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A Phytosociological Study of the Cape Fynbos and other Vegetation at Jonkershoek, Stellenbosch

by

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Abstract

The Braun-Blanquet phytosociological method was tested in the complex Fynbos vegetation of the South-western Cape Region of South Africa. In the Swartboschkloof Nature Reserve, Jonkershoek, the Fynbos, riverine scrub and forest vegetation was classified preliminarily into eight communities, which are described floristically and related to habitat. The results hold promise, and the possibilities of classifying the Cape Fynbos in a formal phytosociological system are discussed.

Introduction

The Braun-Blanquet phytosociological method commonly used in Europe has remained relatively unknown in Southern Africa. Possible reasons for this are language difficulties, the need for more general, rather than more detailed information on the vegetation, and the general non-acceptance of the method by English and American plant ecologists. For many years the only source of information in the English-speaking world was Fuller & Conard's (1932) authorised translation of Braun-Blanquet's first edition of *Pflanzensoziologie* (1928), a work that omitted certain important details of the phytosociological technique. More detailed German works of the phytosociological school were largely inaccessible (for example Ellenberg, 1956; Braun-Blanquet, 1951, 1964).

In recent years an English evaluation of the method was given by Poore (1955, 1956), although his main criticisms were shown by Moore (1962) to be largely unfounded. Becking (1957) reviewed the phytosociological school and its concepts, and Küchler (1967) translated the tabulation techniques from Ellenberg (1956).[1]

Originally, nearly all vegetation surveys undertaken in Southern Africa were on a physiognomic or on a non-formal descriptive basis, with the exception of Acocks (1953) who used his own floristic technique to construct a system of veld types. Recently, multivariate analysis and ordination techniques have been applied by a number of ecologists in the Republic of Southern Africa (see Killick, 1966–67). In the Portuguese territories physiognomic classifications were created, and in each unit one sample was taken. The species list from each sample was rated on the Braun-Blanquet scale of cover-abundance and sociability (e.g. Gomes Pedro & Grandvaux Barbosa, 1955). In Central Africa, Belgian ecologists, traditionally familiar with the Braun-Blanquet method, have set up a hierarchy of syntaxa for the Congolese rain forests (Lebrun & Gilbert, 1954).

In Southern Africa it has often been suggested that the flora is too rich to apply successfully a floristic technique. In the Cape Fynbos, particularly, such techniques were thought to be impracticable. Outside Southern Africa also, Donselaar (1965), in a classification of the Northern Surinam savannas, stated that to use successfully the Braun-Blanquet method the number of species must be moderate.

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[1]The percentage classes of Braun-Blanquet as listed in Table 10, p. 231, Küchler (1967) are not correctly reproduced, as they give the impression of being based purely on cover. In reality they are based on cover and abundance.

From systematically distributed quadrats used for an association analysis of the vegetation of the Cape of Good Hope Nature Reserve, Taylor (1969) also prepared a Braun-Blanquet synthesis table. Due to the rigid sampling technique, a number of quadrats had to be excluded from the table as they were located on community transitions and were not representative of more or less homogeneous stands of vegetation. Nevertheless, he obtained associations that were recognizable in the field. This stimulated the authors to undertake a survey according to the phytosociological techniques described by Braun-Blanquet (1964) and Ellenberg (1956), in order to test its usefulness in the floristically rich Fynbos vegetation. The area chosen was the Swartboschkloof–Sosyskloof Nature Reserve in the Jonkershoek valley near Stellenbosch, as the results could also be used for the International Biological Programme survey of conservation sites.

The Study Area

The Swartboschkloof–Sosyskloof Nature Reserve, 373 hectares in extent, lies in the Jonkershoek Forest Reserve in the Hottentot Holland Mountains some 15 km from Stellenbosch, at 34°00′S latitude and 18°57′E longitude. It was proclaimed a nature reserve in terms of the Forest Act in 1936, to conserve vegetation representative of the Jonkershoek valley.

The vegetation is chiefly Fynbos (Acocks 1953, veld type 69). It consists mainly of sclerophyllous scrub and dwarf scrub, in which amongst other, Restionaceae and Cyperaceae also play an important rôle. A dense scrub grows along the river banks, and upstream, where the valleys narrow, small patches of forest occur. Van der Merwe (1966) analyzed vegetation-site units in the Reserve.

Topography, Geology and Soils

The Reserve is a fan-shaped valley at between 285 m and 1 200 m altitude. The steep slopes average about 30°, ranging from about 5° to 50°. Aspect is largely northerly with only about 5 per cent of southerly facing slopes.

Porphyritic granite of the Pre-Cape System forms the undulating floor of the valley, but is often buried by sandstone talus fans from the medium-grained homogeneous sandstones of the Table Mountain Series. The sandstones are very resistant to erosion so that the valley is bounded by precipitous cliffs and knife-edge ridges. Continuous creep characterizes the talus on the slopes below the cliffs.

The valley was formed by a series of secondary faults, roughly at right angles to those which gave rise to the main Jonkershoek valley. Streams follow the courses of these faults. The jointed layers with a northerly tilt store a fair proportion of the precipitation which is released in conspicuous seepage steps.

Soils are generally poorly developed, rocky and acid, the granite soils being less acid than the sandstone. Those soils derived from granite are often over 1 m deep and more fertile than those from sandstone, which are coarse-textured, skeletal and rarely over 1 m deep. Mixtures of granite and sandstone debris give rise to intermediate soils. Humic and organic soils of varying depth (0,05–2 m) occur locally on wet sites.

Climate

Wicht *et al.* (1969), in describing the climate of the Jonkershoek valley in some detail, notes that "The climate is Etesian of the Mediterranean type,.....with a dry summer and the average temperature of the warmest month below 22°C....." It conforms to Walter & Leith's (1960) Climate Type IV, and to Köppen's (1931) humid-mesothermal *Erica*-climate. Precipitation is usually associated with strong cyclonic winds from the north-west. In summer, strong anti-cyclonic winds from the south-east prevail. These are generally dry, but frequently deposit moisture at highe

altitudes. From a rain-gauge at the mouth of the Swartboschkloof valley the mean annual rainfall over 20 years is about 1 600 mm. Fifty per cent of this fell during the months May to August, and only 12 per cent from December to March, when the greatest moisture deficits occur. Snow falls rarely at higher altitudes.

History of anthropogenic influence

For millenia the Jonkershoek Valley was visited intermittently by Khoisan tribes, but they probably seldom settled there (Schapera, 1930; Seddon, 1966, 1967).

Colonists first settled in the Valley in the late 17th century, but the effects of their agricultural practices on Swartboschkloof was probably first evident after 1832, when the Reserve formed part of land transferred to a farmer living close by. The early farmers used these lands as grazing for sheep, goats and cattle, exploiting the forests for timber, the *Protea arborea* stands for firewood, and such shrubs as *Agathosma crenulata* for medicinal uses.

Early man probably had little effect upon the vegetation, but European colonization would have initiated rapid change. Veld-burning to improve grazing was fairly standard practice, and Swartboschkloof was probably burnt at 4–10 year intervals—more frequently than probably occurred naturally. Grazing would have been restricted largely to the lower slopes owing to the steep topography. The area does not appear to have been cultivated. Mammal populations diminished or disappeared as a result of hunting and the destruction of habitats in the surrounding lowlands.

The acquisition of Jonkershoek by the Department of Forestry in 1933 and proclamation of the Nature Reserve introduced radical changes in land-use. A policy of complete fire protection was adopted, and only recreation and non-destructive research were permitted in Swartboschkloof. The Reserve is surrounded by firebreaks, burnt in spring or autumn on a 4-year rotation. In spite of policy, the whole reserve burnt accidentally in December 1942 and February 1958. Two small fires also occurred during this period.

