

CHAPTER 6

RESULTS

PHYTOSOCIOLOGY OF THE SOUTH AFRICAN LOWVELD MOPANEVELD

6.1 Introduction

The South African Lowveld Mopaneveld was identified as the *Cissus cornifolia* - *Colophospermum mopane* vegetation type during classification of the southern African Mopaneveld (Chapter 5). General interest in the South African Lowveld vegetation and the availability of adequate vegetation data from this area engendered further analysis of this Mopaneveld type. Classification of the *Cissus cornifolia* – *Colophospermum mopane* vegetation type revealed the identification of 4 distinct major plant communities:

1. The *Terminalia sericea* – *Colophospermum mopane* major plant community on sandy soil.
2. The *Acacia nigrescens* – *Colophospermum mopane* major plant community on clayey soil.
3. The *Euclea divinorum* – *Colophospermum mopane* major plant community on deep clayey soils, mainly derived from shale.
4. The *Combretum apiculatum* – *Colophospermum mopane* major plant community on granite and gneiss.

These four major plant communities are distributed mainly in accordance with geological material and consequently soil types varying from sandy soils derived from sandstone to vertic, black clays derived from igneous basalt and gabbro.

The first two major plant communities, namely the *Terminalia sericea* – *Colophospermum mopane* and the *Acacia nigrescens* – *Colophospermum mopane* are discussed. The *Euclea*

divinorum – *Colophospermum mopane* and the *Combretum apiculatum* – *Colophospermum mopane* major communities will be discussed in subsequent papers.

6.2 Description of the major plant communities within the South African Lowveld Mopaneveld

6.2.1 The *Terminalia sericea* – *Colophospermum mopane* major plant community

Tables 6 & 7 are relevant in the description of this major plant community

Figure 20

Over its distribution range, *Colophospermum mopane* usually forms the sole dominant woody component in plant communities occurring on fine-textured, deep sandy clay loam to clay soils on flat or slightly undulating topography (Werger & Coetzee 1978; Madams 1990; Timberlake *et al.* 1993; Timberlake 1995). Mosaic patches of Sandveld, however occur within the Lowveld Mopaneveld, e.g. the Punda Maria Sandveld, Wambiya Sandveld, Phalaborwa Sandveld, Tsende Sandveld, and sandy patches on granitic hillcrests (Van Rooyen *et al.* 1981b; Gertenbach 1983). Although not formally described yet, it is suggested that these Sandveld communities represent a vegetation class. The separation of azonal and intrazonal types from the zonal types during the procedure of analyzing Lowveld Mopaneveld (Chapter 4) was expected to separate all relevés of these Sandveld areas. Certain relevés remained within the scope of Mopaneveld vegetation, hence the identification of the *Terminalia sericea* – *Colophospermum mopane* major plant community. This major community can probably be explained as an ecotone between intrazonal Sandveld communities and the proper Mopaneveld Veld Type (Acocks 1988). The name of this major community may be controversial, suggesting that *C. mopane* and *T. sericea* occur simultaneously in the same community. It rarely happens however that these species, which occupy totally different soil types, will occur together. Where the sandy content is high, *Terminalia sericea* (species group R, Table 7) is dominant over *C. mopane* which, if present, is of very low significance (species group V, Table 7). If conditions favour *C. mopane*, *T. sericea* tends to fade. *Colophospermum mopane* is not present in all communities of the

Terminalia sericea – *C. mopane* major plant community (species group V, Table 7) and where it occurs it is not necessarily the dominant woody species. The question evolves whether Mopaneveld necessarily have to contain *Colophospermum mopane*, and whether total species composition is more important than a single dominant to determine to which vegetation unit a specific plant (stand) belongs.

The *Terminalia sericea* – *Colophospermum mopane* major plant community is confined to coarse-grained, sandy soils derived from either Archaean granite or Sandstone of the Clarens Formation and the Waterberg Group and to a lesser extent sandy soils derived from rhyolite. The soils are usually shallow, well drained, stony and with a very low or no clay content. In its northern distribution on the Waterberg Sandstone the *Terminalia sericea* – *Colophospermum mopane* major community is associated with deep, fine-textured, well-drained sand or loamy sand (Van Rooyen *et al.* 1981b).

This major plant community occurs on plains, slightly undulating landscapes to hilly terrain. On the granitic landscapes, the *Terminalia sericea* – *Colophospermum mopane* major community mostly occurs on flat crests or slightly sloped midslopes, whereas on sandstone, it generally occurs in sandy plains, footslopes, midslopes and plateaus.

The annual rainfall of this major plant community varies considerable due to its discontinuous distribution. In the northern parts of the study area (in the vicinity of Punda Maria in the Kruger National Park), the annual rainfall can reach up to 1 000 mm (Gertenbach 1980), but generally rainfall ranges between 450 and 550 mm per annum (Van Rooyen *et al.* 1981a; Weather Bureau Statistics, 1961 – 1990). In the southern distribution limit of the *Terminalia sericea* – *Colophospermum mopane* major plant community the annual rainfall varies between 450 mm and 600 mm.

The *Terminalia sericea* – *C. mopane* major plant community on sandy soils is characterised by the high abundance values of woody species such as *Terminalia sericea*, *Combretum zeyheri*, *C. collinum*, *Mundulea sericea*, *Strychnos madagascariensis* and *Pseudolachnostylis maprouneifolia* (species group A, Table 6). Herbaceous species of diagnostic value include *Agathisanthemum bojeri*, *Hibiscus engleri*, *Hermannia glanduligera*, *Tephrosia longipes*,

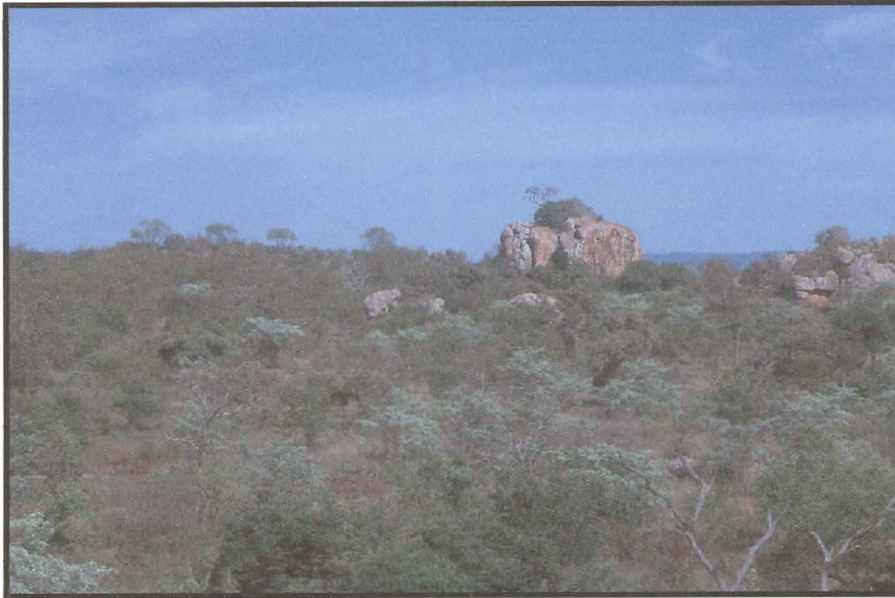
Fimbristylis complanatus and *Xenostegia tridentata* subsp. *angustifolia* (species group A, Table 6).

The *Terminalia sericea* – *Colophospermum mopane* major plant community is subdivided into 2 communities, probably on alliance level in the syntaxonomical rank, and 4 subcommunities, probably on association level:

- 1 The *Clerodendrum ternatum* – *Combretum apiculatum* community
 - 1.1 The *Indigofera filipes* – *Digitaria eriantha* subcommunity
 - 1.2 The *Sclerocarya birrea* – *Colophospermum mopane* subcommunity
- 2 The *Pseudolachnostylis maprouneifolia* – *Guibourtia conjugata* community
 - 2.1 The *Combretum collinum* – *Hermannia glanduligera* subcommunity
 - a) The *Eragrostis pallens* variant
 - b) The *Hymenocardia ulmoides* variant
 - 2.2 The *Diplorhynchus condylocarpon* – *Andropogon gayanus* subcommunity
 - a) The *Combretum apiculatum* variant
 - b) The *Andropogon gayanus* variant

The major differentiation between the two communities can be ascribed to differences in geological substrates they occur on. The *Clerodendrum ternatum* – *Combretum apiculatum* community occurs on sandy ridges derived from Archaean granite or Sandstone of the Clarens Formation, whereas the *Pseudolachnostylis maprouneifolia* – *Guibourtia conjugata* community is confined to Sandstone derived from the Waterberg Group.

a)



b)



Figure 20 The *Terminalia sericea* - *Colophospermum mopane* major plant community in the Kruger National Park. The silver leaves of *T. sericea* interrupt the *C. mopane* dominated vegetation (a). Individuals of *T. sericea* and *C. mopane*(b).

Table 7 has relevance to the discussion of the plant communities, unless indicated different.

1. The *Clerodendrum ternatum* – *Combretum apiculatum* community (Data of Gertenbach 1976 & Gertenbach 1987)

This community occurs on sandy soils derived from Archaean granite as well as Clarens Sandstone. It is well represented towards the southern distribution of the Mopaneveld in the Kruger National Park (Gertenbach 1987). Landscapes associated with granitic substrates are characterised by undulating hills of which the convex crests and midslopes are occasionally inhabited by the *Clerodendrum ternatum* – *Combretum apiculatum* community. Soils vary in depth, but in general the relatively shallow (300 – 600 mm) soils are derived from granite whereas deeper soils originate from Clarens Sandstone. The A-horizon contains more than 80 % sand and an average of 7 % clay. The B-horizon, if present, can be lutocutanic or a deeper apedal and contains higher percentages clay (Gertenbach 1987). Soils are leached and poor in nutrients probably also due to the low clay contents in the soil.

Mean annual rainfall within the *Clerodendrum ternatum* – *Combretum apiculatum* community vary from less than 500 mm up to 600 mm (Gertenbach 1983; Gertenbach 1987).

The *Clerodendrum ternatum* – *Combretum apiculatum* community can structurally be classified as a moderate open to dense bush savanna (Gertenbach 1987) and diagnostic species of this community are listed in species group A. Prominent woody species include amongst others *Clerodendrum ternatum* (species group A) and *Colophospermum mopane* (species group V). Herbaceous species such as *Cissus cornifolia* (species group O), *Tephrosia polystachya* and *Chamaecrista absus* (species group W), and grasses such as *Heteropogon contortus* (species group A) are prominent in this community. Dominant woody species include *Terminalia sericea* (species group R) and *Combretum apiculatum* (species group Z). Other dominant species are mostly grasses, such as *Perotis patens*, *Schmidtia pappophoroides* (species group R), *Aristida congesta* (species group W), *Digitaria eriantha*, *Panicum maximum* and *Pogonarthria squarrosa* (species group Z). The *Clerodendrum ternatum* – *Combretum apiculatum* community is strongly related to the Perotido patentis – Terminalietum sericeae combretotosum apiculati subass. nov. in the Perotido patentis –

Terminalietum sericeae (Bredenkamp & Theron 1990). This association occurs on very acid, leached sandy soils (Bredenkamp & Theron 1990).

