and are only summarised here. Stereo aerial photographs on a scale of 1:50 000 (Task 874 of 1984) were used to delineate homogeneous units on the basis of physiography and physiognomy (Bredenkamp & Theron 1978; Westfall 1981; Gertenbach 1987).

A total of 130 sample plots were surveyed throughout the study area. The sample plot location was determined by means of stratified-random sampling (Westfall 1981). The number of sample plots for each delineated physiographic-physiognomic unit was determined according to the size of each delineated unit.

Termitaria and riparian vegetation was not included in the placing of the sample plots, due to their limited size. Additional sample plots were identified for the termitaria and riparian vegetation and sampling was done in these vegetation types.

A sample plot size of 10 m x 20 m was fixed and used throughout the study area. This size is considered adequate for surveys in savanna vegetation by Coetzee (1975), Coetzee *et al.* (1976), Westfall (1981), Van Rooyen (1983) and Gertenbach (1987).

At each sample plot a list of all the species present, was compiled. A cover-abundance value was given

to each species according to the Braun-Blanquet cover-abundance scale, as given by Mueller-Dombois & Ellenberg (1974) and Werger (1974), and adapted by Barkman *et al.* (1964).

The following habitat information was recorded at each sample plot—symbols are used in the synoptic table: land type was read from the land type map (Land Type Survey Staff 1988); soil forms were classified in accordance with MacVicar *et al.* (1977); the altitude of each sample plot was recorded using an altimeter and is given in metres; the slope of the terrain of each sample plot was measured in degrees, using an optical clinometer.

The following classification of slope units (Westfall 1981) were used in this study:

Symbol	Description	Class
L	level	0.00° -3.49°
G	gentle	3.50° - 17.62°
M	moderate	17.63° - 36.39°
S	steep	36.40°

The aspect of the terrain where each sample plot is situated was determined using a compass. Aspect is given in the eight compass directions, namely: N - North; S - South; NE - Northeast; SW - Southwest; E - East; W - West; SE - Southeast; NW - Northwest.

The surface rock cover in each sample plot was estimated as a percentage stones (> 20 mm diameter), boulders and rocky outcrops. The following five classes were used, based on its potential influence on mechanical use (ploughing) (Van der Meulen 1979; Westfall 1981):

Symbol	Class	Description
O	< 1 %	No limitation on mechanical utilisation
L	1–4 %	Low limitation on mechanical utilisation
M	5–34 %	Moderate limitation on mechanical utilisation
H	35–84 %	High limitation on mechanical utilisation
V	85–100 %	No mechanical utilisation possible

Synthesis

The classification is based on the Braun-Blanquet method of vegetation classification, discussed in detail by Westhoff & Van der Maarel (1980), Mueller-Dombois & Ellenberg (1974) and Werger (1974). Data were captured on the mainframe computer of the University of Pretoria, in the BBNEW software package. It was then exported to be used in the software package BBPC (Bezuidenhout *et al.*

Table 1
 Synoptic table of the major plant communities of
 Marakele National Park
 For symbols see text,
 constancy values = percentage

Community #	1	2	3	4	5
Land type	Ib/Ad	Ad	Ib/Fa	Fa	Ib/Fa
Altitude (x 100 = m)	11-17	12-15	15-20	13-16	13-14
Slope	G,L	G,L	M	M	L
Aspect	All	N	S,E	N	N,E
Surface rock cover	O,H	O,M	H	H	O
Species Group A					
<i>Pappea capensis</i>	59				
<i>Mimusops zeyheri</i>	59				
<i>Olea europaea</i>					
subsp. <i>africana</i>	55				
<i>Cussonia paniculata</i>	52			33	
<i>Diospyros whyteana</i>	52				
<i>Euphorbia ingens</i>	52				
<i>Rhus leptodictya</i>	45				
<i>Cryptolepis transvaalensis</i>	45				
<i>Podocarpus latifolius</i>	38				
<i>Maytenus undata</i>	38				
<i>Zanthoxylum capense</i>	34				
<i>Myrsine africana</i>	31				
<i>Canthium gilfillanii</i>	31				
<i>Calpurnia aurea</i>	31				
<i>Olea capensis</i>	31				
<i>Ficus sur</i>	31				
<i>Grewia occidentalis</i>	31				
Species Group B					
<i>Acacia caffra</i>		65			
<i>Elionurus muticus</i>		61			
<i>Faurea saligna</i>		57			
<i>Aristida congesta</i>		57			
<i>Solanum incanum</i>		48			
<i>Dichrostachys cinerea</i>		43			
<i>Pterocarpus rotundifolius</i>		43		39	
<i>Eragrostis capensis</i>		39			
<i>Sida dregei</i>		39			
<i>Bewisia biflora</i>		39			
<i>Pogonarthria squarrosa</i>		39			
<i>Eragrostis lehmanniana</i>		39			
<i>Perotis patens</i>		35			
<i>Vernonia oligocephala</i>		39			
Species Group C					
<i>Eragrostis curvula</i>	31	65			
<i>Dombeya rotundifolia</i>	52	65		33	
<i>Euclea crispa</i>	41	43			
<i>Grewia flavescens</i>	34	39			
<i>Berchemia zeyheri</i>	48	39			
<i>Ziziphus mucronata</i>	38	35			
Species Group D					
<i>Panicum natalense</i>			75		
<i>Anthospermum hispidula</i>			64		
<i>Urelyterum agropyroides</i>			57		
<i>Thesium utile</i>			52		
<i>Rhynchosia monophylla</i>			50		
<i>Acalypha angustata</i>			50		
<i>Protea caffra</i>			48		
<i>Aeschynomene rehmannii</i>			45		
<i>Indigofera hedyantha</i>			43		
<i>Monocymbium ceresiiforme</i>			43		38

