Bothalia 11,3: 329–347 (1974)

A phytosociological classification of the vegetation of the Jack Scott Nature Reserve*

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ABSTRACT

The vegetation of the Jack Scott Nature Reserve in the Central Bankenveld Veld Type is classified chiefly by the Braun-Blanquet Table Method. Habitat features, physiognomy, total floristic composition, differentiating species, woody plants and prominent grasses and forbs are presented for each community. Characterizing habitat features, in order of importance for the communities, are: exposure, soil texture, geology, slope, aspect, degree of rockiness and previous ploughing. The classification correlates well with the major physiographic and climatic variation in the Reserve and generally does not cut across main physiognomic types. The communities are potentially homogeneous management units.

INTRODUCTION

The Jack Scott Private Nature Reserve is located 50 km west-northwest of Pretoria in the Central Variation of Acocks' (1953) Bankenveld Veld Type and covers approximately 3 100 ha (Fig. 1). The Bankenveld covers approximately 2 356 800 ha or 2 % of the area of South Africa, and the Central Variation contains no state or provincial nature reserves. Conservation of vegetation in this veld type variation is therefore at present dependent on management policies of private landowners (Edwards, 1972a).

The purpose of this study was to provide a classification of the vegetation of the Jack Scott Nature Reserve into ecological units correlated with stable and permanent habitat conditions, distinguishing, therefore, areas of uniform potential for management purposes. To this end, the classification is based mainly on the presence and absence of groups of associated species which show similar response to the environment (Goodall, 1953). Association-analysis (Williams & Lambert, 1959 & 1960) was used to obtain a first approximation of such a classification and was then supplemented by the Braun-Blanquet Table Method (Werger, 1973, 1974).

THE STUDY AREA

History and management

The study area has been managed as a nature reserve for almost two decades, prior to which it belonged to mining companies for more than half a century. Occasional small diggings, old, deserted stone enclosures and a few abandoned farmlands with characteristic vegetation, bear witness to earlier human activities. Historical records indicate that fires occurred annually until the fifties, but are now restricted by roads and firebreaks. Except for firebreaks, no fixed burning programme has been followed although some land was recently burnt to remove excess plant litter.

The Reserve is fenced with a game fence and is not sub-divided into camps. Nevertheless, domestic animals and game do not exert a homogeneous influence on the vegetation. About 100 ha of land surrounding the living quarters of farm labourers are overgrazed and trampled by their restricted number of domestic stock.

* Partly based on an M.Sc. thesis, Universitity of Pretoria.

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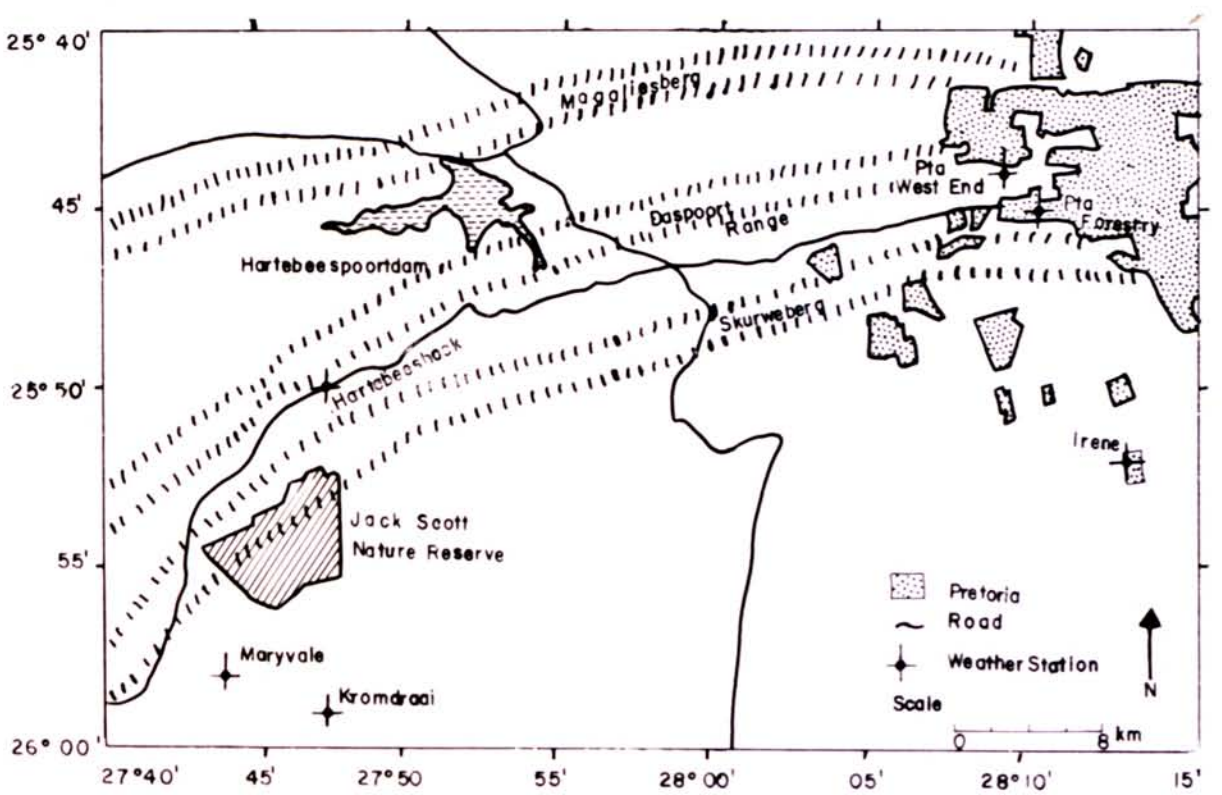

FIG. 1. Geographical positions of the Jack Scott Nature Reserve and weather stations.

Game species occurring mainly in the grasslands are blesbuck, black wildebeest, zebra, springbuck and gemsbuck. Areas around salt licks are extremely trampled and heavily grazed by game. Firebreaks, burned triennially on the same strip of land, attract a considerable number of game and are heavily grazed in some areas. A high dolomite grassland area where these animals concentrate, is also overgrazed and trampled, but other grasslands are generally lightly grazed and in good condition. Giraffe, kudu, bushbuck and nyala concentrate mainly in the savanna and forest areas where they have little apparent influence on the vegetation. Also occurring in the reserve are eland, impala, blue wildebeest, mountain reedbuck, ostriches, jackal, leopard and brown hyaena. The ungulates are completely protected from hunting and efforts are being made to eradicate predators in order to increase the ungulate population. Blesbuck are the most numerous of the game species and numbered over 400 in January, 1972 (Mason, personal communication).

Exotic plants in the Reserve include a number of weeds, mostly annuals, in disturbed areas; a small number of woody plants, such as *Salix babylonica*, *Acacia dealbata* and *Melia azedarach* along streams, an *Opuntia* species on some steep slopes and a single *Prunus persica* tree in a stand of natural vegetation; a local sward of *Pennisetum clandestinum* and lawns of *Pennisetum clandestinum* and *Phylla nodiflora* at two recreation areas.

Apart from a relatively limited area around residential quarters, overgrazed and trampled areas in dolomite grassland, and a few small, isolated, heavily-trampled areas, the vegetation over most of the Reserve is thus uncultivated and little disturbed by human and animal agency.

Physiography

Geological formations in the Reserve are of the Transvaal System where it forms the southern rim of the Bushveld Basin with rocks dipping north at 15° to 30° (Haughton, 1969). Formations occurring in the Reserve (Fig. 2) are, from below and from south to north:

(i) Dolomite and chert of the Dolomite Series;

(ii) shale and quartzite of the Timeball Hill Stage of the Pretoria Series; and

(iii) shale of the Daspoort Stage of the Pretoria Series.

Local post-Bushveld Complex diabase intrusions occur within these formations.

The Reserve is situated at an altitude of between 1 310 m and 1 615 m. The southern part is gently undulating grassland on dolomite, mainly between 1 510 m and 1 570 m with isolated chert-capped hills.

In the north there is the wide west-east valley of the Skeerpoort River. The southern slopes of the upper western part of the valley are formed by chert. In the east the valley cuts through the chert into dolomite with chert occurring above 1 430 m. The southern rim of this valley is a long west-to-east-running chert ridge that is interrupted by a tributary of the Skeerpoort River, originating on the dolomite highlands. Other tributary valleys of the Skeerpoort River, which cut into the southern slopes of the Skeerpoort Valley, are sheltered from cold southern winds by the chert ridge.

The gently undulating floor of the Skeerpoort Valley is mainly shale with few rock outcrops and soil that is generally only a few centimetres deep. On the northern side of the valley are south-facing shale slopes of the Timeball Hill Stage. This ridge is the southernmost of three parallel ranges which mark the transition from Witwatersrand high grassland to Northern Transvaal wooded vegetation. The northern boundary of the Reserve runs along the summit of this ridge with the highest points between 1 520 m and 1 580 m in the west and between 1 360 m and 1 420 m in the east. The rocky summit and northern slopes of this range are formed by layered quartzite, which is more resistant to weathering than the shale buried underneath south-facing talus slopes.

Diabase intrusions are largely limited to the northern part of the Reserve where the dykes are associated with long north-south depressions and drainage lines in shale and quartzite.

Soils in the Reserve are generally residual and shallow. Weathering of dolomite by solution of calcium and magnesium carbonates produces a silica rich sandy loam soil with manganese and iron concretions. Chert weathers mechanically to a silica-rich sandy loam soil. Shale, consisting mainly of iron-rich aluminium silicates produces a typical yellowish to reddish clay loam soil with many termite mounds. Quartzite, being a metamorphic sandstone, forms a sandy soil mixed to a greater or lesser degree with finer clay material from the surrounding shale. Soil from the iron and magnesium-rich diabase is mixed with shale and quartzite colluvium. Soils associated with diabase dykes have a clay loam texture.

Climate

The Reserve is situated in a summer rainfall area with temperate summers and frosty winters, classified as Cwb-climate in Köppen's system (Trewartha, 1954).

Average total radiation measured in Pretoria on a horizontal surface varies from between 560 and 580 cal/cm²/day in December, January and February to between 340 and 360 cal/cm²/day in May, June and July. Direct radiation on north-facing slopes at 26° S latitude is higher than on south-facing slopes, particularly during winter months. This difference in winter radiation becomes even more pronounced since diffuse radiation, which is not aspect dependent, accounts for only 20% of the total radiation in June as against 36% in January (Shulze, 1965).

Data from Pretoria (West End), Pretoria (Forestry) and Irene (Fig. 1), suggest that temperatures are lowest in June and July, with average monthly minima about –5° C and an extreme minimum of about –8,7° C (Weather Bureau, 1954). The average monthly maxima in the hottest months from November to February can be as high as 33,7° C and the extreme maximum recorded at Pretoria (Forestry) is 37, 8°C during November. The average period with at least occasional frost stretches from about April to September with frost usually occurring daily from May until August (Schulze, 1965).

Considerable variation in micro- and meso-climate may be expected in the Reserve due to variation in topography, soils and vegetation structure. The high-lying southern part of the Reserve and tributary valleys of the Skeerpoort River that have been cut through the chert divide, are exposed to cold catabatic winds flowing from the south during many clear, calm winter nights. Frost in valley bottoms suggests the occurrence of thermal belts in sheltered valleys with summits cooling more than slopes and cold air collecting in valley bottoms. Temperatures on north-facing slopes will generally be higher than on south-facing slopes as a result of differences in amount of radiation received.