Methods

Gleason's (1925) regression equation, as reformulated by Goodall (1952), was applied to data from three sets of nested quadrats, 1 m^2 to 256 m^2 in size, to estimate the quadrat size-information ratio (Werger, 1970). On this basis a quadrat size of 100 m^2 was selected. The Braun-Blanquet method does not require uniform sized quadrats, but as many as possible were 100 m^2 for the sake of consistency. Only two quadrats (nos. 14 and 37) were taken at 50 m^2 to avoid obvious heterogeneity due to a sharp change in slope aspect and to a conspicuous vegetational difference. Quadrat nos. 42, 43 and 44 were 128 m^2, being a stage in a set of nested quadrats.

Altogether 44 quadrats were layed out at sites selected on the basis of visually assessed homogeneity of vegetation structure and habitat. Species in each quadrat were listed and rated on the Braun-Blanquet cover-abundance scale. Only permanently recognizable species were recorded, thus omitting annuals and most geophytes. Site features such as slope angle, aspect and altitude were measured, soil depth was estimated, and geological and geomorphological characteristics were noted.

The data were entered in a raw table and from this an association table was compiled (Tables 1 and 2), according to the prescribed methods. Tables 1 and 2 list character species for each community, together with those species with over 50 percent presence in a group of two, three or four related communities. The remaining species are grouped in a "tail" of the tables. Of this "tail", species occuring only once or twice and with low cover-abundances in the quadrats, are listed for convenience in the Appendix. Complete species-quadrat lists are considered important for Braun-Blanquet phytosociological work, because some of the species will assume greater importance when further data are acquired, and are necessary if current concepts of the communities are to be revised.

The communities are named after one or two faithful and conspicuous species, so that they are easily recognizable in the field.

To obtain complete pictures of the communities and their relationships, more data are needed, preferably from other areas. Only then will it be possible to decide with certainty whether some of the below mentioned species are true character species.

The Communities

Based on floristic composition we have distinguished five Fynbos, one riverine scrub and two forest communities.

Fynbos

The Fynbos communities usually consist of two or three layers: a graminoid and dwarf shrub layer, a shrub layer and, in some communities, a tall shrub or small tree layer (Table 1).

1. Protea arborea—Rhus angustifolia *Community*

This community consists of many of the more common Fynbos species. The vegetation usually consists of three layers: a tall shrub and small tree layer from 2–3 m high; a shrub layer 1–1,5 m high; and an undergrowth of sedges, grasses, restionaceous plants, other herbs and dwarf shrubs from about 0,10–0,60 m high. The middle layer usually has the highest cover, although sometimes the upper layer may dominate.

There are a number of possible character species, which are, however, not fully constant, like *Podalyria myrtillifolia*, *Euphorbia genistoides* and *Helichrysum zeyheri*. Constant but not strictly faithful character species appear to be *Diospyros glabra* and *Rhus angustifolia*. A number of species that clearly typify this community and the *Restio perplexus* Community are *Protea arborea* (which has its optimum in this community), *Psoralea obliqua*, *Watsonia pyramidata*, *Themeda triandra* and *Ursinia filiformis*.

The *Protea arborea—Rhus angustifolia* Community is found on relatively deep, detrital, sandy loam soils; slope varies, but aspect is generally between north and east. It is limited to lower altitudes (up to ca. 600 m) in Swartboschkloof.

2. Brunia nodiflora—Psoralea rotundifolia *Community*

This community generally has the usual three strata: a tall shrub and small tree layer (1,5–3 m), a shrub layer (0,60–1,20 m) and an herbaceous dwarf shrub undergrowth (0,10–0,60 m). High cover values are obtained, especially in the undergrowth, although sometimes they are high in the upper layer as well. The community has a number of good character species: *Brunia nodiflora*, *Psoralea rotundifolia*, *Helichrysum teretifolium*, *Corymbium scabrum*, *Danthonia lanata*, *Osteospermum tomentosum* and *Tetraria burmannii*. Abundant here, but common also to the *Thamnochortus gracilis-Hypodiscus aristatus* Community, is *Restio filiformis* (Table 1).

Species common to this community and the *Protea arborea—Rhus angustifolia* Community are *Anthospermum aethiopicum*, *Montinia caryophyllacea*, *Asparagus thunbergianus*, *Diosma hirsuta*, *Ficinia filiformis*, *Lichtensteinia lacera* and a number of other species.

The community occurs in a very distinct habitat, with generally steep slopes (16°–32°) and relatively deep detrital soils, with a definite south-eastern aspect. It occurs mainly at altitudes of 300–500 m.

3. Thamnochortus gracilis—Hypodiscus aristatus *Community*

The shrub layer (0,75–1,50 m high) is the most important stratum in this community. There is an undergrowth of about 0,20–0,50 m high, but the upper layer of ca. 2 m high tall shrubs and small trees if often wanting.

