

# Structural and floristic classifications of Cape Mountain Fynbos on Rooiberg, southern Cape

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## ABSTRACT

Structure and floristic composition of the plant cover were used to establish separate classifications of plant communities in Mountain Fynbos on Rooiberg, South Africa. The structural units and floristic associations closely correlate with each other and their distribution reflects the major environmental influences, aspect and altitude. It is concluded that, despite the preliminary character of the survey, resource inventories of this type are suitable as a foundation for park management.

## RÉSUMÉ

### LES CLASSIFICATIONS STRUCTURALES ET FLORISTIQUES DES BUISSONS DE LA MONTAGNE DU CAP SUR ROOIBERG, CAP AUSTRAL

La composition structurale et floristique de la couverture de plantes ont été utilisés pour établir des classifications séparées de communautés de plantes dans le Fynbos de Montagne sur Rooiberg, en Afrique du Sud. Les unités structurales et les associations floristiques correspondent les unes avec les autres et leur distribution reflète les influences du milieu, de l'aspect et de l'altitude. Il en est conclu que, malgré le caractère préliminaire de l'étude, la ressource d'inventaires de ce type convient comme la fondation pour la conduite de parcs.

## INTRODUCTION

At the request of the Department of Forestry, the first author carried out a survey of the False Macchia (Acocks, 1975) or Mountain Fynbos vegetation of the Rooiberg Mountain Catchment Area to provide basic data for a management plan (Taylor, in press). For this purpose, a simple classification, description and map were needed, dividing the vegetation into units that are visually homogeneous in physiognomy. Because these units had to be recognized by non-botanical personnel, it was decided to adopt a structural classification, rather than a floristic one. The structural survey was done by marking units of more or less uniform vegetation structure and terrain morphology on air photos (scale 1:20 000). These units were then studied in the field. In about a month's field work, sufficient information was gathered to delineate eight major structural units and 20 variations, all of which could be related to habitat. These have been mapped (1:50 000) and described in detail by Taylor (in press).

Management of Mountain Fynbos reserves such as Rooiberg aims at maximum production of clear water from catchments and the maintenance of vegetation diversity both in plant species and plant life forms. Hence, a vegetation study for management purposes should include both a floristic and a structural description. Time did not permit an extensive phytosociological survey on Rooiberg. However, to determine whether the major structural units could also be distinguished by their species composition, a brief Braun-Blanquet survey was carried out. Twenty-eight relevés were laid out subjectively within stands of vegetation that were regarded as representative of the main structural units. In the phytosociological table only vascular plants were taken into account. This paper summarizes and compares the results of the structural and floristic surveys. For in-

formation on the flora and phytogeography of Rooiberg we refer to Taylor (1979).

## LOCATION AND HABITAT

About 20 km south-east of Ladismith, Cape Province (Fig. 1), lies a west-east trending mountain range, divided into more or less equal sections by the Gouritz River. The Rooiberg Mountain Catchment Area, 25 345 ha in extent, comprises a large part of the higher western section of this range at approximately 33°40'S latitude and 21°30'E longitude. It consists of State and private land, managed by the Department of Water Affairs, Forestry and Environmental Conservation for the conservation of water, flora and wild life.

The range is one of a series of isolated mountains located between Montagu and Uniondale, the fynbos of each mountain being separated from that of its neighbours by karroid lowland vegetation of the Little Karroo.

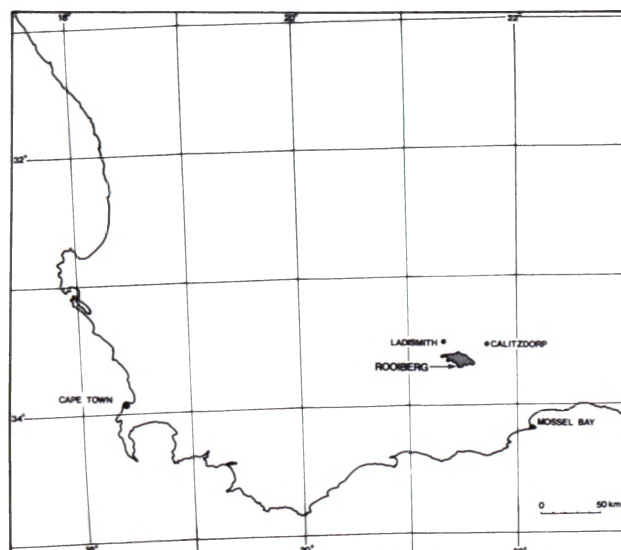


FIG. 1.—Map showing location of Rooiberg in southern Cape.