Two subcommunities were distinguished in the *Clerodendrum ternatum* – *Combretum apiculatum* community:

1.1 The *Indigofera filipes* – *Digitaria eriantha* subcommunity

This moderate- to dense bush savanna mainly occurs on granite of which the soils are shallow, sandy and well-drained. Dominant soil series include Mispah and Glenrosa.

Diagnostic species for the *Indigofera filipes* – *Digitaria eriantha* subcommunity are listed in species group B. *Clerodendrum ternatum* (species group A) and *Combretum zeyheri* (species group Z) are prominent woody species, whereas *Commelina benghalensis* (species group A) is a prominent forb. Grass species such as *Urochloa mosambicensis* (species group A) and *Perotis patens* (species group R), are prominent. Dominant species for this community include amongst others woody species such as *Terminalia sericea* (species group R) and *Combretum apiculatum* (species group Z), forbs such as *Cissus cornifolia* (species group O) and grass species including *Schmidtia pappophoroides* (species group R), *Aristida congesta* (species group W), *Pogonarthria squarrosa*, *Digitaria eriantha* and *Panicum maximum* (species group Z).

1.2 The *Sclerocarya birrea* – *Colophospermum mopane* subcommunity

Within the Lowveld Mopaneveld the *Sclerocarya birrea* – *Colophospermum mopane* subcommunity is mostly a moderately dense to an open shrubveld with occasionally higher trees such as *Sclerocarya birrea* (Gertenbach 1976; Gertenbach 1987). This subcommunity is restricted to deeper sandy soils derived from granite where it inhabits the crests of undulating hills in a typical granitic landscape. The slope of the area is moderate to steep, with almost no rock cover. Termite heaps are abundant on which tree species such as *Colophospermum mopane* and *Diospyros mespiliformis* often occur (Gertenbach 1976).

Diagnostic species for the *Sclerocarya birrea* – *Colophospermum mopane* subcommunity are listed in species group E. Several prominent species characterise this subcommunity, of which *Sclerocarya birrea*, *Lannea schweinfurthii* (species group N), *Terminalia sericea* (species group R) and *Grewia bicolor* (species group W) characterise the woody component. Prominent herbaceous species include forbs such as *Indigofera vicioides* (species group E), *Fimbristylis complanata* (species group I), *Limeum fenestratum* (species group A), *Chamaecrista absus* (species group W) and *Vernonia fastigiata* (species group Z). Prominent grass species are *Heteropogon contortus*, *Eragrostis rigidior* (species group A), *Aristida mollissima* (species group N), *Melinis repens* (species group V), *Panicum maximum*, and *Brachiaria nigropedata* (species group Z). A few species are considerably dominant in this subcommunity of which *Colophospermum mopane* (species group V) and *Combretum apiculatum* (species group Z) cover the woody component. *Cissus cornifolia* (species group O) and *Tephrosia polystachya* (species group W) are dominant forbs whilst *Digitaria eriantha* and *Pogonarthria squarrosa* (species group Z) dominate the herbaceous layer.

2. The *Pseudolachnostylis maprouneifolia* – *Guibourtia conjugata* community

This tree savanna (Van Rooyen *et al.* 1981b) is confined to deep sand in areas underlain by Waterberg Sandstone. It is well represented in the northern parts of the study area (Punda Maria region, Kruger National Park). The topography varies from broken terrain to plains and small mountains where the *Pseudolachnostylis maprouneifolia* – *Guibourtia conjugata* community is restricted to plains and sandy plateaus. It sometimes also occurs on steep footslopes (Van Rooyen *et al.* 1981b). Mostly deep, but also shallow and stony at places, fine-textured sand, loamy sand, sandy clay loam or sandy loam underlies this community. The Sandveld communities are often associated with poor, leached soils. These soil characteristics are adapted from the description by Van Rooyen (1978) on the Sandveld communities. According to data analysis, the *Pseudolachnostylis maprouneifolia* – *Guibourtia conjugata* community comprises only small patches within the *Burkea africana* – *Pseudolachnostylis maprouneifolia* tree savanna, the *Xeroderris stuhlmannii* – *Combretum apiculatum* tree savanna and the *Kirkia acuminata* – *Azelia quansensis* – *Combretum apiculatum* tree savanna (Van Rooyen *et al.* 1981b). Soil characteristics may therefore vary on a smaller scale.

Rainfall for the Punda Maria region varies between 450 mm and 550 mm per annum (Van Rooyen *et al.* 1981b; Weather Bureau Statistics, 1961 – 1990).

The vegetation of this community is not representative of typical Mopaneveld vegetation due to the influence of the Sandveld communities, which probably represent a separate vegetation class. Many diagnostic species for this community will in the outermost exception concurrently be present with *Colophospermum mopane*. These diagnostic species are listed in species group J, of which *Pseudolachnostylis maprouneifolia* (species group J) and *Combretum zeyheri* (species group Z) are prominent in the woody layer. Other prominent species include grasses such as *Pogonarthria squarrosa* and *Andropogon gayanus* (species group Z). Dominant species are mostly grasses of which *Digitaria eriantha* and *Panicum maximum* (species group Z) are the most conspicuous.

Two subcommunities were distinguished:

2.1 The *Combretum collinum* – *Hermannia glanduligera* subcommunity

The *Combretum collinum* – *Hermannia glanduligera* tree savanna is associated with sandy plains (Van Rooyen *et al.* 1981b). Soils are in general leached, deep and contain high percentages of finely grained sand with a low pH. Diagnostic species for this subcommunity are listed in species group K. None of the diagnostic species are prominent or dominant, although they are locally characteristic for this subcommunity. Prominent species include amongst others woody species such as *Terminalia sericea* (species group R), *Pseudolachnostylis maprouneifolia* (species group J) and *Combretum zeyheri* (species group Z), forbs such as *Hermannia glanduligera* (species group K) and grass species such as *Schmidtia pappophoroides*, *Perotis patens* (species group R) and *Pogonarthria squarrosa* (species group Z). Although *Combretum apiculatum* and *Combretum zeyheri* frequently occur (species group Z), they are not dominant in this subcommunity.

Two variants were distinguished:

a) *Eragrostis pallens* variant

The *Eragrostis pallens* tree savanna comprises elements of all four communities within the *Terminalia sericea* – *Pteleopsis myrtifolia* tree savanna (Van Rooyen *et al.* 1981b). It is mainly associated with sandy plains containing leached, deep sandy soils with a low pH. Diagnostic species for this variant are listed in species group L of which the grass *Eragrostis pallens* is the most conspicuous. Other prominent grass species include *Schmidtia pappophoroides* and *Perotis patens* (species group R). Although not highly abundant, *Terminalia sericea* is frequently present in this variant.

b) *Hymenocardia ulmoides* variant

The *Hymenocardia ulmoides* variant comprises elements of both the *Terminalia sericea* – *Pteleopsis myrtifolia* tree savanna and the *Croton gratissimus* – *Phyllanthus reticulatus* tree savanna (Van Rooyen *et al.* 1981b). In general this variant inhabits small patches in the ecotone between Mopaneveld and the Sandveld where soils are rocky, shallow and sandy. Diagnostic species of this variant are listed in species group P. Species such as the tree *Manilkara mochista* (species group P) is a local character species and also prominent in this variant. Other prominent woody species include the tree *Combretum zeyheri* (species group Z), shrubs such as *Hymenocardia ulmoides* (species group P) and *Hexalobus monopetalus* (species group Y) and grasses such as *Schmidtia pappophoroides*, *Perotis patens* (species group R), *Pogonarthria squarrosa* and *Andropogon gayanus* (species group Z). *Digitaria eriantha* and *Panicum maximum* (species group Z) are the only dominant species for this variant.

2.2 The *Diplorhynchus condylocarpon* – *Andropogon gayanus* subcommunity

The habitat of this tree savanna varies from deep, sandy plains to steep, shallow, rocky slopes (Van Rooyen *et al.* 1981b). Soils are in some places strongly leached and contain high percentages of finely grained sand. The soil surface is 40 – 60 % covered with stones (Van

Rooyen *et al.* 1981b). The *Diplorhynchus condylocarpon* – *Andropogon gayanus* subcommunity occurs as patches between the *Burkea africana* – *Pseudolachnostylis maprouneifolia* tree savanna and the *Kirkia acuminata* – *Azelia quanzensis* – *Combretum apiculatum* tree savanna (Van Rooyen *et al.* 1981b). Diagnostic species for this subcommunity are listed in species group S. *Diplorhynchus condylocarpon* (species group S) is the most prominent woody species for this subcommunity. Woody species of less importance include *Pseudolachnostylis maprouneifolia*, *Pteleopsis myrtifolia*, *Guibourtia conjugata* (species group J), *Combretum apiculatum*, *Combretum zeyheri* and *Strychnos madagascariensis* (species group Z). Forbs such as *Vernonia fastigiata* and *Waltheria indica* (species group Z) and grass species such as *Digitaria eriantha*, *Panicum maximum*, *Pogonarthria squarrosa*, *Andropogon gayanus* and *Brachiaria nigropedata* (species group Z) are prominent in the herbaceous layer.

Two variants were distinguished:

a) *Combretum apiculatum* variant

The *Combretum apiculatum* variant is associated with the *Kirkia acuminata* – *Azelia quanzensis* – *Combretum apiculatum* tree savanna identified by Van Rooyen *et al.* (1981b). According to comparisons made with the *Kirkia acuminata* – *Azelia quanzensis* – *Combretum apiculatum* tree savanna (Van Rooyen *et al.* 1981b) this variant occurs mainly on steep south-facing slopes on soils originated from the weathering of the Waterberg and Cave Sandstone. Soils are in general shallow and dark red-brown fine-textured loamy sand to sandy clay loam. Diagnostic species for this variant are listed in species group T. Conspicuous woody species include *Diplorhynchus condylocarpon* (species group S), *Azelia quanzensis*, *Commiphora glandulosa*, *Kirkia acuminata* (species group T) and *Combretum apiculatum* (species group Z), which is also the dominant woody species for this variant. Prominent forb species include *Waltheria indica* and *Vernonia fastigiata* (species group Z) and grasses such as *Aristida congesta* (species group W), *Panicum maximum* and *Pogonarthria squarrosa* (species group Z). *Digitaria eriantha* is the dominant grass species for this community (species group Z).

b) *Andropogon gayanus* variant

The *Andropogon gayanus* variant is associated with the *Burkea africana* – *Pseudolachnostylis maprouneifolia* tree savanna identified by Van Rooyen *et al.* (1981b). According to comparisons made with these communities identified by Van Rooyen *et al.* (1981b), this variant occurs mainly on drier plains and on south-facing slopes on broken landscapes around Punda Maria in the Kruger National Park on Waterberg Sandstone. Soils originated from the weathering of the Waterberg Sandstone are in general red brown to dark red brown fine textured sand or loamy sand. Diagnostic species for this variant are listed in species group X. Although none of the diagnostic species are frequently present in this variant, the absence of species groups L, P and T is diagnostic for this variant in the Punda Maria Sandveld area. Conspicuous woody species include *Diplorhynchus condylocarpon* (species group S), *Pseudolachnostylis maprouneifolia*, *Burkea africana* (species group J) and *Combretum zeyheri* (species group Z), which is also the dominant woody species for this variant. Prominent forb species include *Tephrosia elongata* (species group J) and *Vernonia fastigiata* (species group Z), and grasses such as *Panicum maximum* and *Pogonarthria squarrosa* (species group Z). *Digitaria eriantha* and *Andropogon gayanus* are the dominant grass species for this community (species group Z).