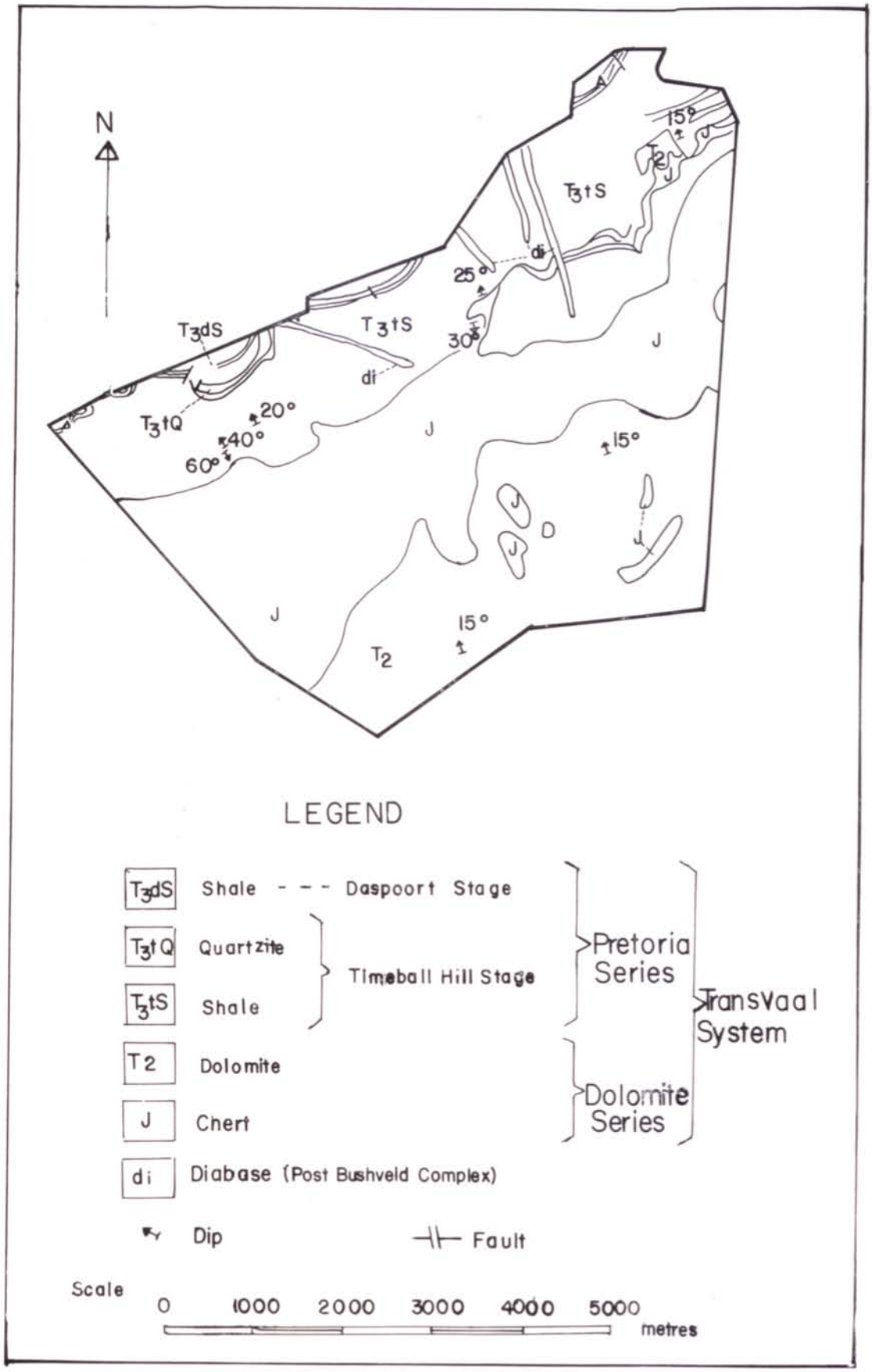

FIG. 2. Geological map of the Jack Scott Nature Reserve (source: unpublished map, Dept. of Mines, Pretoria).

Some idea of the wind regime in the Reserve can be obtained by extrapolating from Pretoria and Jan Smuts weather stations (Schulze, 1965). Northerly to easterly winds similar to those experienced in Pretoria are expected to predominate slightly during summer, a strong predominating south-westerly component, during winter. The strongest winds in the region are usually south-westerly to southerly gusts of short duration, accompanying thunder storms, with the strongest winds occurring mainly in spring (September to November). Whirlwinds due to strong instability and convection may occur on hot summer days.

Rain occurs mainly as showers and thunderstorms of short duration. Average annual rainfall, based on data from Maryvale, Hartebeeshoek and Kromdraai (Fig. 1), is between 670 and 745 mm with 85–90% falling from October to March (Weather Bureau, 1965). Hail storms occur, on the average, on four to five days per year, mainly during the rainy season (Schulze, 1965).

Previous botanical descriptions

The Jack Scott Nature Reserve lies near the boundary between two major vegetation types recognized by authors of all broad vegetation descriptions of the region. Elements of both types occur in the Reserve. Pole Evans (1936) describes these two vegetation types as Mixed Grassland, on the one hand, and Evergreen and Deciduous Trees and Bush on the other, Adamson (1938) as Highveld Grassland and Bushveld, and Acocks (1953) as Bankenveld and Sourish Mixed Bushveld.

A more detailed classification and 1: 30 000 vegetation map by Wells (1964) divided the vegetation on a structural and ecological basis into forest patches, tree communities, grasslands and marshy areas. Tree communities, separated floristically from one another on the basis of dominant trees, were *Protea caffra* veld, *Protea rouppelliae* veld, *Acacia caffra* veld, *Acacia karroo* veld and *Burkea africana* veld. Grasslands were divided physiographically into Valley Grasslands, Rocky Grassland, and Highland Grassland.

METHODS OF SAMPLING AND SYNTHESIS

Samples were divided *pro rata* on an area basis among a number of geomorphological vegetation-physiognomic units delineated on aerial photos and were placed at random within these units. A minimum of ten samples per unit was regarded as sufficient. After placing 188 samples, only old farmlands were undersampled (i.e. contained less than 10 samples) and they were therefore supplemented with four additional samples.

Subsequent to sampling the 192 sites, an additional 37 sampling sites were placed in the following classes, shown by a field check of geological-physiognomical variation to be undersampled: two sites in wooded vegetation on dolomite; five on wooded vegetation on shale without quartzite talus, and ten sites each on diabase, quartzite and magnetite-quartzite.

The total number of samples taken in the reserve was 229, giving an average sampling intensity of one per 13,5 ha.

Scheepers (personal communication) found a rectangular quadrat of 4 m × 4 m the most efficient for highveld vegetation that is similar to large parts of the Reserve. The same size and shape were used in this study.

Physiographic data recorded include geology, rockiness, geomorphology, aspect and slope. Surface stones and soil colour, texture and stoniness were also noted for the top 5 cm of soil. Percentage projected canopy cover and height for each stratum, as well as total percentage canopy cover, were recorded.

All vascular plants in quadrats were recorded and additional species occurring within 2 m of quadrats were noted separately. For 184 quadrats a Braun-Blanquet cover-abundance value (Kershaw, 1964) was estimated for each species. A list of trees and shrubs occurring within the same stand of vegetation near sampling sites, was included as part of each relevé.

A first approximation of the final grouping of quadrats was obtained by normal association-analysis (Williams & Lambert, 1959, 1960), of all relevés, and species occurring in eight or more relevés. To obtain a polythetic classification as well as an inverse analysis, relevés, and also species occurring in two or more relevés were further arranged following the Braun-Blanquet approach (Coetzee, 1972, 1974; Muller *et al*, 1972; Werger, 1973, 1974).

PLANT COMMUNITIES

The hierarchy of plant communities recognized in the Jack Scott Nature Reserve is based on Braun-Blanquet tables which are summarized in a Summary or Roman Table (Table 1.).

In Table 1 each community, based on several relevés, is reduced to a single column. The roman figures in the matrix are ratings of constancy of each species in relevés of each community on a five point scale (Werger, 1973):

I 1 to 20% constancy.
II 21 to 40% constancy.
III 41 to 60% constancy.
IV 61 to 80% constancy.
V 81 to 100% constancy.

The number of relevés summarized in a column is indicated in the table.

No attempt is made at fixing the ranks of syntaxa and the general diagnostic value of species, which are important considerations when naming syntaxa in accordance with the nomenclatural principles of the Braun-Blanquet School (Werger, 1973). Since priority is generally recognized in the Braun-Blanquet School, information from a wider area is desirable in order to avoid premature ranking and naming of syntaxa.

The naming of vegetation types is here based on a combination of prominent species, vegetation structure and habitat, and the names are diagnostic within the reserve when applied in their hierarchical context.

Structural terms are those defined by Fosberg (1967). Communities are classified structurally and functionally into Fosberg's system with the code for each formation given in brackets after each formation name.

Lists of woody plants occurring in communities include plants noted around quadrats in the same stands of vegetation.

Grass, forb and suffrutescent species with a cover abundance of two or more (i.e. very abundant or covering 25% or more of the area) in at least 25% of the relevés representing a community, are listed in Table 2 as prominent species in the grass stratum of that community.

FIGURE 3

VEGETATION MAP OF THE JACK SCOTT NATURE RESERVE

SCALE 1/20000

m 0 200 400 600 800 1000

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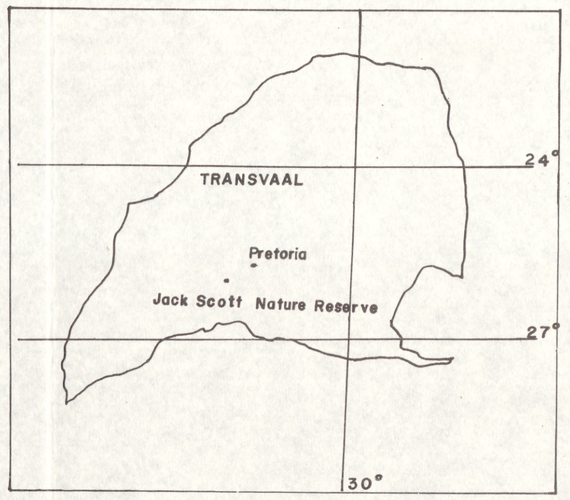
.972/.973

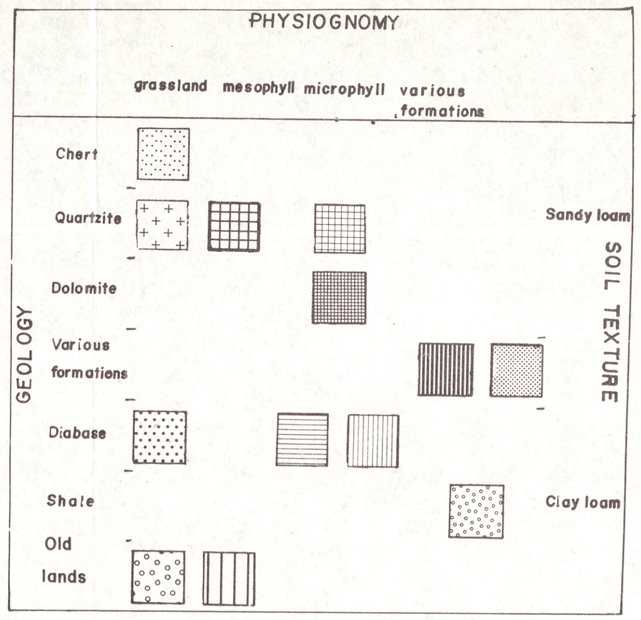
27°43' 44' 45' 46' 47' 27°48'

26°38' 57' 56' 55' 26°54'

POSITION OF THE JACK SCOTT NATURE RESERVE



SCHEMATIC REPRESENTATION OF COMMUNITIES, PHYSIOGNOMY AND HABITAT



LEGEND

1·1	Acacia caffra savanna on diabase	3·1	Protea caffra evergreen savannas on shale
1·2·1	Acacia caffra - Chrysopogon montanus savanna	3·2 A	Grasslands on shale
1·2·2	Acacia caffra - Ruellia cordata savanna	B	Deciduous savannas on shale
1·3	Grasslands and Cussonia paniculata savanna on dolomite	4·1 & 4·3	Vegetation on quartzite outcrops (unmappable dimensions :- - -)
2·1·1	Grasslands on chert rich dolomite	4·2	Steppe savanna and grassland on broken quartzite
2·1·2	Grasslands on chert	5·	Grasslands on old farmlands
2·2	Savannas on chert	6·	Krantz, riparian and kloof communities

- drainage lines
- roads
- trigonometrical beacons
- principal points on air photos

AIR PHOTOGRAPHY 1968 (JOB NO. 603/68)
BOTANICAL SURVEY SECTION
BOTANICAL RESEARCH INSTITUTE
PRIVATE BAG X101, PRETORIA.