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Geomorphologically, the Rooiberg Range is a broad anticlinal fold of Table Mountain Sandstone strata, breached near the top of the arch. The breach has eroded to form a series of deeply incised kloofs that run parallel to the main crest before breaking south in deep gorges that have cut through subsidiary crests. The Table Mountain Sandstones are interrupted by a shale band that can be traced as a sinuous line across the north side of the range. Sandy lithosols cover the greater part of the reserve. Rock outcrops and cliffs are common in the interior kloofs but the main north- and south-facing sides of the range are not excessively steep.

The climate is hot and dry. Situated on the transition between the winter- and summer- rainfall areas, Rooiberg receives only the outer fringe of the winter cyclonic rains and few summer thunderstorms. The mean total precipitation for 1977/1978 (the first year after rain gauges were erected) was about 365 mm, the northern side of the mountain receiving about half as much rain as the southern slopes (P. B. Odenaal, pers. comm.). Probably the most effective precipitation is from condensation of the clouds that form around the high peaks. Considerable temperature and moisture differences may be expected between crests (about 1 400 m altitude) and footslopes of the mountain (about 800 m).

## VEGETATION

### 1. Structural units

The vegetation units identified in the structural survey depict only gross structural characteristics. They are based on simple criteria such as estimated height and canopy cover of the vegetation and estimated proportion of (i) restioid, (ii) narrow-leaved and (iii) proteoid components. These components characterize fynbos vegetation. For convenience, their definitions are repeated here. (i) *Restioid* refers to hemicryptophytic plants of the family Restionaceae with sclerophyllous tubular stems and leaves that have been reduced to membranous, non-photosynthetic scales or small sheaths arising singly from each node. They are often tufted but sometimes rhizomatous. The category includes plants in other families that have a physiognomy similar to the Restionaceae, for example, most *Tetraria* and *Ficinia* species, some *Juncus* species and *Typha*. (ii) *Narrow-leaved* means the very narrow leptophylls, usually sclerophyllous though some may be fleshy or even succulent. It includes flat, involute and cylindrical leaves as well as revolute leaves like those of the Ericaceae. The term had to be substituted for

'ericoid' which is now restricted to revolute sclerophyllous leptophylls. (iii) *Proteoid* is the term for plants with leaves and growth form resembling proteas. They have isobilateral leaves with the shape and texture of a typical protea e.g. *Protea lorifolia*, *P. repens* or broader leaves like *P. nitida* and *P. cynaroides*. *Broad-leaved* is used here to denote the roughly ovate, sclerophyllous leathery leaves of woody shrubs derived from the northern floras as against those of typical fynbos plants (e.g. *Cassine*, *Maytenus*, *Euclea*).

The vegetation units appeared to be suitable mapping units. Where local aspect might significantly affect the vegetation and therefore the management, variations were distinguished within the major structural units. In our description the following letters have been used: N = communities on slopes of northerly aspects, S = communities on southerly aspects, C = communities of crests and K = communities of very steep kloofs. Relative positions of the communities on Rooiberg are shown in Fig. 2.

### Communities with northerly aspects

*Community N1.* This community, comprising *Variations N1a, N1b, C1, C2*, is found on the moderately steep upper and middle slopes (1370–1060 m) to the north of the divide. The vegetation is a closed restioid and narrow-leaved shrubland in which the former element is often predominant or at least conspicuous. Variation N1a of the highlands east of Rooiberg Peak is mainly restioid and about 0.5–1 m high (Fig. 3). Most of the precipitation in this area comes from the condensation of clouds formed by the summer south-east winds. The land is privately owned and was probably burned fairly frequently in the past.

Variation C1 (Fig. 4) occurs on summits and is stunted because of its exposed site. It is sometimes dominated by grasses. Many of the localities, too small to be mapped separately, have been included in Variation C2 which occurs along the crest and major spurs at high altitude. This variation has a higher species diversity and greater variety in dominance and height of species due to many local differences in aspect and degree of slope (Fig. 5). Since the major fire belts are sited on ridges, the Variations C1 and C2, like N1a, have been subject to more frequent and regular burning than other parts of the reserve.