6.2.2 The *Acacia nigrescens* – *Colophospermum mopane* major plant community

Tables 6 & 8 are relevant for the discussion of this major plant community

Figure 21

The *Acacia nigrescens* – *Colophospermum mopane* major plant community, the largest major community within the South African Lowveld Mopaneveld, represents Mopaneveld on clayey soils. It is a well-known vegetation unit, not only to scientists, but also to tourists. This extensive, almost monotonous vegetation unit (as tourists often refer to) is often associated with long stretches of shrubmopaneveld (Figure 21 a). Although it seems to be homogenous and low in species diversity, TWINSPAN results revealed that this extensive vegetation unit comprises four different plant communities, probably on a level higher than the association.

Among the few diagnostic species (species group B, Table 6) are species significantly characteristic of clayey habitats, such as *Setaria incrassata*, an indicator of wet, heavy black clay (Van Oudtshoorn 1994). All diagnostic species are herbaceous although many woody species occur within the *Acacia nigrescens* – *Colophospermum mopane* major community. Prominent woody species present in this major community include *Clerodendrum ternatum*, *Lonchocarpus capassa* (species group E, Table 6), *Maerua parvifolia*, *Combretum hereroense*, *Combretum imberbe* (species group I, Table 6), *Colophospermum mopane*, *Combretum apiculatum*, *Grewia bicolor*, *Sclerocarya birrea*, *Dichrostachys cinerea*, *Acacia nigrescens*, *Dalbergia melanoxylon* and *Commiphora africana* (species group K, Table 6). Woody species are often stunted (Figure 21b) due to the vertic character of the heavy clays derived from igneous rocks (Fraser *et al.* 1987). Isolated high trees of *Combretum imberbe*, *Acacia nigrescens* and *Sclerocarya birrea* in this community is however diagnostic for deeper clayey soil (Gertenbach 1987).

The *Acacia nigrescens* - *Colophospermum mopane* major plant community is related to the *Acacia nigrescens* – *Grewia bicoloris* alliance (Coetzee 1983) and the *Cenchrus ciliaris* alliance described by Gertenbach (1987).

a)



b)



Figure 21 The *Acacia nigrescens* - *Colophospermum mopane* major plant community, the well-known shrubmopaneveld (a) of the South African Lowveld. *Sclerocarya birrea* often occurs in stunted individuals in this major plant community (b).

Four communities, four subcommunities and two variants were identified within the *Acacia nigrescens* – *Colophospermum mopane* major community of the *Cissus cornifolia* – *Colophospermum mopane* Lowveld Mopaneveld:

1. The *Themeda triandra* – *Acacia nigrescens* community
 - 1.1 The *Setaria incrassata* – *Combretum imberbe* subcommunity
 - a) The *Combretum collinum* variant
 - b) The *Combretum imberbe* variant
 - 1.2 The *Digitaria eriantha* – *Acacia nigrescens* subcommunity
 - a) The *Colophospermum mopane* variant
 - b) The *Acacia nigrescens* variant
2. The *Commiphora glandulosa* – *Enneapogon cenchroides* community
 - 2.1 The *Indigofera bainesii* – *Aristida congesta* subcommunity
 - 2.2. The *Phyllanthus parvulus* – *Combretum apiculatum* subcommunity
3. The *Euclea divinorum* – *Panicum maximum* community
4. The *Combretum mossambicense* – *Colophospermum mopane* community

Table 8 has relevance to the species groups referred to in the discussion of these communities, unless stated different.

1. The *Themeda triandra* – *Acacia nigrescens* community

The *Themeda triandra* - *Acacia nigrescens* community occurs along extensive stretches of shrubmopaneveld from the southern distribution of *Colophospermum mopane* in the Kruger National Park (Gertenbach 1987), through the shrubmopaneveld of the central district (north of the Olifants River to the Shingwedzi River) and adjacent Nature Reserves (Purchase 1997), up to the shrubmopaneveld in the northern Kruger National Park (Van Rooyen 1978). The mean annual rainfall for this community varies between 450 mm and 500 mm.

This community is restricted to bottomland clayey soil derived mainly from basic igneous gabbro or basalt. In this slightly undulating landscape to flat terrain, the igneous rocks weather to a dark-coloured, vertic clay. Intrusions of dolerite and other metamorphic rocks

that also produce heavy clays are common within the *Themeda triandra* – *Acacia nigrescens* community.

In the study of Gertenbach (1978) on the gabbro complex in the Kruger National Park, a shrubmopane plant community was recognised as the *Themeda triandra* - *Colophospermum mopane* shrubveld. Although the *Themeda triandra* – *Acacia nigrescens* is to a great extent related to the *Themeda triandra* – *Colophospermum mopane* shrubveld (Gertenbach 1978) in terms of dominant species, these two communities differ in parent geological material as the *Themeda triandra* – *Acacia nigrescens* community is not restricted to gabbro, but is also present on heavy clay derived from igneous basalt and other geological intrusions. Gertenbach (1983) divided the shrubmopaneveld on basalt into three variations of which the *Themeda triandra* – *Acacia nigrescens* community is thought to comprise two of these variants: the *Themeda triandra* variation and the *Setaria woodii* (= *Setaria incrassata*) variation.

Diagnostic species for this community are listed in species group A, Table 8. Conspicuous woody species for the *Themeda triandra* – *Acacia nigrescens* community include *Combretum apiculatum* (species group P), *Colophospermum mopane*, *Acacia nigrescens*, *Dichrostachys cinerea*, *Combretum imberbe* and *Dalbergia melanoxylon* (species group S). Prominent forb species include *Chamaecrista mimosoides* (species group A) while *Cissus cornifolia* (species group P) is dominant in this community. Grass species generally dominate the vegetation layer and include species such as *Themeda triandra*, *Eragrostis superba*, *Heteropogon contortus* (species group A), *Cenchrus ciliaris* (species group B), *Bothriochloa radicans* (species group F), *Panicum coloratum* (species group J), *Digitaria eriantha*, *Aristida congesta*, *Bothriochloa insculpta*, *Schmidtia pappophoroides* (species group P) and *Urochloa mosambicensis* (species group S).

The *Themeda triandra* – *Acacia nigrescens* community is subdivided into two subcommunities and four variants.

1.2 The *Setaria incrassata* – *Combretum imberbe* subcommunity

This open shrubsavanna is confined to melanic clays with structured calcareous clayey subsoil, typical of the Bonheim soil series (Fraser *et al.* 1987), which are derived from basic rocks from the Karoo Sequence as well as dolerite and diabase, which form isolated intrusions in this shrubmopaneveld. Multi-stemmed *Colophospermum mopane* shrubs with an average height of 1 – 2 m is a diagnostic feature for this plant community (Figure 2c). Bredenkamp and Deuschländer (1994) identified the *Themeda triandrae* – *Setarietum incrassatae* as an association confined to the gabbro dyke dissecting the Manyeleti Game Reserve adjacent to the Kruger National Park. Being the dominant grass species of this association, *Setaria incrassata* (species group B) occurs even so dominant in the *Setaria incrassata* – *Combretum imberbe* subcommunity, although occurring on heavy clays derived from, not only gabbro, but also from other basic rocks. This subcommunity is strongly related to the *Setaria woodii* variant of the *Colophospermum mopane* shrubveld on basalt (Gertenbach 1983).

Diagnostic species for this community are listed in species group B, Table 8 of which *Setaria incrassata* is the diagnostic, as well as the dominant grass species. The *Setaria incrassata* – *Combretum imberbe* subcommunity is particularly well presented by different grass species of which *Themeda triandra* (species group A), *Panicum coloratum* (species group J), *Bothriochloa insculpta* (species group P), *Urochloa mosambicensis* (species group S) are dominant and *Heteropogon contortus* (species group A) and *Cenchrus ciliaris* (species group B) prominent. *Ozoroa engleri* (species group B), *Combretum apiculatum* (species group P), *Colophospermum mopane*, *Acacia nigrescens*, *Dichrostachys cinerea*, *Combretum imberbe* and *Dalbergia melanoxylon* (species group S) are among the plant species dominating the woody layer.

a) The *Combretum collinum* variant

The vegetation data of Gertenbach (1976; 1983) and Van Rooyen (1978) contributed to the identification of the *Combretum collinum* variant. This variant basically encompasses the *Pterocarpus rotundifolius/Combretum collinum* woodland (landscape no. 33) described by Gertenbach (1983). This variant is restricted to intrusions of dolerite and diabase, andesite

and tuff of the Waterberg System and schist and banded ironstone, amphibolite and undifferentiated metamorphic formations of the Swaziland System, forming islands in the Mopaneveld (Gertenbach 1983).

Deep, well-drained, dark reddish brown clay (35--55 %) is derived from the geological parent material. The terrain is usually flat to undulating.

Species group C (Table 8) is diagnostic for this community. *Combretum collinum* and *Pterocarpus rotundifolius* (species group C) are confined to this variant in their distribution within the *Acacia nigrescens* – *Colophospermum mopane* major plant community and also dominate the woody layer. According to Gertenbach (1983), dense stands of *Pterocarpus rotundifolius* are associated with higher clay content. A local character species for the *Combretum collinum* variant include *Acacia gerrardii*, a woody species often differentiating plant communities on mesic clay (Coetzee 1983; Gertenbach 1987). Species dominating the herbaceous layer include grasses such as *Setaria incrassata* (species group B), *Urochloa brachyura* (species group C), *Themeda triandra* (species group A) and *Urochloa mosambicensis* (species group S) and forbs such as *Oxalis semiloba* (species group C).

b) The *Combretum imberbe* variant

The *Combretum imberbe* variant is also identified according to the vegetation data of Gertenbach (1976; 1983) and Van Rooyen (1978). This variant relates the *Themeda triandra* variation of the *Colophospermum mopane* shrubveld on basalt (landscape no. 12, Gertenbach 1983) and the *Colophospermum mopane* - *Themeda triandra* shrubsavanna (Van Rooyen 1978).

