

**INTERPRETATION OF THE *ACACIA KARROO* CLASS,
SOUTHERN AFRICA**

by

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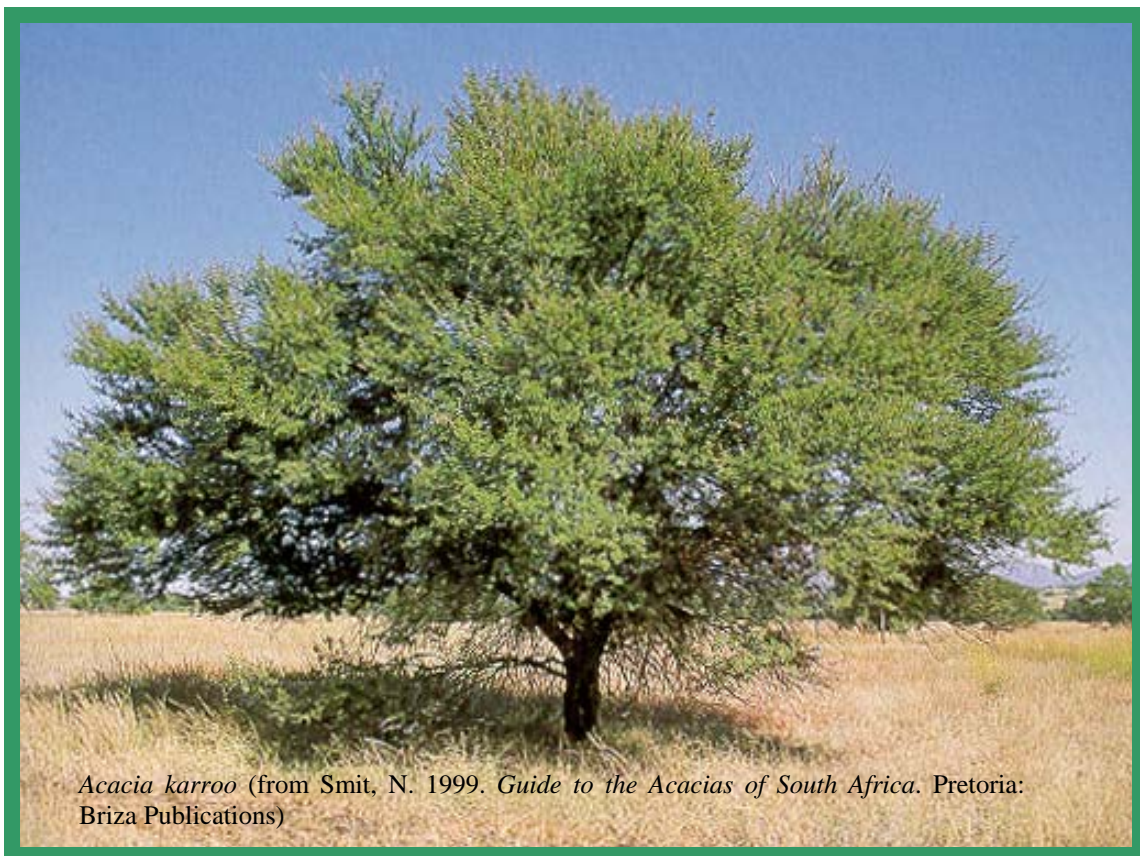
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Co-supervisor: Prof. G.J. Bredenkamp

It is the smallest of all seeds, but when it has grown it is the greatest of shrubs and becomes a tree, so that the birds of the air come and make nests in its branches.

Matthew 13: 32-33



Acacia karroo (from Smit, N. 1999. *Guide to the Acacias of South Africa*. Pretoria: Briza Publications)

Dedicated to my family and friends

SUMMARY

INTERPRETATION OF THE *ACACIA KARROO* CLASS, SOUTHERN AFRICA

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Acacia karroo is an ecologically important and one of the most widespread species in South Africa. There has been an opinion that *Acacia karroo*-dominated vegetation, especially that along river banks, should be classified under one class, and that a comprehensive syntaxonomic review of *Acacia karroo*-dominated syntaxa is needed. The present study was hence initiated with the aim of providing more insight into the syntaxonomic status of all the previously described *Acacia karroo* syntaxa.

A total of 1 553 relevés and 2 006 species from 60 phytosociological studies were hierarchically classified according to Braun-Blanquet procedures. TURBOVEG was used for the input, processing, and presentation of phytosociological data. MEGATAB was used to first construct the phytosociological and synoptic tables. TWINSpan was applied to the floristic data as a first approximation, after which Braun-Blanquet procedures were used to refine the classification. The result of the classification process was a suggested *Acacia karroo Class* differentiated into the following six orders:

- i) *Cyperus longus* – *Asparagus larycinus* Order associated with rivers and streams in the northern Free State. The species composition of this vegetation type indicates that it could represent a transformed *Hemarthria altissima* Class (Du Prezz & Bredenkamp 1991) brought about by degradation and disturbance, and the subsequent encroachment by *Acacia karroo*.
- ii) *Achyranthes aspera* – *Diospyros lycioides* Order represents riparian vegetation of the northern, central, and southern Free State. It mostly occurs on the well developed banks along the rivers, streams, and drainage lines, but can also be found on clayey soils on the floodplains adjacent to the rivers.
- iii) *Felicia filifolia* – *Tragus koelerioides* Order represents false karoid vegetation of the mountains, hills, ridges and valleys of the Graaff-Reinet and Cradock areas in the Eastern Cape, and Beaufort West in the Western Cape.
- iv) *Rhus ciliata* – *Rhus lancea* Order represents false karoid vegetation of the southern Free State and is mainly associated with undulating plains and gentle slopes.
- v) *Acacia mellifera* - *Eragrostis lehmanniana* Order represents vegetation of the Kalahari thornveld found in northwestern Free State, northeastern Northern Cape, as well as southern and central North-West.
- vi) *Teucrium trifidum* – *Themeda triandra* Order is found in northern Free State, in the eastern part of North-West, and also in eastern and western Gauteng, as well as in western Mpumalanga. It occurs in kloofs and sheltered valleys, and also on mountain slopes. It is also encountered on bottomlands and footslopes with deep clayey soils.
- vii) *Acacietalia karroo* (Eckhardt, Van Rooyen & Bredenkamp 1997) represents vegetation of the crests, slopes and footslopes of hills in central-northern KwaZulu-Natal but it is also encountered in the incised river valleys in southern KwaZulu-Natal.

The *Acacia karroo* Class is further differentiated into ten sub-orders, forty alliances, 110 associations, and 39 sub-associations. All communities were described and ecologically interpreted.

Keywords: *Acacia karroo*, alliance, association, Braun-Blanquet method, class, community, MEGATAB, order, synoptic table, TURBOVEG, TWINSPAN.

OPSOMMING

INTERPRETATION OF THE *ACACIA KARROO* CLASS, SOUTHERN AFRICA

deur

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Acacia karroo is ekologies belangrik en een van die wyd verspreidste boomsoorte in Suid-Afrika. 'n Algemene opvatting bestaan dat *Acacia karroo*-gedomineerde plantegroei, veral op rivieroewers en vloedvlaktes geklassifiseer behoort te word in een sintaksonomiese klas, en dat 'n omvattende sintaksonomiese oorsig van *Acacia karroo*-gedomineerde sintaksa nodig is. Die huidige studie is geïnisieer met die doel om meer insig op die sintaksonomiese status van al die beskryfde *Acacia karroo* sintaksa te gee.

'n Totaal van 1 553 relevés and 2 006 spesies uit 60 fitososiologiese studies is hierargies geklassifiseer volgens Braun-Blanquet prosedures. TURBOVEG is gebruik om die data vas te vang en die fitososiologiese data te proseseer. MEGATAB is gebruik om die fitososiologiese en sinoptiese tabelle te konstrueer. TWINSPAN is toegepas om die floristiese data aanvanklik te klassifiseer en daarna is dit deur middel van Braun-Blanquet

prosedures verfyn to finale sinoptiese tabelle. Die resultaat van die klassifikasie proses word as die *Acacia karroo* Klas voorgestel en is gedifferensieer in die volgende ses ordes:

i) *Cyperus longus* – *Asparagus lariginus* Orde geassosieer met riviere en strome in die noordelike Vrystaat. Die spesiesamestelling van hierdie sintakson dui daarop dat dit ‘n getransformeerde *Hemarthria altissima* Klass (Du Prez & Bredenkamp 1991) kan verteenwoordig. Die verandering is moontlike deur agteruitgang en versteuring veroorsaak wat gelei het tot indringing deur *Acacia karroo*.

ii) *Achyranthes aspera* – *Diospyros lycioides* Orde verteenwoordig oewer plantegroei in die noordelike, sentrale en suidelike Vrystaat. Dit kom hoofsaaklik op goed ontwikkelde rivier- en spruitoewers voor maar kan ook op klei gronde op vloedvlaktes langs riviere gevind word.

iii) *Felicia filifolia* – *Tragus koelerioides* Orde verteenwoordig vals karoo-plantegroei in berge, heuwels en valleie in die karoo streke naby Graaff-Reinet en Cradock in die OosKaap asook in die Beaufort Wes omgewing in die WesKaap.

iv) *Rhus ciliata* – *Rhus lancea* Orde verteenwoordig vals karoo-plantegroei in die suidelike Vrystaat en is veral met golwende vlaktes en platterige hellings geassosieer.

v) *Acacia mellifera* - *Eragrostis lehmanniana* Orde verteenwoordig plantegroei van die Kalahari doringveld in die noord-westelike Vrystaat, noordoos NoordKaap asook die sentrale deel van die Noord-Wes Provinsie.

vi) *Teucrium trifidum* – *Themeda triandra* Orde kom in die noord Vrystaat asook die oostelike dele van Noord-Wes, die westelike en oostelike dele van Gauteng sowel as in die westelike Mpumalanga voor. Dit kom in klowe en beskutte valleie asook op berghellings voor. Verder word dit ook gevind op laagliggende dele en voethellings waar diep klei-gronde voorkom.

vii) *Acacietalia karroo* (Eckhardt, Van Rooyen & Bredenkamp 1997) verteenwoordig plantegroei op kruine, hellings en voethellings van heuwels in sentraal en noord KwaZulu-Natal. Dit kom verder ook voor in die diep rivier valleie in suidelike KwaZulu-Natal.

Die *Acacia karroo* Klass word verder onderverdeel in tien sub-orde, veertig alliansies, 110 assosiasies en 39 sub-assosiasies. Al die syntaksa word beskryf en ekologies geïnterpreteer.

Sleutelwoorde: *Acacia karroo*, alliansie, assosiasie, Braun-Blanquet metode, klass, gemeenskap, MEGATAB, orde, synoptiese tabel, TURBOVEG, TWINSPAN.

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CHAPTER ONE

INTRODUCTION

Acacia karroo is the most widespread *Acacia* in our area, found in several biomes throughout southern Africa (Davidson & Jeppe 1981). It grows in bushveld, dry thornveld, grassland, woodland, coastal dunes and sands, as well as coastal scrub (Ross 1979; Davidson & Jeppe 1981). *A. karroo* grows on most soil types, but is often associated with eutrophic soils (Teague & Walker 1988). It is found on soils with a relatively high fertility such as clay and loam soils, often being associated with heavy, clayey soils on the banks of rivers and streams (Smit, 1999), including the banks of dry watercourses (Ross, 1979).

Over the years, various phytosociological studies have provided valuable insight into the various *Acacia karroo* communities in South Africa, and some *Acacia karroo* classes have been identified and described. In the reconnaissance of vegetation classes of the southern and eastern Orange Free State Du Preez & Bredenkamp (1991) recognised the *Acacia karroo* Riparian Thicket as a broad vegetation class occurring over a large part of southern Africa. Bezuidenhout, Bredenkamp & Theron (1994a) described a *Grewia flavae* – *Acacietea karroo* Class associated with quartzite ridges, chert ridges, lava hills and floodplains in North-West Province.

There has been an opinion that *Acacia karroo*-dominated vegetation, especially that along river banks, should be classified under one class (Du Preez 1991, Winterbach 1998), and that a comprehensive syntaxonomic review of *Acacia karroo*-dominated syntaxa is needed. In light of all this, the present study was initiated with the aim of providing more insight into the syntaxonomic status of all the previously described *Acacia karroo* syntaxa. The following were the two main points to consider:

- Because of its wide distribution range, and the fact that it occurs over various biomes, does *Acacia karroo*-dominated vegetation represent one or more than one class?
- What then is a 'typical' *Acacia karroo* class?

A 'typical' *Acacia karroo* Class is very difficult to characterise for various reasons:

- The class has a heterogeneous physiognomy and floristic composition as a result of the microtopography, soils and other site factors (Scheepers 1975).
- Biotic factors such as overgrazing and trampling result in the encroachment of mainly *Acacia karroo* and companion species into areas where grass species have poor basal cover (Scheepers 1975; Rossouw 1983; Müller 1986; Bezuidenhout & Bredenkamp 1990; Bredenkamp, Joubert & Bezuidenhout 1989; Kooij, Scheepers, Bredenkamp & Theron 1991, Du Preez 1991). In some instances such grassland communities are completely transformed.

The description of the *Acacia karroo* Riparian Thicket (Du Preez 1991) is the most accurate for the 'typical' *Acacia karroo* Class described in Chapter 6 of this manuscript. This class represents the thickets usually situated on well-developed levees along rivers, streams and drainage lines, and is also present on clayey soils on the low level terraces and flood plains adjacent to the rivers (Du Preez 1991). Vegetation of this class may also be found on gradual footslopes of hills and ridges (Bezuidenhout & Bredenkamp 1990, Bredenkamp & Bezuidenhout 1990), usually on deep alluvial or colluvial soils situated near drainage lines and rivers (Bredenkamp *et al.* 1989).

Transformed grassland communities encroached upon by *Acacia karroo* are also regarded as part of this class. They occur on clayey soils where overgrazing resulted in denuded grassland (Scheepers 1975; Rossouw 1983; Müller 1986; Bredenkamp & Bezuidenhout 1990; Bredenkamp *et al.* 1989; Kooij *et al.* 1990b,c,d; Kooij *et al.* 1991, Du Preez 1991).

In conclusion, it is worth noting that during the course of this study, certain changes in the classification of the *Acacia* genus have been suggested. According to recent taxonomic research, this genus as we currently know it cannot be maintained as a single entity, but is rather likely to be divided into the following five genera (Orchard & Maslin 2003, Brummitt 2004):

- *Acacia*, preserved for 948 Australian species, seven related species in the Pacific Islands, one or two species in the Madagascar region, and ten in tropical Asia. They all belong to the former sub-genus *Phyllodineae*.
- *Vachellia*, former sub-genus *Acacia*, will contain 163 pantropical species.
- *Senegalia*, former sub-genus *Aculeiferum*, will contain 203 pantropical species.
- *Acaciella*, former sub-genus *Aculeiferum* section *Filicinae*, will contain 15 species from the Americas.
- A yet unnamed genus with 13 species from the Americas.

According to this new proposed classification, ratified at the International Botanical Congress in Vienna in July 2005, *Acacia karroo* will belong to the *Senegalia* genus. However, a decision was made to retain the genus name *Acacia* for the purposes of this study as no formal name combinations have as yet been formally published in the literature. In addition, there have been objections towards preserving the name *Acacia* for the Australian and other related species (Luckow, M., Hughes, C., Schrire, B., Winter, P., Fagg, C., Fortunato, R., Hurter, J., Rico, L., Breteler, F.J., Bruneau, A., Caccavari, M., Craven, L., Crisp, M., Delgado, A.S., Demissew, S., Doyle, J.J., Grether, R., Harris, S., Herendeen, P.S., Hernández, H.M., Hirsch, A.M., Jobson, R., Klitgaard, B.B., Labat, J., Lock, M., MacKinder, B., Pfeil, B., Simpson, B.B., Smith, G.F., Sousa, M.S., Timberlake, J., van der Maesen, J.G., Van Wyk, A.E., Vorster, P., Willis, C.K., Wieringa, J.J. & Wojciechowski, M.F. 2005).

CHAPTER TWO

BACKGROUND ON *ACACIA KARROO* AND RELATED SPECIES

Acacia karroo is one of the most useful and widespread trees in Africa (Palmer & Pitman, 1972). It belongs to the Family Fabaceae (Thorn-tree family), which is the third largest woody plant family in southern Africa. A total of 40 *Acacia* species, subspecies and varieties are represented in South Africa (Smit, 1999). As mentioned in Chapter 1, this genus is to be split into five genera.

The name *Acacia* is derived from the Greek word 'akis' meaning 'point' or 'barb'. *Karoo* distinguishes the species from the other 40-plus trees of the *Acacia* genus. It refers to the Karoo, a semi-arid region in South Africa. It does not, however, signify that this is a species of the Karoo region alone, but that it is the principal and most conspicuous tree of this semi-arid region (Palmer & Pitman, 1972). This specific name is one of the old spellings of karoo that cannot be corrected because of the laws governing botanical nomenclature (Aubrey & Reynolds, 2002).

Acacia refers to the outstanding characteristic of this genus in Africa – its thorns; which may be straight, hooked; in pairs, in three's, or scattered. These are usually the stipules – the leafy outgrowths at the base of the leaves - which in acacias become hard and spiny (Palmer & Pitman, 1972). The thorns on African acacias are important for identification and they may be divided into five main groups according to the size, shape and position of the thorns (Aubrey & Reynolds, 2002). In contrast the Australian *Acacia* species (wattles), which have become serious invader weeds in southern Africa, are all spineless (Van Wyk & Van Wyk, 1997).

The *Acacias* form a very conspicuous component of the woody and shrub vegetation of southern Africa, and they form a most interesting group of plants from a taxonomic, ecological and physiological point of view. They are pod bearing woody plants with thorns, and range from shrubs to large trees. Some species tend to be sprawling or climbing and this character varies with habitat (Davidson & Jeppe, 1981). Some species are very widely distributed and occupy a diverse range of habitats, while others are very restricted in their distribution and are confined to

special ecological niches. Those with an extensive distribution range, like *Acacia karroo*, can be found in several biomes. *Acacia* trees can be found forming local dominant stands in biomes like the Grassland and Nama-Karoo, where woody plants are not such a prominent feature. However, the Savanna biome (bushveld) is clearly distinct with the highest concentration of *Acacia* species (Smit, 1999).

Of the 40-plus species in southern Africa, several are very distinctive and easily recognised by their characteristic growth form, by bark, or by some other peculiarity. The recognition and identification of others, however, is not always simple. This is partly because of the existence among the southern African acacias of several complexes, each containing a number of closely related and taxonomically difficult species. The difficulty experienced in identifying some of the species within each complex is aggravated by the fact that some, for example *A. karroo*, exhibit a tremendous range of morphological variation (Carr, 1976). As Smit (1999) notes, the variation in *A. karroo* is apparently regional with plants from different geographical areas looking distinctly different with regard to one or more features.

The “typical” form of *Acacia karroo* grows in the Karoo, Free State, interior regions of KwaZulu-Natal and over most of the northern parts of the country (Smit, 1999). It is a small to medium-sized tree of 5-12m in height with a rough dark bark, longitudinally fissured and rusty red branches. The foliage is a dense covering of dark green compound leaves. It is usually single-stemmed though multi-stemmed plants are not uncommon, with a rounded and somewhat spreading crown (Palmer & Pitman, 1972; Carr, 1976; Ross, 1979; Davidson & Jeppe, 1981; Smit, 1999). Its most striking feature is its long, paired, straight, shining white thorns which cover the branches. These thorns have a protective function and indicate a remarkable adaptation of *A. karroo* to its environment. They are more numerous and full-sized on the lower branches that are within reach of animals while the higher parts of larger trees are less armed (Palmer & Pitman, 1972).

The extreme variation in *Acacia karroo* form has led to confusions among botanists as many of the variations have been described as different species in the past, resulting in numerous synonyms. One example of this variation is the shrubby form found in the Nongoma District of

KwaZulu-Natal that has a dark smooth bark, horizontally fissured, and a remarkable ability to resist grass fires. It was given a separate name *Acacia inconflagrabilis*, a name indicating “the acacia that does not burn” (Palmer & Pitman, 1972). Another example is the form previously known as *Acacia natalitia* that is found chiefly in the Eastern Cape, KwaZulu-Natal, Swaziland, Mpumalanga, Zimbabwe and Mozambique (Smit, 1999). It has a light, almost white bark and narrower, more numerous pinnae and leaflets, than the typical form (Palmer & Pitman, 1972).

The uncertainty regarding the variations in *A. karroo* has resurfaced among some botanists recently as they consider these differences in form to be distinct enough to warrant division of the species into sub-species or at least varieties, or even to again regard some forms as different species altogether. But the general impression at present is to regard these variations merely as forms of the very variable *Acacia karroo* because even though these different forms are usually distinctive, they are linked to the “central *A. karroo* gene-pool” by numerous and varied intermediate stages that become progressively less and less distinct until it becomes difficult to delimit each variant clearly (Smit, 1999). As a result, many specimens are difficult to assign to a particular variant with any degree of certainty. As Ross (1979) correctly concludes, it therefore seems preferable to regard *A. karroo* as an inherently variable polymorphic species in which no formal infraspecific categories are recognised rather than to fragment the species into a number of somewhat arbitrary infraspecific taxa.

Acacia karroo is closely related to, and shares many features with a group of acacias which have sticky, glandular pods, the pods often appearing as small, reddish-brown pods with conspicuous dots. The species are *A. tenuispina*, *A. nebrownii*, *A. permixta*, *A. swazica*, *A. exuvialis* and *A. borleae*. *A. karroo* differs from them all in lacking the glandular pods (Ross, 1979; Smit, 1999). Due to the highly variable nature of the species, it is possible that some of its different forms may superficially resemble various other species like *A. gerrardii*, *A. nilotica* and *A. robusta* (Smit, 1999).

2.1 ECOLOGICAL SIGNIFICANCE

Ecologically, this is an important species, tightly woven into the lives of people and animals (Palmer & Pitman, 1972).

2.1.1 VALUE AS FODDER AND FOOD SUPPLEMENT

Acacia karroo attracts countless insects, and therefore birds, which in their turn attract lizards, snakes, and mammals, so that in an indirect way it provides food for many creatures. The larvae of several butterfly species feed on the pods and flowers. Even thorns and shoots, especially of young trees, are the food of some butterfly species (Palmer & Pitman, 1972). Its flowers, and those of several other species like *A. mellifera*, *A. caffra*, and *A. robusta*, are important sources of nectar for bees and the production of honey (Smit, 1999). As Aubrey and Reynolds (2002) note, these trees are important for bee-farming as they indirectly result in the production of a pleasantly-flavoured honey.

Furthermore, parts of *Acacia karroo*, and other *Acacia* species, have traditionally been used as food for humans. *Acacia* species can produce large quantities of seeds and in times of need the seeds have been eaten by pastoral people (Coe & Coe, 1987). *Acacia* trees may also indirectly provide food like the edible larvae found in the dead wood of *A. robusta* (Smit, 1999). *A. hebeclada* also indirectly provides food by acting as a “host” to the South African species of truffles. Truffles are underground edible fungi that grow in association with certain species of trees. They are regarded as delicacies and high prices are paid for them (Palmer & Pitman, 1972).

Acacia karroo is particularly a good fodder tree and forms an important part of the diet of a wide range of herbivore species (Palmer & Pitman, 1972). It is highly palatable (Owen-Smith & Cooper, 1987) and acceptable to both domestic and wild species at all stages of maturity despite its thorniness (Teague, 1989). Its foliage is highly favoured by stock and game, so are its seeds and dehiscent pods, which are rich in protein (Pellew & Southgate, 1984), though most animals prefer indehiscent pods (Coe & Coe, 1987; Miller, 1995).

The pods and seeds also play an important role as feed supplements during the dry season (Miller, 1995) and are sometimes collected by farmers to feed their livestock. *Acacia* trees are known to flower profusely and likewise, *Acacia karroo* flowers also form an important food supplement for animals (Smit, 1999). In the Eastern Cape, it has been observed that *Acacia karroo* is selected by goats in preference to grass. However, if the amount of browse available is limited, or when grass is green following rain, they eat considerable amounts of grass (Teague, 1989).

Tests have shown the foliage, pods and flowers of *A. karroo* to be free of hydrocyanic poisoning, a self-protection mechanism used by many trees (Aubrey & Reynolds, 2002). According to Stoltenow and Lardy (1998), hydrocyanic acid, prussic acid or cyanide are all terms relating to the same toxic substance, which is one of the most rapidly acting toxins that affects mammals. The authors note that it is most common in sorghums and related species, however some *Acacia* species have been found to pose the danger of such poisoning to animals. These include *A. erioloba*, whose pods and young leaves have been found to contain prussic acid; as well as the wilted leaves of *A. sieberiana* (Smit, 1999).

Prussic acid normally is not present in plants (Stanton, 2001). However a number of common plants may accumulate large quantities of prussic acid (cyanogenic compounds). These cyanogenic compounds are located in epidermal cells (outer tissue) of the plant, while the enzymes which enable prussic acid production are located in the mesophyll cells (leaf tissue). Any event that causes the plant cell to rupture allowing the cyanogenic compound and the enzyme to combine will produce prussic acid. Plant cells can be ruptured by cutting, wilting, freezing, drought, crushing, trampling, chewing, or chopping (Stoltenow & Lardy, 1998).

Prussic acid poisoning can occur within a few minutes after an animal consumes forage high in prussic acid potential (Allison & Baker, 1980). Ruminant animals (cattle and sheep) are more susceptible to prussic acid poisoning than non-ruminant animals because the ruminal microorganisms have enzymes which will release prussic acid in the animal's digestive tract (Stoltenow & Lardy, 1998). If poisoning occurs from within the rumen, symptoms may take

slightly longer to appear depending upon the animal's condition, feed sources, and type and volume of forage consumed (Allison & Baker, 1980).

Once plants containing prussic acid have been consumed, the toxin rapidly enters the blood stream and is transported throughout the body of the animal. Prussic acid inhibits oxygen utilisation by the cells in the animal's body. In essence, the animal suffocates (Stoltenow & Lardy, 1998). The first symptoms of prussic acid poisoning are accelerated and deep respiration. The nose and mouth may become filled with foam, and in some cases, involuntary urination may occur. These symptoms are followed by depression, inability to stand, severe difficulty in breathing, and finally death (Allison & Baker, 1980).

2.1.2 BUSH ENCROACHMENT

Acacias are, on the whole, easy to grow, frost being the principal limiting factor in many cases. The ease with which *Acacias* grow has facilitated their growth in parts, where they have ousted less hardy plants, resulting in some areas in a dense impenetrable mass of thorn bush, useless to men or animals (Palmer & Pitman, 1972). They are an aggressive invader of valuable farming land and grazing areas, a phenomenon that is usually referred to as bush encroachment.

Bush encroachment in modern times has thus become a serious ecological and farming problem common to many grazing areas throughout grassland and savanna areas of Southern Africa (Du Toit, 1967). *Acacia karroo* encroachment, in particular, is a serious ecological problem in certain veld types in South Africa, especially in the Nama-Karoo, Grassland and Savanna Biomes. The actual phenomenon of bush encroachment is a natural process and in ecological terms, comprises a progression in the plant succession from a lower to a higher seral stage, namely, some form of scrub forest (Trollope, 1980). In other words, it is a transition from grassy to more shrubby ecosystems (Van Vegten, 1983) whereby trees and shrubs invade into open grassland or thicken up in already wooded areas (Trollope, 1980).

One of the most disturbing examples of bush encroachment in South Africa is the intrusion of thorn shrub into what is considered to be climax grassland. Although various encroaching species can be found, *Acacia karroo* is the most important intruder into the grasslands of the Eastern Cape (Du Toit, 1967; Acocks, 1988). These authors state that there is evidence that *A. karroo* is also invading the “Dry *Cymbopogon-Themeda* veld” of the Free State area and the North West Province which until relatively recently were open grassland. In the Northern Cape, encroaching bush has already covered 2.5 million hectares (Moore, Van Niekerk, Knight & Wessels, 1985). Other areas affected by this phenomenon include KwaZulu-Natal (Brown & Booyesen, 1969), as well as Botswana (Van Vegten, 1983) and Zimbabwe (Trollope, 1980).

The most detrimental effect of bush encroachment to farming is that it depresses the production of grasses, mainly due to tree-grass competition for soil moisture (Du Toit, 1968). Browse is generally a poor substitute for grass, especially in sheep/cattle areas, and bush intrusion has already drastically reduced the carrying capacity of vast areas (Du Toit, 1972b). In some parts of the Molopo area bush encroachment is thought to have already decreased grass production by 80 per cent and more. This depressing effect on grass production has resulted in many farms being uneconomical units (Moore *et al.*, 1985).

2.1.2.1 FACTORS PROMOTING BUSH ENCROACHMENT

Acacia species regenerate vegetatively and from seed, with the latter method being dominant (Mucunguzi, 1995). The encroaching species of *Acacia* are spread by seed, and many of these species produce seed having a high percentage of dormancy due to seed coat impermeability (Brown & Booyesen, 1969). According to O'Connor (1995), the encroachment of acacias and other woody species requires successful seed dispersal, germination and seedling establishment.

Germination and seedling establishment are the two major phases in the regeneration of acacias characterized by high mortality rates that influence the populations of acacias (Mucunguzi, 1995). Seedling establishment can be influenced by moisture availability, irradiance and competition from established vegetation, both trees and the grass sward (O'Connor, 1995). Most *Acacia*

species, including *A. karroo*, are thought to be heliophytic and to require high irradiance levels for optimal growth, although *A. karroo* can operate as a facultative sciophyte under certain levels of low irradiance (Du Toit, 1967).

What makes *Acacia karroo* such a successful and prolific encroacher is the fact that it is an adaptable pioneer with an ability to establish itself without shade, shelter or protection from grass fires (Palmer & Pitman, 1972). It is fast growing; it is tolerant of and is believed to have evolved under utilisation by insect and mammalian herbivory and fire, since it has shown itself to be tolerant of defoliation by ungulate herbivory and has the ability to coppice strongly following death or removal of aerial parts by fire or other means (Teague & Walker, 1988). Another contributing factor to the ability of *A. karroo* to encroach is the fact that its seeds have a great tolerance to high temperatures produced during burning; with fire additionally having been observed to stimulate the germination of dormant *A. karroo* seeds (Mbalo & Witkowski, 1997).

According to Trollope (1980), the main factors which prevented bush encroachment before the era of commercial livestock production could have been fire, browsing mechanical damage by large wild ungulates (elephants), grass competition, insects, plant diseases, meteorological phenomena (unseasonal frost) and human activities (agriculture). On the other hand, the factors promoting encroachment in the modern era are complex.

The most widely prevalent assumption is that the encroachment of many woody species has been facilitated by the elimination of veld burning and the introduction of domestic livestock and subsequent “overgrazing” (Du Toit, 1972a; Van Vegten, 1983; O’Connor, 1995). Sustained heavy grazing of grasses can reduce their above- and below-ground biomass, and resource use, which may promote the establishment of woody seedlings because of increased irradiance at ground level and increased availability of below-ground resources (O’Connor, 1995).

Nevertheless, even without the depletion of the grass sward, O’Connor (1995) showed in a study in the False Thornveld of the Eastern Cape that *A. karroo* seedlings are capable of establishing and surviving within a dense grass sward for at least a year, tolerant of low irradiance and of interference. *A. karroo* seedlings were observed to emerge better under conditions of lowest

irradiance and greatest competition and achieved densities far greater than under comparable high irradiance conditions. The beneficial effect of the shade from the grass sward is attributed to the improved soil moisture conditions under shading.

The results of this study suggest that *A. karroo* can develop a seedling bank within an established grass sward, and that the first year of seedling establishment is not strongly influenced by competition. Therefore, O'Connor (1995) suggests that competition from a grass sward may assume greater importance in the growing seasons following the first season. According to the author, the effects of heavy grazing on the grass sward may therefore promote the growth of already established seedlings, rather than promote emergence and initial seedling growth.

The results also distinguish *A. karroo* from some other *Acacia* species whose seedlings appear very sensitive to low irradiance levels (Smith & Goodman, 1987; O'Connor, 1995). In a study of the effects of shading on the establishment and growth of *A. tortilis* seedlings under controlled environmental conditions, it was found that reductions in irradiance (similar to those measured under tree canopies in the field) led to a significant decrease in both root and shoot biomass, as well as changes in carbon allocation. These results suggest that irradiance under both tree and grass canopies could limit seedling establishment, either as a sole factor or in combination with low moisture, predation or fire (Smith & Goodman, 1986).

A further possible contribution of livestock to bush encroachment is by consuming and dispersing seeds of invasive woody species, with their dung pats acting as a suitable environment for seedling germination and establishment (Miller, 1995; O'Connor, 1995). *A. karroo* has dehiscent pods, and is therefore not one of the *Acacia* species considered to be obligately dispersed by mammalian ungulates (Coe & Coe, 1987; Miller, 1995), but the seed of this species is known to be ingested and disseminated by domestic livestock (Miller, 1995; O'Connor, 1995). *A. karroo*, and other species such as *A. sieberiana*, *A. nilotica* and *A. tortilis*, are hard-seeded (Brown & Booysen, 1969) and most of their seeds pass undamaged through an animal's gut (Hoffman, Cowling, Douie & Pierce, 1989). These species are hence thought to be adapted to herbivory due to their hard-seededness.

Whether the consumption by herbivores is advantageous or disadvantageous to *Acacia* seeds is a complex issue. Several authors have suggested that passage of indehiscent *Acacia* seeds through an animal's gut enhances seed germination success (Pellew & Southgate, 1984; Hoffman *et al.*, 1989), a suggestion that is disputed by Coe and Coe (1987). However, Miller (1995) has shown that gut passage does enhance *Acacia* seed germination for both indehiscent and dehiscent species, *Acacia karroo* included.

According to Miller (1995), *Acacia* seeds ingested and defecated by mammalian herbivores have a greater and faster germination than uningested seeds. The author further notes that this is important in seedling establishment since seedlings must establish quickly to avoid predation and other sources of mortality. Though many *Acacia* species are hard-seeded, enhanced germination following gut passage is thought to be either due to the animal's digestive juices softening the seed coat, or the abrasive action of the gut (Pellew & Southgate, 1984; Hoffman *et al.*, 1989; Miller, 1995).

Another advantage of *Acacia* seed ingestion is that it reduces the effect of bruchid beetle parasitism (Pellew & Southgate, 1984). Bruchid beetles (Bruchidae) are common *Acacia* seed predators (Coe & Coe, 1987; Hoffman *et al.*, 1989; Mucunguzi, 1995). Female adults lay eggs on or in developing pods and on emergence from the eggs, larvae eat through the testa (seed coat) wall and enter the seed where they consume the contents during the course of their development (Mucunguzi, 1995).

Mature adults emerge from small circular holes chewed by the larvae off the testa wall (Coe & Coe, 1987). If the predators are still in the egg or early larval stages then ingestion of the pods by herbivores kills them before they are able to mature and eat the seed embryos (Hoffman *et al.*, 1989). Ingestion, therefore, reduces the effect of the seed parasite and increases the germination rate, by encouraging the seed to germinate before the parasite has destroyed the seed content (Pellew & Southgate, 1984).

2.1.2.2 COMBATING BUSH ENCROACHMENT

Clearing of woody species has been found to greatly increase grass- and subsequently animal production (Du Toit 1968; Moore *et al.*, 1985). Mechanical, chemical and biological methods are employed in trying to control the spread of bush. Chemicals such as Tordon 225 and tebuthiuron have been successfully used (Moore *et al.*, 1985). According to the authors, tebuthiuron shows great promise for controlling bush encroachment in the Northern Cape because of its selectivity in favour of the more desirable woody species.

Biological methods sometimes employed include the controlled use of herbivores (especially goats) and fire. Du Toit (1972b) observed in a study in the Eastern Cape that in comparison to continuous/rotational sheep grazing of an *A. karroo* stand, continuous grazing by goats resulted in a higher mortality of trees and more efficient control of seedling regrowth than did rotational grazing. As a result, there was a marked improvement in the cover, composition and vigour of the grass sward where goats grazed (Du Toit, 1972b).

Fire has also been extensively used in combating bush encroachment in savanna because it is known to maintain a balance of grass to trees and shrubs in the savanna areas (Trollope, 1980). However, a rather contradictory situation exists in the literature concerning the effect of fire on the balance of grass to bush. The general observation is that fire favours the development and maintenance of a predominantly grassland vegetation by destroying the juveniles trees and shrubs and preventing the development of more mature plants to a taller fire resistant stage (Trollope, 1980).

However, once the bush has become dominant and is suppressing the grass, fire is no longer effective because of insufficient grass fuel being present to support an intense enough fire. Additionally, many of the tree and shrub species of the savanna areas are highly resistant to fire alone due to dormant buds at the base of the stem from which coppicing occurs. Therefore, burning in some instances merely destroys the aerial portions of trees and shrubs causing them to coppice and produce numerous stems, thus aggravating the problem (Trollope, 1980).

In general, Trollope (1980) observes that fire has different roles in controlling bush encroachment in the moist and arid savannas. In the moist savanna regions (>600 mm p.a) it is possible to control bush encroachment with fire alone, because even though the bush species coppice, the rainfall is sufficient and reliable enough to enable adequate grass material to accumulate under grazing conditions to support frequent enough fires to burn down the coppice growth and control bush seedlings. In the arid savanna regions (<600 mm p.a) which constitute the major portion of the South African savannas, the rainfall is too low and erratic to support frequent enough fires under grazing conditions to prevent the regeneration of bush from coppice and seedling growth (Trollope, 1980).

In grassland, Du Toit (1972a) made observations that the application of fire to combat *A. karroo* intrusion in the Eastern Cape sweetveld was not a practical approach. While fire was found to retard *A. karroo* seedling development, it could however not prevent the seedling establishment. In the sweetveld, herbage production is low except in years with exceptional rainfall, while the potential for herbage loss or wastage is high. Fierce fires to combat bush seedlings are therefore unlikely (Du Toit, 1972a). On investigating the effect of burning on *A. karroo* seedlings, Story (1952) (cited in Du Toit, 1972a) found that the effect of fire depended on the size of plants and the nature of the burn. However, even with a fierce burn, plants a year old survived destruction of top growth, making strong growth from the base.

All in all, while the eradication of *A. karroo* individuals presents little practical difficulty, it is unfortunately true that once the thorn has invaded an area where it was previously absent, it is very difficult to eradicate, since a seed bank which did not previously exist, is established. *A. karroo* trees can produce up to 19 000 seeds annually and these have a high longevity. Consequently, destruction of a stand of *A. karroo* is often followed by considerable regeneration as a result of seedling establishment. This reinfestation seriously affects the economics of bush control and discourages further efforts (Du Toit, 1972a).

2.1.3 SOIL ENRICHMENT

The effect of *A. karroo*, and other tree species, on grasses may not always be negative. It has been shown that grass production can be greatly enhanced by removal of the trees, but there is also evidence that the trees may have a beneficial effect (Kennard & Walker, 1973). Firstly, *A. karroo* is a leguminous tree known to form root nodules, which are swellings on the root that contain nitrogen-fixing microorganisms known as *Rhizobium*. *Rhizobium* possesses the enzyme systems that trap atmospheric nitrogen and convert it to nitrogen compounds useful to plants (Alcama, 1991).

The bulk of the nitrogen compounds accumulates when *Rhizobium* cells die. Legumes like *A. karroo* then use the compounds to construct amino acids and, ultimately, protein (Alcama, 1991). In addition, soil fertility is enhanced under these trees because the nitrogen content in the soil actually increases, thereby becoming available for other plant species (Högberg, 1986; Smit & Swart, 1994). Farmers in bushveld consider *A. karroo* an indicator of sweet veld, which is prized for good grazing and fertile soils (Palmer & Pitman, 1972; Aubrey & Reynolds, 2002).

Secondly, *A. karroo* has a long taproot which enables it to use water and nutrients from deep underground, this and its ability to fix nitrogen, lead to some grasses and other plants thriving in its shade (Aubrey & Reynolds, 2002). The ability of *A. karroo* to use water from deep underground means that it can grow in arid and otherwise inhospitable environments, as long as there is an assured supply of underground water (Acocks, 1988). It hence also acts as an indicator of surface and underground water, especially in arid land (Palmer & Pitman, 1972).

Several studies have been conducted on the positive effect of woody plants on grasses. A well documented tree-grass association in southern African savannas is that of *Panicum maximum* with tree canopies, especially those of several *Acacia* species. *P. maximum* is highly palatable to cattle and other grazers and it has a high production potential. Accordingly, it is considered to be one of the most important fodder grass species in many savanna areas. The grass exhibits a strong association with tree canopy cover, often forming pure stands under trees and seldom occurring in the open (Kennard & Walker, 1973). Smit and Swart (1994) suggest that such grass-

tree associations, which exist in many semi-arid savanna areas, warrant that bush control measures should not simply imply a complete removal of woody plants, but rather tree thinning with a view to reducing negative competition effects.

It has been suggested that possible contributing factors to this association are enhancement of the nutrient supply under tree canopies, especially in respect of Nitrogen and Phosphorus, and enhanced germination of *P. maximum* seeds due to the relative abundance of litter and low temperatures under tree canopies (Kennard & Walker, 1973). Results of an investigation into the relation between tree height of *A. karroo* and *A. tortilis* and the associated occurrence of *P. maximum* in the Sourish Mixed Bushveld (Acocks 1988) of Limpopo Province (formerly Northern Province) showed that *P. maximum* was mainly associated with larger trees. The grass attained pure stands under *A. tortilis* and *A. karroo* trees of >2.0 m and >4.0 m heights respectively (Smit & van Romburgh, 1993).

In the False Thornveld (Acocks 1988) of the Eastern Cape, Stuart-Hill, Tainton and Barnard (1987) demonstrated that the net effect of the favourable or unfavourable influences of *A. karroo* on grass production is dependent on tree density. It was observed that in situations where there were a few *A. karroo* trees, grass production was greater than where there were no trees, but declined as tree density increased beyond a critical level. Another consistent pattern of grass production was observed around isolated *A. karroo* trees, which was characterised by high yields under and immediately south of the tree canopy, and low yields immediately to the north of the canopy. The former was attributed to favourable influences by the tree, such as shade and tree leaf litter, whereas the latter was attributed to reduced water input associated with physical redistribution of rainfall by the tree and competition from the tree for soil water.

2.2 ECONOMIC USES

The value of *A. karroo* is enormous and the list of its uses is endless, hence the strong impression among some people that this species is indeed one of the miracles of the African bush.

2.2.1 DOMESTIC USES

Acacia karroo is of considerable economic value as almost all of its parts, including bark, pods, seeds, leaves and thorns are extremely useful to both humans and animals. For example, the thorns are used as sewing needles, pegs or pins, while its branches are used extensively in farms for the construction of fencing kraals to protect livestock from predators (Smit, 1999). The wood of *A. karroo* has excellent fuel properties, as its heartwood is heavy and hard (Aubrey & Reynolds, 2002). It hence provides valuable fuel for many rural communities, which still rely on wood as the only source of fuel for cooking and heating. In many rural communities the wood is also used as rough construction material in the building of traditional huts and fences (Smit, 1999).

The bark, leaves, gum and other parts are used medicinally in many ways. An infusion of the bark is used to cure diarrhoea and dysentery, while the dried and powdered form of its gum is used for eye treatments (Palmer & Pitman, 1972). A boiled liquid from the bark is sometimes used to treat cattle which have tulip poisoning caused by *Moraea species* [*Homeria* sp.], bulbous plants which are poisonous to stock (Aubrey & Reynolds, 2002). Other *Acacia* species are known to have medicinal properties as well. The leaves of *A. caffra* are chewed for stomach ache, the bark of *A. erioloba* is burnt, crushed and used in treating headaches and the bark of *A. xanthophloea* is used for fevers and eye complaints (Smit, 1999).

2.2.2 COMMERCIAL VALUE

In addition to all the domestic uses of *Acacia karroo*, various commercial products are also obtained from the tree, of which gum is one of the most important. In fact, *A. karroo* gets its common name 'sweet thorn' from this gum which is exuded from wounds in the bark (Aubrey & Reynolds, 2002). This pleasant tasting gum is eaten by people and animals such as monkeys (*Cercopithecus* spp.) and bushbabies (*Galago* spp). It was exported in the past as "Cape Gum"

for use in the confectionary trade (Palmer & Pitman, 1972), but is at present used as an adhesive and as a mouthwash for thrush. It is similar to gum arabic, originally from *A. senegal*, which is most prominently used to thicken many convenience foods, pharmaceuticals and cosmetics, but is also used as a water soluble glue and as a component of water-colour paints and printing inks (Van Wyk & Van Wyk, 1997).

The hard and tough nature of *A. karroo* wood makes it suitable for making furniture, poles, and fence-posts. It is also used to make wooden carvings, which are very popular ornaments in the tourism industry. Stems are cut and used to make woven baskets, while the bark is used to make ropes and mats. This bark and that of several other *Acacia* species, notably *A. nilotica* (bark and pods) contains tannin (Smit, 1999), which is widely used in the tanning of leather, giving it a reddish colour (Aubrey & Reynolds, 2002).

Tannins are naturally occurring plant polyphenols. Their main characteristic is that they bind and precipitate proteins. Tannins act as a defense mechanism in plants against pathogens, herbivores and hostile environmental conditions (Cannas, 2001). The commercial extraction of tannin in this country is mainly from Black Wattle (*Acacia mearnsii*), an introduced Australian species of which the bark yields 36-44 % tannin (Smit, 1999).

CHAPTER THREE

STUDY AREA

Acacia karroo is the most widespread *Acacia* in our area, found throughout southern Africa (Davidson & Jeppe, 1981; Van Wyk & Van Wyk, 1997). It has an extensive distribution range that includes several biomes. It is a species with a wide habitat tolerance as demonstrated by its wide distribution range. It is very adaptable, growing under many differing conditions of soil, climate, and altitude (Palmer & Pitman, 1972).

3.1 ACACIA KARROO DISTRIBUTION AND BROAD HABITAT DESCRIPTION

A. karroo can be found occurring in sub-humid to arid areas, as well as in coastal to upland habitats. Though it has a wide tolerance of moisture and temperature (Teague & Walker, 1988), intense cold and lack of moisture appear to be limiting factors, for it is seldom found on the higher slopes of mountains, while in the arid areas it is associated with sub-soil moisture or stream banks (Palmer & Pitman, 1972). However, of all the South African *Acacia* species it is likely the most tolerant to cold (Smit, 1999).

It grows on most soil types, but is often associated with eutrophic soils (Teague & Walker, 1988). It is found on soils with a relatively high fertility such as clay and loam soils, often being associated with heavy, clayey soils on the banks of rivers and streams (Smit, 1999), including the banks of dry watercourses (Ross, 1979). *A. karroo* also grows in bushveld, dry thornveld, grassland, woodland, coastal dunes and sands, as well as coastal scrub (Ross, 1979; Davidson & Jeppe, 1981).