TABLE 1.—FYNBOS COMMUNITIES

Relevé number	22	6	1	2	36	3	4	5	41	42	43	23	44	13	7	8	9	10	11	27	14	17	19	20	24	25	28	21	29	34	35	33	18	40	38	12
Total number of species	24	23	40	39	43	47	46	31	39	39	40	42	64	53	49	56	43	44	42	30	40	34	43	37	48	43	44	44	35	57	34	31	13	16	27	16
Altitude (m)	380	400	320	320	550	350	460	410	390	420	440	410	440	450	330	390	—	470	500	640	630	650	710	770	540	490	600	510	580	1150	900	940	700	390	550	350
Aspect	NE	N	NE	N	NW	NE	NE	N	N	E	N	N	SE	SE	E	E	E	E	E	W	SE	E	NE	NE	SW	S	W	E	NE	NE	N	NE	E	NE	NW	NE
Slope (°)	11	5	5	3	16	5	26	6	25	24	36	0	32	16	16	18	20	17	21	31	23	15	13	19	28	34	27	28	34	25	35	43	18	8	12	7
Geology (g = Granite; T = Table Mt. Sandstone)	T	gT	gT	gT	gT	gT	T	gT	T	gT	T	gT	g	gT	gT	gT	g	gT	g	T	T	T	T	T	T	T	T	gT	gT	T	T	T	T	gT	g	gT
Soil depth (m)	>1	±1	±1	±1	±1	±1	±1	±1	<,5	±1	<,7	>1	±1	±1	±1	±1	±1	±1	±1	±,5	<,1	<,5	,3	<,3	±1	±,5	±,5	±1	±1	>,5	>,5	<,5	<,5	>1	>1	>1
Total cover (%)	98	98	50	95	98	95	80	98	90	100	95	100	95	80	95	85	80	75	85	80	45	55	85	65	70	80	70	80	85	65	85	80	98	95	95	98
Character species Prot. arb.-Rhus ang. Comm.																																				
Diospyros glabra (L.) de Winter	+	1	+	1	1	2	2	+	+	2	+	1	.	.	r	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	3
Rhus angustifolia L.	.	1	.	+	+	+	+	1	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	1
Cassytha ciliolata Nees	.	+	.	2	.	1	+	+	+	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Pteridium aquilinum (L.) Kuhn	.	1	.	3	2	.	.	3	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2
Podalyria myrtillifolia Willd.	.	.	+	.	+	+	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia genistoides Berg.	.	.	+	+	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum zeyheri (DC.) Less.	.	.	r	r	.	.	r	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhus tomentosa L.	.	.	.	r	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Character species Brun. nodifl.-Psor. rot. Comm.																																				
Psoralea rotundifolia L.f.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum teretifolium (L.) Sweet	.	.	.	.	.	.	.	.	.	+	.	.	r	.	1	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Corymbium scabrum L.f.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	+	1	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brunia nodiflora L.	.	.	.	.	.	.	.	.	.	.	.	.	r	2	.	+	.	+	3	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Danthonia lanata Schrad.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	+	2	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Osteospermum tomentosum (L.f.) T. Norl.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tetraria burmannii C.B. Cl.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Psoralea fruticans (L.) Druce	.	.	.	.	r	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Adenandra serpyllacea Bartl.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elytropappus glandulosus Less.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypodiscus willdenowia Mast.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Character species Thamn. grac.-Hypod. arist. Comm.																																				
Restio sieberi Kunth	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	+	+	1	+	1	1	2	1	1	2	1	+	.	.	.	.
Anthospermum ciliare L.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	r	.	r	+	+	+	+	+	.	+	+	+	+	.	.	.	.	.	.
Thamnochortus gracilis Mast.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	1	+	1	1	1	+	+	.	+	.	.	.	.	.	.
Staberoha cernua (L.f.) Dur. & Schinz	+	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	+	1	1	2	+	.	.	.	.	.	.	.	.	.
Prismatocarpus diffusus A. DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	r	.	+	+	+	.	+	r	.	+	.	.	.	.	.	.
Tetraria capillacea (Thunb.) C.B. Cl.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	+	+	1	1	+	.	.	.	.	.	.	.	.
Tetraria fasciata (Rottb.) C.B. Cl.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	1	1	.	.	.	.	.	.	.	.	.
Hypodiscus aristatus (Thunb.) Nees	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	2	1	+	+	2	.	.	.	.	.	.	.	.
Willdenowia sulcata Mast.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	+	1	.	+	1	.	.	.	.	.	.
Blaeria dumosa Wendl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	+	.	1	1	.	.	.	r	+	.	.	.	.	.	.
Clutia polygonoides L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	+	+	+	.	.	+	.	.	.	.	.	.
Pentameris macrocalycina (Steud.) Schweick.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	+	.	.	.	.	.	+	.	.	.	.	.	.
Widdringtonia cupressoides (L.) Endl.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	+	1	r	r	.	.	.	.	.	.	.	.	.	.	.
Erica coccinea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	3	3	2	.	.	.	.	.	.	.	.	.
Psoralea aculeata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	+	.	.	.	.	.	.	.	.
Elegia racemosa (Poir.) Pers.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	2	.	.	.	.	.	.	.	.	.	.
Cliffortia atrata H. Weim.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	r	.	.	.	.	.	.	.	.	.	.	.	.
Coleonema juniperinum Sond.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Sympieza articulata (Thunb.) N.E. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	+	.	.	.	.	.	.	.	.	.	.	.	.
Lobelia coronopifolia L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Nebelia paleacea Sweet	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	1	2	.	.	.	.	.	.	.	.	.	.
Scyphogyne muscosa (Ait.) Druce	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	2	.	.	.	.	.	.	.	.	.	.	.	.
Character species Restio perpl. Comm.																																				
Cliffortia polygonifolia L.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	r	r	.	.	1	2	2	.	.	.	.
Euryops abrotanifolius (L.) DC.	.	.	.	.	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.
Restio perplexus Kunth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	+	.	.	.	.
Asparagus compactus Salter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.
Venidium semipapposum DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Character species Berz. lan.-Osm. ast. Comm.																																				
Carpha glomerata Nees	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	1
Psoralea aphylla L.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+
Osmitopsis asteriscoides (L.) Cass.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	2	.
Berzelia lanuginosa Brongn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	2	4
Elegia capensis (Burm.f.) Schelpe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	3	.	.	2
Leucadendron salicifolium (Salisb.) Williams	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	3	.
Restio graminifolius Kunth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	.
Cliffortia graminea L.f.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	3	.
Tetraria punctoria C.B. Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.
Elegia thyrsifera Pers.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.
Leptocarpus paniculatus Pillans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Species common to Prot. arb.-Rhus ang., Brun. nodifl.-Psor. rot., Thamno. grac.-Hypod. arist. and Restio perpl. Comms.																																				
Tetraria cuspidata (Rottb.) C.B. Cl.	+	.	+	+	.	+	+	.	+	r	+	.	2	+	+	+	+	+	1	1	+	1	+	+	+	+	+	.	+	+	+	.	.	+	.	.
Cymbopogon marginatus Stapf	1	.	2	2	1	1	+	1	+	+	2	1	+	+	1	1	2	+	.	+	.	.	+	.	+	.	+	+	+	+	2	+	.	.	.	.
Aristea thyrsiflora (Delar.) N.E. Br.	+	3	+	+	+	+	1	+	+	+	.	+	+	+	+	+	+	+	+	+	.	.	+	.	.	.	+	.	+	+	1	+	.	+	.	.
Erica hispidula L.	1	.	.	+	+	+	2	.	.	+	2	.	1	+	r	.	+	+	+	.	+	2	2	1	1	+	+	3	+	.	.	.	1	+	.	+
Clutia alaternoides L.	.	+	+	+	.	+	1	+	+	.	+	+	.	+	+	+	+	+	+	.	+	.	+	+	.	.	+	+	+	+	1	+	.	.	.	.
Stoebe plumosa (L.) Thunb.	+	+	r	3	+	1	2	3	.	1	2	+	+	.	+	+	.	.	.	.	+	.	+	.	+	+	.	.	.	+	4	4	.	1	.	.
Danthonia stricta Schrad.	2	.	1	2	+	1	2	1	.	2	+	2	+	.	+	+	+	+	.	+	.	.	.	+	.	.	.	+	1	.	2	2	.	.	.	.
Restio triticeus Rottb.	+	.	+	.	+	.	+	.	1	.	.	.	2	1	+	1	2	.	+	+	+	.	+	.	.	.	+	+	1	+	+	+	.	.	.	.
Pentaschistus colorata (Steud) Stapf.	+	.	.	+	.	.	+	.	.	.	.	.	1	+	+	.	1	+	.	3	+	.	+	1	1	+	2	1	2	1	.	1	.	.	.	.
Bobartia indica L.	.	.	.	.	+	.	+	+	1	1	.	+	1	1	1	+	+	+	+	+	.	.	.	.	+	.	1	1	1	+	.	.	.	.	.	.
Species common to Prot. arb.-Rhus ang., Brun nodifl.-Psor. rot. and Thamn. grac.-Hypod. arist. Comms.																																				
Leucadendron adscendens R. Br.	+	r	1	+	.	+	.	1	1	1	.	1	.	1	+	+	1	1	1	+	.	+	1	.	r	.	+	r	+	.	.	.	.	.	.	.
Tetraria bromoides (Lam.) Pfeiffer	+	+	.	.	.	.	+	+	+	1	.	r	1	+	+	1	1	1	+	+	.	+	+	.	r	1	+	+	+	.	.	.	.	.	.	.
Cliffortia ruscifolia L.	.	.	.	.	.	1	+	.	2	3	.	+	1	2	.	+	.	4	1	5	+	r	+	+	+	r	+	1	+	r	.	.	.	.	.	.
Erica globulifera Dulfer	+	3	.	1	.	+	1	+	+	3	1	+	1	+	+	.	+	+	+	+	.	.	.	.	+	.	.	r	.	.	.	.	.	.	1	.