This open shrubmopaneveld is differentiated by the absence of species group C, Table 8 and is confined to flat mid-slopes and convex uplands on basaltic terrain of heavy, clayey soil. Soil series dominating the landscape are the Bonheim and Milkwood, both dark-coloured, often calcareous melanic clay (Fraser *et al.* 1987).

The *Combretum imberbe* variant is characterised by a grassy, open shrubveld with *Colophospermum mopane* and *Combretum imberbe* (species group S) dominating the woody layer, often as small trees. Dominant grass species include *Themeda triandra* (species group A), *Setaria incrassata* (species group B) and *Panicum coloratum* (species group J). Forb species are not highly frequent.

1.2. The *Digitaria eriantha* - *Acacia nigrescens* subcommunity

Vegetation data of Gertenbach (1976; 1983) and Purchase (1997) contributed to the identification of this subcommunity. The *Digitaria eriantha* - *Acacia nigrescens* subcommunity is included in the Gabbro complex (Gertenbach 1987), which also include the *Themeda triandra* - *Colophospermum mopane* shrubveld (Gertenbach 1978). The *Digitaria eriantha* - *Acacia nigrescens* subcommunity is however not completely restricted to heavy clays derived from gabbro.

The *Digitaria eriantha* - *Acacia nigrescens* subcommunity is also associated with heavy clay, although shallower than the *Setaria incrassata* – *Combretum imberbe* subcommunity. Geological parent material varies from igneous gabbro and basalt to footslopes of granite and rhyolite. Structurally this subcommunity is a dense, sometimes impenetrable mopane shrubland.

Species group D, Table 8 represents the diagnostic species for the *Digitaria eriantha* – *Acacia nigrescens* subcommunity. *Colophospermum mopane*-dominated shrubland and *Acacia nigrescens*-dominated shrubland alternate in this subcommunity with the latter occupying the heavier clay. *Combretum apiculatum* (species group P) and *Dichrostachys cinerea* (species group S) occur in this community, but of low significance. *Eragrostis rigidior* and *Pogonarthria squarrosa* (species group E) are prominent, whereas *Themeda triandra* (species group A), *Panicum coloratum* (species group J), *Urochloa mosambicensis* (species group S) and *Heteropogon contortus* are the dominant grass species. Forbs of conspicuous value include *Tephrosia polystachya* (species group L) and *Cissus cornifolia* (species group P).

a) The *Colophospermum mopane* variant

The *Colophospermum mopane* variant represents the *Colophospermum mopane*-dominated variant of the *Digitaria eriantha* - *Acacia nigrescens* subcommunity. This variant occupies slightly sloped, clayey terrain, although the percentage clay is lower than the soils of the *Acacia nigrescens* variant (the second variant for this subcommunity) and the *Setaria incrassata* - *Combretum imberbe* subcommunity.

Mid- to footslopes on granite, midslopes and plains on gabbro and footslopes on basalt and rhyolite underly the *Colophospermum mopane* variant.

Diagnostic species for this subcommunity are listed in species group E. Common woody species include *Commiphora africana* (species group I), *Combretum apiculatum* (species group P), *Colophospermum mopane* and *Dichrostachys cinerea* (species group S). High abundance values of *C. mopane* (species group S) express the difference between the *C. mopane* variant and the *Acacia nigrescens* variant on the more heavy clayey soils. Important forb species are *Tephrosia polystachya* (species group L), *Rhynchosia totta* (species group M) and *Cissus cornifolia* (species group P). *Pogonarthria squarrosa* (species group E), *Panicum coloratum* (species group J), *Aristida congesta*, *Digitaria eriantha* (species group P) and *Urochloa mosambicensis* (species group S) are amongst the dominant grass species of this variant.

b) The *Acacia nigrescens* variant

Vegetation data of Gertenbach (1976) and Purchase (1997) contributed to the identification of this variant. The *Acacia nigrescens* variant is restricted to dark-coloured, deep, vertic clayey soil derived from igneous basalt and gabbro. It is to some extent related to the *Bothriochloa radicans* variant within the *Colophospermum mopane* communities on basalt (Gertenbach 1983). The *Acacia nigrescens* variant of this community comprises the *Acacia nigrescens* variant within the *Themeda triandra* - *Colophospermum mopane* shrubveld (Gertenbach 1978). It is noteworthy that *C. mopane* (species group S) and *Combretum apiculatum* (species group P) are not commonly present in this subcommunity. Instead, *Acacia*

nigrescens shrubs dominate the woody component, a significant feature of gabbroic landscapes. The landscape is in general flat to concave.

Diagnostic species for the *Acacia nigrescens* variant are listed in species group F, Table 8. Grass species, such as *Themeda triandra* (species group A) and *Digitaria eriantha* (species group P) and shrubby trees of *Acacia nigrescens* (species group S) are the major contributors to the vegetation cover in the *Acacia nigrescens* variant. Other dominant species include *Sclerocarya birrea* (species group F) and *Grewia bicolor* (species group S) in the woody layer and *Bothriochloa radicans* (species group F) *Panicum maximum* and *Urochloa mosambicensis* (species group S) in the grass layer. The *Acacia nigrescens* variant contains several forb species of significant value, such as *Heliotropium steudneri* (species group J) and *Tephrosia polystachya* (species group L).

2. The *Commiphora glandulosa* – *Enneapogon cenchroides* community

Vegetation data from the studies of Gertenbach (1983; 1987) and Van Rooyen (1978) are included in this community.

The *Commiphora glandulosa* - *Enneapogon cenchroides* community is restricted to slightly undulating to flat terrain where the weathering of basalt, andesite and shale produces fine-textured sand-clay-loam, sand-clay and clayey soil (Van Rooyen 1978; Gertenbach 1987). On the mid- and footslopes, the A-horizon is thin and overlays a thick layer of lime concretions (Gertenbach 1983). According to Gertenbach (1980), this community receives 450–500 mm rainfall annually.

Species group G, Table 8 represents diagnostic species for the *Commiphora glandulosa* - *Enneapogon cenchroides* community, of which *Terminalia prunioides* and *Commiphora glandulosa* (species group G) are prominent woody species for this community. Another conspicuous woody species is the shrub *Grewia bicolor* (species group S). *Seddera capensis* (species group G) is a prominent forb in this community. Dominant species include woodies such as *Colophospermum mopane* (species group S) and grasses such as *Aristida congesta*,

Digitaria eriantha (species group P), *Panicum maximum* and *Enneapogon cenchroides* (species group S).

Two subcommunities within the *Commiphora glandulosa* - *Enneapogon cenchroides* community were identified:

2.1 The *Indigofera bainesii* - *Aristida congesta* subcommunity

Vegetation data of Gertenbach (1976 & 1987) contributed to the identification of this subcommunity, which is restricted to the undulating landscapes originated from basalt. Occurring on the mid- to footslopes, this subcommunity is characterised by a moderate to dense bush savanna on shallow clayey soil. Diagnostic species for this subcommunity are represented in species group H, Table 8. Although representing a subcommunity of the *Commiphora glandulosa* - *Enneapogon cenchroides* community, it is strongly related to the *Themeda triandra* – *Acacia nigrescens* community on melanic clay (species groups I & J). The tree *Commiphora glandulosa* (species group G) is dominant in the woody layer together with *Colophospermum mopane*, *Grewia bicolor* and to a lesser extent *Acacia nigrescens* (species group S). Forbs such as *Seddera capensis* (species group G), *Heliotropium steudneri* (species group J), *Tephrosia polystachya* (species group L), *Rhynchosia totta* (species group M) and *Hibiscus micranthus* (species group P) dominate the herbaceous layer together with grasses including *Aristida congesta*, *Schmidtia pappophoroides* (species group P) and *Enneapogon cenchroides* (species group R).

2.2. The *Phyllanthus parvulus* - *Combretum apiculatum* subcommunity

Vegetation data of Van Rooyen (1978) contributed to the identification of this subcommunity. The *Phyllanthus parvulus* - *Combretum apiculatum* subcommunity is confined to treeveld on deep, moderately alkaline clay derived from basalt, andesite and shale. It is well presented by the *Colophospermum mopane* – *Commiphora glandulosa* – *Seddera capensis* and the *C. mopane* – *Euclea divinorum* – *Enteropogon macrostachys* communities of the Punda Milia – Pafuri – Wambiya district in the northern Kruger National Park (Van Rooyen 1978). The

landscape varies from flat terrain to steep slopes (Van Rooyen 1978). Although the soil contains high percentages clay, the texture is fine-grained revealing non-vertic clays.

Species group K, Table 8 represents the diagnostic species for the *Phyllanthus parvulus* - *Combretum apiculatum* subcommunity. *Combretum apiculatum* (species group P), *Colophospermum mopane* and *Grewia bicolor* (species group S) dominate the woody component whilst *Aristida congesta*, *Digitaria eriantha* (species group P), *Enneapogon cenchroides* (species group R) and *Panicum maximum* (species group S) dominate the grass layer. Forbs that are significantly present include *Phyllanthus parvulus*, *Neuracanthus africanus* (species group K) and *Hibiscus micranthus* (species group P).

3. The *Euclea divinorum* – *Panicum maximum* community

Vegetation data of Gertenbach (1976) and Van Rooyen (1978) contributed to the identification of this community, which represent *Colophospermum mopane* vegetation on dark-coloured, fine to medium textured loamy sand to clayey, alcalic soil (Van Rooyen 1978). These soils are derived mainly from different geological substrates such as shale, andesite, rhyolite, granite and basalt.

The *Euclea divinorum* - *Panicum maximum* community is usually found on plains as well as on gentle slopes. This dense shrub- to treeveld is recognizable from the almost sole dominance of *Colophospermum mopane* trees and *Euclea divinorum* high shrubs (species group N) and is therefore related to the Mopaneveld on shale (*Euclea divinorum* – *Colophospermum mopane* major plant community). The annual rainfall for this community varies between 500 mm and 550 mm (Gertenbach 1980).

Diagnostic species for the *Euclea divinorum* - *Panicum maximum* community are listed in species group N, Table 8. *Euclea divinorum* is the local character species whereas *Colophospermum mopane* (species group S) dominates the woody layer. Dominant in the grass layer are *Aristida congesta*, *Digitaria eriantha* (species group P), *Enneapogon cenchroides* (species group R) and *Panicum maximum* (species group S).

