

Progress with vegetation studies in the Sourish Mixed Bushveld of the western Transvaal

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ABSTRACT

The Sourish Mixed Bushveld of the western Transvaal is being studied using the Braun-Blanquet method. The vegetation includes: (a) woodland of cooler sites on crests and steeper south-facing slopes; (b) woodland of warmer sites on gentle north-facing slopes; and (c) grassland and woodland of plains with slight relief on calcareous substrata.

Six vegetation types are provisionally described in terms of their main structure, floristic composition (dominant and characteristic species) and habitat. The syntaxonomic relationships between these types are mentioned briefly and the types are considered in terms of Acocks's classification of South African veld types.

RÉSUMÉ

PROGRÈS DES ÉTUDES SUR LE "SOURISH MIXED BUSHVELD" DE L'OUEST-TRANSVAAL

On étudie le "Sourish Mixed Bushveld" de l'Ouest-Transvaal par la méthode de Braun-Blanquet. La végétation inclut: (a) les bois des endroits plus frais sur les crêtes et les pentes plus raides orientées vers le sud; (b) les bois des endroits plus chauds sur les pentes douces orientées vers le nord; et (c) les prairies et les bois des plaines à relief peu accusé sur des substrats calcaires.

On décrit provisoirement six types de végétation d'après leur structure principale, leur composition floristique (espèces dominantes et caractéristiques) et l'habitat. Les relations syntaxonomiques entre ces types sont brièvement mentionnées et les types sont considérés en fonction de la classification des types de velds sud-africains proposée par Acocks.

INTRODUCTION

In 1974 the author started a vegetation survey at a semi-detailed scale of some "bushveld" types in the Transvaal (see next paragraph). The aim of the study is to confirm and refine some of Acocks's (1953) veld types, to study community and habitat relations and to develop a broad basic framework for description and hierarchical classification of the Central Transvaal Bushveld according to the principles and techniques of the Braun-Blanquet approach to vegetation ecology. This paper gives a brief account of some of the work done in the western Transvaal Sourish Mixed Bushveld. A more complete treatment is in preparation as part of a doctoral dissertation (Van der Meulen, in preparation).

According to Coetzee (1977) the term "bushveld" refers to vegetation consisting of a mixture of trees and shrubs of varying height together with grasses and forbs. These structural elements occur in widely varying proportions often over short distances. This concept is useful and has been widely used in Southern Africa for the wooded grassy vegetation types south of the Cunene, Okavango and Limpopo Rivers. In general, the term "bushveld" can be considered to encompass the full range of the concepts "woodland" and "bush" (or "thicket") being adopted and standardized at the Botanical Research Institute. According to the usage advocated, bushveld covers the following broad categories:—

"Bush": Trees less than 8 diameters apart, shrubs less than 2 diameters apart;

"Closed shrubland": Trees more than 8 diameters apart, shrubs less than 2 diameters apart;

"Closed woodland": Trees less than 2 diameters apart, shrubs more than 2 diameters apart;

"Open woodland": Trees 2 to 8 diameters apart, shrubs more than 2 diameters apart;

"Sparse woodland": Trees 8 to 30 diameters apart, shrubs more than 2 diameters apart.

SURVEY AREA AND METHODS

The area dealt with is situated at elevations between 1 200 m and 1 500 m in the western Transvaal, roughly between Rustenburg in the east and the Botswana border in the west. To the north of it are the lower-lying areas of the Central Transvaal Bushveld Basin and to the south is the Highveld. The study area amounts to some 7 000 km², mainly underlain by sedimentary rocks of the Transvaal System together with a smaller extent of calcareous volcanic rocks of the Ventersdorp System. The Transvaal System consists mainly of alternating beds of quartzite and shale with occasional interbedded lavas of andesitic character, and also alternating beds of dolomite and chert (Du Toit, 1954). The quartzites and shales have formed cuestas with steep faces to the south and gentle dip slopes to the north. The dip slopes and associated bottomlands run parallel for long distances. The quartzites form the dip slopes and, in places, also scarps, while the less resistant shales tend to occupy lower ground. Local relief varies by not more than 300 m. Dolomite and Ventersdorp rocks have formed terrain with slight relief in the west of the area.