Aristea capitata Ker.	.	.	+	.	+	.	.	.	+	.	.	.	.	+	+	+	.	r	+	.	.	+	+	+	+	+	+	.	.	+	.	.	.	.	.	.
Eremia totta (Thunb.) Don.	.	+	.	.	.	.	.	+	+	2	+	+	+	+	.	.	.	.	+	.	+	.	+	+	+	r	+	.	.	.	.	.	.	.	.	.
Erica nudiflora L.	+	.	.	.	.	.	+	.	.	+	.	+	+	+	+	.	+	+	+	1	.	.	.	.	+	.	1	r	+	.	.	.	.	.	.	.
Species common to Prot. arb.-Rhus ang. and Brun. nodifl.-Psor. rot. Comms.																																				
Anthospermum aethiopicum L.	.	+	+	1	+	2	+	+	1	1	2	1	+	+	+	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r
Montinia caryophyllacea Thunb.	.	2	.	1	+	1	+	1	+	1	+	+	r	+	+	+	+	+	.	+	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.
Restio gaudichaudianus Kunth	.	+	2	.	2	2	1	.	1	3	3	1	3	+	1	+	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+	.	.	.	+
Asparagus thunbergianus Schultf.	.	.	1	1	+	1	+	1	+	+	1	+	.	+	+	+	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Diosma hirsuta L.	+	+	+	.	.	.	+	.	+	+	+	+	1	+	+	+	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Protea neriifolia R. Br.	.	2	.	.	5	+	+	1	5	4	.	3	1	3	5	.	.	.	.	.	.	.	.	r	.	.	.	4	.	.	.	.	.	.	+	.
Ficinia filiformis Schrad.	.	.	+	.	+	+	.	+	+	r	.	.	+	r	+	+	+	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Lichtensteinia lacera Ch. & Sch.	.	.	.	+	+	+	.	.	+	+	+	.	.	r	+	+	+	r	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Rhus rosmarinifolia Vahl.	.	+	+	1	+	+	.	+	+	+	+	+	.	.	+	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Protea repens (L.) Linn.	.	.	.	+	.	2	.	.	2	.	.	2	.	2	+	4	+	.	.	.	.	r	.	r	.	.	.	.	4	.	.	.	.	.	.	.
Berkheya armata (Vahl.) Druce	.	.	+	.	+	.	.	.	+	1	+	.	+	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pentaschistus curvifolia (Schrad.) Stapf.	+	.	.	.	.	+	.	.	.	.	+	+	.	+	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Species common to Prot. arb.-Rhus ang. and Restio perpl. Comms.																																				
Protea arborea Houtt.	.	.	2	1	1	2	1	2	1	+	2	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	r	+	+	.	+	2	.	.	.	.
Watsonia pyramidata (Andr.) Stapf	.	.	+	.	.	+	+	+	1	2	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	2	.	.	.	.
Themeda triandra Forsk.	.	.	1	+	2	1	.	.	+	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.
Psoralea obliqua E. Mey.	.	+	1	+	+	+	.	+	+	r	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.
Ursinia filiformis Griessel	+	.	+	+	.	.	+	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Species common to Brun. nodifl.-Psor. rot. and Thamn. grac.-Hypod. arist. Comms.																																				
Restio filiformis Poir.	r	.	.	.	.	.	.	.	.	.	.	.	2	2	+	1	+	3	2	+	+	.	.	r	.	+	+	+	1	.	.	.	.	.	.	.
Tetraria ustulata (L.) C.B. Cl.	.	.	.	.	+	r	.	.	.	.	.	.	1	+	.	1	r	+	.	.	+	.	+	r	+	.	+	.	+	.	.	.	.	.	.	.
Metalasia muricata (L.) Don.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	r	1	+	+	+	+	+	2	+	.	.	.	.	.	.	.	.
Pentaschistus steudelii McClean	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.	+	+	.	+	+	.	r	+	+	+	.	.	r	.	.	.	.	.	.
Penaea mucronata L.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	2	1	.	.	.	.	.	+	+	.	1	.	+	+	2	+	.	.	.	.	.	.
Ursinia crithmoides (Berg.) Poir.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	.	+	r	r	.	r	.	.	+	.	r	.	.	r	+	+	.	.	.	.	.
Corymbium glabrum L.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	r	+	1	.	.	.	+	.	+	.	+	+	+	.	1	+	.	.	.	.	.	.
Accompanying species																																				
Protea acaulis Thunb.	.	+	+	+	.	+	.	.	.	+	.	+	+	+	.	+	.	+	+	+	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.
Erica plukeneti L.	.	.	.	.	.	.	r	.	.	r	.	1	+	2	+	.	+	.	2	.	r	+	+	.	r	.	+	.	.	+	+	.	.	.	.	.
Haplocarpha lanata (Thunb.) Less.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	r	+	+	.	+	.	.	.	.	r	+	+	.	.	.	+	+	.	.	.	.	.
Maytenus oleoides (Lam.) Loes.	.	.	.	+	.	1	+	1	+	+	.	2	+	.	1	1	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	1	r	.	.	.
Cliffortia cuneata Ait.	.	.	.	+	2	1	.	.	2	.	1	.	+	r	.	+	.	.	.	+	.	.	.	.	.	.	.	+	2	.	.	3	.	.	.	.
Centella glabrata L.	.	.	+	.	+	+	.	.	.	.	.	.	r	.	.	+	.	+	.	.	+	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.
Corymbium villosum Less.	.	.	+	.	+	+	.	.	+	+	.	.	+	.	.	.	.	r	.	.	.	.	.	.	+	.	.	r	.	+	.	.	.	.	.	.
Elegia juncea Linn.	.	.	.	.	.	.	1	.	.	.	.	.	+	+	.	r	.	.	.	.	+	+	.	.	.	.	1	+	.	+	r	.	.	.	.	.
Osmites hirsuta Less.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	+	+	+	.	.	.	r	+	.	.	.	.	.
Agathelpis dubia (L.) Hutch.	.	.	.	.	r	.	.	.	.	.	.	.	.	r	.	.	+	.	.	r	r	.	.	.	+	.	.	.	+	+	+	.	.	.	.	.
Stoebe spiralis Less.	.	.	.	.	+	.	.	.	r	.	.	.	.	r	.	+	.	.	.	.	+	r	.	+	.	.	.	.	.	r	.	.	.	.	.	.
Scabiosa columbaria L.	.	.	r	.	.	.	+	.	.	r	.	+	.	+	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Caesia eckloniana Roem. & Schult.	.	+	+	.	+	+	+	.	.	.	.	.	.	+	+	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gnidia inconspicua Meisn.	.	r	.	.	.	.	.	.	.	r	+	.	.	r	+	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erica articularis L.	+	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Phylica spicata L.f.	+	1	+	.	+	.	.	.	.	.	.	.	+	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypodiscus albo-aristatus (Nees) Mast.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	2	.	1	.	.	.	.	.	.	+	.	+	1	1	.	.	.	.	.	.
Leucadendron spissifolium (Knight) Williams	.	.	.	.	.	.	1	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	1	+	+	.	.	.	.	.	.	.	.	.
Ficinia bracteata Boeck.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.	.	.
Ficinia deustra (Berg.) Levyns	.	.	.	.	+	.	.	.	.	r	.	.	.	+	.	+	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Ehrharta ramosa Thunb.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	r	.	+	+	+	.	.	.	.
Thamnochortus fruticosus Berg.	+	.	+	r	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Schizaea pectinata (L.) Sw.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	.	.	r	.	+	+	.	.	.	.	.	.	.	.	.	.
Gerbera crocea (L.) O. Kuntze	.	.	+	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
Agathosma juniperifolia Bartl.	.	r	.	.	.	+	.	.	.	.	.	.	.	+	.	r	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Restio cuspidatus Thunb.	.	.	.	+	.	.	.	.	.	.	.	+	r	.	.	.	.	.	r	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Erica curvirostris Salisb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	.	.	.	.	r	.	.	.	+	+
Ehrharta bulbosa Sm.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Cannamois virgata (Rottb.) Steud.	.	.	.	.	1	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.
Stoebe cinerea (L.) Thunb.	.	.	.	+	.	.	r	.	.	.	.	.	.	+	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erica calycina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.
Helichrysum odoratissimum (L.) Sweet	.	.	.	.	+	.	.	.	.	.	.	.	.	.	r	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Muraltia heisteria (L.) DC.	.	.	+	.	+	.	.	.	.	.	.	.	r	.	.	r	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pellaea viridis (Forsk.) Prantl	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	r	.	.	.
Phylica pubescens Ait.	.	.	.	.	1	.	.	3	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Muraltia alopecuroides (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	r	.	.	.	+	.	.	.	1	.	.	.
Helichrysum crispum (L.) D. Don.	.	.	.	+	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Helichrysum cymosum (L.) D. Don.	.	.	.	.	.	.	+	.	.	+	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mohria caffrorum Desv.	.	.	.	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aspalathus laricifolius Berg.	.	.	1	.	.	r	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ehrharta dura Nees ex Trin.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.
Argyrolobium lunatis (L.) Druce	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
Senecio pinifolius (L.) Lam.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Linum thunbergii Eckl. & Zeyh.	.	.	.	.	.	.	.	.	.	r	.	.	.	r	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anaxeton asperum (Thunb.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.
Salvia africana L.	.	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rochea subulata (L.) Adamson	.	.	.	.	.	.	r	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Senecio erubescens Ait.	.	.	.	.	.	.	.	r	.	.	.	+	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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A number of good character species typify this community: *Thamnochortus gracilis*, *Hypodiscus aristatus*, *Anthospermum ciliare*, *Staberoha cernua*, *Prismatocarpus diffusa*, *Tetraria capillacea*, *Tetraria fasciculata*, *Willdenowia sulcata*, *Blaeria dumosa*, *Clutia polygonoides* and others (see Table 1). *Restio sieberi* is highly constant but common also to the *Restio perplexus* Community.