4. The *Combretum mossambicense* – *Colophospermum mopane* community

Vegetation data of Gertenbach (1976) and Purchase (1997) contributed to the identification of this community. The *Combretum mossambicense* – *Colophospermum mopane* community is commonly found on alluvial floodplains or bottomlands in the basaltic landscapes where it represents a high treeveld. Percentage clay in the soil varies between 15 and 55. Due to the extensive alluvial plains in the distribution of the Lowveld Mopaneveld, the annual rainfall of this community varies significantly. Species group Q, Table 8 represents the diagnostic species for this community of which many species are annuals. *Colophospermum mopane* is well presented in this community (species group S), whereas other woody species occurring in lesser dominance include *Maytemus senegalensis*, *Grewia flavescens* (species group Q), *Combretum mossambicense* (species group R), *Combretum imberbe* and *Lonchocarpus capassa* (species group S). Annual forbs such as *Achyranthes aspera*, *Sida cordifolia* (species group Q) and *Pupalia lappacea* (species group R) dominate the herbaceous layer indicating the disturbance typically associated with alluvial plains along drainage lines. The only common grass species in this community is *Panicum maximum* (species group S).

Table 6 Synoptic presentation of the four vegetation units in the Lowveld Mopaneveld

Vegetation type	1	2	3	4
Number of relevés	145	425	383	158
Species Group A				
<i>Terminalia sericea</i>	65	3	14	.
<i>Combretum zeyheri</i>	28	1	8	3
<i>Agathisanthemum bojeri</i>	25	5	9	1
<i>Trichoneura grandigluma</i>	31	2	8	2
<i>Perotis patens</i>	39	1	13	0.6
<i>Hibiscus engleri</i>	14	3	3	1
<i>Mundulea sericea</i>	25	5	5	3
<i>Brachiaria nigropedata</i>	41	9	6	0.6
<i>Hermannia glanduligera</i>	17	4	2	4
<i>Combretum collinum</i>	18	7	3	1
<i>Monsonia angustifolia</i>	10	3	10	6
<i>Monechma debile</i>	10	6	6	2
<i>Pteleopsis myrtifolia</i>	11	.	.	.
<i>Guibourtia conjugata</i>	10	.	.	.
<i>Pseudolachnostylis maprouneifolia</i>	15	0.9	.	.
<i>Brachiaria serrata</i>	10	1	4	1
<i>Aristida mollissima</i>	32	0.9	3	0.6
<i>Strychnos madagascariensis</i>	40	4	8	.
<i>Boscia albitrunca</i>	16	5	4	0.6
<i>Hemizygia bracteosa</i>	16	0.7	8	.
<i>Tephrosia longipes</i>	20	1	2	1
<i>Aristida meridionalis</i>	17	0.5	3	.
<i>Fimbristylis complanatus</i>	25	3	5	1
<i>Zornia species</i>	15	0.5	2	.
<i>Xenostegia tridentata</i> subsp. <i>angustifolia</i>	41	2	6	.
Species Group B				
<i>Cenchrus ciliaris</i>	0.7	26	7	4
<i>Rhynchosia minima</i>	0.7	11	3	6
<i>Sorghum versicolor</i>	.	12	0.8	0.6
<i>Setaria incrassata</i>	.	18	0.8	4
<i>Neorautanenia amboensis</i>	.	15	.	.
<i>Urochloa brachyura</i>	2	11	0.5	.
<i>Neuracanthus africanus</i>	1	11	0.8	6
<i>Fingerhuthia africana</i>	.	19	9	8
Species Group C				
<i>Vigna unguiculata</i>	52	15	8	2
<i>Vernonia fastigiata</i>	37	21	10	9
<i>Indigofera heterotricha</i>	11	12	2	3
Species Group D				
<i>Grewia monticola</i>	7	9	18	8
<i>Ximenia americana</i>	5	5	13	4
<i>Sporobolus fimbriatus</i>	2	8	12	8
<i>Sporobolus panicoides</i>	0.7	0.2	12	0.6
<i>Sida chrysantha</i>	.	0.5	14	7
<i>Leucas neuffizeana</i>	.	.	27	5
<i>Vernonia poskeana</i>	0.7	1	14	4
<i>Monsonia burkeana</i>	1	1	11	5
<i>Sansevieria hyacinthoides</i>	0.7	2	12	10
<i>Enneapogon scoparius</i>	2	5	25	9



Vegetation type	1	2	3	4
Number of relevés	145	425	383	158
<i>Heliotropium strigosum</i>	7	4	17	6
<i>Kyllinga alba</i>	10	4	19	4
<i>Aristida scabrivalvis</i>	.	0.2	28	5
<i>Tricliceras laceratum</i>	0.7	.	13	0.6
<i>Aristida stipitata</i> subsp. <i>graciliflora</i>	0.7	.	18	.
<i>Seddera suffruticosa</i>	.	0.5	13	4
<i>Commiphora pyracanthoides</i>	0.7	.	18	2
<i>Grewia subspathulata</i>	.	0.5	28	3
<i>Limeum viscosum</i>	4	0.2	18	5
<i>Crabbea velutina</i>	7	5	38	3
<i>Rhinacanthus xerophilus</i>	1	2	15	9
<i>Chascanum hederaceum</i>	2	0.9	11	3
<i>Sesamum alatum</i>	5	0.2	16	7
<i>Commiphora mollis</i>	8	4	23	1
<i>Coccinia rehmannii</i>	.	2	17	8
<i>Aptosimum lineare</i>	7	4	42	6
Species Group E				
<i>Kohautia virgata</i>	35	13	21	8
<i>Clerodendrum ternatum</i>	37	33	43	7
<i>Ozoroa engleri</i>	24	13	13	0.6
<i>Combretum mossambicensis</i>	15	13	17	6
<i>Lonchocarpus capassa</i>	19	22	16	9
Species Group F				
<i>Peltophorum africanum</i>	15	6	21	5
<i>Ceratotheca triloba</i>	11	5	45	6
<i>Hibiscus sidiformis</i>	10	9	22	8
<i>Ipomoea magnusiana</i>	39	5	25	3
<i>Crotalaria schinzii</i>	17	.	14	3
<i>Chamaesyce neopolycnemoides</i>	24	6	30	4
<i>Polygala sphenoptera</i>	19	6	21	8
<i>Ornithogalum seineri</i>	15	4	17	4
<i>Chamaecrista absus</i>	50	6	22	4
<i>Andropogon gayanus</i>	37	10	15	0.6
<i>Indigofera filipes</i>	15	0.9	24	2
<i>Crotalaria virgulata</i>	14	9	14	4
<i>Bulbostylis hispidula</i>	12	0.5	18	8
<i>Cassia abbreviata</i>	11	5	12	4
<i>Xerophyta retinervis</i>	12	0.7	13	.
Species Group G				
<i>Acacia gerrardii</i>	0.7	8	8	22
<i>Urochloa panicoides</i>	.	.	5	20
<i>Ocimum americanum</i>	3	3	8	25
<i>Geigeria ornativa</i>	.	0.7	5	17
<i>Amaranthus thunbergii</i>	.	1	7	12
<i>Ipomoea coptica</i>	4	1	6	18
<i>Bolusanthus speciosus</i>	0.7	4	8	18
<i>Sida rhombifolia</i>	.	4	3	20
<i>Orthosiphon suffrutescens</i>	5	6	9	17
<i>Trianthema salsoloides</i>	.	0.2	2	17
<i>Hypertelis salsoloides</i>	.	0.2	3	12
<i>Dactyloctenium geminatum</i>	.	.	0.8	11
<i>Achyroopsis leptostachys</i>	1	0.2	0.3	17



Vegetation type	1	2	3	4
Number of relevés	145	425	383	158
<i>Cyathula lanceolata</i>	.	0.9	2	13
<i>Zanthoxylum humile</i>	.	0.9	1	10
<i>Sporobolus ioclados</i>	1	0.9	0.3	10
<i>Dactyloctenium aegyptium</i>	3	2	5	24
<i>Abutilon guineense</i>	3	5	2	18
<i>Chloris roxburghiana</i>	.	4	1	12
Species Group H				
<i>Dicoma tomentosa</i>	8	7	59	15
<i>Eragrostis lehmanniana</i>	0.7	1	11	10
<i>Chloris virgata</i>	3	5	12	49
<i>Acalypha indica</i>	9	9	52	16
<i>Asparagus setaceus</i>	7	9	47	27
<i>Talinum caffrum</i>	8	6	29	25
<i>Oropetium capense</i>	6	5	26	14
<i>Indigofera rhytidocarpa</i>	10	9	36	21
<i>Boerhavia diffusa</i>	.	5	12	13
<i>Hemibstaedia odorata</i>	6	5	23	23
<i>Cucumis africanus</i>	8	7	19	22
<i>Indigofera lupatana</i>	7	5	10	15
<i>Phyllanthus incurvus</i>	.	0.7	14	11
<i>Melhania prostrata</i>	1	0.2	30	14
<i>Endostemon tereticaulis</i>	1	0.5	49	15
<i>Phyllanthus asperulatus</i>	.	0.7	28	11
<i>Aristida adscensionis</i>	1	5	65	29
<i>Gisekia africana</i>	3	0.9	17	13
<i>Tribulus terrestris</i>	0.7	2	13	17
<i>Sporobolus nitens</i>	.	3	12	54
<i>Portulaca kermesina</i>	.	0.2	25	29
<i>Abutilon austro-africana</i>	0.7	6	30	70
<i>Justicia anagalloides</i>	1	2	12	13
<i>Chlorophytum galpinii</i>	2	2	14	12
<i>Ehretia amoena</i>	1	4	15	15
<i>Commelina erecta</i>	8	3	17	15
<i>Pupalia lappacea</i>	4	6	25	36
<i>Justicia flava</i>	0.7	5	12	38
<i>Melhania rehmannii</i>	1	7	22	10
<i>Corbichonia decumbens</i>	.	8	19	15
<i>Solanum coccineum</i>	0.7	3	18	25
<i>Achyranthes aspera</i>	0.7	4	13	11
<i>Hibiscus pusillus</i>	2	8	12	17
<i>Grewia flavescens</i>	3	3	29	16
<i>Grewia villosa</i>	.	2	25	10
<i>Brachiaria deflexa</i>	0.7	4	46	17
<i>Grewia hexamita</i>	4	2	20	11
Species Group I				
<i>Pavonia burchellii</i>	3	11	30	30
<i>Blepharis integrifolia</i>	8	10	21	37
<i>Maytenus heterophylla</i>	9	14	24	22
<i>Acacia tortilis</i>	2	10	10	23
<i>Sida dregei</i>	9	12	17	23
<i>Brachiaria xantholeuca</i>	5	13	17	11
<i>Ormocarpum trichocarpum</i>	6	11	21	32