3.2. PHYSICAL ENVIRONMENT

According to Kooij, Bredenkamp and Theron (1990), knowledge of the physical environment of an area is necessary for the understanding, and therefore, ecological interpretation of the abstract vegetation units identified during a phytosociological survey. The terrain morphology, as well as climate, are some of the important elements that affect the outcome of phytosociological surveys.

3.2.1 PHYSIOGRAPHY

The study area encompasses all the nine provinces of South Africa including Lesotho and Swaziland and consists of surveyed locations where *Acacia karroo* communities occur (Table 3.1). South Africa, the southernmost country in Africa, extends from approximately latitude 22° to 35° south, and longitude 16° to 33° east. It is bordered on the north by Namibia, Botswana, Zimbabwe, Mozambique, and Swaziland; on the east and south by the Indian Ocean; and on the west by the Atlantic Ocean. Lesotho forms an enclave in the northeastern part of the country (Figure 3.1).

South Africa has a diverse and dramatic landscape. As the relief map (Figure 3.2) shows, the country is in the west, south and east surrounded by a chain of mountains. This chain, consisting of many single mountain ranges, is known as the Great Escarpment (including the Cape Fold Region and Great Karoo) (Figure 3.2). In the east, in the area of the Drakensberg of Natal and in Lesotho, it reaches heights of almost 4 000 metres. In the south and west, the highest peaks are at about 2 000 metres. In front of the escarpment, there is a partially very narrow coastal strip termed the Lowveld (Coast Forelands) (Figure 3.2). The western part of this lowveld is a coastal desert, reaching up to Namibia and Angola. Beyond the escarpment inwards is the central high plateau of South Africa, called the Highveld (includes the Interior Plain and Central Interior Plain) (Figure 3.2). It has heights of between 1 000 and 1 700 metres. It slowly declines towards the north, to the Kalahari basin that does not have an outlet. Because the surrounding mountain chain forms a catchment area for the clouds from the sea, the precipitation on the Highveld is low which results in arid, semi-desert conditions.

Table 3.1. Summary of the study area, indicating data sources used

AUTHOR	YEAR	AREA	NÖ. OF RELEVÉS	VEGETATION UNIT/S*
<u>GRASSLAND</u>				
Free State				
Fuls, E.R.	1993	Parys-Vrede-Warden area (Northern Free State)	75	Gm3 Eastern Free State Clay Grassland Gm4 Eastern Free State Sandy Grassland Gm5 Basotho Montane Shrubland Gm6 Frankfort Highveld Grassland Gm7 Northern Free State Shrubland Gh6 Central Free State Grassland Gh8 Bloemfontein Karroid Grassland Gh10 Vaal-Vet Sandy Grassland Gh11 Vredefort Dome Granite Grassland
Kooij, M.S., Bredenkamp, G.J. & Theron, G.K.	1990a, b, c, d, e	Wesselsbron-Bothaville- Vredefort-Hennenman area (North Western Free State)	41	Gh6 Central Free State Grassland Gh9 Western Free State Clay Grassland Gh10 Vaal-Vet Sandy Grassland Gh15 Carletonville Dolomite Grassland Gm11 Rand Highveld Grassland AZa5 Highveld Allivial Vegetation AZi10 Highveld Salt Pans
Kooij, M.S., Scheepers J.C., Bredenkamp, G.J. & Theron, G.K.	1991, 1992	Kroonstad (North Western Free State)	34	Gh6 Central Free State Grassland Gh9 Western Free State Clay Grassland Gh10 Vaal-Vet Sandy Grassland Gh15 Carletonville Dolomite Grassland Gm11 Rand Highveld Grassland AZa5 Highveld Allivial Vegetation AZi10 Highveld Salt Pans
Muller, D.B.	1986	Willem Pretorius Game Reserve (Winburg- Ventersburg-Senekal area, North Western Free State)	87	Gm3 Eastern Free State Clay Grassland Gh6 Central Free State Grassland Gh7 Winburg Grassy Shrubland Gh8 Bloemfontein Karroid Grassland
Rossouw, L.F.	1983	Bloemfontein (Central Free State)	32	Gh7 Winburg Grassy Shrubland Gh8 Bloemfontein Karroid Grassland AZa5 Highveld Allivial Vegetation
Malan, P.W.	1992	Bloemfontein (Central Free State)	22	Gh7 Winburg Grassy Shrubland

	1998	Fauresmith-Petrusburg-Bloemfontein-Zastron area (Southern Free State)	34	Gh2 Aliwal North Dry Grassland Gh3 Xhariep Karroid Grassland Gh4 Besemkaree Koppies Shrubland Gh5 Bloemfontein Dry Grassland Gh7 Winburg Grassy Shrubland Gh9 Western Free State Clay Grassland Gm1 Zastron Moist Grassland Gm5 Basotho Montane Shrubland SVk4 Kimberley Thornveld SVk5 Vaalbos Rocky Shrubland Nku3 Northern Upper Karoo AZi10 Highveld Salt Pans AZa4 Upper Gariep Alluvial Vegetation
Werger, M.J.A.	1973a	Upper Orange River (From Lesotho/ Southern Free State border to Mazelsfontein in Northern Cape)	58	Gh2 Aliwal North Dry Grassland Gh3 Xhariep Karroid Grassland Gh4 Besemkaree Koppies Shrubland SVk4 Kimberley Thornveld SVk5 Vaalbos Rocky Shrubland Nku3 Northern Upper Karoo Nku4 Eastern Upper Karoo AZa4 Upper Gariep Alluvial Vegetation
	1973b	Tussen die Riviere Game Farm (Bethulie, Southern Free State)	4	Gh3 Xhariep Karroid Grassland Gh4 Besemkaree Koppies Shrubland Nku4 Eastern Upper Karoo AZa4 Upper Gariep Alluvial Vegetation
Du Preez, P.J.	1990	Vredefort Dome (Vredefort area, Northern Free State)	14	Gh11 Vredefort Dome Granite Grassland SVcb9 Gold Reef Mountain Bushveld SVcb11 Andesite Mountain Bushveld
	1991	Korannaberg (Zastron-Bloemfontein-Winburg-Bethlehem area in South-eastern Free State, including Maseru and Mokhotlong in Lesotho)	5	Gh2 Aliwal North Dry Grassland Gh3 Xhariep Karroid Grassland Gh4 Besemkaree Koppies Shrubland Gh5 Bloemfontein Dry Grassland Gh7 Winburg Grassy Shrubland Gh8 Bloemfontein Karroid Grassland Gm1 Zastron Moist Grassland Gm3 Eastern Free State Clay Grassland Gm4 Eastern Free State Sandy Grassland Gm5 Basotho Montane Shrubland Gm7 Northern Free State Shrubland Gd5 Northern Drakensberg Highland Grassland Gd6 Drakensberg – Amathole Afromontane Fynbos Gd8 Lesotho Highland Basalt Grassland Gd10 Drakensberg Afromontane Heathland AZa4 Upper Gariep Alluvial Vegetation Nku4 Eastern Upper Karoo
North-West				
Bredenkamp, G.J. & Bezuidenhout, H.	1990	Faan Meintjies Nature Reserve (Klerksdorp,	21	Gh10 Vaal-Vet Sandy Grassland Gh12 Vaal Reefs Dolomite Sinkhole Woodland

		Eastern North-West)		SVcb11 Andesite Mountain Bushveld
	1994	Boskop Dam Nature Reserve (Potchefstroom, Eastern North-West)	6	Gm11 Rand Highveld Grassland Gh15 Carletonville Dolomite Grassland SVcb10 Gauteng Shale Mountain Bushveld
Bezuidenhout, H., Bredenkamp, G.J., Theron, G.K & Morris, J.W.	1994	Lichtenburg (Central North-West)	10	Gh10 Vaal-Vet Sandy Grassland Gh13 Klerksdorp Thornveld Gh14 Western Highveld Sandy Grassland Gh15 Carletonville Dolomite Grassland
Bezuidenhout, H.	1991, 1993, 1994a, b, c	Delareyville-Lichtenburg-Krugersdorp-Potchefstroom area (Eastern North-West)	127	SVk1 Mafikeng Bushveld SVk2 Stella Bushveld SVk3 Schweizer-Reneke Bushveld SVk4 Kimberley Thornveld SVcb10 Gauteng Shale Mountain Bushveld SVcb11 Andesite Mountain Bushveld Gh10 Vaal-Vet Sandy Grassland Gh12 Vaal Reefs Dolomite Sinkhole Woodland Gh13 Klerksdorp Thornveld Gh14 Western Highveld Sandy Grassland Gh15 Carletonville Dolomite Grassland Gm11 Rand Highveld Grassland AZa5 Highveld Alluvial Vegetation
Bezuidenhout, H., Bredenkamp, G.J. & Elsenbroek, J.H.	1988	Vredefort Dome (North-West of Parys, Northern Free State)	5	SVcb9 Gold Reef Mountain Bushveld
Gauteng				
Van Wyk, S.	1983	Abe Bailey Nature Reserve (Carletonville, South western Gauteng)	4	Gh10 Vaal-Vet Sandy Grassland SVcb10 Gauteng Shale Mountain Bushveld
Bredenkamp, G.J. & Theron, G.K.	1978, 1980	Suikerbosrand Nature Reserve (Heidelberg, South eastern Gauteng)	33	Gm8 Soweto Highveld Grassland Gm9 Tsakane Clay Grassland SVcb9 Gold Reef Mountain Bushveld SVcb11 Andesite Mountain Bushveld
Bezuidenhout, H. & Bredenkamp, G.J.	1991	Mooi River catchment area (Carletonville, South western Gauteng)	2	Gm8 Soweto Highveld Grassland Gm9 Tsakane Clay Grassland Gm11 Rand Highveld Grassland Gh10 Vaal-Vet Sandy Grassland Gh12 Vaal Reefs Dolomite Sinkhole Woodland Gh15 Carletonville Dolomite Grassland SVcb8 Moot Plains Bushveld SVcb9 Gold Reef Mountain Bushveld SVcb10 Gauteng Shale Mountain Bushveld SVcb11 Andesite Mountain Bushveld

Coetzee, J.P., Bredenkamp, G.J. & Van Rooyen, N.	1995a, 1995b	Pretoria-Witbank- Heidelberg area (Eastern Gauteng/Western Mpumalanga)	19	Gm6 Frankfort Highveld Grassland Gm8 Soweto Highveld Grassland Gm9 Tsakane Clay Grassland Gm11 Rand Highveld Grassland Gm12 Eastern Highveld Grassland Gh15 Carletonville Dolomite Grassland SVcb6 Marikana thornveld SVcb9 Gold Reef Mountain Bushveld SVcb11 Andesite Mountain Bushveld SVcb12 Central Sandy Bushveld SVcb13 Loskop Mountain Bushveld AZi11 Subtropical Salt Pans AZf3 Eastern Temperate Freshwater Wetlands AZf4 Drakensberg Wetlands
<hr/>				
Mpumalanga				
Burgoyne, P.M.	1995	Belfast-Dullstroom- Roosenekal-Lydenburg area (Northern Mpumalanga)	5	Gm11 Rand Highveld Grassland Gm12 Eastern Highveld Grassland Gm16 KaNgwane Montane Grassland Gm18 Lydenburg Montane Grassland Gm19 Sekhukhune Montane Grassland Gm21 Lydenburg Thornveld AZf3 Eastern Temperate Freshwater Wetlands
Matthews, W.S., Bredenkamp, G.J. & Van Rooyen, N.	1992	Haenertsburg- Burgersfort-Graskop area (Transvaal escarpment, Northern Mpumalanga/Northern Province)	4	Gm18 Lydenburg Montane Grassland Gm21 Lydenburg Thornveld Gm22 Northern Escarpment Dolomite Grassland Gm23 Northern Escarpment Quartzite Sourveld Gm25 Woodbush Granite Grassland Gm26 Wolkberg Dolomite Grassland Gm27 Strydpoort Summit Sourveld FOz2 Northern Afrotropical Forest
Smit, C.M., Bredenkamp, G.J., Van Rooyen, N., Van Wyk, A.E. & Combrinck, J.M.	1997	Witbank Nature Reserve (Witbank, Western Mpumalanga)	9	Gm11 Rand Highveld Grassland Gm12 Eastern Highveld Grassland AZf3 Eastern Temperate Freshwater Wetlands

De Frey, W.H.	1999	Belfast-Barberton-Piet Retief-Wakkerstroom area (South Eastern Mpumalanga)	25	Gm8 Soweto Highveld Grassland Gm12 Eastern Highveld Grassland Gm13 Amersfoort Highveld Clay Grassland Gm14 Wakkerstroom Montane Grassland Gm15 Paulpietersburg Moist Grassland Gm16 KaNgwane Montane Grassland Gm18 Lydenburg Montane Grassland Gm22 Northern Escarpment Dolomite Grassland Gm23 Northern Escarpment Quartzite Sourveld SV19 Legogote Sour Bushveld SV113 Barberton Serpentine Sourveld SV114 Swaziland Sour Bushveld AZf3 Eastern Temperate Freshwater Wetlands
<hr/>				
KwaZulu-Natal				
Eckhardt, H.C.	1998	Helpmekaar-Wakkerstroom-Louwsburg-Babanango area (Central Northern KwaZulu-Natal)	56	Gm4 Eastern Free State Sandy Grassland Gm5 Basotho Montane Shrubland Gm6 Frankfort Highveld Grassland Gm13 Amersfoort Highveld Clay Grassland Gm14 Wakkerstroom Montane Grassland Gm15 Paulpietersburg Moist Grassland Gs1 Northern Zululand Mistbelt Grassland Gs2 Ithala Quartzite Sourveld Gs3 Low Escarpment Moist Grassland Gs4 Northern KwaZulu-Natal Moist Grassland Gs5 Northern KwaZulu-Natal Shrubland Gs6 KwaZulu-Natal Highland Thornveld Gs7 Income Sandy Grassland Gs8 Mooi River Highland Grassland SV11 Makuleke sandy Bushveld SV12 Nwambyia-pumbe Sandy Bushveld SV114 Swaziland Sour Bushveld FOz2 Northern Afrotropical Forest AZf3 Eastern Temperate Freshwater Wetlands

Perkins, L.	1997	Southern KwaZulu-Natal (Between Estcourt and the KwaZulu- Natal/Eastern Cape border)	22	Gd4	Southern Drakensberg Highland Grassland
				Gd5	Northern Drakensberg Highland Grassland
				Gd7	uKhahlamba Basalt Grassland
				Gd8	Lesotho Highland Basalt Grassland
				Gs4	Northern KwaZulu-Natal Moist Grassland
				Gs6	KwaZulu-Natal Highland Thornveld
				Gs8	Mooi River Highland Grassland
				Gs9	Income Sandy Grassland
				Gs10	Drakensberg Foothill Moist Grassland
				Gs11	Southern KwaZulu-Natal Moist Grassland
				Gs12	East Griqualand Grassland
				Gs13	Mabela Sandy Grassland
				SVs2	Thukela Thornveld
				SVs3	KwaZulu-Natal Hinterland Thornveld
				FOz2	Northern Afrotropical Forest
				FOz3	Southern Mistbelt Forest
				AZf3	Eastern Temperate Freshwater Wetlands
Robbeson, R.A.J.	1998	North Western KwaZulu- Natal (Between the Durnacol-Ladysmith- Estcourt area and the Free State/Lesotho border)	94	Gs3	Low Escarpment Moist Grassland
				Gs4	Northern KwaZulu-Natal Moist Grassland
				Gs5	Northern KwaZulu-Natal Shrubland
				Gs6	KwaZulu-Natal Highland Thornveld
				Gs7	Income Sandy Grassland
				Gs8	Mooi River Highland Grassland
				Gs9	Income Sandy Grassland
				Gs10	Drakensberg Foothill Moist Grassland
				Gd5	Northern Drakensberg Highland Grassland
				Gd6	Drakensberg – Amathole Afrotropical Fynbos
				Gd7	uKhahlamba Basalt Grassland
				Gd8	Lesotho Highland Basalt Grassland
				SVs1	Thukela Valley Bushveld
				SVs2	Thukela Thornveld
				SVs3	KwaZulu-Natal Hinterland Thornveld
				FOz2	Northern Afrotropical Forest
				FOz3	Southern Mistbelt Forest
AZf3	Eastern Temperate Freshwater Wetlands				

Smit, C.M., Bredenkamp, G.J. & Van Rooyen, N.	1992	Newcastle-Memel- Chelmsford Dam area (North Western KwaZulu-Natal North Western KwaZulu-Natal)	2	Gm4 Eastern Free State Sandy Grassland Gm5 Basotho Montane Shrubland Gm13 Amersfoort Highveld Clay Grassland Gs3 Low Escarpment Moist Grassland Gs4 Northern KwaZulu-Natal Moist Grassland Gs6 KwaZulu-Natal Highland Thornveld FOz2 Northern Afrotropical Forest AZf3 Eastern Temperate Freshwater Wetlands
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SAVANNA

Limpopo (Northern Province)

Bredenkamp, G.J. & Van Vuuren, D.R.J.	1977	Turfloop Dam (Pietersburg area, Central Northern Province)	14	SVcb23 Polokwane Plateau Bushveld
Schmidt, A.G., Theron, G.K. & Van Hoven, W.	1993	Rhino Ranch (Ellisras- Villa Nora area, Western Northern Province)	12	SVcb17 Waterberg Mountain Bushveld SVcb18 Roodeberg Bushveld SVcb19 Limpopo Sweet Bushveld AZa7 Subtropical Alluvial Vegetation
Westfall, R.H., Van Rooyen, N. & Theron, G.K.	1985	Groothoek Farm (Thabazimbi, South Western Northern Province)	4	SVcb16 Western Sandy Bushveld SVcb17 Waterberg Mountain Bushveld
Coetzee, B.J., Van der Meulen, F., Zwanziger, S., Gonsalves, P. & Weisser, P.J.	1976	Nylsvley Nature Reserve (Naboomspruit area, Southern Northern Province)	17	SVcb12 Central Sandy Bushveld SVcb15 Springbokvlakte Thornveld AZa7 Subtropical Alluvial Vegetation
Van Rooyen, N. & Bredenkamp, G.J.	1999	Suikerboschplaat Farm (Vaalwater, South Western Northern Province)	2	SVcb12 Central Sandy Bushveld SVcb17 Waterberg Mountain Bushveld
Van Staden, P.J	2002	Marakele National Park (Thabazimbi, South Western Northern Province)	3	SVcb16 Western Sandy Bushveld SVcb17 Waterberg Mountain Bushveld Gm29 Waterberg-Magaliesberg Summit Sourveld

Siebert, S.J. (Includes Kritzinger, J. (1992) for Maandagshoek)	2001	Sekhukhuland Centre of Plant Endemism (Lebowakgomo-Burgersfort-Roosenekal area, Southern Northern Province/Northern Mpumalanga border area)	37	Gm11 Rand Highveld Grassland Gm19 Sekhukhune Montane Grassland Gm20 Leolo Summit Sourveld Gm21 Lydenburg Thornveld SVcb12 Central Sandy Bushveld SVcb13 Loskop Mountain Bushveld SVcb14 Loskop Thornveld SVcb25 Pong Dolomite Mountain Bushveld SVcb26 Ohrichstad Mountain Bushveld SVcb27 Sekhukhune Plains Bushveld SVcb28 Sekhukhune Mountain Bushveld
Breebaart, L. & Deutschländer, M.	1997	Goedverwacht Farm (Lebowakgomo area, Southern Northern Province)	24	SVcb15 Springbokvlakte Thornveld SVcb25 Pong Dolomite Mountain Bushveld SVcb27 Sekhukhune Plains Bushveld
North-West				
Brown, L.R. & Bredenkamp, G.J.	1994	Southern section of Borakalo Nature Reserve (Brits-Assen area, North Eastern North-West)	34	SVcb15 Springbokvlakte Thornveld SVcb16 Western Sandy Bushveld
Brown, L.R., Bredenkamp, G.J. & Van Rooyen, N.	1995, 1996, 1997	Western and Northern sections of Borakalo Nature Reserve	21	SVcb15 Springbokvlakte Thornveld SVcb16 Western Sandy Bushveld
Coetzee, B.J.	1975	Rustenburg Nature Reserve (Magaliesberg/Rustenburg, Northern North-West)	16	SVcb3 Zeerust Thornveld SVcb8 Moot plains Bushveld SVcb9 Gold Reef Mountain Bushveld
Kalahari				
Smit, K.			301	SVk1 Mafikeng Bushveld SVk2 Stella Bushveld SVk3 Schweiser-Reneke Bushveld SVk4 Kimberley Thornveld SVk5 Vaalbos Rocky Shrubland SVk6 Schmidtsdrif Thornveld SVk7 Ghaap Plateau Vaalbosveld SVk8 Kuruman Vaalbosveld SVk9 Kuruman Thornveld SVk10 Kuruman Mountain Bushveld SVk11 Molopo Bushveld SVk12 Kathu Bushveld SVk13 Olifantshoek Plains Thornveld SVk14 Postmasburg Thornveld SVk15 Koranna-Langeberg Mountain Bushveld SVk16 Gordonia Plains Shrubland AZi3 Southern Kalahari Megacha AZi10 Highveld Salt Pans
Northern Cape				
Bezuidenhout, H.	1996	Augrabies Falls National	8	NKb1 Lower Gariep Brokenveld

		Park (Augrabies, North Western Northern Cape)		NKb2 Blouputs Karroid Thornveld NKb3 Bushmanland Arid Grassland NKb5 Kalahari Karroid Shrubland AZa3 Lower Gariep Alluvial Vegetation
<hr/>				
Eastern Cape				
Van der Walt, P.T.	1980	Mountain Zebra National Park (Cradock, Central Eastern Cape)	17	Gh1 Karoo Escarpment Grassland NKu4 Eastern Upper Karoo AT13 Eastern Cape Escarpment Thicket
Brown, L.R. & Bezuidenhout, H.	2000	Mountain Zebra National Park (De Rust section)	40	Gh1 Karoo Escarpment Grassland NKu4 Eastern Upper Karoo AT13 Eastern Cape Escarpment Thicket
Palmer, A.R.	1989	Karoo Nature Reserve (Graaff-Reinet, South Western Eastern Cape)	24	Gh1 Karoo Escarpment Grassland NKu2 Upper Karoo Hardeveld NK14 Albany Brokenveld AT14 Camdebo Escarpment Thicket AZi6 Southern Karoo Riviere
<hr/>				
Western Cape				
Rubin, F. & Palmer, A.R.	1996	Karoo National Park (Beaufort West, North Eastern Western Cape)	9	Gh1 Karoo Escarpment Grassland NKu2 Upper Karoo Hardeveld NK11 Gamka Karoo
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*	Vegetation	units	according to	Mucina and Rutherford (2006)

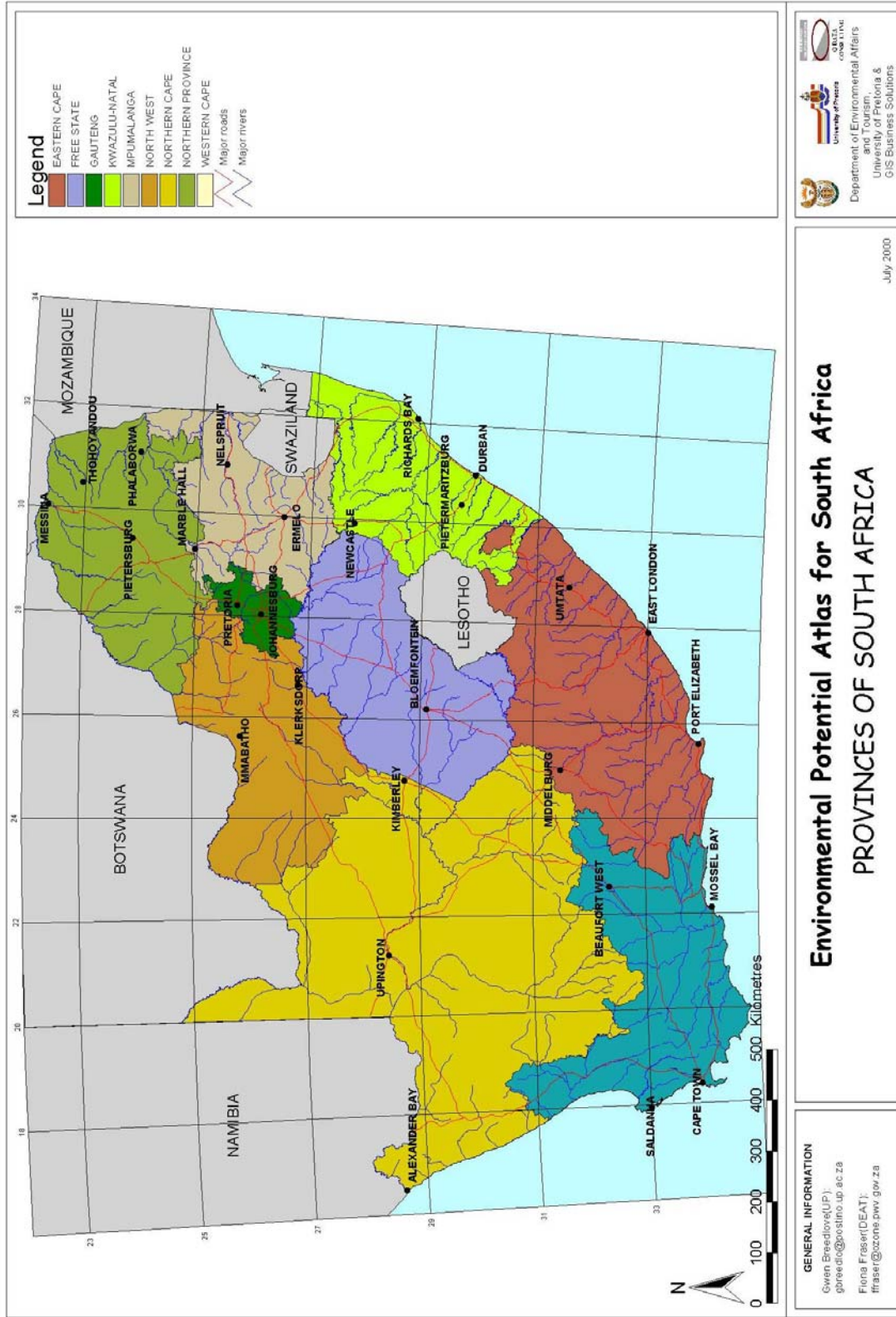
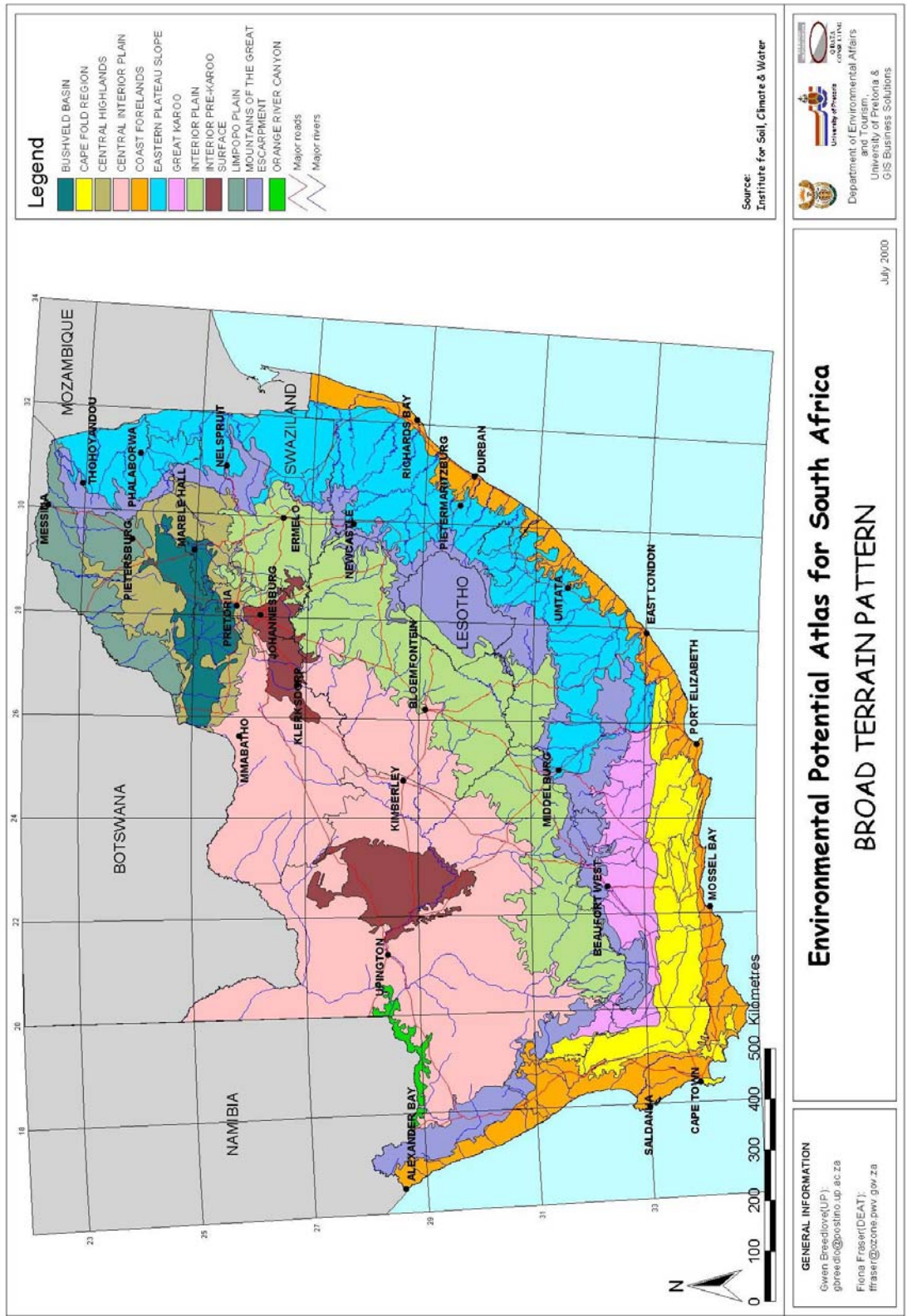


Figure 3.1. Map of South Africa



3.2.2 CLIMATE

Climate has a major influence on vegetation distribution, for plants depend directly or indirectly on the atmosphere for certain fundamental materials, for their successful growth and reproduction. Different species, for instance, vary in their minimum requirements for, and in their tolerance of, particular climatic conditions and these conditions therefore play a major role in determining where a particular plant can or cannot exist (Schulze & McGee, 1978). The authors regard light, temperature and moisture as the climatic factors of greatest importance in vegetation development.

3.2.2.1 THE IMPORTANCE OF RAINFALL AND TEMPERATURE IN VEGETATION STUDIES

Among the various climatic parameters which influence the gross features of vegetation differences on earth, water is the most important. Limitations in water availability are frequently a restrictive factor in plant development, and water is essential for the maintenance of physiological and chemical processes within the plant, including germination, growth and reproduction. Water also acts as a carrier of nutrient food supply in solution. The reservoir of soil water on which land plants draw is derived from precipitation mainly in the form of rainfall, fog and snow, of which the first two are considered important in southern Africa (Schulze & McGee, 1978).

In plant ecology, as Mostert (1958) points out, knowledge of the total rainfall is not enough. What is more important is the amount of water in the soil which is available to the plants. Although the long-term average annual rainfall may appear to be adequate for a good vegetation growth, its effectiveness is greatly reduced by its distribution and unreliability. The effectiveness of the rainfall does not depend only on its distribution but also upon the evaporation, temperature, penetration and soil type. In addition, the duration and severity of the dry season as well as periodic droughts are of great importance in determining plant growth (Mostert, 1958).

Temperature also plays a major part in determining floristic variations. Within plant communities or associations the direct influences of temperature affect, among other things, rates of growth, seed germination and time of flowering (Schulze & McGee, 1978). However, as Mostert (1958) notes, it is not the mean temperature values that have a great influence on plants. Instead, the plants are affected more by temperature extremes, which, together with the daily temperature fluctuations are of prime biological importance; and often the limiting factors for plant growth. On a larger scale, however, temperature alone is not a significant factor in determining major regional vegetation formations, although its indirect influence on water availability through its effects on, for instance, evapotranspiration rates, is of primary importance (Schulze & McGee, 1978).

3.2.2.2 RAINFALL AND TEMPERATURE DISTRIBUTIONS IN SOUTH AFRICA

South Africa is part of the subtropical zone but compared to other regions in this zone, temperatures in many areas of South Africa are rather lower. According to Schulze (1979), altitude plays a role in temperature distributions in South Africa, with lower areas experiencing higher temperatures than the surrounding higher country. The lowest mean temperatures are found along the great escarpment, whilst the highest mean temperatures are encountered in the Kalahari (Figure 3.3). The coastal areas are, on the other hand, more affected by the ocean currents. The warm Agulhas current keeps the east coast warmer than the west coast, while on the contrary the moderate to cold temperatures in the west coast are due to the cold Benguela current (Schulze, 1979).

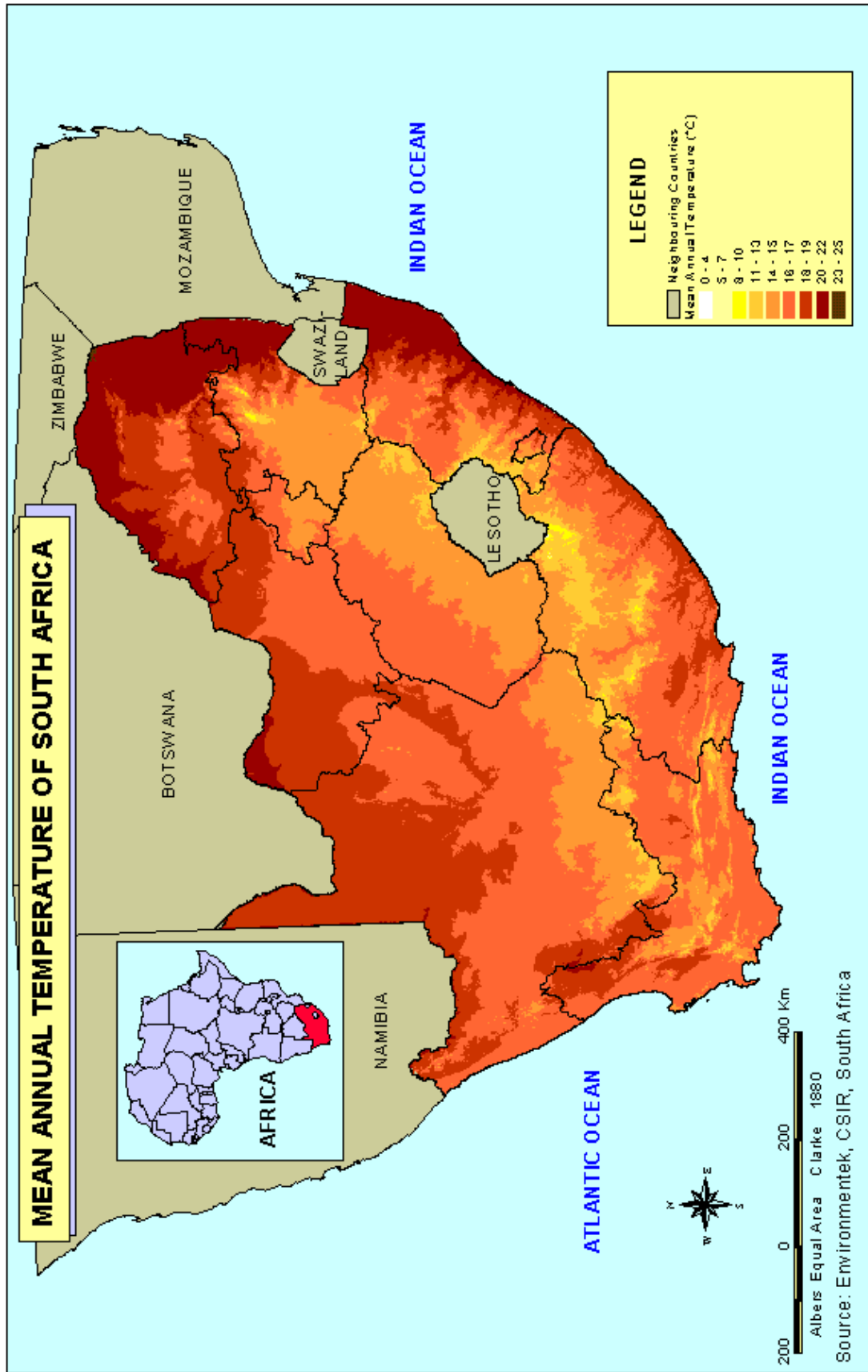


Figure 3.3. Mean annual temperature of South Africa

Rainfall in the interior northern regions of South Africa is almost exclusively a summer phenomenon. Towards the coast, especially southwards and south-westwards in the Western Cape, winter rainfall is predominant. According to Schulze (1979), altitude not only influences temperature but rainfall as well. This influence is most pronounced in the south-western part of the Western Cape where the average rainfall over the coastal plateau is markedly low but increases considerably on the mountain ranges (Figure 3.4). However, on the southern and eastern escarpment this increase of rainfall with altitude, though considerable, is not quite as pronounced. Schulze (1979) attributes this rainfall/altitude relationship to several factors such as distance from the sea, aspect with regard to the rain-bearing winds and the nature of the rainfall (thunderstorm, cyclonic).

3.2.2.3 SOUTH AFRICAN CLIMATE ACCORDING TO THE KÖPPEN CLIMATE CLASSIFICATION

The Köppen classification, based mainly on rainfall and temperature statistics, is normally used to describe climate (Schulze, 1947). This classification has been widely applied in southern Africa because of its simplicity (Schulze & McGee, 1978). South Africa has six main types of climate (Schulze, 1947), according to the first two letters of this classification. These are Aw, BS, BW, Cs, Cw, and Cf (Figure 3.5).

A climates

These are warm tropical climates with mean temperature above 18° C for all months; the subdivisions are based on differences in precipitation.

Aw: This is the only A climate present in South Africa. Though it is most prevalent in Mozambique, the climate type is found on a very small area on the South African north-eastern border with Mozambique. It is characterised by dry winter season and rainfall is in the summer season.

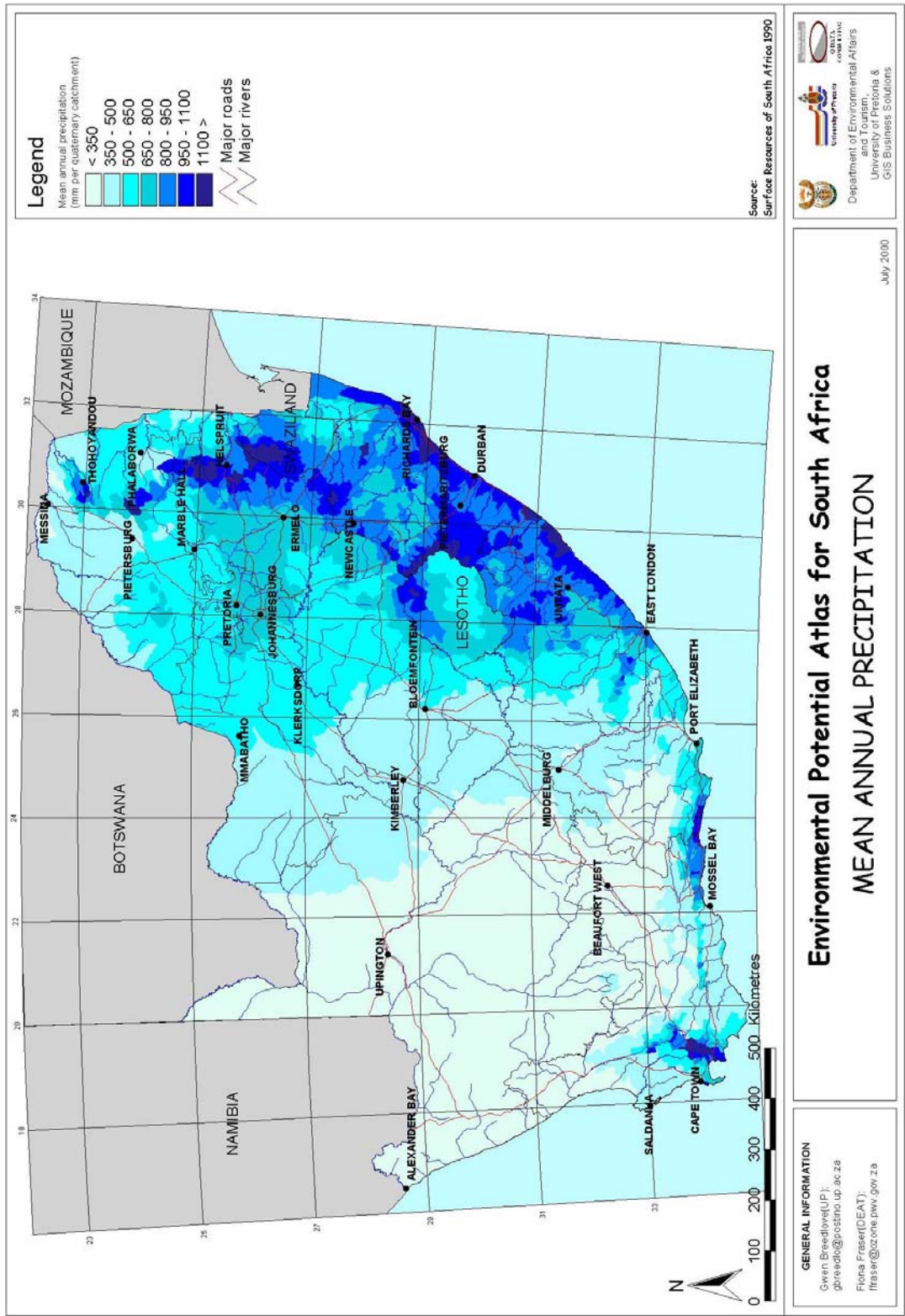


Figure 3.4. Mean annual precipitation of South Africa

B climates

These are arid climates which include a wide range of temperature and a range of moisture; the subdivisions are based on temperature and rainfall.

BS: This is an arid (steppe) climate that occupies the central interior of the country. Its subdivisions are based mainly on differences in temperature. BSh, the first subdivision, is hot and dry and the mean annual temperature is over 18°C. An example of this climate is Pietersburg (Figure 3.6) which has an average annual rainfall of only 478mm and a mean annual temperature of 18.2°C (Table 3.2). The second subdivision, BSk, is characterised by dry and cold conditions with mean annual temperature below 18°C, but the hottest month exceeds 18°C. Bloemfontein (Figure 3.6) falls under this climate because of its average annual rainfall of only 559mm (Table 3.2) and though its mean temperature is 15.9°C, the hottest month (February) has an average temperature of 21.8°C.

BW: This climate occupies most of the western interior and west coast of South Africa. It is a desert climate in which rain is very minimal. Like with the BS type, its subdivisions are based on temperature differences. BW_h represents a dry and hot desert with mean annual temperature over 18°C. This can be seen in Beaufort West (Figure 3.6), which has an annual mean temperature of 17.7°C. It is a very dry area with an average annual rainfall of only 236mm (Table 3.2). BW_k occupies the narrow west coastal belt and is characterised by cold and dry conditions, with mean annual temperature below 18°C, but has the hottest month exceeding 18°C. Upington exemplifies this climate type with its minimal rainfall (189mm) and low mean annual temperature (20.5°C).

C climates

These are warm temperate climates that are characterised by seasonality in temperature and have mild winters. Different C climates are based on seasonality of precipitation (f,w,s) and severity of winter (a,b). The coldest month ranges in temperature from 18°C to -3°C.

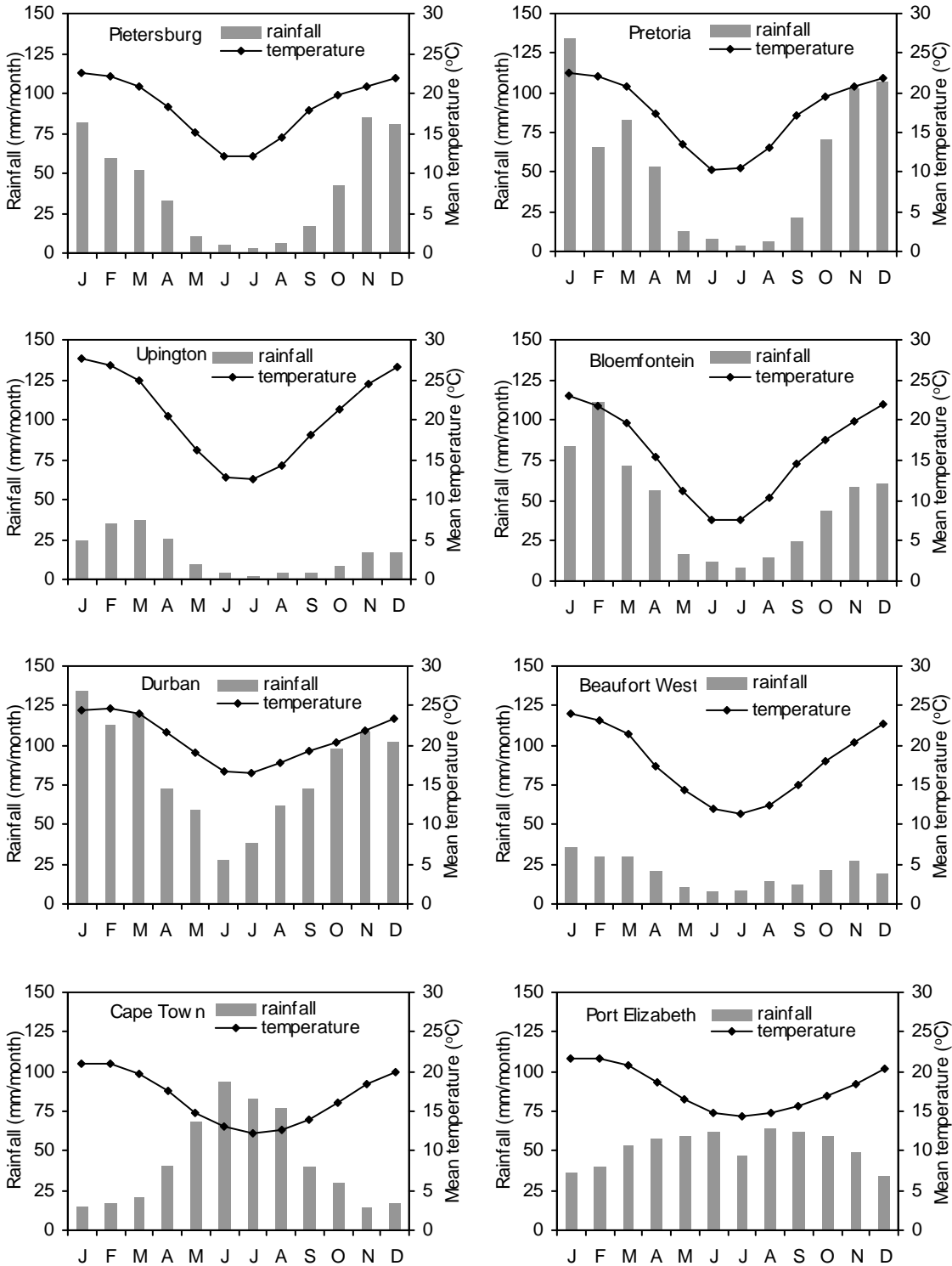


Figure 3.6. Long-term (1961 – 1990)* monthly rainfall and mean temperature of eight major weather stations of South Africa (Data source: South African Weather Service) * Beaufort West: 1963 – 1987

Table 3.2. Long-term (1961 – 1990)* average of annual rainfall and mean temperature of eight major weather stations of South Africa (Data source: South African Weather Service)

Station	Latitude	Longitude	Altitude	Rainfall	Temperature	Climate [†]
Pietersburg	23°52′S	29°27′E	1230m	478mm	18.2°C	BSh
Pretoria	25°44′S	28°10′E	1286m	667mm	17.4°C	Cwb
Upington	28°24′S	21°16′E	836m	189mm	20.5°C	BWk
Bloemfontein	29°06′S	26°18′E	1351m	559mm	15.9°C	BSk
Durban	29°58′S	30°57′E	8m	1009mm	20.8°C	Cfa
Beaufort West	32°21′S	22°36′E	842m	236mm	17.7°C	BWh
Cape Town	33°59′S	18°36′E	42m	515mm	16.7°C	Csb
Port Elizabeth	33°59′S	25°36′E	60m	627mm	17.9°C	Cfb

* Beaufort West: 1963 – 1987

[†] Köppen climate classification

Cf: The climate occupies the eastern coastal belt and is characterised by sufficient rainfall during all months. Cfa has the warmest month temperature over 22°C, while the warmest month in Cfb is below 22°C. Durban (Cfa) and Port Elizabeth (Cfb) are examples of the Cf climate. Durban has an average annual rainfall of 1009mm and mean temperature of 20.8°C, though January, the warmest month, has temperature of 24.4°C. Port Elizabeth has an average annual rainfall of 627mm and mean temperature of 17.9°C, with January, the warmest month, having temperature of 21.7°C.

