

The vegetation and identification of management units of the Honnet Nature Reserve, Northern Province, South Africa

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An analysis of the vegetation of the Honnet Nature Reserve, Northern Province is presented. Relevés were compiled in 56 stratified random sample plots. The Braun-Blanquet procedure revealed 12 distinct plant communities and four sub-communities. The Variable Quadrant Plot Method was used in the structural analysis of the communities and management units. The data were ordinated using Detrended Correspondence Analysis (DECORANA) to determine possible relations and gradients between and in the plant communities. Six management units were identified by means of the vegetation ordination, plant communities and the physical environment. A hierarchical classification, description and ecological interpretation of the vegetation units and a description of the management units are presented.

Keywords: Braun-Blanquet classification, DECORANA, management units, Mopane Veld, ordination, plant communities, veld condition.

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Introduction

A nature reserve can be thought of as an area of land which has effectively been removed from the development stream for the purpose of perpetuating natural conditions. Management, in this context, is the set of means by which that purpose is realised (Pyle 1980).

The Mopane Veld (Acocks 1988) is from an agricultural point of view a problem area (Louw 1970). Droughts and intensive overgrazing have resulted in veld deterioration and it is also suggested that bush encroachment may have taken place over the years (Grossman 1988). Only broad-scale vegetation studies by Louw (1970) and Acocks (1988) exist for the Mopane Veld. In view of the lack of information concerning the natural vegetation and veld condition of the study area, an ecological study of the area is necessary for future land-use planning, management and conservation strategies. Since plant associations commonly reflect a particular range of uniform environmental variables

(Mueller-Dombois & Ellenberg 1974), the classification and description of homogeneous vegetation units forms the basis for delineation of homogeneous physiographic units for management purposes (Shackleton *et al.* 1991). The aim of this study was to classify, describe and map the plant communities of the Honnet Nature Reserve and to delineate it, according to similar vegetation and environmental factors, into management units for management purposes.

Study area

The Honnet Nature Reserve (1898 ha) is situated between 22°35'–22°39'S latitude and 30°08'–30°12'E longitude, north of the Soutpansberg, 36 km south of Messina in the Mopane Veld (Acocks 1988).

The altitude ranges from 520 m in the north to 728 m in the south of the reserve. The topography is flat with ridges on the southern border and in the north, and a small non-perennial river which drains into the Njelele

River, which forms the northern border. The geology of the area consists mainly of basalt (Drakensberg Formation), Clarens Sandstone (Clarens Formation), dolerite, ijolite and alluvium. The soils belong to the deep sandy soils of the Hutton soil form, shallow, calcareous soils of the Glenrosa soil form and deep clay, highly erodible soils of the Oakleaf soil form (MacVicar *et al.* 1977; Botha 1993).

The study area is characterised by hot summers and mild winters, with the daily mean maximum temperatures being 33.5 °C in the summer (January) and 24.9 °C in winter (June/July). The mean annual rainfall for the Tshipise rainfall station is 339.2 mm (Weather Bureau, Department of Environmental Affairs and Tourism, Pretoria). The rainfall is seasonal. The wet season, when 75 % of the annual rain falls, has a peak in February, while the dry season stretches from April to October.

Methods

Relevés were compiled in 56 stratified random sample plots. The stratification units were structural-floristic homogeneous units subjectively identified and mapped with the aid of aerial photographs.

The plot size for the herbaceous and woody layers was fixed at 200 m² (Bredenkamp 1982; Coetzee 1982; Pauw 1988; Schmidt 1992). In each sample plot all the plant species were recorded and Braun-Blanquet cover-abundance values were accorded to each species (Mueller-Dombois & Ellenberg 1974; Weger 1974). To determine the structure (density and percentage canopy spread) of the woody layer the variable quadrant plot method (Coetzee & Gertenbach 1977) was used. Environmental data recorded at sample sites include soil type and depth, erosion, rockiness of soil surface and degree of utilization by herbivores (Van Rooyen 1978; Schmidt 1992).

The Braun-Blanquet procedure together with TWINSpan (Hill 1974a; Bredenkamp *et al.* 1989; Kooij *et al.* 1990) was applied to the floristic data matrix to derive a classification of plant communities. An ordination, Detrended Correspondence Analysis (DECORANA) (Hill 1974b) was applied to the floristic data to determine probable vegetation gradients.

Taxa names conform to those of Arnold & De Wet (1993). The nomenclature of plant communities is based on recommendations by Edwards (1983).

The veld condition was determined within each of the six management units, using the line transect method (Snyman 1989). Nineteen 200-point recordings were made, representative of the management units. The data were analysed according to the ecological index method of Vorster (1982).

Results and Discussion

Classification

In total, 166 species were recorded in 56 relevés with an average of 15 species per relevé. The vegetation was divided into 12 plant communities and four sub-communities (Table 1; Fig. 1).

Description of plant communities

1. The *Sclerocarya birrea* - *Panicum coloratum* High Closed Woodland

This plant community is restricted to well-drained, red, sandy soils of the Hutton soil form, with a low clay content (Table 2), and is represented by two relevés with an average of 13 species per relevé (Table 1).

The vegetation is characterised by species group A, which includes the diagnostic woody species *Sclerocarya birrea*, *Dichrostachys cinerea* and the diagnostic herbaceous species *Tephrosia longipes*, *Limeum fenestratum* and *Leucas martinicensis* (Table 1). Other species which are common in the community include *Acacia nilotica*, *Combretum mossambicense*, *Monechma divaricatum*, *Panicum coloratum*, *Eragrostis lehmanniana* and *Enneapogon cenchroides* (Table 1).