Variation N1b, less frequently burnt, represents vegetation of northerly aspects west of Rooiberg Peak and below Variations C1 and C2. Low narrow-

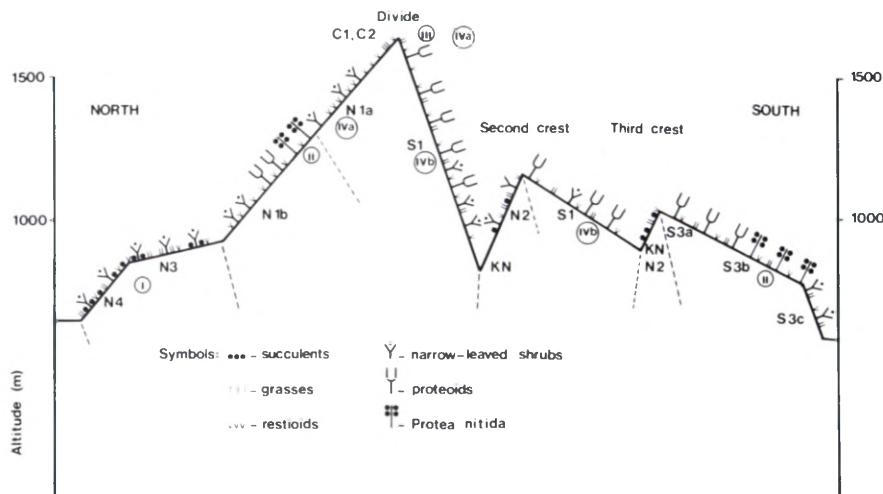


FIG. 2.—Relative positions of communities on Rooiberg.



FIG. 3.—Variation N1a above the headwaters of Groenkloof, east of Rooiberg Peak.



FIG. 4.—Variation C1 of Community N1 on the summit of Rooiberg Peak. The conspicuous grass is a *Pentaschistis* species.



FIG. 5.—Variation C2 of Community N1 on the spur running north-west from Rooiberg Peak to Taays Rand. The vegetation is restioid with *Protea eximia* in the right foreground. In and beyond the shadow is a patch of dense proteoid shrubland on a local southerly slope.





leaved shrubs prevail, but at middle altitudes the proteoid element (*Protea repens*, *P. eximia*, *P. lorifolia*) increases in height (up to 2 m) and cover (up to 75%) (Fig. 6). *Leucadendron salignum* extends in a broad belt across the middle slopes, giving them a yellow-green speckled appearance. At the middle altitudinal limit of this variation is a similar belt of the grey-leaved small tree, *Protea nitida* (Waboom) which, though less widespread than *Leucadendron salignum*, often overlaps its range. This 'Waboomveld' is recognizable on air photos but is too restricted in area to map separately.

**Community N2.** Including *Variations NE and NW*, this community occurs between about 1 300 and 650 m on steep northerly slopes beneath the second crest (Fig. 7). These lower slopes receive less cloud moisture and are therefore warmer and drier than those of Variation N1a, north of the divide. Narrow-leaved shrubs exceed restioids in cover while proteoids are rare and of a more xeromorphic type, like *Protea lorifolia*. The community contains a fair

number of succulents and grasses although their cover is not high. Sites with north-east and north-west aspects are separated as *Variations NE and NW* respectively. The narrow-leaved shrub *Passerina vulgaris* tends to dominate on both aspects and *Protea punctata* occurs locally on upper slopes in variation NE.

**Community N3.** This community is found between 1 060 and 900 m on the plateau or shelf on the northern side of the mountain below Variation N1b. Slopes are gentle to almost level and very stony. The vegetation, about one metre in height, is characterized by the predominance of narrow-leaved shrubs in the upper canopy (Fig. 8). In lower layers, restioids, grasses and succulents (mainly *Mesembryanthemaceae*) can be quite numerous.

At the western limit of the range or at the outer edge of the plateau where less rain falls, elements of *Renosterveld*, especially the *Renosterbos* (*Elytropappus rhinocerotis*), become conspicuous.



FIG. 6.—Variation N1b where the proteoid cover reaches up to 75%: *Protea lorifolia* in the foreground, *P. eximia* behind, c. 1–2 m.