Cs: This is a Mediterranean climate restricted to the extreme southwestern Cape. It is characterised by warm conditions with winter rainfall and summer as the dry season. Csa has the temperature of the warmest month over 22°C while it is below that in Csb. Cape Town is an example of a Csb climate with an average annual rainfall of 515mm with most of the rain falling in the winter season between May and August (Figure 3.6). Its mean temperature is 16.7°C and the warmest month is February with 21°C.

Cw: This is a temperate climate with dry winter season. Like all the other C climates, its subdivisions are distinguished by the temperature of the warmest month; Cwa has temperatures of the warmest month over 22°C while the warmest month of Cwb has lower temperature. Cwb climate can be seen in Pretoria (Figure 3.6) where the average annual rainfall is 667mm and most of it falls during the summer season between October and March. The mean temperature is 17.4°C, but the warmest month (January) has temperature of 22.5°C.

3.3 BROAD VEGETATION DESCRIPTION

Several descriptions and delimitations of the vegetation of South Africa have been carried out. The most notable being those by Acocks (1988), Rutherford and Westfall (1994), Low and Rebelo (1996). The latest and most comprehensive description of South Africa's vegetation is the one by Mucina and Rutherford (2006).

Groupings termed Biomes (biotic communities) have been described for plants and/or animals living together with some degree of permanence, so that large-size patterns in global plant cover can be observed. Biomes broadly correspond with climatic regions, although other environmental controls are sometimes important.

Each biome has a characteristic set of plant and animal species as well as a characteristic overall physiognomy (for example a general appearance given by the plant shapes). The general plant characteristics give a characteristic visual signature to the vegetation of the biome. Rutherford and Westfall (1994) map seven biomes in South Africa: Grassland, Savanna, Succulent Karoo, Nama-Karoo, Forest, Fynbos and Desert. Low and Rebelo (1996) include a Thicket biome. The location of the eight biomes is shown in Figure 3.7. Mucina and Rutherford (2006) describe nine biomes. All the previous ones are include plus the Indian Ocean Coastal Belt as the ninth biome. Three of these abovementioned biomes, namely Grassland, Savanna, and Nama-Karoo, are part of the present study.

Grassland: The Grassland Biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Altitude varies from near sea level to 2 850 m above sea level. Due to the high elevation cold and relatively dry condition prevail on the Highveld. The winters are cold, dry with frequent occurrences of frost. The summers are hot and the rainfall occurs mainly during this season. The amount of rainfall varies spatially from 400 to 2 500mm per annum. Fire is important in grassland systems to maintain structural and textural patterns (Low and Rebelo 1996; Mucina *et al.* 2006a).

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. Trees are absent, except in a few localised habitats. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees. Grasses of the genera *Andropogon*, *Cymbopogon*, *Diheteropogon*, *Heteropogon*, *Hyparrhenia*, *Monocymbium*, *Schizachyrium*, *Themeda*, *Trachypogon*, and *Tristachya* are temperate species with relatively low nutritional value and high tannin content. The woody species often found in grassland are *Acacia karroo*, *A. sieberiana*, species of *Protea*, *Cussonia*, *Diospyros*, *Gymnosporia* and many more.

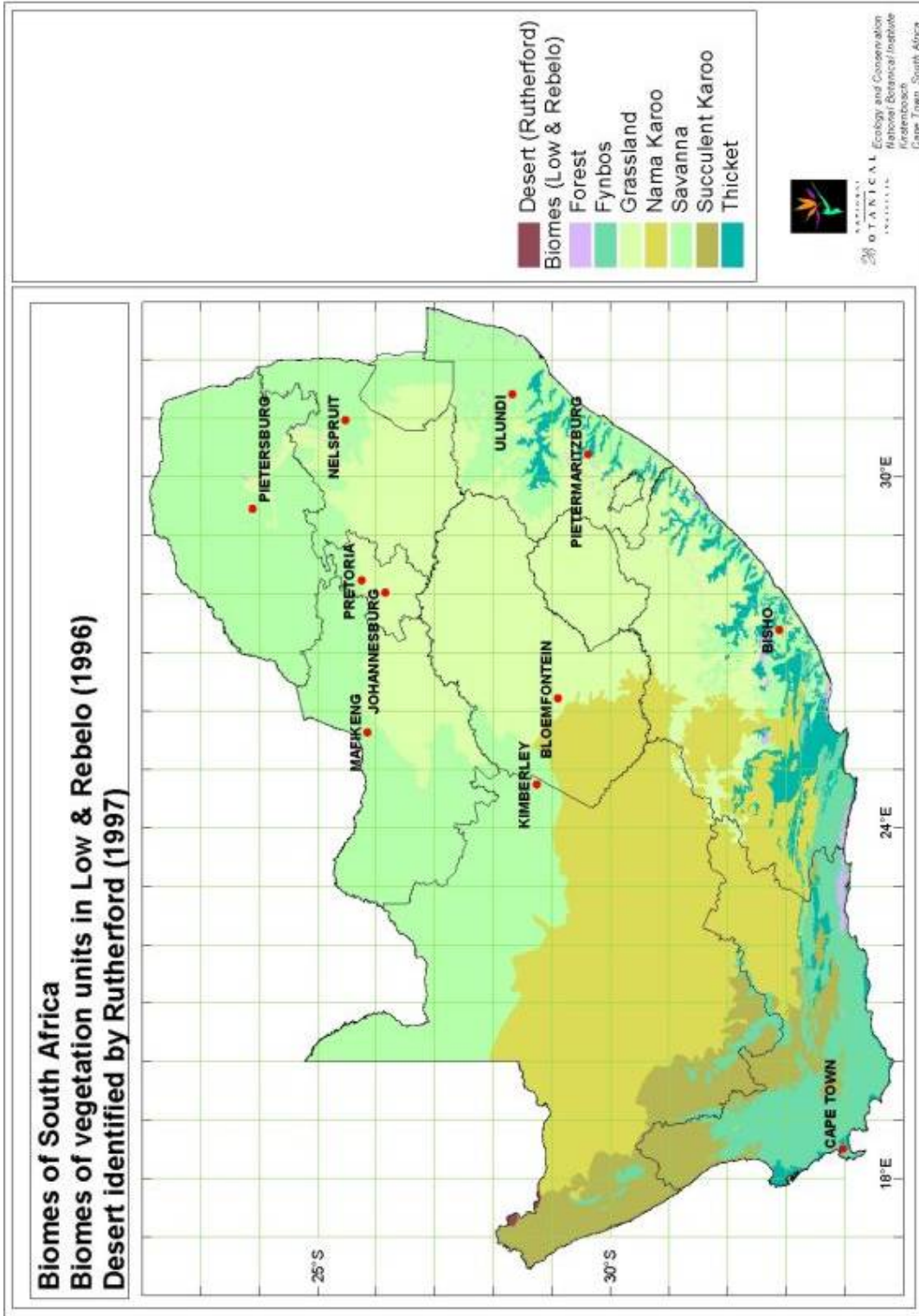


Figure 3.7. Biomes of South Africa (South African National Biodiversity Institute)

(<http://www.plantzafrica.com/vegetation/vegimages/biomes800.jpg>)

These trees and shrubs can tolerate frequent fires by being serotinous and to resprout after fires (Low and Rebelo 1996; Mucina *et al.* 2006a).

Savanna: The Savanna Biome is the largest biome in southern Africa, occupying 46% of its area, and over one-third the area of South Africa. It is well developed over the lowveld and Kalahari region of South Africa and is also the dominant vegetation in Botswana, Namibia and Zimbabwe. Altitude ranges from sea level to 2 000 m; rainfall varies from 235 to 1 000 mm per year; frost may occur from 0 to 120 days per year; and almost every major geological and soil type occurs within the biome. Major factors delimiting the biome is altitude (occur below 1 500m above sea level), the lack of sufficient rainfall which prevents the upper layer from dominating, coupled with fires and grazing, which keep the grass layer dominant (Low and Rebelo 1996; Rutherford *et al.* 2006).

It is characterised by a grassy ground layer and a distinct upper layer of woody plants. The amount of cover depends on rainfall and the degree of grazing. Three major regions can be found in the Savanna biome of South Africa namely the Kalahari bushveld bioregion, the central bushveld bioregions and the Mopane bioregion. The more arid savanna is dominated by microphyllous species where numerous *Acacia* species dominate the tree component. More broad-leaved species such as *Terminalia*, *Burkea*, *Combretum*, *Pterocarpus*, *Pheniloptera* (*Lonchocarpus*), *Colophospermum* and several others dominate the higher rainfall areas (Low and Rebelo 1996; Rutherford *et al.* 2006).

Nama Karoo: The Nama Karoo Biome occurs on the central plateau of the western half of South Africa, at altitudes between 500 and 2 000 m, with most of the biome falling between 1 000 and 1 400 m. It is the second-largest biome in the region. The rain falls in summer, and varies between 100 and 520 mm per year.

The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. In comparison to the other biomes, this biome's flora is not particularly rich. The rainfall and seasonality is highly unpredictable. Grasses of the genera *Aristida*, *Eragrostis*, *Stipagrostis* and *Schismus* are prominent in the Nama-Karoo, the dwarf shrubs are represented by genera such as *Eriocephalus*, *Lycium*, *Monechma*, *Osteospermum*, *Pegoletia*, *Phaeoptilum*, *Pteronia*, *Selago*, *Zygophyllum*, e.t.c. (Low and Rebelo 1996; Mucina *et al.* 2006b)

CHAPTER FOUR

METHODS

For any vegetation survey, the choice of the methods of vegetation description employed depends on a number of factors:

- (i) the purpose of the survey,
- (ii) the scale of the study,
- (iii) the overall habitat type, and
- (iv) the resources available (finance, equipment, manpower and time) (Kent and Coker, 1996).

It is important that the method chosen be quantitative and repeatable because this has relevance for future work. The basic methodology of all vegetation analysis involves the collection of community samples or relevés that are considered to be representative of and to reflect the general characteristics of the vegetation under study. The most widely used and arguably the most efficient of all types of sampling are those based upon the relevé of the Braun-Blanquet school of Plant Sociology which, in a variety of modified forms, has been used as a data base for many methods of analysis, ordination and classification (Mueller-Dombois & Ellenberg 1974; Kent & Coker 1996; Van der Maarel 2005).

4.1 DESCRIPTION OF THE METHODS

The study was based on existing data from Braun-Blanquet classifications. The Braun-Blanquet method of vegetation classification is not described here, but was described in detail by Braun-Blanquet (1932), Werger (1974), as well as Mueller-Dombois and Ellenberg (1974), Kent & Coker (1996); Van der Maarel (2005) amongst others.

Werger (1974) regards the Braun-Blanquet method as one of the most significant tools in the study of the environment, especially because it meets three essential requirements of a vegetation ecology study, namely:

- (i) it is scientifically sound,
- (ii) it fulfils the necessity of classification at an appropriate level, and
- (iii) it is the most efficient and versatile amongst comparable approaches.

4.1.1 Data synthesis

Data were obtained from a large database of vegetation studies that exists at the University of Pretoria. The aim was to select all relevés that are known to contain *Acacia karroo* and a total of 1553 relevés were selected, comprising 60 studies from all the nine South African provinces. The specific areas where the studies were conducted, as well as the authors that are included in this study are given in Table 3.1 of Chapter 3.

Because phytosociological tables are difficult and impractical to handle with large data sets, synoptic tables were instead used due to relatively easier manipulation of data on such tables. In addition, synoptic tables are the most appropriate tools to carry out the hierarchisation procedure since it is easy to assess which species are faithful to the various communities. The principle of synoptic tables is based on rating the presence of each species within a community on a constancy scale as follows (Mueller-Dombois and Ellenberg, 1974, Kent & Coker 1996; Van der Maarel 2005):

- r – Species present in 1-5% of the relevés of a community
- + - Species present in 6-10% of the relevés of a community
- I - Species present in 11-20% of the relevés of a community
- II - Species present in 21-40% of the relevés of a community
- III - Species present in 41-60% of the relevés of a community
- IV - Species present in 61-80% of the relevés of a community
- V - Species present in 81-100% of the relevés of a community

The data synthesis involved the following two phases:

Phase 1

The basic techniques used in this phase are the computer classification programmes TURBOVEG (Hennekens, 1996a) and MEGATAB (Hennekens, 1996b). The initial phase of synthesis involved the feeding of all the floristic data from the various studies into TURBOVEG, from where it was exported to MEGATAB (Hennekens, 1996b) for classification. The TWINSpan classification algorithm (Hill, 1979a) was used as a first approximation for the classification of the data, followed by refinement of the classification results through the use of MEGATAB. The result was a synoptic table which revealed four major vegetation types, namely savanna, grassland, wetland and karroid communities. This synoptic table is discussed in Chapter 5.

Phase 2

Each of the four vegetation units was then classified into a separate synoptic table, using the same procedures of MEGATAB and TWINSpan as described above. From each of the four synoptic tables, all clusters that represent characteristic *Acacia karroo* communities were identified and extracted into a separate synoptic table, which was subsequently classified. This synoptic table is described in detail in Chapter 6.

The remainder of the relevés from three of the four tables (savanna, grassland, and wetland communities) were then classified again and refined using the same procedures of MEGATAB and TWINSpan as described above. The karroid communities were found to all represent the nucleus *Acacia karroo* communities and were hence all included in the synoptic table for the *Acacia karroo* class. The tables are discussed in Chapter 7 (savanna, grassland, and wetland communities).

4.2 DESCRIPTION OF SYNTAXA

- i) For the *Acacia karroo* Class (Chapter 6), the names of some already-described syntaxa have been changed in some instances because some syntaxa from the various studies shared similar names. In such cases, the original names are given as synonyms.

- ii) The Code of Syntaxonomical Literature was not followed in this thesis because the various syntaxa are mere suggestions at this stage. The syntaxa of the *Acacia karroo* Class will formally be published according to the Code of Syntaxonomical Literature in future.
- iii) Syntaxa are described as follows:
- Habitat descriptions for both newly-described and already-described syntaxa are given according to the original authors.
 - The abundance of the species is determined from phytosociological tables of the original studies, as the present study utilises synoptic tables and hence the cover-abundance status of each species cannot be shown on such tables. Likewise, the names of newly-described syntaxa are derived from the original phytosociological tables.
 - Diagnostic species are given according to the new classification as many of the original diagnostic species have proven to be only regionally/locally diagnostic and have hence not retained such status in this classification. Those that have retained their diagnostic character are mentioned thus or indicated with an **asterisk (*)** in the descriptions (Chapters 6 and 7).
 - The association is the basic rank in the synoptic table for the *Acacia karroo* Class (Chapter 6). Where associations are constituted from a group of lower ranking syntaxa such as sub-associations and communities, such syntaxa are indicated in the descriptions but not on the synoptic table. Their habitat descriptions and diagnostic species are given according to the original authors. In instances where orders have been subdivided into sub-orders, associations and their lower ranking constituent syntaxa are not indicated on the table but are mentioned only in the text and described according to the original authors.
 - The communities in Chapter 7 are described according to the original authors except for those that have been grouped together for the first time.

CHAPTER FIVE

AN OVERVIEW OF THE *ACACIA KARROO* COMMUNITIES IN SOUTHERN AFRICA

From a total of 1 553 relevés and 2 006 species selected for this study, TWINSpan classification produced five main vegetation types (Table 5.1), which are summarised below. A complete description of these vegetation types is given in Chapters Six and Seven.

5.1 Savanna Communities

The areas of the Savanna Biome where *Acacia karroo* occurs are the Limpopo Province (the list of authors who have done work in this province is given on Table 3.1 in Chapter Three), North-West (Coetzee 1975; Brown & Bredenkamp 1994; Brown, Bredenkamp & Van Rooyen 1995, 1996, 1997; Siebert 2001) and parts of Mpumalanga (Siebert 2001). Vast communities of *Acacia karroo* also occur in the Kalahari region (Smit 2000).

Acacia karroo communities can be encountered on predominantly sandy soils on bottomlands, footslopes and mountain slopes. They can also be found as riparian thicket on clayey soils along stream and river banks. The vegetation is classified under two classes described by Winterbach, Bredenkamp, Deutschländer and Mucina (2000).

The first is the *Englerophyto magalismsontani* – *Acacietea caffrae*, a mountain bushveld found on the slopes of the Waterberg and the Magaliesberg, Witwatersrand, and Suikerbosrand. It occurs mainly on sandy soils underlain by solid rock (Winterbach *et al.* 2000). In the present classification, this class is represented by the *Kirkia wilmsii* – *Terminalia prunioides* Closed Mountain Bushveld and the *Combretum hereroense* – *Grewia vernicosa* Open Mountain Bushveld described by Siebert, Van Wyk and Bredenkamp (2002). These communities occur

within the Sekhukhuneland Centre of Plant Endemism (SPCE), which stretches from the Limpopo Province into the Mpumalanga Province, and includes towns such as Roosenekal, Steelpoort, and Sekhukhune. They are predominantly restricted to the warm slopes and valleys of undulating hills and mountains.

The mountain bushveld is differentiated from other savanna communities by the presence of species from group A, which include *Ectadiopsis oblongifolium*, *Combretum erythrophyllum*, *Sida spinosa*, *Schotia brachypetala*, *Croton gratissimus*, *Kirkia wilmsii*, and *Hippobromus pauciflorus*.

The second class is the *Panico maximi – Acacietea tortilis*, which represents a microphyllous Thorny Bushveld that occurs in the Transvaal Plateau Basin, comprising the flat Bushveld Basin and the Waterberg, Soutpansberg and Pietersburg Plateaus. It is characteristic of the dark, clayey soils often developed over basalt in the low lying areas (Winterbach *et al.* 2000).

The class is distinguished by *Urochloa mosambicensis*, *Leucas glabrata*, *Justicia flava*, and *Grewia monticola* (Species group K), while the original diagnostic species identified by Winterbach *et al.* (2000) include *Acacia karroo*, *Acacia nilotica*, *Rhus lancea*, *Eragrostis rigidor*, and *Cymbopogon pospischillii*. Other species that occur in this class are represented in species groups from B to J.

5.2 Grassland Communities

Extensive phytosociological work has been done in the grassland Biome; the list of authors who have done work in this biome is given on Table 3.1 in Chapter Three. *Acacia karroo* often encroaches degraded grassland and can be found occurring on plains where soils are sufficiently deep. It can also be encountered in sheltered sites on the slopes, where habitat conditions are relatively moist. Species from group V, namely *Selago densiflora*, *Brachiaria serrata*, *Vernonia oligocephala*, and *Hermannia depressa* differentiate this vegetation type.

5.3 Riparian Thickets

The riparian thickets are found occurring in the Free State (Scheepers 1975; Rossouw 1983; Müller 1986; Kooij *et al.* 1990b,c,d; Kooij *et al.* 1991; Du Preez 1991; Fuls 1993; Malan 1998).

Acacia karroo-dominated riparian vegetation is associated with deep, clayey alluvial deposits that occur along stream and river banks, and occasionally on the river beds. The thickets also extend to the floodplains and bottomlands adjacent to the watercourses. This vegetation type forms the core of the *Acacia karroo* Class suggested in Chapter Six and is distinguished by *Tagetes minuta*, *Setaria verticillata*, and *Bidens bipinnata* (Species group AK).

5.4 Wetland Communities

Wetland communities in which *Acacia karroo* is usually encountered are found in KwaZulu-Natal (Robbeson 1998; Eckhardt, Van Rooyen & Bredenkamp 1996b), Mpumalanga (De Frey 1999; Smit, Bredenkamp, Van Rooyen, Van Wyk & Combrinck 1997) and Northern Province (Siebert 2001; Siebert *et al.* 2002). Although these communities occur in both the Savanna and Grassland Biomes, they are regarded here as a distinct vegetation type because of their unique species composition.

This vegetation type differs from the riparian thickets (vegetation type 5.3) described above, which are mainly associated with clayey soils along rivers and streams. The wetland communities described here are generally associated with moist sandy soils and are dominated by grasses and forbs. *Acacia karroo* in these communities is the only notable woody species, but is not as prominent as in the Riparian Thickets (vegetation type 5.3).

The differentiating species are *Paspalum dilatatum*, *Mariscus congestus*, *Scabiosa columbaria*, *Phragmites australis*, *Gomphostigma virgatum*, *Verbena bonariensis*, and *Equisetum ramosissimum* (Species group AT).

Two major communities are recognised within this vegetation type. The first is the *Hemarthria altissima* Class described by Du Preez and Bredenkamp (1991) for the southern and eastern Free State. It represents vegetation of moist soils on marshes, streambanks, riverbanks, dam edges, and vleis. Although *Acacia karroo* is not present in communities described by Du Preez and Bredenkamp (1991), it can be encountered in other wetland communities regarded as part of this class, namely those of the Helpmekaar-Utrecht-Louwsburg area in central-northern KwaZulu-Natal (Eckhardt, Van Rooyen & Bredenkamp 1996b). The class is distinguished by species such as *Hemarthria altissima*, *Paspalum distichum*, *Leersia hexandra*, and *Eragrostis micrantha* (Species group AO).

The other distinct community is the *Fuirena pubescens* – *Schoenoplectus corymbosus* Wetland Vegetation described by Siebert *et al.* (2002). This wetland vegetation is found throughout the Sekhukhuneland on stream banks in valleys, in seepage areas on mountain slopes, and also in wetlands on the mountain plateaus. It is associated with wet, vertic black clay soils (Siebert *et al.* 2002). The main differentiating factor between this vegetation and other *Acacia karroo*-dominated riparian vegetation is the absence of the woody species from species group AR, which are the usual companions of *Acacia karroo* along the riverbanks. Siebert *et al.* (2002) regard the community to be rather an extension of the wetlands of the Steenkampsberg described by Bloem (1988). It is distinguished by the presence of species from group AS, which include *Cliffortia nitidula*, *Fuirena pubescens*, *Andropogon eucomus*, *Conyza scabrida*, and *Miscanthus junceus*.

5.5 Nama Karoo Communities

This is karroid vegetation of the Fauresmith-Petrusburg-Bloemfontein-Zastron area in southern Free State (Malan 1998), as well as the Graaff-Reinet (Palmer 1989) and Cradock (Van Der Walt 1980; Brown & Bezuidenhout 2000) areas in the Eastern Cape. It comprises overgrazed and

trampled veld found on gentle slopes and plateaus in south-western Free State (Malan 1998), and is also associated with rocky habitats on hot and dry slopes in the Graaff-Reinet (Palmer 1989) and Cradock areas (Van Der Walt 1980; Brown & Bezuidenhout 2000). Acocks (1988) ascribes the presence of *Acacia karroo* in these veld types to bush encroachment occurring as a result of overgrazing. The distinguishing species for this vegetation type are the dwarf shrubs *Pentzia incana* and *Chrysocoma ciliata* (Species group AW) (Table 5.1).

CHAPTER SIX

THE SUGGESTED SYNTAXONOMY OF THE *ACACIA KARROO* CLASS IN SOUTHERN AFRICA

The *Acacia karroo* Class is a broad vegetation class occurring over a large part of southern Africa. The class has been informally described by Du Preez (1991), and Du Preez and Bredenkamp (1991) as vegetation representing the thickets usually situated on well-developed levees along rivers, streams and drainage lines, and also on clayey soils on lower terraces and floodplains adjacent to rivers. The class also includes vegetation found on deep alluvial or colluvial soils on gradual footslopes of hills and ridges, usually situated near drainage lines and rivers. Grassland communities encroached upon by *Acacia karroo* are also included in this class.

6.1 CLASSIFICATION

The suggested hierarchical classification of the *Acacia karroo* Class is as follows:

1. *Cyperus longus* – *Asparagus larycinus* Order
 - 1.1 *Echinochloa holubii* – *Acacia karroo* Alliance
 - 1.1.1 *Ziziphus mucronata* - *Rhus pyroides* Association
 - i) *Bromus catharticus* Sub-association
 - ii) *Xanthium strumarium* Sub-association
 - 1.1.2 *Leersia hexandra* – *Echinochloa holubii* Association
 - i) *Setaria nigrirostris* – *Acacia karroo* Sub-association
 - ii) *Echinochloa stagnina* – *Acacia karroo* Sub-association
 - 1.2 *Lobelia thermalis* – *Eragrostis plana* Alliance
 - 1.2.1 *Cyperus marginatus* – *Rhus pyroides* Association
 - 1.2.2 *Rhus pyroides* – *Andropogon appendiculatus* Association

2. *Achyranthes aspera* – *Diospyros lycioides* Order

2.1 *Chenopodium album* – *Ziziphus mucronata* Alliance

2.1.1 *Acacia karroo* – *Gymnosporia buxifolia* Association

i) *Diospyros lycioides* – *Rhus pyroides* Sub-association

ii) *Salix capensis* – *Cyperus rotundus* Sub-association

2.1.2 *Oxalo* – *Ziziphetum* Du Preez 1991

i) *Oxalo* – *Ziziphetum* – *rhoetosum pyroides* Du Preez 1991

ii) *Oxalo* – *Ziziphetum* – *rhoetosum lanceae* Du Preez 1991

iii) *Oxalo* – *Ziziphetum* – *chloroetosum* Du Preez 1991

2.2 *Melico* – *Sporobolion* Du Preez 1991

2.2.1 *Enneapogono* – *Acacietum* Müller 1986

2.2.2 *Setario* - *Protasparagetum* Müller 1986

i) *Setario* – *Protasparagetum* - *acacietosum* Müller 1986

2.2.3 *Rhoo* – *Ehrhartetum erectae* Du Preez 1991

i) *Rhoo* – *Ehrhartetum erectae* – *celtoetosum* Du Preez 1991

ii) *Rhoo* – *Ehrhartetum erectae* – *atriplecietosum* Du Preez 1991

2.2.4 *Trichoneura grandiglumis* – *Acacia karroo* Association

2.3 *Diospyrion lycioidis* Werger 1980

2.3.1 *Rhoo* – *Diospyretum* Werger 1980

i) *Acacia karroo* – *Celtis africana* Sub-association

ii) *Rhoo* – *Diospyretum* – *acacietosum karroo* Werger 1980

2.3.2 *Zizipho* – *Acacietum karroo* Werger 1980

3. *Felicia filifolia* – *Tragus koelerioides* Order

3.1 *Pentzia incana* - *Chrysocoma ciliata* Alliance

3.1.1 *Asparagus mucronatus* – *Eragrostis curvula* Association

i) *Setaria sphacelata* – *Acacia karroo* Sub-association

ii) *Grewia occidentalis* – *Rhus lucida* Sub-association

3.1.2 *Rhus undulata* – *Pentzia incana* Association

i) *Acacia karroo* – *Stipagrostis namaquensis* Sub-association

ii) *Selago geniculata* – *Felicia muricata* Sub-association

3.2 *Eragrostis chloromelas* – *Asparagus suaveolens* Alliance

3.2.1 *Carissa macrocarpa* – *Asparagus suaveolens* Association

- i) *Tragus koelerioides* – *Becium burchellianum* Sub-association
- ii) *Setaria sphacelata* – *Cadaba aphylla* Sub-association

3.2.2 *Urochloa panicoides* – *Pentzia globosa* Association

- i) *Selago geniculata* – *Eragrostis obtusa* Sub-association
- ii) *Psilocaulon junceum* – *Eragrostis lehmanniana* Sub-association

4. *Rhus ciliata* – *Rhus lancea* Order

4.1 *Lycium hirsutum* – *Asparagus larycinus* Alliance

4.1.1 *Panicum maximum* – *Rhus pyroides* Association

- i) *Setaria verticillata* - *Chenopodium album* Sub-association
- ii) *Rhus pyroides* – *Asparagus larycinus* Sub-association

4.1.2 *Crassula lanceolata* – *Ziziphus mucronata* Association

- i) *Crassula lanceolata* – *Acacia karroo* Sub-association
- ii) *Heteromorpha arborescens* – *Nidorella resedifolia* Sub-association
- iii) *Olea europaea* – *Heteromorpha arborescens* Sub-association

4.2 *Rhus erosa* – *Rhus burchellii* Alliance

4.2.1 *Rhus lancea* – *Buddleja saligna* Association

- i) *Acacia karroo* – *Schinus molle* Sub-association
- ii) *Osyris lanceolata* – *Rhus lancea* Sub-association

4.2.2 *Euryops subcarnosus* ssp. *minor* – *Rhigozum trichotomum* Association

4.2.3 *Asparagus striatus* – *Acacia karroo* Association

- i) *Enneapogon scaber* – *Rhigozum trichotomum* Sub-association
- ii) *Olea europaea* – *Acacia karroo* Sub-association
- iii) *Hertia pallens* – *Rhigozum trichotomum* Sub-association

5. *Acacia mellifera* - *Eragrostis lehmanniana* Order

5.1 *Rhus tridactyla* - *Tarchonanthus camphoratus* Sub-order

5.1.1 *Tarchonanthus camphoratus* – *Aristida meridionalis* Alliance

- i) *Tarchonanthus camphoratus* – *Anthospermum rigidum* Association

ii) *Tarchonanthus camphoratus* – *Blepharis marginata* Association

5.1.2 *Tarchonanthus camphoratus* – *Enneapogon scoparius* Alliance

i) *Tarchonanthus camphoratus* – *Acacia robusta* Association

ii) *Tarchonanthus camphoratus* – *Enneapogon desvauxii* Association

iii) *Tarchonanthus camphoratus* – *Acacia erioloba* Association

iv) *Tarchonanthus camphoratus* – *Solanum tomentosum* Association

v) *Tarchonanthus camphoratus* – *Enneapogon scoparius* Association

5.2 *Acacia erioloba* – *Eragrostis lehmanniana* Sub-order

5.2.1 *Acacia erioloba* – *Acacia mellifera* Alliance

i) *Acacia mellifera* – *Monechma incanum* Association

ii) *Acacia mellifera* – *Melhania rehmannii* Association

iii) *Acacia mellifera* – *Rhus dregeana* Association

iv) *Acacia mellifera* – *Kyphocarpa angustifolia* Association

5.2.2 *Acacia erioloba* – *Stipagrostis uniplumis* Alliance

i) *Acacia erioloba* – *Stachys spathulata* Association

ii) *Acacia erioloba* – *Amphiglossa triflora* Association

iii) *Acacia erioloba* – *Dichrostachys cinerea* Association

iv) *Acacia erioloba* – *Kyllinga alba* Association

5.2.3 *Acacia erioloba* – *Eragrostis rigidior* Alliance

i) *Acacia erioloba* – *Osteospermum muricatum* Association

ii) *Acacia erioloba* – *Phyllanthus maderaspatensis* Association

iii) *Acacia erioloba* – *Enneapogon cenchroides* Association

iv) *Acacia erioloba* – *Dipcadi papillatum* Association

v) *Acacia erioloba* – *Aristida stipitata* Association

5.3 *Tarchonanthus camphoratus* – *Eragrostis lehmanniana* Sub-order

5.3.1 *Tarchonanthus camphoratus* – *Fingerhuthia africana* Alliance

i) *Tarchonanthus camphoratus* – *Panicum coloratum* Association

ii) *Olea europaea* - *Tarchonanthus camphoratus* Association

5.3.2 *Acacia tortilis* – *Tarchonanthus camphoratus* Alliance

i) *Acacia erioloba* – *Dicoma anomala* Association

ii) *Pentzia globosa* – *Acacia tortilis* Association

- iii) *Hertia pallens* – *Tarchonanthus camphoratus* Association
- iv) *Ledebouria graminifolia* – *Tarchonanthus camphoratus* Association
- v) *Dicoma capensis* – *Tarchonanthus camphoratus* Association
- vi) *Tarchonanthus camphoratus* – *Boscia albitrunca* Association
- vii) *Pentzia incana* - *Tarchonanthus camphoratus* Association

5.4 *Acacia karroo* – *Cynodon dactylon* Sub-order

5.4.1 *Asparagus laricinus* – *Cynodon dactylon* Alliance

- i) *Aristida congesta* – *Panicum coloratum* Association
- ii) *Eragrostis rigidor* – *Panicum coloratum* Association
- iii) *Helichrysum aureonitens* – *Themeda triandra* Association

5.4.2 *Cirsium vulgare* – *Cynodon dactylon* Alliance

- i) *Fingerhuthia africana* – *Panicum coloratum* Association
- ii) *Setaria verticillata* – *Acacia karroo* Association

5.4.3 *Chloris virgata* - *Acacia karroo* Alliance

- i) *Enneapogon cenchroides* – *Panicum coloratum* Association
- ii) *Aristida congesta* – *Themeda triandra* Association

6. *Teucrium trifidum* – *Themeda triandra* Order

6.1 *Blepharis integrifolia* – *Asparagus laricinus* Sub-order

6.1.1 *Atriplex semibaccata* – *Acacia karroo* Alliance

- i) *Acacia karroo* – *Melica decumbens* Association
- ii) *Acacia karroo* – *Eragrostis chloromelas* Association

6.1.2 *Hemizygia pretoriae* – *Acacia karroo* Alliance

- i) *Eustachys paspaloides* – *Acacia karroo* Association
- ii) *Sporobolo fimbriatis* – *Tarchonanthetum camphoratis* Fuls *et al.* 1992a

6.1.3 *Themeda triandra* – *Asparagus laricinus* Alliance

- i) *Enneapogono scoparii* – *Diospyretum lycioidis* Fuls *et al.* 1992a
- ii) *Panicum coloratum* – *Acacia karroo* Association

6.1.4 *Tribulus terrestris* – *Asparagus laricinus* Alliance

- i) *Asparagus suaveolens* – *Rhus lancea* Association

6.2 *Tragus berteronianus* – *Asparagus laricinus* Sub-order

6.2.1 *Bulbine narcissifolia* – *Acacia karroo* Alliance

- i) *Triraphis andropogonoides* – *Acacia karroo* Association
 - ii) *Asparagus larycinus* – *Acacia karroo* Association
 - iii) *Acacia karroo* – *Hibiscus pusillus* Association
- 6.2.2 *Acacion karroo* Bezuidenhout & Bredenkamp 1991a
- i) *Sporobolo africana* – *Acacietum karroo* Bezuidenhout & Bredenkamp 1991a
 - ii) *Elionurus muticus* – *Acacia karroo* Association
 - iii) *Rhoo pyroidis* – *Acacietum karroo* Bezuidenhout, Bredenkamp & Theron 1993
 - iv) *Tarchonanthera camphorata* – *Acacietum karroo* Bezuidenhout, Bredenkamp & Theron 1993
 - v) *Grewia flava* – *Acacia karroo* Association
- 6.2.3 *Protasparago africana* – *Acacion karroo* Bezuidenhout, Bredenkamp & Theron 1994b
- i) *Protasparago suaveolentis* - *Acacietum karroo* Bezuidenhout *et al.* 1994b
 - ii) *Eragrostido curvulae* – *Acacietum karroo* Bezuidenhout *et al.* 1994b
 - iii) *Rhoo lanceae* – *Acacietum caffrae* Bezuidenhout *et al.* 1994b
- 6.2.4 *Chascanum hederaceum* – *Asparagus suaveolens* Alliance
- i) *Zizipho mucronatae* – *Acacietum karroo* Bezuidenhout *et al.* 1994d
 - ii) *Acacia karroo* – *Ziziphus mucronata* Association
 - iii) *Acacietum karroo* – *caffrae* Bezuidenhout *et al.* 1994c
- 6.2.5 *Acacion eriolobae* Bezuidenhout, Bredenkamp & Theron 1993
- i) *Stipagrostis uniplumis* – *Acacietum eriolobae* Bezuidenhout *et al.* 1993
 - ii) *Terminalietum sericeae* – *Acacietum eriolobae* Bezuidenhout *et al.* (1993)
- 6.2.6 *Setaria sphacelata* - *Asparagus larycinus* Alliance
- i) *Cynodon dactylon* – *Acacia karroo* Association
 - ii) *Eustachys paspaloides* – *Acacia karroo* Association
- 6.3 *Zanthoxylum capense* – *Euclea crispa* Sub-order
- 6.3.1 *Euclea crispa* – *Rhoicissus tridentata* Alliance
- i) *Rhus pyroides* – *Rhamnus prinoides* Association
 - ii) *Acacia caffra* – *Aloe marlothii* Association
 - iii) *Acacia karroo* – *Teucrium trifidum* Association
- 6.3.2 *Rhus leptodictya* – *Grewia occidentalis* Alliance

i) *Acacia karroo* – *Eragrostis chloromelas* Association

ii) *Acacia caffra* – *Eragrostis chloromelas* Association

6.3.3 *Acacia karroo* – *Lippia javanica* Association

i) *Acacia karroo* – *Gymnosporia polyacantha* Association

ii) *Acacia karroo* – *Adenia digitata* Association

iii) *Acacia karroo* – *Teucrium trifidum* Association

7. *Acacietalia karroo* Eckhardt, Van Rooyen & Bredenkamp 1997

7.1 *Berkheya onopordifolia* - *Diospyros lycioides* Sub-order

7.1.1 *Eragrostio curvulae* – *Acacietum caffrae* Eckhardt *et al.* 1997

i) *Panicum maximum* – *Clerodendretum glabrum* Eckhardt *et al.* 1997

ii) *Alooe maculatae* – *Rhoetum pentheri* Eckhardt *et al.* 1997

iii) *Stipoides dregeanae* - *Rhoetum pyroidis* Eckhardt *et al.* 1997

iv) *Rhoetum pentheri* – *Acacietum caffrae* Eckhardt *et al.* 1997

7.1.2 *Trachypogon spicati* – *Diospyrion lycioidis* Eckhardt *et al.* 1997

i) *Conyso bonariensis* – *Cymbopogonetum validi* Eckhardt *et al.* 1997

ii) *Cymbopogon validi* – *Acacietum karroo* Eckhardt *et al.* 1997

7.1.3 *Berkheya onopordifolia* – *Acacia karroo* Alliance

i) *Brachiario eruciformis* – *Acacietum karroo* Eckhardt *et al.* 1997

ii) *Sporobolus pyramidalis* – *Acacietum sieberianae* Eckhardt *et al.* 1997

iii) *Eragrostis plana* – *Acacia karroo* Association

iv) *Setaria sphacelata* – *Acacia karroo* Association

7.2 *Acacia nilotica* – *Gymnosporia buxifolia* Sub-order

7.2.1 *Rhus pentheri* – *Acacia karroo* Alliance

7.2.1.1 *Barleria obtusa* – *Acacia nilotica* Association

i) *Panicum maximum* – *Bothriochloa insculpta* Sub-association

ii) *Buddleja loricata* – *Aloe marlothii* Sub-association

iii) *Vepris lanceolata* – *Ziziphus mucronata* Sub-association

iv) *Euclea natalensis* – *Hyparrhenia hirta* Sub-association

7.2.1.2 *Hyparrhenia hirta* – *Rhus pentheri* Association

i) *Aristida congesta* ssp *barbicollis* – *Eragrostis superba* Sub-association

ii) *Acacia karroo* – *Heteropogon contortus* Sub-association

iii) *Rhus dentata* – *Paspalum dilatatum* Sub-association

7.2.2 *Acacia sieberiana* – *Acacia karroo* Alliance

i) *Acacia sieberiana* – *Eriosema salignum* Association

ii) *Acacia sieberiana* – *Gymnosporia buxifolia* Association

7.3 *Tristachya leucothrix* – *Acacia karroo* Sub-order

7.3.1 *Hyparrhenia hirta* – *Acacia caffra* Alliance

i) *Acacia caffra* – *Tristachya leucothrix* Association

ii) *Acacia caffra* – *Ozoroa paniculosa* Association

7.3.2 *Pentanisia prunelloides* – *Acacia karroo* Alliance

i) *Hyparrhenia hirta* – *Rhus dentata* Association

ii) *Acacia karroo* – *Themeda triandra* Association

6.2 DESCRIPTION OF THE PLANT COMMUNITIES

1. *Cyperus longus* – *Asparagus laricinus* Order

Nomenclatural type: *Echinochloa holubii* – *Acacia karroo* Alliance

This vegetation is associated with watercourses in the northern Free State, ranging from deeply incised, fast draining rivers to moderately incised, relatively slow-draining streams. The diagnostic species include *Salix babylonica*, *Hemarthria altissima*, *Cyperus longus*, *Paspalum dilatatum*, and *Cyperus fastigiatus* (Species group 8). The species associated with this order are also characteristic of the *Hemarthria altissima* Class described by Du Preez and Bredenkamp (1991). This could indicate that the vegetation of the *Hemarthria altissima* Class could change to that of the *Acacia karroo* Class due to degradation and disturbance of the wetland vegetation and resultant encroachment by *Acacia karroo*.

Two alliances and four associations are recognised under this order.

1.1 *Echinochloa holubii* – *Acacia karroo* Alliance

Synonym: *Echinochloa holubii* – *Acacia karroo* Riverain Vegetation (Fuls 1993)

Nomenclatural type: *Ziziphus mucronata* - *Rhus pyroides* Association

The community was originally described by Fuls (1993) and is found in the Wesselsbron-Welkom-Kroonstad-Viljoenskroon area, in north-western Free State. It is associated with deeply incised or moderately incised rivers and streams. Streamflow is relatively fast to intermediate, but standing or slow draining water may be present in seasonal or perennial pools (Fuls 1993).

The alliance is characterised by *Echinochloa holubii*, *Paspalum distichum*, and *Alternanthera nodiflora* (Species group 3). Two associations are recognised under the alliance.

1.1.1 *Ziziphus mucronata* - *Rhus pyroides* Association

Synonym: *Ziziphus mucronata* – *Rhus pyroides* Short Riverine Thicket (Fuls 1993)

Nomenclatural type: *Xanthium strumarium* Sub-association

This riparian thicket was originally described by Fuls (1993). It is associated with deeply incised perennial rivers and larger streams (i.e. Vals River, Renoster River and Vaal River). The watercourses are characterised by relatively dry streambanks. Signs of disturbance and retrogression are evident within this plant community, due to periodic flooding, streambank erosion, as well as trampling and overgrazing by livestock. Bush encroachment by *Acacia karroo*, *Rhus pyroides* and *Ziziphus mucronata* is also evident (Fuls 1993).

The most common tree species are *Salix mucronata* (Species group 1), the alien *Salix babylonica* (Species group 8), *Rhus pyroides* (Species group 100) and *Ziziphus mucronata* (Species group 109), while shrubs often encountered are *Asparagus lariginus* (Species group 100), *Gymnosporia buxifolia* and *Diospyros lycioides* (Species group 109).

The diagnostic species are *Salix mucronata**, *Gomphocarpus fruticosus*, *Setaria pumila*, and the exotics *Verbena officinalis** and *Eucalyptus** species (Species group 1). Fuls (1993) regards the overall prominence of exotic species within the plant community as a serious threat to the preservation of this wetland type.

Fuls (1993) identified the following two communities, which are regarded here as sub-associations:

i) *Bromus catharticus* Sub-association

Synonym: *Bromus catharticus* Variant (Fuls 1993)

Nomenclatural type: Relevé 26, Table 4.1 (Fuls 1993)

The community was originally differentiated mostly by annual weeds which are primarily indicators of disturbance or retrogression (Fuls 1993). These include *Bromus catharticus*, *Achyranthes aspera*, and *Bidens bipinnata*.

ii) *Xanthium strumarium* Sub-association

Synonym: *Xanthium strumarium* Variant (Fuls 1993)

Nomenclatural type: Relevé 14, Table 4.1 (Fuls 1993)

Like the *Bromus catharticus* Sub-association, this community is also characterised by species indicative of disturbance or retrogression. The original diagnostic species include *Xanthium strumarium*, *Argemone subfusiformis*, *Setaria pallide-fusca*, and *Sesbania punicea*.

1.1.2 *Leersia hexandra* – *Echinochloa holubii* Association

Nomenclatural type: *Setaria nigrirostris* – *Acacia karroo* Sub-association

This vegetation is associated with moderately incised streambeds, and streambanks that are wetter than in the *Salix mucronata* - *Rhus pyroides* association (association 1.1.1). The

* Refers to diagnostic species from original descriptions

diagnostic species are *Panicum stapfianum*, *Setaria nigrirostris*, *Leersia hexandra*, and *Scabiosa columbaria* (Species group 2). Grasses are most prominent and dominate the streambanks. They include *Panicum stapfianum*, *Setaria nigrirostris* (Species group 2), *Echinochloa holubii* (Species group 3), and *Themeda triandra* (Species group 109). *Acacia karroo* (Species group 110) is also abundant on the streambanks. Within the stream, *Paspalum distichum* (Species group 3) and *Cyperus longus* (Species group 8) are dominant.