Table 1 (continued)

Community #	1	2	3	4	5
Land type	Ib/Ad	Ad	Ib/Fa	Fa	Ib/Fa
Altitude (x 100 = m)	11-17	12-15	15-20	13-16	13-14
Slope	G,L	G,L	M	M	L
Aspect	All	N	S,E	N	N,E
Surface rock cover	O,H	O,M	H	H	O
<i>Tristachya rehmannii</i>			41		
<i>Cheilanthes hirta</i>			39		
<i>Dicoma anomala</i>			39		
<i>Vernonia galpinii</i>			39		
<i>Xerophyta retinervis</i>			36		
<i>Chaetacanthus costatus</i>			36		
<i>Senecio venosus</i>			36		
<i>Rhynchosia nitens</i>			34		
<i>Indigofera mollicoma</i>			34		
<i>Pentanisia angustifolia</i>			32		
<i>Parinari capensis</i>			32		
Species Group E					
<i>Eragrostis racemosa</i>		70	82		
<i>Trachypogon spicatus</i>		30	80		
<i>Bulbostylis burchellii</i>		30	73		
<i>Themeda triandra</i>		78	59		
<i>Gnidia capitata</i>		43	34		
Species Group F					
<i>Setaria lindenberiana</i>					100
<i>Rhoicissus revoilii</i>					89
<i>Hypoestes forskalii</i>					78
<i>Pseudolachnostylis</i>					
<i>maprouneifolia</i>					78
<i>Strychnos pungens</i>					72
<i>Diplorhynchus</i>					
<i>condylocarpon</i>					67
<i>Ochna pulchra</i>					67
<i>Elephantorrhiza burkei</i>					61
<i>Littonia modesta</i>					61
<i>Stylochiton natalense</i>					56
<i>Maytenus tenuispina</i>					56
<i>Lantana rugosa</i>					50
<i>Tephrosia rhodesica</i>					44
<i>Cryptolepis oblongifolia</i>					44
<i>Tapiphyllum parvifolium</i>					44
<i>Kalanchoe paniculata</i>					39
<i>Apodytes dimidiata</i>					39
<i>Aristida scabrivalvus</i>					33
<i>Turraea obtusifolia</i>					33
<i>Ancylbotrys capensis</i>					33
<i>Talinum caffrum</i>					33
Species Group G					
<i>Englerophytum</i>					
<i>magalismontanum</i>			43	100	
<i>Aristida transvaalensis</i>			50	61	
<i>Rhynchosia totta</i>			52	56	
<i>Loudetia simplex</i>			86	50	
<i>Tephrosia longipes</i>			68	50	
<i>Stachys natalensis</i>			36	50	
<i>Sphenostylis angustifolia</i>			45	33	
<i>Rhus dentata</i>			45	33	
Species Group H					
<i>Burkea africana</i>		43		94	
<i>Combretum molle</i>		30		94	
<i>Lannea discolor</i>		43		83	
<i>Ozoroa paniculosa</i>		30		50	

Table 1 (continued)

Community #	1	2	3	4	5
Land type	Ib/Ad	Ad	Ib/Fa	Fa	Ib/Fa
Altitude (x 100 = m)	11-17	12-15	15-20	13-16	13-14
Slope	G,L	G,L	M	M	L
Aspect	All	N	S,E	N	N,E
Surface rock cover	O,H	O,M	H	H	O
<i>Phyllanthus parvulus</i>		35		78	
<i>Raphionachne galpinii</i>		43		56	
<i>Setaria sphacelata</i>		78		44	
<i>Heteropogon contortus</i>		87		44	
<i>Vitex rehmannii</i>		39		61	
Species Group I					
<i>Andropogon schirensis</i>		43	80	61	
<i>Commelina africana</i>		39	64	100	
<i>Diheteropogon amplexans</i>		30	73	67	
<i>Schizachyrium sanguineum</i>		30	50	33	
<i>Fadogia homblei</i>		39	57	50	
<i>Melinis repens</i>		78	36	72	
<i>Brachiaria serrata</i>		70	39	44	
Species Group J					
<i>Vangueria infausta</i>	34	74	55	94	
<i>Asparagus transvaalensis</i>	38	39	43	56	
<i>Pellaea calomelanos</i>	31	30	50	89	
<i>Cheilanthes viridis</i>	38			56	
Species Group K					
<i>Xyris capensis</i>					88
<i>Andropogon huilensis</i>					88
<i>Miscanthus junceus</i>					63
<i>Fuirena pubescens</i>					56
<i>Monopsis decipiens</i>					50
<i>Helichrysum aureonitens</i>					50
<i>Ischaemum fasciculatum</i>					44
<i>Aristida junciformis</i>					44
<i>Ascolepis capensis</i>					44
<i>Sebaea leiostyla</i>					44
<i>Hypericum lalandii</i>					44
<i>Syzygium cordatum</i>					38
<i>Verbena bonariensis</i>					38
<i>Cyperus thorncroftii</i>					38
<i>Cliffortia linaerifolia</i>					31
<i>Arundinella nepalensis</i>					31
<i>Drosera madagascariensis</i>					31