The entire area has a hot, dry steppe climate with rainfall in summer, designated by Köppen as BShw (Schulze, 1947). Rainfall increases slightly to the east and varies from 500–700 mm per year. Temperatures average between 20–24°C in summer and between 10–15°C in winter (Weather Bureau, 1954).

Quartzite and Dolomite have weathered to poor red apedal sands, in South Africa classified as the Hutton Form (Van der Eyk *et al.*, 1969). Dolomite sands are mostly shallow and rocky and they have a neutral to slightly basic reaction. On lavas and diabase sills, red structured soils occur, belonging to the Shortlands Form. Soils developed from the softer shales are of the Glenrosa Form, representing a type in which various stages of weathering rock are intimately mixed with the soil particles. Ventersdorp rocks have formed a variety of dark soils with a neutral to slightly basic reaction. Limestone concretions are common. Lithosols and rock outcrops occupy large areas on all substrata.

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On Acocks's (1953) map of South African Veld Types, the area is mapped as Sourish Mixed Bushveld (Veld Type 19) with a few outliers of Mixed Bushveld (Veld Type 18) in extensive bottomlands. However, vegetation of bottomlands, scarps and other steep rock faces, riverine kloofs and river banks will not be discussed in this paper for the sake of brevity.

The Braun-Blanquet approach, as recently described by Westhoff and Van der Maarel (1973) and Werger (1974), was applied in this study. Units of more or less uniform relief and vegetation physiognomy were demarcated by means of aerial photographs and field reconnaissance. Sample plots, or relevés, were placed within representative stands of vegetation to exclude as much heterogeneity as possible, in terms of floristic composition, structure and habitat, within the scope of the survey. Local studies in several types of bushveld by Coetzee (1974, 1975) and Coetzee *et al.* (1976) have shown that a suitable size for relevés was 20 m × 10 m for the sampling of grasses and herbs, to be enlarged for adequate recording of the woody plants. In the present study the woody plants are mostly recorded in a 30 m radius circular plot, with a 20 m × 10 m subplot for the grasses and herbs as a sub-sample. However, the form of the plot is not fixed but can be adapted if necessary so that the plot represents an example of one vegetation type only. The vegetation types are described on the basis of 120 relevés containing over 600 species. Communities are recognized on the basis of their dominant, characteristic and differential species. The dominant species of a community have the highest cover-abundance value recorded for the grouping of relevés concerned. Characteristic and differential species may be inconspicuous, but can still be used to distinguish one community from another. In Braun-Blanquet methodology, the latter are referred to as species with relative faithfulness showing preference for a particular community when compared with certain other communities.

RESULTS AND DISCUSSION

Six types of vegetation are described and arranged according to the following habitats:—

1. Vegetation of cooler sites on crests and steeper south-facing slopes;
2. Vegetation of warmer sites on gentle north-facing slopes; and
3. Vegetation of plains with slight relief on calcareous substrata.

1. *Vegetation of cooler sites on crests and steeper south-facing slopes.* The vegetation associated with cooler habitats occurs on lithosols on quartzites, shales and lavas and includes two main types:

- (a) the *Acacia caffra*—*Faurea saligna* Open Woodland, and
- (b) the *Protea caffra* Open Woodland.

The former is usually an open or semi-open woodland with low trees up to 5 m tall (Fig. 1). Projected canopy cover of woody plants varies between 2–20%. *Acacia caffra* and *Faurea saligna* are the characteristic and dominant woody plants and are sometimes the only trees present. The field layer is composed of grasses up to 1 m tall. Dominant grasses include *Elyonurus argenteus*, *Themeda triandra* and *Cymbopogon plurinodis*. Amongst the characteristic species are the grasses *Rhynchelytrum setifolium*, *Eragrostis racemosa*, *Trachypogon spicatus*, *Bewisia biflora*, *Cymbopogon excavatus*, *Urelytrum squarrosus* and *Tristachya biseriata*.