2. The *Colophospermum mopane* - *Terminalia prunioides* High Open Woodland

This community occurs mostly on the Hutton, Glenrosa and Oakleaf soil forms

Table 1
A phytosociological table of the vegetation of the Honnet Nature Reserve, Northern Province

Community number	1	2	3	4	5	6	7	8	9	10	11	12												
	2.1	2.2					8.1	8.2																
Relève number	104	352	123	423	424	313	212	304	355	000	453	35	44	1002	10	1505	213	42	11	24				
	64	724	909	108	126	1028	789	396	1556	785	1816	40	79	114	172	433	242	55	01	33				
Species group A																								
<i>Sclerocarya birrea</i>	3B																							
<i>Tephrosia longipes</i>	A										1													
<i>Limeum fenestratum</i>	+			+																				
<i>Dichrostachys cinerea</i>	IR								R															
<i>Leucas martinicensis</i>	1																							
Species group B																								
<i>Colophospermum mopane</i>																								
<i>Ocimum canum</i>	1																							
<i>Dicoma tomentosa</i>	+																							
Species group C																								
<i>Sesamothamnus lugardii</i>																								
<i>Geigeria burkei</i>																								
<i>Phyllanthus parvulus</i>																								
<i>Melhania forbesii</i>																								
<i>Catophractes alexandri</i>																								
Species group D																								
<i>Kyphocarpa angustifolia</i>																								
<i>Boscia foetida</i>																								
<i>Canthium gilfillianii</i>																								
Species group E																								
<i>Acacia nilotica</i>	1																							
<i>Cucumis hirsutus</i>																								
<i>Ehretia rigida</i>																								
Species group F																								
<i>Acacia senegal</i>																								
<i>Grewia retinervis</i>																								
<i>Ehretia amoena</i>																								
Species group G																								

Table 1
(continued)

Enneapogon canchroides	R+ ++	+ 1	+++ 1 1+111	A+ A 1 1+1+1 1 1	A+	++ 1	+
Grewia bicolor	++	1+	+++ ++	+++ RR 1+1 1	R	R+	+
Panicum coloratum	+ 1	A+ R	+	+	+	+ 1+R	1
Boerhavia diffusa	+	R	RR+	R	R	+	+
Species group P							
Hellotropium ciliatum	1	+	+	+	1 1 1	1 1 1	AA
Aristida adscensionis	+	+	+	R 1 +	+	+	++ +
Tribulus terrestris	+	+	+	1 1 +	+	+	++ + +
Ipomoea cairica	+	+	+	+	+	+	++ + +
Species group Q							
Acacia boreale							IBA
Species group R							
Eragrostis lehmanniana	1	1+	++ 1 1+ +	++ 1 1+ 1 1	++ R +	+ + AA 1 1 1	1
Species group S							
Sida cordifolia	+	R	++	+	+	+ +	+
Hermannia rigida	+	++	+	+	+	R +	+
Pavonia burckelii	+	1	1	+	+	1	A 1
Acalypha glabrata	+	R	+	+	+	+	+
Indigofera dalzieloides	+	+	+	+	+	+	+
Limnium aethiopicum	+	+	+	+	+	+	+
Lantana rugosa	+	+	+	+	+	+	+
Indigofera sp. 2	+	+	+	+	+	+	+
Vernonia cinerascens	1	RR	+	+	+	+	A
Cyathula lanceolata	+	+	+	+	+	+	+
Tephrosia lupinifolia	+	+	+	+	+	+	+
Achyranthes aspera	+	+	+	+	+	+	+
Chamaesyce neopolycnemoides	+	+	+	+	+	+	+
Securinega virosa	R	+	+	+	1R +	R	1
Cenchrus ciliaris	+	+	+	+	+	+	+
Pupalia lappacea	+	++	+	+	+	+	+
Grewia villosa	+	+	+	+	+	+	+
Waltheria indica	+	+	+	+	+	+	+
Justicia betonica	1	+	+	+	+	+	+
Nibiscus praeteritus	+	+	+	+	+	+	+
Barleria trassvalensis	+	+	+	+	+	+	+
Vernonia poskeana	+	+	+	+	+	+	+
Salanites pedicularis	+	+	+	+	+	+	+
Argyrobolus stipulaceus	+	+	+	+	+	+	+
Requienia sphaerosperma	+	+	+	+	+	+	+
Tephrosia polystachya	+	+	+	+	+	+	+
Protaspargus africana	+	+	+	+	+	+	+
Bossie sp. 1	+	+	+	+	+	+	+
Jatropha spicata	R	R	+	+	+	+	+
Combretum spiculatum	+	+	+	+	+	+	+

(Table 2) on the plains and along water drainage lines and is represented by 15 relevés with an average of 13 species per relevé (Table 1).

The vegetation is characterised by species group B which includes *Colophospermum mopane*, *Ocimum canum* and *Dicoma tomentosa* (Table 1). Other species commonly present in this community are *Grewia bicolor*, *Eragrostis lehmanniana*, *Panicum coloratum* and *Enneapogon cenchroides* (Table 1). This community can be divided into two sub-communities.

2.1 The *Colophospermum mopane* - *Canthium gilfillanii* High Open Woodland

This sub-community is mostly restricted to the highly erodible Oakleaf soil form with a high clay content (Table 2) along the drainage lines and is represented by six relevés with an average of 12 species per relevé (Table 1).

Table 2
Selected soil characteristics of soil forms of the
Honnet Nature Reserve, Northern Province
(Botha 1993)

Soil form	Soil depth (mm)	% Clay A-horizon
Hutton	0-20	8
	20-40	8
	40-60	8
	100-120	8
Glenrosa	0-20	12
	20-40	12
Oakleaf	60-80	>35
	80-100	>35
	100-120	>35

The vegetation is characterised by species group B, with the absence of species groups D, K, and N (Table 1). No diagnostic species were noted (Table 1; Species group B). Species commonly found in this sub-com-

munity are *Colophospermum mopane*, *Canthium gilfillanii*, *Terminalia prunioides*, *Abutilon angulatum*, *Enneapogon cenchroides*, *Panicum coloratum* and *Eragrostis lehmanniana* (Table 1).