1996), After a TWINSpan analysis (Hill 1979), the output of the resulting classification was imported into a spreadsheet, for refinement by Braun-Blanquet procedures (Behr & Bredenkamp 1988; Bredenkamp & Brown 2003). The final classification of the relevés was then interpreted for identification of major communities, where-after a synoptic table was compiled by calculating the percentage constancy of each species in each of the major communities identified. The result is given in Table 1.

Results

The vegetation composition of the study area is summarised in a synoptic table (Table 1). All species with a constancy value of more than 30 % in any community were included in the synoptic table. This table therefore shows the most frequently found species of each major community and summarises the relationship between the five major plant communities recognised.

Classification

The following major communities were identified:

A. Forest Communities:

1. *Olea europaea* subsp. *africana* - *Diospyros whyteana* Major Community

B. Sour Bushveld and North Eastern Mountain Sourveld Communities:

2. *Acacia caffra*-*Heteropogon contortus* Major Community
3. *Protea caffra*-*Loudetia simplex* Major Community
4. *Burkea africana*-*Setaria lindenberiana* Major Community

C. Wetland Communities:

5. *Andropogon huilensis*-*Xyris capensis* Major Community.

Description of the Major Communities

A. Forest Communities

1. *Olea europaea* subsp. *africana*-*Diospyros whyteana* Major Community

This major community occurs as forests in the kloofs, as dense bush clumps on south and east facing slopes and as bush clumps on termitaria. The kloofs are the least exposed of the geomorphology classes found in the study area, with water in the spruits.

The species composition of the *Olea europaea* subsp. *africana*-*Diospyros whyteana* Major Community is given in Table 1. These forests and dense bush clumps have

the following diagnostic species, all being trees or shrubs (Species Group A, Table 1): *Pappia capensis*, *Mimusops zeyheri*, *Olea europaea* subsp. *africana*, *Cussonia paniculata*, *Diospyros whyteana*, *Euphorbia ingens*, *Rhus leptodictya*, *Cryptolepis transvaalensis*, *Podocarpus latifolius*, *Maytenus undata*, *Zanthoxylum capense*, *Myrsine africana*, *Canthium gilfillanii*, *Calpurnia aurea*, *Ficus sur*, *Olea capensis* and *Grewia occidentalis*.

Although various different plant communities can be recognised within these forests and bush clumps (Van Staden 2003), species such as *Podocarpus latifolius*, *Mimusops zeyheri*, *Diospyros whyteana*, *Canthium gilfillanii* and *Olea capensis* are prominent throughout the range of this vegetation.

Grass and forb species are scanty under the dense forest vegetation, only *Eragrostis curvula*, *Asparagus transvaalensis*, *Pellaea calomelanos* and *Cheilanthes viridis* occurred with a constancy of more than 30 %.

The *Olea europaea* subsp. *africana*-*Diospyros whyteana* Major Community is floristically related to the Sour Bushveld communities (Communities 2, 3 and 4) within the park (Species Group J), but shows particular affinity to the *Acacia caffra*-*Heteropogon contortus* Major Community through Species Group C.

Coetsee (1975) described a related community from the Rustenburg Nature Reserve as *Hypoestes verticillaris*-*Mimusops zeyheri* Forests, and Westfall (1981) described a similar community from the Farm Groothoek in the Waterberg as Kloof Forest Communities on moderately deep soils in moist, sheltered habitats. Du Preez *et al.* (1991) classified this type of forest as typical Afromontane Forests, where these forests occur in specific niches in deep valleys, protected gorges, crevices and ravines along the eastern and western slopes of the Drakensberg mountain range.

Coetsee *et al.* (1976) described termitaria bush clump communities from the Nylsvley Nature Reserve, which have diagnostic

species similar to the bush clump communities on termitaria in the Marakele National Park.

- B Sour Bushveld and North Eastern Mountain Sourveld Communities
2. *Acacia caffra*-*Heteropogon contortus* Major Community

This major community represents a Sour Bushveld (Acocks 1988) with open to dense savanna typically found on the slopes of the Waterberg, and more open woodland or grassland on the summits. This open to closed woodland vegetation is found on gradual to moderately steep slopes (mainly footslopes) of outcrops, hills, ridges and mountains, which are widely distributed over Marakele National Park. It is restricted to shallow and rocky soils with a relatively high nutritional status (Coetsee 1975), derived from diabase and also from quartzite (Bezuidenhout *et al.* 1994). Many of the sample plots were located on diabase, which forms the substrate of this major community.