Two communities described by Fuls (1993) represent sub-associations:

i) *Setaria nigrirostris* – *Acacia karroo* Sub-association

Synonym: *Setaria nigrirostris* – *Acacia karroo* Low Riverain Bushland (Fuls 1993)

Nomenclatural type: Relevé 2, Table 4.1 (Fuls 1993)

The wetland community is associated with moderately incised streambeds. Small trees of *Rhus pyroides* and *Acacia karroo* are often encountered, but they do not occur abundantly. The streambanks are dominated by grasses such as *Setaria nigrirostris*, *Andropogon appendiculatus*, *Themeda triandra*, *Cymbopogon pospischillii*, *Panicum stapfianum*, and *Echinochloa holubii*. The original diagnostic species include *Setaria nigrirostris*, *Andropogon appendiculatus*, *Themeda triandra*, *Haplocarpha scaposa*, and *Berkheya radula*.

ii) *Echinochloa stagnina* – *Acacia karroo* Sub-association

Synonym: *Echinochloa stagnina* – *Acacia karroo* Low Riverain Bushland (Fuls 1993)

Nomenclatural type: Relevé 45, Table 4.1 (Fuls 1993)

The community is associated with moderately incised streambeds and wet, clayey streambanks. Its diagnostic species are *Echinochloa stagnina*, *Panicum repentellum*, and *Aster squamatus*. Noteworthy is the dominance of *Cyperus longus* within the stream. *Paspalum distichum* within the streambed, and the abundance of *Acacia karroo* on the streambanks.

1.2 *Lobelia thermalis* – *Eragrostis plana* Alliance

Nomenclatural type: *Rhus pyroides* – *Andropogon appendiculatus* Association

This wetland occurs in northern Free State. It is found in the Vredefort-Kroonstad-Lindley-Heilbron area (Fuls *et al.* 1992c), and in the Heilbron-Lindley-Warden-Villiers area (Fuls 1993). The community is restricted to relatively fast-draining watercourses, and is associated with intermediate or deep streambed incision. Diagnostic species are *Lobelia thermalis*, *Agrostis lachnantha*, *Rumex crispus* and *Helictotrichon turgidulum* (Species group 6). Grasses and forbs are most dominant, with *Rhus pyroides*, *Asparagus laricinus* (Species group 100), and *Acacia karroo* (Species group 110) being the only prominent woody species.

The following associations represent the alliance:

1.2.1 *Cyperus marginatus* – *Rhus pyroides* Association

Synonym: *Cyperus marginatus* – *Rhus pyroides* Variant (Fuls *et al.* 1992c)

Nomenclatural type: Relevé 181, Table 1 (Fuls *et al.* 1992c)

The community is found in ravines with deep streambed incision. It is associated with dry streambanks that are characterised by a conspicuous woody component (Fuls *et al.* 1992c). The diagnostic species are *Lactuca* species, *Mariscus congestus*, *Persicaria decipiens*, and *Vigna vexillata** (Species group 4). Grasses and forbs are prominent and include *Lactuca* species, *Mariscus congestus* (Species group 4), *Hemarthria altissima*, *Paspalum dilatatum*, *Cyperus fastigiatus*, *Andropogon appendiculatus*, *Cyperus marginatus*, *Eragrostis plana* (Species group 8), and *Cynodon dactylon* (Species group 100). *Rhus pyroides*, *Asparagus laricinus* (Species group 100), and *Acacia karroo* (Species group 110) are the only prominent woody species.

1.2.2 *Rhus pyroides* – *Andropogon appendiculatus* Association

Synonym: *Rhus pyroides* – *Andropogon appendiculatus* Wetland (Fuls 1993)

Nomenclatural type: Relevé 169, Table 3.6.1 (Fuls 1993)

This is a restricted community with an open to slightly dense patchy thicket. It is associated with slightly moist streambanks (Fuls 1993). *Pulicaria scabra*, *Verbena brasiliensis*, *Aster squamatus*, *Mentha longifolia*, *Galium capense*, and *Lobelia angolensis* (Species group 5) are the diagnostic species. *Salix babylonica* (Species group 8), *Rhus pyroides*, *Asparagus laricinus* (Species group 100), and *Acacia karroo* (Species group 109) dominate the thicket, while the most common grasses and forbs are *Panicum hystricula*, *Hemarthria altissima*, *Paspalum dilatatum*, *Cyperus fastigiatus*, *Andropogon appendiculatus*, and *Eragrostis plana* (Species group 8).

2. *Achyranthes aspera* – *Diospyros lycioides* Order

Synonym: *Acacia karroo* Riparian Thicket (Du Preez & Bredenkamp 1991)

Nomenclatural type: *Melico* – *Sporobolion* Du Preez 1991

The order represents riparian vegetation of the Vredefort Dome Area (Du Preez & Venter 1990) in northern Free State, the communities of the central Free State, namely the Modder River (Rossouw 1983) and Willem Pretorius Game Reserve (Muller 1986) in the Bloemfontein area, as well as communities along the Orange River (Werger 1980) in southern Free State. The *Acacia karroo* riparian thicket mostly occurs on the well developed banks along the rivers, streams, and drainage lines. It can also be found on clayey soils on the floodplains adjacent to the rivers (Du Preez & Bredenkamp 1991). The diagnostic species for this order are *Achyranthes aspera* (Species group 26) and *Setaria verticillata* (Species group 59).

Three alliances and eight associations are recognised under this order.

2.1 *Chenopodium album* – *Ziziphus mucronata* Alliance

Nomenclatural type: *Oxalo* – *Ziziphetum* Du Preez 1991

The alliance represents riparian communities of the Modder River (Rossouw 1983) and the Vredefort Dome Area (Du Preez & Venter 1990). It occurs along riverbanks, where it is associated with deep and clayey alluvial soils. *Chenopodium album* (Species group 11) is the only diagnostic species.

Two associations are recognised.

2.1.1 *Acacia karroo* – *Gymnosporia buxifolia* Association

Synonym: *Acacia karroo* – *Maytenus heterophylla* community (Du Preez & Venter 1990)

Nomenclatural type: *Salix capensis* – *Cyperus rotundus* Sub-association

This community is found in the Vredefort Dome Area in northern Free State. It was originally described by Du Preez and Venter (1990) as a tree community restricted to the islands and banks of the Vaal River, where deep alluvial deposits cover large areas and the soil is a clay loam texture.

Ipomoea purpurea, *Panicum schinzii** and *Cyperus rotundus** (Species group 9) are the diagnostic species. Constant woody species are *Rhus pyroides*, *Asparagus laricinus* (Species group 100), *Maytenus hetetophylla* (Species group 109), and *Acacia karroo* (Species group 110), while *Cyperus rotundus* (Species group 9), *Tagetes minuta* (Species group 20), and *Achyranthes aspera* (Species group 26) are prominent in the herbaceous layer. The only prominent grass species is *Ehrharta erecta* (Species group 20).

Du Preez and Venter (1990) described two sub-communities that constitute this association. These two sub-communities may be regarded as sub-associations:

i) *Diospyros lycioides* – *Rhus pyroides* Sub-association

Synonym: *Diospyros lycioides* – *Rhus pyroides* sub-community (Du Preez & Venter 1990)

Nomenclatural type: Relevé 105, Table 1 (Du Preez & Venter 1990)

The community occurs on the drier alluvial deposits on either side of the river and on the bigger islands. It is characterised by the presence of the species *Diospyros lycioides*, *Ipomoea purpurea*, and *Cestrum laevigatum*. The tree layer includes the dominant species *Diospyros lycioides*, *Rhus*

pyroides, *Ziziphus mucronata*, *Acacia karroo*, and *Celtis africana*, while the herbaceous layer is dominated by *Achyranthes aspera*, *Tagetes minuta*, and *Ehrharta erecta*.

ii) *Salix capensis* – *Cyperus rotundus* Sub-association

Synonym: *Salix capensis* – *Cyperus rotundus* sub-community (Du Preez & Venter 1990)

Nomenclatural type: Relevé 111, Table 1 (Du Preez & Venter 1990)

The community is restricted to the water edge and is disturbed due to the occasional flooding of the riverbanks. It is characterised by the dominant tree *Salix mucronata* [*S. capensis*], *Oenothera rosea*, and *Equisetum ramosissimum*. Other prominent species include *Cyperus rotundus*, *Acacia karroo*, and *Tagetes minuta*.

The following variants are recognised by Du Preez and Venter (1990):

- The *Verbena bonariensis* - *Datura ferox* Variant is associated with drier, disturbed areas of clay loam soils.
- The *Phragmites australis* – *Eichhornia crassipes* Variant is restricted to the waterside of the islands and riverbanks. The soil is clay loam, deep and rocky.

2.1.2 *Oxalo* – *Ziziphetum* Du Preez 1991

Synonym: The *Acacia karroo* Community (Rossouw 1983)

Nomenclatural type: *Oxalo* – *Ziziphetum* – *rhoetosum pyroides* Du Preez 1991

This community was originally described by Rossouw (1983) and later assigned a different taxonomic ranking by Du Preez (1991). It is a woodland community that extends from the banks of the Modder River in Bloemfontein to the adjacent floodplains and the river valleys. It also occurs along dry drainage channels away from the river. The soils are generally deep, clayey and alluvial. The community is characterised by sometimes impenetrable shrubs. Near the

watercourses the trees are larger and form a closed community, becoming shorter and sparser towards higher-lying ground.

The dominant species is *Acacia karroo* (Species group 110), with other tree species occurring extensively, but never dominant in this community. These include *Ziziphus mucronata* and *Diospyros lycioides* (Species group 109). Prominent shrubs and dwarf shrubs include *Asparagus cooperi* (Species group 19), *Atriplex semibaccata* (Species group 25), *Achyranthes aspera* (Species group 26), and *Asparagus larycinus* (Species group 100).

Where the tree community is not dense, the ground underneath is closely covered by forbs such as *Oxalis depressa* (Species group 10), *Bidens bipinnata* (Species group 19), *Tagetes minuta* (Species group 20), and *Clematis brachiata* (Species group 81). Prominent grasses in such areas include *Melica decumbens* (Species group 25), *Cynodon dactylon* (Species group 100), and *Eragrostis curvula* (Species group 109).

The diagnostic species are from species group 10 and are *Oxalis depressa*, *Sonchus oleraceus*, *Solanum retroflexum*, *Opuntia vulgaris*, *Rosenia humilis*, *Moraea pallida*, and *Senecio hastatus*.

Three sub-associations are recognised by Rossouw (1983) and Du Preez (1991).

i) *Oxalo – Ziziphetum – rhoetosum pyroides* Du Preez 1991

Synonym: *Acacia karroo – Rhus pyroides* Sub-community (Rossouw 1983)

Nomenclatural type: Relevé 46, Table 15 (Rossouw 1983)

The community occurs exclusively along the banks of the Modder River. It is a community of dense bush clumps in which little undergrowth is possible. It is dominated by *Acacia karroo*, in association with *Diospyros lycioides* and *Ziziphus mucronata*. The shrubs *Asparagus cooperi* and *Asparagus larycinus* are also common and form thick spiny clumps, while *Lycium hirsutum* and *Lycium cinereum* thrive in the shade of the taller trees but also usually occur as dense clumps in open areas between the trees. The climber *Clematis brachiata* is also of common occurrence.

Where the tree community is less dense, the undergrowth is dominated by the herbs *Bidens bipinnata*, *Tagetes minuta*, *Atriplex semibaccata* and *Achyranthes aspera*. The grasses *Setaria verticillata* and *Eragrostis curvula* are also common. Rossouw (1983) originally distinguished this community with the species *Rhus pyroides*, *Lycium hirsutum*, *Lycium cinereum*, *Rubia horrida*, *Pentarrhinum insipidum*, *Chenopodium album*, and *Moraea simulans*.

ii) *Oxalo – Ziziphetum – rhoetosum lanceae* Du Preez 1991

Synonym: *Acacia karroo – Rhus lancea* Sub-community (Rossouw 1983)

Nomenclatural type: Relevé 61, Table 15 (Rossouw 1983)

This community is restricted to the seasonal drainage lines away from the river and is mostly undisturbed or locally moderately utilised. It is composed of the prominent trees and shrubs *Olea europaea*, *Asparagus cooperi*, *Rhus lancea*, *Diospyros lycioides*, *Ziziphus mucronata* and *Acacia karroo*. These bushes form an irregular, usually open community, but in a few places they form closed stands.

The ground vegetation is rather sparse, and this can be attributed to the dense shade cast by closed portions of the trees. In less dense areas, the vegetation is dominated by the forbs *Bidens bipinnata* and *Tagetes minuta*, as well as the grass *Bromus catharticus*. The original diagnostic species for this community are *Rhus lancea* and *Olea europaea*.

iii) *Oxalo – Ziziphetum – chloroetosum* Du Preez 1991

Synonym: *Acacia karroo – Chloris virgata* Sub-community (Rossouw 1983)

Nomenclatural type: Relevé 48, Table 15 (Rossouw 1983)

A relatively large scrub community associated with floodplains adjacent to watercourses, lower pediment slopes of dolerite hills, and disturbed areas along roads. Moisture and soil depth are the factors concerned in the distribution of this community, as it is best developed on wetter but well-drained situations.

This community is more open and generally consists of predominating grasses with scattered trees, shrubs, and forbs in between. It is highly trampled and overgrazed. *Chloris virgata* occurs continuously throughout the community. Other grasses present are *Melica decumbens* and *Eragrostis curvula*. Bush clumps are formed by individuals of *Acacia karroo*; and the shrubs *Lycium cinereum*, *Pentzia globosa* and *Asparagus laricinus*. *Bidens bipinnata* and *Tagetes minuta* are frequent in disturbed and overgrazed areas. The original diagnostic species for this community are *Chloris virgata*, *Rosenia humilis*, *Themeda triandra*, and *Felicia muricata*.

Rossouw (1983) recognised the following two variants:

- *Acacia karroo* – *Chloris virgata* – *Cynodon incompletus* Variant occurring on plains and footslopes of hills.
- *Acacia karroo* – *Chloris virgata* – *Lycium horridum* Variant associated with disturbed roadsides.

2.2 *Melico* – *Sporobolion* Du Preez 1991

Nomenclatural type: *Setario* - *Protasparagetum* Müller 1986

Communities that represent this alliance were initially described by Müller (1986), and later by Du Preez (1991). The community occurs in the Willem Pretorius Game Reserve (Müller 1986), where it is associated with streambanks, plains and vlei-like areas. The diagnostic species for the community are *Cynodon hirsutus*, *Solanum tomentosum* var. *coccineum*, and *Cirsium vulgare* (Species group 18).

Müller (1986) and Du Preez (1991) described four associations under the alliance.

2.2.1 *Enneapogono* – *Acacietum* Müller 1986

Nomenclatural type: Relevé 86, Table 8.1 (Müller 1986)

The community occurs on slightly undulating plains adjacent to the footslopes of ridges (Müller 1986). Its only diagnostic species is *Garuleum pinnatifidum* (Species group 13). Müller (1986) originally identified the grass *Enneapogon scoparius* (Species group 53) as the diagnostic species, and its presence further differentiates the community from the other three associations. Prominent species include *Cynodon hirsutus* (Species group 18), *Enneapogon scoparius* (Species group 53), *Pentzia globosa*, *Felicia muricata* (Species group 81), *Aristida congesta* (Species group 99), and *Acacia karroo* (Species group 110).

2.2.2 *Setario – Protasparagetum* Müller 1986

Nomenclatural type: *Setario – Protasparagetum - acacietosum* (Müller 1986)

The community is found on clayey soils in low-lying, vlei-like areas (Müller 1986). It is characterised by the grass *Setaria incrassata* (Species group 14), which together with *Aristida bipartita*, *Crabbea angustifolia*, and *Eragrostis chloromelas* are the original diagnostic species for the association. Prominent woody species include *Asparagus cooperi* (Species group 19) and *Asparagus laricinus* (Species group 100), with *Setaria incrassata* (Species group 14), *Pentzia globosa* (Species group 81), *Aristida bipartita* (Species group 97), *Conyza podocephala* (Species group 98), *Cynodon dactylon* (Species group 100), *Eragrostis curvula*, and *Themeda triandra* (Species group 109) among the dominant species in the herbaceous layer.

The following sub-association is recognised by (Müller 1986) and Du Preez (1991):

i) *Setario – Protasparagetum - acacietosum* Müller 1986

Nomenclatural type: Relevé 117, Table 8.1 (Müller 1986)

The sub-association is associated with low-lying plains and is regarded by Müller (1986) as a transition towards the *Enneapogono – Acacietum*. It has no diagnostic species but is dominated by species such as *Acacia karroo*, *Setaria incrassata*, *Eragrostis curvula*, and *Rubia petiolaris*.

2.2.3 *Rhoo – Ehrhartetum erectae* Du Preez 1991

Nomenclatural type: *Rhoo – Ehrhartetum erectae – atriplectetosum* Du Preez 1991

This association is restricted to the steep banks of the Sand River (Müller 1986). It was originally described by Müller (1986) as *Rhoo – Diospyretum* and the indication was that it is part of the *Rhoo – Diospyretum* described by Werger (1980) for the Upper Orange River Valley. However, a later classification by Du Preez (1990) revealed that the association is quite different from that described by Werger (1980) and hence Du Preez (1990) subsequently renamed it *Rhoo – Ehrhartetum erectae*.

The diagnostic species for the community are *Cyathula uncinulata* and *Dicliptera clinopodia* (Species group 17), while *Ehrharta erecta* (Species group 20), *Bromus catharticus* (Species group 25), and *Setaria verticillata* (Species group 59) further differentiate the community due to their notable absence/poor presence in the other three associations. Prominent species include *Bromus catharticus* (Species group 25), *Rhus pyroides*, *Asparagus larycinus* (Species group 100), *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110).

Two sub-associations described by Müller (1986) and Du Preez (1991) are included under this association.

i) *Rhoo – Ehrhartetum erectae – celtoetosum* Du Preez 1991

Synonym: *Acacia karroo* Variant of the *Rhoo – Diospyretum celtidetosum* (Müller 1986)

Nomenclatural type: Relevé 171, Table 8.1 (Müller 1986)

The community was originally described by Müller (1986) as the *Acacia karroo* Variant of the *Rhoo – Diospyretum celtidetosum*. It occurs on clayey soils, on footslopes of hills along seasonal drainage lines. Original diagnostic species include *Dicliptera clinopoda*, *Olea europaea* subsp. *africana*, and *Gymnosporia buxifolia*. The prominent tree *Celtis africana* further differentiates the community (Müller 1986).

ii) *Rhoo – Ehrhartetum erectae – atriplecietosum* Du Preez 1991

Nomenclatural type: Relevé 144, Table 8.1 (Müller 1986)

Synonym: *Rhoo – Diospyretum acacietosum* (Werger 1980, Müller 1986)

The synonym for this community is *Rhoo – Diospyretum acacietosum* described by Müller (1986). It is mostly restricted to the lower pediment slopes of the dolerite hills in the vicinity of the Sand River. Although Müller (1986) and Du Preez (1991) did not identify any diagnostic species, the community is characterised by the constant presence and dominance of *Acacia karroo*. Other prominent species include *Diospyros lycioides*, *Sporobolus fimbriatus*, and *Tagetes minuta*.

2.2.4 *Trichoneura grandiglumis – Acacia karroo* Association

Synonym: *Trichoneuro – Ziziphietum – acacietosum* (Müller 1986)

Nomenclatural type: Relevé 441, Table 8.1 (Müller 1986)

The community was originally described informally by Müller (1986) as the *Trichoneuro – Ziziphietum – acacietosum*, a sub-association belonging to the *Diospyrion lycioides* (Werger 1980). It was later described under the same name but in a different unspecified alliance by Du Preez (1991). However, the present classification has two indications that differ from the previous two studies. Firstly, it indicates that the community can be regarded as part of the *Melico – Sporobolion* (Du Preez 1991) and does not belong in a different alliance. Secondly, it indicates that the community could be considered as an association, and as the sub-association was not validly published by Müller (1986), a change in the name is suggested.

This is a community of slightly elevated plains, where it is found on sandy soils (Müller 1986). It is characterised by the grass *Trichoneura grandiglumis** (Species group 50), which together with *Cynodon dactylon*, *Asparagus laricinus* (Species group 100), and *Acacia karroo* (Species group 110) are among the dominant species.

2.3 *Diospyrion lycioidis* Werger 1980

Lectotype: *Rhoo – Diospyretum* Werger 1980

This is riparian vegetation of the Upper Orange River valleys described by Werger (1980). It occurs on levees characterised by fine, deep alluvial sand. The diagnostic species for the community are *Asparagus setaceus** and *Chenopodium murale** (Species group 24). There is a notable absence/poor presence of the woody species *Asparagus laricinus* (Species group 100) and *Ziziphus mucronata* (Species group 109), as well as the grasses *Cynodon dactylon* (Species group 100), *Eragrostis curvula*, and *Themeda triandra* (Species group 109), which are prominent in the previous two alliances.

Werger (1980) identified two associations under the alliance.

2.3.1 *Rhoo – Diospyretum* Werger 1980

Lectotype: *Rhoo – Diospyretum – acacietosum karroo* Werger 1980

The vegetation covers the levees from the Lesotho border all the way to the vicinity of Colesberg (Werger 1980). Its diagnostic species are *Cineraria lobata** and *Melianthus comosus** (Species group 21), while *Asparagus setaceus* (Species group 24), *Atriplex semibaccata*, *Lycium hirsutum* (Species group 25), *Lycium cinereum* (Species group 66), *Clematis brachiata* (Species group 82), *Asparagus suaveolens* (Species group 89), *Rhus pyroides* (Species group 100), and *Diospyros lycioides* (Species group 109) are the dominant species.

The following sub-associations, described by Werger (1980), represent the association (Werger 1980):

i) *Acacia karroo – Celtis africana* Sub-association

Synonym: *Acacia karroo* Variant of the *Rhoo – Diospyretum – celtidetosum* Werger 1980

Acacia karroo – Celtis africana Community (Werger 1973)

Lectotype: Relevé 118, Table 4 (Werger 1980)

The community was described by Werger (1980) as part of the *Rhoo – Diospyretum - celtidetosum*, which occurs from the Lesotho border to the vicinity of Norvalspont. This particular variant can be encountered from Goedemoed westwards to Norvalspont, and is distinguished by the presence of *Acacia karroo*. The community is dominated by the woody species *Rhus pyroides*, *Asparagus suaveolens*, *Celtis africana*, *Acacia karroo*, and *Diospyros lycioides*, with *Melica decumbens*, *Lycium hirsutum*, and *Lycium cinereum* among the prominent species in the herbaceous layer.

ii) *Rhoo – Diospyretum – acacietosum karroo* Werger 1980

Lectotype: Relevé 76, Table 4 (Werger 1980)

The sub-association occurs between Norvalspont and the vicinity of Colesberg. The original diagnostic, and prominent species is *Acacia karroo*. Other prominent species include *Rhus pyroides*, *Asparagus suaveolens*, *Diospyros lycioides*, and *Lycium hirsutum*.

2.3.2 *Zizipho – Acacietum karroo* Werger 1980

Lectotype: Relevé 418, Table 4 (Werger 1980)

The community covers the remainder of the Upper Orange River valley, occurring on the levees from Colesberg westwards. Its diagnostic species are *Nicotiana glauca*, *Lycium* species*, and *Senecio* species* (Species group 23). The community is further characterised by the presence and dominance of *Setaria verticillata* (Species group 59) and *Ziziphus mucronata* (Species group 109), both of which were part of the original diagnostic species identified by Werger (1980) for the *Zizipho – Acacietum karroo*. Constant and prominent species are *Lycium hirsutum* (Species group 25), *Setaria verticillata* (Species group 59), *Lycium cinereum* (Species group 66), *Ziziphus mucronata*, *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110).

3. *Felicia filifolia* - *Tragus koelerioides* Order

Nomenclatural type: *Rhus undulata* – *Pentzia incana* Association

The order represents false karroid vegetation of the mountains, hills, ridges and valleys of the Graaff-Reinet and Cradock areas in the Eastern Cape. This vegetation type is also encountered in Beaufort West in the Western Cape. It is differentiated by *Felicia filifolia*, *Helichrysum dregeanum*, *Cynodon incompletus*, *Lycium oxycarpum*, and *Eriocephalus eriocoides* (Species group 33), with *Tragus koelerioides* (Species group 48) further differentiating the community. The only species of constant occurrence include *Cynodon incompletus* (Species group 33), *Tragus koelerioides* (Species group 48), *Chrysocoma ciliata* (Species group 53), and *Digitaria eriantha* (Species group 81), while there is a notable absence of *Rhus pyroides*, *Asparagus laricinus* (Species group 100), and *Ziziphus mucronata* (Species group 109), species normally prominent in *Acacia karroo* dominated communities.

Two alliances are recognised.

3.1 *Pentzia incana* – *Chrysocoma ciliata* Alliance

Nomenclatural type: *Asparagus mucronatus* – *Eragrostis curvula* Association

The alliance represents vegetation of the mountain and valley slopes, and can also be encountered along drainage lines. *Pentzia incana* (Species group 29), *Tragus koelerioides* (Species group 48), and *Chrysocoma ciliata* (Species group 53) are among the constantly present species. The diagnostic species are *Pentzia incana* and *Teucrium africanum* (Species group 29).

Two associations are classified under the alliance.

3.1.1 *Asparagus mucronatus* – *Eragrostis curvula* Association

Nomenclatural type: *Setaria sphacelata* – *Acacia karroo* Sub-association

This is a community of the Mountain Zebra National Park near Cradock, in the Eastern Cape Province (Van der Walt 1980). It occurs on hot shaly slopes and also on doleritic valley slopes. The soils are doleritic, relatively shallow and stoney.

Acacia karroo (Species group 110) is the only constantly prominent species in the tree layer, with *Asparagus suaveolens* (Species group 89) and *Grewia occidentalis* (Species group 108) occasionally prominent. The dwarf shrub *Chrysocoma ciliata* (Species group 53) and the grasses *Tragus koelerioides* (Species group 48), *Eragrostis obtusa* (Species group 71), *Digitaria eriantha* (Species group 81), and *Eragrostis curvula* (Species group 109) are some of the constantly present species in the herbaceous layer. The diagnostic species are *Asparagus mucronatus*, *Aptosimum decumbens*, and *Jamesbrittenia pinnatifida* (Species group 27).

The following communities are regarded as sub-associations:

i) *Setaria sphacelata* – *Acacia karroo* Sub-association

Synonym: *Setaria neglecta* – *Acacia karroo* Community Van der Walt 1980

Nomenclatural type: Relevé 107, Table 6 (Van der Walt 1980)

This is shrubland of steep, hot northern and north-eastern shaly slopes. There is heavy utilisation by herbivores in the community. The dominant species are the dwarf shrub *Pentzia incana*, the grass *Setaria sphacelata* [*Setaria neglecta*], and also *Acacia karroo*, with the latter two being original diagnostic species as well. Other original diagnostic species are *Solanum capense*, *Limeum aethiopicum*, *Grewia occidentalis*, and *Diospyros lycioides*.

ii) *Grewia occidentalis* – *Rhus lucida* Sub-association

Synonym: *Grewia occidentalis* – *Rhus lucida* Community Van der Walt 1980

Nomenclatural type: Relevé 84, Table 5 (Van der Walt 1980)

This is xeric shrubland of doleritic valley slopes. It is found on the low, dry pediment slopes of valleys such as Steynhoek, Fonteinkloof, and Boesmankloof. It is characterised by the woody species *Rhus lucida*, *Grewia occidentalis*, and *Diospyros austro-africana*, which are also the

prominent species. Other prominent species include *Acacia karroo*, also diagnostic, *Aristida adscensionis*, and *Eragrostis curvula*.

3.1.2 *Rhus undulata* – *Pentzia incana* Association

Nomenclatural type: *Selago geniculata* – *Felicia muricata* Sub-association

This woody community is found along the drainage lines of the Karoo National Park (Rubin & Palmer 1996) and the Andries Vosloo Kudu Reserve (Palmer 1981). It is characterised by *Rhus undulata*, *Grewia robusta*, *Helichrysum rosum*, *Carissa bispinosa* [*Carissa haematocarpa*] and *Lycium schizocalyx* (Species group 28).

The association consists of the following sub-associations:

i) *Acacia Karroo* – *Stipagrostis namaquensis* Sub-association

Synonym: *Acacia Karroo* – *Stipagrostis namaquensis* Riparian Woodland Rubin & Palmer 1996

Nomenclatural type: Relevé 141, Table 1 (Rubin & Palmer 1996)

This is a distinctive woody community of the Karoo National Park, situated west to northwest of Beaufort West in the Western Cape Province (Rubin & Palmer 1996). The community is found along the drainage lines, where the habitat comprises of deep, sandy alluvium and is extremely disturbed/unstable due to unpredictable flooding. *Acacia karroo* dominates, but other species may include *Grewia robusta*, *Gymnosporia polyacantha*, *Diospyros lycioides*, and *Rhus lancea*. *Cynodon incompletus* often dominates the grass layer. The original diagnostic species are *Acacia karroo*, *Cenchrus ciliaris*, *Stipagrostis namaquensis*, and *Hyparrhenia hirta*.

ii) *Selago geniculata* – *Felicia muricata* Sub-association

Synonym: *Walafrida geniculata* – *Felicia muricata* Community Palmer 1981

Nomenclatural type: Relevé 25, Table 7 (Palmer 1981)

The mesic vegetation is found in the vicinity of Grahamstown in the Eastern Cape Province. It is associated with the drainage lines which traverse the Andries Vosloo Kudu Reserve (Palmer 1981). Soils are generally deep, clayey and stoney. The original diagnostic species are *Helichrysum rosum*, *Felicia muricata*, *Clutia laxa*, *Selago geniculata*, *Sporobolus fimbriatus*, and *Nemesia floribunda*.

Palmer (1981) distinguished the following two variants:

- *Rhus refracta* – *Selago geniculata* Variation, a predominantly woody community restricted to drainage lines of low altitude.
- *Eragrostis lehmanniana* – *Selago geniculata* Variation is a bushclump savanna characterised by chamaephytes, succulents and grasses of karroid origin.

3.2 *Eragrostis chloromelas* – *Asparagus suaveolens* Alliance

Nomenclatural type: *Carissa macrocarpa* – *Asparagus suaveolens* Association

This is another community of the Mountain Zebra National Park near Cradock, in the Eastern Cape Province (Brown & Bezuidenhout 2000). According to Acocks (1988), the area can be classified as False Karroid Broken Veld. The community is found at the De Rust section of the park, and is mostly associated with mountain slopes and ridges, as well as lower lying valley bottoms. Mispah, Oakleaf, and Swartland are the dominant soil forms.

Eragrostis chloromelas (Species group 32) is the only diagnostic species, but the alliance can be further differentiated by the presence of other grasses such as *Aristida meridionalis* (Species group 50), *Enneapogon scoparius* (Species group 53), and *Aristida adascensionis* (Species group 60).

The alliance is differentiated into two associations.

3.2.1 *Carissa macrocarpa* – *Asparagus suaveolens* Association

Nomenclatural type: *Setaria sphacelata* – *Cadaba aphylla* Sub-association

The community is associated with mountain midslopes and footslopes, and also valley bottoms in the northern and western parts of the Mountain Zebra National Park. It can also be encountered in the central, southern and eastern parts of the park, where it is confined to rocky ridges and seasonally dry riverbeds (Brown & Bezuidenhout 2000). The diagnostic species for the community are *Asparagus* species, *Tephrosia* species, and *Carissa macrocarpa* (Species group 30), while *Enneapogon scoparius* (Species group 53) and *Acacia karroo* (Species group 110) dominate.

This association is made up of the following sub-associations:

i) *Tragus koelerioides* – *Becium burchellianum* Sub-association

Synonym: *Tragus koelerioides* – *Becium burchellianum* Grassland Brown & Bezuidenhout 2000

Nomenclatural type: Relevé 38, Table 1 (Brown & Bezuidenhout 2000)

The community is associated with mountain midslopes and footslopes, and also valley bottoms. The presence of the dwarf shrub *Becium burchellianum*, which totally dominates the community, is diagnostic.

Brown and Bezuidenhout (2000) identified and described the following as sub-communities:

- *Protasparagus striatus* - *Becium burchellianum* Grassland is restricted to the midslopes of the Salpeterkop mountain and is associated with the Ib land type. The dominant soil-rock complex consists of high percentage rock cover, while the Mispah soil form is subdominant.

- *Becium burchellianum* – *Acacia karroo* Woodland is associated with the drainage lines of the Fc and Ag land types. The habitat is rocky and the dominant soil forms are Oakleaf and Mispah.

ii) *Setaria sphacelata* – *Cadaba aphylla* Sub-association

Synonym: *Setaria sphacelata* – *Cadaba aphylla* Shrubland Brown & Bezuidenhout 2000

Nomenclatural type: Relevé 27, Table 1 (Brown & Bezuidenhout 2000)

The community is found on rocky ridges and seasonally dry riverbeds dominated by soils of the Mispah and Oakleaf forms. The habitat is highly rocky and consists mainly of relatively steep slopes. Original diagnostic species for this community are *Cadaba aphylla* and *Setaria sphacelata*.

The following communities are classified under this shrubland (Brown & Bezuidenhout 2000):

- *Enneapogon scoparius* – *Ehretia rigida* Shrubland is characteristic for plateau midslopes of the Da land type. The habitat is rocky, while the dominant soil forms are Mispah and Swartland.
- *Sporobolus africanus* – *Acacia karroo* Woodland occurs in various habitats ranging from steep eastern and southern slopes to lower lying seasonally dry riverbeds of the Fc land type. It is differentiated into two variants, *Pollichia campestris* Variant and *Solanum supinum* Variant. The *Pollichia campestris* Variant is mainly found on steep slopes where soils are shallow and rocky, and Mispah is the dominant soil form. The *Solanum supinum* Variant is found on the cool and moist footslopes where the habitat is highly rocky and dominated by the Mispah and Swartland soil forms. It also occurs in the seasonally dry riverbeds dominated by the Oakleaf and Mispah soil forms.

3.2.2 *Urochloa panicoides* – *Pentzia globosa* Association

Synonym: *Aristida congesta* subsp. *barbicollis* – *Pentzia globosa* Grassland (Brown & Bezuidenhout 2000)

Nomenclatural type: *Selago geniculata* – *Eragrostis obtusa* Sub-association

The grassland is found on plateau midslopes and valley bottoms, where the terrain is generally flat. It is associated with shallow, rocky soils. The community is characterised by the presence of *Urochloa panicoides** (Species group 16) and *Lycium cinereum* (Species group 66). The grasses *Tragus koelerioides* (Species group 48), *Enneapogon scoparius* (Species group 53), *Eragrostis obtusa* (Species group 71), *Eragrostis lehmanniana* (Species group 81), and *Heteropogon contortus* (Species group 108) dominate, with *Pentzia globosa* (Species group 81), and *Acacia karroo* (Species group 110) being equally prominent.

The following two sub-associations are recognised, as described by Brown and Bezuidenhout (2000):

i) *Selago geniculata* – *Eragrostis obtusa* Sub-association

Synonym: *Walafrida geniculata* – *Eragrostis obtusa* Grassland Brown & Bezuidenhout 2000

Nomenclatural type: Relevé 24, Table 1 (Brown & Bezuidenhout 2000)

The community is restricted to the higher lying plateau areas and gentle sloping valley bottoms of the Da land type. The terrain is generally flat and the dominant soil forms are Mispah, Swartland, and Valsrivier. Original diagnostic species include the dwarf shrubs *Selago geniculata*, *Pentzia incana*, and *Hermannia spinosa* together with *Gazania krebsiana* and *Asparagus thunbergianus*. *Acacia karroo* is prominent locally, but the most dominant species is the dwarf shrub *Pentzia globosa* together with the grasses *Eragrostis obtusa* and *Enneapogon scoparius*.

ii) *Psilocalon junceum* – *Eragrostis lehmanniana* Sub-association

Synonym: *Psilocalon junceum* – *Eragrostis lehmanniana* Grassland Brown & Bezuidenhout 2000

Nomenclatural type: Relevé 7, Table 1 (Brown & Bezuidenhout 2000)

This open grassland is found in the lower lying valley bottoms associated with the Ag land type. Certain localised areas of the community are characterised by a high rock cover, while the dominant soil forms are Hutton, Mispah, and Oakleaf. *Psilocalon junceum*, *Panicum maximum*, *Opuntia aurantiaca*, *Delosperma frutescens*, and *Blepharis capensis* are the original diagnostic species. *Eragrostis lehmanniana* and *Pentzia globosa* dominate the herbaceous layer, with isolated *Acacia karroo* trees, found closer to the drainage lines, and the grass *Enneapogon scoparius* being locally dominant.

4. *Rhus ciliata* – *Rhus lancea* Order

Nomenclatural type: *Rhus erosa* – *Rhus burchellii* Alliance

This order represents vegetation of the southern Free State (comprising the towns Bloemfontein, Petrusburg, Fauresmith, Wepener, Zastron and Bethulie). The diagnostic species are *Rhus burchellii* and *Rhus ciliata* (Species group 39), and so are *Chenopodium album* (Species group 11) and *Tribulus terrestris* (Species group 63)

The order comprises two alliances.

4.1 *Lycium hirsutum* – *Asparagus larycinus* Alliance

Synonym: *Acacia karroo* – *Protasparagus larycinus* Major Community (Malan, Venter & Du Preez 2001)

Nomenclatural type: Relevé 523, Table 1 (Malan *et al.* 2001)

This is a widespread shrub community mainly associated with the low-lying areas and undulating plains along public roads. The location of this community is restricted to areas where wind-blown sand and gravel eroding from higher-lying areas often cover the soil surface (Malan *et al.* 2001).

The alliance is characterised by *Cyperus longus* (Species group 8), *Tagetes minuta* (Species group 20), *Lycium hirsutum* (Species group 25), *Clematis brachiata* (Species group 81), *Celtis africana* (Species group 89), and *Rhus pyroides* (Species group 100). Widely distributed trees include *Olea europaea* (Species group 36), *Rhus lancea* (Species group 71), *Ziziphus mucronata*, *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110). *Asparagus lariginus* (Species group 100) is the only abundant shrub, while the sedge *Cyperus longus* (Species group 8) is also common. Grasses are scarce and are restricted to patchy occurrences of *Setaria verticillata* (Species group 59), *Sporobolus fimbriatus* (Species group 66), *Eragrostis obtusa* (Species group 71), and *Themeda triandra* (Species group 109).

Two associations further characterise this alliance.

4.1.1 *Panicum maximum* – *Rhus pyroides* Association

Nomenclatural type: *Setaria verticillata* - *Chenopodium album* Sub-association

This bottomland vegetation occurs in dry riverbeds. The habitat is fairly unstable due to seasonal flooding and drying. Overgrazing of pasture and trampling by livestock frequently occurs (Malan *et al.* 2001).

The community has no diagnostic species. Prominent species include *Cyperus longus* (Species group 8), *Lycium hirsutum* (Species group 25), *Panicum maximum* (Species group 66), *Rhus lancea* (Species group 71), *Rhus pyroides*, *Asparagus lariginus* (Species group 100), *Ziziphus mucronata*, *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110).

The following two communities described by Malan *et al.* (2001) are regarded as sub-associations:

i) *Setaria verticillata* - *Chenopodium album* Sub-association

Synonym: *Setaria verticillata* *Chenopodium album* Variant Malan *et al.* 2001

Nomenclatural type: Relevé 495, Table 6.1 (Malan 1998)

The community is restricted to the disturbed and overgrazed zones of dry riverbeds. The original diagnostic species are *Setaria verticillata* and *Chenopodium album* (Malan 1998, Table 6.1), two pioneers which colonise disturbed habitats. *Acacia karroo* is inconspicuous, instead *Cyperus longus* is conspicuous, with *Rhus pyroides* and *Rhus lancea* small, but numerous. Forbs are inconspicuous and are restricted to *Chenopodium album*, *Tagetes minuta*, *Artemisia afra*, and *Zinnia peruviana*, as well as the climber *Clematis brachiata*.

ii) *Rhus pyroides* – *Asparagus larycinus* Sub-association

Synonym: *Rhus pyroides* – *Protasparagus larycinus* Variant Malan *et al.* 2001

Nomenclatural type: Relevé 524, Table 6.1 (Malan 1998)

This vegetation unit occurs in dry riverbeds with a thick layer of dolerite gravel, which gives it a rocky appearance, covering the soil surface. The deeper soil layers are clayey. Diagnostic species are absent. The most abundant woody species are *Rhus pyroides* and *Diospyros lycioides*. *Acacia karroo* and *Rhus lancea* are, although inconspicuous, the most abundant trees. The sedge *Cyperus longus* often forms dense stands. Grasses are scarce and restricted to *Panicum maximum*, *Themeda triandra*, and *Sporobolus fimbriatus*.

4.1.2 *Crassula lanceolata* – *Ziziphus mucronata* Association

Nomenclatural type: *Crassula lanceolata* – *Acacia karroo* Sub-association

The community occurs in bottomland situations and wet riverbeds. *Crassula lanceolata* (Species group 34) is the only diagnostic species, while *Tagetes minuta* (Species group 20), *Rhus lancea*

(Species group 71), *Clematis brachiata* (Species group 81), *Celtis africana* (Species group 89), *Asparagus laricinus* (Species group 100), *Ziziphus mucronata* (Species group 109), and *Acacia karroo* (Species group 110) are the most prominent species.

The following communities described by Malan *et al.* (2001) are regarded as sub-associations:

i) *Crassula lanceolata* – *Acacia karroo* Sub-association

Synonym: *Crassula lanceolata* – *Acacia karroo* Variant Malan *et al.* 2001

Nomenclatural type: Relevé 523, Table 1 (Malan *et al.* 2001)

The community is associated with wet riverbeds at the footslopes of dolerite hills. The soil is sandy with fine dolerite stones from upslope visible on the surface (Malan *et al.* 2001). *Crassula lanceolata* and *Pollichia campestris* are the only differentiating species. *Acacia karroo* is the most abundant tree species, with *Rhus pyroides*, *Celtis africana*, *Ziziphus mucronata*, and *Diospyros lycioides* also abundant.

ii) *Heteromorpha arborescens* – *Nidorella resedifolia* Sub-association

Synonym: *Heteromorpha trifoliata* – *Nidorella resedifolia* Sub-community Malan *et al.* 2001

Nomenclatural type: Relevé 266, Table 1 (Malan *et al.* 2001)

This community is restricted to bottomland situations where poorly drained calcareous soils occur. The soil is calcareous-clayey and calcareous stones are visible on its surface (Malan *et al.* 2001). The vegetation is overgrazed and *Heteromorpha arborescens* with *Nidorella resedifolia* are diagnostic. *Acacia karroo* and *Ziziphus mucronata* are the most abundant tree species. Other tree species include *Olea europaea* and *Rhus lancea*, with *Rhus ciliata* the only locally abundant shrub.

iii) *Olea europaea* – *Heteromorpha arborescens* Sub-association

Synonym: *Olea europaea* – *Heteromorpha trifoliata* Woodland Malan, Venter & Du Preez
1995

Nomenclatural type: Relevé 163, Table 1 (Malan *et al.* 1995)

This woodland occurs mainly on rocky slopes and in ravines. The most important soils are the Swartland and Hutton soil forms (Malan *et al.* 1995). *Heteromorpha arborescens* is the only diagnostic shrub and *Eragrostis obtusa* the only diagnostic grass species. Other diagnostic species are *Commelina eckloniana*, *Selago saxatilis*, *Crassula lanceolata*, and *Salsola kali*. The most conspicuous woody species are *Grewia occidentalis*, *Olea europaea*, *Asparagus larycinus*, *Rhus burchellii*, *Ziziphus mucronata*, *Buddleja saligna*, and *Rhus cilata*. Other abundant species are *Solanum coccineum*, *Tagetes minuta*, *Triraphis andropogonoides*, *Eragrostis lehmanniana*, *Themeda triandra*, and *Cheilanthes eckloniana*.

4.2 *Rhus erosa* – *Rhus burchellii* Alliance

Nomenclatural type: *Asparagus striatus* – *Acacia karroo* Association

This community is associated with gentle slopes characterised by shallow, rocky soils. The diagnostic species are *Osyris lanceolata*, *Cheilanthes eckloniana*, *Cotoneaster species*, and *Rhus erosa* (Species group 38).

The alliance is differentiated into three associations.

4.2.1 *Rhus lancea* – *Buddleja saligna* Association

Synonym: *Rhus lancea* – *Buddleja saligna* Sub-community Malan, Venter & Du Preez
1998

Nomenclatural type: *Acacia karroo* – *Schinus molle* Sub-association

The association is encountered on gentle south-facing slopes and in drainage channels with shallow soils. The soil is slightly rocky and fine gravel covers the soil surface (Malan *et al.* 1998).

The diagnostic species are *Buddleja saligna* and *Schinus molle* (Species group 35). The most dominant species are *Buddleja saligna* (Species group 35), *Olea europaea* (Species group 36), *Rhus burchellii*, *Rhus ciliata* (Species group 39), *Rhus lancea* (Species group 71), and *Themeda triandra* (Species group 109).

The association comprises the following sub-communities described by Malan *et al.* (1998):

i) *Acacia karroo* – *Schinus molle* Sub-association

Synonym: *Acacia karroo* – *Schinus molle* Variant Malan *et al.* 1998

Nomenclatural type: Relevé 366, Table 1 (Malan *et al.* 1998)

The community is associated with the footslopes of south-facing slopes in drainage channels. The soil is generally clayey and covered by a thick layer of gravel and stones (Malan *et al.* 1998). *Acacia karroo*, together with the exotic *Schinus molle* originally differentiated this community. *Rhus lancea*, *Olea europaea*, and *Buddleja saligna* dominate the vegetation. The only abundant shrubs are *Rhus burchellii* and *Rhus ciliata*, with *Themeda triandra* and *Eragrostis lehmanniana* being the most abundant grasses.

ii) *Osyris lanceolata* – *Rhus lancea* Sub-association

Synonym: *Osyris lanceolata* – *Rhus lancea* Variant Malan *et al.* 1998

Nomenclatural type: Relevé 578, Table 1 (Malan *et al.* 1998)

The community is restricted to ravines of south-facing footslopes. The habitat is moist and large dolerite boulders are common. The soil surface is trampled due to continuous overgrazing by livestock. No diagnostic species were identified by Malan *et al.* (1998). *Osyris lanceolata*, *Rhus lancea* and *Olea europaea* are the only regularly occurring tree species present. *Buddleja saligna* and *Rhus erosa* are the most prominent shrubs. Grasses are scarce with *Elionurus muticus*, *Themeda triandra*, and *Heteropogon contortus* being most common.