TABLE 1. Constancy of Species in Communities

Community Number	1/1	1/2/1	1/2/2	1/3/1 (a)	1/3/1 (b)	1/3/2	2/1/1 (a) (i)	2/1/1 (a) (ii)	2/1/1 (b)	2/1/2 (a)	2/1/2 (b)	2/2/1	2/2/2	2/2/3 (a)	2/2/3 (b)	3/1/1	3/1/2	3/1/3	3/2	4/1	4/2	4/3	4/4	4/5	5/1	5/2
Number of Quadrats	9	6	7	7	19	16	8	12	5	12	9	4	3	10	3	12	10	10	23	11	5	4	5	4	7	6
Habitat:																										
Soil texture (S=Sandy loam, C=clay loam)	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	S	C	S	S	C	C
Geology (C=chert, D=dolomite, I=diabase, Q=quartzite, S=shale)	I	D C	D C	D	D	D C	C D	C D	C D	C	C	C	C D	C	C	S	S	S	S	Q	Q	Q	C	C	S	S
Slope in % of 45° (G<12, S=12–30, V>30)	S V	V	S V	G	G	S V	G S V	G S V	G	G S	G S	V	V	G S	S	S V	S	S	G	S	S	V	S	V	G	G
Aspect (N = northerly; S=southerly; B=northerly & southerly; ( )=mainly)	B (S)	N	B (N)	B (N)	B (S)	B (N)	N	S	B	N	N	N	S	N	N	S	S	S	B (N)	N	N	N	B (N)	B	B	S
Rockiness (U = banks; M = massive outcrops; B=abundant large boulders; R = abundant small outcrops; X=no outcrops; X¹=old farm lands)	X	R	R	U	R X	R	R	R	X	R	X	R	R	R	R	X	X	R	R X	U	B	U	B	M	X¹	X¹
Artemisia afra Jacq.	IV																									
Sida dregei Burtt Davy	IV																									
Teucrium capense Thunb.	IV																									
Asparagus africanus Lam.	II																									
Asparagus virgatus Bak.	II																									
Aster harveyanus Kuntze	II																									
Corchorus asplenifolius Burch.	II																									
Euclea crispa (Thunb.) Guerke	II																									
Oxalis corniculata L.	II																									
Rhus leptodictya Diels	II																									
Rhus pyroides Burch.	II																									
Senecio striatifolius DC.	II																									
Stachys aethiopica L.	II																									
Ziziphus mucronata Willd.	II																									
Ziziphus zeyherana Sond.	II																									
Chrysopogon montanus Trin.		V																								
Enneapogon scoparius Stapf		V	II																							
Kalanchoe paniculata Harv.		IV	I			I																				
Setaria lindenbergiana (Nees) Stapf		III	I																							
Loudetia flavida (Stapf) C. E. Hubb.		I	III			I																				
Trichoneura grandiglumis (Nees) Ekman		I	I	III	III	II					I			II												
Triraphis andropogonoides (Steud.) Phill.				III	III	I																				
Euphorbia cf. *pseudotuberosa* Pax			I	III	III	I																				
Chaetacanthus costatus Nees				V	I	I																				
Scabiosa columbaria L.				III	II	I																				
Indigofera malacostachys Benth.				III	I	II																				
Hypoxis rigidula Bak.				I	II	I																				II
Kalanchoe thyrsiflora Harv.				I	I	I																				
Aster muricatus Less.				V	IV	I		I		I	II			I			I	I	I							
Callilepis leptophylla Harv.				III	II																					
Aristida congesta Roem. & Schult. subsp. *congesta*				I	III	I																				
Fingerhuthia sesleriaeformis Nees			I	V	I																					
Euphorbia rhombifolia Boiss.				III																						
Sutera burkeana Hiern				III		I																				
Euphorbia inaequilatera Sond.					III																					
Eustachys mutica (L.) Cufod.	II	IV	V	IV	II	IV																				
Acacia caffra (Thunb.) Willd.	IV	IV	IV																							
Anthephora pubescens Nees	II	V	III			I																				
Microchloa caffra Nees		IV	III	I	I	III																				
Phyllanthus parvulus Sond.		III	IV	II	I	II																				
Kohautia lasiocarpa Klotzsch		I	II	III	III	III																				
Ipomoea obscura (L.) Ker—Gawl.		II	I	III	I	I																				
Sporobolus stapfianus Gand.		III	I		I	I																				
Mariscus capensis (Steud.) Schrad.		II	I		I	I																				
Vellozia viscosa Bak.		I	II			I																				
Vernonia oligocephala (DC.) Sch. Bip. ex Walp.		I	II	III		I																				
Acalypha angustata Sond.	II		I		I	I																				

Table 1. Constancy of Species in Communities (*continued*)

Community Number	1/1	1/2/1	1/2/2	1/3/1 (a)	1/3/1 (b)	1/3/2	2/1/1 (a) (i)	2/1/1 (a) (ii)	2/1/1 (b)	2/1/2 (a)	2/1/2 (b)	2/2/1	2/2/2	2/2/3 (a)	2/2/3 (b)	3/1/1	3/1/2	3/1/3	3/2	4/1	4/2	4/3	4/4	4/5	5/1	5/2
Monocymbium ceresiiforme (Nees) Stapf							V	V	II	III	II	II	IV	I		I			I							
Leucas neuflizeana Courb.					I	I	IV	II	III	III	IV	I	IV	IV									I			
Digitaria brazzae (Franch.) Stapf							III	II	V	IV	IV	II		I												
Dianthus mooiensis F. N. Williams							III	IV		III	II			II												
Pygmaeothamnus zeyheri (Sond.) Robyns								II	III			II	II	I	II								II		III	
Crassula transvaalensis (Kuntze) K. Schum.				I	I	I	II	II	III	III	II		IV	I											II	
Hemizygia pretoriae (Gürke) M. Ashby							II	I	III				II													
Sporobolus eylesii Stent & Rattray							I	III	II						II											
Babiana hypogea Burch.							IV	I						I												
Hermannia lancifolia Szyszyl.							III	III																		
Asclepias stellifera Schltr.							II	II	I	I				I												
Oxygonum dregeanum Meisn.					I	I	II	I	I	I	III															
Helichrysum galpinii Schltr. & Moeser								III				I	I													
Psammotropha mucronata (Thunb.) Fenzl							I	I	I	I	I		II	I												
Helichrysum setosum Harv.													V	I												
Bulbostylis oritrephes (Ridl.) C.B.Cl.	II							II			I		I	II	V	IV	III	IV	I							
Indigofera pretoriana Harms															II	II	II	III	II							
Vernonia natalensis Sch. Bip.																III	III	II	I							
Polygala amatymbica Eckl. & Zeyh.				III	I											III	I	II	I							
Digitaria diagonalis (Nees) Stapf																I	V		I							
Lasiosiphon burchellii Meisn.																I		II	II							
Graderia subintegra Mast.																	II	I	I							
Senecio erubescens Ait.								I					I	II		III							I			
Polygala sp. (B.J.C. No. 795)																II										
Phyllanthus incurvis Thunb.																		I	III	I						
Cyperus obtusiflorus Vahl																		II	II							
Oldenlandia herbacea (L.)Roxb.										I													IV			
Vernonia monocephala Harv.				I	I	I	I	I	I				II	I	II			I	I	I	V					
Vernonia staehelinoides Harv.														I							IV		I			
Indigofera comosa N.E. Br.														II							III					
Crassula nodulosa Schonl.																					III					
Burkea africana Hook.																						IV				
Dichapetalum cymosum (Hook.) Engl. & Prantl																						IV				
Pavetta zeyheri Sond.																						III				
Rhynchosia nitens Benth.																						III				
Sphedamnocarpus pruriens (Juss.) Szyszyl.																						III				
Diospyros lycioides Desf. subsp. *guerkei*(Kuntze)DeWint.																						III				
Sutera caerulea Hiern																								III		
Aristida transvaalensis Henr.							I										I		II	I	IV		II	IV		
Cymbopogon marginatus (Steud.) Stapf ex Burtt Davy																			I	I	II	III	III	III		
Commelina africana L.																				II	II	III	II	II		
Tapiphyllum parvifolium (Sond.) Robyns																				II		IV		III		
Rhus magalismontana Sond.																						III		II		
Cynodon dactylon (L.) Pers.																									V	V
Walafrida densiflora Rolfe																									III	V
Solanum incanum L.		II			I																				III	V
Hyparrhenia hirta (L.) Stapf																										
Wahlenbergia calendonica Sond.																									II	V
Sporobolus africanus (Poir.) Robyns & Tournay																									III	III
Conyza podocephala DC.	II																								I	IV
Hypericum aethiopicum Thunb. subsp. *sonderi* (Bredell) N. Robson	II																									V
Hermannia depressa N.E.Br.	III			I	II																				I	IV
Eriosema salignum E. Mey.																										IV
Verbena officinalis L.	I																									IV
Euphorbia sp. (B.J.C. 804)	II																									III

Table 1. Constancy of Species in Communities (*continued*)