2.2. The *Colophospermum mopane* - *Grewia villosa* Low Closed Woodland

This sub-community occurs on the Hutton and Glenrosa soil forms with a clay content of 8 % and 12 % respectively (Table 2) on the plains and is represented by nine relevés with an average of 17 species per relevé (Table 1).

This sub-community is distinguished from the *Colophospermum mopane* - *Canthium gilfillanii* High Closed Woodland by the presence of species groups D, K and N (Table 1). Except for *Grewia villosa* (Species group S) no other diagnostic species were noted for this sub-community (Table 1; Species group B).

Species common in this sub-community are *Colophospermum mopane*, *Ocimum canum*, *Dicoma tomentosa*, *Kyphocarpa angustifolia*, *Terminalia prunioides*, *Abutilon angulatum*, *Evolvulus alsinoides*, *Monechma divaricatum*, *Hermannia odorata*, *Enneapogon cenchroides* and *Eragrostis lehmanniana* (Table 1).

3. The *Sesamothamnus lugardii* - *Catophractes alexandri* Low Open Woodland

This plant community is restricted to the shallow soils of the Glenrosa soil form with a clay content of 12 % (Table 2) and is represented by six relevés with an average of 19 species per relevé (Table 1).

The vegetation is characterised by species group C, which includes the diagnostic woody species *Sesamothamnus lugardii* and *Catophractes alexandri* and the diagnostic herbaceous species *Geigeria burkei*, *Phyllanthus parvulus* and *Melhaniania forbesii* (Table 1). Species that are most conspicuous in the community are *Boscia foetida*, *B. albitrunca*, *Commiphora merkeri*, *Enneapogon*

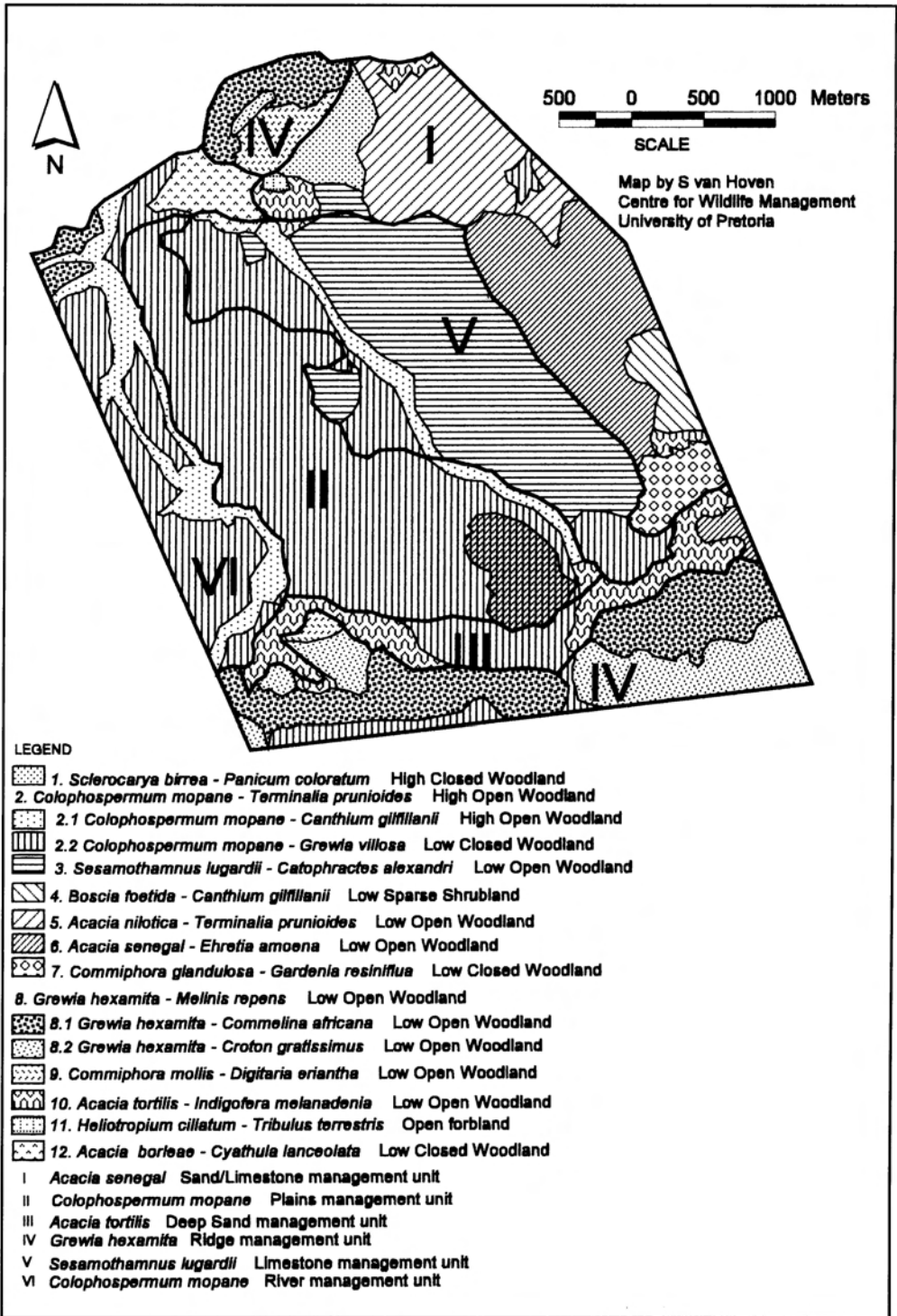


Fig. 1. Vegetation and management map of the Honnet Nature Reserve, Northern Province

cenchroides and *Eragrostis lehmanniana* (Table 1).

4. The *Boscia foetida* - *Canthium gilfillanii*
Low Sparse Shrubland

The community is restricted to the rocky, shallow Glenrosa soil form with a clay content of 12 % (Table 2) and is represented by three relevés with an average of 15 species per relevé (Table 1).