4.2.2 *Euryops subcarnosus ssp. minor* – *Rhigozum trichotomum* Association

Synonym: *Euryops multifidus* – *Rhigozum trichotomum* Community Malan 1998

Nomenclatural type: Relevé 620, Table 5.1 (Malan 1998)

The community is associated with calcareous-rich soils of the low-lying areas. Surrounding dolerite boulders create a cooler and moister habitat; no gravel is visible on the soil surface. *Rhigozum trichotomum* (Species group 37) is dominant and often forms very dense stands together with *Acacia karroo* (Species group 110) over large areas of trampled veld. *Euryops subcarnosus ssp. minor* (Species group 37) grows well in the low-lying areas, especially in areas where stagnant water occurs for long periods of time. The diagnostic species are *Euryops subcarnosus ssp. minor*, *Salsola glabrescens*, *Rhigozum trichotomum*, *Euphorbia mauritanica*, and *Saltera sarcocolla* (Species group 37).

4.2.3 *Asparagus striatus* – *Acacia karroo* Association

Nomenclatural type: *Hertia pallens* – *Rhigozum trichotomum* Sub-association

The association is found on shallow soils on the plateaus and gentle slopes. It has no diagnostic species but is differentiated by the presence of species such as *Lycium* species (Species group 23), *Asparagus striatus* (Species group 31), and *Sporobolus fimbriatus* (Species group 66). Many of the species in this community are poorly represented and *Acacia karroo* (Species group 110) is one of the prominent species.

The following communities described by Malan (1998) are regarded as sub-associations:

i) *Enneapogon scaber* – *Rhigozum trichotomum* Sub-association

Synonym: *Enneapogon scaber* – *Rhigozum trichotomum* Malan 1998

Nomenclatural type: Relevé 132, Table 5.1 (Malan 1998)

This is an infrequent community which occurs only on the rocky outcrops of dolerite on the plateaus along the Orange River in the region of the Gariep Dam. The soil is covered with large

rock slabs (Malan 1998). *Enneapogon scaber* differentiates this community and grows extremely well between the rock slabs. Also present but less frequent are *Acacia karroo*, *Heteropogon contortus*, and *Enneapogon scoparius*.

ii) *Olea europaea* – *Acacia karroo* Sub-association

Synonym: The *Olea europaea* – *Acacia karroo* Woodland Malan *et al.* 1995

Nomenclatural type: Relevé 179, Table 1 (Malan *et al.* 1995)

This woodland is associated with moderately steep slopes which receive moisture from upslope. The soil is shallow and contains a relatively high clay content. Soils of the Valsrivier, Sterkspruit, and Dundee forms are the most prominent. This is a typical tree community, dominated by *Acacia karroo*, which is the only diagnostic tree species present. Other abundant trees include *Olea europaea*, *Ziziphus mucronata*, *Diospyros lycioides*, and *Buddleja saligna*. *Asparagus laricinus*, *Rhus burchellii*, *Rhus ciliata*, and *Euclea crispa* are the most prominent shrubs. *Nenax microphylla* and *Xanthium spinosum* are the only diagnostic forbs. *Themeda triandra*, *Triraphis andropogonoides*, and *Eragrostis lehmanniana* are the prominent grasses.

iii) *Hertia pallens* – *Rhigozum trichotomum* Sub-association

Synonym: *Hertia pallens* – *Rhigozum trichotomum* Community Malan 1998

Nomenclatural type: Relevé 614, Table 5.1 (Malan 1998)

The community occurs on the calcareous-rich soils of the flat pediplains of the south-western Free State. Dolerite and Ecca sandstone are overlain by a layer of loamy Kalahari sand (Malan 1998). *Hertia pallens* is the only species differentiating this community and, together with *Rhigozum obovatum* and *Acacia karroo*, are the only abundant species present.

5. *Acacia mellifera* - *Eragrostis lehmanniana* Order

Nomenclatural type: *Rhus tridactyla* - *Tarchonanthus camphoratus* Sub-order

This extensive community represents vegetation of the Kalahari thornveld described by Smit (2000). It can be found in northwestern Free State, northeastern Northern Cape, as well as southern and central North-West. The community is distinguished by species from group 60, namely *Acacia mellifera*, *Geigeria ornativa*, *Tragus racemosus*, *Eragrostis rigidior*, *Eragrostis echinochloidea*, *Pentzia viridis*, *Lycium bosciifolium*, *Eragrostis trichophora*, *Aristida adscensionis*, *Acacia hebeclada*, and *Rhus leptodictya*.

The order is differentiated into four sub-orders.

5.1 *Rhus tridactyla* - *Tarchonanthus camphoratus* Sub-order

Synonym: *Tarchonanthus camphoratus* – *Aristida diffusa* Closed Shrubland Smit 2000

Nomenclatural type: *Tarchonanthus camphoratus* – *Enneapogon scoparius* Alliance

Smit (2000) originally classified this community as an order. It is mainly associated with the Kuruman hills, but may also be found on other higher-lying hills. Soils are relatively shallow and predominantly of the Mispah, Hutton, and Glenrosa forms.

The community is characterised by *Euclea undulata*, *Melhania rehmannii*, *Phyllanthus angolensis*, *Evolvulus alsinoides*, and *Asparagus retrofractus* (Species group 41). Prominent species include *Aristida diffusa* (Species group 53), *Acacia mellifera* (Species group 60), *Tarchonanthus camphoratus* (Species group 69), *Eragrostis lehmanniana* (Species group 81), and *Heteropogon contortus* (Species group 108).

Two alliances are recognised.

5.1.1 *Tarchonanthus camphoratus* – *Aristida meridionalis* Alliance

Nomenclatural type: *Tarchonanthus camphoratus* – *Anthospermum rigidum* Association

The community occurs on rocky plains and ridges, and also on footslopes east of the Kuruman hills (Smit 2000). It has no diagnostic species, but was originally differentiated by *Aristida meridionalis*, *Indigofera daleoides*, *Amphiglossa triflora*, *Rhynchosia holosericea*, *Glossochillus burchellii*, *Hermannia tomentosa*, *Tripteris aghillana*, *Convolvulus ocellatus*, and *Senecio inaequidens*. The tree and shrub layer is dominated by species such as *Rhus tridactyla* (Species group 50), *Tarchonanthus camphoratus* (Species group 69), and *Asparagus larycinus* (Species group 100), while prominent species in the herbaceous layer include *Stipagrostis uniplumis* (Species group 51), *Aristida diffusa* (Species group 53), *Eragrostis lehmanniana* (Species group 81), *Aristida congesta* (Species group 99), and *Heteropogon contortus* (Species group 108). *Acacia karroo* is hardly present in this community.

The following two associations described by Smit (2000) constitute the alliance (not shown on Table 6.1):

i) *Tarchonanthus camphoratus* – *Anthospermum rigidum* Association

Synonym: *Tarchonanthus camphoratus* – *Anthospermum rigidum* Open Shrubland Smit 2000

Nomenclatural type: Relevé 555, Table 12 (Smit 2000)

The community occurs on rocky plains and ridges east of the Kuruman hills, from Kuruman to Mount Carmel. It is mainly associated with deep Hutton soils, as well as relatively shallow Mispah soils (Smit 2000). The original diagnostic species are *Anthospermum rigidum*, *Blepharis integrifolia*, *Rhynchosia adenodes*, *Eragrostis obtusa*, and *Rhus leptodictya*, while *Aristida meridionalis*, *Euclea undulata*, *Rhus tridactyla*, *Aristida congesta*, *Tarchonanthus camphoratus*, *Eragrostis lehmanniana*, *Heteropogon contortus*, and *Stipagrostis uniplumis* are the dominant species.

ii) *Tarchonanthus camphoratus* – *Blepharis marginata* Association

Synonym: *Tarchonanthus camphoratus* – *Blepharis marginata* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 675, Table 12 (Smit 2000)

The community is found on rocky plains and hills east of the Kuruman hills in the Daniëlskuil area. It is associated with Mispah and, to a lesser extent, Hutton soils that range from shallow to deep (Smit 2000). The community is differentiated by *Blepharis marginata*, *Nolletia ciliaris*, *Hibiscus trionum*, *Limeum viscosum*, *Eriocephalus* species, and *Monechma incanum*. It is mostly dominated by *Themeda triandra*, *Rhus tridactyla*, *Aristida diffusa*, *Tarchonanthus camphoratus*, and *Eragrostis lehmanniana*.

5.1.2 *Tarchonanthus camphoratus* – *Enneapogon scoparius* Alliance

Nomenclatural type: *Tarchonanthus camphoratus* – *Acacia erioloba* Association

The community occurs on hills in the border area between the Northern Cape and North-West. It is associated with shallow Mispah and Clovelly soils, and also relatively deep Hutton soils (Smit 2000). The diagnostic species are *Indigofera* species, *Rhus dregeana*, *Felicia fascicularis*, and *Kohautia cynanchica* (Species group 40), while some of the most dominant species are *Rhus tridactyla* (Species group 50), *Aristida diffusa*, *Enneapogon scoparius* (Species group 53), *Acacia mellifera* (Species group 60), *Tarchonanthus camphoratus* (Species group 69), *Eragrostis lehmanniana* (Species group 81), and *Heteropogon contortus* (Species group 108).

The following five communities described by Smit (2000) are regarded as associations (not shown on Table 6.1):

i) *Tarchonanthus camphoratus* – *Acacia robusta* Association

Synonym: *Tarchonanthus camphoratus* – *Acacia robusta* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 316, Table 12 (Smit 2000)

The community is found on rocky hills in the Amalia, Jan Kempdorp, and Schweizer-Reneke areas in North-West Province, also in Warrenton, on the Northern Cape border. It is associated with relatively shallow and sandy soils that are predominantly of the Mispah and Glenrosa forms (Smit 2000).

The original diagnostic species are *Acacia robusta*, *Schkuhria pinnata*, *Aptosimum procumbens*, *Barleria macrostegia*, *Indigofera species*, *Hermannia quartiniana*, and *Chloris virgata*. Some of the dominant species in the tree and shrub layer are *Acacia robusta*, *Acacia tortilis*, *Rhus tridactyla*, and *Tarchonanthus camphoratus*, while the herbaceous layer is dominated by the grasses *Enneapogon scoparius*, *Aristida diffusa*, *Eragrostis lehmanniana*, and *Heteropogon contortus*, as well as the forbs *Chascanum hederaceum* and *Evolvulus alsinoides*.

ii) *Tarchonanthus camphoratus* – *Enneapogon desvauxii* Association

Synonym: *Tarchonanthus camphoratus* – *Enneapogon desvauxii* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 452, Table 12 (Smit 2000)

The community is encountered on hills and ridges where soils are relatively shallow, rocky, and predominantly of the Mispah and Hutton forms (Smit 2000). It is characterised by *Enneapogon desvauxii*, *Eragrostis echinochloidea*, *Geigeria filifolia*, and *Pentzia globosa*. Some of the dominant species include the woody *Acacia tortilis* and *Olea europaea*, the grasses *Enneapogon desvauxii*, *Enneapogon cenchroides*, and *Enneapogon scoparius*, as well the forbs *Melhanian rehmarii* and *Phyllanthus maderaspatensis*.

iii) *Tarchonanthus camphoratus* – *Acacia erioloba* Association

Synonym: *Tarchonanthus camphoratus* – *Acacia erioloba* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 823, Table 12 (Smit 2000)

The community occurs on rocky hills characterised by deep, sandy soils of the Hutton and Mispah forms (Smit 2000). It is differentiated by *Acacia erioloba*, *Senna italica*, *Geigeria brevifolia*, *Monechma divaricatum*, *Zygophyllum pubescens*, *Hermbstaedtia odorata*, and

Polygala leptophylla. Prominent species include *Acacia erioloba*, *Euclea undulata*, *Rhus tridactyla*, *Rhus dregeana*, *Aristida diffusa*, *Tarchonanthus camphoratus*, and *Acacia mellifera*.

iv) *Tarchonanthus camphoratus* – *Solanum tomentosum* Association

Synonym: *Tarchonanthus camphoratus* – *Solanum tomentosum* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 505, Table 12 (Smit 2000)

The community is found in the same area as the *Tarchonanthus camphoratus* – *Acacia erioloba* Association, namely the Kuruman, Daniëlskuil, and Postmasburg areas in the Northern Cape. The habitat conditions are also similar to those in the previous association (Smit 2000).

The differentiating species for the community are *Solanum tomentosum*, *Kalanchoe paniculata*, *Acacia hebeclada*, *Melhania rehmannii*, *Aristida congesta*, *Enneapogon cenchroides*, and *Phyllanthus maderaspatensis*. Prominent species include *Enneapogon scoparius*, *Euclea undulata*, *Rhus tridactyla*, *Aristida diffusa*, *Tarchonanthus camphoratus*, and *Heteropogon contortus*.

v) *Tarchonanthus camphoratus* – *Enneapogon scoparius* Association

Synonym: *Tarchonanthus camphoratus* – *Enneapogon scoparius* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 331, Table 12 (Smit 2000)

The community occurs as local patches on dolomite and limestone on rocky hills. It is mainly associated with relatively shallow Hutton and Mispah soils (Smit 2000). The differentiating species are *Enneapogon scoparius*, *Aristida adscensionis*, *Acacia karroo*, and *Tragus racemosus*. The tree and shrub layer is poorly developed but some of the prominent species in are *Olea europaea*, *Rhus lancea*, *Rhus tridactyla*, and *Tarchonanthus camphoratus*. Dominant grasses include *Enneapogon scoparius*, *Aristida diffusa*, *Eragrostis lehmanniana*, and *Heteropogon contortus*. *Geigeria ornativa* and *Selago densiflora* are the only forbs of notable occurrence.

5.2 *Acacia erioloba* – *Eragrostis lehmanniana* Sub-order

Synonym: *Acacia erioloba* – *Eragrostis lehmanniana* Open Tree Community Smit 2000

Nomenclatural type: *Acacia erioloba* – *Eragrostis rigidior* Alliance

The community occurs mainly on rocky plains between the Kuruman hills, Asbesberge, Langeberge, and Ghaap plateau. It is associated with deep sandy soils that are predominantly of the Hutton and Clovelly forms (Smit 2000).

The diagnostic species are *Pentzia calcarea*, *Bulbine frutescens*, and *Oxygonum dregeanum* (Species group 46), while the most prominent species include *Acacia erioloba*, *Stipagrostis uniplumis* (Species group 51), *Acacia hebeclada* (Species group 60), *Tarchonanthus camphoratus* (Species group 69), *Grewia flava* (Species group 80), *Eragrostis lehmanniana* (Species group 81), *Aristida congesta* (Species group 99), *Ziziphus mucronata* (Species group 109), and *Acacia karroo* (Species group 110).

The alliance is differentiated into three alliances, two of which were originally described by Smit (2000), and one which is a combination of two alliances also described by Smit (2000).

5.2.1 *Acacia erioloba* – *Acacia mellifera* Alliance

Synonym: *Acacia erioloba* – *Acacia mellifera* Closed Shrubland Smit 2000

Nomenclatural type: *Acacia mellifera* – *Rhus dregeana* Association

The community mainly occurs in the Hotazel, Kuruman, Kathu, and Daniëlskuil areas in the Northern Cape. It is found on sandy and rocky plains, and also on dry streams. The soils are generally of the Hutton and Clovelly forms and range from relatively shallow to deep (Smit 2000).

The diagnostic species for the community are *Acacia haematoxylon**, *Trianthema triquetra*, *Gisekia africana*, and *Berkheya zeyheri* (Species group 42). Species that dominate the community are *Acacia erioloba*, *Stipagrostis uniplumis* (Species group 51), *Acacia mellifera*

(Species group 60), *Tarchonanthus camphoratus* (Species group 69), *Grewia flava* (Species group 80), *Eragrostis lehmanniana* (Species group 81), and *Aristida congesta* (Species group 99).

This alliance comprises the following four associations (not shown on Table 6.1) described by Smit (2000):

i) *Acacia mellifera* – *Monechma incanum* Association

Synonym: *Acacia mellifera* – *Monechma incanum* Short Bushveld Smit 2000

Nomenclatural type: Relevé 147, Table 10 (Smit 2000)

This community is scattered in the Kathu area and is associated with deep Clovelly and Hutton soils. It is characterised by species such as *Monechma incanum*, *Stipagrostis obtusa*, *Salsola rubescens*, and *Aptosimum marlothii*. The dominant trees and shrubs are *Acacia mellifera*, *Acacia haematoxylon*, *Acacia erioloba*, *Grewia flava*, *Tarchonanthus camphoratus*, *Lycium cinereum*, *Ziziphus mucronata*, and *Diospyros lycioides*. The herbaceous layer is poorly developed but prominent grasses include *Stipagrostis obtusa*, *Eragrostis lehmanniana*, *Stipagrostis uniplumis*, and *Eragrostis trichophora*, while *Geigeria ornativa* and *Senna italica* are the prominent forbs.

ii) *Acacia mellifera* – *Melhania rehmannii* Association

Synonym: *Acacia mellifera* – *Melhania rehmannii* Sparse Shrubland Smit 2000

Nomenclatural type: Relevé 1005, Table 10 (Smit 2000)

The community is encountered north of Kuruman, specifically in the Kakoje area and northeast of Kathu. It occurs on flat plains characterised by deep, sandy soils dominated by the Clovelly and Hutton forms (Smit 2000). The original diagnostic species for the community are *Melhania rehmannii*, *Hypertelis salsoloides*, *Solanum nigrum*, and *Hermbstaedia odorata*. The tree and shrub layer is dominated by *Acacia mellifera*, *Acacia erioloba*, *Grewia flava*, and *Tarchonanthus camphoratus*. The dominant species in the herbaceous layer include *Eragrostis echonochloidea*, *Eragrostis lehmanniana*, *Eragrostis trichophora*, *Schmidtia pappophoroides*, *Geigeria ornativa*, and *Selago densiflora*.

iii) *Acacia mellifera* – *Rhus dregeana* Association

Synonym: *Acacia mellifera* – *Rhus dregeana* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 796, Table 10 (Smit 2000)

The community occurs on rocky plains east and west of the Kuruman hills, in the Kuruman, Bolham, and Kathu areas. It is associated with deep, sandy soils that are predominantly of the Hutton and Mispah forms (Smit 2000). The community is differentiated by species such as *Rhus dregeana*, *Sida dregei*, *Euclea crispa*, *Indigofera charlieriana*, and *Waltheria indica*. Some of the prominent species are *Acacia erioloba*, *Rhus dregeana*, *Acacia mellifera*, *Aristida meridionalis*, *Melinis repens*, *Eragrostis lehmanniana*, *Sida dregei*, *Kyphocarpa angustifolia*, and *Pupalia lappacea*.

iv) *Acacia mellifera* – *Kyphocarpa angustifolia* Association

Synonym: *Acacia mellifera* – *Kyphocarpa angustifolia* Open Tree Community Smit 2000

Nomenclatural type: Relevé 1867, Table 10 (Smit 2000)

This community is associated with relatively shallow to deep Hutton and Clovelly soils. It is characterised by species such as *Tricholaena monachne*, *Kyphocarpa angustifolia*, *Pupalia lappacea*, and *Limeum viscosum*, while prominent species include *Acacia mellifera*, *Acacia erioloba*, *Gymnosporia buxifolia*, *Aristida meridionalis*, *Aristida stipitata*, *Melinis repens*, *Dicoma schinzii*, *Indigofera daleoides*, *Gnidia polycephala*.

5.2.2 *Acacia erioloba* – *Stipagrostis uniplumis* Alliance

Nomenclatural type: *Acacia erioloba* – *Amphiglossa triflora* Association

This community is spread over three provinces. It found in the Northern Cape, specifically in the Kuruman-Reivilo area, to the west of the Ghaap plateau, and northeast of Kuruman. It can also be encountered in the Ganyesa-Setlagole area in the North-West, and also in the Christiana-

Bloemhof-Hoopstad-Hertzogville area in the Free State. The habitat is mainly characterised by flat, rocky, and sandy plains (Smit 2000).

The community has no diagnostic species but is dominated by *Acacia erioloba*, *Stipagrostis uniplumis* (Species group 51), *Tarchonanthus camphoratus* (Species group 69), *Grewia flava* (Species group 80), *Eragrostis lehmanniana* (Species group 81), and *Aristida congesta* (Species group 99).

The alliance comprises the following four associations (not shown on Table 6.1) which were originally classified by Smit (2000) under two separate orders, namely the *Acacia erioloba* – *Rhynchosia holoserica* Open Tree Community and the *Acacia erioloba* – *Acanthocycos naudinianus* Open Tree Community:

i) *Acacia erioloba* – *Stachys spathulata* Association

Synonym: *Acacia erioloba* – *Stachys spathulata* Open Tree Community Smit 2000

Nomenclatural type: Relevé 724, Table 10 (Smit 2000)

The community is found in the Reivilo area, as well as north of Kuruman. Soils are predominantly of the Hutton, Clovelly, and Mispah forms, and range from relatively shallow to deep (Smit 2000). The original diagnostic species include *Stachys spathulata*, *Berkheya carlinopsis*, *Fingerhuthia africana*, and *Heliotropium strigosum*. The community is dominated by, among others, the trees *Acacia erioloba*, *Ziziphus mucronata*, and *Rhus lancea*, the grasses *Fingerhuthia africana*, *Tragus koelerioides*, and *Digitaria eriantha*, as well as the forbs *Stachys spathulata*, *Indigofera daleoides*, and *Hermannia tomentosa*.

ii) *Acacia erioloba* – *Amphiglossa triflora* Association

Synonym: *Acacia erioloba* – *Pterothrix spinescens* Open Tree Community Smit 2000

Nomenclatural type: Relevé 523, Table 10 (Smit 2000)

This community occurs in the Kuruman-Reivilo area on flat, rocky, and sandy plains. It is associated with relatively shallow to deep soils that are predominantly of the Hutton and Mispah

forms (Smit 2000). The original diagnostic species for the community include *Amphiglossa triflora* [*Pterothrix spinescens*], *Geigeria brevifolia*, *Triraphis andropogonoides*, *Anthospermum rigidum*, and *Cadaba aphylla*, while prominent species include the trees *Acacia erioloba*, *Ziziphus mucronata*, and *Rhus lancea*, the grasses *Tragus koelerioides*, *Aristida meridionalis*, and *Melinis repens*, as well as the forbs *Dicoma schinzii*, *Hermannia tomentosa*, and *Selago densiflora*.

iii) *Acacia erioloba* – *Dichrostachys cinerea* Association

Synonym: *Acacia erioloba* – *Dichrostachys cinerea* Open Tree Community Smit 2000

Nomenclatural type: Relevé 1013, Table 10 (Smit 2000)

The community occurs in the Ganyesa-Setlagole area on deep soils predominantly of the Clovelly and Hutto forms, and also on relatively shallow Mispah and Milkwood soil forms (Smit 2000). It is characterised by, among others, *Bulbine frutescens*, *Dichrostachys cinerea*, *Erlangia misera*, *Verbesina encelioides*, and *Chenopodium album*. The most prominent species in the tree and shrub layer include *Acacia mellifera*, *Dichrostachys cinerea*, and *Terminalia sericea*, while the *Tragus koelerioides*, *Aristida stipitata*, and *Eragrostis rigidior*, as well as the forbs *Dicoma schinzii*, *Rhynchosia confusa*, and *Dicoma capensis* are prominent in the herbaceous layer.

iv) *Acacia erioloba* – *Kyllinga alba* Association

Synonym: *Acacia erioloba* – *Kyllinga alba* Open Tree Community Smit 2000

Nomenclatural type: Relevé 173, Table 10 (Smit 2000)

The community can mainly be encountered in the Christiana-Bloemhof-Hoopstad-Hertzogville area in western Free State. It occurs on plains and valley floors dominated by deep Clovelly, Hutton, Oakleaf, and Sterkspruit soil forms (Smit 2000). Some of its original diagnostic species are *Kyllinga alba*, *Cleome rubella*, *Urochloa panicoides*, and *Arctotis venusta*. The most prominent species in the tree and shrub layer include *Acacia erioloba*, *Ziziphus mucronata*, and *Acacia hebeclada*, while the herbaceous layer is dominated by, among others, the grasses *Urochloa panicoides*, *Aristida stipitata*, and *Cynodon dactylon*.

5.2.3 *Acacia erioloba* – *Eragrostis rigidor* Alliance

Synonym: *Acacia erioloba* – *Eragrostis rigidor* Open Tree Community Smit 2000

Nomenclatural type: *Acacia erioloba* – *Dipcadi papillatum* Association

The community extends over two provinces. It occurs in the Schweizer-Reneke and Amalia area, as well as in the Vryburg – Ganyesa – Stella - Kameel area in North-West. It can also be found in the Bloemhof – Hoopstad-Hertzogville – Christiana area in western Free State (Smit 2000).

The diagnostic species are *Hermannia quartiniana*, *Aerva leucura*, *Coccinia sessilifoila*, *Monsonia burkeana*, *Dicoma capensis*, *Hibiscus marlothianus*, and *Helichrysum paronychioides* (Species group 44), while *Acacia erioloba*, *Stipagrostis uniplumis* (Species group 51), *Tarchonanthus camphoratus* (Species group 69), *Grewia flava* (Species group 80), *Eragrostis lehmanniana* (Species group 81), and *Aristida congesta* (Species group 99) are among the dominant species.

The alliance comprises the following five associations (not shown on Table 6.1) described by Smit (2000):

i) *Acacia erioloba* – *Osteospermum muricatum* Association

Synonym: *Acacia erioloba* – *Osteospermum muricatum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 962, Table 10 (Smit 2000)

The community is found in North-West where it extends from Vryburg northwards beyond Stella, eastwards towards Kameel and westwards towards Klein-Tswaing. It occurs on plains, ridges, and valley floors characterised by generally sandy soils of the Hutton, Clovelly, Mispah, Avalon, Sterkspruit, and Oakleaf forms (Smit 2000).

The original diagnostic species include *Osteospermum muricatum*, *Rhynchosia confusa*, *Dicoma capensis*, *Cenchrus ciliaris*, and *Indigofera alternans*. Prominent species in the tree and shrub layer include *Acacia erioloba*, *Grewia flava*, and *Tarchonanthus camphoratus*, while the

herbaceous layer is dominated by, among others, *Eragrostis rigidor*, *Eragrostis superba*, and *Cynodon dactylon*. *Indigofera daleoides*, *Hibiscus pusillus*, and *Hertia pallens* are among the prominent forbs.

ii) *Acacia erioloba* – *Phyllanthus maderaspatensis* Association

Synonym: *Acacia erioloba* – *Phyllanthus maderaspatensis* Open Tree Community Smit 2000

Nomenclatural type: Relevé 734, Table 10 (Smit 2000)

The community occurs north and west of Christiana on sandy and relatively shallow soils of the Hutton, Mispah, Sterkspruit forms (Smit 2000). It is differentiated by *Phyllanthus maderaspatensis*, *Menodora africana*, *Heliotropium ciliatum*, and *Oxalis depressa*, among others. Its prominent species include *Eragrostis rigidor*, *Aristida congesta*, *Acacia tortilis*, *Eragrostis lehmanniana*, *Grewia flava*, *Eragrostis trichophora*, *Tarchonanhtus camphoratus*, and *Schmidtia pappophoroides*.

iii) *Acacia erioloba* – *Enneapogon cenchroides* Association

Synonym: *Acacia erioloba* – *Enneapogon cenchroides* Open Tree Community Smit 2000

Nomenclatural type: Relevé 407, Table 10 (Smit 2000)

Like the *Acacia erioloba* – *Phyllanthus maderaspatensis* Association, this community occurs north and west of Christiana. Soils range from very shallow to deep and are predominantly of the Hutton, Mispah, Clovelly, and Sterkspruit forms (Smit 2000). The community is differentiated by *Enneapogon cenchroides*, *Geigeria filifolia*, and *Teucrium trifidum*, while prominent species include *Aristida congesta*, *Eragrostis lehmanniana*, *Acacia erioloba*, *Stipagrostis uniplumis*, *Schmidtia pappophoroides*, and *Acacia karroo*.

iv) *Acacia erioloba* – *Dipcadi papillatum* Association

Synonym: *Acacia erioloba* – *Dipcadi papillatum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 326, Table 10 (Smit 2000)

This community is mainly encountered in the Schweizer-Reneke, Amalia, and Christiana areas, but traces of it can be found in the Kuruman area, and also south of Hoopstad. The dominant soil forms are Hutton and Clovelly, which are deep, though relatively shallow Sterkspruit and Estcourt forms area also present (Smit 2000).

The original diagnostic species include *Dipcadi papillatum*, *Berkheya zeyheri*, and *Rhynchosia adenodes*, while prominent species include *Eragrostis rigidior*, *Eragrostis lehmanniana*, *Acacia erioloba*, *Aristida congesta*, *Stipagrostis uniplumis*, *Grewia flava*, *Eragrostis trichophora*, *Tarchonanthus camphoratus*, *Schmidtia pappophoroides*, and *Acacia karroo*.

v) *Acacia erioloba* – *Aristida stipitata* Association

Synonym: *Acacia erioloba* – *Aristida stipitata* Open Tree Community Smit 2000

Nomenclatural type: Relevé 339, Table 10 (Smit 2000)

Like the *Acacia erioloba* – *Dipcadi papillatum* Association, this community is also encountered in the Schweizer-Reneke, Amalia, and Christiana areas, under similar habitat conditions (Smit 2000). It is differentiated by *Aristida stipitata*, *Aptosimum decumbens*, *Diospyros pallens*, and *Sutera halimifolia*, and dominated by, among others, *Eragrostis lehmanniana*, *Acacia erioloba*, *Aristida congesta*, *Stipagrostis uniplumis*, *Grewia flava*, *Eragrostis trichophora*, *Tarchonanthus camphoratus*, *Schmidtia pappophoroides*, *Rhus lancea*, and *Acacia karroo*.

5.3 *Tarchonanthus camphoratus* – *Eragrostis lehmanniana* Sub-order

Synonym: *Tarchonanthus camphoratus* – *Eragrostis lehmanniana* Closed Shrubland Smit 2000

Nomenclatural type: *Tarchonanthus camphoratus* – *Fingerhuthia africana* Alliance

This is a community of the plains and rocky hills, regarded by Smit (2000) to be a distinct class, but the present classification shows that it is to be considered a sub-order. It is found on rocky,

sandy soils that are predominantly of the Mispah, Hutton, and Glenrosa forms. The Hutton soils are the most deep, while the other two forms are relatively shallow.

The community has no diagnostic species but is differentiated from the previous two sub-orders by the absence of species from groups 40-46. The original diagnostic species identified by Smit (2000) include *Tarchonanthus camphoratus* (Species group 69), *Eragrostis lehmanniana*, *Digitaria eriantha* (Species group 81), *Ziziphus mucronata* (Species group 109), and *Acacia karroo* (Species group 110). The most prominent woody species are *Tarchonanthus camphoratus* (Species group 69), *Grewia flava* (Species group 80), *Ziziphus mucronata* (Species group 109), and *Acacia karroo* (Species group 110), while abundant grasses include *Eragrostis trichophora*, *Aristida adscensionis* (Species group 60), *Sporobolus fimbriatus* (Species group 66), *Eragrostis lehmanniana*, *Digitaria eriantha* (Species group 81), and *Heteropogon contortus* (Species group 108).

Two alliances further differentiate the sub-order. They were originally described by Smit 2000 as orders under the *Tarchonanthus camphoratus* – *Eragrostis lehmanniana* Closed Shrubland.

5.3.1 *Tarchonanthus camphoratus* – *Fingerhuthia africana* Alliance

Synonym: *Tarchonanthus camphoratus* – *Fingerhuthia africana* Closed Shrubland Smit 2000

Nomenclatural type: *Tarchonanthus camphoratus* – *Panicum coloratum* Association

This is a community of the Kimberley-Barkly West area in the Northern Cape, the Reivilo-Schweizer-Reneke area in the North West, and the Boshof-Christiana-Bothaville area in the Free State. It is encountered on plains, rocky hills and ridges dominated by soils of the Mispah, Glenrosa, Hutton, and Clovelly forms.

The community is differentiated by species from group 47, namely *Diospyros pallens*, *Helichrysum* species, *Amphiglossa triflora*, and *Rhynchosia holosericea*. The most prominent species are *Tarchonanthus camphoratus* (Species group 69), *Rhus lancea* (Species group 71),

Grewia flava (Species group 80), *Eragrostis lehmanniana* (Species group 81), and *Ziziphus mucronata* (Species group 109).

The alliance comprises the following two associations, previously described by Smit (2000) as alliances (not shown on Table 6.1):

i) *Tarchonanthus camphoratus* – *Panicum coloratum* Association

Synonym: *Tarchonanthus camphoratus* – *Panicum coloratum* Open Shrubland Smit 2000

Nomenclatural type: Relevé 353, Table 11 (Smit 2000)

The community mainly occurs on rocky plains east of Olifantshoek. Southwest of Bothaville and in the Christiana area, it is found close to seasonal streams and pans. Its dominant soil forms are Mispah, Glenrosa, Hutton, and Sterkspruit forms. The original diagnostic species identified by Smit (2000) are *Panicum coloratum*, *Setaria verticillata*, *Sesamum triphyllum*, *Nerine laticoma*, and *Elephantorrhiza elephantina*.

The following two communities described by Smit (2000) as associations make up this community:

- *Acacia karroo* – *Brachiaria nigropedata* Open Shrubland is mainly encountered in the areas of Olifantshoek in the Northern Cape and Christiana in the Free State. It occurs on plains dotted with a few rocky hills and ridges, where soils are predominantly of the Hutton, Mispah, and Sterkspruit forms.
- *Tarchonanthus camphoratus* – *Hermannia cococarpa* Open Shrubland occurs on slightly undulating to flat plains and rocky hills. Soils are generally sandy and dominated by the Sterkspruit and Mispah forms.

ii) *Olea europaea* - *Tarchonanthus camphoratus* Association

Synonym: *Olea europaea* - *Tarchonanthus camphoratus* Open Shrubland Smit 2000

Nomenclatural type: Relevé 338, Table 11 (Smit 2000)

The community mainly occurs on flat to slightly undulating plains west of Reivilo up to Kuruman. In the Kimberley-Boshoff-Warrenton area it is encountered on rocky hills, as well as seasonal streams and pans. The soils are generally sandy and dominated by the Mispah, Glenrosa, Hutton, and Sterkspruit forms.

Smit (2000) differentiated this community with species such as *Chrysocoma ciliata*, *Diospyros austro-africana*, *Tragus koelerioides*, *Olea europaea*, *Rhus pyroides*, and *Nenax microphylla*. The most prominent species include *Olea europaea*, *Rhus tridactyla*, *Eragrostis lehmanniana*, and *Tarchonanthus camphoratus*.

The association comprises the following communities which Smit (2000) classified as associations of the *Olea europaea* - *Tarchonanthus camphoratus* Open Shrubland:

- *Olea europaea* – *Antephora pubescens* Open Shrubland is found on rocky hills in the Hertzogville-Boshof-Kimberley area, as well as in the Vryburg surroundings and in Spitskop. Its dominant soil forms are Mispah, Hutton, Glenrosa, and Shortlands.
- *Olea europaea* – *Chrysocoma ciliata* Open Shrubland is mainly associated with rocky plains in the Koopmansfontein area, as well as in the vicinity of Warrenton, Kimberley, and Boshof. The predominant soil forms are Mispah, Glenrosa, Hutton, Shortlands, and Valsrivier.

5.3.2 *Acacia tortilis* – *Tarchonanthus camphoratus* Alliance

Synonym: *Acacia tortilis* – *Tarchonanthus camphoratus* Closed Shrubland Smit 2000

Nomenclatural type: *Dicoma capensis* – *Tarchonanthus camphoratus* Association

The alliance is mainly encountered on the Ghaap plateau and east of the southern section of the Kuruman Hills. It is associated with rocky footslopes and slightly undulating plains (Smit 2000). The community has no diagnostic species, but was originally distinguished by *Acacia tortilis*,

Eragrostis superba, *Geigeria filifolia*, *Tripteris aghillana*, *Acacia hebeclada*, and *Felicia fascicularis*. The most dominant species are *Rhus tridactyla* (Species group 50), *Acacia tortilis* (Species group 52), *Tarchonanthus camphoratus* (Species group 70), *Rhus lancea* (Species group 71), *Eragrostis lehmanniana* (Species group 81), and *Aristida congesta* (Species group 99).

The alliance is differentiated into the following seven associations (not shown on Table 6.1) described by Smit (2000):

i) *Acacia erioloba* – *Dicoma anomala* Association

Synonym: *Acacia erioloba* – *Dicoma anomala* Open Tree Community Smit 2000

Nomenclatural type: Relevé 700, Table 11 (Smit 2000)

The community is encountered north and northeast of Kimberley, as well as north of Koopmansfontein. It is associated with flat to slightly undulating plains and also moderate slopes of hills. The soils are generally deep and predominantly of the Hutton and Clovelly forms (Smit 2000).

The community is differentiated by *Acacia erioloba*, *Sutera halimifolia*, *Dicoma anomala*, and *Solanum incanum*. Dominant trees and shrubs include *Acacia erioloba*, *Rhus lancea*, and *Acacia karroo*, while dominant grasses include *Eragrostis superba*, *Eragrostis lehmanniana*, and *Heteropogon contortus*. Other forbs are not as well represented and only *Heliotropium ciliatum*, *Geigeria filifolia*, and *Pentzia viridis* are conspicuous.

ii) *Pentzia globosa* – *Acacia tortilis* Association

Synonym: *Pentzia globosa* – *Acacia tortilis* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 690, Table 11 (Smit 2000)

The community is found west and northwest of Daniëlskuil and also on the eastern side of the Kuruman hills (Smit 2000). It is associated with sandy Hutton and Mispah soils. The original diagnostic species are *Pentzia globosa*, *Gnidia polycephala*, and *Salsola kali*, while prominent species include *Acacia tortilis*, *Rhus tridactyla*, and *Eragrostis lehmanniana*.

iii) *Hertia pallens* – *Tarchonanthus camphoratus* Association

Synonym: *Hertia pallens* – *Tarchonanthus camphoratus* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 301, Table 11 (Smit 2000)

The community exists under habitat conditions similar to the *Pentzia globosa* – *Acacia tortilis* Association. It is characterised by the species *Hertia pallens*, *Chenopodium album*, *Lycium bosciifolium*, and *Aptosimum lineare*. *Acacia mellifera*, *Acacia tortilis*, *Rhus tridactyla*, *Rhus lancea*, *Asparagus africanus*, and *Lycium cinereum* are some of the dominant species in the tree and shrub layer. Dominant grasses include *Enneapogon cenchroides*, *Eragrostis echinochloidea*, and *Digitaria eriantha*, while *Hertia pallens*, *Geigeria filifolia*, and *Salvia verbenaca* are some of the prominent herbs.

iv) *Ledebouria graminifolia* – *Tarchonanthus camphoratus* Association

Synonym: *Ledebouria graminifolia* – *Tarchonanthus camphoratus* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 787, Table 11 (Smit 2000)

The community is restricted to the Ghaap plateau and can be encountered in Koopmansfontein northwards of the Ghaap plateau to the Reivilo area (Smit 2000). It is associated with moderately deepsandy soils that are predominantly of the Mispah and Hutton forms. The original diagnostic species are *Ledebouria graminifolia*, *Anthospermum rigidum*, *Solanum tomentosum*, and *Commelia erecta* while prominent species include the woody species *Acacia tortilis*, *Rhus tridactyla*, and *Rhus lancea*, the grasses *Schmidtia pappaphoroides*, *Aristida congesta*, and *Eragrostis lehmanniana*, as well as the forbs *Geigeria filifolia*, *Hibiscus pusillus*, and *Lantana rugosa*.

v) *Dicoma capensis* – *Tarchonanthus camphoratus* Association

Synonym: *Dicoma capensis* – *Tarchonanthus camphoratus* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 742, Table 11 (Smit 2000)

The community is found on dolomite and limestone on the Ghaap plateau, from Reivilo northwards on the northern part of the Ghaap plateau (Smit 2000). The original diagnostic species are *Dicoma capensis*, *Barleria macrostegia*, *Indigofera heterotricha*, *Opuntia stricta*, *Cadaba aphylla*, *Chascanum pinnatifidum*, *Conyza bonariensis*, and *Rhus burchellii*. The tree and shrub layer is dominated by species such as *Acacia tortilis*, *Rhus tridactyla*, and *Tarchonanthus camphoratus*. Prominent species in the herbaceous layer include the grasses *Eragrostis rigidor*, *Enneapogon scoparius*, and *Cymbopogon pospischillii*, as well as the shrublets *Lippia scaberima* and *Pentzia viridis*, and the forb *Aptosimum procumbens*.

vi) *Tarchonanthus camphoratus* – *Boscia albitrunca* Association

Synonym: *Tarchonanthus camphoratus* – *Boscia albitrunca* Sparse Tree Community Smit 2000

Nomenclatural type: Relevé 1004, Table 11 (Smit 2000)

The community occurs as local patches on moderately deep soils that are predominantly of the Hutton and Mispah forms, though other forms such as Clovelly, Glenrosa, and Rensburg are also present. It is characterised by the species *Boscia albitrunca*, *Evolvulus alsinoides*, *Cenchrus ciliaris*, *Portulaca oleracea*, *Peliostomum leucorrhizum*, *Kalanchoe paniculata*, and *Cleome angustifolia*. The tree and shrub layer is dominated by species such as *Acacia mellifera*, *Acacia tortilis*, and *Tarchonanthus camphoratus*. *Enneapogon cenchroides*, *Enneapogon scoparius*, and *Eragrostis echinochloidea* are some of the prominent grasses in the herbaceous layer, with the forbs *Geigeria filifolia*, *Kyphocarpa angustifolia*, and *Pentzia viridis* also prominent.

vii) *Pentzia incana* - *Tarchonanthus camphoratus* Association

Synonym: *Pentzia incana* - *Tarchonanthus camphoratus* Closed Shrubland Smit 2000

Nomenclatural type: Relevé 1024, Table 11 (Smit 2000)

The community occurs on rocky plains and hills in the Vryburg-Taung-Amalia region in North-West Province. It is associated with relatively shallow Mispah and Glenrosa soil forms, and also moderately deep Hutton soils (Smit 2000). The original diagnostic species are *Pentzia incana*, *Aptosimum marlothii*, *Achyranthes aspera*, *Trianthema triquetra*, and *Salsola rabieana*. Some of

the prominent species include the woody *Acacia mellifera*, *Acacia tortilis*, and *Tarchonanthus camphoratus*, the grasses *Enneapogon cenchroides*, *Aristida congesta*, and *Aristida adscensionis*, including the forbs *Pentzia incana*, *Kyphocarpa angustifolia*, and *Pentzia viridis*.

5.4 *Acacia karroo* – *Cynodon dactylon* Sub-order

Synonym: *Acacia karroo* – *Panicum coloratum* Open Shrubland Smit 2000

Nomenclatural type: *Cirsium vulgare* – *Cynodon dactylon* Alliance

The sub-order is found on the riverbanks and riverbeds of seasonal rivers, as well as in seasonal streams and pans, where water accumulates sporadically (Smit 2000). It is differentiated by *Berkheya radula**, *Eragrostis rotifer*, and *Xanthium spinosum* (Species group 58), while the dominant species include *Chloris virgata* (Species group 59), *Panicum coloratum* (Species group 81), *Cynodon dactylon* (Species group 100), and *Acacia karroo* (Species group 110).

The sub-order is differentiated into three alliances.

5.4.1 *Asparagus larycinus* – *Cynodon dactylon* Alliance

Synonym: *Asparagus larycinus* – *Acacia karroo* Open Tree Community Smit 2000

Nomenclatural type: *Helichrysum aureonitens* – *Themeda triandra* Association

The community is found near seasonal streams and pans (Smit 2000). Its diagnostic species are *Leptochloa fusca*, *Duthiastrum linifolium*, and *Argemone ochroleuca** (Species group 54), as well as *Setaria incrassata* (Species group 14). The most prominent species in the tree and shrub layer are *Rhus lancea* (Species group 71), *Ziziphus mucronata* (Species group 109), and *Acacia karroo* (Species group 110), while the herbaceous layer is dominated by the grasses *Chloris virgata* (Species group 59), *Sporobolus fimbriatus* (Species group 66), *Panicum coloratum*, *Digitaria eriantha* (Species group 81), *Cynodon dactylon* (Species group 100), and *Themeda triandra* (Species group 109). *Schkuhria pinnata* (Species group 81) and *Bidens pilosa* (Species group 97) are the prominent forbs.

The alliance is differentiated into the following three associations (not shown on Table 6.1) described by Smit (2000):

i) *Aristida congesta* – *Panicum coloratum* Association

Synonym: *Aristida congesta* – *Panicum coloratum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 324, Table 13 (Smit 2000)

The community occurs in the Christiana, Amalia, and Schweizer-Reneke areas. It is associated with deep soils of the Katspruit, Willowbrook, Dundee, and Rensburg forms (Smit 2000). Some of the original diagnostic species are *Aristida congesta*, *Rhus tridactyla*, and *Andropogon appendiculatus*, while the most dominant species are *Themeda triandra*, *Sporobolus fimbriatus*, *Rhus lancea*, *Stachys spathulata*, *Chloris virgata*, *Digitaria eriantha*, *Cynodon dactylon*, *Panicum coloratum*, *Eragrostis micrantha*, and *Ziziphus mucronata*.

ii) *Eragrostis rigidor* – *Panicum coloratum* Association

Synonym: *Eragrostis rigidor* – *Panicum coloratum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 311, Table 13 (Smit 2000)

The community is mainly found in the Amalia area, near pans. It is associated with sandy soils dominated by the Willowbrook and Rensburg forms (Smit 2000). It is differentiated by *Kalanchoe rotundifolia*, *Pentzia incana*, *Bulbine frutescens*, *Eragrostis rigidor*, *Diospyros austro-africana*, *Vahlia capensis*, and *Barleria macrostegia*. Prominent species are *Themeda triandra*, *Sporobolus fimbriatus*, *Rhus lancea*, *Cynodon dactylon*, and *Panicum coloratum*.

iii) *Helichrysum aureonitens* – *Themeda triandra* Association

Synonym: *Helichrysum aureonitens* – *Themeda triandra* Open Tree Community Smit 2000

Nomenclatural type: Relevé 399, Table 13 (Smit 2000)

The community is associated with seasonal streams in Bothaville, Spitskop, and Daniëlskuil. It is differentiated by *Helichrysum aureonitens*, *Pentzia globosa*, *Hypertelis salsoloides*, *Juncus rigidus*, and *Viscum rotundifolium*, while the dominant species are *Diospyros lycioides*, *Rhus leptodictya*, *Setaria incrassata*, *Themeda triandra*, *Sporobolus fimbriatus*, *Cynodon dactylon*, *Eragrostis micrantha*, *Ziziphus mucronata*, and *Acacia karroo*.