FIG. 7.—The second crest showing Community N2 between the skyline and the steep cliffs. Variation NE the darker patch at top left, and Community KN on the precipitous lower slopes.



FIG. 8.—At Nicolaaskloof, typical Community N3 is confined to the sloping shelf in the foreground. On the rocky slopes beyond, N3 intergrades with proteoid N1b above the figure's head.



FIG. 9.—Community N4 on the steep north-facing basal slope.



**Community N4.** This community occurs on steep north-facing slopes between 900 and 700 m, below Community N3 down to the base of the mountain. The soils are very stony, shallow and dry. Like the previous one, Community N4 is dominated by narrow-leaved shrubs (Fig. 9) but the vegetation is more open and poorer in species content, containing some karroid elements and more succulents than usual in fynbos because this community borders on the karroid vegetation of the lowlands.

**Community KN** (including *Community K*). The main drainage of upper Rooiberg comprises four complex kloof systems that occupy the rift south of the divide. In their upper reaches the kloofs run parallel to the divide and then drain south. The north side of the range is drained by five large kloofs running east or north-east and a series of shorter, shallower kloofs running north. Community KN is found at lower levels of all the southward draining kloofs.

The habitat is a very steep to precipitous rock slope with some soil accumulated in pockets and bands between the vertical cliffs (Figs 7 & 10). The kloofs draining north or north-east have no distinct north or south aspects, but the vegetation of their steep sides, Community K, appears structurally similar to that of Community KN. In both communities the canopy cover is low (about 25–70%) and consists of scattered shrubs with a rounded growth form 1–2 m in diameter, interspersed with coarse restioids and grasses, some broad-leaved bushes of tropical affinity (e.g. *Diospyros dichrophylla* and *Cussonia spicata*) and succulents in the ground layer. Proteoids are usually absent. The vegetation, like the habitat, is very similar to N4.

#### *Communities with southerly aspects*

**Community S1.** This community, which includes *Variations SW* and *SE*, is found on moderately steep



to very steep southerly slopes from 1 490 m down to about 630 m. The well drained, shallow soil consists of fine grey humic sand with some leaf litter. At high elevations, these slopes receive moisture condensed from the clouds that form in the south-east wind, therefore reducing the effect of the hot, dry summers. The vegetation is dense shrubland with a closed, uniform canopy of proteoids up to 2 m high. There is at least one lower layer of restioids and narrow-leaved shrubs similar in structure to the canopy of Community N1a.

Within Community S1 there are several structural variations, possibly resulting from differing proteoid dominance: at the highest, steepest sites, *Protea punctata* occurs in almost pure stands with some *Leucadendron comosum* (Fig. 11); at middle altitudes *Leucadendron eucalyptifolium* becomes either dominant or co-dominant with *Protea punctata*. At still lower elevations, the number of proteoid species increases with the addition of *Protea eximia* and *P. neriifolia* but their total cover decreases until

at the lowest parts the proteoid layer contributes about 50% canopy cover and is only about 1 m high, while the restioid and narrow-leaved layer becomes closed. Since these structural variations either form mosaics or intergrade with each other, they cannot be mapped separately at the 1: 50 000 scale. Variations SW and SE, with western and eastern aspects respectively, are mappable units of the open proteoid community of lower altitudes down to about 400 m, which include *Protea repens*, *P. lorifolia* and *Leucadendron salignum*. Grasses are also more frequent in these variations than in the other variations of Community S1.

**Community S2.** This community was found only in a small area on the steep upper south-easterly slopes of the peak marked by Trigonometrical Survey beacon No. 149. Stands on similar sites on the highest peaks, which possibly belong to the same community, have been affected by a fire belt. Shallow, black, humic soil, more moist than other Rooiberg soils, occurs between the bands of outcrop-



FIG. 10.—North-facing krans on the left with vestiges of Community KN at its base. Gorge of the south-flowing Bos-rivier.



FIG. 11.—Tall dense proteoid shrubland of Community S1 dominated by *Protea punctata* with a fringe of *P. eximia* in front, bordering on a fire-belt in the foreground where restioids and narrow-leaved shrubs of the lower layer are prominent.