On the lower, less rocky slopes with deeper soils the *Acacia caffra*-dominated vegetation often grades into communities of the plains forming a mixed thornveld, as also described from the Rustenburg Nature Reserve (Coetsee 1975). On the other hand, the most mesic *Acacia caffra*-dominated vegetation shows some affinity to higher altitude *Protea caffra*-dominated vegetation that normally occurs at cooler sites (Species Group E, Table 1), at altitudes above the *Acacia caffra*-dominated vegetation, as also reported by Coetsee (1975).

The soils are mainly shallow, of the Mispah or Glenrosa Form, though deeper soils of the Hutton or Clovelly Form are encountered at the foot of the mountain slopes (MacVicar *et al.* 1977). The soil depth varies from 100 mm to more than 1000 mm (Land Type Survey Staff 1988).

The species composition of the *Acacia caffra*-*Heteropogon contortus* Major Community is given in Table 1. This major community is differentiated from the other major communities in the area by the following

diagnostic plant species (Species Group B, Table 1): *Acacia caffra*, *Faurea saligna*, *Dichrostachys cinerea*, *Pterocarpus rotundifolius*, *Elionurus muticus*, *Aristida congesta*, *Eragrostis capensis*, *Bewisia biflora*, *Perotis patens*, *Eragrostis lehmanniana*, *Pogonarthria squarrosa*, *Solanum incanum*, *Sida dregei* and *Vernonia oligocephala*.

Acacia caffra is mostly a dominant woody species, with other prominent species such as *Faurea saligna*, *Burkea africana*, *Dichrostachys cinerea*, *Pterocarpus rotundifolius*, *Vitex rehmannii*, *Vangueria infausta*, *Ozoroa paniculosa*, *Lansea discolor* and *Combretum molle* also prominently present in certain plant communities. Quite often the woody species are grouped in bush clumps, resulting in a savanna with scattered individual trees and bush clumps.

The prominent grass species include *Trachypogon spicatus*, *Themeda triandra*, *Setaria sphacelata*, *Schizachyrium sanguineum*, *Melinis repens*, *Heteropogon contortus*, *Eragrostis racemosa*, *Diheteropogon amplexens*, *Brachiaria serrata*, *Andropogon schirensis* and the diagnostic *Elionurus muticus* and *Eragrostis lehmanniana*.

The most frequently found forbs include *Pellaea calomelanos*, *Gnidia capitata*, *Fadogia homblei*, *Bulbostylis burchellii*, *Asparagus transvaalensis*, *Solanum incanum* and *Vernonia oligocephala*.

The Sour Bushveld (Acocks 1988) communities that occur in the park (Communities 2, 3 and 4) are all floristically related, indicated by Species Group I, but also through Species Groups E, G and H.

Descriptions of *Acacia caffra*-dominated vegetation are given by Bezuidenhout *et al.* (1988) from the Vredefort Dome area, Bezuidenhout & Bredenkamp (1991) from the North-West Province grasslands and Grobler *et al.* (2002) from the Johannesburg-Pretoria area. Particularly good examples (*Eustachys mutica*-*Acacia caffra* Woodlands) are provided by Coetzee (1975) from the Rustenburg Nature Reserve, Bezuidenhout *et al.* (1994) from the slopes of the hills

and ridges in the North-West Province, and Coetzee *et al.* (1994, 1995) from the Magaliesberg in the Pretoria area. Coetzee (1974) described *Acacia caffra* Savannas on diabase and in sheltered valleys from the Jack Scott Nature Reserve. Westfall (1981) described a similar community as Woodland on moderately deep soils in moderately exposed habitats, from the Farm Groothoek in the Waterberg.

3. *Protea caffra*-*Loudetia simplex* Major Community

The *Protea caffra*-*Loudetia simplex* Major Community is representative of Acocks' (1988) Sour Bushveld on moderately deep to deep soils in moderately exposed habitats. This mountain bushveld is found on gradual to steep rocky hills and ridges in the Marakele National Park. This vegetation type is prominent on the higher altitude slopes and crests. The soils are mainly very shallow, of the Mispah and Glenrosa Forms. The soil depth varies from 10 mm to 500 mm (Land Type Survey Staff 1988).

The species composition of the *Protea caffra*-*Loudetia simplex* Major Community is given in Table 1. This major community is differentiated by the following diagnostic plant species (species group D, Table 1):

Protea caffra, *Urelyterum agropyroides*, *Tristachya rehmannii*, *Panicum natalense*, *Monocymbium ceresiiforme*, *Xerophyta retinervis*, *Vernonia galpinii*, *Thesium utile*, *Senecio venosus*, *Rhynchosia nitens*, *Rhynchosia monophylla*, *Pentanisia angustifolia*, *Parinari capensis*, *Indigofera mollicoma*, *Indigofera hedyantha*, *Dicoma anomala*, *Cheilanthes hirta*, *Chaetacanthus costatus*, *Anthospermum hispidula*, *Aeschynomene rehmannii* and *Acalypha angustata*.