Many of the species common to the *Protea arborea—Rhus angustifolia* and the *Brunia nodiflora—Psoralea rotundifolia* Communities, are rare or absent here, but as Table 1 shows, there are many others, especially *Leucadendron adscendens* and *Tetraria bromoides*, that are common to all these communities.

The community occurs at fairly high altitudes (±500–800 m), on Table Mountain Sandstone soils of various depths. Slopes are moderate to steep (13°–34°). There is no prevalent aspect.

4. Restio perplexus *Community*

Although this community is only represented by three samples, it is, nevertheless, quite distinct from the other communities. The community is usually two-layered (undergrowth layer of herbs, sedges, grasses and dwarf shrubs 0,20–0,40 m high; shrub layer 0,60–1,50 m high), although there may be an open small tree layer 3–4 m high.

Restio perplexus appears to be a good character species. *Cliffortia polygonoides* and *Euryops abrotanifolius* are abundant and/or constant, but not strictly faithful (see Table 1).

Again, some species, for example *Clutia alaternoides*, are common to all four communities so far described, while many of the species generally occurring in either the first two communities or the first three communities are absent in this *Restio perplexus* Community. As already pointed out, this latter community has a number of species in common with the first *Protea arborea—Rhus angustifolia* Community. The relationship between these two communities is, however, not yet clear.

Relevé 34 cannot be unequivocally placed in this Community, because it contains species typical of the *Thamnochortus gracilis—Hypodiscus aristatus* Community. This relevé may be more heterogeneous than was thought, due to its position in a firebreak.

The community occurs at high altitudes (±800–1 100 m) on soils of ca. 50 cm depth on Table Mountain Sandstone. Steep slopes (25°–40°), with a general north-eastern aspect, seem typical.

5. Berzelia lanuginosa—Osmitopsis asteriscoides *Community*

This Fynbos community on seepage areas along drainage lines is very different from all others. The vegetation is dense, with an undergrowth of ca. 0,50 m high, a middle layer of sedges and shrubs 1–2 m high, and an open tree layer 3–5 m high. The permanently moist soil often contains a high percentage of organic matter.

Character species are thought to be *Berzelia lanuginosa*, *Osmitopsis asteriscoides*, *Carpha glomerata*, *Leucadendron salicifolium*, *Elegia capensis*, *Restio graminifolius*, *Cliffortia graminea*, *Tetraria punctoria*, *Elegia thyrsifera* and *Leptocarpus paniculatus*. Very few of the species common in the other Fynbos communities are present in this Community.

Riverine Scrub and Forest

The stream channels are generally fringed by woody vegetation. This is largely a dense scrub, but locally real forest occurs, especially where the valley narrows. Small patches of forest also occur on coarse, loose scree. These woody communities have a few faithful species in common (e.g. *Secamone alpini* and *Restio subverticillatus*) and there is a mutual overlap in species between the different communities (Table 2).

TABEL 2.—Forest and Riverine Scrub Communities

Relevé number	31	37	39	30	32	15	16	26
Total number of species	27	30	34	24	18	18	15	10
Altitude (m)	350	330	320	560	700	640	640	510
Aspect	N	N	N	N	NE	E	E	N
Slope (°)	0	0	0	15	25	35	35	15
Geology (g = Granite, T = Table Mt. Sandstone)	gT	gT	gT	gT	T	T	T	T
Soil depth (m)	1	1	1	1	—	—	—	—
Total cover (%)	100	100	100	95	85	90	90	85
Character species Brab. stell. **Comm.**								
Podalyria calyptrata Willd.	3	3	1	r	.	.	.	.
Brabeium stellatifolium L.	3	4	3	.	.	.	.	.
Halleria elliptica Thunb.	+	1	1	.	.	.	.	.
Blechnum capense (L.) Schlecht.	1	1	+	.	.	.	.	.
Pentameris thuarii Beauv.	r	+	+	.	.	.	.	.
Freylinia oppositifolia Spin.	2	+	.	.	.	.	.	.
Restio quadratus Mast.	+	.	+	.	.	.	.	.
Asparagus asparagoides (L.) Wight	r	.	+	.	.	.	.	.
Mettrosideros angustifolia Smith	.	.	4	.	.	.	.	.
Myrica serrata Lam.	.	1	.	.	.	.	.	.
Character species Rap. mel. **Comm.**								
Rapanea melanophloeos (L.) Mez	.	.	.	3	2	.	.	.
Kiggelaria africana L.	.	.	.	1	1	.	.	.
Pellaea viridis (Forsk.) Prantl	.	.	.	+	+	.	.	.
Asplenium aethiopicum Backer	.	.	.	+	r	.	.	.
Character species Heer. arg. **Comm.**								
Heeria argentea (E. Mey.) Kuntze	.	.	.	.	.	3	3	3
Rumohra adiantiformis (Forsk.) Ching	.	.	.	.	.	1	1	.
Aloe mitriformis Mill.	.	.	.	.	.	1	+	.
Oftia africana (L.) Bocq.	.	.	.	.	.	+	+	.
Species common to Brab. stell., Rap. mel. **and** Heer. arg. **Comms.**								
Maytenus oleoides (Lam.) Loes.	1	1	.	2	+	1	2	.
Secamone alpini Schultes	.	.	+	+	1	1	2	2
Hartogia schinoides (Thunb.) C. A. Smith	.	.	r	.	1	2	1	2
Restio subverticillatus Mast.	2	+	.	.	+	+	+	.
Blechnum punctulatum Sw.	1	.	1	2	+	.	r	.
Myrsine africana L.	.	.	+	+	.	+	.	+
Knowltonia capensis (L.) Muth	+	.	.	+	+	+	.	.
Chironia baccifera L.	.	+	.	.	.	r	r	.
Species common to Rap. mel. **and** Heer. arg. **Comms.**								
Podocarpus elongatus (Ait.) Pers.	.	.	.	3	2	1	3	3
Olea africana Mill.	.	.	.	1	3	1	r	+
Maytenus acuminatus (L.f.) Loes.	.	.	.	3	2	+	.	1
Halleria lucida L.	.	.	.	1	1	.	r	+
Zantedeschia aethiopica Spreng.	.	.	.	.	+	1	+	+
Olinia cymosa Thunb.	.	.	.	1	2	.	.	4
Species common to Brab. stell. **and** Rap. mel. **Comms.**								
Asparagus scandens Thunb.	+	.	1	1	+	.	.	.
Cunonia capensis L.	1	r	.	.	+	.	.	.
Ilex mitis (Jacq.) Radlk.	1	.	2	2	.	.	.	.
Brachylaena neriifolia (L.) R. Br.	.	2	2	+	.	.	.	.
Oplismenus hirtellus (L.) Beauv.	r	.	+	r	.	.	.	.
Other intruding species								
Ehrharta ramosa Thunb.	+	1	+	.	.	.	.	.
Pteridium aquilinum (L.) Kuhn	+	1	+	.	.	.	.	.
Asparagus thunbergianus Schult. f.	+	+	+	.	.	.	.	.
Rhus angustifolia L.	+	+	+	.	.	.	.	.
Cassytha ciliolata Nees	+	+	+	.	.	.	.	.
Diospyros glabra (L.) de Winter	+	+	.	+	.	.	.	.
Cliffortia cuneata Ait.	1	+	+	.	.	.	.	.
Aristea thyrsiflora (Delar.) N.E. Br.	+	+	.	.	.	.	.	.
Restio gaudichaudianus Kunth	.	+	+	.	.	.	.	.
Elegia capensis (Burm.f.) Schelpe	.	1	+	.	.	.	.	.
Carpha glomerata Nees	+	.	r	.	.	.	.	.