Community Number	1/1	1/2/1	1/2/2	1/3/1 (a)	1/3/1 (b)	1/3/2	2/1/1 (a) (i)	2/1/1 (a) (ii)	2/1/1 (b)	2/1/2 (a)	2/1/2 (b)	2/2/1	2/2/2	2/2/3 (a)	2/2/3 (b)	3/1/1	3/1/2	3/1/3	3/2	4/1	4/2	4/3	4/4	4/5	5/1	5/2
Cassia biensis (Steyaert) Mendonca & Torre			I	II	II	II	I		II	II	IV	III	II	I	II		I	I		I	I		I		II	
Bulbostylis burchellii (Fic. & Hiern) C.B.Cl.			III		I	IV	V	V	III	V	V	V	V	I	II			I	II	I	III		IV			
Crabbea angustifolia Nees			II	IV	V	III	III	I	III	II	IV	II	IV	V	II			I	II							
Cyanotis speciosa (L.f.) Hassk.				I	II	III	V	IV	III	IV	IV	III	IV	III	II						II		II			
Tristachya rehmannii Hack.					II	V	V	V	V	V	V	V	V	IV	II				II		IV		III			
Sporobolus pectinatus Hack.				V	II	IV	V	V	II	V	V	V	IV	III	IV								III			
Dicoma gerrardii Harv.			I	II	II	I		III	II	I	III							I	II		I		I			
Lotononis tenella Eckl. & Zeyh.					II	I	II	I	I	III	II	I		I				I	I							
Anthericum fasciculatum Bak.					II	II	I	I	I	I	I	I		I	II											
Digitaria monodactyla (Nees) Stapf				I	IV	II	IV	III	IV	III	IV		I	I												
Gazania krebsiana Less subsp. *serrulata* (DC.) Roessler					II	I	IV	IV		II	I			I		I		I	I							
Digitaria tricholaenoides Stapf					II	I	III	II	III					I									I			
Polygala hottentotta Presl			II	I	II	II	III			I					II											
Anthericum cooperi Bak.				I	III	I		I	III										I							
Eragrostis capensis (Thunb.) Trin.			I	III		II					I			I	II											
Geigeria burkei Harv. subsp. *burkei*				I	III	I	III	III	II																	
Schizachyrium sanguineum (Retz.) Alst.	II			I		V	II	V	II	V	III	V	IV	IV	IV	IV	V	IV	V	V	V	IV	V		III	
Tephrosia longipes Meisn.				I	I	I	II	I		I	III	III	V	II	II	II	II	III	III	V		II	III	II		
Loudetia simplex (Nees) C. E. Hubb.			I			II	IV	V		V	II	IV	V	V	II	III		II	II	V	V	III	IV	IV		
Sphenostylis angustifolia Sond.			I		I	II	II	III	I	IV	IV	IV		II		II	I	II	II	V		IV	III	II		
Parinari capensis Harv.					II	II	IV	IV	III	V	V	IV		V	II			I	I	IV	V	II	IV	II		
Urelytrum squarrosum Hack.					I	V	IV	V		IV	IV	IV	II	II	IV	III	III	II	III	I	IV		II			
Pearsonia sessilifolia Duemmer							II	III		I	IV	II	IV	II	II	IV	III	III	I	II		II	III	II		
Panicum natalense Hochst.							IV	V	III	II	II		IV	III		V	III	III	III	III	IV		III			
Senecio serra Sond.				I	I	II	I	I				II	V	I	II	II	I		I	I			II			
Nolletia rarifolia (Turcz.) Steetz								I		II	II	I		II	II	II	III	III	III	II			I			
Thesium transvaalense Schltr.						I	II	IV	I	III	IV	III		II		II		I	III							
Protea caffra Meisn.													V	IV	IV	III	III	II	I	II	I		I			
Albuca setosa Jacq.							II	I		II						I		II	I	I			II			
Ochna pulchra Hook.								I		I	II	III		I								II	II	II		
Helichrysum adscendens (Thunb.) Less.					I	I		III					V			III							I			
Alloteropsis semialata (R.Br.) Hitchc.								II					II			V	I		I							
Rhynchelytrum setifolium (Stapf) Chiov.	III	II	III	II	I	V	IV	V	V	IV	V	III	V	V	IV	II	II	IV	V	V	V	V	IV	III	I		
Brachiaria serrata (Thunb.) Stapf.	III		II	V	V	V	V	V	IV	V	V	V	V	V	IV	V	V	V	V	V	V	III	III		II		
Diheteropogon amplectens (Nees) W. D. Clayton	III		III	V	V	V	V	IV	II	V	V	V	V	V	V	V	V	V	V	V	V	IV	III		III		
Eragrostis racemosa (Thunb.) Steud.	II	II	II	I	IV	V	V	V	V	V	V	V	V	V	IV	V	V	V	V	III	II		V		IV		
Trachypogon spicatus (L.f.) Kuntze			I	IV	V	V	V	V	V	V	V	III	V	IV	V	V	V	V	V	V	V	III	IV	II			
Senecio venosus Harv.	III		I	II	IV	II	V	V	IV	III	IV	III	IV	III	IV	IV	IV	III	III	III	V		I		III		
Elionurus argenteus Nees	II		V	V	IV	V	V	IV	V	V	V	IV	IV	IV	V	IV	IV	V	V	IV	V		IV		II		
Setaria perennis Hack.	III		V	V	IV	IV	III	I	II	I	III	II		III	V	I	III	II	I	I	IV	V	III		I		
Andropogon schirensis Hochst. ex A. Rich.				III	IV	II	V	IV	V	IV	IV	V	IV	V	V	V	V	V	III	V	V	III	III	II			
Themeda triandra Forsk.	V		IV	V	V	V	IV	III	III	III	IV	V		V	V	V	V	V	V	IV	III		IV		V		
Nidorella hottentotica DC.	III	I	IV	V	III	IV		II	II	I	II		II	III	II	III	IV	I	II				III		IV	V	
Anthospermum rigidum Eckl. & Zeyh.	II			III	II	IV	IV	V	I	II	II	II	V	III	II	I		III	III	I			II		V	V	
Indigofera hedyantha Eckl. & Zeyh.	II			III	II	I	II	I	I	III	II	III			II	II	II	II	II	I			II		II		
Diplachne biflora Hack	II			V	II	IV	IV	II	II	III	V		II	IV	V	I	III	III	III	I	I		IV				
Kohautia amatymbica Eckl. & Zeyh.	I				II	I	I	II	I	II	II			I		IV	III	II	II	I			I		III	III	
Thesium cytisoides A. W. Hill					I	I	I	I		I	II	III	II	I	IV	II	II		I	I	II				II	I	
Eragrostis curvula (Schrad.) Nees	V	I	V	V	V	IV								I	II		I		I	I		IV	I	II	V	V	
Oxalis obliquifolia Steud. ex Rich.	II			I	II	II		I				III	IV	I	II	III	III	I					I		II	II	
Erigeron floribundus (H.B. & K.) Sch. Bip.	III				I	I	I	I	I			II		II		IV	III	II	II				III		III	V	
Pellaea calomelanos (Swartz) Link		V	V	I	I	IV	I	I		I		V	IV	III	V			II		I			V	V			
Vellozia retinervis Bak.		V	III	I		IV	II	III		III	I	V	V	II	IV			II			III		V				
Rhynchosia totta (Thunb.) DC.			I	III	I	I				I					V	III	IV	II	I				I		III	II	
Pentanisia angustifolia Hochst.					I	I	I	III	I	II	II			I	II	IV	III	I	III								
Indigofera burkeana Benth.	III			II	I	I							IV	II	IV	V	III	IV	III	I							

Table 1. Constancy of Species in Communities (*continued*)

Community Number	1/1	1/2/1	1/2/2	1/3/1 (a)	1/3/1 (b)	1/3/2	2/1/1 (a) (i)	2/1/1 (a) (ii)	2/1/1 (b)	2/1/2 (a)	2/1/2 (b)	2/2/1	2/2/2	2/2/3 (a)	2/2/3 (b)	3/1/1	3/1/2	3/1/3	3/2	4/1	4/2	4/3	4/4	4/5	5/1	5/2
Cymbopogon excavatus(Hochst.) Stapf	III		I		II	II		I							IV		V	II	III						V	V
Ruellia cordata Thunb.	III	I	V	V	III	III						II	II	I	IV				I		I		III			
Asparagus suaveolens Burch.		III	II	V	I	III				I					IV	I		I	I		IV		II			
Rhynchelytrum repens (Willd.) C. E. Hubb.		I	IV		I	II				I								I	I	I		III	II	II	III	
Gnaphalium undulatum L.	III							I			I		II	I		III	III	I	I						II	
Becium obovatum (E. Mey. ex Benth.) N. E. Br							II	I	I	II				I		I		I	II				I			
Elephantorrhiza elephantina (Burch.) Skeels				V	III	I										I	I	II	II						III	I
Trachyandra saltii (Bak.) Oberm.					I	I	I	II		I						I				II		II		II		
Helichrysum caespititium Sond.				I	I	I		I	II				I		I										II	
Arthrosolen sericocephalus Meisn.			I	I		I	I			I	I			I												
Setaria flabellata Stapf	II																III		I						III	II
Maytenus spp.	II											I		I	II											
Athrixia elata Sond	II															I	I	I	I							
Blepharis sp. cf. B. *innocua* C.B.Cl.					I	I	I			I	I															
Gladiolus ieḍulis Burch. ex Ker.								I									I		I							
Pogonarthria squarrosa (Licht.) Pilg.			I	I	I																				II	
Mohria caffrorum (L.) Desv.													IV	I												
Eragrostis sclerantha Nees														I									I			
Striga elegans Benth.																	I		I							
Fimbristylis ovata (Burm. f.) Kern.					II	I																				
Bulbostylis humilis Kunth			I		I																					
Lotononis pulchra Duemmer																		I	I							
Hibiscus microcarpus Garcke																	I		I							
Bidens biternata (Lour.) Merr. & Sherff.	II																									
Lotononis eriantha Benth.								II																		
Raphionacme elata N.E.Br.								I																		

TABLE 2. PROMINENT (P) SPECIES IN GRASS STRATUM (EXCLUDING KRANTZ, RIPARIAN AND KLOOF COMMUNITIES)

Habitat	Diabase & Dolomite							Chert & Chert-rich Dolomite									Shale			Large boulders, rock banks & massive outcrops			Old farmlands		
Community number	1/1	1/2/1	1/2/2	1/3/1 (a)	1/3/1 (b)	1/3/2	2/1/1 (a) (i)	2/1/1 (a) (ii)	2/1/1 (b)	2/1/2 (a)	2/1/2 (b)	2/2/1	2/2/2	2/2/3 (a)	2/2/3 (b)	3/1/1	3/1/2	3/1/3	3/2	4/1	4/2	4/3	4/4	4/5	5/1	5/2
Eragrostis curvula				P		P	P	P	P						P					P				P	P
Heteropogon contortus				P	P	P	P	P	P						P										P	
Eustachys mutica					P	P	P	P	P																	
Anthephora pubescens				P	P	P																				
Rhynchelytrum repens						P																				
Elephantorrhiza elephantina							P																			
Enneapogon scoparius					P																					
Setaria lindenbergiana					P																					
Tristachya rehmannii									P			P	P	P	P	P	P	P	P							
Sporobolus pectinatus								P	P			P	P	P	P	P	P	P								
Bulbostylis burchellii												P	P	P	P	P	P	P								
Urelytrum squarrosum									P			P	P		P	P	P	P								
Digitaria monodactyla								P	P			P	P	P		P										
Digitaria brazzae												P		P	P											
Monocymbium ceresiiforme												P	P	P												
Parinari capensis														P	P						P					
Sporobolus eylesii												P														
Digitaria tricholaenoides												P														
Helichrysum setosum														P												
Pellaea calomelanos														P												
Rhynchosia totta															P											

Table 2. PROMINENT (P) SPECIES IN GRASS STRATUM (EXCLUDING KRANTZ, RIPARIAN AND KLOOF COMMUNITIES) (*continued*)

Habitat	Diabase & Dolomite					Chert & Chert-rich Dolomite									Shale				Large boulders, rock banks & massive outcrops					Old farmlands	
Community number	1.1	1.2.1	1.2.2	1.3.1.1	1.3.1.2	1.3.2	2.1.1 (a) (i)	2.1.1 (a) (ii)	2.1.1 (b)	2.1.2 (a)	2.1.2 (b)	2.2.1	2.2.2	2.2.3 (a)	2.2.3 (b)	3.1.1	3.1.2	3.1.3	3.2	4.1	4.2	4.3	4.4	4.5	5.1	5.2
Senecio serra													P												
Senecio venosus														P											
Cymbopogon excavatus	P													P			P							P	P
Alloteropsis semialata																P									
Chaetacanthus burchellii																P									
Vernonia natalensis																P									
Cymbopogon marginatus																				P	P	P			
Aristida transvaalensis																				P		P			
Dichapetalum cymosum																				P					
Cynodon dactylon																								P	P
Hyparrhenia hirta																									P
Setaria flabellata																								P	
Sporobolus africanus																									P
Trachypogon spicatus	P			P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P			
Elyonurus argenteus				P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P		P		
Eragrostis racemosa					P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		P		P	P	
Brachiaria serrata	P			P		P	P	P	P	P	P	P	P	P		P	P	P	P	P	P				
Diheteropogon amplectens				P	P	P		P		P	P	P		P	P	P	P	P	P	P	P	P			
Loudetia simplex							P	P		P		P	P	P	P	P		P	P	P	P	P	P		
Andropogon schirensis							P	P	P	P		P		P	P		P	P	P	P	P				
Schizachyrium sanguineum						P			P		P		P	P	P			P	P	P		P		P	
Panicum natalense							P	P	P			P	P			P	P	P							
Diplachne biflora				P		P				P				P			P					P			
Vellozia retinervis											P											P			
Rhynchelytrum setifolium	P		P			P	P	P	P	P		P	P	P	P			P	P	P	P	P	P		
Themeda triandra	P		P	P	P	P	P	P			P		P	P	P	P	P	P	P					P	
Setaria perennis	P		P	P	P	P	P				P		P	P	P		P			P	P	P	P		

In the vegetation map of the Reserve (Fig. 3) mapping units correspond to vegetation types at various levels of the classification. Numbering of communities in the legend corresponds to their numbering in the text.