The vegetation is characterised by species group D with *Kyphocarpa angustifolia*, *Boscia foetida* and *Canthium gilfillanii* as the diagnostic species (Table 1). These species also occur in other communities, but have a low cover-abundance value in those communities (Table 1). The most conspicuous species occurring in this community are *Acacia senegal*, *Terminalia prunioides*, *Grewia bicolor*, *Croton menyhartii*, *Enneapogon cenchroides* and *Eragrostis lehmanniana* (Table 1).

5. The *Acacia nilotica* - *Terminalia prunioides* Low Open Woodland

This community occurs on well-drained soils of the Hutton soil form with a low clay content of 8 % (Table 2) and is represented by three relevés with an average of 15 species per relevé (Table 1).

The vegetation of the community is characterised by species group E, which includes the diagnostic species *Acacia nilotica*, *Ehretia rigida* and *Cucumis hirsutus* (Table 1). Other species generally present are *Terminalia prunioides*, *Boscia foetida*, *Combretum mossambicense*, *Monechma divaricatum*, *Tribulus terrestris*, *Enneapogon cenchroides*, *Eragrostis lehmanniana* and *Stipagrostis uniplumis* (Table 1).

6. The *Acacia senegal* - *Ehretia amoena*
Low Open Woodland

This community is associated with the well-drained, red soils of the Hutton soil form with a clay content of 8 % (Table 2) and is

represented by five relevés with 12 to 20 species per relevé (Table 1).

The vegetation is characterised by species group F and the diagnostic woody species *Acacia senegal*, *Grewia retinervis* and *Ehretia amoena* (Table 1). Other species conspicuous in the community are *Commiphora mollis*, *Terminalia prunioides*, *Acacia tortilis*, *Grewia bicolor*, *Monechma divaricatum*, *Stipagrostis uniplumis*, *Enneapogon cenchroides* and *Eragrostis lehmanniana* (Table 1).

7. The *Commiphora glandulosa* - *Gardenia resiniflua* Low Closed Woodland

The community is encountered on well-drained, rocky soils of the Hutton soil form (Table 2) and is represented by two relevés with 14 to 21 species per relevé (Table 1).

The vegetation of the community is characterised by species group G and the diagnostic woody species *Commiphora glandulosa*, *Commiphora merkeri* and *Gardenia resiniflua* (Table 1). Other common species of the community are *Terminalia prunioides*, *Grewia bicolor*, *Acacia senegal*, *Abutilon angulatum*, *Evolvulus alsinoides*, *Hermannia odorata*, *Tribulus terrestris*, *Enneapogon cenchroides* and *Eragrostis lehmanniana* (Table 1).

8. The *Grewia hexamita* - *Melinis repens*
Low Open Woodland

This community occurs on the sandstone ridges at the northern and southern borders of the Honnet Nature Reserve (Fig. 1), on well-drained, shallow, rocky soils of the Hutton soil form (Table 2) as well as rocky outcrops. The community is represented by five relevés with 11 to 27 species per relevé (Table 1).

The vegetation is characterised by species group I with the diagnostic woody species *Grewia hexamita* and *Acacia erubescens* and the diagnostic graminoid *Melinis repens* (Table 1). This community can be divided into two sub-communities.

8.1. The *Grewia hexamita* - *Commelina africana* Low Open Woodland

This community is restricted to the shallow, well-drained soils of the Hutton soil form (Table 2) on the north and east facing slopes of the ridges (Fig. 1) and is represented by three relevés with an average of 22 species per relevé (Table 1).

The vegetation of this sub-community is characterised by species group J with the diagnostic species *Acacia nigrescens* and *Androstachys johnsonii* (Table 1). The diagnostic forbs include *Commelina africana*, *Senecio harveianus* and *Cleome angustifolia* (Table 1; Species group J). Conspicuous species encountered in this sub-community are *Monechma divaricatum*, *Heliotropium ciliatum*, *H. strigosum*, *Achyranthes aspera*, *Enneapogon cenchroides* and *Eragrostis lehmanniana* (Table 1).

8.2. The *Grewia hexamita* - *Croton gratissimus* Low Open Woodland

This community is restricted to the well-drained, shallow, rocky soils of the Hutton soil form (Table 2) on the summit of the ridges on the Honnet Nature Reserve (Fig. 1) and is represented by two relevés with 11 and 27 species per relevé respectively (Table 1).

The vegetation of this sub-community is characterised by species group I and the absence of species group J and the dominant species *Grewia hexamita*, *Acacia erubescens* and *Melinis repens* (Table 1). Other species generally present are *Ficus glumosa*, *Ziziphus mucronata*, *Androstachys johnsonii*, *Clematis brachiata*, *Aristida meridionalis* and *Panicum coloratum* (Table 1).

9. The *Commiphora mollis* - *Digitaria eriantha* Low Open Woodland

This community is situated on the south and southwest facing slopes of the ridges on the Honnet Nature Reserve, on shallow, rocky soils of the Hutton soil form with a low clay content (Table 2). The community is represented by three relevés with 12 to 19 species per relevé (Table 1).

The vegetation is characterised by species group L including the diagnostic woody species *Commiphora mollis* and *Grewia hexamita* and the herbaceous species *Tephrosia multijuga* and *Digitaria eriantha* (Table 1). Conspicuous species encountered in this community are *Combretum mossambicense*, *Grewia bicolor*, *Croton menyhartii*, *Hermannia rigida*, *Enneapogon cenchroides* and *Panicum coloratum* (Table 1).

10. The *Acacia tortilis* - *Indigofera melanadenia* Low Open Woodland

The community occurs mostly on deep, sandy, well-drained soils of the Hutton as well as on the Oakleaf soil form with a clay content of >35 % (Table 2). This Low Open Woodland is represented by five relevés with an average of 17 species per relevé (Table 1).