Leaf forms: B = broad-leaved sclerophylls; N = narrow-leaved leptophylls; (N) = slightly broader than N; G = graminoid; P = proteoid; R = restioid (Restionaceae); (R) = restioid (other families); S = succulent; O = other forms.  
See text for definitions.

Community number		I								II					III				IVa				IVb			
Altitude (m)										1					1 1 1 1 1				1 1 1 1 1				1 1 1 1 1			
		8 8 8 9 8 7 6 9 8								5 6 8 0 6 5					4 4 3 2 2				4 3 4 3				3 3 4 3			
		5 2 0 1 5 7 4 6 3								6 2 8 8 4 0					6 9 1 5 9				1 7 1 1				8 4 0 2			
		3 3 0 4 3 7 0 0 8								4 5 4 2 0 3					9 0 2 0 5				0 0 7 1				5 1 2 6			
Structural units		N N N N N N N N N								S S S N S S					C C C C C				N N C C				S S S S			
		4 4 4 3 3 3 3 3 3								3 3 3 1 3 3					1 1 1 2 2				1 1 2 1				1 1 1 1			
										b									a a							
Total number of species		1 1 3 2 2 2 2 5 4								7 5 5 4 4 3					3 3 3 3 3				3 4 4 3				4 4 2 3			
		7 4 5 9 1 9 3 3 0								4 0 1 5 9 9					2 9 0 4 8				2 5 3 8				8 5 7 6			
Relevé number		4 4 4 4 4 4 4 4 4								4 4 4 4 4 4					4 4 2 4 4				4 4 4 4				4 4 4 4			
		7 8 3 7 8 8 8 2 2								4 4 3 4 7 4					7 3 2 3 3				3 3 0 7				3 4 3 3			
		5 5 3 3 6 8 7 9 8								7 4 7 2 1 8					4 0 2 6 9				4 2 5 2				5 1 1 8			
Differential species for community of northern lower slopes																										
N	Felicia filifolia	1 1 + + + + + +																								
S	Zygophyllum sp. (rel. 487)	+ + + +																								
N	Euryops erectus	1 + + x								+																
N	Aspalathus granulata																									
(N)	Relhania squarrosa	+ + + 1																								
G	Ehrharta calycina									x + +																
S	Mesem. sp. (No. 123)	x + +																								
Differential species for community of middle slopes																										
P	Protea nitida									2 1 2 1 1																
O	Mohria caffrorum									+ 1 + + 2																
(R)	Ficinia deusta	+								+ + + + +																
(N)	Eroeda imbricata									+ + x + 1 +					+											
(N)	Pelargonium myrrhifolium									+ + + + +																
N	Elytropappus glandulosus	+								1 2 1 2 +									2				+ + +			
G	Themeda triandra									+ 1 1 2																
N	Sutera stenophylla									+ + + +																
P	Leucadendron salignum									1 2 1									1							
S	Carpobrotus sp. (rel. 448)	x								+					+								+			
O	Chamaraea capensis									+ + +																
B	Euclea polyandra									x x +																
O	Aristea pusilla									x x +																
Differential species for communities of lower and middle slopes																										
N	Eriocephalus umbellulatus	+ 1 + +								2 1 +																
N	Aspalathus sceptum-aureum	+ + + +								x x + +																
O	Hermannia odorata	+ +								x + 1 +																
O	Lobelia spartioides	+ +								x + + +																
N	Phyllis rigidifolia	+ + + +								+ + + +																
R	Restio gaudichaudianus	+ 2 + +								+ 2 +					+											
G	Merxmüllera arundinacea	2 1 1								3 +																
N	Elytropappus rhinocerotis	2 1 1								1																
N	Aspalathus hirta	+								+					2											
Differential species for community of summits and crest																										
N	Selago brevifolia														+ + +											
N	Rutaceae (Taylor 9210)														+ + +											
N	Helichrysum ericoides														+ 1 +											
O	Gazania linearis														+ + +											
S	Crassula sp., cf. cephalophora														+ +											
O	Pelargonium tricolor														+ +				x							
Differential species for communities of lower and middle slopes and crest																										
G	Pentaschistis eriostoma	+ + + + + 1 1								1 1 1 1 +					2 3 1				+ +							
N	Anthospermum aethiopicum	1 1 + 1 + +								+ + 1					+											
(R)	Ficinia nigrescens	+ + + + +								+					+ +											
R	Restio cuspidatus	x + + + +								1 1 1 1 +					1 1 + x											
Differential species for community of southern upper slopes																										
P	Protea punctata																		x				+ + 5 1			







FIG. 12.—The dense, narrow-leaved shrubland Community S2 on a cool, moist slope.