1. *Diabase and dolomite vegetation*

This vegetation includes savanna and grass formations on diabase and dolomite and is characterized by the presence of the *Eustachys mutica* species group (Table 1). *Eustachys mutica*, which occurs in all these communities and has a high fidelity for this vegetation, is associated with soils derived from diabase and dolomite that are both rich in bases. *Eustachys mutica* is negatively associated with the *Loudetia simplex* group (Table 1), which is characteristic of the poorer soils on chert, shale and quartzite.

1.1 Acacia caffra *Savanna on diabase*

This community occurs on the clay-loam soils of long depressions on diabase dykes, where the soil is moister and presumably, relatively rich in bases (Fig. 4).

The structure is generally deciduous thorn savanna (1I2/3) with *Acacia caffra* as the most prominent tree. The *Artemisia affra* species group (Table 1) characterizes this community.

Woody plants of the community, with percentage presence in relevés, are:

Acacia caffra	(89)	*Buddleia salviifolia*	(11)
Artemisia affra	(67)	*Cassine burkeana*	(11)
Maytenus spp.	(67)	*Celtis africana*	(11)
Ziziphus mucronata	(56)	*Combretum molle*	(11)
Euclea crispa	(44)	*Cussonia paniculata*	(11)
Acacia karroo	(33)	*Dombeya rotundifolia*	(11)
Fagara capensis	(33)	*Ochna pulchra*	(11)
Rhus leptodictya	(33)	*Olea africana*	(11)
Rhus pyroides	(33)	*Ozoroa paniculosa*	(11)
Carissa bispinosa	(22)	*Protea caffra*	(11)
Diospyros lycioides	(22)	*Rhus lancea*	(11)
Pappea capensis	(22)	*Rhus zeyheri*	(11)
Ziziphus zeyherana	(22)		

1.2 Acacia caffra *Savanna of sheltered valleys*

Two types of *Acacia caffra* Savanna, characterized by *Enneapogon scoparius*, *Kalanchoe paniculata* and *Setaria lindenbergiana*, occur in sheltered valleys. *Chrysopogon montanus*, which belongs to the same species group (Table 1) is characteristic of the more xeric of the two communities, occurring on very steep, north-facing slopes. The geology in these valleys is generally a mixture of dolomite and chert. Slopes are rocky and *Pellaea calomelanos* and *Vellozia retinervis*, typical of rocky slopes, are markedly constant in both communities.

1.2.1 Acacia caffra-Chrysopogon montanus *Savanna*

This community occurs on warm slopes that are steeper than 30%, are rocky, north-facing, and underlain by dolomite and chert in sheltered valleys. The community belongs to Fosberg's (1967) microphyllous, deciduous thorn shrub savanna (1K2/5), with *Acacia caffra* and *Ozoroa paniculosa* generally the more prominent trees, and is characterized by *Chrysopogon montanus* (Fig. 5).

The following shrub and tree species were recorded in relevés of the community with percentage presence indicated in brackets:

Acacia caffra	(100)	*Ximenia caffra*	(33)
Ozoroa paniculosa	(100)	*Combretum zeyheri*	(17)
Cussonia paniculata	(67)	*Ficus ingens*	(17)
Dombeya rotundifolia	(67)	*Maytenus sp.*	(17)
Combretum molle	(50)	*Ochna pulchra*	(17)
Mundulea sericea	(50)	*Rhus zeyheri*	(17)
Vangueria infausta	(50)	*Tarchonanthus camphoratus*	(17)

1.2.2 Acacia caffra-Ruellia cordata *Savanna*

This mesic community of sheltered *Acacia caffra* valley vegetation, occurs on the lower parts of north-facing slopes of less than 30% and on south-facing slopes that have over 12% slope. Structurally, the community includes deciduous thorn savanna (1I2/3) and microphyllous deciduous thorn savanna (1K2/5), with *Acacia caffra* as the most prominent woody species (Fig. 5).

Several species, notably the dominant grasses *Setaria perennis*, *Eragrostis curvula* and *Themeda triandra* occur in common with many exposed cool, higher-altitude communities. These grasses, as well as the following species, differentiate the cooler mesic from the warm xeric variation of the sheltered valleys:

Elyonurus argenteus
Ruellia cordata
Nidorella hottentottica
Diheteropogon amplectens
Chaetacanthus burchellii
Brachiaria serrata
Polygala hottentottica
Crabbea angustifolia
Bulbostylis burchellii

Woody plants of the community are:

Acacia caffra (100% presence)		*Ximenia caffra*	(43)
Ozoroa paniculosa	(86)	*Combretum zeyheri*	(28)
Vangueria infausta	(71)	*Bequaertiodendron magalismontanum*	(14)
Ziziphus mucronata	(71)	*Burkea africana*	(14)
Mundulea sericea	(57)	*Diospyros lycioides*	(14)
Combretum molle	(43)	*Ficus ingens*	(14)
Dombeya rotundifolia	(43)	*Lannea discolor*	(14)
Fagara capensis	(43)	*Rhus zeyheri*	(14)
Maytenus sp.	(43)	*Tarchonanthus camphoratus*	(14)
Ochna pulchra	(43)		
Protea caffra	(43)		

Fig. 4. Diabase dykes, indicated by arrows, with contrasting vegetation, in the Timeball Hill Stage.

Fig. 5. *Acacia caffra* Savanna of sheltered valleys. The herb stratum of the *Acacia caffra-Chrysopogon montanus* Savanna on the right, has a white appearance. *Acacia caffra - Ruellia cordata* Savana grows in the rest of the valley.

1.3 *Grasslands and* Cussonia paniculata *Savanna on dolomite*

Vegetation characterized by the *Trichoneura grandiglumis* species group occurs on the gently undulating dolomite highlands in the south of the Reserve and on the steep valley slopes formed by tributaries of the Skeerpoort River that have cut through the chert.

1.3.1 *Grasslands on gently undulating dolomite highland*

Two grassland communities on virtually pure dolomite high terrain with slopes of less than 12% (Fig. 6) are differentiated from grassland on steep, mixed dolomite-chert slopes by the following species:

Triraphis andropogonoides, *Callilepis leptophylla*, *Euphorbia* sp. cf. *E. pseudotuberosa*, *Aster muricatus* *Elephantorrhiza elephantina*.

(a) Grassland on extensive dolomite outcrop

The rocky habitat of this community is illustrated in Fig. 7.

Structurally this community falls into Fosberg's (1967) seasonal grass steppe (2G2/1). *Ozoroa paniculosa* occasionally occurs as an isolated shrub. The community is characterized by *Fingerhuthia sesleriaeformis*, *Euphorbia rhombifolia* and *Sutera burkeana* and is further differentiated from the less rocky grassland on gently undulating dolomite highland by the constancy of the following species:

Ipomoea obscura
Polygala amatymbica
Sporobolus pectinatus
Eragrostis capensis
Ruellia cordata
Nidorella hottentottica
Brachiaria serrata
Diheteropogon amplectens
Elyonurus argenteus
Setaria perennis
Eragrostis curvula
Rhynchosia totta
Elephantorrhiza elephantina
Asparagus suaveolens
Diplachne biflora
Vernonia oligocephala
Sporobolus pectinatus
Themeda triandra
Eustachys mutica
Heteropogon contortus
Trachypogon spicatus

Elephantorrhiza elephantina is a prominent forb.

(b) Grassland on non-rocky dolomite areas

Rocks are few and inconspicuous in this community which in heavily-grazed parts has the appearance of seasonal orthophyll meadows (short grass) (1M2/1), and in lightly-grazed areas may be classified as seasonal orthophyll tall grass (1L2/1).

Fig. 6. Grasslands on gently undulating dolomite highlands.

Fig. 7. Grassland on banks of dolomite rock.

Euphorbia inaequilatera, an apophyte, is characteristic, probably as a result of heavy grazing. Some of the following species, which differentiate this community from the previous, are more constant in this community, probably also as a result of grazing pressure:

Geigeria burkei subsp. *burkei*
Anthericum cooperi
Digitaria tricholaenoides
Anthericum fasciculatum
Tristachya rehmannii
Digitaria monodactyla
Aristida congesta subsp. *congesta*
Gazania krebsiana subsp. *serrulata*
Lotononis tenella
Parinari capensis
Cymbopogon excavatus
Senecio venosus
Eragrostis racemosa
Fimbristylis ovata

Large areas in this community are heavily grazed, especially firebreaks and the summit areas that are constantly overgrazed and severely trampled. *Elyonurus argenteus* increases in heavily-grazed parts of the grassland. This is clearly evident when grazed areas within the Reserve are compared with ungrazed areas outside. On firebreaks in lower parts of the area where there is hardly any grazing, it can be seen that within three years litter accumulates to such an extent that fire becomes necessary to maintain the present vegetation.

1.3.2 *Grassland and* Cussonia paniculata *Savanna on steep dolomite slopes*

This vegetation type occurs on steeper-than-12% rocky slopes of dolomite mixed with chert, that are exposed to cold southerly weather (Fig. 8). It includes seasonal orthophyll tall grass (1L2/1) and mesophyllous, evergreen sclerophyll savanna [1I1/2 (a)] with scattered *C. paniculata* trees on south-facing slopes in these exposed valleys.

The following species differentiate grassland and *Cussonia paniculata* Savanna of steep dolomite slopes from the two grassland communities on gently undulating dolomite highland:

(i) *Pellaea calomelanos* and *Vellozia retinervis*, which occur on rocky slopes;

(ii) *Microchloa caffra*, which occurs on rocky dolomite slopes in exposed areas as well as in mesic areas of sheltered valleys;

(iii) *Tristachya rehmannii*, which is a dominant grass in this exposed valley vegetation, and *Bulbostylis burchellii*. Both species are found on sandy loam soils of exposed areas, including highlands;

(iv) *Schizachyrium sanguineum* and *Urelytrum squarrosum*, prominent in this vegetation (Table 2) and *Loudetia simplex*, are three species found on acid soils derived from chert, quartzite and shale; and

(v) *Rhynchelytrum setifolium*, another prominent grass in this community, and one which occurs in all communities of the Reserve, is markedly more constant on steep slopes of exposed valleys than on the gently undulating dolomite highland.

2. *Chert vegetation with or without scattered small rock outcrops*

Rolling chert grassland covers most of the thick chert cap of the high central-western part of the Reserve whereas *Protea caffra* Savanna occurs on chert hills and summits in the more strongly-dissected central and central-eastern parts where the chert is thinner (Fig. 9).