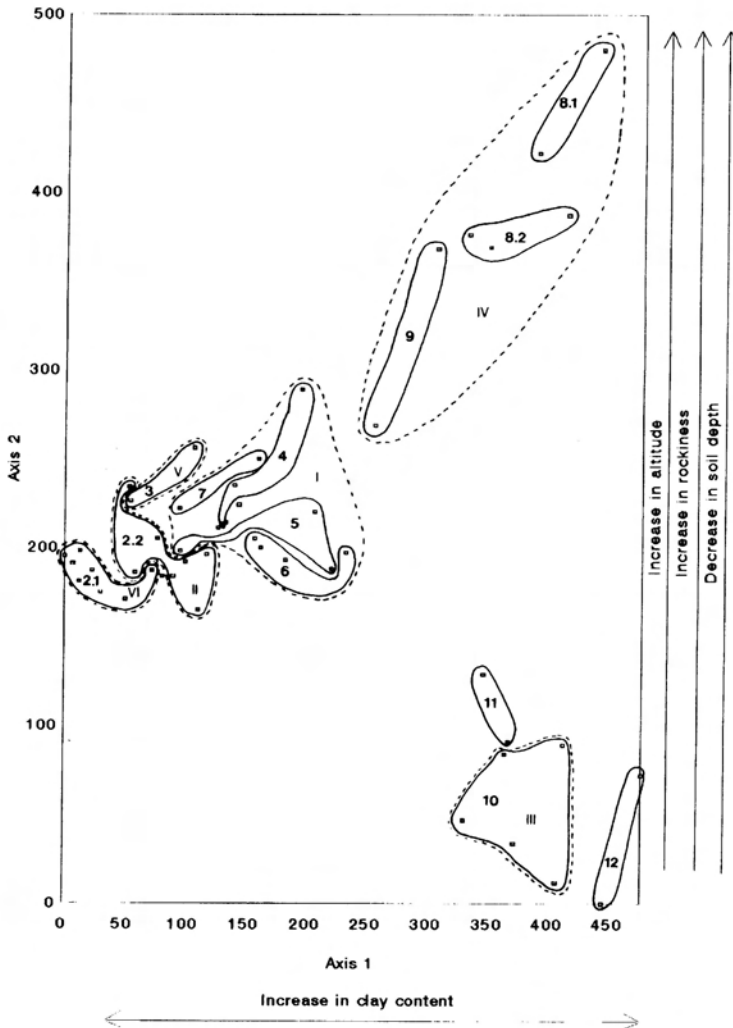
The vegetation is characterised by species group M and the diagnostic species *Acacia tortilis*, *Indigofera melanadenia* and *Schmidtia pappophoroides* (Table 1). The most conspicuous species occurring in this community are *Grewia bicolor*, *Sclerocarya birrea*, *Solanum panduriforme*, *Eragrostis lehmanniana*, *Stipagrostis uniplumis* and *Aristida adscensionis* (Table 1).

Sclerocarya birrea occurs in local stands in the community, but these stands are too small to map.

11. The *Heliotropium ciliatum* - *Tribulus terrestris* Open Forbland

This community is restricted to a disturbed area on the well-drained Hutton soil form with a clay content of 8 % (Table 2) and is represented by two relevés with an average of 6 species per relevé (Table 1).

The community is characterised by the absence of species groups A to O and Q, no diagnostic species nor any woody species occur in this community (Table 1). Species that generally occur in this community are *Heliotropium ciliatum*, *Tribulus terrestris*, *Ipomoea cairica*, *Aristida adscensionis* and *Eragrostis lehmanniana* (Table 1).



Legend:

2-12 - Corresponds with Fig. 1.

- I - *Acacia senegal* Sand/Limestone management unit
- II - *Colophospermum mopane* Plains management unit
- III - *Acacia tortilis* Deep Sand management unit
- IV - *Grewia hexamita* Ridge management unit
- V - *Sesamothamnus lugardii* Limestone management unit
- VI - *Colophospermum mopane* River management unit

Fig. 2. DECORANA ordination of the vegetation of the Honnet Nature Reserve, Northern Province (Eigen values: Axis 1 = 0.759; Axis 2 = 0.641)

The presence of *Tribulus terrestris* points to the disturbance of the area, due to the clearance of the area for polo fields, that did not materialise.

12. The *Acacia borleae* - *Cyathula lanceolata* Low Closed Woodland

This community is situated on the Glenrosa and Oakleaf soil forms with a clay content of 12 % and >35 % (Table 2) in the northwest corner of the Honnet Nature Reserve. The community is represented by two relevés with 9 to 10 species per relevé (Table 1).

The vegetation is characterised by species group Q and the diagnostic woody species *Acacia borleae* (Table 1). No diagnostic herbaceous species occur in this community.

The most conspicuous species in this community are *Cyathula lanceolata*, *Acalypha glabrata*, *Indigofera daleoides*, *Cenchrus ciliaris*, *Aristida stipitata* and *Eragrostis lehmanniana* (Table 1).

Ordination

The distribution of relevés along the first and second axes of the DECORANA ordination is given in Fig. 2. A discontinuity in the distribution of some of the plant communities and sub-communities and some of the different management units can be observed. The delineation of the plant communities and management units is arbitrary and cannot always be linked to discontinuity. The

Table 3
Mean density (ind/ha) and mean percentage apparent canopy spread of woody species found in six management units in the Honnet Nature Reserve, Northern Province

Management unit	Characteristic	Height classes (m)						Total
		>5	4-5	3	2	1	0.5	
I	Density	36	88	66	139	96	383	808
	Canopy spread	1.29	11.85	16.05	11.80	9.79	6.12	56.90
II	Density	15	72	115	202	235	224	863
	Canopy spread	2.79	7.06	9.93	11.61	12.46	7.61	51.46
III	Density	2	25	58	143	26	60	314
	Canopy spread	0.25	1.82	4.90	14.09	33.03	10.76	64.85
IV	Density	6	28	46	31	58	240	409
	Canopy spread	1.03	6.31	10.20	12.68	7.65	3.52	41.39
V	Density	0	27	94	67	72	174	434
	Canopy spread	0.00	1.97	11.65	16.11	11.37	10.35	51.45
VI	Density	46	157	181	219	213	231	1 047
	Canopy spread	3.25	15.13	23.16	25.28	26.94	17.98	111.74