FIG. 13.—Scattered Waboom (*Protea nitida*) barely discernible in the narrow-leaved matrix of Community S3 on the middle slopes above Bufelsfontein.

ping bedrock. The vegetation is a dense, narrow-leaved shrubland up to 1.5 m tall in which species indicating moist conditions, like *Berzelia intermedia* and *Psoralea pinnata*, are prominent (Fig. 12). Near the lower limit some tall proteoid and restioid components (*Protea punctata* and *Cannamois virgata*) occur.

**Community S3.** This community has a wide distribution from the third crest of the range down to the foot of the mountain and along its entire length. The gentle to moderate southerly slopes have dry, sandy lithosols. In the west, the slope becomes steep, with bands of kranes (cliffs) interspersed with colluvial boulders. The vegetation varies in height and cover but is generally less dense than that of Communities S1 and S2. Floristically and structurally, Community S3 is probably the most diverse of all the Rooiberg vegetation types. *Leucadendron salignum*, the only constant feature, occurs virtually everywhere. **Community S3a** of the upper slopes between 915 and about 760 m has a fairly dense mixed proteoid vegetation with the highest concentration of proteoid

species in the reserve; the understorey is chiefly restioid. A belt of Waboomveld, with *Protea nitida* conspicuous, extends along the middle slopes from about 760 m to 640 m (**Community S3b**); narrow-leaved shrubs predominate and grasses are fairly frequent (Fig. 13). Along the lowest slopes, especially to the west, is a zone of karroid narrow-leaved shrubs (e.g. *Pteronia*, *Relhania*) about 1.5 m high constituting up to 75% canopy cover, in which the coarse tufted grass *Merxmuellera arundinacea* is often conspicuous (**Community S3c**.)

## 2. Floristic units

We have sampled the vegetation by means of Braun-Blanquet relevés (Table 1) varying in size from the usual 50 m<sup>2</sup> to about 100 m<sup>2</sup>, 200 m<sup>2</sup> or 300 m<sup>2</sup> depending on differing vegetation structure. Some units, like S1, are undersampled, the rare ones like S2, KN & N2 are not sampled at all, while others have been sampled more intensively because of their special interest, e.g. the *Protea nitida*-dominated Waboomveld which occurs in different floristic subdivisions throughout the range of Mountain Fynbos.