The chert grasslands have a number of characterizing species that occur neither in the chert savannas nor in dolomite and shale vegetation. But the only species that differentiate chert savannas from chert grassland occur also on diabase, shale and dolomite, indicating a relationship of the chert savanna to these latter communities. The difference between grasslands and *Protea caffra* Savanna on chert slopes of less than 30% cannot be related to any observed differences in geology, soil texture, rockiness, stoniness, altitude, slope, aspect or disturbance, other than the previously mentioned thickness of the underlying chert cap. On chert slopes of more than 30%, *Protea caffra* Evergreen Savanna occurs on south-facing slopes, and deciduous savanna on north-facing slopes. The chert vegetation is characterized by the *Monocymbium ceresiiforme* species group (Table 1).

2.1 *Grasslands on chert and chert-rich dolomite*

Seasonal orthophyll tall grass (1L2/1) on chert and mixed chert-dolomite soils are characterized by *Digitaria brazzae* and *Oxygonum dregeanum* and further differentiated from savannas on chert by:

(i) *Digitaria monodactyla* and *Lotononis tenella*, which also occur on steep dolomite slopes in exposed valleys with chert-capped summits, where a chert influence also exists, and in non-rocky dolomite grasslands, where the effect of the dolomite parent material has diminished as a result of leaching; and

(ii) *Kohautia amatymbica* and *Pentanisia angustifolia*, which occur also on shale.

Fig. 8. An exposed dolomite valley originating on the highland. Summits are chert capped.

2.1.1 *Grasslands on chert-rich dolomite*

About 50% of the dolomite region is paricularly rich in chert and has grasslands characterized by *Hemizygia pretoriae* and *Hermannia lancifolia*. These grasslands are further differentiated from grasslands on pure chert by *Digitaria tricholaenoides*, *Geigeria burkei* subsp. *burkei* and *Babiana hypogea*.

(a) Grassland on rocky chert-rich dolomite areas

The rocky variation of chert-rich grassland, found on moderate to steep slopes, is differentiated from the non-rocky variation by:

Loudetia simplex
Urelytrum squarrosum
Gazania krebsiana subsp. *serrulata*
Hermannia lancifolia
Babiana hypogea
Pearsonia sessilifolia
Vellozia retinervis
Dianthus mooiensis
Monocymbium ceresiiforme
Sporobolus pectinatus
Diheteropogon amplectens
Anthospermum rigidum
Sphenostylis angustifolia

North-facing slopes differ floristically from south-facing slopes.

(i) The community of north-facing slopes is characterized by *Babiana hypogea* and differentiated from the community of south-facing slopes by:

Leucas neuflizeana, which is restricted to chert and chert-rich dolomite soils;

Polygala hottentotta, which occurs also on dolomite of the highlands and cooler, exposed valleys;

Crabbea angustifolia, which is restricted to dolomite and chert; and

Diplachne biflora and *Setaria perennis*, with wider distributions.

(ii) The community of south-facing slopes is characterized by *Helichrysum galpinii* and *Sporobolus eylesii* and differentiated from the north-facing slope community by:

Helichrysum adscendens, characteristic of the vegetation on south-facing shale, chert and chert-rich dolomite slopes;

Pentanisia angustifolia and *Thesium transvaalense*, which occur mainly on highland chert and shale soils; and

Dicoma gerrardii, which occurs widely on dolomite of exposed highlands and on chert

The distributions of the differentiating species of this community and comparison with those of the former community, suggest that the two communities occur on soils with differing nutritional status. The community of south-facing slopes is differentiated by species that are associated with poor soils and cool, mesic conditions, whereas differentiating species of the community on north-facing slopes have wider distributions on dolomite.

(b) Grassland on non-rocky, chert-rich dolomite areas.

The non-rocky, chert-rich grassland is differentiated from the two communities on rocky, chert-rich dolomite by *Anthericum cooperi*, which characterizes grassland on non-rocky dolomite and non-rocky, chert-rich dolomite, and *Digitaria brazzae*, which is otherwise restricted to chert-derived soils.

2.1.2 *Grasslands on chert*

Grasslands on chert are differentiated from grasslands on chert-rich dolomite by *Nolletia rarifolia*, which is characteristic of the vegetation on soils derived from chert and shale.

(a) Grassland on rocky chert areas.

This grassland is distinguished from grasslands on non-rocky chert areas by *Loudetia simplex*, *Vellozia retinervis* and *Schizachyrium sanguineum*.

(b) Grassland on non-rocky chert areas.

Grassland on non-rocky chert areas is differentiated from grassland on rocky chert by *Crabbea angustifolia*, *Cassia biensis*, *Dicoma gerrardii* and *Diplachne biflora*.

2.2 *Savannas on chert.*

Savannas on chert are differentiated from grasslands on chert and chert-rich dolomite by:

(i) *Ruellia cordata*, which also occurs in wooded vegetation of chert areas containing many boulders, on diabase dykes and in all dolomite communities;

(ii) *Heteropogon contortus*, which also occurs on diabase dolomite and shale;

(iii) *Pellaea calomelanos*, which is very constant on rocky dolomite slopes and in chert areas with many boulders; and

(iv) *Oxalis obliquifolia* and *Senecio serra*, occurring also on diabase and in some dolomite and shale communities.

2.2.1 *Deciduous savanna on chert*

Deciduous, broad, sclerophyll shrub savanna (1K2/2) occurs on north-facing chert slopes that have a slope angle of more than 30%. The community is distinguished from evergreen savannas on chert by *Ochna pulchra* and *Sphenostylis angustifolius*. The

Fig. 9. Rolling chert grassland in the foreground with *Protea caffra* savanna on chert hills in the background.

following woody species were noted in and near quadrats with the percentage presence given in parentheses:

Ochna pulchra	(75)	*Maytenus sp.*	(25)
Tapiphyllum parvifolium	(50)	*Nuxia congesta*	(25)
Bequaertiodendron magalismontanum	(25)	*Protea caffra*	(25)
	(25)	*Vangueria infausta*	(25)
Cussonia paniculata	(25)	*Ximenia caffra*	(25)
Dombeya rotundifolia	(25)	*Ziziphus mucronata*	(25)
Fagara capensis			

Of the four samples representing this community, three are very fragmentary stands, which explains the low percentage presence of woody species.

2.2.2 Protea caffra *Evergreen Savanna on very steep south-facing chert slopes*

Evergreen broad sclerophyll shrub savanna (1K1/2) occurs in exposed areas on south-facing chert slopes with more than 30% slope angle. The community, represented by only three relevés, is characterized by *Helichrysum setosum*, *Mohria caffrorum* and *Senecio serra* and also differentiated from other chert savannas by:

(i) *Crassula transvaalensis*, *Monocymbium ceresiiforme* and *Hemizygia pretoriae*, otherwise restricted to grasslands; and

(ii) *Helichrysum adscendens* and *Alloteropsis semialata*, which are most constant in communities of steep to very steep, south-facing slopes underlain by shale and chert-rich dolomite.

Protea caffra is the constant dominant woody species and *Loudetia simplex* the dominant grass. Other woody species recorded are *Vangueria infausta*, *Bequaertiodendron magalismontanum*, *Nuxia congesta*, *Pavetta zeyheri* and *Rothmannia capensis*.

2.2.3 Protea caffra *Evergreen Savanna on chert slopes of less than* 30%

Species that differentiate this community from *Protea caffra* Evergreen Savanna that occurs on very steep, south-facing slopes, are: *Chaetacanthus burchellii*, *Setaria perennis*, *Themeda triandra*, *Parinari capensis*.

Protea caffra, *Diplachne biflora* and *Indigofera burkeana* differentiate this evergreen savanna from deciduous savanna on chert.

Two variations of the community occur, the major variation and an ecotonal variation occurring on the transition to *Acacia caffra* Savanna of sheltered valleys. Both variations are evergreen broad sclerophyll shrub savanna (1K1/2) with *Protea caffra* forming the upper stratum and *Ochna pulchra*, which is an abundant shrub in the grass layer.

(a) *Protea caffra—Bulbostylis burchellii* Savanna

This main variation of the community is differentiated from the ecotonal variation by:

Leucas neuflizeana	*Loudetia simplex*
Crabbea angustifolia	*Panicum natalense*
Bulbostylis burchellii	*Parinari capensis*
Tristachya rehmannii	

Woody plants, with percentage presence, are:

Protea caffra	(90)	*Vangueria infausta*	(20)
Ochna pulchra	(60)	*Ficus ingens*	(10)
Ozoroa paniculasa	(30)		

(b) Ecotonal *Protea caffra–Rhynchosia totta* Savanna

This ecotonal variation, represented by three relevés, occurs in more sheltered and dolomite-rich habitats than the major variation, and borders on the *Acacia caffra* Savanna of sheltered dolomite valleys. The following species, which do not occur elsewhere on chert, differentiate the ecotonal from the major variation of the community:

(i) *Rhynchosia totta*, which occurs also on dolomite and shale;

(ii) *Cymbopogon excavatus*, which occurs also on dolomite, shale and diabase; and

(iii) *Asparagus suaveolens*, occuring also on dolomite and on north-facing slopes with abundant quartzite boulders.

Woody plants are:

Protea caffra	(100% presence)	*Maytenus heterophylla*	(33)
Ozoroa paniculosa	(100)	*Mundulea sericea*	(33)

3. *Shale vegetation*

Vegetation on shale includes evergreen savannas on steep south-facing slopes and on summits, deciduous savanna on steep, rocky slopes, at low altitudes, and grassland on gentle slopes and steep, non-rocky north-facing slopes (Fig. 10). These communities are characterized by the *Bulbostylis oritrephes* species group (Table 1)

3.1 Protea caffra *Evergreen savannas on shale*

The Protea evergreen broad sclerophyll shrub savannas (1K1/2) on shale include three communities on summits and south-facing slopes with more than 12% slope of the Timeball Hill Stage. The upper stratum consists only of low *Protea caffra* trees. The

Fig. 10. *Protea caffra* Savanna on steep south facing shale slopes (A) and grassland on gently undulating shale slopes (B).

characteristic species of these savannas is *Vernonia natalensis*, and they are differentiated from other communities on shale by *Protea caffra*, *Pearsonia sessilifolia* and *Rhynchosia totta*.

3.1.1 Protea caffra—Alloteropsis semialata *Savanna of non-rocky, upper pediment slopes and non-rocky summits*

This community occurs on very steep, upper pediment slopes and summits on soil mainly derived from shale but usually mixed with quartzite colluvium. The community is characterized by *Senecio erubescens* and a *Polygala* sp. (BJC795) and is differentiated from other evergreen savannas on shale by:

(i) *Alloteropsis semialata* and *Helichrysum adscendens*, both occuring also on very steep, south-facing chert slopes and south-facing, chert-rich dolomite slopes; and

(ii) *Thesium transvaalense*, which has a wide distribution on chert and chert-rich dolomite.

Protea caffra Savanna of non-rocky, upper slopes and summits is also differentiated from *Protea caffra* Savanna on lower pediment slopes by *Polygala amatymbica* and *Loudetia simplex*.

3.1.2 Protea caffra—Digitaria diagonalis *Savanna of non-rocky, lower pediment slopes*

Digitaria diagonalis is characteristic of this savanna which is differentiated from other evergreen savannas on shale by *Setaria flabellata*, characteristic of deep clay-loam soils on diabase and shale. The community is also distinguished from the *Protea-Alloteropsis* Savanna of upper pediment slopes and summits, by *Cymbopogon excavatus* and *Setaria perennis*.

Prominent grasses are:

Brachiaria serrata	*Diheteropogon amplectens*
Themeda triandra	*Elyonurus argenteus*
Trachypogon spicatus	*Panicum natalense*
Cymbopogon excavatus	*Setaria perennis*
Eragrostis racemosa	

3.1.3 Protea caffra—Rhynchelytrum setifolium *Savanna of rocky summits and steep, rocky, south-facing slopes*

Species that differentiate this community from other evergreen savannas on shale are:

(i) *Lasiosiphon burchellii*, *Phyllanthus incurvis* and *Cyperus obtusiflorus*, all three being virtually restricted to this community, to shale grasslands and to deciduous savannas on shale:

(ii) *Pellaea calomelanos* and *Vellozia retinervis* which occur widely on rocky areas; and

(iii) *Anthospermum rigidum* and *Rhynchelytrum setifolium*, two widely-occurring species.