This major community is dominated by the tree *Protea caffra*. Other prominent woody species include *Vangueria infausta*, *Rhus dentata* and *Englerophytum magalison-tanum*.

The most prominent grasses that are often found in this major community are *Trachy-*

pogon spicatus, *Themeda triandra*, *Schizachyrium sanguineum*, *Melinis repens*, *Loudetia simplex*, *Eragrostis racemosa*, *Diheteropogon amplexens*, *Brachiaria serrata*, *Aristida transvaalensis* and *Andropogon schirensis*.

Many forb species are present in this vegetation; the most frequently encountered include *Tephrosia longipes*, *Stachys natalensis*, *Sphenostylis angustifolia*, *Rhynchosia totta*, *Pellaea calomelanos*, *Gnidia capitata*, *Fadogia homblei*, *Commelina africana*, *Bulbostylis burchellii* and *Asparagus transvaalensis*.

Many authors described *Protea caffra*-dominated vegetation, mainly from Sour Bushveld and Bankenveld, including Coetzee (1974, 1975) from the Magaliesberg area, Bredenkamp & Theron (1978) from the Suikerbosrand, Behr & Bredenkamp (1988), from the Witwatersrand, Bezuidenhout *et al.* (1994) from the Gatsrand area in North-West Province, Coetzee *et al.* (1995), Bredenkamp & Brown (1998a; 1998b) from the natural areas of the Western Metropolitan Local Council and Grobler *et al.* (2002) within various natural open spaces in Gauteng. This emphasises the floristic relationships between Bankenveld, Sour Bushveld and the Drakensberg area (Bredenkamp & Brown 2003).

4. *Burkea africana*-*Setaria lindenberghiana* Major Community

This major community represents Sour Bushveld (Acocks 1988). It occurs on gentle to moderately steep slopes of rocky sandstone hills, where soils are litholitic and large rock boulders cover 53 % of the soil surface. Aspects are mostly northerly, and these slopes are warm and dry. The soils are mainly of the Mispah and Glenrosa Forms. The soil varies from 10 mm to more than 500 mm in depth (Land Type Survey Staff 1988).

This vegetation type is also found at the northernmost areas of the Bankenveld in the Pretoria and Rustenburg areas and is found at high altitudes on warm northern and

northeastern aspects with gradual to very steep slopes (Bredenkamp & Brown 2003). The shallow soils are covered with large boulders and smaller rocks that in some cases provide moister microhabitats than the surrounding areas.

The species composition of the *Burkea africana*-*Setaria lindenberghiana* Major Community is given in Table 1. This major community is differentiated by the following diagnostic plant species (species group D, Table 1):

Tapiphyllum parvifolium, *Strychnos pungens*, *Rhoicissus revoilii*, *Pseudolachnostylis maprouneifolia*, *Ochna pulchra*, *Maytenus tenuispina*, *Elephantorrhiza burkei*, *Diplorhynchus condylocarpon*, *Cryptolepis oblongifolia*, *Apodytes dimidiata*, *Acylobotrys capensis*, *Setaria lindenberghiana*, *Aristida scabrivalvus*, *Turraea obtusifolia*, *Tephrosia rhodesica*, *Talinum caffrum*, *Stylochiton natalense*, *Littonia modesta*, *Lantana rugosa*, *Kalanchoe paniculata* and *Hypoestes forskoolii*.

Apart from the above prominent diagnostic species, other prominent woody species include *Vitex rehmannii*, *Vangueria infausta*, *Rhus dentata*, *Ozoroa paniculosa*, *Lannea discolor*, *Englerophytum magalismontanum*, *Combretum molle* and *Burkea africana*.

Grass species that are prominent in this community include *Setaria sphacelata*, *Schizachyrium sanguineum*, *Melinis repens*, *Loudetia simplex*, *Heteropogon contortus*, *Diheteropogon amplexens*, *Brachiaria serrata*, *Aristida transvaalensis* and *Andropogon schirensis*.

Forbs include *Tephrosia longipes*, *Stachys natalensis*, *Sphenostylis angustifolia*, *Rhynchosia totta*, *Pellaea calomelanos*, *Fadogia homblei*, *Cheilanthes viridis* and *Asparagus transvaalensis*.

Coetzee (1975) described a similar community as the *Barleria bremekampii*-*Diplorhynchus* Tree Savanna from Rustenburg Nature Reserve, and Westfall (1981) described a similar community as a Woodland, representative of Acocks' (1988) Sour

Bushveld, on moderately deep to deep soils in moderately exposed habitats from the Waterberg.

Further examples of this vegetation were described from the scarps and slopes of the Jack Scott (Coetzee 1974), from the warm temperate mountain bushveld within the Pretoria-Witbank-Heidelberg areas by (Coetzee *et al.* 1993), from the Melville koppies Nature Reserve (Ellery 1994), from the natural areas of the western local Metropolitan Council of Gauteng by Bredenkamp & Brown (1998a) and within various natural open spaces in Gauteng by Grobler *et al.* (2002).