6. Brabeium stellatifolium *Community*

This dense scrub up to 5 m high fringes the lower, less steep parts of the streams. Character species include *Brabeium stellatifolium*, *Podalyria calyptrata*, *Halleria elliptica*, *Blechnum capense*, *Pentameris thuarii*, *Freylinia oppositifolia* and others. More information might necessitate subdivision into two communities, one with the character species *Meterosideros angustiolia*, and the other lacking it.

7. Rapanea melanophloeos *Community*

This community constitutes the largest part of the forest vegetation. It occurs at higher altitudes along stream channels, with steep gradients. Further downstream the rivers are fringed by the *Brabeium stellatifolium* Community.

There are two tree layers. The highest reaches 10–12 m, the other 5–8 m, beneath which is a "layer" largely formed by saplings. There is no shrub layer and very little undergrowth. Character species of the community are *Rapanea melanophloeos* and, possibly, *Kiggelaria africana*, *Pellaea viridis* and *Asplenium aethiopicum*.

8. Heeria argentea *Community*

This forest community occurs in small patches on coarse, loose screes. There is usually a singly tree layer, with an average height of 7–8 m, sometimes reaching 10 m. The undergrowth consists of herbs and small shrubs up to 0,60 m high with a low cover. The trees are covered with lichens and mosses, indicating that moisture condensation often occurs.

Character species are *Heeria argentea*, which has a high cover, and possibly *Rumohria adiantiformis*. The species *Aloe mitriformis* and *Oftia africana* may also be considered character species of the undergrowth where the tree canopy is open.

The two *Rapanea* and *Heeria* forest communities in Swartboschkloof have some species in common of which *Podocarpus elongatus* is the most abundant. This species and other common species, such as *Olea africana*, *Maytenus acuminatus*, *Hartogia schinoides* and *Olinia cymosa*, all form canopy trees, while *Halleria lucida* and *Myrsine africana* occur regularly in the understory.

Discussion

The main purpose was to test the Braun-Blanquet phytosociological method on the floristically rich Fynbos vegetation. In that a practical classification into communities based on floristic criteria has been possible, and because these communities can be correlated with definite environmental factors, we may conclude that the Braun-Blanquet method can be successfully applied to the analysis of Fynbos vegetation. This contradicts Donselaar's statement (1965) that the species number must be moderate if the method is to be successful.

Walter (1968) states that, on the South-west Cape mountains near the coast, aspect plays a more important rôle than altitude. The rather strict aspect preferences of the *Protea arborea—Rhus angustifolia* and the *Brunia nodiflora—Psoralea rotundifolia* Communities seem to confirm this, although the *Thamnochortus gracilis—Hypodiscus aristatus* Community does not show any aspect preference, and is correlated in Swartboschkloof with altitude and geological substrate. However, it is difficult to distinguish whether altitude or geological substrate is the more important, since these two factors are correlated with each other.

Adamson (1931) sampled the vegetation of north and west slopes of Table Mountain between 300 and 360 m, on granite with overlying Table Mountain Sandstone talus, in order to find "some explanation of the apparent variability of the floras" of the communities which he floristically distinguished. Although he noted that "the floristic composition of a community must ultimately be its most important characteristic", he could not prove this when he tried to express it in terms of species dominance, concluding that there was life-form dominance rather than species dominance. Nevertheless, our results show that when floristic composition is used as a criterion, it is indeed possible to characterize communities.

It is remarkable that conspicuous vegetational structures do not always coincide with the boundaries of communities defined upon floristic composition. We find the dense sclerophyllous *Protea neriifolia* and *Protea repens* dominated scrub distributed in the three most common Fynbos communities, although mainly concentrated in the *Protea arborea—Rhus angustifolia* and the *Brunia nodiflora—Psoralea rotundifolia* communities. The relationships between physiognomic structure and phytosociological classification have been discussed by Westhoff (1968). He uses the term "Twin Formation" for "strata which vary independently on [of] each other", or "stands which are floristically hardly, but structurally considerably different." These situations occur where extreme habitat factors prevail. Burning is considered to be such an extreme factor. Donselaar (1965) found that in the Surinam savannas the floristic composition of some treeless areas was so similar to the undergrowth of a certain type of tree savanna, that they should both be placed in the same association, arguing that the floristic principle should predominate over the structural one. Dansereau & Arros (1959), who favour the principle of structure, argue that decisions of the kind similar to the above are too arbitrary and they doubt the reality of such associations.

Since Fynbos is recurrently burned and the structure of the Fynbos is very often closely related to the elapse of time since the last burning, we feel, like Donselaar (1965), that a floristically based system of communities is more consistent and practical.

It is interesting to note that Tables 1 and 2 show the intrusion into the *Brabeium stellatifolium* and *Berzelia lanuginosa—Osmitopsis asteriscoides* Communities of some species that usually occur in other Fynbos. Such species are *Asparagus thunbergianus*, *Rhus angustifolia*, *Rhus rosmarinifolia*, *Diospyros glabra*, *Aristea thysiflora*, *Cliffortia cuneata*, *Erica hispidula*, *Protea neriifolia*, *Anthospermum aethiopicum* and *Ehrharta ramosa*. Both the *Brabeium stellatifolium* and the *Berzelia lanuginosa—Osmitopsis asteriscoides* Communities occur only as long narrow strips of vegetation along stream channels and seepage lines. The Communities are thus characterized by a high ratio of margin to surface area, or a large "edge effect." Because of this large "edge effect," intruding species from surrounding communities are more likely to be found throughout such long narrow communities compared with communities of another shape. Species that are most likely to intrude are those with a wide ecological amplitude, as appears to be the case for some of the species listed above. Other intruding species, like *Pteridium aquilinum* and *Cassytha ciliolata*, seem to be ones with their optimal occurrence in ecotones, especially ecotones of a shrubby nature. In Leeuwen's (1966) terminology they can be called species of the "limes convergens", that is species living under unstable conditions, usually as large numbers of individuals.

Adamson (1927) and Walter (1968) point out that on the Table Mountain Plateau *Schizaea pectinata* can be very abundant and proves to be a good indicator of fire. In Swartboschkloof this species was not abundant, however, and was not present in the quadrats sampled on the firebreaks. Adamson (1935) found that after a fire in the vegetation on the slopes of Table Mountain, *Euryops abrotanifolius* increased quickly during the first three years and was dominant for the following two years. From then on the species decreased rapidly. Our results from Swartboschkloof also link *Euryops abrotanifolius* with the fire factor. In quadrats 34 and 35, situated on the firebreak, it scored cover-abundance values of 2 (5–25%), whereas it occurred in only two other quadrats, in old stands, with low values.