- I - *Acacia senegal* Sand/Limestone management unit
- II - *Colophospermum mopane* Plains management unit
- III - *Acacia tortilis* Deep Sand management unit
- IV - *Grewia hexamita* Ridge management unit
- V - *Sesamothamnus lugardii* Limestone management unit
- VI - *Colophospermum mopane* River management unit

Table 4
Mean density (ind/ha) of the most conspicuous tree species in the different management units in the Honnet Nature Reserve, Northern Province

Species	Density					
	I	II	III	IV	V	VI
<i>Boscia foetida</i>	184	-	-	-	-	-
<i>Grewia bicolor</i>	101	-	-	-	-	-
<i>Acacia nilotica</i>	99	-	-	-	-	-
<i>Colophospermum mopane</i>	-	558	29	-	-	550
<i>Clerodendrum glabrum</i>	-	92	-	-	-	103
<i>Terminalia prunioides</i>	-	74	-	-	52	-
<i>Acacia tortilis</i>	-	-	136	-	-	-
<i>Rhigozum obovatum</i>	-	-	40	-	-	-
<i>Acacia nigrescens</i>	-	-	-	89	-	-
<i>Croton gratissimus</i>	-	-	-	65	-	-
<i>Androstachys johnsonii</i>	-	-	-	56	-	-
Bossie sp. 1	-	-	-	-	117	-
<i>Sesamothamnus lugardii</i>	-	-	-	-	63	-
<i>Acacia borleae</i>	-	-	-	-	-	184

- I - *Acacia senegal* Sand/Limestone management unit
 II - *Colophospermum mopane* Plains management unit
 III - *Acacia tortilis* Deep Sand management unit
 IV - *Grewia hexamita* Ridge management unit
 V - *Sesamothamnus lugardii* Limestone management unit
 VI - *Colophospermum mopane* River management unit

delineation of the relevés that represents the same plant community follows the phytosociological table (Table 1). A definite gradient in clay content of the soils is illustrated along the first axis, with a decrease in clay content from left (>35 %) to right (8 %). Along the second axis a gradient in soil depth, rockiness and altitude can be recognised. Communities situated to the bottom of the axis are associated with deep soils, lower altitude and rockiness, whereas communities to the top are associated with shallow soils, higher altitude and rockiness.

Management units

Six different management units were identified by means of ordination and on floristic

affinity, soil form and topography. These management units are mapped (Fig. 1) and described in terms of the structure of the woody vegetation.

I. The *Acacia senegal* Sand/Limestone management unit

This management unit includes the *Boscia foetida* - *Canthium gilfillanii* Low Sparse Woodland, *Acacia nilotica* - *Terminalia prunioides* Low Open Woodland, *Acacia senegal* - *Ehretia amoena* Low Open Woodland, *Commiphora glandulosa* - *Gardenia resiniflua* Low Closed Woodland and the *Sclerocarya birrea* - *Panicum coloratum* High Closed Woodland on shallow, red, rocky soils of the Hutton soil form (Fig. 1; Table 2). The density of woody species in

this management unit is 808 individuals per hectare (Table 3) with the most individuals in the 0.5 m height class, namely 383 individuals per hectare. The most abundant species are *Boscia foetida*, *Grewia bicolor* and *Acacia nilotica* respectively (Table 4). The percentage apparent canopy spread is 56.9 % with the highest spread in the 3 m height class (Table 3).

The veld condition of this management unit is poor (Table 5). The main grass species are *Enneapogon cenchroides*, an Increaser IIb, and *Eragrostis lehmanniana*, an Increaser IIa species (Table 6) (Visser 1995).

Table 5
The veld condition according to the ecological index method (Vorster 1982) of the Honnet Nature Reserve, Northern Province

Management unit	Veld condition
I	354
II	254
III	481
IV	359
V	313
VI	402
Total study area	360

- I - *Acacia senegal* Sand/Limestone management unit
- II - *Colophospermum mopane* Plains management unit
- III - *Acacia tortilis* Deep Sand management unit
- IV - *Grewia hexamita* Ridge management unit
- V - *Sesamothamnus lugardii* Limestone management unit
- VI - *Colophospermum mopane* River management unit

II. The *Colophospermum mopane* Plains management unit

The *Colophospermum mopane* - *Grewia villosa* Low Closed Woodland community forms the *Colophospermum mopane* Plains management unit, which is associated with calcareous Hutton and Glenrosa soil forms with a clay content of 8 % and 12 % respectively (Fig. 1; Table 2). The density of 863 individuals per hectare is the second highest

on the Honnet Nature Reserve (Table 3). The highest percentage apparent canopy spread is at the 1 m height class which correlates with the highest density at the 1 m height class (Table 3), with *Colophospermum mopane*, *Clerodendrum glabrum* and *Terminalia prunioides* occurring in the highest densities (Table 4).

This management unit has a very poor veld condition, with a veld condition score of 254 (Table 5). The main grass species in this unit are *Enneapogon cenchroides* and *Eragrostis lehmanniana*, with Decreaser species contributing only 5.25 % (Table 6) and the bare patches, 44.25 %, the highest of all management units (Table 6) (Visser 1995).

III. The *Acacia tortilis* Deep Sand management unit

This management unit is represented by the *Acacia tortilis* - *Indigofera melanadenia* Low Open Woodland on deep, red, sandy soils of the Hutton soil form (Fig. 1; Table 2). The density of woody species in this unit is 314 individuals per hectare (Table 3), mostly *Acacia tortilis*, *Rhigozum obovatum* and *Colophospermum mopane* (Table 4), which renders it the management unit with the lowest density of woody species. The percentage apparent canopy spread is 64.85 %, the second highest in the study area (Table 3).