5. *Andropogon huilensis*-*Xyris capensis*
Major Community Major

Many streams arise in seepage areas, for instance on mountain slopes within Marakele National Park. These are seasonally or perennially waterlogged sponges, with vegetation dominated by sedges and other hygrophilous angiosperms and mosses (Noble & Hemens 1978). This major wetland community occurs along streams and tributaries of the Matlabas, Mamba and Sterkstroom rivers and shallow submerged marshy areas or sponges.

The soils are wet, mainly of the Avalon, Hutton, Katspruit, Oakleaf and Westleigh Forms, derived from sandstone of the Sandriviersberg Formation (De Vries 1968, 1969). The soil depth varies between 300–1 200 mm (Land Type Survey Staff 1988).

The species composition of this wetland Major Community is given in Table 1. This major community is differentiated by the following diagnostic plant species (Species Group K): *Syzygium cordatum*, *Cliffortia linaerifolia*, *Andropogon huilensis*, *Aristida junciformis*, *Arundinella nepalensis*, *Ischaemum fasciculatum*, *Miscanthus junceus*, *Ascolepis capensis*, *Cyperus thorncroftii*, *Drosera madagascariensis*, *Fuirena pubescens*, *Helichrysum aureonitens*, *Hypericum lalandii*, *Monopsis decipiens*, *Sebaea*

leiostyla, *Verbena bonariensis* and *Xyris capensis*.

Coetzee (1975) described similar communities from the Rustenberg Nature Reserve as the *Aristida junciformis*-*Arundinella nepalensis* Grassland and the *Pteridium aquilinum*-*Phragmites mauritianus* Reedswamp.

Discussion

The vegetation of the study area was classified in a hierarchical, plant sociological system by using the Braun-Blanquet technique. The floristic data from 130 relevés were classified to identify five major plant communities. These plant communities were ecologically interpreted by habitats. These major plant communities should form the basis for a management plan, and should also be the basis for a more detailed classification of the vegetation of this national park.

According to White (1978) the majority of the tree species in South African Afromontane forests are widespread. Amongst them are, inter alia, *Podocarpus latifolius*, *Olea capensis* and *Myrsine africana* that occur as diagnostic species in the *Olea europaea* subsp. *africana*-*Diospyros whyteana* Major Community within the study area. These forests on the Waterberg have a clear floristic affinity to the Afromontane forests found in the Drakensberg (Du Preez *et al.* 1991), indicating a much more widespread distribution of forests at previous times, with the Waterberg forests being a western relict (Bredenkamp *et al.* 2002). The above mentioned assemblage of species could almost be used to define the Afromontane region as a whole. Not one species occurs throughout, but most species of the assemblage are present on virtually every “island” of Afromontane forest in the region.

It is interesting to note that the vegetation on the termitaria have species similar to the forest communities, and are therefore included into this major community. The greater water holding capacity of the soils worked over by the termites renders these habitats suitable for forest development (Coetzee *et al.* 1976).

The *Acacia caffra*-*Heteropogon contortus* Major Community on footslopes, *Protea caffra*-*Loudetia simplex* Major Community on cooler southerly facing slopes and the *Burkea africana*-*Setaria lindenbergiana* Major Community on the warmer northerly facing slopes have a clear floristic relationship with similar plant communities in the Bankenveld. The relationships between Sour Bushveld, Sourish Mixed Bushveld and Bankenveld woodland communities (Acocks 1988) are clearly indicated by Bredenkamp & Brown (2003) and can further be demonstrated from studies by Van Vuuren & Van der Schijff (1970), Du Plessis (1972), Theron (1973), Coetzee (1975), Van der Meulen (1979), Westfall (1981) and Coetzee (1993). Furthermore, Coetzee (1993), O'Connor & Bredenkamp (1997) and Bredenkamp & Brown (2003) indicated that the Bankenveld vegetation also shows an affinity to the Drakensberg flora. This relationship may also be seen in the presence of the Afromontane forests in the Drakensberg, Bankenveld and Waterberg.

In the cooler, southern parts of the Bankenveld, *Acacia caffra*-dominated vegetation is usually found on lower and warmer north-facing slopes, e.g., in the Vredefort Dome area, though in the warmer northern parts e.g. the Marakele National Park, it may be found at higher altitudes, on crests or south-facing slopes (Coetzee 1975; Bezuidenhout *et al.* 1994; Coetzee *et al.* 1995).

Due to the complex mosaic distribution pattern of the sub-communities that are included under the major communities, a vegetation map is more appropriate when the details of the sub-communities are published.