At higher elevations (over 1 350 m) or otherwise cooler localities, this vegetation grades into a *Protea caffra* Open Woodland (Fig. 2). This is also an open to semi-open low woodland on various types of lithosols. *Protea caffra* is the characteristic tree and often forms homogeneous stands with hardly any other woody plant. *Eragrostis racemosa*, *Tristachya biseriata* and *Trachypogon spicatus* are characteristic and dominant grasses in the field layer which shares many characteristic species with the field layer of the first-mentioned community. This *Protea*-dominated bushveld is a marginal type of bushveld, closely related to the grassland of moister, cooler high-lying areas.

2. *Vegetation of warmer sites on gentle north-facing slopes.* The warmer north-facing slopes are underlain by quartzites and the degree of slope is usually much lower than on south-facing slopes. The vegetation on these sites differs strongly from that of the cooler habitats. Rocky places with more than 50% outcrop, usually support dense and low woodland up to 4 m tall, the *Croton gratissimus*—*Canthium gilfillanii* Closed Woodland (Fig. 3). *Croton gratissimus* is dominant and characteristic in the tree layer with 10 to 35% canopy cover, but sometimes more. Other characteristic woody plants include *Turraea obtusifolia*, *Canthium gilfillanii*, *C. huillense*, *Ficus ingens*, *Tapiphyllum parvifolium* and *Ochna pretoriensis*. There is hardly any soil and the field layer is sparse with *Fimbristylis hispidula* as the dominant species and *Aristida diffusa* a local sub-dominant.



FIG. 1.—*Acacia caffra*—*Faurea saligna* Open Woodland on cool rocky slopes near Swartruggens. The dominant tree is *Faurea saligna* up to 4 m tall.

FIG. 2.—*Protea caffra* Open Woodland up to 3 m tall, on cool rocky slopes near Zeerust. Dominant and characteristic grasses include *Rhynchelytrum setifolium* and *Urelytrum squarrosus*

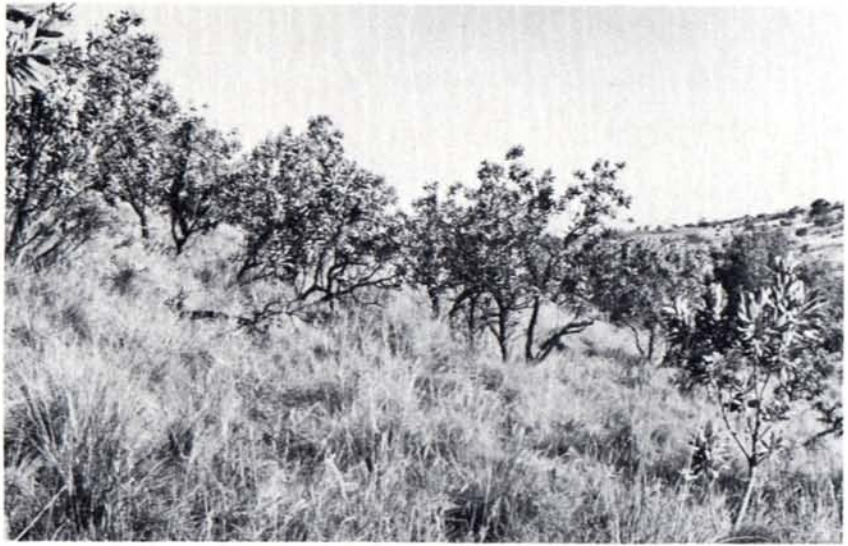


FIG. 3.—Example of *Croton gratissimus* — *Canthium gilfillanii* Closed Woodland up to 4 m tall on quartzite outcrop with *Croton gratissimus* as dominant and characteristic tree.



On the less rocky parts, deeper Hutton soils have developed. The vegetation is a *Burkea africana*—*Terminalia sericea* Closed Woodland (Fig. 4). This is a tall and multi-layered woodland up to 10 m or 15 m tall, particularly on the deep soils of more level sites. Tree canopy cover varies between 15–35%. *Combretum zeyheri* is the dominant tree with *Burkea africana* and *Terminalia sericea* as co-dominants. The latter is especially common on deep sands. Dominant species in the field layer include *Digitaria eriantha* and *Fimbristylis hispidula*. Local characteristic grasses include *Eragrostis pallens*, *E. gummiflua*, *Trichoneura grandiglumis* and *Pogonarthria squarrosa*.