Floristic data on Fynbos vegetation in the literature are limited, and complete species lists of quadrat samples are unavailable. It is, therefore, difficult to link the Communities presently distinguished, with communities described in other Fynbos literature. As early as 1908, Marloth presented an outstanding description of the flora and vegetation of the Cape, describing the vegetation on a structural and geographical basis. In his general descriptive account of the vegetation of Table Mountain, Adamson (1927) mentions a number of species from the ".... plateau communities on sandy soils....", which are typical of the *Thamnochortus gracilis—Hypodiscus aristatus* Community described here. The habitat and altitude of these two communi-

ties also show similarities. Further study may show closer correlations. In addition, the Communities he briefly described from seepage areas and along stream channels, show floristic similarities, through species such as *Berzelia lanuginosa* and *Osmitopsis asteriscoides*, with those of Swartboschkloof. The same is true for gorge forest and riverine scrub communities in both areas.

Taylor (1969) mentions, among others, *Pentaschistis colorata* and *Staberoha cernua* as preferential species for one of two communities forming a mosaic in the "plateau fynbos association" in the Cape of Good Hope Nature Reserve. It is probable that this community is related to the *Thamnochortus gracilis—Hypodiscus aristatus* Community. Certainly, his "*Osmitopsis* seepage scrub association" is closely related to our *Berzelia lanuginosa—Osmitopsis asteriscoides* Community. His description of the *Protea arborea* pseudo savannah association" (waboomveld; Taylor, 1963), with typical species *Protea arborea*, *Montinia caryophyllaceae*, *Rhus rosmarinifolia*, *Leucospermum conocarpodendron*, *Themeda triandra*, *Hermannia cuneifolia*, *Cymbopogon marginatus* and *Bobartia incica*, strongly suggests it belongs to the *Protea arborea—Rhus angustifolia* Community.

Relevés from the Fynbos are expected to accumulate and will enable ecologists to classify the vegetation in a hierarchical system of associations, alliances, orders and classes. A special difficulty in classifying the complete Fynbos vegetation lies in the fact that many species have a very limited distribution. This will make it necessary to distinguish geographical races of an association, or regional associations with a limited geographical extension. Communities earn the status of an independent regional association only if they have their own character species and alliance character species, as pointed out by Oberdorfer (1968). If they differ only in the accompanying species, they are geographical races of one association. Problems of this nature will need to be handled very carefully in classifying Fynbos vegetation.

It is inevitable in such a survey that some quadrats will be badly sited. They may either fall on an ecotone (probably Quadrat 34), or give an unrepresentative picture of the vegetation type to which they belong (Quadrat 27), or represent a different vegetation which is clearly undersampled (Quadrat 22). All such samples are usually left out of the association table, because they do not contribute to an understanding of the vegetation. Quadrats which are wrongly sited cannot be used, but if they represent an undersampled community, as in Quadrat 22, they should be kept until more information becomes available. We have here included these stands in Table 1 to give an example of sampling errors.

Many more relevés, especially from elsewhere in the Fynbos are required for a successful phytosociological classification (see Tüxen, 1970). We have not presented a formal hierarchical system here because of a lack of data; this report should be regarded as a challenge to South African ecologists to prove and improve the classification and so to build up an understanding of the vegetation.

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Samevatting

Die fitososiologiese metode volgens Braun-Blanquet is getoets in die komplekse Fynbos vegetasie van die Suidwes-Kaap in Suid-Afrika. In die Swartboschkloof Natuurreserwe, Jonkershoek, is die Fynbos, die oewerstruikgewas en die woudvegetasie voorlopig in agt gemeenskappe ingedeel. Hierdie gemeenskappe is floristies beskryf en die verband tussen die gemeenskappe en sekere habitatfaktore is aangedui. Die resultate is belowend en die moontlikhede om die Kaapse Fynbos te kan klassifiseer in 'n formele fitososiologiese sisteem is bespreek.

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Appendix

Species excluded from Table I (relevé numbers and cover-abundance values in brackets)

Ehrharta capensis Thunb. (1: +)
Chironia baccifera L. (2: +)
Hibiscus aethiopicus L. (2: +)
Hartogia schinoides (Thunb.) C. A. Smith (3: r)
Myrsine africana L. (3: +)
Stoebe aethiopica L. (3: +)
Crassula obvallata L. (4: +)
Senecio umbellatus L. (4: +)
Apodytes dimidiata E. Mey. ex Benth. (5: r)
Halleria elliptica Thunb. (5: 1)
Stoebe aethiopica L. (8: +)
Tetraria compar (L.) Lestib. (8: +)
Cliffortia subsetacea Diels ex Bol. (10: r)
Halleria elliptica Thunb. (12: +)
Struthiola ciliata (L.) Lam. (13: +)
Adenandra uniflora Willd. (14: +)
Centella virgata (L.f.) Druce (14: +)
Danthonia lupulina R. & Schult. (14: r)
Eragrostis curvula (Schrad.) Nees (14: +)
Heterolepis aliena (L.f.) Druce (14: +)
Osteospermum spinosum L. (14: +)
Carpacoce spermacocea (Reichb.) Sond. (18: +)
Epischoenus villosus Levyns (18: +)
Gleichenia polypodioides Sm. (18: +)
Pelargonium angulosum Ait. (19: r)
Struthiola ciliata (L.) Lam. (19: r)
Protea cynaroides L. (20: r)
Apodytes dimidiata E. Mey. ex Benth. (21: r)
Berzelia intermedia Schld. (21: +)
Elegia asperiflora Kunth (22: 1)
Elegia vaginulata Mast. (22: 5)
Chrysanthemoides monolifera (L.) T. Norl. (23: +)
Ehrharta calycina Sm. (23: +)
Pelargonium pinnatum (L.) L'Her. (23: +)
Rhynchosia capensis (Burm.) Schinz (24: +)
Erica racemosa Thunb. (25: +)
Leptocarpus sp. (25: +)
Pseudognidia anomala Phillips (25: r) (27: r)
Ficinia capillaris Levyns (28: +)
Leptocarpus sp. (28: +)
Pelargonium tabulare (L.) L'Her. (28: +)
Peucedanum sieberianum Sond. (29: +)
Asplenium aethiopicum Bacher (33: r)
Chironia baccifera L. (33: 1)
Myrsine africana L. (33: 3)
Pentameris thuarii Beauv. (33: +)
Psoralea pinnata L. (33: 1)
Zantedeschia aethiopica Spreng. (33: +)
Athrixia heterophylla (Thunb.) Less. (34: +)
Castalis nudicaulis (L.) T. Norl. (34: +)
Erica longifolia Ait. (34: +)
Ficinia zeyheri Boeck. (34: +)
Gnidia juniperifolia Lam. (34: +)
Leontonyx glomeratus (L.) DC. (34: +)
Peucedanum sieberianum Sond. (34: +)
Selago serrata Berg. (34: +)
Tetraria involucrata (Rottb.) C.B. Cl. (34: +)
Ursinia dentata (L.) Poir. (34: +)
Ficinia trichodes (Schrad.) Benth. ex Hk.f. (35: 1)
Pelargonium tabulare (L.) L'Her. (35: +)
Pentaschistis aristidoides (Thunb.) Stapf (35: 1)
Senecio bipinnatus (L.f.) Less. (35: +)
Ehrharta calycina Sm. (36: r)
Olea africana Mill. (36: r)
Asparagus scandens Thunb. (38: r)
Blechnum capense (L.) Schlecht. (38: +)
Centella eriantha (Rich.) Druce (38: +)
Halleria lucida L. (38: 1)
Kiggellaria africana L. (38: +)
Myrica serrata Lam. (38: +)
Psoralea pinnata L. (38: +)
Rapanea melanophloeos (L.) Mez. (38: +)
Rubus cf. *rigidus* Smith (38: +)
Tetraria cf. *cuspidata* (Rottb.) C.B. Cl. (38: 2)
Zantedeschia aethiopica Spreng. (38: +)
Danthonia cincta Schrad. (40: 1)
Elegia asperiflora Kunth (40: 2)
Erica intervallaris Salisb. (40: +)
Juncus capensis Thunb. (40: r)
Restio quadratus Mast. (40: +)
Tetraria flexuosa (Thunb.) C.B. Cl. (40: r)
Erica cerinthoides L. (41: +)
Crassula obvallata L. (43: r)

Crassula scabra L. (43: +)
Eragrostis capensis (Thunb.) Trin. (43: +)
Eroeda capensis (L.) Levyns (43: r)
Heterolepis aliena (L.f.) Druce (43: +)
Heteropogon contortus (L.) Beauv. (43: +)
Pellaea pteroides (L.) Prantl (43: 1)
Pentaschistis juncifolia Stapf (43: r)
Plagiochloa uniolae (L.f.) Adams. & Sprague (43: +)
Anemone capensis L. (44: r)
Aspalathus crenata (L.) R. Dahl. (44: +)
Eroeda capensis (L.) Levyns (44: r)
Metalasia cephalotes (Thunb.) Less (44: 1)

Species excluded from Table II (relevé numbers and cover-abundance values in brackets).