References

- ACOCKS, J.P.H. 1988. Veld types of South Africa. *Memoirs of the botanical Survey of South Africa* 57: 1-146.
- BARKMAN, J.J., J. MORAVEC & S. RAUCHERT. 1964. Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. *Acta Botanica Neerlandica* 13: 394-449.
- BEHR, C.M. & G.J. BREDEKAMP. 1988. A phytosociological classification of the Witwatersrand National Botanical Garden. *South African Journal of Botany* 54: 525-533.
- BEZUIDENHOUT, H. 1992. Verslag oor die abiotiese komponent van die Kransberg Nasionale Park. Unpublished internal report.
- BEZUIDENHOUT, H., H.C. BIGGS & G.J. BREDEKAMP. 1996. A process supported by the utility BBPC for analysing Braun-Blanquet data on a personal computer. *Koedoe* 39(1): 107-112.
- BEZUIDENHOUT, H., & G.J. BREDEKAMP. 1991. The vegetation of the Bc Land Type in the western Transvaal grassland, South Africa. *Phytocoenologia* 19: 497-518.
- BEZUIDENHOUT, H., G.J. BREDEKAMP & J.H. ELSENBROEK. 1988. Die plantegroei van die alkaligraniet en aangrensende kwartsiet in die Vredefortkoepel noordwes van Parys. *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 7: 4-9.
- BEZUIDENHOUT, H., G.J. BREDEKAMP & G.K. THERON. 1994. Syntaxonomy of the vegetation of the Fb land type in the western Transvaal grassland, South Africa. *South African Journal of Botany* 60: 72-80.
- BREDEKAMP, G.J. & L.R. BROWN. 1998a. *A vegetation assessment of the open spaces in the Western Metropolitan local Council area*. Pretoria: Ekotrust CC.
- BREDEKAMP, G.J. & L.R. BROWN. 1998b. *A vegetation assessment of open spaces in the northern areas of the Northern Metropolitan Local Council*. Pretoria: Ekotrust CC.
- BREDEKAMP, G.J. & L.R. BROWN. 2003. A reappraisal of Acocks' Bankenveld: Origin and diversity of vegetation types. *South African Journal of Botany* 69(1): 7-26.
- BREDEKAMP, G.J., F. SPADA & E. KAZMIERCZAK. 2002. On the origin of northern and southern hemisphere grasslands. *Plant Ecology* 163(2): 209-229.
- BREDEKAMP, G.J. & G.K. THERON. 1978. A synecological account of the Suikerbosrand Nature Reserve. 1. The phytosociology of the Witwatersrand geological system. *Bothalia* 12: 513-529.
- BROWN, L.R. 1997. A plant ecological study and wildlife management plan of the Borakalalo Nature Reserve, North-west Province. Ph.D. thesis. University of Pretoria, Pretoria.
- COETZEE, B.J. 1974. A phytosociological classification of the vegetation of the Jack Scott Nature Reserve. *Bothalia* 11: 329 - 347.
- COETZEE, B.J. 1975. A phytosociological classification of the Rustenburg Nature Reserve. *Bothalia* 11: 561-580.
- COETZEE, B.J. & M.J.A. WERGER. 1975. On association—Analysis and the classification of plant communities. *Vegetatio* 30: 201-206.