3.2 *Grasslands and deciduous savanna on shale*

Deciduous shrub savanna (1K2) on shale is represented by only three relevés from steep rocky slopes in low areas of the north-eastern part of the Reserve and includes microphyllous deciduous thorn shrub savanna (1K2/5) with *Acacia caffra* as the most prominent woody plant, and deciduous, broad sclerophyll shrub savanna (1K2/2) with *Mundulea sericea*. Seasonal orthophyll tall grass (1L2/1), represented by 19 relevés, occurs on non-rocky, north-facing slopes steeper than 12% and on all slopes with a less-than-12%-slope angle, with or without shale outcrops.

Grasslands and deciduous savanna on shale are characterized by *Phyllanthus incurvis* and further differentiated from evergreen savannas on shale by:

Crabbea angustifolia	*Tristachya rehmannii*
Bulbostylis burchellii	*Heteropogon contortus*
Dicoma gerrardii	

The savanna and grassland formations are not separable on the species content of the 4×4 m samples taken. Woody species in the savanna formations are:

Mundulea sericea (100% presence)			
Acacia caffra	(33)	*Ozoroa paniculosa*	(33)
Combretum molle	(33)	*Protea caffra*	(33)
Maytenus sp.	(33)	*Tapiphyllum parvifolium*	(33)

4. *Vegetation with abundant large boulders, on quartzite outcrop and on massive chert outcrops*

This vegetation is characterized by the *Aristida transvaalensis* species group (Table 1). Quartzite communities, which occur on the summits and north-facing slopes of the Timeball Hill Stage, are less exposed to cold winds from the south than the chert communities.

4.1 *Wooded and grass formations on steep quartzite sheet outcrop*

Soils on the very narrow quartzite outcrops with slopes of 12–30%, have a clay-loam texture due to the influence of the surrounding shale. Stands of vegetation in this habitat are fragmentary. Physiognomic variations include deciduous orthophyll shrub steppe savanna (2E2/2), *Protea caffra* evergreen, broad sclerophyll scrub (2B1/2), and seasonal

Fig. 11. Broken rocky quartzite landscape with steppe savanna and steppe ragssland.

grass steppe (2G2/1). The community is negatively differentiated by the absence of differentiating species of other communities on sheet outcrops, of massive outcrops or with abundant large boulders.

Woody plants include:

Tapiphyllum parvifolium (78% presence)		*Diospyros lycioides*	(11)
Protea caffra	(44)	*Rhus pyroides*	(11)
Bequaertidendron magalismontanum	(22)	*Strychnos pungens*	(11)
Combretum molle	(22)	*Vangueria infausta*	(11)
Burkea africana	(11)	*Ximenia caffra*	(11)

4.2 *Steppe savanna and grass steppe on broken quartzite*

Broken, rocky quartzite with abundant boulders is a conspicuous feature of the landscape in which this community occurs (Fig. 11). The soil is a sandy loam. Structural variations include *Protea caffra* evergreen sclerophyll shrub steppe savanna (2E1/2) and seasonal grass steppe (2G2/1), and are characterized by the *Crassula nodulosa* species group (Table 1). Woody species recorded include *Protea caffra* and *Ximenia caffra*, both present in only one out of five relevés.

4.3 *Steppe scrub and scrub on very steep quartzite sheet outcrop*

Stands of the community are small and fragmentary and occur on slopes that are steeper than 30% and have a clay-loam soil. The vegetation includes *Burkea africana* deciduous sclerophyll steppe scrub (2B2/2); *Tapiphyllum parvifolium* deciduous sclerophyll scrub (1B2/3); and *Protea caffra* evergreen, broad sclerophyll steppe scrub (2B1/2). The *Burkea africana* species group (Table 1) is characteristic of this community.

Woody species are:

Burkea africana (75% presence)		*Ficus ingens*	(25)
Diospyros lycioides	(75)	*Maytenus sp.*	(25)
Tapiphyllum parvifolium	(75)	*Myrsine africana*	(25)
Pavetta zeyheri	(50)	*Ochna pulchra*	(25)
Rhus magalismontanum	(50)	*Protea caffra*	(25)
Rhynchosia nitens	(50)	*Strychnos pungens*	(25)
Sphedamnocarpus pruriens	(50)	*Ximenia caffra*	(25)
		Ziziphus mucronata	(25)

Dichapetalum cymosum, a suffrutescent plant, is prominent in the grass stratum and has a constancy of 75%.

4.4 *Steppe scrub, steppe savanna and savanna with abundant boulders on chert*

The vegetation of very rocky, broken chert outcrops includes *Protea caffra* evergreen sclerophyll shrub savanna (1K1/2), deciduous sclerophyll shrub steppe savanna (2E2/2) and deciduous sclerophyll steppe scrub (2B2/2). The community is characterized by *Oldenlandia herbacea* and is differentiated from other very rocky communities by:

Ruellia cordata	*Erigeron floribundus*
Sporobolus pectinatus	*Diplachne biflora*
Nidorella hottentottica	*Eragrostis racemosa*

Woody species in the community are:

Ochna pulchra (100% presence)		*Acacia caffra*	(20)
Protea caffra	(80)	*Canthium sp.*	(20)
Ozoroa paniculosa	(60)	*Clutia monticola*	(20)
Ximenia caffra	(60)	*Combretum molle*	(20)
Burkea africana	(40)	*Rhus magalismontanum*	(20)
Nuxia congesta	(40)	*Rhynchosia nitens*	(20)
Vangueria infausta	(40)		

4.5 *Steppe scrub and scrub on massive chert outcrops*

The community is characterized by *Sutera caerulea* and includes deciduous sclerophyll steppe scrub (2B2/2) and deciduous sclerophyll scrub (1B2/3), with plants growing in crevices and very shallow humic sandy loam soils amongst massive solid chert rocks.

The following woody species were recorded:

Tapiphyllum parvifolium (75% presence)		*Burkea africana*	(25)
Bequaertiodendron magalismontanum	(50)	*Cassine aethiopica*	(25)
Canthium gilfillanii	(50)	*Combretum molle*	(25)
Dombeya rotundifolia	(50)	*Diospyros lycioides*	(25)
Nuxia congesta	(50)	*Fagara capensis*	(25)
Vangueria infausta	(50)	*Ficus ingens*	(25)
Acacia caffra	(25)	*Ochna pulchra*	(25)
Acokanthera oppositifolia	(25)	*Ozoroa paniculosa*	(25)
		Pappea capensis	(25)
		Ximenia caffra	(25)

5. *Grasslands on abandoned farm lands*

These secondary grasslands include seasonal orthophyll tall grass (1L2/1) and seasonal orthophyll meadows (short grass) (1M2/1) and are characterized by the *Cynodon dactylon* species group (Table 1). Twelve of the thirteen quadrats in abandoned lands were on clay-loam soils. These quadrats do not show a very localized variation on sandy-loam soils observed to be dominated by *Eragrostis gummiflua*, which is a prominent grass on such soils. The two variations that were sampled, are:

5.1 Cynodon dactylon—Themeda triandra *Grassland*

This community, representing a later stage in the secondary succession, is differentiated from *Cynodon dactylon-Conyza podocephala* grassland on abandoned lands, by:

Themeda triandra	*Diheteropogon amplectens*
Eragrostis racemosa	*Schizachyrium sanguineum*
Rhynchelytrum repens	*Senecio venosus*
Elephantorrhiza elephantina	*Pygmaeothamnus zeyheri*

5.2 Cynodon dactylon—Conyza podocephala *Grassland*

This earlier seral community is differentiated from the previous by:

Hyparrhenia hirta	*Sporobolus africanus*
Conyza podocephala	*Eriosema salignum*
Hermannia depressa	*Verbena officinalis*
Hypericum aethiopicum subsp. *sonderi*	

6. *Krantz, riparian and kloof communities*

The vegetation in these habitats was not sampled by quadrats and is not included in Table 1. The following is a general description of this vegetation.

6.1 *Krantz vegetation*

Krantz communities include a range of formations, namely evergreen, succulent steppe scrub (2B1/5) and evergreen, succulent shrub steppe savanna (2E1/4) in which *Aloe mutabilis* is a prominent species; deciduous sclerophyll steppe scrub (2B2/2); and deciduous sclerophyll shrub steppe savanna (2E2/2).

A chasmophyte, *Ficus ingens*, is conspicuous on krantzes, and *Aloe mutabilis* occurs generally in rock crevices and in shallow soil against shale krantzes along the Skeerpoort River and its tributaries (Fig. 12). Abundant shrubs and trees include:

Bequaertiodendron magalismontanum	*Maytenus tenuispina*
Dombeya rotundifolia	*Nuxia glomerulata*
Combretum molle	*Pappea capensis*

Less frequent or locally abundant trees and shrubs are:

Acacia ataxacantha	*Heteromorpha arborescens*
Brachylaena rotundata	*Lannea discolor*
Buddleia saligna	*Osyris lanceolata*
Canthium gilfillanii	*Pittosporum viridiflorum*
Cassine burkeana	*Rhus leptodictya*
Dovyalis zeyheri	*Rhynchosia nitens*
Fagara capensis	*Tapiphyllum parvifolium*
Ficus soldanella	*Urera tenax*
Grewia occidentalis	

FIG. 12. *Ficus ingens*, front left, and *Aloe mutabilis* growing on shale krantzes.

Grasses and forbs include:

Aristida transvaalensis
Commelina africana
Crassula setulosa
Dichapetalum cymosum
Hibiscus lunariifolius
Kalanchoë rotundifolia
Kyllinga melanosperma
Pellaea calomelanos
Pellaea viridis
Setaria lindenbergiana
Tragia rupestris

6.2 *Riparian herbaceous vegetation*

Riparian herbaceous vegetation includes the following communities:

(a) Broad-leafed seasonal submerged meadows (1P2/2) in which *Berula thunbergii*, a rooted plant with floating leaves, is abundant.

(b) Evergreen orthophyll graminoid marsh (1M1/2) occurring as dense narrow stands of *Juncus oxycarpus* fringing moving water.

(c) Tall evergreen graminoid marshes (1L1/2) composed of dense stands of either *Cyperus sexangularis* or *Juncus punctorius*, occur as narrow, fringing zones along water courses (Fig. 13).

(d) Seasonal fern meadows (1N2/2) which occur as dense stands of *Pteridium aquilinum*.

(e) Seasonal orthophyll tall grass (1L2/1), in which dense stands of *Hyparrhenia tamba* occur on flat areas, as well as on slopes and along streams. In some places isolated individuals of riparian-forest tree and shrub species, or of *Acacia karroo* occur in this tall grass. In localized places *Hyparrhenia tamba* also forms a dense undergrowth in riparian forest and in *Acacia karroo* deciduous thorn scrub (thornbush) (1B2/4).

6.3 *Riparian scrub*

This scrub occurs on flat areas and gentle slopes in and along streams, generally in less sheltered areas than riparian forest. The vegetation includes:

(a) evergreen orthophyll swamp scrub [1B1/3 (a)], with *Salix woodii* as a prominent shrub or small tree.

(b) evergreen reed swamp [1B1/3 (b)], where *Phragmitis australis* is dominant;

(c) evergreen narrow sclerophyll swamp [1B1/3 (d)], with *Rhus lancea* as prominent shrub or small tree, particularly on low islands;

(d) broad-leafed evergreen orthophyll scrub [1B1/1 (a)], with *Buddleia salviifolia*, along streams; and

(e) deciduous thorn scrub (thornbush) (1B2/4), in which *Acacia karroo* is dominant, along streams.