5.4.2 *Cirsium vulgare* – *Cynodon dactylon* Alliance

Synonym: *Cirsium vulgare* – *Cynodon dactylon* Open Tree Community Smit 2000

Nomenclatural type: *Setaria verticillata* – *Acacia karroo* Association

This community is found on dry streambeds and pans (Smit 2000). It has no diagnostic species but is distinguished from the *Asparagus laricinus* – *Cynodon dactylon* Alliance by the presence of *Cullen tomentosum*, *Scirpoides dioecus* (Species group 56), *Senecio inaequidens*, and *Stachys spathulata* (Species group 57). The most dominant species are *Scirpoides dioecus* (Species group 56), *Rhus lancea* (Species group 71), *Cynodon dactylon* (Species group 100), *Ziziphus mucronata*, *Themeda triandra* (Species group 109), and *Acacia karroo* (Species group 110).

The following two communities described by Smit (2000) are regarded as associations (not shown on Table 6.1):

i) *Fingerhuthia africana* – *Panicum coloratum* Association

Synonym: *Fingerhuthia africana* – *Panicum coloratum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 1025, Table 13 (Smit 2000)

The community is associated with pans in the Reivilo area and also east of the Kuruman hills. It can also be found on dry streambeds mainly in Koopmansfontein and Vryburg (Smit 2000). The original diagnostic species for the community are *Melolobium calycinum*, *Fingerhuthia africana*, *Pentzia viridis*, *Amphiglossa triflora*, *Hebenstretia angolensis*, *Gazania krebsiana*, *Chenopodium album*, *Olea europaea*, *Deverra denudata*, *Acacia mellifera*, and *Eragrostis truncata*. Some of

the dominant species include *Scirpoides dioecus*, *Themeda triandra*, *Stachys spathulata*, *Cynodon dactylon*, *Panicum coloratum*, and *Selago densiflora*.

ii) *Setaria verticillata* – *Acacia karroo* Association

Synonym: *Setaria verticillata* – *Acacia karroo* Closed Tree Community Smit 2000

Nomenclatural type: Relevé 402, Table 13 (Smit 2000)

This community is found on the riverbeds and riverbanks. It is differentiated by *Setaria verticillata*, *Xanthium spinosum*, *Corchorus asplenifolius*, *Verbena bonariensis*, and *Gymnosporia buxifolia*, and dominated by *Setaria verticillata*, *Themeda triandra*, *Chloris virgata*, *Digitaria eriantha*, *Schkuhria pinnata*, *Bidens pilosa*, *Cynodon dactylon*, *Ziziphus mucronata*, and *Acacia karroo*.

5.4.3 *Chloris virgata* - *Acacia karroo* Alliance

Nomenclatural type: *Enneapogon cenchroides* – *Panicum coloratum* Association

The community is associated with pans and seasonal streams in Spitskop, Molopo River, and Jan Kempdorp. It is also found in the Vryburg-Taung area and the Gamagara River near Daniëlskuil. Soils range from shallow to very deep and are dominated by the Mispah, Dundee, Oakleaf, and Katspruit forms. Like the *Cirsium vulgare* – *Cynodon dactylon* Alliance, this community has no diagnostic species but is distinguished by the absence of species from groups 56 and 57, which are present in the previous two alliances. Some of the prominent species are *Nidorella resedifolia*, *Chloris virgata* (Species group 59), and *Acacia karroo* (Species group 110).

i) *Enneapogon cenchroides* – *Panicum coloratum* Association

Synonym: *Enneapogon cenchroides* – *Panicum coloratum* Open Tree Community Smit 2000

Nomenclatural type: Relevé 514, Table 13 (Smit 2000)

This is a community of pans and streambeds dominated by shallow to deep soils of the Mispah, Dundee, Oakleaf, and Katspruit forms (Smit 2000). It is distinguished by *Persicaria hystricula*,

Enneapogon cenchroides, *Tragus racemosus*, *Lycium cinereum*, and *Heliotropium steudneri*, and dominated by *Panicum coloratum*, *Selago densiflora*, and *Nidorella resedifolia*.

ii) *Aristida congesta* – *Themeda triandra* Association

Synonym: *Aristida congesta* – *Themeda triandra* Open Tree Community Smit 2000

Nomenclatural type: Relevé 1033, Table 13 (Smit 2000)

The community can be encountered on the Gamagara River near Daniëlskuil and Harts River in the Spitskop area. The original diagnostic species are *Aristida congesta*, *Eragrostis echinochloidea*, *Conyza bonariensis*, and *Chenopodium* species, while most prominent species are *Themeda triandra*, *Cynodon dactylon*, *Eragrostis micrantha*, and *Acacia karroo*.

6. *Teucrium trifidum* – *Themeda triandra* Order

Nomenclatural type:

This is a thicket/woodland community found in northern Free State, in the eastern part of North-West, and also in eastern and western Gauteng, as well as in western Mpumalanga. It occurs in kloofs and sheltered valleys, and also on mountain slopes. It is also encountered on bottomlands and footslopes with deep clayey soils. The diagnostic species are *Teucrium trifidum*, *Eustachys paspaloides*, *Elionurus muticus*, *Acacia caffra*, *Asparagus suaveolens*, and *Celtis africana* (Species group 89).

The order is differentiated into three sub-orders.

6.1 *Blepharis integrifolia* – *Asparagus larycinus* Sub-order

Nomenclatural type: *Tribulus terrestris* – *Asparagus larycinus* Alliance

This is a degraded thicket community of the northern Free State. It is encountered on bottomlands with deep clayey soils, often found along valley flats, on rocky outcrops and on some streambanks. On the upland situations it can be encountered on crests and midslopes of dolerite hills, as well as on dry, rocky ridges.

Blepharis integrifolia and *Sporobolus ioclados* (Species group 65) are the diagnostic species, while the most prominent species include *Asparagus laricinus* (Species group 100), *Themeda triandra* (Species group 109) and *Acacia karroo* (Species group 110).

The sub-order comprises four alliances.

6.1.1 *Atriplex semibaccata* – *Acacia karroo* Alliance

Synonym: *Acacia karroo* – *Protasparagus laricinus* Thornveld (Kooij, Scheepers, Bredenkamp & Theron 1991)

Nomenclatural type: *Acacia karroo* – *Eragrostis chloromelas* Association

The community, described by Kooij *et al.* (1991), occurs in the Kroonstad area. It is situated on the uplands as well as in the bottomlands along valley flats and steep streambanks.

This is a distinct community from the other three alliances, notably characterised by the absence of *Tagetes minuta* (Species group 20), *Arctotis aspera* (Species group 64), *Panicum maximum* (Species group 65), as well as species from group 83. Its diagnostic species are *Albuca setosa* and *Dimorphotheca zeyheri* (Species group 81). The original diagnostic species for this community, identified by Kooij *et al.* (1991), were *Asparagus laricinus*, *Acacia karroo*, and *Teucrium trifidum*. These species, together with *Cynodon hirsutus* (Species group 18), *Atriplex semibaccata* (Species group 25), *Blepharis integrifolia* (Species group 65), *Felicia muricata*, *Panicum coloratum* (Species group 81), and *Themeda triandra* (Species group 109) are the most prominent species.

The alliance is differentiated into the following two associations, which are not shown on Table 6.1:

i) *Acacia karroo* – *Melica decumbens* Association

Synonym: *Acacia karroo* – *Melica decumbens* Bottomland Thornveld Kooij *et al.* 1991

Nomenclatural type: Relevé 101, Table 1 (Kooij *et al.* 1991)

This community is situated in the bottomlands along the valley flats, steep riverbanks or in ravines. It also extends up the main tributary streams and minor drainage lines, and also in small kloofs and narrow ravines. The soils range from the vertic Rensburg form to the Oakleaf form.

The diagnostic species are *Melica decumbens*, *Gymnosporia buxifolia*, *Delosperma sutherlandii*, *D. herbeum*, *Diospyros lycioides*, *Pentarrhinum insipidum* and *Rhus pyroides*. Constantly present species include *Asparagus laricinus*, *Acacia karroo*, *Teucrium trifidum*, *Cynodon dactylon*, and *Themeda triandra*.

Kooij *et al.* (1991) distinguish the following community under this thornveld:

- The *Acacia karroo* – *Celtis africana* Ravine Thornveld is situated along narrow ravines and small kloofs.

ii) *Acacia karroo* – *Eragrostis chloromelas* Association

Synonym: *Acacia karroo* – *Eragrostis chloromelas* Upland Thornveld Kooij *et al.* 1991

Nomenclatural type: Relevé 203, Table 1 (Kooij *et al.* 1991)

The thornveld is typically associated with extensive sheet and ledge outcrops of sandstone, and dolerite sills and dykes, on summits and structural terraces, plateaus, rocky ridges and hills. The soils are black vertic clays of the Arcadia form, and are generally shallow and rocky.

The diagnostic species are *Corchorus asplenifolius*, *Eragrostis chloromelas*, *Aristida congesta*, *Sporobolus ioicladus*, *Eragrostis barbinodis*, *Indigofera alternans*, *Eragrostis* species,

Anthericum fasciculatum, *Hermania coccocarpa*, *Digitaria argyrograpta* and *Aptosimum procumbens*. Constantly present species are the grasses *Panicum coloratum*, *Cynodon hirsutus*, *Eragrostis lehmanniana*, *Aristida congesta*, *Digitaria argyrograpta*, *Cynodon dactylon* and *Themeda triandra*, as well as the woody species *Acacia karroo* and *Asparagus laricinus*. These two woody species tend to severely encroach overgrazed areas (Kooij *et al.* 1991).

6.1.2 *Hemizygia pretoriae* – *Acacia karroo* Alliance

Nomenclatural type: *Eustachys paspaloides* – *Acacia karroo* Association

This is a degraded community of the northern Free State. It occurs on the rocky outcrops of the Heilbron-Lindley-Warden-Villiers area (Fuls, Bredenkamp & Van Rooyen 1993a) and on dolerite hills in the Vredefort-Kroonstad-Lindley-Heilbron area (Fuls, Bredenkamp & Van Rooyen 1992a). The diagnostic species for this community are *Mohria caffrorum*, *Hemizygia pretoriae*, and *Kalanchoe rotundifolia* (Species group 62).

The alliance comprises the following two associations, which are not shown on Table 6.1:

i) *Eustachys paspaloides* – *Acacia karroo* Association

Synonym: *Eustachys paspaloides* – *Acacia karroo* Low Thicket Fuls *et al.* 1993a

Nomenclatural type: Relevé 262, Table 1 (Fuls *et al.* 1993a)

The plant community is found on the rocky outcrops of the Heilbron-Lindley-Warden-Villiers area. It is restricted to the Vegkop area and is characterised by severe overutilisation and consequent *Acacia karroo* encroachment (Fuls *et al.* 1993a). *Acacia karroo*, *Eustachys paspaloides*, *Waltheria indica*, *Teucrium trifidum*, and *Kalanchoe rotundifolia* are the diagnostic species.

ii) *Sporobolo fimbriatis* – *Tarchonantheum camphoratis* Fuls *et al.* 1992a

Nomenclatural type: Relevé 146, Table 1 (Fuls *et al.* 1992a)

This community is exclusively associated with dolerite hills in the Vredefort-Kroonstad-Lindley-Heilbron area. It is characterised by retrogression due to overgrazing and mismanagement (Fuls *et al.* 1992a). Diagnostic woody species include *Tarchonanthus camphoratus*, *Grewia flava*, and *Grewia occidentalis*, while *Sporobolus fimbriatus*, *Panicum maximum*, *Eustachys paspaloides*, and *Digitaria eriantha* are the prominent grasses.

6.1.3 *Themeda triandra* – *Asparagus larycinus* Alliance

Nomenclatural type: *Panicum coloratum* – *Acacia karroo* Association

The community occurs in the Vredefort-Kroonstad-Lindley-Heilbron area, in the northern Free State. It is encountered on bottomlands (Fuls, Bredenkamp & Van Rooyen 1992b) and also on dry, rocky ridges (Fuls *et al.* 1992a).

The community has no diagnostic species but is differentiated from the previous two alliances by the presence of species such as *Cymbopogon excavatus* and *Bidens pilosa* (Species group 97). Prominent species include the trees *Ziziphus mucronata* (Species group 109) and *Acacia karroo* (Species group 110), as well as the grasses *Eragrostis curvula* and *Themeda triandra* (Species group 109).

The following two communities (not shown on Table 6.1) are regarded as associations:

i) *Enneapogono scoparii* – *Diospyretum lycioidis* Fuls *et al.* 1992a

Nomenclatural type: Relevé 157, Table 1 (Fuls *et al.* 1992a)

The community typically occurs on relatively dry and often disturbed steep slopes of rocky ridges. These are northerly facing slopes and hence relatively dry. This enhances the palatability of the grasses and hence the areas are utilized preferentially by herbivores; subsequently this leads to the degradation of the vegetation. The community is characterised by the grasses *Enneapogon scoparius* and *Hyparrhenia hirta*, and also the shrub *Diospyros lycioides*.

ii) *Panicum coloratum* – *Acacia karroo* Association

Synonym: *Panicum coloratum* – *Acacia karroo* Low Thicket (Fuls, Breckenkamp & Van Rooyen 1992b)

Nomenclatural type: Relevé 120, Table 1 (Fuls *et al.* 1992b)

This is a low thicket encountered in low-lying areas where duplex soils are mostly predominant. Fuls *et al.* (1992b) regard this community to be most often the result of bush encroachment brought about by severe disturbance and degradation. Hence, *Acacia karroo*, a known vigorous invader, is the dominant species and diagnostic species. Other diagnostic species include the woody species *Rhus pyroides* and *Ziziphus mucronata*, as well as the forbs *Tagetes minuta* and *Bidens pilosa*, which occur as undergrowth.

6.1.4 *Tribulus terrestris* – *Asparagus larycinus* Alliance

Synonym: *Protasparagus larycinus* – *Acacia karroo* Bushland (Fuls 1993)

Nomenclatural type: *Asparagus suaveolens* – *Rhus lancea* Association

The bushland community is associated with crests and midslopes in the Welkom-Bothaville-Kroonstad area (Fuls 1993) and is characterised by moderate to severe herbivore utilisation.

The community is characterised by *Tribulus terrestris*, *Portulaca quadrifida**, *Opuntia ficus-indica**, and *Commelina benghalensis** (Species group 63). Other species that further characterise the community are *Urochloa panicoides* (Species group 16), *Cynodon hirsutus* (Species group 18), and *Bidens bipinnata** (Species group 19). The most dominant species are *Asparagus larycinus* (Species group 100) and *Acacia karroo* (Species group 110), their dominance being ascribed to bush encroachment (Fuls 1993). Grasses are also prominent including *Tragus berteronianus* (Species group 79), *Panicum coloratum* (Species group 81), and *Cynodon dactylon* (Species group 100). The karroid shrub *Pentzia globosa* (Species group 81) is equally prominent.

The following community recognised by Fuls (1993) is regarded as an association (not shown on Table 6.1):

i) *Asparagus suaveolens* – *Rhus lancea* Association

Synonym: *Protasparagus suaveolens* – *Rhus lancea* Variant Fuls 1993

Nomenclatural type: Relevé 11, Table 5.1 (Fuls 1993)

The community is encountered on rocky outcrops. Its diagnostic species are *Asparagus suaveolens*, *Rhus lancea*, *Gymnosporia buxifolia*, *Diospyros lycioides*, and *Lycium* species.

6.2 *Tragus berteronianus* – *Asparagus larycinus* Sub-order

Synonym: *Grewia flavae* – *Acacietea karroo* Bezuidenhout, Bredenkamp and Theron 1994a

Nomenclatural type: *Acacia karroo* Bezuidenhout & Bredenkamp 1991a

Communities under this sub-order (except *Ledebouria marginata* – *Themeda triandra* Alliance (6.2.1)) are found in North-West and Gauteng. They were described by Bezuidenhout *et al.* (1994a) under *Grewia flavae* – *Acacietea karroo*.

The *Tragus berteronianus* – *Asparagus larycinus* sub-order is mostly associated with deep to moderately deep, clayey soils usually found at the footslopes and bottomland flats. Its diagnostic species are *Tragus berteronianus*, *Barleria macrostegia*, *Oxalis* species, *Aristida canescens*, *Vernonia oligocephala*, and *Anthospermum hispidulum* (Species group 79).

The sub-order comprises six alliances.

6.2.1 *Bulbine narcissifolia* – *Acacia karroo* Alliance

Nomenclatural type: *Acacia karroo* – *Hibiscus pusillus* Association

The community can be found in north western Free State, in the areas of Bothaville, Viljoenskroon, Vredefort, Kroonstad, Hennenman, Welkom, and Wesselsbron. It is mostly associated with sandy soils on riverbanks and valleys (Kooij, Bredenkamp & Theron 1990b,c,d). The vegetation is generally overgrazed and in a degraded condition. The diagnostic species are *Ledebouria marginata*, *Bulbine narcissifolia*, *Menodora africana*, *Portulaca kermesina* (Species group 67) and *Acacia hebeclada* (Species group 60). The most prominent species are *Asparagus laricinus* (Species group 100), *Eragrostis curvula*, *Themeda triandra* (Species group 109), and *Acacia karroo* (Species group 110).

The alliance comprises the following associations, which are not indicated on Table 6.1:

i) *Triraphis andropogonoides* – *Acacia karroo* Association

Synonym: *Triraphis andropogonoides* – *Acacia karroo* Woodland Kooij *et al.* 1990c

Nomenclatural type: Relevé 11, Table 5.1 (Fuls 1993)

The woodland is associated with the B land type and is mostly found on the gradual slopes towards the Vaal and Renoster River valleys on moderately deep, reddish, sandy loam soils of the Hutton and Glenrosa soil forms. Areas in this community are often severely overgrazed, resulting in an increase of woody species (Kooij *et al.* 1990c).

The community is characterised by the woody and semi-woody species *Acacia karroo*, *Asparagus laricinus*, *Asparagus suaveolens* and *Ziziphus mucronata*, and also the grass species *Eragrostis trichophora*. In addition to the diagnostic species, the following grass species are constantly present: *Themeda triandra*, *Eragrostis curvula*, *Aristida congesta*, *Panicum coloratum*, *Cynodon dactylon* and *Cymbopogon pospischillii*, and forbs such as *Hibiscus pusillus*, *Gomphrena celosioides* and the dwarf shrub *Felicia muricata*.

ii) *Asparagus laricinus* – *Acacia karroo* Association

Synonym: *Protasparagus laricinus* – *Acacia karroo* Woodland Kooij *et al.* 1990b

Nomenclatural type: Relevé 11, Table 5.1 (Fuls 1993)

The woodland was described by Kooij *et al.* (1990b) as a bottomland community of the D land type, found along dry watercourses or seasonal rivulets on vertic Rensburg and Acardia soil forms, on duplex soils such as the Sterkspruit, Valsrivier and Swartland forms, as well as on alluvial soils such as the Oakleaf and Dundee forms.

The vegetation is mostly severely overgrazed and in a poor condition. The grass cover is low, associated with an increase in density of *Acacia karroo*, *Asparagus larycinus*, and *Ziziphus zeyheriana*, and an encroachment of the karoo shrub *Pentzia incana*. Constantly present species in the herbaceous layer are *Eragrostis superba*, *Corchorus asplenifolius*, *Ledebouria marginata*, *Panicum coloratum* and *Eragrostis obtusa*. Kooij *et al.* (1990b) identified *Acacia karroo*, *Asparagus larycinus*, *Ziziphus mucronata*, *Gomphrena celosioides*, *Commelina eckloniana*, *Ziziphus zeyheriana*, and *Teucrium trifidum* as the diagnostic species.

iii) *Acacia karroo* – *Hibiscus pusillus* Association

Synonym: *Acacia karroo* – *Hibiscus pusillus* Thornveld Kooij *et al.* 1990d

Nomenclatural type: Relevé 11, Table 5.1 (Fuls 1993)

The thornveld is restricted to the watercourses and drainage lines of the A land type. The soils are usually deep, red to yellow sandy soils of the Hutton or Clovelly forms. The vegetation is generally overgrazed and in a degraded condition (Kooij *et al.* 1990d).

The diagnostic species are the woody species *Acacia karroo*, *Acacia hebeclada*, the shrubby *Asparagus suaveolens*, *Asparagus larycinus* and *Lycium cinereum*, the grass *Sporobolus fimbriatus*, the forbs *Hibiscus pusillus*, *Hibiscus trionum*, *Pollichia campestris*, and the succulent *Portulaca kermesina*. The herbaceous layer is dominated by *Eragrostis curvula*. Other species constantly present are *Pentzia globosa*, *Cynodon dactylon*, *Bulbine narcissifolia*, *Felicia muricata*, *Solanum incanum*, *Eragrostis obtusa*, *Kyllinga alba*, *Barleria macrostegia*, *Ledebouria marginata*, and *Selago densiflora*.

6.2.2 *Acacion karroo* Bezuidenhout & Bredenkamp 1991a

Synonym: *Rhoo lanceae* – *Acacion karroo* Bezuidenhout, Bredenkamp & Theron 1993

Nomenclatural type: *Rhoo pyroidis* – *Acacietum karroo* Bezuidenhout, Bredenkamp & Theron 1993

This woodland occurs in the Ottosdal-Lichtenburg-Ventersdorp-Potchefstroom area (Bezuidenhout & Bredenkamp 1991a), the Lichtenburg-Delareyville-Ottosdal area (Bezuidenhout, Bredenkamp & Theron 1993), and the Faan Meintjes Nature Reserve (Bredenkamp & Bezuidenhout 1990). It is associated with moderately deep, clayey soils usually found at the footslopes and bottomland flats.

The diagnostic species are *Eragrostis gummiflua* and *Pseudognaphalium oligandrum* (Species group 68). The woody layer is dominated by *Grewia flava* (Species group 80), *Asparagus suaveolens* (Species group 89), *Rhus pyroides*, *Asparagus laricinus* (Species group 100), and *Acacia karroo* (Species group 110). *Digitaria eriantha* (Species group 81), *Setaria sphacelata*, *Aristida congesta* (Species group 99), *Eragrostis curvula* and *Themeda triandra* (Species group 109) are the prominent grasses.

The alliance is differentiated into five associations, two of which were classified under the *Acacion karroo* (Bezuidenhout & Bredenkamp 1991a). These are the *Sporobolo africana* – *Acacietum karroo* and the *Elionurus muticus* – *Acacia karroo* Association. Another two were classified under the *Rhoo lanceae* – *Acacion karroo* (Bezuidenhout, Bredenkamp & Theron 1993), namely the *Rhoo pyroidis* – *Acacietum karroo* and the *Tarchonantho camphorati* – *Acacietum karroo*.

Although these two alliances were validly published, the present classification indicates that they should both form one alliance. This is mainly because the two occur under similar habitat conditions and were originally distinguished by similar diagnostic species, namely *Acacia karroo*, *Asparagus laricinus*, and *Asparagus suaveolens*.

The following are the five associations, which are not shown on Table 6.1:

i) *Sporobolo africana* – *Acacietum karroo* Bezuidenhout & Bredenkamp 1991a

Nomenclatural type: *Sporobolo africana* – *Acacietum karroo ziziphetosum mucronatae*
Bezuidenhout & Bredenkamp 1991a

The community occurs in the Ottosdal-Potchefstroom-Ventersdorp-Lichtenburg area. It is found on relatively dry footslopes and midslopes, associated with shallow to slightly deep soils of the Mispah, Glenrosa and Hutton forms (Bezuidenhout & Bredenkamp 1991a). The diagnostic species are *Sporobolus africanus* and *Asparagus africanus*, while prominent species include *Grewia flava*, *Acacia karroo*, *Asparagus suaveolens*, *Rhus pyroides*, *Themeda triandra*, and *Aristida congesta*.

The association is sub-divided into the following two sub-associations, as described by Bezuidenhout and Bredenkamp (1991a):

- *Sporobolo africana* – *Acacietum karroo ziziphetosum mucronatae* is strongly associated with the footslopes of the Bc land type.
- *Sporobolo africana* – *Acacietum karroo nidorelletosum resedifoliae* is usually found on flat midslopes where soils are often relatively deep.

ii) *Elionurus muticus* – *Acacia karroo* Association

Synonym: *Elionurus muticus* – *Acacia karroo* Community Bezuidenhout & Bredenkamp
1991a

Nomenclatural type: Relevé 158, Table 1 (Bezuidenhout & Bredenkamp 1991a)

Like the *Sporobolo africana* – *Acacietum karroo*, this community occurs in the Ottosdal-Potchefstroom-Ventersdorp-Lichtenburg area. It is strongly associated with wet bottomland plains characterised by deep soils of the Hutton, Valsrivier and Swartland forms (Bezuidenhout & Bredenkamp 1991a). No diagnostic species were identified but the prominent woody species include *Acacia karroo*, *Asparagus laricinus*, and *Rhus pyroides*. The grasses *Elionurus muticus*,

Eragrostis racemosa, *Aristida canescens*, *Themeda triandra*, *Eragrostis curvula* are some of the prominent species in the herbaceous layer.

iii) *Rhoo pyroidis* – *Acacietum karroo* Bezuidenhout, Bredenkamp & Theron 1993

Nomenclatural type: *Rhoo pyroidis* – *Acacietum karroo protasparagetosum africana*
Bezuidenhout, Bredenkamp & Theron 1993

The association is found in the Delareyville-Ottosdal-Lichtenburg area. It represents woody vegetation of the Bd and Ea land types. It is associated with moderately deep, poorly drained, clayey alluvial soils that are dominated by the Valsrivier, Swartland, Sterkspruit, Westleigh, Mispah, and Glenrosa forms (Bezuidenhout *et al.* 1993). The diagnostic species are *Rhus pyroides*, *Gymnosporia buxifolia*, *Pavonia burchellii*, and *Teucrium trifidum*, while prominent species include *Asparagus suaveolens*, *Acacia karroo*, *Sporobolus africanus*, *Eragrostis curvula*, and *Themeda triandra*.

The association comprises the following sub-associations, as described by Bezuidenhout *et al.* (1993):

- *Rhoo pyroidis* – *Acacietum karroo protasparagetosum africana* occurs on the Bd land type under the same habitat conditions as described for *Rhoo pyroidis* – *Acacietum karroo*.
- *Rhoo pyroidis* – *Acacietum karroo nidorelletosum resedifoliae* is found on the Ea and Bd land types where it is mainly restricted to the bottomland flats with moderately deep, alluvial soils.

iv) *Tarchonanthera camphorati* – *Acacietum karroo* Bezuidenhout, Bredenkamp & Theron 1993

Nomenclatural type: Relevé 653, Table 1 (Bezuidenhout *et al.* 1993)

The association also occurs in the Delareyville-Ottosdal-Lichtenburg area where it is restricted to the bottomland flats of the Ae land type. It is associated with less clayey soils of the Hutton,

Mispah and Clovelly forms (Bezuidenhout *et al.* 1993). The diagnostic species are *Tarchonanthus camphoratus*, *Eragrostis rigidor*, and *Aloe zebrina*. The tree and shrub layer is dominated by *Acacia karroo*, *Rhus lancea*, *Tarchonanthus camphoratus*, *Rhus ciliata*, and *Grewia flava*, while prominent species in the herbaceous layer are *Eragrostis rigidor*, *Sporobolus africanus*, *Heteropogon contortus*, *Eragrostis curvula*, and *Cymbopogon pospischillii*.

v) *Grewia flava* – *Acacia karroo* Association

Synonym: *Grewia flava* – *Acacia karroo* Woodland Bredenkamp & Bezuidenhout 1990

Nomenclatural type: Relevé 9, Table 1 (Bredenkamp & Bezuidenhout 1990)

The woodland was described by Bredenkamp and Bezuidenhout (1990) and is found in the Faan Meintjes Nature Reserve north-east of the town of Klerksdorp. It occurs on the lower footslopes of lava and quartzite hills and also on adjacent plains of the Ba land type. It is associated with fairly shallow Hutton and Glenrosa soils.

The vegetation is characterised by *Acacia karroo* and *Sporobolus fimbriatus*. *A. karroo* is also the dominant species in the tree stratum. The herbaceous layer is dominated by the grasses *Setaria sphacelata*, *Digitaria eriantha* and *Cymbopogon pospischillii*, while forbs that occur constantly include *Pavonia burchellii*, *Anthospermum hispidulum*, *Ledebouria marginata*, *Solanum incanum* and *Pollichia campestris*.

6.2.3 *Protasparago africana* – *Acacia karroo* Bezuidenhout, Bredenkamp & Theron 1994b

Nomenclatural type: *Rhus lanceae* – *Acacietum caffrae* Bezuidenhout *et al.* 1994b

The alliance, which lacks diagnostic species, represents all of the woodland of the Ba land type found in the Lichtenburg-Krugerdsorp-Klerksdorp area (Bezuidenhout *et al.* 1994b). The tree species *Acacia karroo* and *Acacia caffra*, as well as the shrub *Rhus pyroides*, the bushy forb *Asparagus africanus*, and the perennial forb *Teucrium trifidum* are the original diagnostic species for this community, as identified by Bezuidenhout *et al.* (1994b). *Asparagus africanus* (Species

group 76), *Asparagus suaveolens* (Species group 89), *Rhus pyroides* (Species group 100), *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110) dominate the tree layer. The herbaceous layer is dominated by *Cynodon dactylon* (Species group 100), *Eragrostis curvula*, and *Themeda triandra* (Species group 109).

Bezuidenhout *et al.* (1994b) described the following three associations (not shown on Table 6.1) under the alliance:

i) *Protasparago suaveolentis* - *Acacietum karroo* Bezuidenhout *et al.* 1994b

Nomenclatural type: Relevé 184, Table 1 (Bezuidenhout *et al.* 1994b)

The community occurs in the bottomland flats where it invades overgrazed grassland. It is associated with deep, clayey and relatively poorly drained soils that are mostly dominated by Glencoe, Longlands and Fernwood soil forms. *Acacia robusta*, *Tarchonanthus camphoratus*, and *Clematis brachiata* are among the diagnostic species. The woody component includes the trees *Acacia karroo* and *Acacia robusta*, as well as the shrubs *Grewia flava* and *Rhus pyroides*. The herbaceous layer consists of the prominent grasses *Sporobolus africanus*, *Eragrostis curvula*, and *Digitaria eriantha*, while the forbs *Teucrium trifidum* and *Pavonia burchellii* are also conspicuous.

ii) *Eragrostido curvulae* – *Acacietum karroo* Bezuidenhout *et al.* 1994b

Nomenclatural type: Relevé 159, Table 1 (Bezuidenhout *et al.* 1994b)

The community associates strongly with the footslopes of the hills of the Ba land type where it forms large patches of thorny microphyllous bushveld. It occurs on deep and clayey Hutton, Mispah and Avalon soils. There are no diagnostic species. The woody component consists of *Acacia caffra*, *Acacia karroo*, *Rhus pyroides*, *Diospyros lycioides*, and *Asparagus laricinus*. The only prominent forb is *Teucrium trifidum*, while the grasses *Eragrostis curvula*, *Cynodon dactylon*, and *Melinis repens* are also prominent.

iii) *Rhoo lanceae* – *Acacietum caffrae* Bezuidenhout *et al.* 1994b

Nomenclatural type: Relevé 241, Table 1 (Bezuidenhout *et al.* 1994b)

This community is found high up on the midslopes of the Ba land type. This relatively high lying woodland associates with deep and well drained soils that are predominantly Hutton and Mispah. The diagnostic species of this community are *Rhus lancea*, *Acacia hebeclada*, and *A. erioloba*. They, together with *Acacia caffra*, dominate the tree stratum. The herbaceous layer consists of the prominent forb *Teucrium trifidum*, and the prominent grasses *Sporobolus africanus*, *Themeda triandra*, *Eragrostis curvula*, *Aristida congesta*, *Cynodon dactylon*, and *Setaria sphacelata*.

6.2.4 *Chascanum hederaceum* – *Asparagus suaveolens* Alliance

Nomenclatural type: *Acacietum karroo – caffrae* Bezuidenhout *et al.* 1994c

This community is associated with footslopes characterised by a rocky habitat. Some of the most prominent species include the trees *Ziziphus mucronata* (Species group 109) and *Acacia karroo* (Species group 110), as well as the grasses *Eragrostis curvula* and *Themeda triandra* (Species group 109). The community is characterised by *Chascanum hederaceum*, *Dicoma anomala*, *Pogonarthria squarrosa*, and *Trichoneura grandiglumis* (Species group 50).

The alliance is represented by the following three associations, which are not shown on Table 6.1):

i) *Zizipho mucronatae* – *Acacietum karroo* Bezuidenhout *et al.* 1994d

Nomenclatural type: Relevé 523, Table 1 (Bezuidenhout *et al.* 1994d)

This is a community of the Fa land type, found in the Lichtenburg-Krugersdorp-Klerksdorp area (Bezuidenhout *et al.* 1994d). It occurs on footslopes, sometimes encroaching into the floodplains when overgrazing or other forms of disturbance occur. The soils are relatively deep and clayey with Hutton, Mispah and Glenrosa soil forms being dominant.

The diagnostic species are *Acacia karroo*, which dominates the tree stratum, *A. hereroensis*, *A. caffra*, *Ziziphus mucronata*, *Sporobolus fimbriatus* and *Tarchonanthus camphoratus*. Other prominent species are the grasses *Eragrostis lehmanniana*, *Eragrostis curvula*, *Themeda triandra*, and *Digitaria eriantha*.

ii) *Acacia karroo* – *Ziziphus mucronata* Association

Synonym: *Acacia karroo* – *Ziziphus mucronata* savanna Bezuidenhout, Bredenkamp & Elsenbroek 1988

Nomenclatural type: Relevé 424, Table 1 (Bezuidenhout *et al.* 1988)

The plant community occurs in the Vredefort Dome area, north west of the town of Parys. It is found on highly rocky footslopes of ridges, on alluvial and colluvial soils (Bezuidenhout *et al.* 1988). The tree stratum is dominated by the diagnostic tree *Acacia karroo*, with *Ziziphus mucronata*, *Pappea capensis*, *Celtis africana*, and *Rhus leptodictya* also prominent. Other diagnostic species include *Dicoma gerradii* and *Corchorus asplenifolius*, which together with *Themeda triandra* and *Eragrostis curvula*, are among the dominant species in the herbaceous layer.

iii) *Acacietum karroo* – *caffrae* Bezuidenhout *et al.* 1994c

Nomenclatural type: Relevé 292, Table 1 (Bezuidenhout *et al.* 1994c)

The community occurs in the Klerksdorp-Potchefstroom-Carletonville area. It is found on the footslopes and midslopes of the rocky outcrops and hills of the Fb land type. The diagnostic tree species *Acacia karroo*, *Ziziphus mucronata* and *Celtis africana* dominate the community. Other diagnostic species are the grasses *Digitaria eriantha*, *Tragus berteronianus* and *Eragrostis obtusa*, as well as the forbs *Hibiscus pusillus*, *Blepharis angustifolia* and *Pavonia burchellii*.

Bezuidenhout *et al.* (1994c) recognised the following two sub-associations:

- *Acacietum karroo – caffrae rhoetosum pyroidis* is associated with the footslopes of the rocky outcrops and hills. It occurs on deep soils that are predominantly Hutton and Glenrosa.
- *Acacietum karroo – caffrae barlerietosum macrostegiae* is found on midslopes and sometimes on footslopes . The soils are fairly shallow and predominantly Mispah, Glenrosa and Hutton.

6.2.5 *Acacion eriolobae* Bezuidenhout, Bredenkamp & Theron 1993

Nomenclatural type: *Stipagrostis uniplumis* – *Acacietum eriolobae* Bezuidenhout *et al.* 1993

The community, originally described by Bezuidenhout *et al.* (1993), occurs in the Lichtenburg-Delareyville-Ottosdal area. It is associated with the aeolian soils in the Bd land type and adjacent Ae and Ah land types. The deep, clayey but well-drained soils are situated on the footslopes of the A land types (Bezuidenhout *et al.* 1993).

The community is characterised by *Acacia erioloba**, *Stipagrostis uniplumis*, *Antephora pubescens*, *Elephantorrhiza elephantina*, and *Solanum supinum* (Species group 52), while *Acacia hebeclada** (Species group 60) can also be regarded as diagnostic. *Grewia flava* (Species group 80) and *Digitaria eriantha* (Species group 81) are among the prominent species.

Bezuidenhout *et al.* (1993) described the following two associations (not shown on Table 6.1) under the alliance:

i) *Stipagrostis uniplumis* – *Acacietum eriolobae* Bezuidenhout *et al.* 1993

Nomenclatural type: Relevé 629, Table 1 (Bezuidenhout *et al.* 1993)

This community occurs on the footslopes of the Ae and Bd land types. It is found on relatively deep, well-drained, sandy soils that are predominantly Avalon, Westleigh and Glencoe. The

diagnostic species are the grasses *Stipagrostis uniplumis*, *Schmidtia pappophoroides*, *Brachiaria nigropedata*, and *Rhus ciliata*. *Stipagrostis uniplumis*, *Antephora pubescens*, and *Digitaria eriantha* are the prominent grasses, with *Acacia erioloba* and *Grewia flava* being the dominant woody species.

ii) *Terminalietum sericeae* – *Acacietum eriolobae* Bezuidenhout *et al.* 1993

Nomenclatural type: Relevé 656, Table 1 (Bezuidenhout *et al.* 1993)

The community is also found on the footslopes but mainly in the Ah land type. It is associated with deep, sandy soils of the Clovelly and Avalon forms. *Terminalia sericea*, *Grewia flavescens*, *Ozoroa paniculosa*, *Dicerocaryum eriocarpum*, and *Dichrostachys cinerea* are the diagnostic species. The woody layer is dominated by *Acacia erioloba* and *Grewia flava*, while grass species that are prominent include *Aristida diffusa*, *Eragrostis lehmaniana*, *Aristida congesta*, and *Digitaria eriantha*.

6.2.6 *Setaria sphacelata* - *Asparagus laricinus* Alliance

Nomenclatural type: *Cynodon dactylon* – *Acacia karroo* Association

The woodland is found in the Lichtenburg area (Bezuidenhout, Bredenkamp, Theron & Morris 1994f) and also in the Abe Bailey Nature Reserve (Van Wyk 1983). It is associated with bottomland situations characterised by deep, clayey soils. The most dominant species include *Eragrostis lehmanniana* (Species group AAF), *Eragrostis superba* (Species group AAJ), and *Acacia karroo* (Species group ABJ). The diagnostic species are *Guilleminea densa*, *Oropetium capense*, and *Antizoma angustifolia* (Species group 78).

The alliance comprises the following associations (not shown on Table 6.1):

i) *Cynodon dactylon* – *Acacia karroo* Association

Synonym: *Cynodon dactylon* – *Acacia karroo* Woodland Bezuidenhout *et al.* 1994f

Nomenclatural type: Relevé 181, Table 2 (Bezuidenhout *et al.* 1994f)

The community is found in the Lichtenburg area. It is mostly restricted to bottomland situations with deep, clayey soils (Bezuidenhout *et al.* 1994f). The diagnostic species include the woody species *Acacia karroo* and *Gymnosporia buxifolia*, which are also part of the dominant trees, as well as the forbs *Antizoma angustifolia* and *Solanum supinum*. The most common grasses are *Sporobolus africanus*, *Cynodon dactylon*, and *Eragrostis lehmanniana*.

ii) *Eustachys paspaloides* – *Acacia karroo* Association

Synonym: *Eustachys paspaloides* – *Acacia karroo* Bush Van Wyk 1983

Nomenclatural type: Relevé 130, Table 5.1 (Van Wyk 1983)

The community occurs in the Abe Bailey Nature Reserve, north of the town of Carletonville in Gauteng (Van Wyk 1983). It is found in dolomite areas in and around sinkholes, and is associated with deep, clayey soils where the Hutton soil form is most predominant. The community is dominated by woody species such as *Acacia karroo*, *Rhus pyroides*, and *Grewia flava*, while *Eustachys paspaloides* and *Eragrostis chloromelas* are among the prominent species in the herbaceous layer. The diagnostic species are *Acacia karroo* and *Bonatea speciosa*.

6.3 *Zanthoxylum capense* – *Euclea crispa* Sub-order

Nomenclatural type: *Euclea crispa* – *Rhoicissus tridentata* Alliance

This is a woodland community of eastern Gauteng/western Mpumalanga, where it occurs in kloofs and sheltered valleys, and also on mountain slopes. Its diagnostic species are *Zanthoxylum capense*, *Cussonia paniculata*, *Gymnosporia polyacantha*, and *Aloe greatheadii* (Species group 88). *Eragrostis curvula*, *Themeda triandra* (Species group 109), and *Acacia karroo* (Species group 110) are the only prominent species that are widespread in this community, while others such as *Acacia caffra* and *Asparagus suaveolens* (Species group 89) only attain local dominance. There are three alliances under this sub-order.

6.3.1 *Euclea crispa* – *Rhoicissus tridentata* Alliance

Synonym: *Euclea crispa* – *Rhoicissus tridentata* Bush and Savanna communities
Bredenkamp & Theron (1980)

Nomenclatural type: *Acacia karroo* – *Teucrium trifidum* Association

This community can be found in the kloofs and valleys, and on slopes of the mountains within the Suikerbosrand Nature Reserve, which is located south-east of Johannesburg (Bredenkamp & Theron 1980).

The vegetation is characterised by *Isoglossa grantii**, *Eragrostis patentipilosa**, *Kalanchoe paniculata*, *Delosperma mahonii* (Species group 82), and *Rhus leptodictya** (Species group 60). *Acacia karroo* (Species group 110) is the most prominent woody species, followed by *Euclea crispa* (Species group 106) and *Diospyros lycioides* (Species group 109). The liane *Rhoicissus tridentata* (Species group 106) features prominently in the tree and shrub layers, while the herbaceous layer is dominated by *Eragrostis curvula* and *Themeda triandra* (Species group 109).

Bredenkamp and Theron (1980) described the following communities that are now regarded as associations (not shown on Table 6.1):

i) *Rhus pyroides* – *Rhamnus prinoides* Association

Synonym: *Rhus pyroides* – *Rhamnus prinoides* – *Acacia karroo* Variant Bredenkamp & Theron 1980

Nomenclatural type: Relevé 9, Table 2 (Bredenkamp & Theron 1980)

This community was described by Bredenkamp and Theron (1980) as a variant of the *Rhus pyroides* – *Rhamnus prinoides* Forest, which is dense forest vegetation found mainly in sheltered kloofs. The *Rhus pyroides* – *Rhamnus prinoides* Association occurs in relatively dry kloofs, on clay loam soils.

This is a densely wooded community characterised by well-defined tree and shrub strata that are dominated by *Euclea crispa*, *Rhus pyroides*, *Celtis africana*, *Rhamnus prinoides*, *Diospyros*

lycioides, and *Acacia karroo*. Lianes often present in the tree and shrub strata include *Clematis brachiata* and *Rhoicissus tridentata*. Species such as *Ehrharta erecta* and *Isoglossa grantii* are prominent in the herbaceous layer. The community is characterised by the presence of *Acacia karroo* and *Teucrium trifidum*.

ii) *Acacia caffra* – *Aloe marlothii* Association

Synonym: *Acacia caffra* – *Aloe marlothii* Variant Bredenkamp & Theron 1980

Nomenclatural type: Relevé 12, Table 2 (Bredenkamp & Theron 1980)

This community was originally described as a variant of the *Euclea crispa* – *Buddleja saligna* – *Acacia caffra* Bush (Bredenkamp & Theron 1980). It is situated on steep, rocky slopes that face north, north-west, and north-east.

The most conspicuous trees include *Aloe marlothii*, *Acacia caffra*, and *Rhus leptodictya*. The herbaceous layer varies with variation in the tree and shrub canopy, but is dominated by grasses such as *Eragrostis curvula* and *Themeda triandra*. The community is characterised by *Aloe marlothii*, *Tarchonanthus camphoratus*, *Aristida junciformis*, *Helinus integrifolius* and *Melhania prostrata*.

iii) *Acacia karroo* – *Teucrium trifidum* Association

Synonym: *Acacia karroo* – *Teucrium capense* Savanna Communities Bredenkamp & Theron 1980

Nomenclatural type: *Acacia karroo* – *Teucrium capense* – *Felicia muricata* Savanna (Bredenkamp & Theron 1980)

This open savanna occurs at relatively low altitudes, on clay loam soils, in sheltered valleys and often along dry stream banks. It is mostly dominated by *Acacia karroo*, which together with *Teucrium trifidum*, *Aristida congesta*, *Cynodon dactylon*, *Delosperma mahonii* and *Pollichia campestris* characterise the community.

Bredenkamp and Theron (1980) distinguished three variations under this community:

- *Acacia karroo* – *Teucrium trifidum* – *Conyza podocephala* Savanna is situated on gentle, fairly rocky slopes that face north-east, south and south-west.
- *Acacia karroo* – *Teucrium trifidum* – *Felicia muricata* Savanna is situated on flat, rockless areas on black clay soils.
- *Acacia karroo* – *Acacia caffra* – *Teucrium trifidum* Savanna is found on moderately steep, rocky slopes on the hills adjacent to the *Acacia karroo* – *Teucrium trifidum* – *Felicia muricata* Savanna.

6.3.2 *Rhus leptodictya* – *Grewia occidentalis* Alliance

Synonym: *Rhus leptodictya* – *Grewia occidentalis* Woodland Smit, Bredenkamp, Van Rooyen, Van Wyk & Combrinck (1997)

Nomenclatural type: *Acacia caffra* – *Eragrostis chloromelas* Association

This woodland community can be found in the Witbank Nature Reserve, directly east of the town of Witbank in Mpumalanga. It occurs on sheltered sites within the reserve, associated with shallow, rocky soils that are predominantly of the Glenrosa and Mispah form (Smit *et al.* 1997).

The community is characterised by *Commelina eckloniana*, *Heteromorpha arborescens*, *Berchemia zeyheri*, *Helinus integrifolius*, *Solanum mauritianum* (Species group 85), and *Tagetes minuta* (Species group 20), while *Themeda triandra* (Species group 109) and *Acacia karroo* (Species group 110) are the most prominent species.

Two associations are included in this alliance (not shown on Table 6.1), described by Smit *et al.* (1997):

i) *Acacia karroo* – *Eragrostis chloromelas* Association

Synonym: *Acacia karroo* – *Eragrostis chloromelas* Open Woodland Smit *et al.* 1997

Nomenclatural type: Relevé 33, Table 1 (Smit *et al.* 1997)

The community occurs on disturbed footslopes characterised by sandy soils with little or no surface rock. *Acacia karroo* is the dominant tree, while *Eragrostis chloromelas* dominates the herbaceous layer. The diagnostic species are mostly weeds indicative of disturbance; they are *Achyranthes aspera*, *Aristida congesta* ssp. *barbicollis*, *Hibiscus microcarpus*, *Pentarrhinum insipidum*, *Zinnia peruviana*, and the exotic climber *Araujia sericifera*.

ii) *Acacia caffra* – *Eragrostis chloromelas* Association

Synonym: *Acacia caffra* – *Eragrostis chloromelas* Open Woodland Smit *et al.* 1997

Nomenclatural type: Relevé 11, Table 1 (Smit *et al.* 1997)

The community is dominated by *Acacia caffra* and *A. karroo*. Diagnostic species include *Gerbera jamesonii*, *Scadoxus puniceus* and *Bonatea speciosa*, species typical of undisturbed shady habitats under trees. *Psydrax livida*, *Anomatheca laxa*, *Eustachys paspaloides*, and *Setaria spahacelata*.