The two vegetation types on quartzite merge into each other where the substratum becomes more rocky or less rocky and they have several characteristic species in common, including woody plants such as *Ochna pulchra*, *Burkea africana*, *Euclea natalensis*, *Securidaca longipedunculata* and *Strychnos pungens*.

3. *Vegetation of terrain with slight relief on calcareous substrata.* Calcareous Dolomite and Ventersdorp rocks have formed extensive plains with slight relief in the west between Zeerust and Mafeking. Mean annual rainfall varies from about 500–550 mm. In general the vegetation is a mosaic of woodland and grassland with sparse tree growth, the latter especially on the Dolomite.

The vegetation on the Dolomite is described as the *Olea africana*—*Tarchonanthus camphoratus* Semi-open Woodland (Fig. 5). Trees are up to 4 m tall and the canopy cover of the woody plants varies from 5–10%. On rock outcrops, canopies sometimes almost touch. *Olea africana* and *Tarchonanthus camphoratus* are the dominant trees. Many sites are heavily grazed and *Aristida congesta* subsp. *congesta* and *Eragrostis lehmanniana* have become the dominant grasses, as commonly occurs on overgrazed sites. Characteristic and locally co-dominant grasses are *Stipagrostis*



FIG. 4.—*Burkea africana*—*Terminalia sericea* Closed Woodland on deeper sands with *Burkea africana* (right), *Terminalia sericea* (left) and *Ochna pulchra* shrubs (foreground).



FIG. 5.—*Olea africana*—*Tarchonanthus camphoratus* Semi-open Woodland on Dolomite near Ottoshoop. *Rhus lancea* (left) and *Olea africana* (middle) in background. *Vitex zeyheri* (left) and *Tarchonanthus camphoratus* (right) in foreground.

uniplumis, *Fingerhuthia africana* and *Oropetium capense*, the latter being a very tiny species here typically growing on rocks with little soil cover. Locally, a variant of this type occurs. This is a low closed woodland, dominated by *Vitex zeyheri* up to 2 or 3 m tall (Fig. 6).

In other communities, *Vitex zeyheri* is often also associated with outcrops of various non-calcareous rocks. Grassland with very sparse tree growth is provisionally grouped with the woodlands on the Dolomite because the floristic composition is similar to that of the field layer in these woodlands.

The vegetation on Ventersdorp rocks resembles that on the Dolomite but also shows affinities with more xerophytic types of the Central Kaap Plateau to the south-west and is described as the *Rhus lancea*—*Diospyros austro-africanum* Open Woodland (Fig. 7). In general, this is an open to semi-open woodland with trees or shrubs up to 4 m tall and *Rhus lancea* as the dominant tree. Species indicating affinities with

the Central Kaap Plateau include the shrubs *Diospyros austro-africanum*, *Rhus ciliata* and *Indigofera sessilifolia*, the herbs *Melhania griquensis*, *Hermannia linnaeoides*, *Aptosimum albomarginatum* and some species of *Pentzia* and *Chrysocoma*, and the grass *Eragrostis echinochloidea*. In places, *Rhus ciliata* tends to dominate the field layer, possibly because of overgrazing. Several of these species probably reach their easternmost extent in this type of vegetation (cf. Werger, 1973).

Some syntaxonomic notes about the vegetation types

The following syntaxonomic notes on the vegetation types are tentative. New data will be gathered during the present survey and in later, more detailed studies. When they become available, the hierarchical rank of a community and diagnostic value of a species are likely to change. Nevertheless, it is useful to place the communities in their syntaxonomic perspective at this stage.

FIG. 6.—*Vitex zeyheri*-dominated Closed Woodland on Dolomite near Otsohoop.



FIG. 7.—*Rhus lancea*—*Diospyros austro-africanum* Open Woodland on Ventersdorp rocks near Mafeking. *Rhus lancea* as dominant tree, *Fingerhuthia africana* as dominant grass. *Tarchonanthus camphoratus* and *Diospyros austro-africanum* in foreground (right).