TABLE 2.—Comparison of structural and floristic units

Structural unit (and variations)	Floristic unit	Main habitat characteristics	Predominant species
N1 (incl. N1a, N1b, C1, C2) Closed restioid and narrow-leaved shrubland up to 1 m (N1a, C1, C2), with proteoid (2 m) dominance at middle altitudes (N1b) and graminoid dominance on summits (C1)	III, IVa  (II)	Highlands and crests (N1a, C1, C2); moderately steep upper and middle northern slopes (N1b)	<i>Restio fruticosus</i> , <i>R. cuspidatus</i> , <i>Thamnochortus argenteus</i> , <i>Hypodiscus purpureus</i> , <i>Tetraria ustulata</i> , <i>Centella virgata</i> , <i>Lightfootia rigida</i> , <i>Aspalathus rubens</i> , <i>Pentaschistis eriostoma</i> , <i>P. colorata</i> , <i>Ehrharta ramosa</i> .
N2 Fairly open to dense narrow-leaved and restioid shrubland up to 1,5 m with grasses and succulents.	Not sampled	Steep northern slopes beneath the second crest	<i>Passerina vulgaris</i> , <i>Elytropappus glandulosus</i> , <i>Muraltia</i> spp., <i>Restio</i> spp.
N3 Fairly dense narrow-leaved and restioid shrubland up to 1 m with grasses and succulents	I	Gentle to almost level lower northern slopes	<i>Felicia filifolia</i> , <i>Anthospermum aethiopicum</i> , <i>Passerina vulgaris</i> , <i>Elytropappus rhinocerotis</i> (loc.), <i>Euryops erectus</i> , <i>Relhania squarrosa</i> , <i>Phylla rigidifolia</i> , <i>Restio fruticosus</i> , <i>Hypodiscus striatus</i> , <i>Thamnochortus argenteus</i> , <i>Pentaschistis eriostoma</i> , <i>Merxmüllera arundinacea</i> , <i>Mesems</i> , <i>Crassula</i> spp.
N4 Fairly open narrow-leaved shrubland up to 1 m with succulents and karroid elements	I	Steep lower northern slopes beneath community N3	
KN (incl. K) Open narrow-leaved and broad-leaved shrubland up to 1,75 m with coarse restioids, grasses and succulents	Not sampled	Very steep rock slopes of kloofs	<i>Metasia pallida</i> , <i>Phylla purpurea</i> , <i>Cullumia bisulca</i> , <i>Diospyros dichrophylla</i> , <i>Restio fruticosus</i> , <i>Merxmüllera arundinaceae</i> , <i>Crassula</i> spp.
S1 (incl. SW, SE) Dense proteoid shrubland up to 2 m with lower restioids and narrow-leaved shrubs	IVb	Moderate to very steep upper southern slopes	<i>Protea punctata</i> , <i>Leucadendron comosum</i> , <i>L. eucalyptifolium</i> , <i>Erica hispidula</i> , <i>E. calycina</i> , <i>Elegia juncea</i> , <i>Tetraria ustulata</i>
S2 Dense narrow-leaved shrubland up to 1,5 m	Not sampled	Steep upper southern slopes (limited area)	<i>Berzelia intermedia</i> , <i>Psoralea pinnata</i> , <i>Cannamois virgata</i>
S3 (incl. S3a, b, c) Fairly dense mixed proteoid shrubland up to 1,5 m (S3a); narrow-leaved shrubland (1 m) with <i>Protea nitida</i> conspicuous and emergent to 2,5 m (S3b); fairly open narrow-leaved karroid shrubland to 2 m (3c)	II (= S3b) S3a, c not sampled	Gentle to moderate lower southern slopes: upper (S3a), middle (S3b) and lower (S3c) zones; one relevé on north side of mountain	<i>Protea repens</i> , <i>P. neriifolia</i> (S3a); <i>Protea nitida</i> , <i>Leucadendron salignum</i> (S3b), <i>Anthospermum ciliare</i> , <i>Elytropappus glandulosus</i> , <i>Lightfootia rigida</i> , <i>Aspalathus sceptrum-aureum</i> , <i>Sutera stenophylla</i> , <i>Eroeda imbricata</i> , <i>Restio cuspidatus</i> , <i>Ficinia deusta</i> , <i>Pentaschistis eriostoma</i> , <i>Cymbopogon marginatus</i> ; <i>Themeda triandra</i> (S3b)

COMPARISON OF STRUCTURAL AND FLORISTIC UNITS

A comparison of the structural and floristic units is summarized in Fig. 2 & Table 2.

**Community I.** Of the lower northern slopes this community comprises all relevés in structural units N3 and N4. Predominant growth forms include restioids (*Restio fruticosus*, *Thamnochortus argenteus*, *Hypodiscus striatus*) and narrow-leaved shrubs (*Felicia filifolia*, *Passerina vulgaris*). The first three relevés of this community are located in structural unit N4 which, it was noted, is poorer in species than N3. In fact, Relevés 475 and 485 have the lowest species content of any in the survey.

**Community II.** This 'Waboomveld' community represents stands of middle and lower slopes mainly with southerly aspects (structural unit S3b) characterized not only by *Protea nitida* but also by *Mohria caffrorum* and *Pelargonium myrrhifolium*, species that are frequent in Waboomveld over a wide geographical range. Predominant life forms include proteoids (*Protea nitida*, *Leucadendron salignum*), narrow-leaved shrubs (*Elytropappus glandulosus*, *Anthospermum ciliare*), restioids (*Restio cuspidatus*, *R. fruticosus*) and grasses (*Pentaschistis eriostoma*, *Themeda triandra*). At the footslopes of the mountain, below the Waboomveld, karroid elements (e.g. *Pteronia* and *Relhania* spp.) are found.