The veld condition of this management unit is good (Table 5) with *Eragrostis lehmanniana*, an Increaser IIa, contributing 40.25 % to the herbaceous species present (Table 6) (Visser 1995).

IV. The *Grewia hexamita* Ridge management unit

This management unit includes the *Grewia hexamita* - *Melinis repens* Low Open Woodland and the *Commiphora mollis* - *Digitaria eriantha* Low Open Woodland on shallow, rocky soils of the Hutton soil form (Fig. 1; Table 2). The density of woody individuals is 409 individuals per hectare with the most individuals in the 0.5 m height class. *Acacia nigrescens*, *Croton gratissimus*

Table 6

The ecological status (Vorster 1982) and percentage occurrence of the different grass species, forbs and bare patches in the different management units on the Honnet Nature Reserve, Northern Province

Plant species	Ecological status	Management units					
		I	II	III	IV	V	V I
<i>Aristida adscensionis</i>	I 2c	0.33	3.50	1.50	-	1.25	-
<i>Aristida meridionalis</i>	I 2b	-	-	0.75	-	-	-
<i>Aristida stipitata</i>	I 2c	-	-	-	1.00	-	-
<i>Cenchrus ciliaris</i>	D	-	-	-	-	-	1.25
<i>Cynodon dactylon</i>	I 2b	-	-	-	-	-	10.00
<i>Enneapogon cenchroides</i>	I 2b	31.75	18.75	9.75	31.83	81.75	15.25
<i>Eragrostis lehmanniana</i>	I 2a	15.67	15.50	40.25	6.00	-	14.25
<i>Panicum coloratum</i>	D	1.50	0.50	-	0.83	-	-
<i>Panicum maximum</i>	D	-	-	-	0.50	-	20.00
<i>Schmidtia pappophoroides</i>	D	0.92	4.75	9.25	1.33	-	0.12
<i>Stipagrostis uniplumis</i>	I 2a	10.50	2.50	1.75	2.17	-	-
Forbs	I 2b	11.75	10.75	17.50	40.17	0.25	5.25
Bare patches		27.58	44.25	19.25	16.17	16.75	33.63

D: Decreaser - species which is dominant in veld in excellent condition and which decreases when veld is under or overutilised.

I 2a: Increaser IIa - species increases when veld is moderately overgrazed over the long term.

I 2b: Increaser IIb - species increases when veld is heavily overgrazed over the long term.

I 2c: Increaser IIc - species increases when veld is excessively overgrazed over the long term.

I - *Acacia senegal* Sand/Limestone management unit

II - *Colophospermum mopane* Plains management unit

III - *Acacia tortilis* Deep Sand management unit

IV - *Grewia hexamita* Ridge management unit

V - *Sesamothamnus lugardii* Limestone management unit

VI - *Colophospermum mopane* River management unit

and *Androstachys johnsonii* are the most abundant species (Table 4). The percentage apparent canopy spread is 41.39 %, with the highest percentage canopy spread in the 2 m height class (Table 3).

This management unit has a poor veld condition (Table 5). Forbs and the graminoid *Enneapogon cenchroides* contribute the most to the herbaceous species present in the management unit (Table 6) (Visser 1995).

V. The *Sesamothamnus lugardii* Limestone management unit

The *Sesamothamnus lugardii* - *Catophractes alexandri* Low Open Woodland community on calcareous soils of the Glenrosa soil form with a clay content of 12 % (Fig. 1; Table 2), forms the *Sesamothamnus lugardii* Limestone management unit. The density of woody species in this unit is 434 individuals per hectare, mainly *Bossie* sp.1,

Sesamothamnus lugardii and *Terminalia prunioides* (Table 4), with the most individuals in the 0.5 m height class whereas the percentage apparent canopy spreads are the highest in the 1 m, 2 m and 3 m height classes (Table 3).

The veld condition of this unit is poor, with a veld condition score of 313 (Table 5), with *Enneapogon cenchroides* contributing 81.75 % to the herbaceous species present and bare patches 16.75 % (Table 6) (Visser 1995).

VI. The *Colophospermum mopane* River management unit

The *Colophospermum mopane* - *Canthium gilfillanii* High Open Woodland and the *Acacia borleae* - *Cyathula lanceolata* Low Closed Woodland are included in this management unit. It occurs on erodible soils of the Oakleaf soil form with a high clay content (>35 %) mostly along the drainage lines (Fig. 1; Table 2). This management unit has the highest density of woody plants per hectare (1 047 ind/ha; Table 3), with *Colophospermum mopane*, *Acacia borleae* and *Clerodendrum glabrum* being the most abundant species (Table 4). The high density of woody species in the 0.5 m, 1 m, 2 m and 3 m height classes are supported by the highest percentage apparent canopy spread in the 1 m, 2 m and 3 m height classes (Table 3).

The veld condition of this management unit is fair (Table 5), with the highest presence of Decreaser species, namely *Cenchrus ciliaris* (1.25 %), *Panicum maximum* (20.00 %) and *Schmidtia pappophoroides* (0.12 %) and 33.63 % bare patches (Table 6) (Visser 1995).

Conclusion

The Braun-Blanquet procedure was successfully applied since clearly defined plant communities could be distinguished which are related to specific environmental conditions, viz. soil depth, clay content and rockiness, as well as altitude.

According to Acocks (1988) the Honnet Nature Reserve is situated in the Mopane Veld (veld type 15). However, Louw (1970) classified the study area as part of the *Colophospermum* - *Commiphora* - *Terminalia prunioides* community which is confirmed by the different communities of the Honnet Nature Reserve.

The large number of increaser species in the herbaceous layer (Table 5) and the low cover-abundance values (Table 1) of these species reflect the degradation of the veld which could be due to overstocking with game and low annual rainfall. The delineation of the plant communities after the recovery of the veld might differ from the present delineation, and these data could be used as reference to the state to which the forb layer could degrade owing to heavy grazing and low rainfall.