6.3.3 *Acacia karroo* – *Lippia javanica* Alliance

Synonym: *Acacia karroo* – *Lippia javanica* Woodland Coetzee, Bredenkamp & Van Rooyen (1995)

Nomenclatural type:

This is vegetation of the Pretoria-Witbank-Heidelberg area, an area described by Acocks (1988) as comprising Mixed Bushveld and/or Sour Bushveld (Coetzee *et al.* 1995). The community is situated on severely overgrazed areas on the undulating and flat plains of the Ba land type.

A characteristic feature of this community is a dense woody layer of *Acacia caffra* (Species group 89) and *A. karroo* (Species group 110), which often form dense bush clumps. In these bush clumps species such as *Celtis africana* (Species group 89), *Euclea crispa* (Species group 106), and *Ziziphus mucronata* (Species group 109) occur abundantly. Conspicuous grass species

are *Elionurus muticus* (Species group 89), *Setaria sphacelata* (Species group 99), *Eragrostis curvula*, and *Themeda triandra* (Species group 109). *Canthium gilfillanii*, *Senecio lydenburgensis*, *Rhus zeyheri*, and *Dombeya rotundifolia* (Species group 87) are the diagnostic species, while *Acacia karroo*, *Lippia javanica* and *Vernonia oligocephala* were identified by Coetzee *et al.* (1995) as diagnostic species in the original description.

The alliance comprises three associations (not shown on Table 6.1) described by Coetzee *et al.* (1995).

i) *Acacia karroo* – *Gymnosporia polyacantha* Association

Synonym: *Acacia karroo* – *Maytenus polyacantha* Sub-community Coetzee *et al.* 1995

Nomenclatural type: Relevé 218, Table 1 (Coetzee *et al.* 1995)

The community is found on localised small hills west of Heidelberg and is associated with relatively shallow, rocky soils representing the Glenrosa and Mispah soil forms. A characteristic feature of this sub-community is a severely degraded grass layer that has only *Hyparrhenia hirta*, *Themeda triandra*, *Elionurus muticus* and *Eragrostis curvula* as grasses of notable occurrence. The diagnostic species are *Gymnosporia polyacantha*, *Felicia filifolia*, *Rhus rigida* and *Carissa bispinosa*.

ii) *Acacia karroo* – *Adenia digitata* Association

Synonym: *Acacia karroo* – *Adenia digitata* Sub-community Coetzee *et al.* 1995

Nomenclatural type: Relevé 26, Table 1 (Coetzee *et al.* 1995)

The sub-community occurs on east-facing slopes at a localised area south-east of Pretoria. It is associated with shallow soils of the Glenrosa form. These soils are fairly rocky, consisting of rock sheets and rocky outcrops. Diagnostic species are *Eragrostis gummiflua*, *E. superba*, *Melinis nerviglumis*, *Heteropogon contortus*, *Geigeria burkei*, *Striga elegans*, *Adenia digitata*, and *Vernonia galpinii*.

iii) *Acacia karroo* – *Teucrium trifidum* Association

Synonym: *Acacia karroo* – *Teucrium trifidum* **Sub-community** Coetzee *et al.* 1995

Nomenclatural type: Relevé 153, Table 1 (Coetzee *et al.* 1995)

The sub-community is situated on flat plains characterised by deep Hutton and Clovelly soils. Diagnostic species are *Teucrium trifidum*, *Aloe zebrina* and *Conyza podocephala*.

7. *Acacietalia karroo* Order Eckhardt, Van Rooyen & Bredenkamp 1997

Nomenclatural type: *Acacia nilotica* – *Gymnosporia buxifolia* Sub-order

This order was identified and described by Eckhardt *et al.* (1997) as a woodland/thicket community of central-northern KwaZulu-Natal. The present classification indicates that the order can be expanded to include communities of north-western KwaZulu-Natal (Robbeson 1998) and southern KwaZulu-Natal (Perkins 1997). The community is mostly restricted to the crests, slopes and footslopes of hills, but in southern KwaZulu-Natal it is also encountered in the incised river valleys.

The diagnostic species are *Rhus dentata*, *Cymbopogon nardus*, and *Conyza obscura* (Species group 105). The most widespread and prominent species are the woody *Rhus dentata* (Species group 105), *Ziziphus mucronata*, *Gymnosporia buxifolia* (Species group 109), and *Acacia karroo* (Species group 110), as well as the grasses *Heteropogon contortus* (Species group 108), *Eragrostis curvula*, and *Themeda triandra* (Species group 109).

Three sub-orders are recognised.

7.1 *Berkheya onopordifolia* - *Diospyros lycioides* Sub-order

Synonym: *Acacietalia karroo* Order (Eckhardt, Van Rooyen & Bredenkamp 1997)

Nomenclatural type: *Eragrostis curvulae* – *Acacia caffrae* (Eckhardt *et al.* 1997)

The community was originally described by Eckhardt *et al.* (1997) as the *Acacietalia karroo* order, but the present classification indicates that it should be considered a sub-order. It is found in central-northern KwaZulu-Natal, in the Utrecht-Helpmekaar-Babanango-Louwsburg area. The community represents woodlands and thickets with a patchy distribution, mostly restricted to slopes and midslopes. These woodlands and thickets mainly occur in the Northern and Southern Tall Grassveld and the Natal Sour Sandveld as described by Acocks (1988). The soils are clayey and moderately deep, with the most encountered being the Glenrosa form.

The diagnostic species are *Berkheya onopordifolia*, *Athrixia phyllicoides*, *Chaetacanthus burchellii*, and *Cyphostemma sulcatum*. (Species group 93). In the original description by Eckhardt *et al.* (1997), *Acacia karroo*, *Bidens pilosa*, *Setaria sphacelata* and *Aristida bipartita* are the diagnostic species. The grass stratum is well represented by prominent species such as *Cymbopogon excavatus* (Species group 97), *Hyparrhenia hirta* (Species group 107), *Heteropogon contortus* (Species group 108), *Eragrostis curvula*, and *Themeda triandra* (Species group 109), while *Rhus dentata* (Species group 105) and *Diospyros lycioides* (Species group 109) dominate the tree stratum. Eckhardt *et al.* (1997) note that overgrazed grasslands adjoining these woodlands and thickets are often found to be invaded by shrubs and trees of *Acacia karroo*.

Three alliances are recognised.

7.1.1 *Eragrostio curvulae* – *Acacion caffrae* Eckhardt *et al.* 1997

Nomenclatural type: *Rhoo pentheri* – *Acacietum caffrae* (Eckhardt *et al.* 1997)

The vegetation is found in the area around Dundee, Utrecht and directly north of Vryheid. Around Dundee it covers smaller koppies, whereas in the Utrecht area, it is restricted to the slopes of the Belelasberg, representing Acocks' (1988) Valley Bushveld (Eckhardt *et al.* 1997).

The diagnostic species are *Scutia myrtina**, *Asparagus virgatus*, *Aloe maculata*, *Poa annua*, *Clausena anisata*, *Dombeya burgessiae*, *Isoglossa eckloniana*, *Leonotis ocymifolia* (Species group 90), and *Acacia caffra** (Species group 89). Prominent, and often dominant, species

include the woody species *Rhus dentata* (Species group 105), *Euclea crispa* (Species group 106), *Ziziphus mucronata*, *Diospyros lycioides* (Species group 109), and *Acacia karroo* (Species group 110), as well as the grasses *Cymbopogon excavatus* (Species group 97) and *Eragrostis curvula* (Species group 109).

Eckhardt *et al.* (1997) described the associations (not shown on Table 6.1) that represent this alliance as follows:

i) *Panicum maximum* – *Clerodendretum glabrum* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 179, Table 1 (Eckhardt *et al.* 1997)

This is a short closed woodland with a well-developed grass layer. It occurs exclusively on sandstone of the Vryheid Formation, and dolerite. The predominant soil type is the Glenrosa form, although a combination of the latter and the Mispah form are occasionally encountered.

The original diagnostic species are *Panicum maximum*, *Vepris lanceolata*, *Ficus abutilifolia*, *Hypoestes forskalii*, and *Isoglossa eckloniana*. Other important species include *Clausena anisatha*, *Acacia caffra*, *Rhus pentheri*, *Scutia myrtina*, *Clerodendrum glabrum*, *Rhus pyroides*, *Acacia karroo*, *Diospyros lycioides*, and *Eragrostis curvula*.

ii) *Aloo maculatae* – *Rhoetum pentheri* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 54, Table 1 (Eckhardt *et al.* 1997)

This is a low to short closed woodland occurring on moderate slopes as well as on crests of smaller koppies. Eckhardt *et al.* (1997) identified no diagnostic species, but conspicuous and often dominant species include the woody species *Rhus pentheri*, *Ziziphus mucronata*, *Euclea crispa*, *Acacia karroo*, and *Rhus dentata*, and the grass *Eragrostis curvula*. The association has high species richness, this being ascribed to the heterogeneous nature of the koppies.

iii) *Stipo dregeanae* - *Rhoetum pyroidis* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 262, Table 1 (Eckhardt *et al.* 1997)

This is a low to short closed woodland occurring on moderate, southern slopes. No diagnostic species were identified by Eckhardt *et al.* (1997), but the most dominant and conspicuous species are the woody *Acacia caffra*, *Rhus pentheri*, *Rhus pyroides*, *Ziziphus mucronata*, *Gymnosporia buxifolia*, *Acacia karroo*, and *Diospyros lycioides*, the forb *Achyranthes aspera*, and the grasses *Stipa dregeana*, *Poa annua*, *Sporobolus africanus*, and *Eragrostis curvula*.

iv) *Rhus pentheri* – *Acacietum caffrae* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 185, Table 1 (Eckhardt *et al.* 1997)

This is a low to short closed woodland occurring in a variety of habitats, ranging from dongas to relatively steep, mainly south-facing slopes. The community had no diagnostic species identified by Eckhardt *et al.* (1997), but prominent species are the woody species *Acacia caffra*, *Rhus pentheri*, *Ziziphus mucronata*, *Euclea crispa*, *Acacia karroo*, *Diospyros lycioides*, and *Rhus dentata*, and the grasses *Eragrostis curvula*, *Hyparrhenia hirta*, *Cymbopogon excavatus*, and *Themeda triandra*.

7.1.2 *Trachypogo spicati* – *Diospyrion lycioidis* Eckhardt *et al.* 1997

Nomenclatural type: *Cymbopogon validi* – *Acacietum karroo*

The alliance generally occurs as a low thicket, though in some places it occurs as a low to short closed woodland (Eckhardt *et al.* 1997). It is characterised by *Helichrysum nudifolium**, *Schistostephium crataegifolium*, *Senecio isatideus*, and *Pteridium aquillinum* (Species group 91). The most prominent species include *Cymbopogon nardus* (Species group 105), *Hyparrhenia hirta* (Species group 107), *Eragrostis curvula*, and *Diospyros lycioides* (Species group 109).

Eckhardt *et al.* (1997) described three associations under this alliance, one of which is the *Trichoneuro grandiglumis* – *Canthietum mundianum*. They regard, and validly published this association as the nomenclatural type of the *Trachypogo spicati* – *Diospyrion lycioidis* even though no *Acacia karroo* was actually recorded in the sample plots from this association.

However this nomenclatural type is not appropriate for the present classification and hence *Cymbopogono validi* – *Acacietum karroo* is suggested as a new replacement.

The alliance comprises the following two associations (not shown on Table 6.1) described by Eckhardt *et al.* (1997):

i) *Conyso bonariensis* – *Cymbopogonetum validi* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 421, Table 1 (Eckhardt *et al.* 1997)

This is a low thicket occurring on moderate to relatively steep slopes of all four aspects. It is characterised by *Conyza obscura*, while the most dominant species are *Diospyros lycioides*, *Cymbopogon nardus*, and *Hyparrhenia hirta*. *Acacia karroo* is hardly present as it is very sparsely distributed (Eckhardt *et al.* 1997).

ii) *Cymbopogono validi* – *Acacietum karroo* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 400, Table 1 (Eckhardt *et al.* 1997)

This is a low thicket, in some areas becoming a low closed woodland, that is generally restricted to steep slopes. It has no diagnostic species but prominent and often dominant species include *Acacia karroo*, *Diospyros lycioides*, *Cymbopogon nardus*, *Eragrostis curvula*, *Hyparrhenia hirta*, and *Cymbopogon excavatus*.

7.1.3 *Berkheya onopordifolia* – *Acacia karroo* Alliance

Nomenclatural type: *Sporobolo pyramidalis* – *Acacietum sieberianae*

The community is associated with gentle slopes, though it is sometimes encountered on the crests. The soils are generally deep and clayey. There are no diagnostic species, but the most

prominent species include *Hyparrhenia hirta* (Species group 107), *Eragrostis curvula*, and *Acacia karroo* (Species group 110).

The alliance comprises the following four associations, as described by Eckhardt *et al.* (1997):

i) *Brachiario eruciformis* – *Acacietum karroo* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 48, Table 1 (Eckhardt *et al.* 1997)

The low thicket occurs on crests and moderately steep slopes. Soils are clayey and relatively deep. The original diagnostic species identified by Eckhardt *et al.* (1997) are *Brachiaria eruciformis*, *Zinnia peruviana*, *Stachys natalensis*, and *Urochloa panicoides*, all four species suggesting a relatively high degree of disturbance. The disturbance is further indicated by the prominence and often dominance of *Eragrostis curvula* and *Bidens pilosa* in the herbaceous layer. *Themeda triandra* is also very prominent in this layer, while the woody stratum is dominated totally by *Acacia karroo*.

Eckhardt *et al.* (1997) recognised the following sub-associations:

- *Brachiario eruciformis* – *Acacietum karroo themedetosum triandrae* sub-association occurs on the slopes and crests of smaller koppies and is associated with clayey soils that are predominantly of the Mayo form.
- *Brachiario eruciformis* – *Acacietum karroo bothriochloetosum insculptae* sub-association is a low thicket of the slopes that is usually restricted to deep, clayey soils. Eckhardt *et al.* (1997) regard this community as an extension of the previous sub-association.

ii) *Sporobolo pyramidalis* – *Acacietum sieberianae* Eckhardt *et al.* 1997

Nomenclatural type: Relevé 507, Table 1 (Eckhardt *et al.* 1997)

The low thicket sometimes occurs on rocky ridges, but is usually found on the slopes. It is associated with moderately deep and clayey soils. The diagnostic species are the densely tufted

grass *Sporobolus pyramidalis*, the small forb *Hermannia depressa*, and *Acacia sieberiana*, which can occur as a large tree. Prominent and often dominant species include *Acacia karroo*, *Bothriochloa insculpta*, *Eragrostis curvula* and *Hyparrhennia hirta*.

iii) *Eragrostis plana* – *Acacia karroo* Association

Synonym: *Eragrostis plana* – *Acacia karroo* Thicket Eckhardt *et al.* 1997

Nomenclatural type: Relevé , Table 1 (Eckhardt *et al.* 1997)

This low thicket is restricted exclusively to flat to gently sloping midslopes with deep, clayey soils derived mainly from dolerite but also from sandstone of the Vryheid Formation.

The community has no diagnostic species. The only woody species is *Acacia karroo*, which together with *Eragrostis plana*, *E. curvula*, *Hyparrhenia hirta* and *Themeda triandra*, largely constitute the community. Eckhardt *et al.* (1997) note that this community has a strong affinity with grassland and consider it to be a transition from thicket to grassland.

iv) *Setaria sphacelata* – *Acacia karroo* Association

Synonym: *Setaria sphacelata* – *Acacia karroo* Thicket Eckhardt *et al.* 1997

Nomenclatural type: Relevé , Table 1 (Eckhardt *et al.* 1997)

The low thicket occurs on shallow, clayey soils of the Glenrosa form. It is mostly associated with moderate east-facing slopes. No diagnostic species are recognised but the dominant species include *Acacia karroo*, *Eragrostis curvula*, and *Hyparrhenia hirta*. Smaller clusters of *Acacia sieberiana* are sometimes encountered (Eckhardt *et al.* 1997).

7.2 *Acacia nilotica* – *Gymnosporia buxifolia* Sub-order

Nomenclatural type: *Rhus pentheri* – *Acacia karroo* Alliance

The woodland/wooded grassland is found in the valleys, footslopes and slopes of hills of KwaZulu-Natal. It consists of a woody layer dominated by *Ziziphus mucronata*, *Gymnosporia*

buxifolia (Species group 109), and *Acacia karroo* (Species group 110), and a herbaceous layer consisting of the dominant grasses *Hyparrhenia hirta* (Species group 107), *Eragrostis curvula*, and *Themeda triandra* (Species group 109). The species that differentiate the sub-order are the thorn trees *Acacia nilotica* and *Acacia sieberiana* (Species group 102).

Two alliances are recognised under this sub-order.

7.2.1 *Rhus pentheri* – *Acacia karroo* Alliance

Synonym: The *Maytenus heterophylla* – *Rhus pentheri* community (Robbeson 1998)

Nomenclatural type: *Hyparrhenia hirta* – *Rhus pentheri* Association

This is woodland of the Ladysmith-Colenso-Estcourt-Winterton-Bergville area, in north-western KwaZulu-Natal (Robbeson 1998). It is found mainly in the Valley Bushveld (Acocks 1988) characterised by hot valleys and low rainfall. The community is restricted to the crests, slopes and footslopes of rocky hills and consists of a grass layer with a dominant shrubby woody component. The soils are generally shallow and sandy, and are predominantly of the Mispah form.

The diagnostic species for this community include *Vernonia capensis**, *Sida rhombifolia*, *Chamaecrista comosa*, and *Berkheya speciosa* (Species group 95). The tree canopy is dominated by woody species such as *Rhus pentheri* (Species group 97), *Gymnosporia buxifolia* (Species group 109), and *Acacia karroo* (Species group 110). The herbaceous layer is dominated by the grasses *Cymbopogon excavatus*, *Melinis repens* (Species group 97), and *Themeda triandra* (Species group 109), as well as forbs such as *Lantana rugosa* (Species group 86) and *Zinnia peruviana* (Species group 97).

The alliance is differentiated into two associations.

7.2.1.1 *Barleria obtusa* – *Acacia nilotica* Association

Nomenclatural type: *Panicum maximum* – *Bothriochloa insculpta* Sub-association

The association is found on slopes and footslopes of rocky hills in an area where the landscape is characterised by high hills incised with deep valleys and undulating plains, with interspersed rocky hills. The diagnostic species for the community are *Barleria obtusa*, *Hypoestes forskoolii*, *Panicum natalense*, and *Vangueria parvifolium*. The community is dominated by the woody species *Rhus pentheri* (Species group 97), *Acacia nilotica* (Species group 102), *Gymnosporia buxifolia* (Species group 109), and *Acacia karroo* (Species group 110). The herbaceous layer is dominated by grass species such as *Cymbopogon excavatus*, *Melinis repens* (Species group 97), and *Themeda triandra* (Species group 109).

The following four communities described by Robbeson (1998) are regarded as sub associations:

i) *Panicum maximum* – *Bothriochloa insculpta* Sub-association

Synonym: *Panicum maximum* – *Bothriochloa insculpta* variation (Robbeson 1998)

Nomenclatural type: Relevé 23, Table 7.2 (Robbeson 1998)

This is a disturbed community occurring on slopes of rocky hills in Valley Bushveld (Acocks 1988). The community is characterised by the grasses *Panicum maximum* and *Sporobolus fimbriatus*, The forbs *Cheilanthes quadripinnata*, *Phyllanthus burchellii*, *Bidens formosa*, and *Ipomoea obscura*, as well as the tree *Acacia robusta*. Prominent grasses include *Panicum maximum*, *Sporobolus fimbriatus*, *Bothriochloa insculpta*, and *Themeda triandra*, while prominent forbs are *Tagetes minuta*, *Zinnia peruviana*, and *Lippia javanica*. The tree layer is dominated by *Gymnosporia buxifolia*, *Rhus pentheri*, *Acacia karroo*, *Diospyros lycioides*, and *Euclea crispa*.

ii) *Buddleja loricata* – *Aloe marlothii* Sub-association

Synonym: *Buddleja loricata* – *Aloe marlothii* sub-variation

Nomenclatural type; Relevé 486, Table 7.2 (Robbeson 1998)

This is an open savanna community located on slopes and footslopes of hills. It has been grazed intensively and this is noted in the occurrence of unpalatable grass species such as *Sporobolus pyramidalis* and *Cymbopogon excavatus*. Various woody species present include *Tarchonanthus camphoratus*, *Acacia nilotica*, *Acacia karroo*, *Rhus pentheri*, *Ziziphus mucronata*, *Gymnosporia buxifolia*, and *Aloe marlothii*. The community is differentiated by *Buddleja loricata*, *Kalanchoe rotundifolia*, and *Juncus infausta*.

iii) *Vepris lanceolata* – *Ziziphus mucronata* Sub-association

Synonym: *Vepris lanceolata* – *Ziziphus mucronata* sub-variation (Robbeson 1998)

Nomenclatural type; Relevé 434, Table 7.2 (Robbeson 1998)

The sub-association is located in the area of Monte Cristo on warm slopes and footslopes of hills that have been moderately utilised. This vegetation consists of a closed canopy dominated *Tarchonanthus camphoratus*, *Euclea natalensis*, *Gymnosporia buxifolia*, *Acacia karroo*, *Rhus pentheri*, *Ziziphus mucronata*, *Acacia caffra*, *Clerodendrum glabrum*, *Aloe marlothii*, *Diospyros lycioides*, and *Euclea crispa*. Prominent grasses include *Eragrostis superba*, *Bothriochloa insculpta*, *Hyparrhenia hirta*, *Themeda triandra*, *Cymbopogon excavatus*, and *Setaria sphacelata*. Diagnostic species include *Vepris lanceolata*, *Vitex rehmanii*, *Setaria nigrirostris*, and *Grewia villosa*.

iv) *Euclea natalensis* – *Hyparrhenia hirta* Sub-association

Synonym: *Euclea natalensis* – *Hyparrhenia hirta* sub-variation (Robbeson 1998)

Nomenclatural type; Relevé 337, Table 7.2 (Robbeson 1998)

The sub-association occurs on rocky slopes of hills where soils are shallow. The woody species *Gymnosporia buxifolia*, *Acacia karroo*, *Euclea natalensis*, *Rhus rigida*, *Aloe marlothii*, and *Diospyros lycioides* are prominent. The grass layer is dominated by *Sporobolus pyramidalis*, *Eragrostis superba*, *Hyparrhenia hirta*, *Themeda triandra*, *Cymbopogon excavatus*, and *Melinis repens*. There are no diagnostic species.

7.2.1.2 *Hyparrhenia hirta* – *Rhus pentheri* Association

Nomenclatural type: *Aristida congesta* ssp *barbicollis* – *Eragrostis superba* Sub-association

The association occurs on slopes and footslopes of rocky hills dominated by soils of the Mispah form. Grass species that occur abundantly include *Cymbopogon excavatus*, *Melinis repens* (Species group 97), *Hyparrhenia hirta* (Species group 107), and *Themeda triandra* (Species group 109). Prominent forbs include *Solanum elaeagnifolium* (Species group 96), *Aloe marlothii*, *Bidens pilosa*, and *Zinnia peruviana* (Species group 97), while *Acacia sieberiana* (Species group 102), *Rhus dentata* (Species group 105), and *Acacia karroo* (Species group 110) dominate the tree layer. The association has no diagnostic species.

The following three sub-associations are recognised:

i) *Aristida congesta* ssp *barbicollis* – *Eragrostis superba* Sub-association

Synonym: *Aristida congesta* ssp *barbicollis* – *Eragrostis superba* sub-variation (Robbeson 1998)

Nomenclatural type: Relevé 420, Table 7.2 (Robbeson 1998)

The community is found on the footslopes of hills that have been severely utilised. According to Robbeson (1998), evidence of intensive grazing is noted in the high cover of unpalatable grass species such as *Sporobolus pyramidalis*, *Bothriochloa insculpta*, *Aristida congesta* subsp. *barbicollis*, *Cymbopogon excavatus*, and *Melinis repens*. Other prominent grasses include *Eragrostis superba*, *Hyparrhenia hirta*, and *Themeda triandra*. The diagnostic species are *Blepharis longispica*, *Trichoneura grandiglumis*, and *Acacia tortilis*.

ii) *Acacia karroo* – *Heteropogon contortus* Sub-association

Synonym: *Acacia karroo* – *Heteropogon contortus* sub-variation (Robbeson 1998)

Nomenclatural type: Relevé 423, Table 7.2 (Robbeson 1998)

The community is found on rocky footslopes of hills. The vegetation is severely grazed, resulting in the presence of undesirable species such as *Bothriochloa insculpta*, *Sida rhombifolia*, *Hermannia depressa*, *Cymbopogon excavatus*, *Melinis repens*, *Zinnia peruviana*, *Aloe marlothii*, and *Lippia javanica* (Robbeson 1998). Prominent species include *Rhus pentheri*, *Acacia karroo*, *Gymnosporia buxifolia*, *Acacia nilotica*, and *Acacia sieberiana*. There are no diagnostic species.

iii) *Rhus dentata* – *Paspalum dilatatum* Sub-association

Synonym: *Rhus dentata* – *Paspalum dilatatum* sub-community (Robbeson 1998)

Nomenclatural type: *Cephalanthus natalensis* – *Diospyros lycioides* variation (Robbeson 1998)

The sub-association occurs on slopes and footslopes of rocky hills, where the predominant soil form is Mispah. The diagnostic species are *Paspalum dilatatum*, *Rhynchosia reptabunda*, *Hyparrhenia dregeana*, *Brachiaria serrata*, *Trachypogon spicatus*, *Conyza bonariensis*, *Cucumis zeyheri*, *Diheteropogon amplexans*, *Conyza podocephala* and *Indigofera hedyantha*. Grass species that occur abundantly include *Hyparrhenia hirta*, *Eragrostis plana* and *Sporobolus africanus*, while prominent forbs include *Bidens pilosa*, *Zinnia peruviana* and *Lantana rugosa*. The tree layer is dominated by *Acacia karroo*, *Acacia sieberiana* and *Rhus dentata*.

Robbeson (1998) recognised the following two variations:

- The *Acacia sieberiana* – *Bidens pilosa* variation is found on midslopes and footslopes of rocky hills in the Southern Tall Grassveld (Acocks 1988).
- The *Cephalanthus natalensis* – *Diospyros lycioides* variation occurs on crests and slopes of rocky hills that have been moderately to severely grazed.

7.2.2 *Acacia sieberiana* – *Acacia karroo* Alliance

Synonym: *Hyparrhenia hirta* – *Acacia sieberiana* wooded grassland community of the Winterton-Estcourt-Muden Plain (Perkins 1997)

Nomenclatural type: *Acacia sieberiana* – *Eriosema salignum* Association

This wooded grassland occurs on the plains of the dry upland savanna in the Estcourt- Greytown area in southern KwaZulu-Natal (Perkins 1997). It is associated with sandy soils dominated by Arcadia and Estcourt soil forms.

The forb *Hypoxis rigidula** (Species group 101) is the diagnostic species. *Acacia sieberiana* (Species group 102) is the dominant woody species, with *Acacia karroo* (Species group 110) also occurring abundantly. The herbaceous layer is open and dominated by tufted grasses such as *Eragrostis curvula* (Species group 109).

The alliance comprises the following two associations (not shown on Table 6.1):

i) *Acacia sieberiana* – *Eriosema salignum* Association

Synonym: *Acacia sieberiana* – *Eriosema salignum* wooded crest sub-community (Perkins 1997)

Nomenclatural type: Relevé 73, Table 5 (Perkins 1997)

The community is found on crests and gentle, non-rocky slopes. The tree canopy is open and dominated by the thorn trees *Acacia sieberiana* and *Acacia karroo*. The herbaceous layer includes grass species such as *Themeda triandra*, *Hyparrhenia hirta*, *Eragrostis curvula* and *Heteropogon contortus*. Forbs in this community include *Hypoxis rigidula*, *Rhynchosia totta* var. *totta*, *Berkheya multijuga*, *Eriosema salignum*, and *Trachyandra asperata*. The latter two are the diagnostic species.

ii) *Acacia sieberiana* – *Gymnosporia buxifolia* Association

Synonym: *Acacia sieberiana* – *Maytenus heterophylla* wooded slope sub-community (Perkins 1997)

Nomenclatural type: Relevé 79, Table 5 (Perkins 1997)

The community is found on rocky, gentle slopes. *Acacia sieberiana* dominates the woody layer, with *Gymnosporia buxifolia*, *Diospyros austro-africana*, and *Cussonia paniculata* also being common. The herbaceous layer is dominated by *Themeda triandra* and *Hyparrhenia hirta*, and forbs present include *Hypoxis rigidula*, *Acalypha punctata*, and *Haemanthus humilis*. The diagnostic species include *Diospyros austro-africana*, *Buddleja salviifolia*, *Acacia nilotica*, and *Haemanthus humilis*.

7.3 *Tristachya leucothrix* – *Acacia karroo* Sub-order

Nomenclatural type: *Hyparrhenia hirta* – *Acacia caffra* Alliance

The wooded grassland is found in the incised river valleys of southern KwaZulu-Natal, especially the Mkomazi and Mzimkulu River valleys. These valleys, classified by Acocks (1988) as Southern Tall Grassveld, are deeply incised and have a subhumid to mild subarid climate.

The diagnostic species are *Tristachya leucothrix*, *Richardia brasiliensis*, *Aloe arborescens*, and *Helichrysum aureonitens* (Species group 104), which together with *Hyparrhenia hirta* (Species group 107), *Eragrostis curvula* and *Themeda triandra* (Species group 109) dominate the herbaceous layer. *Acacia karroo* (Species group 110) occurs constantly throughout the tree layer.

The sub-order comprises the following alliances, as described by Perkins (1997):

7.3.1 *Hyparrhenia hirta* – *Acacia caffra* Alliance

Synonym: *Hyparrhenia hirta* – *Acacia caffra* south-facing wooded grassland community of the incised river valleys (Perkins 1997)

Nomenclatural type: *Acacia caffra* – *Ozoroa paniculosa* Association

This community is restricted to south-facing slopes, largely in the valleys of the Mkomazi and Mzimkulu rivers. The south-facing slopes are protected from hot winds and insolation, and consequently more soil moisture is available. The soils are shallow, the most common form being Avalon.

The community has no diagnostic species but Perkins (1997) originally identified *Acacia caffra*, *Grewia occidentalis*, *Euclea crispa* and *Paspalum dilatatum* as the diagnostic species. The most dominant woody species are *Acacia caffra* (Species group 89) and *Acacia karroo* (Species group 110), while the herbaceous layer is dominated by the grasses *Hyparrhenia hirta* (Species group 107) and *Themeda triandra* (Species group 109).

The alliance comprises the following associations (not shown on Table 6.1):

i) *Acacia caffra* – *Tristachya leucothrix* Association

Synonym: *Acacia caffra* – *Tristachya leucothrix* south-facing non-rocky sub-community (Perkins 1997)

Nomenclatural type: Relevé 3, Table 5 (Perkins 1997)

The community is located on south-facing slopes within incised river valleys, but is restricted to slopes with few or no rocks. No diagnostic species were identified. The dominant woody species are the trees *Acacia caffra* and *Acacia karroo*. Other shrubs and trees present include *Grewia occidentalis*, *Euclea crispa*, *Ziziphus mucronata*, and *Rhus dentata*. The creeper *Rhoicissus tridentata* is also common. Dominant grasses are *Tristachya leucothrix*, *Hyparrhenia hirta*, *Eragrostis curvula*, and *Themeda triandra*. The forb layer is less prominent than the grasses, but *Hypoxis rigidula*, *Sebaea leiostyla*, *Vernonia natalensis*, *Acalypha depressinerva*, and *Hermannia depressa* are present.

ii) *Acacia caffra* – *Ozoroa paniculosa* Association

Synonym: *Acacia caffra* – *Ozoroa paniculosa* south-facing rocky sub-community (Perkins 1997)

Nomenclatural type: Relevé 48, Table 5 (Perkins 1997)

The community is found on rocky, moderate south-facing slopes that are characterised by cooler and moist conditions. It is dominated by the thorn trees *Acacia caffra* and *Acacia karroo*, with other woody species *Grewia occidentalis* and *Euclea crispa* also being present. Dominant grasses are *Sporobolus africanus*, *Hyparrhenia hirta*, and *Themeda triandra*, while dominant forbs include *Helichrysum aureonitens*, *Richardia brasiliensis*, *Conyza obscura*, *Acalypha schinzii*, *Hermannia depressa*, and *Helichrysum miconiifolium*. The diagnostic species are *Ozoroa paniculosa*, *Mohria caffrorum* var. *caffrorum*, *Pentanisia angustifolia*, and *Taraxacum officinale*.

7.3.2 *Pentanisia prunelloides* – *Acacia karroo* Alliance

Synonym: *Hyparrhenia hirta* – *Acacia karroo* north-facing wooded grassland community
(Perkins 1997)

Nomenclatural type: *Hyparrhenia hirta* – *Rhus dentata* Association

This community is restricted to north-facing slopes in the incised river valleys. It has one diagnostic species, *Pentanisia prunelloides* (Species group 103). *Acacia karroo* (Species group 110) is the sole prominent woody species, while the herbaceous layer is dominated by grasses, especially *Hyparrhenia hirta* (Species group 107) and *Themeda triandra* (Species group 109), and to a lesser extent by *Tristachya leucothrix* (Species group 104), *Eragrostis racemosa* (Species group 106), *Heteropogon contortus* (Species group 108), and *Eragrostis curvula* (Species group 109). The forbs are less prominent, the most common being *Pentanisia prunelloides* (Species group 103), *Helichrysum aureonitens* (Species group 104), and *Hermannia depressa* (Species group 107).

The alliance comprises the following associations (not shown on Table 6.1):

i) *Hyparrhenia hirta* – *Rhus dentata* Association

Synonym: *Hyparrhenia hirta* – *Rhus dentata* north-facing rocky grassland sub-community
(Perkins 1997)

Nomenclatural type: Relevé 12, Table 5 (Perkins 1997)

The community is located on hot, dry and rocky north-facing slopes. The dominant trees are *Acacia karroo* and *Rhus dentata*. Other common shrubs/small trees are *Ziziphus mucronata* and *Rhoicissus tridentata*. Dominant grasses are *Themeda triandra* and *Hyparrhenia hirta*, with *Eragrostis curvula* also present.

ii) *Acacia karroo* – *Themeda triandra* Association

Synonym: *Acacia karroo* – *Themeda triandra* north-facing non-rocky grassland sub-community (Perkins 1997)

Nomenclatural type: Relevé 35, Table 5 (Perkins 1997)

The community is found on north-facing slopes with few or no rocks. The only woody species present is *Acacia karroo*, which is also common. The grass cover is less dense but dominated by *Themeda triandra* and *Hyparrhenia hirta*. Other abundant grasses include *Tristachya leucothrix*, *Eragrostis racemosa*, *Heteropogon contortus*, and *Eragrostis curvula*. Forbs present include *Vernonia natalensis*, *Acalypha depressinerva*, *Hermannia depressa*, *Pentanisia prunelloides*, and *Helichrysum aureonitens*.

CHAPTER SEVEN

ACACIA KARROO COMMUNITIES IN OTHER CLASSES

A *Acacia karroo* is a species with an extensive distribution range that includes several biomes. It is very adaptable and has wide habitat tolerance, growing under many differing conditions of soil, climate, and altitude. Although it is often associated with heavy, clayey soils on the banks of rivers and streams (Chapter 6), it also grows in bushveld, dry thornveld, grassland, and woodland. This chapter highlights its wide distribution range.

The decision to describe the communities below in this chapter and not to include them in the suggested *Acacia karroo* Class was based on two factors:

- These communities have already been validly classified (and published) by their original authors under distinct and designated classes other than the *Acacia karroo* Class.
- If not, they were found not to correspond to the *Acacia karroo* Riparian Thicket described by Du Preez and Bredenkamp (1991). The delimitation and descriptions of this riparian thicket are regarded as diagnostic for the *Acacia karroo* Class of Chapter 6.

7.1 ACACIA KARROO IN SAVANNA COMMUNITIES

The Savanna Biome in South Africa is described by Low and Rebelo (1996) as follows:

“It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubland, where it is dense as Woodland, and the intermediate stages are locally known as Bushveld.”

Savanna communities are represented in Table 7.1. The woody layer is dominated by *Rhus pyroides* (Species group AF), *Ziziphus mucronata*, *Diospyros lycioides* (Species group AH), and *Acacia karroo* (Species group AI). The grassy layer is dominated by *Urochloa mosambicensis*

(Species group S), *Panicum maximum* (Species group Y), *Heteropogon contortus* (Species group AD), and *Themeda triandra* (Species group AE).

7.1.1 CLASSIFICATION

The following is a hierarchical classification of the savanna communities:

1. *Englerophyto magalismsontani* – *Acacietea caffrae* Class Winterbach, Bredenkamp, Deutschländer & Mucina 2000
 - 1.1 *Eragrostio lehmannianae* – *Hippobrometum pauciflori* Association Siebert 2001
2. *Kirkia wilmsii* – *Terminalia prunioides* Closed Mountain Bushveld Siebert, Van Wyk & Bredenkamp 2002
 - 2.1 *Celtido africanae* – *Combretetum erythrophyllii* Association Siebert 2001
3. *Acacia karroo* - *Panicum maximum* Open Woodland Breebaart & Deutschländer 1997
 - 3.1 *Sporobolus ioclados* – *Gymnosporia buxifolia* Short Closed Woodland
 - 3.2 *Commiphora africana* - *Digitaria velutina* Low Open Woodland
4. *Panico maximi* – *Acacietea tortilis* Class Winterbach, Bredenkamp, Deutschländer & Mucina 2000
 - 4.1 *Acacia karroo* – *Acacia mellifera* Short Closed Woodland Schmidt, Theron & Van Hoven 1993
 - 4.2 *Acacietum nilotico* – *tortilis* Association Winterbach 1998
 - 4.3 *Falkio oblongi* – *Acacietum nilotica* Association Winterbach 1998
 - 4.4 *Aristida canescens* - *Acacia tortilis* Bushveld Winterbach 1998
 - 4.4.1 *Acacia erubescens* – *Acacia luederitzii* – *Plectranthus madagascariensis* Thornveld Brown, Bredenkamp & Van Rooyen 1997
 - 4.4.2 *Perotis patens* – *Terminalia sericea* Woodland Brown & Bredenkamp 1994
 - 4.4.3 *Ziziphus mucronata* – *Acacia karroo* Woodland Brown, Bredenkamp & Van Rooyen 1997
 - 4.5 *Acacion hebecladae* – *rehmannianae* Alliance Winterbach 1998
5. *Eustachys mutica* – *Acacia caffra* Woodlands Coetzee 1975

6. *Ziziphus mucronata* Closed Woodland Bezuidenhout 1996

7.1.2 DESCRIPTION OF THE PLANT COMMUNITIES

1. *Englerophyto magalismontani* – *Acacietea caffrae* Class Winterbach, Bredenkamp, Deuschländer & Mucina 2000

This mountain bushveld is found on the slopes of the Waterberg and the Magaliesberg, Witwatersrand, and Suikerbosrand. It occurs mainly on sandy soils (Winterbach *et al.* 2000).

In the present classification this class is represented by a mountain bushveld community described by Siebert (2001). The community occurs within the Sekhukhuneland Centre of Plant Endemism (SPCE), which stretches from the Northern Province into the Mpumalanga Province, and includes towns such as Roossenekal, Steelpoort, and Sekhukhune. The community is predominantly restricted to the warm slopes and valleys of undulating hills and mountains.

Although Siebert, Van Wyk and Bredenkamp (2002) consider the mountain bushveld communities of Sekhukhuneland as part of the proposed class of *Englerophyto magalismontani* – *Acacietea caffrae* (Winterbach *et al.* 2000), they point out that the class does not consider the entire range of mountain bushveld types on clay and sandy soils of South Africa. They hence propose a more inclusive *Acacia caffra* Mountain Bushveld Class, with an *Englerophytum magalismontanum* – *Acacia caffra* order on nutrient-poor sandy soils and a *Kirkia wilsii* – *Acacia caffra* order on nutrient-rich clay soils. The latter would then be representative of Sekhukhuneland (Siebert *et al.* 2002).

1.1 *Eragrostio lehmanniana* – *Hippobrometum pauciflori* Association Siebert 2001

The community is part of the *Combretum hereroense* – *Grewia vernicosa* Open Mountain Bushveld originally described by Siebert (2001), and occurs predominantly as scattered thickets

in large river valleys, dongas or eroded areas. The soils are generally sandy and of the Hutton form.

The diagnostic species are *Vitex obovata*, *Psiadia punctulata*, *Mimusops zeyheri**, and *Rhoicissus tridentata* (Species group A). The dominant species include the forb *Psiadia punctulata* (Species group A) and the tree *Hippobromus pauciflorus* (Species group C).

The association is differentiated into the following three sub-associations (Siebert 2001):

- *Eragrostio lehmanniana* – *Hippobrometum pauciflori rhoetosum batophyllae* Sub-association is a scattered thicket found on the slopes of dongas in the large valleys to the east of the Leolo Mountains. It is found predominantly on deep soils of the Bonheim and Valsrivier forms.
- *Eragrostio lehmanniana* – *Hippobrometum pauciflori sorgetosum bcoloris* Sub-association is a scattered thicket of gently sloping valleys. It is associated with rocky, eroded sandy and clay soils that are predominantly Hutton and Bonheim.
- *Eragrostio lehmanniana* – *Hippobrometum pauciflori elionuretosum mutici* Sub-association represents dense, tall thicket of footslopes and valleys. It is associated with rocky Hutton soils.

2. *Kirkia wilmsii* – *Terminalia prunioides* Closed Mountain Bushveld Siebert, Van Wyk & Bredenkamp 2002

This is mountain bushveld of the Sekhukhuneland. It is predominantly restricted to the warm slopes and valleys of undulating hills and mountains. Surface rocks are predominant and abundant in various habitats (Siebert 2001), while soils are generally clayey (Siebert *et al.* 2002). The community is also classified under Central Bushveld Riverine Forests, a subunit of the Northern Highveld Forests. This is according to the Classification System for South African

Indigenous Forests, a classification undertaken for the Department of Water Affairs and Forestry (Environmentek CSIR 2003).

2.1 *Celtido africana* – *Combretetum erythrophyllii* Association Siebert 2001

This is a closed riparian thicket to forest found in valleys along large rivers such as the Steelpoort and Olifants. It is associated with red loam Oakleaf soils.

The community is distinguished by 23 species, nine of which are the original diagnostic species identified by Siebert (2001). These include woody species *Celtis africana**, *Ficus sur**, *Melia azedarach**, and *Spirostachys africana**, as well as the prominent grasses *Panicum deustum* and *Sporobolus fimbriatus* (Species group B). Dominant woody species include *Flueggea virosa* (Species group B), *Hippobromus pauciflorus* (Species group C), *Ziziphus mucronata*, *Diospyros lycioides* (Species group AH), and *Acacia karroo* (Species group AI), while prominent forbs are *Hypoestes aristata*, *Cardiospermum corindum* (Species group B), and *Achyranthes aspera* (Species group AF).

Two sub-associations are recognised (Siebert 2001):

- The *Celtido africana* – *Combretetum erythrophyllii acacietosum caffrae* Sub-association is a closed scattered woodland found along the Steelpoort River in the broad valleys between mountains.
- The *Celtido africana* – *Combretetum erythrophyllii acacietosum galpinii* Sub-association is a tall closed woodland found on the riverbanks.

* Diagnostic species from original descriptions \ authors

3. *Acacia karroo* - *Panicum maximum* Open Woodland Breebaart & Deutschländer 1997

This is vegetation of Goedverwacht, a farm situated south of Pietersburg in the Limpopo Province. The entire vegetation of the farm can be broadly classified as an *Acacia karroo* - *Panicum maximum* Open Woodland, characterised by predominantly shallow, sandy soils (Breebaart & Deutschländer 1997).

The community is characterised by the presence of *Digitaria velutina*, *Acacia burkei*, *Enneapogon scoparius*, *Asparagus* species, and *Indigofera cryptantha* (Species group F). Grasses with a high constancy are *Digitaria velutina* (Species group F) and *Panicum maximum* (Species group Y). There is also a high number of forbs, which Breebaart and Deutschländer (1997) ascribe to probable disturbance caused by grazing and trampling. Some of the most conspicuous tree species are *Dichrostachys cinerea* (Species group N), *Rhus pyroides* (Species group AF), and *Acacia karroo* (Species group AI), while *Grewia flava* (Species group S) is one of the most encountered shrubs.

The present classification distinguishes two major communities in this woodland, though Breebaart and Deutschländer (1997) made no such distinction.

3.1 *Sporobolus ioclados* – *Gymnosporia buxifolia* Short Closed Woodland

This community occurs along the banks of the Ngwaritzi and Olifants Rivers, and also within the floodplain of the latter. It is associated with deep clayey, poorly drained soils of the Oakleaf, Dundee, and Valsrivier forms.

The community is distinguished by *Sporobolus ioclados*, *Solanum* species, *Bidens pilosa*, and *Dactyloctenium aegyptium* (Species group D). Besides *Acacia karroo* (Species group AI), the other dominant woody species are *Gymnosporia buxifolia* (Species group T), *Rhus pyroides* (Species group AF), and *Diospyros lycioides* (Species group AH), with *Grewia flava* (Species group S) and *Ziziphus mucronata* (Species group AH) also of notable occurrence. The most

dominant grass species is *Panicum maximum* (Species group Y) while the dominant forb is *Achyranthes aspera* (Species group AF).

The woodland comprises the following communities described by Breebaart and Deutschländer (1997):

- *Euclea undulata* – *Setaria verticillata* Short Closed Woodland occurs along the banks of the Ngwaritzi River and is restricted to deep clayey, poorly drained soils of the Oakleaf form.
- *Dactyloctenium aegyptium* – *Urochloa mosambicensis* Low Closed Grassland occurs within the floodplain of the Olifants River and is confined to deep, clayey alluvial soils of the Dundee form.
- *Bothriochloa insculpta* – *Gymnosporia buxifolia* Short Closed Woodland is found along the banks and within the floodplain of the Olifants River, where it is encountered on deep clayey and poorly drained soils of the Valsrivier form.
- *Combretum erythrophylum* – *Rhus pyroides* Short Closed Woodland is encountered on the banks of the Ngwaritzi and Olifants Rivers, and is associated with deep clayey, poorly drained soils of the Valsrivier form.

3.2 *Commiphora africana* - *Digitaria velutina* Low Open Woodland

This community occurs predominantly on the plains, but can also be encountered along the upper banks of the Ngwaritzi River and along the ridges. It is associated with shallow, well-drained sandy soils of the Hutton and Glenrosa forms.