Relevé 448 has no *Protea nitida* and few other differential species. It would seem that within Community II the species-rich Waboom stands are, in special situations, part of a wider-ranging vegetation

type that lacks *Protea nitida* and is in general less rich in species content. This hypothesis might have important management implications and can only be tested by more sampling. Relevé 442 is the only one in Waboomveld on the northern side of the mountain. It occurs at a considerably higher altitude than any of the relevés on the south side. Almost two decades ago Taylor (1963) observed that *Protea nitida* 'does seem to occur at higher altitudes on the northern slopes', probably to compensate for the hotter and drier conditions found there.

**Community III.** This community comprises relevés situated on summits and the crest fire-belt (structural units C1 & C2), burnt just less than four years before the survey. Predominant life forms include narrow-leaved shrubs (*Centella virgata*, *Aspalathus rubens*, *Selago brevifolia*) and restioids (*Restio cuspidatus*, *R. fruticosus*). The three summit relevés, Relevés 474, 430 and 222 all show high scores for the grass *Pentaschistis eriostoma*; *Ehrharta ramosa* and *Pentaschistis colorata* also occur in the community. Relevé 439 is particularly poor in differential species. It may represent a related but undersampled community. Within Community III, this relevé is the only one not situated on the main crest and that has vegetation over 1 m in height, suggesting that it may lie outside the four-year old firebelt.

**Community IV.** This community comprises two subcommunities, a and b, mainly distinguished from each other by the presence in IVb of an overstorey of proteoids (*Protea punctata*, *Leucadendron* spp.) and



the fact that IVa has no differential species. Subcommunity IVb occurs on upper southern slopes bearing the proteoid structural unit S1. In Subcommunity IVa two relevés (432, 434) are on upper north-facing slopes bearing the restioid structural unit N1a; one (405) is on a spur (C2) and one (472) is on a summit (C1). Therefore three structural units appear to be combined in one floristic group. On the other hand, one structural unit (C1) has three relevés (474, 430 & 222) in floristic Community III and one (472) in IVa. The data are insufficient to determine whether these anomalies are due to fire-age or other habitat factors. They may merely show that structural units N1a, C1 and C2 are not distinct entities.

Table 1 indicates that stands of lower and middle slopes, bearing the structural units N3, N4 and S3 (floristic Communities I, I and II respectively) are floristically more related to each other than to any of the other stands. The same appears to apply to stands of crests and upper slopes bearing the structural units N1 and S1 (floristic Communities III + IVa and IVb respectively).

The results from the structural and floristic surveys indicate that structure and species composition of the vegetation are related to major habitat factors like altitude and aspect.

#### CONCLUDING REMARKS

Both in the structural and the floristic surveys, we have sampled only the major matrix of fynbos communities and not the detailed patterns. Our results are therefore provisional.

The floristic survey, even a brief one like that on Rooiberg, supported and supplemented the structural survey. The latter can be done without extensive *a priori* knowledge of the complex fynbos flora, and has the advantage of being quicker and the data can be used by personnel with little botanical training. Emphasis is not on the plant species but rather on its functional adaptation to the environment. The structurally homogeneous units will be characterized by particular life and growth forms and can be expected to react in a reasonably uniform way to treatment such as burning, and to use such as grazing by game. The structural classification will therefore help managers to delineate management units, to determine rotation lengths and stocking rates, to maintain balanced, natural ecosystems and to monitor physiognomic changes.

In the floristic survey, emphasis is on species composition of the plant cover, and the ecological amplitudes of plant species are used to describe plant communities and their interrelationships. The floristic classification will indicate which species and communities are threatened, and will provide information on how to conserve them and how to maintain species diversity.

In conclusion, we think that a combination of a structural and floristic survey, as we have described, is a necessary and suitable basis for fynbos conservation management.

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#### UITTREKSEL

*Die struktuur en floristiese samestelling van die plantegroei is gebruik vir die daarstelling van afsonderlike klassifikasies van plantgemeenskappe in Bergfynbos op Rooiberg, Suid-Afrika. Die strukturele eenhede en floristiese assosiasies is sterk met mekaar gekorreleer en hulle verspreiding weerspieël die vernaamste omgewingsfaktore, nl. aspek en hoogte bo seespieël. Ten spyte van die voorlopige aard van die opname, is die gevolgtrekking dat hulbronopnames van hierdie aard 'n geskikte grondslag vorm vir die bestuur van natuurlike gebiede.*

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