- COETZEE, B.J., F. VAN DER MEULEN, S. ZWANZIGER, P. GONSALVES & P.J. WEISSER. 1976. A phytosociological classification of the Nylsvley Nature Reserve. *Bothalia* 12: 137-160.
- COETZEE, B.J., P. VAN WYK, W.P.D. GERTENBACH, A. HALL-MARTIN & S.C.J. JOUBERT. 1981. 'n Plantekologiese verkenning van die Waterberggebied in die Noord-Transvaalse Bosveld. *Koedoe* 24:1-23.
- COETZEE, J.P. 1993. Phytosociology of the Ba and Ib land types in the Pretoria-Witbank-Heidelberg area. MSc thesis, University of Pretoria, Pretoria.
- COETZEE, J.P., G.J. BREDEKAMP & N. VAN ROOYEN. 1993. The Sub-humid Warm Temperate Mountain Bushveld plant communities of the Pretoria-Witbank-Heidelberg area. *South African Journal of Botany* 59(6): 623-632.
- COETZEE, J.P., G.J. BREDEKAMP & N. VAN ROOYEN. 1994. An overview of the physical environment and vegetation units of the Ba and Ib land types of the Pretoria-Witbank-Heidelberg area. *South African Journal of Botany* 60(1): 49-61.
- COETZEE, J.P., G.J. BREDEKAMP & N. VAN ROOYEN. 1995. Plant communities of the Sub-humid Cool Temperate Mountain Bushveld in the Pretoria Witbank Heidelberg area. *South African Journal of Botany* 61: 114-122.
- DE VRIES, W.C.P. 1968-69. Stratigraphy of the Waterberg System in the Southern Waterberg area, Northwestern Transvaal. *Annals of the Geological Survey in South Africa* 43-56.
- DU PLESSIS, C.J. 1972. 'n Floristies-ekologiese studie van die plaas Doornkop in die distrik Middelburg, Transvaal. MSc Thesis, University of Pretoria, Pretoria.
- DU PREEZ, P.J., G.J. BREDEKAMP & H.J.T. VENTER. 1991. The syntaxonomy and synecology of the forests in the eastern Orange Free State, South Africa. I. The *Podocarpetalia latifolii*. *South African Journal of Botany* 57: 198-206.
- EDWARDS, D. 1972. Botanical survey and agriculture. *Proceedings of the Grassland Society of South Africa* 7: 15-19.
- ELLERY, W.N. 1994. *The vegetation ecology of Melville Koppies Nature reserve and Louw Geldenhuys View Site: Proposals for their Management*. Johannesburg: Botanical Society of South Africa.
- GERTENBACH, W.P.D. 1987. 'n Ekologiese studie van die Suidelike Mopanieveld in die Nasionale Krugerwildtuin. D.Sc proefskrif (Ongepubliseer). Universiteit van Pretoria.
- GROBLER, C.H., G.J. BREDEKAMP & L.R. BROWN. 2002. Natural woodland vegetation and plant species richness of the urban open spaces in Gauteng, South Africa. *Koedoe* 45: 19-34.
- HILL, M.O. 1979. Twinspan - a Fortran program for arranging multivariate data in an ordered two way table by classification of individuals and attributes. Cornell University, Ithaca, New York.
- LAND TYPE SURVEY STAFF. 1988. Land types of the maps 2426 Thabazimbi, 2428 Nylstroom. *Memoirs of the agricultural natural Resources of South Africa* 10: 1-431.
- LOW, A.B. & A.G. REBELO. 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.
- MACVICAR, C.N., R.F. LOXTON, J.J.N. LAMBRECHTS, J. LE ROUX, J.M. DE VILLIERS, E. VERSTER, F.R. MERRY-WEATHER, T.H. VAN ROOYEN & H.J. VON M. HARMSE. 1977. *Grondklassifikasie, 'n binomiese sisteem vir Suid Afrika*. Pretoria: Departement Landbou Tegnieke Dienste.
- MUELLER-DOMBOIS, D. & H. ELLENBERG. 1974. *Aims and Methods of Vegetation Ecology*. New York: Wiley.
- NOBLE, R.G. & J. HEMENS. 1978. Inland water ecosystems in South Africa a review of research needs. *South African Natural Science Progress Report* 34: 1-150.
- O'CONNOR, T.G. & G.J. BREDEKAMP. 1997. Grassland. Pp. 215-257. In: COWLING R.M., D.M. RICHARDSON & S.M. PIERCE (eds.). *Vegetation of Southern Africa*. Cambridge: Cambridge University Press.
- Rutherford, M.C. & R.H. Westfall. 1994. Biomes of southern Africa: An objective categorization. *Memoirs of the botanical Survey of South Africa* 63: 1-94
- SOUTH AFRICAN COMMISSION FOR STRATIGRAPHY (SACS). 1980. Stratigraphy of South Africa. Part 1 (Comp. L.E. Kent). *Lithostratigraphy of the Republic of South Africa, South West Africa/Namibië and the Republics of Bophuthatwana, Transkei, and Venda*. Pretoria: Government Printer. (Handbook for Geological Survey in South Africa 8.)
- THERON, G.K. 1973. 'n Ekologiese studie van die Plantegroei van die Loskopdam - natuurreservaat Ongepubl. D.Sc - thesis, University of Pretoria, Pretoria.
- VAN DER MEULEN, F. 1979. *Plant sociology of the Western Transvaal Bushveld*. *South Africa: Syn-taxonomic and synecological study*. Vaduz: Cramer. (*Dissertationes Botanica* 49.)
- VAN ROOYEN, N. 1983. Die Plantegroei van die Roodeplaatdam - natuurreservaat II. Die plantgemeenskappe. *South African Journal of Botany* 2: 115 -125.
- VAN STADEN, P.J. 2002. An ecological study of the plant communities of Marakele National Park. M.Sc. thesis, University of Pretoria, Pretoria.
- VAN VUUREN, D.R.J. & H.P. VAN DER SCHIFF. 1970. 'n Vergelykende ekologiese studie van die plantegroei van 'n noordelike en suidelike kloof

- van die Magaliesberg. *Tydskrif vir Natuurwetenskappe* 10: 16-75.
- WERGER, M.J.A. 1974. On concepts and techniques applied in the Zürich-Montpellier method of vegetation survey. *Bothalia* 11(3): 309-323.
- WESTFALL, R.H. 1981. The plant ecology of the farm Groothoek, Thabazimbi District. M.Sc. thesis, University of Pretoria, Pretoria.
- WESTFALL, R.H., N. VAN ROOYEN & G.K. THERON. 1985. The plant ecology of the farm Groothoek, Thabazimbi District. 2. Classification. *Bothalia* 15: 655-688.
- WESTHOFF, V. & E. VAN DER MAAREL. 1980. The Braun-Blanquet approach. Pp. 287-399. In: R.H. WHITTAKER (ed.). *Classification of plant communities*. The Hague: Junk.
- WHITE, F. 1978. The Afromontane region. Pp. 465-513. In: WERGER, M.J.A. (ed.). *Biogeography and ecology of Southern Africa*. The Hague: Junk.