Herbaceous undergrowth species in these scrub communities include:

Bromus willdenowii
Carex cernua
Cyperus denudatus
Ehrharta erecta
Hyparrhenia tamba
Juncus effusus
Kyllinga melanosperma
Leersia hexandra
Scirpus inclinatus

6.4 *Riparian and kloof forests*

These forests are found along streams that are sheltered by high, steep slopes, on deep soils at the foot of krantzes, or on steep slopes in sheltered kloofs. The vegetation includes evergreen broad sclerophyll forest (1A1/6) with *Olea africana* as dominant tree species, and dry-season deciduous

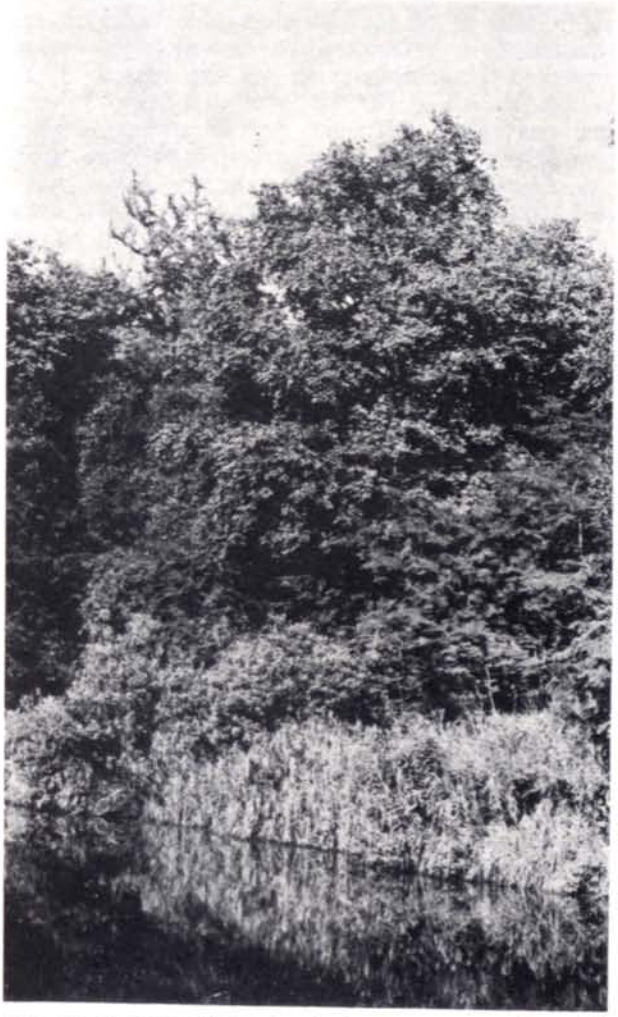


FIG. 13. A seam of riparian herbaceous communities with *Cyperus sexangularis* and *Juncus punctorius* and riverine forest of *Acacia ataxacantha*, *Celtis africana* and other trees behind.

forest (1A2/3) (Fig. 13) with *Acacia ataxacantha*, *Celtis africana* and *Combretum erythrophyllum* among the dominant tree species. Other trees and shrubs in the forests are:

Acacia caffra
Acokanthera oppositifolia
Brachylaena rotundata
Buddleia saligna
Cassine burkeana
Cassinopsis ilicifolia
Diospyros lycioides subsp. *guerkei*
Diospyros whyteana
Dovyalis zeyheri
Ehretia rigida
Euclea crispa
Fagara capensis
Grewia occidentalis
Ilex mitis
Kiggelaria africana
Maytenus heterophylla
Maytenus tenuispina
Maytenus undata
Mimusops zeyheri
Myrica serrata
Myrsine africana
Olinia emarginata
Osyris lanceolata
Pittosporum viridiflorum
Rhamnus prinoides
Rhus dentata
Rhus eckloniana.
Rhus pyroides

Herbs and lianes include:

Achyranthes sicula
Asparagus asparagoides
Asparagus buchananii (*liane*)
Asparagus laricinus
Asparagus setaceus
Asparagus virgatus
Bidens pilosa
Bowiea volubilis (*liane*)
Clematis brachiata (*liane*)
Commelina africana
Cyperus albostriatus
Cyphostemma cirrhosum
Ehrharta erecta
Galinsoga parvifolia
Helinus integrifolius (*liane*)
Hyparrhenia tamba
Kalanchoe rotundifolia
Priva meyeri
Rhoicissus tridentata (*liane*)
Rhynchosia caribaea (*liane*)
Setaria chevalieri
Setaria lindenbergiana
Sida rhombifolia
Stipa dregeana
Teucrium capense

DISCUSSION AND CONCLUSIONS

The sampling strategy used in this study adequately represented floristic types that cover large areas in the Reserve. Important types that cover small areas and are related to obvious physiographic variation are also usually well sampled. The floristic classification presented accommodates all but two relevés of the sampled variation. The classification is related to conspicuous habitat differences. At a broad level, vegetation differences are associated with soil texture, geology, exposed highlands or low, sheltered valleys, very rocky areas, and abandoned farm lands. Subdivisions into lesser communities are associated with slope, aspect, degree of rockiness and geology.

The plant communities recognized are distinguished by their total floristic composition and are polythetically separable on the presence and absence of groups of associated species that are related to specific environmental factors. The main vegetation types that include a number of communities are distinguished on the basis of their total floristic composition, which includes less conspicuous but good ecologically-differentiating species and are also fairly well differentiated by prominent species as shown in Table 2. With the exception of fragmentary stands of very rocky areas, basis communities of the hierarchy do not cut across the structural-functional vegetation formations.

Due to their floristic as well as structural-functional homogeneity, the communities are basic units that should be taken account of for management of the wild life. Descriptions and tables of communities include basic plant ecological information required for management units such as main habitat features, physiognomy, a fairly complete list of species, differentiating species, woody species and prominent species in the grass stratum. Typical sites for further observation and extrapolation over mapped units should be selected with reference to this basic information on communities. Distributions and habitat preferences of particular grass and forb species of significance for wild life management can be obtained by referring to Table 1 and to descriptions of communities. Table 1 is incomplete in respect of woody plants because of the small size of the quadrats, but the percentage presence of woody plants in communities is provided in the text. Structural, functional formations of krantzes, along streams and in kloofs are largely specific for different habitats. Species lists for these physiognomic-ecological communities show them to be floristically well differentiated.

Finally, from this study of a small area in the Central Bankenveld, it is concluded that this Veld Type Variation includes a large number of plant communities, which represent natural ecosystems of which none are officially conserved (Edwards, 1972a & b).

ACKNOWLEDGEMENTS

The Department of Agricultural Technical Services made this study possible by seconding me to the University of Pretoria. The study was undertaken under supervision of Dr G. K. Theron of the University's Department of General Botany and Dr D. Edwards from the Botanical Research Institute.

I wish to thank Col. J. Scott for the opportunity of studying the vegetation of his nature reserve and for facilities provided.

To the staff members of the Botanical Research Institute my appreciation for their indispensible assistance, in particular: Dr M. J. A. Werger for his keen interest and valuable discussions; Mrs E. van Hoepen and other members of the herbarium for naming plant specimens; Messrs N. Jarman, J. W. Morris, J. C. Scheepers and J. Vahrmeijer for helpful comments; and Mrs M. L. Jarman, Mrs G. E. Thomas and Miss L. Teversham for technical assistance, including drawing of figures.

I also gratefully acknowledge the contributions made by the following persons: Mr D. R. Mason for his unpublished geological and physiognomic maps of the reserve which he put at my disposal; Dr H. Jansen and Messrs B. Meinster and W. C. P. de Vries for geological information; and Dr P. J. Gouws for help on the soils.

OPSOMMING

Die plantegroei van die Jack Scott-natuurreservaat is hoofsaaklik met behulp van die Braun-Blanquet-metode geklassifiseer. Die habitatkenmerke, fisionomie, totale floristiese samestelling, differensiërende spesies, bome en struike en prominente grasse en kruide van elke gemeenskap word verstrek. Blootstelling, grondtekstuur, geologie, helling, aspek, mate van rotsagtigheid en vroeëre bewerking van die grond is, in volgorde van belangrikheid, onderskeidende habitatkenmerke. Die klasifikasie korreleer goed met die uitstaande fisiografiese en klimatologiese variasie in die Reservaat en individuele gemeenskappe sluit oor die algemeen nie meer as een van die hoof fisionomiese tipes in nie. Die gemeenskappe is potensieel homogene bestuurseenhede.

REFERENCES

ACOCKS, J. P. H. 1953. Veld types of South Africa. *Mem. Bot. Surv. S. Afr.* 28: 1–192.

ADAMSON, R. S. 1938. *The vegetation of South Africa.* London: British Empire Vegetation Committee.

COETZEE, B. J. 1972. *'n Plantsosiologiese studie van die Jack Scott-natuurreservaat.* M.Sc. thesis, University of Pretoria.

COETZEE, B. J. 1974. Improvement of association-analysis classification by Braun-Blanquet technique. *Bothalia* 11: 365–367.

EDWARDS, D. 1972a. *Conservation areas in relation to Veld Types.* Unpubl. ms., Bot. Res. Inst., Pretoria. (in press Kudu).

EDWARDS, D. 1972b. Botanical survey and agriculture. *Proc. Grassld. Soc. Sth. Afr.* 7: 15–19.

FOSBERG, F. R. 1967. A classification of vegetation for general purposes *in* C. F. Peterken (ed.) *IBP, Handbook* 4. *Guide to the checksheet for IBP areas* p. 73–120. Oxford: Blackwell Scientific Publications.

GOODALL, D. W. 1953. Objective methods for the classification of vegetation. I. The use of positive interspecific correlation. *Aust. J. Bot.* 1: 39–63.

HAUGHTON, S. H. 1969. *Geological history of Southern Africa.* Cape Town: Geol. Soc. S. Afr.

MULLER, P. J., WERGER, M. J. A., COETZEE, B. J., EDWARDS, D. & JARMAN, N. G. 1972. An apparatus for facilitating the manual tabulation of phytosociological data. *Bothalia* 10: 579–582.

POLE EVANS, I. B. 1936. A vegetation map of Southern Africa. *Mem. Bot. Surv. S. Afr.* 15: 1–23.

SCHULZE, B. R. 1965. *W.B.* 28. *Climate of South Africa.* 8. *General survey* Pretoria. Govt. Printer.

TREWARTHA, G. T. 1954. *An introduction to climate.* New York. McGraw-Hill.

WEATHER BUREAU. 1954. W.B. 19. *Climate of South Africa. Climate Statistics.* Pretoria. Govt. Printer.

WEATHER BUREAU. 1965. W.B. 29. *Climate of South Africa.* 9. *Average monthly rainfall up to the end of* 1960. Pretoria. Govt. Printer.

WELLS, M. J. 1964. Die plantegroei van die Jack Scott-natuurreservaat. *Fauna Flora, Transv.* 15: 17–25.

WERGER, M. J. A. 1973. *Phytosociology of the upper Orange River valley, South Africa. A syntaxonomical and synecological study.* Pretoria: V & R.

WERGER, M. J. A. 1974. On concepts and techniques applied in the Zürich-Montpellier method of vegetation survey. *Bothalia* 11 (3):

WILLIAMS, W. T. & LAMBERT, J. M. 1959. Multivariate methods in plant ecology. I. Association analysis in plant communities. *J. Ecol.* 47: 83–101.

WILLIAMS, W. T. & LAMBERT, J. M. 1960. Multivariate methods in plant ecology. II. The use of an electronic digital computer for association-analysis. *J. Ecol.* 48: 689–710.

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