Vegetation type	1	2	3	4
Number of relevés	145	425	383	158

<i>Maerua parvifolia</i>	8	20	44	36
<i>Euclea divinorum</i>	7	15	20	55
<i>Combretum hereroense</i>	9	25	25	35
<i>Seddera capensis</i>	4	31	25	42
<i>Themeda triandra</i>	1	45	14	41
<i>Bothriochloa insculpta</i>	3	37	10	10
<i>Terminalia prunioides</i>	0.7	13	35	11
<i>Tragus berteronianus</i>	8	13	82	71
<i>Bothriochloa radicans</i>	0.7	12	32	37
<i>Commiphora glandulosa</i>	5	13	7	10
<i>Combretum imberbe</i>	4	27	9	13
<i>Ehretia rigida</i>	6	18	4	17
<i>Panicum coloratum</i>	5	29	9	26

Species Group J

<i>Waltheria indica</i>	43	6	63	25
<i>Melhania didyma</i>	11	5	20	16
<i>Mariscus rehmannianus</i>	11	6	24	31
<i>Indigofera bainesii</i>	20	9	23	14
<i>Tricholaena monachne</i>	55	9	47	12
<i>Leucas glabrata</i>	30	7	36	26
<i>Crotalaria sphaerocarpa</i>	23	5	13	13
<i>Limeum fenestratum</i>	17	2	29	11
<i>Cyperus rupestris</i>	15	4	34	15
<i>Kyphocarpa angustifolia</i>	39	8	81	70

Species Group K

<i>Panicum maximum</i>	81	68	87	87
<i>Aristida congesta</i>	71	73	86	80
<i>Digitaria eriantha</i>	94	74	61	52
<i>Colophospermum mopane</i>	48	83	42	30
<i>Combretum apiculatum</i>	87	50	86	13
<i>Grewia bicolor</i>	35	43	86	70
<i>Enneapogon cenchroides</i>	28	44	72	44
<i>Cissus comifolia</i>	65	45	78	17
<i>Sclerocarya birrea</i>	41	26	51	12
<i>Melinis repens</i>	46	15	48	4
<i>Dichrostachys cinerea</i>	52	48	64	40
<i>Urochloa mosambicensis</i>	25	52	65	83
<i>Pogonarthria squarrosa</i>	78	19	52	12
<i>Ziziphus mucronata</i>	12	12	20	18
<i>Lannea schweinfurthii</i>	33	19	31	10
<i>Acacia nigrescens</i>	10	53	61	49
<i>Cymbopogon plurinodis</i>	10	23	27	22
<i>Hermannia boraginiflora</i>	16	10	59	13
<i>Eragrostis superba</i>	11	44	20	34
<i>Dalbergia melanoxydon</i>	41	34	24	22
<i>Schmidia pappophoroides</i>	63	55	69	35
<i>Albizia harveyi</i>	25	22	26	35
<i>Phyllanthus pentandrus</i>	12	11	13	25
<i>Heteropogon contortus</i>	37	54	27	20
<i>Commiphora africana</i>	21	25	38	18
<i>Ipomoea crassipes</i>	21	17	15	20
<i>Phyllanthus species</i>	21	19	19	22



Vegetation type	1	2	3	4
Number of relevés	145	425	383	158
<i>Chamaecrista mimosoides</i>	27	21	25	15
<i>Rhynchosia totta</i>	36	36	42	18
<i>Tragia dioica</i>	11	17	20	30
<i>Ipomoea obscura</i> var. <i>obscura</i>	10	19	16	22
<i>Lantana rugosa</i>	12	18	31	35
<i>Solanum panduriforme</i>	17	29	35	55
<i>Hibiscus micranthus</i>	35	37	86	55
<i>Flueggea virosa</i>	12	22	29	23
<i>Heliotropium steudneri</i>	10	25	56	38
<i>Tephrosia polystachya</i>	57	37	83	53
<i>Acacia exuvialis</i>	11	23	43	30
<i>Corchorus asplenifolius</i>	24	25	67	39
<i>Eragrostis rigidior</i>	38	27	63	33
<i>Indigofera vicioides</i>	23	22	39	16
<i>Phyllanthus maderaspatensis</i>	15	23	27	16
<i>Commelina benghalensis</i>	17	15	48	39
<i>Ruellia patula</i>	10	14	46	52
<i>Evolvulus alsinoides</i>	37	11	74	49
<i>Melhania forbesii</i>	18	15	60	42
<i>Commelina africana</i>	28	10	36	20

Table 7 Phytosociological table of the *Terminalia sericea* - *Colophospermum mopane* major plant community

Relevé numbers (Turboveg database)	1 1 1 2	1 1 1 1 1 2 2	2 2 2 2 3 3 3 3 4 4 3	5 3 3 4 4 4 4 5 6 7	6 6 6 6 7 7 7 7	6 6 6 7 7 7	6 6 7 7 7	6 6 6 6
Community number	1.1	1	1.2	2	2.1	2	2.2	
Species Group A								
<i>Clerodendrum tematum</i>	a a + a 1 a a	. . 1 + . 1 . . 1	. . + . + + . . + + .	. + . . + + . . .	. . + . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Heteropogon contortus</i>	. + . . 1 . . .	. . + 1 . + 1 . + +	+ + + . + + + . 1 + 1	+ a 1 . .	. 1 . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Kohautia virgata</i>	. + 1 . . . . .	. . + 1 + . 1 1 . 1	+ + 1 + + . 1 . 1 .	. . . . . + + +	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Eragrostis rigidior</i>	. 1 . . + . . .	1 a 1 . . a 1 . . +	1 . . + + . . + + + +	. 1 1 . + + . 1 . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Commelina benghalensis</i>	1 + . 1 . + +	+ . + . . . + . . .	. . . . . + . . . . .	+ . . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Indigofera bainesii</i>	. . a + a . . .	+ . + . . . a 1 + 1	+ . + + + . . . . .	+ . . . . . + . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Chamaesyce neopolycnemoides</i>	. . + . . . . .	+ + . . . + . . . .	. . . . . + + . . . +	. + + + + + + +	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Urochloa mosambicensis</i>	. . . . + + . .	+ + + . . 1 + + + +	+ +	a + . 1 . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Albizia harveyi</i>	1 . . . . . . .	. . . . . + + + 1 .	. . . + + . + . 1 +	. . + + + . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Ruellia patula</i>	. . + . + . . .	. . . . . . . + +	+ + . . . . . . . .	. . . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Commiphora africana</i>	+ . . . + . . .	. . . . . + + . . .	+ . . . . + + . . . .	. 1 . . + + + . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Ipomoea crassipes</i>	. . . . . + . .	+ . . . . . . . . .	+ + . + . . . . . +	. . . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Phyllanthus species</i>	. . + . . . + . .	. . . . . . . . +	. . . . . + + . . . +	+ + + . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Limeum fenestratum</i>	. . + . . . . .	+ . . . . . . . . .	. . . . . + . . . . +	. + 1 + . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Mariscus rehmannianus</i>	+ . + + . + +	+ . . . . . . . . .	. . . . . . . . . .	. . . . . + + + . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Heliotropium steudneri</i>	1 . + . . + . .	+ . . . . . . . . .	. . . . . . . . . .	. + . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Blepharis integrifolia</i>	. . . + . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Combretum hereroense</i>	. . . 1 . . a . .	. . . . . + . . . .	. . . . . + . . . .	. + + . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
<i>Oxygonum alatum</i>	+ . . . . . . .	. . . . . . . . . .	. . . . . + + . . . .	. . . . . + . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .	. . . . . . . . .
Species Group B								
<i>Indigofera filipes</i>	. 1 a	+ 1 1 . + + . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Sida dregei</i>	. . + . + . . .	+ . + + . . + . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Maytenus heterophylla</i>	. . . . + . . .	. . . . . + . . . . 1	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Acacia burkei</i>	. . . . . 1 . .	. . + . . + . . . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Thunbergia dregeana</i>	. . . . + . . .	. . + . . . . + . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Chascanum hederaceum</i>	. . + . . . . .	. . . . . + + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Limeum viscosum</i>	. 1 . . . . . .	+ . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
Species Group C								
<i>Talinum caffrum</i>	+ + + + . + r	. . . . . + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . . . . . .	. . . . . . . . . .
<i>Limeum sulcatum</i>	. . 1 + . + . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .	. . . . . + . . . .	. . . . . . . . . .

Relevé numbers (Turboveg database)	1 1 1 2	1 1 1 1 1 2 2	2 2 2 2 3 3 3 3 4 4 3	5 3 3 4 4 4 4 5 6 7	6 6 6 6 7 7 7 7	6 6 6 7 7 7	6 6 7 7 7	6 6 6 6
Community number	1.1	1	1.2	2	2.1	2	2.2	
<i>Merremia kentrocaulos</i>	. . . + + +	. . . . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Sporobolus africanus</i>	. . . + + +	. . . . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Pterodiscus aurantiacus</i>	. + . . +	. . . . .	. + . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Gisekia africana</i>	+ . + . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Senna italica</i>	. . . . + +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Abutilon guineense</i>	. . . . + a	. . . . .	. . . . .	. . . . .	. . . . .	. + . . . .	. . . . .	. . . . .
Species Group D								
<i>Phyllanthus pentandrus</i>	. . . . .	+ + + . . + + +	. . . . .	. . . . .	. . . . .	. + . . . .	. . . . .	. . . . .
<i>Ormocarpum trichocarpum</i>	. . . . .	. + . . . + + +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Helichrysum candolleianum</i>	. . . . .	1 . 1 . . . +	+ . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Orthosiphon suffrutescens</i>	. . . . .	+ . + . . 1	. . . . .	1 . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Urochloa brachyura</i>	. . . . .	+ . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Cucumis hirsutus</i>	. . . . .	. . . . + .	. . . . .	. . . . .	. . . . .	. + . + . .	. . . . .	. . . . .
<i>Justicia anagalloides</i>	. . . . .	. . . . + +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Chascanum adenostachyum</i>	. . . . .	. . . . a .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
Species Group E								
<i>Ozoroa engleri</i>	. . . . .	. . . . .	. . + . . + . +	. + . + . +	. . . . .	. . . . .	. . . . .	. . . . .
<i>Dicoma tomentosa</i>	. . . . .	+ . . . .	. . + . . +	a . . . +	. . . . .	. . . . .	. . . . .	. . . . .
<i>Phyllanthus maderaspatensis</i>	. . . . .	. . . . .	. . + . . +	. + . . . +	. . . . .	. . . . .	. . . . .	. . . . .
<i>Indigofera vicioides</i>	. . . . .	. . . . .	. . + . . 1 +	. + 1 . . +	. . . . .	. . . . .	. + . . . .	. . . . .
Species Group F								
<i>Crotalaria schinzii</i>	. . . . .	. . . . .	. . 1 1 + 1 . . + . 1	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Indigofera heterotricha</i>	. . . . .	. . . . .	. . + . . 1 . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Jatropha zeyheri</i>	. . . . .	. . . . .	. . + + + . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Aristida meridionalis</i>	. . . . .	1 . . . .	. + a . . . + 1 . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Hemizygia bracteosa</i>	. . . . .	. . . . .	a a . . . a + . . +	. . . . .	. . . . .	. + . . . .	. . . . .	. + . . . .
<i>Striga bilabiata</i>	. . . . .	. . . . .	. . . . . + . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Oropetium capense</i>	. . . . .	. . . . .	. . . . . + . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Hemizygia elliotii</i>	. . . . .	. . . . .	. . . . . a . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
Species Group G								
<i>Trichoneura grandigluma</i>	. . +	+ + + 1 + + . + + +	+ + + 1 + . . + . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Ornithogalum seineri</i>	+ + . + . +	. + . + . + + +	+ + + . . . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Polygala sphenoptera</i>	. . + . . . .	. + + . . . . +	. + . + 1 + . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Brachiana serrata</i>	+ 1 + + . .	a . 1 . . . +	1 . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Acacia oxuvialis</i>	. . . . + . .	. + a . . + + +	. . . . . + + . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Ipomoea obscura v. obscura</i>	r . . . + . .	. . . . .	. . . . . + . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Stylosanthes fruticosa</i>	. . . + . . .	. . + + . + . .	. . . . . + . . +	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Melhania didyma</i>	. . . r . . .	. + . . . + . .	. + . . . + . . +	. . . . .	. . . . .	. + . . . .	. . . . .	. . . . .