Some of the plant communities are too small to manage separately, and were arbitrarily grouped together, according to similarity in soil form, topography and vegetation, into six management units. These units (compare Fig. 1) should serve as suitable management units in which to monitor key environmental parameters central to the philosophy of Adaptive Management (Walters & Hillborn 1978) which should be aimed at the protection of the diverse vegetation through habitat protection and improvement.

Peel (1989) states that a veld condition score of 475 for the area is good, whereas Pauw (1988) states that a veld condition score of 330 is poor, therefore the veld condition of the study area can be described as moderate to poor.

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References

- ACOCKS, J.P.H. 1988. Veld types of South Africa. 3rd ed. *Memoirs of the Botanical Survey of South Africa* 57: 1-146.
- ARNOLD, T.H. AND B.C. DE WET. (eds.). 1993. Plants of southern Africa: names and distribution. *Memoirs of the Botanical Survey of South Africa* 62: 1-825.
- BOTHA, J.H. 1993. Bestuursplan vir die Honnet-natuurreservaat. Pietersburg: Hoofdirekoraat: Natuur- en Omgewingsbewing, Transvaalse Provinsiale Administrasie. (Ongepubliseerde verslag)
- BREDENKAMP, G.J. 1982. 'n Plantekologiese studie van die Manyeleti Wildtuin. DSc-proefskrif, Universiteit van Pretoria, Pretoria.
- BREDENKAMP, G.J., A.F. JOUBERT AND H. BEZUIDENHOUT. 1989. A reconnaissance survey of the vegetation of the plains in the Potchefstroom-Fochville-Parys area. *South African Journal of Botany* 55: 199-206.
- COETZEE, B.J. 1982. Phytosociology, vegetation structure and landscapes of the central district, Kruger National Park. DSc thesis, University of Pretoria, Pretoria.
- COETZEE, B.J., AND W.P.D. GERTENBACH. 1977. Technique for describing woody vegetation composition and structure in inventory type classification, ordination and animal habitat surveys. *Koedoe* 20: 67-75.
- EDWARDS, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 14: 705-712.
- GROSSMAN, D. 1988. Relations between ecological, sociological and economic factors affecting ranching in the north-western Transvaal. PhD thesis, University of the Witwatersrand, Johannesburg.
- HILL, M.O. 1974a. *TWINSpan - A Fortran program for arranging multivariate data in an ordered two-way table by classification of individuals and attributes*. New York: Cornell University.
- HILL, M.O. 1974b. *DECORANA - a Fortran Program for detrended correspondence analysis and reciprocal averaging*. New York: Cornell University.
- KOOIJ, M.S., G.J. BREDENKAMP AND G.K. THERON. 1990. Classification of the vegetation of the B land type in north-western Orange Free State. *South African Journal of Botany* 56: 309-318.
- LOUW, A.J. 1970. 'n Ekologiese studie van Mopanieveld noord van die Soutpansberg. DSc(Agric)-proefskrif, Universiteit van Pretoria, Pretoria.
- MACVICAR, C.N., J.M. DE VILLIERS, R.F. LOXTON, E. VERSTER, J.J.N. LAMBRECHTS, F.R. MERRYWEATHER, J. LE ROUX, T.H. VAN ROOYEN AND H.J. VON M. HARMSE. 1977. *Soil classification: A binomial system for South Africa*. Pretoria: Department of Agricultural Technical Services. (Scientific Bulletin No. 390).
- MUELLER-DOMBOIS, D. AND H. ELLENBERG. 1974. *Aims and methods of vegetation ecology*. New York: Wiley.
- PAUW, J.C. 1988. Riglyne vir die bestuur van die natuurlewe in die bosveldgemeenskappe van die Atherstone Natuurreservaat in die Noordwes-Transvaal. MSc (Natuurlewebestuur)-verhandeling, Universiteit van Pretoria, Pretoria.
- PEEL, M.J.S. 1989. Determinants of veld composition on a number of ranches in the North-western Transvaal. MSc (Wildlife Management) thesis, University of Pretoria, Pretoria.
- PYLE, R.M. 1980. 18. Management in Nature Reserves. Pp. 319-328. In: SOULÉ, M.E. AND WILCOX, B.A. (eds.). *Conservation biology, an evolutionary ecological perspective*. Sunderland, Massachusetts: Sinauer.
- SCHMIDT, A.G. 1992. Guidelines for the management of some game ranches in the Mixed Bushveld communities of the north-western Transvaal, with special reference to Rhino Ranch. MSc (Wildlife Management) thesis, University of Pretoria, Pretoria.
- SHACKLETON, C.M., J.E. GRANGER, B. MCKENZIE AND M.T. MENTIS. 1991. Multivariate analysis of coastal grasslands at Mkambati Game Reserve, north-eastern Pondoland, Transkei. *Bothalia* 21: 91-107.
- SNYMAN, D.D. 1989. Verwantskap tussen veldtoestand, reëval en dierebelading in die Mopanieveld. MSc (Agric)-verhandeling, Universiteit van Pretoria, Pretoria.
- VAN ROOYEN, N. 1978. 'n Ekologiese studie van die plantgemeenskappe van die Punda Miliapafuri-Wambiyagebied in die Nasionale Krugerwildtuin. MSc-verhandeling, Universiteit van Pretoria, Pretoria.
- VISSER, N. 1995. 'n Ekologiese studie van en 'n natuurlewebestuurplan vir die Honnet-natuurreservaat, Noordelike Provinsie. MSc (Natuurlewebestuur)-verhandeling, Universiteit van Pretoria, Pretoria.
- VORSTER, M. 1982. The development of the ecological index method for assessing veld condition in the Karoo. *Proceedings of the Grassland Society of Southern Africa* 17: 84-89.
- WALTERS, C.J. AND X. HILLBORN. 1978. Ecological optimization and adaptive management. *Annual Review of Ecology and Systematics* 9: 157-188.
- WERGER, M.J.A. 1974. On concepts and techniques applied in the Zürich-Montpellier method of vegetation survey. *Bothalia* 1: 165-176.