The *Acacia caffra*—*Faurea saligna* Open Woodland and the *Protea caffra* Open Woodland are considered to be two separate associations, together forming an alliance. Such an alliance comprises low and open to semi-open woodlands on lithosols of cool habitats. The following are the most important differential species:

<i>Athrixia elata</i>	<i>Pearsonia sessilifolia</i>
<i>Rhynchelytrum setifolium</i>	<i>Helichrysum coriaceum</i>
<i>Eragrostis racemosa</i>	<i>Protea caffra</i>
<i>Bewsia biflora</i>	<i>Cussonia paniculata</i>
<i>Trachypogon spicatus</i>	

The *Croton gratissimus*—*Canthium gilfillanii* Closed Woodland and the *Burkea africana*—*Terminalia sericea* Closed Woodland of quartzite country can also be regarded as two associations grouped into an alliance, comprising a variety of low to tall, closed woodlands on outcrop, lithosols and deeper sands of warmer habitats. The most important differential species are as follows:

<i>Strychnos pungens</i>	<i>Terminalia sericea</i>
<i>Ochna pulchra</i>	<i>Aristida diffusa</i>
<i>Securidaca longipedunculata</i>	<i>Perotis patens</i>
<i>Burkea africana</i>	<i>Eragrostis gummiflua</i>
<i>Euclea natalensis</i>	

The two alliances are grouped into an order comprising vegetation of the hilly bushveld country between the sour types (both bushveld and grassland) of the higher mountains and plateaux, and the mixed bushveld types of the Central Transvaal Bushveld Basin. This corresponds well with Acocks's (1953) habitat description of Sourish Mixed Bushveld. Differential species for the order include *Combretum zeyheri*, *C. molle*, *Dombeya rotundifolia*, *Vitex zeyheri*, *Vangueria infausta* and *Faurea saligna* among the woody plants, and *Diheteropogon filifolius*, *D. amplectens*, *Schizachyrium sanguineum*, *S. jeffreysii*, *Loudetia simplex* and *L. flavida* among the grasses. Differential species within this order for the cooler as well as the warmer rocky sites are *Setaria lindenbergiana*, *Chrysopogon serrulatus*, *Pellaea calomelanos*, *P. viridis*, *Rhus magalismontanum* and *Bequaertiodendron magalismontanum*.

The *Olea africana*—*Tarchonanthus camphoratus* Semi-open Woodland on the Dolomite and the *Rhus lancea*—*Diospyros austro-africanum* Open Woodland on the Ventersdorp rocks may also be regarded as two separate associations and grouped into an alliance, comprising open to semi-open, or locally closed

woodland of shallow and rocky soils on calcareous substrata. Differential grasses include *Stipagrostis uniplumis*, *Oropetium capense* and *Fingerhuthia africana*. Another differential character is the high cover of *Rhus lancea* and *Tarchonanthus camphoratus*. The alliance occupies an intermediate position between the sourish mixed types of the hilly bushveld to the east and vegetation types of the Central Kaap Plateau to the west. Typical tree species of Sourish Mixed Bushveld like *Faurea saligna*, *Combretum zeyheri*, *C. molle*, *Dombeya rotundifolia* and *Vangueria infausta* are absent. Typical grasses like species of *Diheteropogon* and *Loudetia* are present locally. Species showing affinities with vegetation types of the Kaap Plateau have already been listed.

The two vegetation types on calcareous substrata are also mapped by Acocks (1953) as Sourish Mixed Bushveld. However, on the basis of their different habitats (a comparatively low rainfall, a calcareous substratum and an almost flat terrain) and certain differences in floristic composition, it is suggested that they should be excluded from the Sourish Mixed Bushveld concept.

UITTREKSEL

Die Suur Gemengde Bosveld van die westelike Transvaal word bestudeer deur middel van die Braun-Blanquet metode. Die plantegroei sluit in: (a) boomveld van die koeler groeiplekke op heuweltoppe en steiler suidelike hellings; (b) boomveld van die warmer groeiplekke op matige noordelike hellings; en (c) grasland en boomveld van 'n vlakke met effense reliëf op kalkryke gesteentes.

Die struktuur, floristiese samestelling (dominante en kenmerkende plantsoorte) en habitat van ses plantegroei-tipes word voorlopig beskryf. Die sintaksonomiese

verwantskappe tussen hierdie tipes word kortliks genoem en hulle word vergelyk met Acocks se veld tipes van Suid-Afrika.

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