Relevé numbers (Turboveg database)	1 1 1 2	1 1 1 1 2 2	2 2 2 3 3 3 3 4 4 3	5 3 3 4 4 4 5 6 7	6 6 6 6 7 7 7 7	6 6 6 7 7 7	6 6 7 7 7	6 6 6 6
Community number	1.1	1	1.2	2	2.1	2	2.2	
Species Group H								
<i>Litogyne gariepina</i>				+	a			
<i>Ocimum americanum</i>					+			
<i>Euclea divinorum</i>	+		r		+			
<i>Bothriochloa insculpta</i>						a	b	
<i>Rhigozum zambeziacum</i>				1	+			
<i>Kyllinga alba</i>	+		+			+		
<i>Triliceras glandulifera</i>						+		
Species Group I								
<i>Fimbristylis complanata</i>		1	+	1	+		a	+
<i>Hermannia boraginiflora</i>	+		1	+	+	+		+
<i>Cymbopogon plurinodis</i>			1	+				+
<i>Tragia dioica</i>	+			+				+
<i>Eragrostis superba</i>			+	+				+
<i>Cyperus rupestris</i>	+			+				+
<i>Xerophyta retinervis</i>		+				1		
<i>Ceratotheca triloba</i>				+			+	
Species Group J								
<i>Pseudolachnostylis maprouneifolia</i>					r		r	1
<i>Burkea africana</i>					r		+	r
<i>Gulbourtia conjugata</i>					r	r		a
<i>Pteleopsis myrtifolia</i>					r	r		1
<i>Striga asiatica</i>					+	+		
<i>Spermacoce senensis</i>								+
<i>Tephrosia elongata</i>								+
<i>Ochna pulchra</i>					r			+
<i>Hibiscus engleri</i>								+
Species Group K								
<i>Combretum collinum</i>					r	r	+	r
<i>Hermannia glanduligera</i>					+			+
<i>Spirostachys africana</i>					r	r		r
<i>Strychnos decussata</i>					r	r		1
<i>Catunaregam spinosa</i>	a				r			r
<i>Monechma debile</i>								+
Species Group L								
<i>Eragrostis pallens</i>						3	3	1
<i>Indigofera inhambanens</i>						1	+	+
<i>Tarenna zygoon</i>						+		+

Relevé numbers (Turboveg database)	1 1 1 2	1 1 1 1 1 2 2	2 2 2 2 3 3 3 3 4 4 3	5 3 3 4 4 4 4 5 6 7	6 6 6 6 7 7 7 7	6 6 6 7 7 7	6 6 7 7 7	6 6 6 6
Community number	1.1	1	1.2		2.1	2	2.2	
<i>Crotalaria sphaerocarpa</i>	. . + . . .	. . . . . + . . .	. . . . . . . . . . .	. + . . + . . . + +	. . . . . + . . . . .	. . . . . + . . . . .	. . . . .	. . . . .
<i>Corchorus asplenifolius</i>	. + . . . . .	+ . . . . . . . . . .	+ + . . . . . + + . . .	. . . . . + . . . . .	+ + . . . . . + . . . . .	. . . . . + . . . . .	. . . . .	. . . . .
<i>Flueggea virosa</i>	. . . + . . .	+ . . . . . . . . . .	. . . . . + . . . . . +	. + . . . . . . . . . .	. . . . . . . . . . .	. . . . . 1 . . . . .	. . . . .	. . . . .
<i>Maerua parvifolia</i>	. . . . + . .	+ . . . . . . . + . .	. . . . . + + . . . . .	. . . . . . . . . . .	. . . . . . . . . . .	. . . . . + . . . . .	. . . . .	. . . . .
Species Group S								
<i>Diplorhynchus condylocarpon</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . . r . . . . .	. . . . . r	1 + . a	r r r r r
<i>Blepharis maderaspatensis</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. + + + +	. . . + .
<i>Bulbostylis hispidula</i>	+ + + . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	+ + . . .	+ + + +
<i>Rhynchosia venulosa</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	+ . . . .	. . . + +
Species Group T								
<i>Artabotrys brachypetalus</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . . r . . . . .	. . . . .	1 . . + .	r
<i>Phyllanthus reticulatus</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	+ . + + .	. . . . .
<i>Afzella quanzensis</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	1 . . . . .	+ + + . .	. . . . .
<i>Commiphora glandulosa</i>	. . . . .	. . . . .	. . . . .	. + . . . . .	. . . . .	. . . . . 1 . . . . .	+ . + + .	. . . . .
<i>Pellaea calomelanos</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . + . +	. . . . .
<i>Kirkia acuminata</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	+ 1	+ + . 1 1	. . . . .
Species Group U								
<i>Hippocratea crenata</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . . r r . . . . .	. . . . .	. + . . .	. . . . .
<i>Corchorus kirkii</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . . + + . . . . 1	. . . . .	. + . . +	. . . . .
<i>Rhynchosia resinosa</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . . + . . . . +	. . . . .	. . + 1 .	. . . . .
<i>Boscia albitrunca</i>	. . . . .	. . . . .	. . . . . + . . . . +	. . . . . 1	r . . . r r r . . . . .	. . . . .	+ . + . .	. . . . .
Species Group V								
<i>Colophospermum mopane</i>	. . . . .	3 b . a .	+ + + . 1 . 1 + + 1 + r	1 a b b a a b a a 1	. . . . .	. . . . .	1 . . . .	. . . . .
<i>Melinis repens</i>	. . . . .	. . . . . + + + + +	1 . + . + + + . + . +	. + . . + . + a . .	. . . . .	+ . . . .	1 . + +	. . . . .
<i>Enneapogon cenchroides</i>	. . . . .	. . . . . + . . . . + +	+ . . . . + + . + . +	. + . . . . 1 . . . .	. . . . . + . . . .	+ . . . .	a . . +	. . . . .
<i>Combretum mossambicens</i>	. . . . .	. . . . . + + . . . . .	. . . . . + . . . . +	. . . . . + . . . . +	. . . . . r . . . . .	. . . . .	. . . + .	. . . . .
Species Group W								
<i>Aristida congesta</i>	+ m 1 + . + +	a a a m + b + + a +	1 + + + + + 1 . + 1 + +	. + . 1 + + 1 a + +	3 . . b 1 . . . . .	. . . . .	1 + + +	. . . . .
<i>Tephrosia polystachya</i>	. . . + 1 + b	1 . + 1 . + + . . .	1 + + + + + . .	+ 1 1 + . 1 + + + +	. + + + + . . . . .	. . . . .	+ + . . .	. . . . .
<i>Chamaecrista absus</i>	+ + + . + . .	. a . . . . + + . . .	. + + + 1 1 . 1 + + . +	+ + + . 1 + . + +	. . . . . + + + +	+ . . . .	. . . + .	. . . . .
<i>Grewia bicolor</i>	. . . . . b . . . . .	. . . . . . . . . . .	+ . . + . + . + + . +	+ + . . . . . + 1	. r . r . r . . . . .	. . . . .	. . . + +	. . . . .
<i>Zomia species</i>	. . . + . . .	1 . . + . . . . . . .	. . . . . + . . . . 1 . . . .	. . . + . . . . .	. . . . . + . . . .	. . . . .	+ + + . .	. . . . .
<i>Solanum panduriforme</i>	. . . + . + .	. + . . . + . . . . .	. . . . . + . . . . + . . . .	. . . . . + . . . . + 1	. . . . .	. . . . .	. . . 1 .	. . . . .
<i>Tragus berteronianus</i>	. . . . . + . . .	. . . + . . . . . . . .	. . . . . . . . . . .	. . . . . . . . . . .	. . . . .	. . . . .	. . . + .	. . . . .
<i>Indigofera lupatana</i>	. . . + 1 . .	. + . . + + + . . . .	. . . . . . . . . . .	. . . . . . . . . . .	. . . . .	+ . . . .	. . . a .	. . . . .
<i>Commiphora mollis</i>	. . . . . + . . . . .	. . . . . . . . + . . . .	. . . . . . . . . . .	. + . . . . . + . . . . .	. . . . .	. . . . .	. . . + .	. . . . .