Ficinia capillaris Levyns (15: r)
Heterolepis aliena (L.f.) Druce (15: +)
Sutera hispida (Thunb.) Druce (15: +)
Viscum rotundifolium L.f. (16: +)
Anthospermum aethiopicum L. (30: r)
Leonotis leonurus R. Br. (30: +)
Schoenoxipheum lanceum (Thunb.) Kukenthal (30: +)
Leptocarpus paniculatus Pillans (31: +)
Struthiola myrsinites Lam. (31: +)
Cliffortia atrata H. Weim. (37: 1)
Erica plukeneti L. (37: +)
Phylica pubescens Ait. (37: +)
Protea arborea Houtt. (37: r)
Protea neriifolia R. Br. (37: r)
Schizaea tenella Kaulf. (37: r)
Stoebe plumosa (L.) Thunb. (37: +)
Thesium strictum Berg. (37: r)
Centella eriantha (Rich.) Drude (39: +)
Cyperus congestus Vahl (39: +)
Helichrysum odoratissimum (L.) Sweet (39: +)
Osteospermum ciliatum Berg. (39: +)
Othonna quinquedentata Thunb. (39: +)
Pelargonium vitifolium Ait. (39: +)
Psoralea cordata (L.) Salter (39: +)
Psoralea fruticans (L.) Druce (39: +)
Scirpus sp. (39: r)

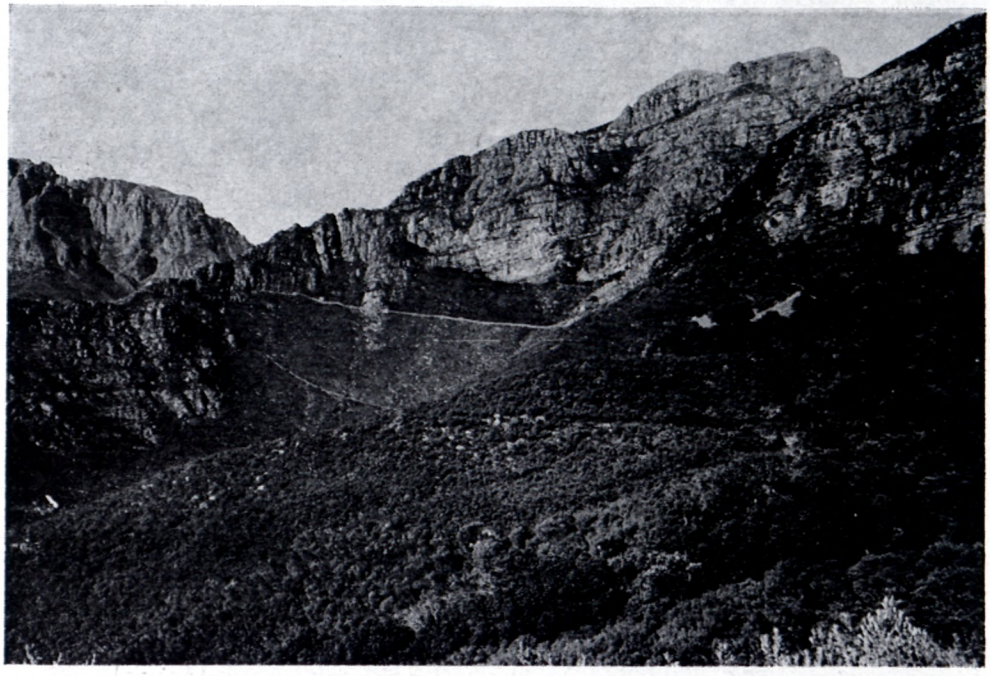

PLATE 1.—General view of Swartboschkloof Nature Reserve. Foreground vegetation mainly **Protea arborea—Rhus angustifolia** Community; slopes of centre mountain ridge mainly **Brunia nodiflora—Psoralea rotundifolia** Community; right centre **Heeria argentea** Community on scree (Photo: F. J. Kruger).

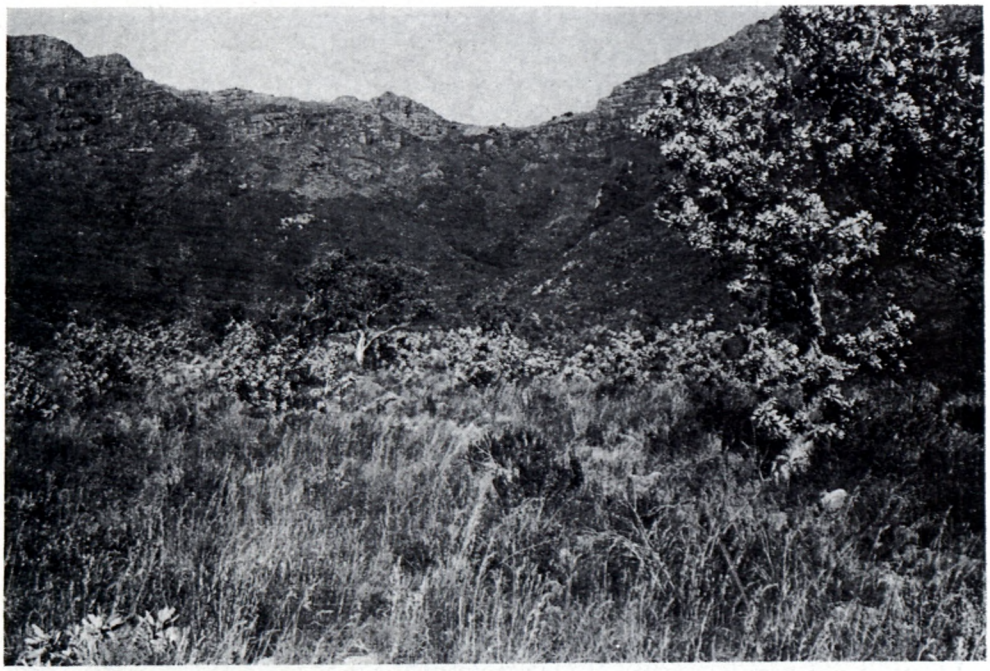

PLATE 2.—**Protea arborea—Rhus angustifolia** Community. Tree on right **Protea arborea**; foreground mainly **Tetraria bromoides**. Note **Rapanea melanophloeos** Community in ravines in background (Photo: F. J. Kruger).

PLATE 3.—**Brunia nodiflora—Psoralea rotundifolia** Community. Left flowering **Brunia nodiflora**; right restionaceous plants (Photo: F. J. Kruger).

PLATE 4.—**Thamnochortus gracilis—Hypodiscus aristatus** Community showing restionaceous character (Photo: F. J. Kruger).

PLATE 5.—**Rapanea melanophloeos** Community in steep ravines (Photo: F. J. Kruger).