Relevé numbers (Turboveg database)	1 1 1 2 | 1 1 1 1 1 2 2 | 2 2 2 2 3 3 3 3 4 4 3 | 5 3 3 4 4 4 4 5 6 7 | 6 6 6 6 7 7 7 7 | 6 6 6 7 7 7 | 6 6 7 7 7 | 6 6 6 6
Community number	1.1 | 1 | 1.2 | 2.1 | 2.2
<i>Andropogon gayanus</i>	. . 1 . . . . | + . . . . . 1 + | 1 + + + . a . 1 1 . + | . . . . + + 1 . . . | . . . . . . . . | . . 1 . 1 b | . . a . . | b 4 4 4
<i>Melhania forbesii</i>	. . . . . . | + . . . . + + + . | . . . . . . . . . . . . | . + . . . . . + + | . . + . + . . . | + . 1 . . . | . . . 1 . | . . + .
<i>Strychnos madagascariensis</i>	. . . . . . | + 1 a 1 1 . . . . . | . . . . + a . . 1 . . . | . . . . + . . + . . | . . . . r r r . | + + . r r . | . . + 1 1 | . . + .
<i>Ipomoea magnusiana</i>	. . . . . + | + . . . . . . . + | + . . 1 . + + + 1 . . . | . + . . + + . . . . | + . . . . + + . | . . . . + + | . . . . . | . . + . .
<i>Bracharia nigropedata</i>	. . . . . . | . + . . . . . . . . | . a . . + + a . . a + | . + . + a + + + . 1 | . + 1 + . . . 1 | . . . . . . | . a . . a | + . . b
<i>Vernonia fastigiata</i>	. . . . . . | . a . 1 . + + . . | . + . . + . 1 + . . + . | . . . . 1 + + + + . | . . . . + . . | . . . + . + | . + + 1 1 | + + . +
<i>Mundulea sericea</i>	. . . . . . | . . . . . . . . . . | . + + + . 1 . . 1 + | . . . . + . . . . | . . . . . . . . | . 1 1 . . . | . 1 . . . | . . r .
<i>Tricliceras schinzii</i>	. . . . . . | . . . + . . . . . . . | . . . . + + . . + . . . | . . . . . . . . . . | . . . . . . . . | . . . . . . | . . . + + | . . . + .
<i>Crabbea velutina</i>	. . . . . . | . . . . . . . . . . | + . . . . . . . + . . . | . . . . . . . . . . | . . . + . . . . | + . . . . . | + . . . . | . . . + +
<i>Tricalysia junodii</i>	. . . . . . | . . . . . . . . . . | . . . . . . . . . . | . + . . . . + . . . | . . . . . . . . . . | . . + . . . . | . + . . + | r . . .
<i>Asparagus setaceus</i>	. . . . . . | . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . + + | . . . . . . . . | . + + . . . . | . . . . . | . . . +

Relevé numbers
(Turboveg database)

4 5 5 5 5 5 6	4 4 4 5 7 4 4	2 2 2 4 5 5 5	1 1 1 1 3	1 2 2 2 3 3 5	5 6 6 6 7 6 7 6	3 4 5 6 6 7 6 6	6 0 0 4 4 5 4 9
8 2 3 7 7 7 9 7	4 4 6 9 8 6 0 4	3 4 8 7 0 1 7 4	1 1 6 3 3 7 9 2	9 9 1 6 7 3 8 1	9 1 1 3 3 2 0 4	3 3 7 0 7 0 5 3	3 1 1 0 0 4 8 3
0 3 5 2 5 7 1 2	6 7 5 7 3 9 3 3	9 0 0 0 9 2 4 5	2 4 5 7 8 0 5 3	3 0 5 3 2 2 3 4	6 2 3 8 2 2 6 4	7 3 9 1 6 2 0 4	1 2 5 5 8 9 2 8

Community number

1.1	1	1.2	2.1	2	2.2	3	4
-----	---	-----	-----	---	-----	---	---

Species Group E

<i>Eragrostis rigidior</i>	. . . + . . . . .	. 1	+ . 1 . 1 + 1 .	. . . . . 1 . . . . .	. . . . .	. . . . .	. + . . . . . +	. . . . .
<i>Pogonarthria squarrosa</i>	. . . . .	. . . . .	. 1 + + + .	. . . + . . .	. . . . .	. . . . .	. . . . . + .	. . . . .
<i>Aristida adscensionis</i>	. . . . .	. . . . .	. + . . . + .	. . . + . . .	. . . . .	. . . . .	. . . . . + .	. + . . . . .
<i>Sida dregei</i>	. . . . .	. . . . .	+ . . + + . .	. + . . . . .	. + . . . . .	. . . . .	. + . . . . .	. . . . .
<i>Blepharis integrifolia</i>	. . . . . + . . .	. . . . .	+ . . + . r .	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Commelina africana</i>	. . . . .	. . . . .	+ + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Melhania didyma</i>	. . . . .	. . . . .	. + . . . + .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Chamaecrista absus</i>	. . . . .	. . . . .	. . . . + . .	. . . . . + .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Abutilon austro-africanum</i>	. . . . .	. . . . .	+ . + . . . .	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .

Species Group F

<i>Bothriochloa radicans</i>	. . . . .	. . . . .	b a . . . 1 .	a . 1 3 a . 1 4	. 1 b . . . . .	. . . . .	. . . . .	. . . . .
<i>Sclerocarya birrea</i>	+ r . . .	. . . . . r . . .	. . . . . r . . .	4 + . + + + . r	r r r . . . + . .	. . . . .	. + . . . +	. . . . .
<i>Ipomoea crassipes</i>	. . . + . . . . .	. . . . . + . . .	. . . . .	. + + + . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Ehretia amoena</i>	. . . . .	. . . . .	. . . . .	+ . . + . r .	1 . . . . .	. . . . .	. . . . .	. . . . .
<i>Polygala sphenoptera</i>	. . . . .	. . . . .	. . . . .	. . . + . + .	. . . + . . .	. . . . .	. . . . .	. . . . .
<i>Eragrostis ciliaris</i>	. . . . .	. . . . . + . . .	. . . . .	+ . . + . . .	. + . . . . .	. . . . .	. . . . .	. . . . .
<i>Cyperus obtusiflorus</i>	. . . . .	. . . . .	. . . . .	+ . . . + . .	. + . . . . .	. . . . .	. . . . .	. . . . .
<i>Merremia palmata</i>	. . . . .	. . . . .	. . . . .	+ . . . 1 . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Hibiscus pusillus</i>	. . . . . + . . .	. . . . .	. . . . .	. . . + . . +	. . . . .	. . . . .	. . . . .	. . . . .

Species Group G

<i>Commiphora glandulosa</i>	. . . . .	. . . . .	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Seddera capensis</i>	. . . . .	. + . . . + . .	. + . + . r 1 .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Terminalia prunioides</i>	. . . . .	. . . . .	. . . . .	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .

Species Group H

<i>Indigofera bainesii</i>	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Orthosiphon suffrutescens</i>	+ . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Sericorema remotiflora</i>	. . . . . + . . .	. . . . . + . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Merremia kentrocaulos</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Ipomoea magnusiana</i>	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .

Species Group I

<i>Commiphora africana</i>	. . . . .	. . . . .	. + . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
<i>Tragia dioica</i>	. . . . .	. . . . .	. + . . . + . .	. 1 + . . + .	. + . a . . +	. . . . .	. . . . .	. . . . .

Relevé numbers
(Turboveg database)

4 5 5 5 5 5 6	4 4 4 4 5 7 4 4	2 2 2 4 5 5 5	1 1 1 1 3	1 2 2 2 3 3 5	5 6 6 6 7 6 7 6	3 4 5 6 6 7 6 6	6 0 0 4 4 5 4 9
8 2 3 7 7 7 9 7	4 4 6 9 8 6 0 4	3 4 8 7 0 1 7 4	1 1 6 3 3 7 9 2	9 9 1 6 7 3 8 1	9 1 1 3 3 2 0 4	3 3 7 0 7 0 5 3	3 1 1 0 0 4 8 3
0 3 5 2 5 7 1 2	6 7 5 7 3 9 3 3	9 0 0 0 9 2 4 5	2 4 5 7 8 0 5 3	3 0 5 3 2 2 3 4	6 2 3 8 2 2 6 4	7 3 9 1 6 2 0 4	1 2 5 5 8 9 2 8

Community number

1	1	1	1
1.1	1.2	2.1	2.2
			3
			4

Species Group L

<i>Tephrosia polystachya</i>	+ + . a + . + 1	. + 1 + + 1 . +	+ + . + + . +	+ . . + . +
<i>Fingerhuthia africana</i>	. + 1	. . + + . + + .	. + . + . . .
<i>Corbichonia decumbens</i>	. . . . . r	. + 1 + + . + . . .

Species Group M

<i>Phyllanthus maderaspatensis</i>	. . . + . . + + . . + +	. . . + + +
<i>Corchorus asplenifolius</i>	. . . + + . + + . . . + + +	. . . + + +
<i>Hermannia glanduligera</i>	. . . + . . + .	. . . + . . . .	. . . . . . .	. . . + . + . .	. . . + . . . .
<i>Rhynchosia totta</i>	. . . . . + + + 1 . +	. . . + . + + +	+ + + . + + + + + . . .

Species Group N

<i>Euclea divinorum</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. 1 + . b . a
<i>Chloris roxburghiana</i>	. . . . . . .	1 . . . . . .	. . . . . . r	. . . . . . .	. 1 + . . . 1
<i>Ruellia patula</i>	. . . . . . .	. + . . . . .	. . . . . . .	. . . . . . .	+ + + . . . .
<i>Asparagus plumosus</i>	. . . . . . .	. . . + . . . .	. . . . . . .	. . . . . . .	+ . + . . . .
<i>Zanthoxylum capense</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . . 1 + . .

Species Group O

<i>Abutilon fruticosum</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . + . 1 + .
<i>Sporobolus fimbriatus</i>	. . . . . . .	. . . . . + . .	. . . . . . .	. . . . . . .	. . . + . . .
<i>Elytraria acaulis</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . . + . . +
<i>Megalochlamys revoluta</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . . + . . .
<i>Enteropogon macrostachys</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . . + . . 1 . +
<i>Ximenesia americana</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . . . . .	. . . + . . 1 . .
<i>Leucas glabrata</i>	. . . . . . .	. . . + . . . .	. . . . . . .	. . . + . . . .	. . . + . . +
<i>Barleria lancifolia</i>	. . . . . . .	. . . . . . .	. . . . . . .	. . . + . . . .	. . . + . . + +

Species Group P

<i>Aristida congesta</i>	+ 1 + . . . + + .	. + . . + 1 +	+ a 1 + 1 . + .	+ + b + + + . +	+ a 1 1 + 1 + a	a a 4 + a . a +	+ 1 . + a 3 . .
<i>Digitaria eriantha</i>	a . b +	. 1 . . + . a a	+ a b b 1 b + a	a a b b a 1 1 a	a a . 1 a a .	a a 1 1 . . 3	. + b + a a . .
<i>Hibiscus micranthus</i>	. . . . . . .	. . . . . . .	. . . + + + .	. . . . . . .	. . . + + 1 + + .	. . . + + + 1 + + + + + . .
<i>Bothriochloa insculpta</i>	1 1 . . . + . 1	. . . a . + b b	. . . a a + . . .	. . . . . . .	. . . b a 1 3 .	. . . + . a 1 . .	. . . b 1 . . . +
<i>Combretum apiculatum</i>	+ . r 1 + 1 + .	. . . + . . . b	. + . a . 1 . . .	. a +	. . . + . + . +	3 b b 1 b . a +	. . . a
<i>Schmidtia pappophoroides</i>	. + . . . . . .	. + . b . 1 + 1	+ . . + + . 1 .	. + 1 . + + . 1	b a . a a + 1 1	. . . 1 . + + .	. . . + . 1 . .
<i>Cissus cornifolia</i>	+ . . + . . . .	. . . + . . . +	+ . . 1 1 1 + +	. 1 1 . . + + . + + . . . +	. . . + . . . +
<i>Vernonia fastigiata</i>	. . + . . . . .	. . . + . . 1 . +	+ + +	1 1 + + . . . +	. . . + + +