The diagnostic species for the community include *Commiphora africana*, *Hermannia modesta*, *Aristida canescens*, *Opuntia ficus-indica*, and *Melhania* species (Species group E). The

community is further differentiated from the *Sporobolus ioclados* – *Gymnosporia buxifolia* Short Closed Woodland by the presence of species from groups N and AD, and by the absence of those from groups T, AE, and AF.

Grasses are most prominent in the community and include *Aristida canescens* (Species group E), *Enneapogon scoparius* (Species group F), *Aristida adscensionis*, *Eragrostis rigidior*, *Schmidtia pappophoroides* (Species group N), and *Panicum maximum* (Species group Y). *Acacia senegal* (Species group E), *Dichrostachys cinerea* (Species group N), and *Acacia karroo* (Species group AI) are the prominent woody species.

The woodland represents the following communities (Breebaart & Deutschländer 1997):

- *Acacia tortilis* – *Schmidtia pappophoroides* Low Open Woodland is found on the plains and occurs on well-drained, sandy soils of the Hutton and Glenrosa forms.
- *Ximения caffra* – *Heteropogon contortus* Low Open Woodland occurs along the upper banks of the Ngwaritzi River and along the ridges, where it is restricted to well-drained and very shallow sandy soils of the Glenrosa form. The habitat is rocky.
- *Aristida diffusa* – *Enneapogon scoparius* Low Open Woodland is found in seepage lines of the plains, characterised by shallow, well-drained sandy soils of the Hutton and Glenrosa forms.

4. *Panicum maximi* – *Acacietea tortilis* Class Winterbach, Bredenkamp, Deutschländer & Mucina 2000

This vegetation is described by Winterbach *et al.* (2000) as a microphyllous Thorny Bushveld that occurs in the Transvaal Plateau Basin, comprising the flat Bushveld Basin and the Waterberg, Soutpansberg and Pietersburg Plateaus. It is characteristic of the dark, clayey soils often developed over basalt in the low lying areas (Winterbach *et al.* 2000).

The class is presently distinguished by *Acacia tortilis* and *Schkuhria pinnata* (Species group X), while the original diagnostic species identified by Winterbach *et al.* (2000) include *Acacia karroo*, *Acacia nilotica*, *Rhus lancea*, *Eragrostis rigidor*, and *Cymbopogon pospischillii*.

The *Panico maximi* – *Acacietea tortilis* is represented by four communities in the present classification.

4.1 *Acacia karroo* – *Acacia mellifera* Short Closed Woodland Schmidt, Theron & Van Hoven 1993

The community is found on Rhino Ranch, a game ranch east of the town of Ellisras in the Limpopo Province (Schmidt, Theron & van Hoven 1993). Rhino Ranch is situated in the transition zone between Arid Sweet Bushveld and Mixed Bushveld (Acocks 1988). The *Acacia karroo* – *Acacia mellifera* Short Closed Woodland is restricted to clayey soils of the Arcadia form.

The diagnostic species include *Acacia mellifera**, *Leucas glabrata**, *Cenchrus ciliaris**, and *Brachiaria deflexa** (Species group G).

The following two variants are recognised by Schmidt *et al.* (1993):

- *Acacia karroo* – *Boscia foetida* Variant is restricted to black clay soils.
- *Acacia karroo* – *Chloris virgata* Variant is found on red clay soils.

4.2 *Acacietum nilotico* – *tortilis* Association Winterbach 1998

Synonym: *Acacia nilotica* – *Acacia tortilis* Variation (Coetzee, Van der Meulen, Zwanziger, Gonsalves & Weisser 1976)

This is vegetation of the Nylsvley Nature Reserve, south of Naboomspruit in the Limpopo Province (Coetzee *et al.* 1976). The Reserve occurs in Acocks' (1988) Mixed Bushveld. This vegetation is found on the flat bottomlands, typically on calcareous alluvium. Soils are predominantly of the Oakleaf, Valsrivier, and Acardia forms.

The community is distinguished by *Achyroopsis avicularis*, *Justicia protracta*, *Elaeodendron transvaalense*, and *Solanum tomentosum* var. *coccineum* (Species group H). The tree and shrub layer is dominated by *Euclea undulata*, *Acacia nilotica* (Species group M), *Justicia flava* (Species group R), *Acacia tortilis* (Species group X), *Asparagus suaveolens* (Species group AC), *Ziziphus mucronata* (Species group AH), and *Acacia karroo* (Species group AI). *Panicum maximum* (Species group Y) is the most prominent grass.

4.3. *Falkio oblongi* – *Acacietum nilotica* Association Winterbach 1998

Synonym: *Aristida bipartita* – *Setaria woodii* Tree Savanna and Grassland (Coetzee *et al.* 1976)

This is another community of the Nylsvley Nature Reserve, found occurring on bottomland characterised by vertic soils of the Acardia form. It was originally described by Coetzee *et al.* (1976) as *Aristida bipartita* – *Setaria woodii* Tree Savanna and Grassland and later by Winterbach (1998) as the *Falckio oblongi* – *Acacietum nilotica* Association.

Although Winterbach (1998) classified this community under the *Panico maximi* – *Acacietea tortilis* Class, it probably belongs to a separate class, found on vertic soils within the Savanna Biome. It is distinguished by the original diagnostic species recognised by Coetzee *et al.* (1976), which include *Nesaea schinzii*, *Aristida bipartita*, *Senecio inornatus*, *Salvia repens*, and *Falkia oblonga* (Species group I).

4.4 *Aristida canescens* - *Acacia tortilis* Bushveld Winterbach 1998

The communities that represent this vegetation were originally identified and described by Brown and Bredenkamp (1994), as well as Brown, Bredenkamp and Van Rooyen (1995, 1996, 1997). The vegetation occurs on the Borakalalo Nature Reserve, north of the town of Brits in the North-West Province, an area Acocks (1988) describes as Mixed and Sourish Mixed Bushveld.

The bushveld is presently distinguished by the forb *Commelina erecta* and the woody species *Rhus lancea* (Species group Q), while *Grewia subspathulata* and *Aristida canescens* are the original diagnostic species identified by Winterbach (1998).

The bushveld comprises three communities.

4.4.1 *Acacia erubescens* – *Acacia luederitzii* – *Plectranthus madagascariensis* Thornveld Brown, Bredenkamp & Van Rooyen 1997

The community is associated with dry to moderately dry habitat, characterised by predominantly sandy soils and sometimes clayey soils (Brown *et al.* 1997). The species that distinguish this community are *Tephrosia capensis* and *Portulaca quadrifida* (Species group J).

The community represents the following two communities:

- *Portulaca quadrifida* – *Acacia tortilis* Woodland is found on the western section of the Reserve. It occurs on sandy to loamy soils in the lowlands north of the Mogosane Mountains (Brown *et al.* 1995).
- *Eragrostis rigidor* – *Acacia luederitzii* Woodland is found throughout the reserve in old and seasonal riverbeds where brackish soils are found (Brown *et al.* 1996).

4.4.2 *Perotis patens* – *Terminalia sericea* Woodland Brown & Bredenkamp 1994

The community is found on sandy soils on the southern section of the Borakalo Nature Reserve (Brown & Bredenkamp 1994). It is distinguished by the presence of the species *Abutilon austro-africana*, *Stipagrostis uniplumis**, and *Dicerocaryum eriocarpum* (Species group K).

The following four sub-communities and two variants represent this community (Brown & Bredenkamp 1994):

- *Acacia luederitzii* – *Combretum hereroense* – *Terminalia sericea* Woodland is found on sandy soils on the edges of the Klipvoor Dam.
- *Eragrostis gummiflua* – *Terminalia sericea* Mixed Woodland occurs on sandy soils.
- *Eragrostis pallens* – *Terminalia sericea* Woodland is strongly associated with deep sandy soils and is differentiated into the *Eragrostis pallens* – *Terminalia sericea* – *Burkea africana* woodland variant and the *Eragrostis pallens* – *Terminalia sericea* – *Cleome maculata* mixed woodland variant.
- *Schizachyrium jeffreysii* - *Terminalia sericea* Woodland is found on granite soil with granite boulders.

4.4.3 *Ziziphus mucronata* – *Acacia karroo* Woodland Brown, Bredenkamp & Van Rooyen 1997

The vegetation type is situated on the banks of the Moretele River and its tributaries in both the northern and the western sections of the Borakalalo Nature Reserve. It is mainly associated with loamy to clayey soils, though it can be found on sandy soils in some tributaries (Brown *et al.* 1997).

The community is presently distinguished by the common reed *Phragmites australis* (Species group P) which, together with *Combretum erythrophyllum*, *Bothriochloa insculpta*, and *Aerva leucura* are the original diagnostic species (Brown *et al.* 1997).

Although this community is similar to the communities of the *Acacietea karroo* (Chapter 6) in that it is *Acacia karroo*-dominated riparian vegetation, it shows more affinity towards communities of the *Panico maximi – Acacietea tortilis* and is hence correctly included by Winterbach (1998) in this class.

The woodland represents the following communities:

- *Ziziphus mucronata – Acacia karroo* Riverine Woodland and its two sub-communities occur on the western section of the Reserve. The woodland is found all along the banks of the Moretele and Blokspruit Rivers, on loamy to clayey alluvial soil (Brown *et al.* 1995). It is differentiated into *Urochloa mosambicensis-Eragrostis rigidior-Acacia karroo* Riverine Woodland and *Panicum maximum-Combretum erythrophyllum-Acacia karroo* Riverine Woodland.
- *Panicum maximum – Acacia karroo* Woodland is also found along the banks of the Moretele River and its tributaries on loamy and clayey soils, but on the northern section of the Reserve (Brown *et al.* 1996).

4.5 *Acacion hebecladae – rehmannianae* Alliance Winterbach 1998

Synonym: *Acacia karroo* Riverine communities (Bredenkamp & Van Vuuren 1977)

This is a fairly open to dense woody vegetation found in the vicinity of Turfloop Dam, east of the town of Pietersburg in the Northern Province (Bredenkamp & Van Vuuren 1977). It occurs mainly along the streams and adjacent areas of clayey soils.

The community is characterised by species from group U, namely *Asparagus africanus*, *Aloe marlothii*, *Aloe greatheadii**, *Senecio burchellii*, and *Acacia rehmanniana*, while the original diagnostic species include *Acacia karroo*, *Rhus pyroides*, and *Bidens bipinnata* (Bredenkamp & Van Vuuren 1977).

The alliance is represented by the following two associations described by Winterbach (1998):

- *Zizipho mucronatae* – *Acacietum karroo*, a synonym to *Acacia karroo* – *Ziziphus mucronata* Thicket (Bredenkamp & Van Vuuren 1977), is very dense woody vegetation found along the streambanks.
- *Sporoboli africani* - *Acacietum karroo* (Synonym: *Acacia karroo* – *Sporobolus africanus* Savanna (Bredenkamp & Van Vuuren 1977)) is a fairly open savanna found on clayey soils on the plains, usually adjacent to the streambanks where the dense *Zizipho mucronatae* – *Acacietum karroo* occurs.

5. *Eustachys mutica* – *Acacia caffra* Woodlands Coetzee 1975

This is vegetation of the Rustenburg Nature Reserve, situated southwest of the town of Rustenburg in the North-West Province (Coetzee 1975). The community represents *Acacia caffra* dominated woodlands found on the slopes of the Magaliesberg, and also on flat surfaces with clay-loam soils.

The diagnostic species for the community include *Ledebouria* species*, *Dombeya rotundifolia**, *Euclea crispa**, *Oxalis obliquifolia**, and *Clematis oweniae** (Species group Z). The community is dominated by *Acacia caffra* (Species group AF), with *Ziziphus mucronata* (Species group AH) and *Acacia karroo* (Species group AI) also featuring prominently in the tree stratum. The most prominent shrub is *Lantana rugosa* (Species group AA), while the herbaceous layer is dominated by the grasses *Setaria sphacelata* (Species group Z), *Eragrostis curvula* (Species group AA), and

Themeda triandra (Species group AE), as well as the forbs *Ledebouria* species and *Oxalis obliquifolia* (Species group Z).

The *Eustachys mutica* – *Acacia caffra* Woodlands comprise the following communities (Coetzee 1975):

- *Digitaria smutsii* – *Acacia caffra* Variation (of the *Combretum zeyheri* – *Acacia caffra* Woodland) is a moderately xeric woodland found on alluvial soils of the flats between the northeastern foothills of the Magaliesberg.
- *Brachiaria serrata* – *Acacia caffra* Woodland has two variations, the *Laggera crispata* - *Acacia caffra* Variation which occurs on litholitic soils of the lower northeast to east-facing slopes of valleys, and the *Protea caffra* – *Acacia caffra* Variation which is restricted to the flats and gentle slopes.
- *Setaria lindenbergiana* – *Acacia caffra* Woodland is found on litholitic soils on cooler aspect slopes on the western side of the Magaliesberg and in the valleys.

6. *Ziziphus mucronata* Closed Woodland Bezuidenhout 1996

This is a community of the Augrabies Falls National Park, located west of the town of Upington in the Northern Cape (Bezuidenhout 1996). It is associated with the drainage lines, floodplains and islands of the Orange River. The dominant soil forms are Dundee and Oakleaf.

The community is characterised by the conspicuous woody component *Lycium bosciifolium**, *Rhus pentheri*, *Maerua gilgii**, *Euclea pseudebenus**, and *Gymnosporia linearis* [*Maytenus linearis*] (Species group AG). Other species that characterise this community are *Acacia mellifera* and *Cenchrus ciliaris** (Species group G), as well as *Phragmites australis* (Species group P)

The following two sub-communities are recognised by Bezuidenhout (1996):

- *Tamarix usneoides* – *Ziziphus mucronata* Closed Woodland is associated with the alluvial deposits as well as intrusive granite outcrops of the Orange River and of large sandy drainage lines.

- *Diospyros lycioides* – *Ziziphus mucronata* Closed Woodland is associated with deep Dundee soils found on the islands of the Orange River, as well as on small floodplains along the river.

Table 7.1: Synoptic table of the *Acacia karroo* savanna communities

Vegetation type	16	19	17	18	7	8	9	10	4	5	6	1	2	14	13	15	25	22	27	28	29	30	23	24	26	32	33	35	36	37	38	39	40					
Number of relevés	4	4	4	3	6	2	4	3	3	4	2	4	7	6	2	3	4	5	4	10	4	6	5	5	3	4	3	4	4	5	2	4	4					
Community number	1		2		3.1			3.2			4.1	4.2	4.3	4			4.4			4.5			5				6											
Species group A																																						
<i>Vitex obovata</i>	V	V																																				
<i>Psiadia punctulata</i>	IV	III	II																														III					
<i>Mimusops zeyheri</i>	IV	III																																				
<i>Rhoicissus tridentata</i>	IV	III																																III				
Species group B																																						
<i>Celtis africana</i>			V	V																																		
<i>Ectadiopsis oblongifolium</i>			V	V																														III				
<i>Panicum deustum</i>	IV		V	V																																		
<i>Asparagus racemosus</i>			V	IV																																		
<i>Flueggea virosa</i>			IV	V																																		
<i>Secamone filiformis</i>			IV	V																																		
<i>Hypoestes aristata</i>			IV	V																																		
<i>Sida spinosa</i>			IV	V																																		
<i>Sporobolus fimbriatus</i>			IV	V																														II				
<i>Terminalia prunioides</i>			IV	IV																																		
<i>Rhus engleri</i>			IV	IV																																		
<i>Cardiospermum corindum</i>			IV	IV																																		
<i>Euclea divinorum</i>			IV	II																																		
<i>Berkheya zeyheri</i>	III		IV	II																																		
<i>Cymbopogon nardus</i>			IV	II																																		
<i>Carissa bispinosa</i>			IV	II	I					III			V																									
<i>Pavonia burchellii</i>			III	V																																		
<i>Ficus sur</i>			III	IV																																		
<i>Cyphostemma sulcatum</i>			III	II																																		
<i>Melia azedarach</i>			III	II		II																																
<i>Grewia caffra</i>			III	II																																		
<i>Spirostachys africana</i>			II	IV																																		
<i>Kirkia wilmsii</i>			II	IV																																		
Species group C																																						
<i>Hippobromus pauciflorus</i>	V	V	V	II																																		
<i>Olea europaea</i>	V		II	II																														III				
<i>Schotia brachypetala</i>	III	III	II	IV																																		
<i>Croton gratussimus</i>		II	III	IV																																		
Species group D																																						
<i>Sporobolus ioclados</i>					II	III	V	IV		II				I																								
<i>Solanum species</i>					IV		III																															
<i>Bidens pilosa</i>					III	V	III																															
<i>Dactyloctenium aegyptium</i>					III	V	II							III			II										I	IV										
Species group E																																						
<i>Commiphora africana</i>					I				V	IV	V	II																										
<i>Hermannia modesta</i>									V	III	V		I																									
<i>Boscia albitrunca</i>			II						V	III	III	II								II	III												II	II				
<i>Sarcostemma viminalis</i>									V	II	V																											
<i>Aristida canescens</i>					I				IV	V	V							II	III	II		I	II															
<i>Opuntia ficus-indica</i>									IV	V	V																											
<i>Melhania species</i>									IV	V	V																											
<i>Limeum species</i>					I				IV	IV	III																											
<i>Dicoma anomala</i>									IV	II	V																											
<i>Acacia senegal</i>					I				IV	II	V																											
<i>Ceratothera triloba</i>					I				IV	II	V																											
<i>Senna italica</i>									IV		III																											
<i>Pavetta gardeniifolia</i>			II	II					II	V	V		I																									
<i>Aptosimum lineare</i>									II	II	V		I																									
<i>Panicum natalense</i>					I				IV	V																												
<i>Ipomoea species</i>									IV	IV																												
<i>Fingerhuthia africana</i>		IV								V	V																											
<i>Indigofera species</i>										IV	V		II																									
Species group F																																						
<i>Digitaria velutina</i>					V	III	IV	V	V	V	V		I																									
<i>Acacia burkei</i>					IV			II	II	V	III																											
<i>Enneapogon scoparius</i>					II	III	III		V	IV	V									III	III		V	I														
<i>Asparagus species</i>					V		II	II	IV	V																												
<i>Indigofera cryptantha</i>	</																																					

7.2 ACACIA KARROO IN GRASSLAND AND SHRUB COMMUNITIES

The grassland and shrub communities are represented in Table 7.2, of which communities 1-3 represent woodland/shrub communities dominated by such woody species as *Diospyros lycioides* and *Ziziphus mucronata* (Species group AB). Grasslands are represented by communities 4-6, and are dominated/distinguished by the grasses *Eragrostis plana*, *Hyparrhenia dregeana* (Species group Y), *Melinis repens*, *Sporobolus africanus*, and *Diheteropogon amplexans* (Species group Z). Equally prominent are *Eragrostis curvula*, *Setaria sphacelata*, *Cymbopogon excavatus* (Species group AA), and *Themeda triandra* (Species group AB).

7.2.1 CLASSIFICATION

The following is a classification of the grassland and shrub communities:

1. *Acacio ataxacanthae* - *Celtidetum africanae* Association Matthews, Bredenkamp & Van Rooyen 1992
2. *Acacia karroo* – *Gladiolus ecklonii* – *Themeda triandra* Open Woodland Burgoyne 1995
3. *Rhoetea erosae* Class Werger 1980
 - 3.1 *Ehrharto* – *Oleetum* – *rhoetosum lanceae* Sub-association Du Preez 1991
 - 3.2 *Rhoo* – *Scolopion* Alliance Müller 1986
4. *Themeda triandra* – *Eragrostis plana* Class Du Preez & Bredenkamp 1991
 - 4.1 *Chaetacanthus costatus* - *Cymbopogon excavatus* Open Thornveld
 - 4.1.1 *Hermannia depressa* – *Anthospermum rigidum* Sub-community Robbeson 1998
 - 4.1.2 *Hyparrhenia hirta* – *Themeda triandra* Grassland Community Robbeson 1998
 - 4.1.3 *Scabiosa columbaria* – *Aster peglerae* Sub-variation Robbeson 1998
 - 4.2 *Trirapho andropogonoidis* – *Elionuretum mutici* Association Bezuidenhout, Bredenkamp & Theron 1993
5. *Tristachya leucothrix* – *Trachypogon spicatus* Class Du Preez & Bredenkamp 1991
 - 5.1 *Elionuro muticusae* – *Trachypogonetum spicati* Association Siebert 2001

6. *Geigeria burkei* – *Melinis repens* Community

6.1 *Acacia nilotica* – *Aristida congesta* Community

6.1.1 *Perotis patens* – *Hyperthelia dissoluta* Pure Short Closed Grassland Community De Frey 1999

6.1.2 *Pavetta edentula* – *Pellaea calomelanos* Low/Short Thicket Community De Frey 1999

6.2 *Dombeya rotundifolia* – *Heteropogon contortus* Low/Short Thicket Community

7.2.2 DESCRIPTION OF THE PLANT COMMUNITIES

1. *Acacio ataxacanthae* - *Celtidetum africanae* Association Matthews, Bredenkamp & Van Rooyen 1992

The community represents wooded areas found in the dry dolomitic regions of the north-eastern mountain sourveld of Mpumalanga, and also south eastern Northern Province (Matthews *et al.* 1992). It is mainly found on rock outcrops near or on the bottom of valleys as well as in some protected areas on valley sides.

The community is characterised by well-defined tree and shrub strata that are dominated by *Celtis africana* (Species group E), *Diospyros lycioides* (Species group AB), and *Acacia karroo* (Species group AC). Lianas often present in the tree and shrub strata include *Clematis brachiata* (Species group A) and *Rhoicissus tridentata* (Species group W). The herbaceous layer is not well developed with the most common grass species being *Panicum maximum* (Species group A) occurring in the shade of trees and shrubs. The diagnostic species include *Acacia ataxacantha**, *Clematis brachiata**, *Ipomoea purpurea**, *Rumex sagittatus**, and *Helinus integrifolius** (Species group A).

2. *Acacia karroo* – *Gladiolus ecklonii* – *Themeda triandra* Open Woodland Burgoyne 1995

This is a community of the plains and slopes of northern Mpumalanga, in the Belfast-Lydenburg-Dullstroom area (Burgoyne 1995). It is a grassland community where trees are a major component. *Rhynchosia nervosa* and *Justicia anagalloides* (Species group B) differentiate the community, while *Heteropogon contortus* (Species group AA) and *Acacia karroo* (Species group AC) are among the prominent species.

3. *Rhoetea erosae* Class Werger 1980

This class was originally described by Werger (1980) for the shrub communities occurring along the Upper Orange River Valley. In the present classification, it represents the shrub communities of southern and eastern Free State as described by Du Preez and Bredenkamp (1991). It represents shrub communities typical of the talus slopes of mountains, as well as dolerite hills and ridges. The class also includes grassy shrubland communities which occur on low dolerite outcrops (Du Preez 1991).

Species that distinguish this class include those originally identified by Du Preez (1991), namely *Celtis africana**, *Asparagus suaveolens**, *Rhus burchellii**, *Achyranthes aspera**, and *Bidens bipinnata** (Species group E). Prominent woody species include *Celtis africana*, *Rhus lancea*, *Rhus burchellii* (Species group E), *Diospyros lycioides* (Species group AB), and *Acacia karroo* (Species group AC). Prominent grasses include *Enneapogon scoparius* (Species group E), *Eragrostis curvula* (Species group AA), and *Themeda triandra* (Species group AB).

3.1 *Ehrharto* – *Oleetum* – *rhoetosum lanceae* Sub-association Du Preez 1991

Synonym: *Olea africana* – *Rhus lancea* Sub-community (Rossouw 1983)

The community, which was originally described by Rossouw (1983), is part of the *Chrysocomo* – *Selagenea albidae* sub-class (Du Preez 1991). It occurs in the Bloemfontein area, where it is

restricted to relatively moist habitats found in gorges and drainage lines on the slopes of dolerite hills. It is distinguished by *Gymnosporia polyacantha*, *Buddleja saligna*, *Sphaeralcea bonariensis**, *Sisymbrium capense*, *Eucomis autumnalis*, *Asparagus laricinus*, and *Diospyros austro-africana* (Species group C). Woody species are most prominent, especially *Buddleja saligna* (species group C), *Celtis africana*, *Rhus lancea*, *Olea europaea*, *Grewia occidentalis* (Species group E), *Diospyros lycioides*, and *Ziziphus mucronata* (Species group AB).

3.2 *Rhoo – Scolopion Alliance* Müller 1986

Synonym: *Grewio – Isoglossion grantii Alliance* (Du Preez 1991)

The alliance is part of the *Rhoo – Rhoicissenea tridentatae* sub-class proposed by Du Preez (1991). It represents shrubland originally described by Müller (1986) for the Willem Pretorius Nature Reserve, located north of the town of Winburg in the Free State. The shrubland occupies plateaus and steep slopes of dolerite hills, as well as rocky outcrops of the Beaufort Formation (Du Preez 1991).

Species from group D differentiate the alliance, including the original ones identified by Müller (1986) namely *Scolopia zeyheri**, *Isoglossa grantii**, *Panicum deustum**, and *Chascanum pinnatifidum*. The dominant species include *Celtis africana*, *Olea europaea*, *Grewia occidentalis*, *Achyranthes aspera* (Species group E), and *Acacia karroo* (Species group AC).

4. *Themeda triandra – Eragrostis plana Class* Du Preez & Bredenkamp 1991

The class, proposed by Du Preez and Bredenkamp (1991), represents moist grasslands of the plains at relatively high altitudes and high rainfall. It is presently represented by two communities, which are distinguished by *Helichrysum rugulosum**, *Eragrostis capensis**, *Hermannia depressa**, *Eragrostis racemosa*, *Acalypha angustata*, and *Cynodon dactylon* (Species group M).

4.1 *Chaetacanthus costatus* - *Cymbopogon excavatus* Open Thornveld

This is vegetation of north-western KwaZulu-Natal (Robbeson 1998), an area that includes the towns Estcourt, Colenso and Ladysmith, as well as Bergville and Winterton. The vegetation is characteristic of plains adjacent to the footslopes of the Drakensberg where soils are mostly shallow and tend to be sandy or sandy loam. It is described by Robbeson (1998) as Open Thornveld, a variation of Acocks' (1988) Southern Tall Grassveld. Because Robbeson (1998) did not assign a specific name to this vegetation type and only referred to it as Open Thornveld, it is assigned a name in the present classification.

The community is generally dominated by grasses such as *Cymbopogon excavatus* (Species Group AA), *Themeda triandra*, and *Hyparrhenia hirta* (Species group AB), while *Acacia sieberiana* (Species group U) and *Acacia karroo* (Species group AC) are the only woody species of frequent occurrence. The community is distinguished by *Anthospermum rigidum*, *Corchorus confusus*, *Phyllanthus parvulus*, *Conyza podocephala*, *Ipomoea oblongata*, *Chaetacanthus costatus*, *Crepis hypochoeridea*, *Berkheya speciosa*, *Alloteropsis semialata*, and *Hibiscus aethiopicus* (Species group J).

Three communities represent this Open Thornveld.

4.1.1 *Hermannia depressa* – *Anthospermum rigidum* Sub-community Robbeson 1998

This is a community of the slopes and footslopes of rocky hills, characterised by deep sandy soils. It is distinguished by species from group F, which include *Crassula alba*, *Ledebouria ovalifolia*, *Sonchus oleraceus*, *Hypoxis oblonga*, and *Indigofera dregeana*. Grasses such as *Eragrostis capensis* (Species group M), *Trachypogon spicatus* (Species group U), *Diheteropogon amplexans* (Species group Z), *Cymbopogon excavatus* (Species Group AA), *Themeda triandra* and *Hyparrhenia hirta* (Species group AB), dominate the vegetation, as well as the forbs *Anthospermum rigidum*, *Corchorus confusus* (Species group J), *Helichrysum rugulosum* and

Hermannia depressa (Species group M). *Acacia karroo* (Species group AC) is the only prominent woody species.

4.1.2 *Hyparrhenia hirta* – *Themeda triandra* Grassland Community Robbeson 1998

The community represents open grassland plains close to rocky hills. The diagnostic species are from group G, namely *Eragrostis chloromelas**, *Schkuhria pinnata**, *Selago tenuifolia*, *Bothriochloa insculpta**, *Chamaecrista comosa*, *Alysicarpus rugosus*, and *Aristida* species. Grasses are dominant, especially *Cymbopogon excavatus* (Species group AA), *Themeda triandra*, and *Hyparrhenia hirta* (Species group AB), with the woody species *Acacia sieberiana* (Species group U) and *Acacia karroo* (Species group AC) prominent in some areas.

The following five sub-communities and one variation are included in the community (Robesson 1998):

- *Aloe marlothii* – *Conyza podocephala* Sub-community is associated with shallow sandy soils and is relatively severely utilised.
- *Diheteropogon amplexans* – *Tristachya leucothrix* Sub-community occurs on crests and footslopes of rocky hills, where the habitat is rocky and highly utilised.
- *Helichrysum rugulosum* – *Anthospermum rigidum* Sub-community is a tall grassveld encroached by *Acacia sieberiana* seedlings, probably as a result of severe grazing of the sub-community.
- *Sporobolus pyramidalis* – *Crabbea hirsuta* Variation is characterised by deep sandy soils and is intensively grazed.
- *Acacia karroo* – *Themeda triandra* Sub-community is found on flat plains with dolerite rocks and deep clayey soils.

- *Acacia karroo* – *Aristida bipartita* Sub-community is situated nearby streams that are temporarily flooded during the rainy season. It is found on clayey vertic soils and is in a degraded condition.

4.1.3 *Scabiosa columbaria* – *Aster peglerae* Sub-variation Robbeson 1998

This vegetation is found on slopes of rocky hills where soils are shallow and of the Mispah form. It represents open grassland with a few woody species. The dominant grasses are *Cymbopogon excavatus* (Species group AA), *Themeda triandra*, and *Hyparrhenia hirta* (Species group AB), while prominent forbs include *Acalypha angustata* (Species group M) and *Scabiosa columbaria* (Species group P). *Aloe marlothii* (Species group Y) is the only woody species of significant occurrence. *Eriosema cordatum* and *Leonotis ocymifolia* (Species group I) distinguish the community.

4.2 *Trirapho andropogonoidis* – *Elionuretum mutici* Association Bezuidenhout, Bredenkamp & Theron 1993

This is a relatively high altitude grassland of the Ottosdal-Delareyville-Lichtenburg area, in North-West Province. It is found on the midslopes of the Bd land type, where soils are well-drained, sandy and predominantly of the Hutton, Avalon and Mispah forms (Bezuidenhout, Bredenkamp & Theron 1993). Species that characterise the community are the grasses *Trichoneura grandiglumis* and *Eragrostis gummiflua*, as well as the forbs *Berkheya onopordifolia*, *Cyanotis speciosa*, and *Lippia javanica* (Species group L). The most common species include *Elionurus muticus* (Species group Q), *Eragrostis curvula* (Species group AA), and *Themeda triandra* (Species group AB).

The following communities are classified under the grassland:

- *Helichrysum rugulosum* – *Conyza podocephala* Grassland occurs in the Pretoria-Witbank-Heidelberg area, where it is mainly restricted to moist, deep soils on the undulating and flat plains within the Ba land type. The dominant soil forms are Glenrosa, Clovelly, and Hutton (Coetzee, Bredenkamp & Van Rooyen 1995b).
- *Helichrysum rugulosum* – *Hyparrhenia hirta* Grassland represents vegetation of northern KwaZulu Natal. It is a short to tall closed grassland found on midslopes of low-lying, flat to undulating plains. Soils are moderately deep and predominantly of the Glenrosa, Mispah, and Clovelly forms (Eckhardt, Van Rooyen & Bredenkamp 1996a).

5. *Tristachya leucothrix* – *Trachypogon spicatus* Class Du Preez & Bredenkamp 1991

Synonym: *Harpochloo* – *Tristachyetea leucothrichis* Class (Du Preez 1991)

This class represents grassland of moist, high altitude mountain slopes and plateaus. It includes the plateau grassland of Korannaberg, the grassland communities of the high-lying sandy soils in the Clocolan-Ficksburg area, the grassland communities of the high-lying sandy soils of the Bethlehem area, the grassland communities of Golden Gate, and the grassland communities of the Platberg mountain near Harrismith (Du Preez 1991).

5.1 *Elionuro muticusae* – *Trachypogonetum spicati* Association Siebert 2001

This is rocky mountain grassland found on lower footslopes and valley bottoms of the Sekhukhuneland Centre of Plant Endemism (Siebert 2001). The soils are deep and predominantly vertic Arcadia and Steendal forms. This community is part of the *Themeda triandra* – *Senecio microglossus* Cool Moist Grassland, which Siebert *et al.* (2002) regard as part of the proposed *Tristachya leucothrix* – *Trachypogon spicatus* Class (Du Preez & Bredenkamp 1991).

The community is differentiated by 24 species from group O, which include the original diagnostic species by Siebert (2001), namely the small trees *Rhamnus prinoides** and *Rhus rogersii**, the grasses *Brachiaria eruciformis** and *Setaria incrassata**, and the forbs *Striga elegans**, *Indigofera evansiana**, and *Kohautia caespitosa**. Grasses and forbs are abundant and prominent species include the forb *Senecio microglossus* (Species group O), the grasses *Cymbopogon nardus*, *Hyparrhenia filipendula* (Species group O), *Elionurus muticus* (Species group Q), *Diheteropogon amplexans* (Species group Z), *Setaria sphacelata* (Species group AA), and *Themeda triandra* (Species group AB).

Siebert (2001) recognises the following two sub-associations:

- *Elionuro muticusae* – *Trachypogonetum spicati bewsietosum biflorae* Sub-ass. is moist, cool mountain grassland on gentle footslopes, restricted to deep Steendal soils.
- *Elionuro muticusae* – *Trachypogonetum spicati acacietosum tortilis* Sub-ass. represents wooded grassland communities in valley bottoms where Arcadia soils are predominant.

6. *Geigeria burkei* – *Melinis repens* Community

The individual communities that represent this vegetation type were identified and described by De Frey (1999), but they are classified together under one major community for the first time in the present classification. This grassland community represents vegetation of the mountains and plains of southeastern Mpumalanga, specifically the Belfast-Barberton-Piet Retief-Wakkerstroom area (De Frey 1999). It is associated with sandy loam soils, with Glenrosa as the dominant soil form.

The diagnostic species are *Commelina africana*, *Diospyros whyteana*, *Combretum apiculatum*, *Geigeria burkei*, and *Peltophorum africanum* (Species group X). Grasses dominate, the most prominent being *Hyperthelia dissoluta* (Species group T), *Melinis repens* (Species group Z),

Cymbopogon pospischillii, *Heteropogon contortus*, and *Aristida congesta* (Species group AA), with *Acacia karroo* (Species group AC) the most prominent woody species.

The vegetation is represented by two communities which are differentiated by terrain type, with the *Acacia nilotica* – *Aristida congesta* Community being associated with undulating plains and the *Dombeya rotundifolia* – *Heteropogon contortus* Low/Short Thicket Community being mountain vegetation.

6.1 *Acacia nilotica* – *Aristida congesta* Community

This is a community of strongly undulating plains, associated with sandy to sandy loam soils dominated by the Glenrosa form. The diagnostic species for the community are *Acacia nilotica*, *Pellaea calomelanos*, *Hyperthelia dissoluta*, and *Loudetia flavida* (Species group T), while the grasses *Melinis repens* (Species group Z), *Heteropogon contortus*, *Aristida congesta* (Species group AA), and *Acacia karroo* (Species group AC) are some of the common species.

6.1.1 *Perotis patens* – *Hyperthelia dissoluta* Pure Short Closed Grassland Community De Frey 1999

This is grassland of slopes characterised by sandy to sandy loam soils of the Hutton and Glenrosa forms. It is differentiated by the prominent species *Aristida sciurus*, *Trichopteryx dregeana*, and *Pogonarthria squarrosa*, as well as other less prominent species *Perotis patens**, *Dicerocaryum eriocarpum*, and *Richardia brasiliensis* (Species group R). Other common species include *Tagetes minuta* (Species group K), *Hyperthelia dissoluta* (Species group T), *Melinis repens* (Species group Z), *Cymbopogon excavatus* and *Aristida congesta* (Species group AA). *Acacia karroo* (Species group AC) is the only prominent woody species.

6.1.2 *Pavetta edentula* – *Pellaea calomelanos* Low/Short Thicket Community De Frey 1999

The community occurs along the crest of strongly undulating plains, where soils are generally sandy to sandy loam, rocky and predominantly of the Glenrosa form. It is characterised by species from group S, which include *Setaria lindenbergiana*, *Solanum panduriforme*, *Sclerocarya birrea*, *Zanthoxylum capense*, *Pappea capensis*, and *Euphorbia ingens*.

Grasses are most abundant in the community, with a few prominent woody species. Prominent grasses are *Hyperthelia dissoluta* (Species group T), *Melinis repens* (Species group Z), *Eragrostis curvula*, *Setaria sphacelata*, *Cymbopogon pospischillii*, *Heteropogon contortus*, *Aristida congesta* (Species group AA), and *Themeda triandra* (Species group AB). *Pavetta edentula*, *Gymnosporia buxifolia*, *Rhoicissus tridentata*, *Dombeya rotundifolia* (Species group W), *Aloe marlothii* (Species group Y), and *Acacia karroo* . (Species group AC) are the most prominent woody species, with *Pellaea calomelanos* (Species group T) the forb of most common occurrence.

The community comprises the following three sub-communities (De Frey 1999):

- *Ehretia rigida* – *Pavetta edentula* Sub-community occurs on the midslopes and footslopes of the undulating plains where soils are rocky and large boulders are a prominent feature. The plains around these rocky outcrops are dotted with widely spaced trees, and shrubs amongst the cracks and crevasses. The shrubs and trees form a closed canopy.
- *Gerbera piloselloides* – *Pavetta edentula* Sub-community occurs on steep slopes and is characterised by a higher percentage surface rock, in the form of rock sheets. The trees do not form a closed canopy.
- *Ficus glumosa* – *Pavetta edentula* Sub-community is associated with rocky crests where the canopy is either open or closed.

6.2 *Dombeya rotundifolia* – *Heteropogon contortus* Low/Short Thicket Community

This is mountain vegetation associated with north facing slopes and characterised by sandy clay loam to sandy clay Glenrosa soils. It is differentiated by *Raphionacme velutina*, *Panicum natalense*, *Stachys natalensis*, *Cussonia spicata*, *Berkheya seminivea*, *Vernonia natalensis*, and *Sebaea grandis* (Species group V). Some of the prominent species are *Dombeya rotundifolia* (Species group W), *Heteropogon contortus*, *Cymbopogon excavatus* (Species group AA), and *Themeda triandra* (Species group AB).

The following two communities described by De Frey (1999) are included in this community:

- *Faurea rochetiana* – *Schistostephium crataegifolium* Low/Short Sparse Shrubland is associated with steep north facing slopes dotted with large rocks. It is found on sandy clay loam to sandy clay Glenrosa soils.
- *Acacia karroo* – *Heteropogon contortus* Low/Short Thicket Community is a closed canopy community associated with moderately steep slopes in valleys. The soils are sandy clay loam to sandy clay, with Glenrosa being the predominant soil form.

Table 7.2 continued.

Vegetation type	1	18	15	11	12	14	13	2	3	4	5	6	7	8	9	27	28	29	16	17	19	20	22	21	23	24	
Number of relevés	4	5	3	7	10	6	3	2	4	3	3	4	6	10	5	4	8	4	3	4	3	2	3	4	4	3	
Community number	1	2	3.1	3.2			4			4.1			4.2			5			6			6.1			6.2		
								4.1.1	4.1.2			4.1.3									6.1.1	6.1.2					
Species group J																											
Anthospermum rigidum	.	I	.	.	.	I	II	V	II	V	IV	IV	.	+	III	.	.	II	II	.	.	.	.	.	.	II	.
Corchorus confusus	V	.	II	.	II	II	.	II	.	.	.	.	.	.	.	.	.	.	.	IV
Phyllanthus parvulus	III	II	II	II	III	IV	III	I	.	.	.	.	.	.	.	.	.	.	.	II
Conyza podocephala	.	.	.	I	+	.	.	III	III	.	II	.	.	+	II	.	I	.	IV	.	.	.	.	.	.	.	.
Ipomoea oblongata	.	I	.	.	.	.	.	III	II	.	IV	IV	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.
Chaetacanthus costatus	III	.	V	IV	IV	II	III	III	.	.	.	.	.	.	.	.	.	.	.	II
Crepis hypchoeridea	III	.	V	II	II	I	II	I	.	.	.	.	.	.	.	.	.	.	.	.
Berkheya speciosa	III	.	IV	.	II	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Alloteropsis semialata	.	I	.	.	.	.	.	III	.	II	IV	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Hibiscus aethiopicus	.	.	.	+	I	.	.	III	.	II	.	II	.	.	III	.	.	.	.	.	II	.	.	.	.	.	.
Species group K																											
Zinnia peruviana	.	.	III	II	IV	II	.	.	II	.	II	II	I	+	II	.	.	.	.	.	II	.	.	.	.	.	II
Tagetes minuta	.	.	II	II	III	V	.	.	II	.	II	II	I	+	II	.	.	.	.	.	IV	.	.	.	.	.	.
Lantana rugosa	.	.	.	IV	V	IV	.	.	.	II	II	.	.	+	I	.	.	.	.	.	.	.	.	.	.	.	IV
Felicia muricata	.	.	.	IV	I	IV	.	.	II	.	II	III	I	.	.	IV	.	.	II	.	.	.	.	.	.	.	.
Hibiscus trionum	.	.	.	II	IV	II	.	.	II	.	II	III	IV	.	.	IV	.	.	.	.	.	.	II	.	.	II	.
Species group L																											
Trichoneura grandiglumis	I	II	.	.	.	.	.	.	.	.	V	I	III	.	.	.	.	.	.	.	.	.
Berkheya onopordifolia	IV	.	III	.	.	.	.	.	.	.	.	.
Cyanotis speciosa	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	III	I	II	.	.	.	.	.	.	.	.	.
Eragrostis gummiiflua	III	.	+	.	III	.	V	.	.	.	IV	.	.	.	.	IV
Lippia javanica	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	II	.	.	II	.	.	.	.	II	.
Species group M																											
Helichrysum rugulosum	V	III	II	V	V	I	.	I	II	II	V	.	.	.	.	.	.	.	II	.
Eragrostis capensis	.	II	.	.	.	.	.	V	III	.	V	II	II	+	.	III	II	IV	.	.	II	.	II	.	.	.	.
Hermannia depressa	V	II	IV	II	IV	IV	+	III	V	III	.	.	.	.	.	.	.	.	.	.
Eragrostis racemosa	.	III	.	.	.	II	II	III	III	II	V	II	.	I	III	III	IV	III	.	.	.	II	.	.	II	.	II
Acalypha angustata	II	.	.	.	.	.	.	III	II	II	.	.	.	+	V	III	IV	.	.	.	.	.	.	.	.	II	.
Cynodon dactylon	.	.	IV	.	.	.	.	III	.	.	II	.	.	I	.	III	.	IV	.	.	II	.	.	.	.	.	.
Species group N																											
Crabbea angustifolia	.	.	.	II	.	IV	.	.	II	.	II	.	.	+	I	III	II	.	.	.	.	.	.	II	.	.	.
Eragrostis superba	.	.	II	.	+	II	IV	.	.	.	III	.	.	+	.	III	II	.	IV	.	.	III	.	.	.	.	.
Vernonia oligocephala	II	II	.	.	+	II	II	.	.	.	III	.	.	+	.	IV	III	.	.	.	.	.	.	.	.	II	.
Species group O																											
Senecio microglossus	V	V	.	.	.	.	.	.	.	.	.	.
Cymbopogon nardus	II	.	.	.	.	.	V	V	.	.	.	.	.	II	.	.	.	.
Gnidia caffra	.	I	.	.	.	.	.	.	.	II	.	.	.	.	.	V	V	.	.	.	.	.	.	.	.	III	.
Rhynchosia spectabilis	V	IV	.	.	.	.	.	.	.	.	.	.
Thesium gracilentum	V	III	.	.	.	.	.	.	.	.	.	.
Striga elegans	V	III	.	.	.	II	.	.	.	.	.	.
Athrixia elata	IV	V	.	.	.	.	.	II	.	II	.	II
Hyparrhenia filipendula	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V	.	III	.	.	III	.	.	.	.	.
Loudetia simplex	IV	V	.	.	.	.	II	.	II	.	III	.
Berkheya insignis	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V	.	.	.	.	.	.	.	.	.	.
Brachiaria eruciformis	IV	IV	.	.	.	.	.	.	.	.	.	.
Rhamnus prinoides	IV	IV	.	.	.	.	.	.	.	.	.	.
Senecio lygodes	IV	III	.	.	.	.	.	.	.	.	.	.
Indigofera evansiana	IV	III	.	.	.	.	.	.	.	.	.	.
Indigofera egens	IV	II	.	.	.	.	.	.	.	.	.	.
Setaria incrassata	II	V	.	.	.	.	.	.	.	.	.	.
Vitex obovata	II	IV	.	.	.	.	.	III	.	.	.	.
Polygala amatymbica	II	III	.	.	.	.	.	.	.	.	.	.
Aloe greatheadii	+	.	.	II	.	II	III	.	.	.	.	.
Eragrostis nindensis	I	.	II	III	.	.	.	.	.	.	.
Kohautia caespitosa	II	III	.	.	.	.	.	.	.	.	.	.
Rhus rogersii	II	III	.	.	.	.	.	.	.	.	.	.
Cephalaria zeyheriana	II	III	.	.	.	.	.	.	.	.	.	.
Rhynchosia totta	.	I	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	II	III	.	.	.	.	.	.	.
Species group P																											
Scabiosa columbaria	III	.	IV	IV	II	II	I	IV	III	I	II	IV	III	.	.	.	.	.	.	.
Striga asiatica	III	.	II	.	.	IV	+	.	.	.	.	IV	II	.	.	.	.	.	.	.
Aristida bipartita	II	IV	.	.	II	III	.	.	.	.	II	IV	IV	II	.	.	II	.	.	.
Species group Q																											
Elionurus muticus	.	.	.	I	III	IV	.	III	.	IV	.	III	II	.	II	III	IV	.	V	V	.	.	.	.	.	II	.
Brachiaria serrata	.	I	.	.	+	II	II	.	.	.	II	II	II	II	.	IV	II	.	V	IV	.	.	.	.	.	.	.
Species group R																											
Aristida scirus	V	.	IV	.	.	.	.
Trichopteryx dregeana	V	.	II	.	.	.	.
Perotis patens	V	.	II	.	.	.	.
Pogonarthria squarrosa	I	II	.	.	.	.	.	.	.	.	.
Dicerocaryum eriocarpum	IV	.	IV	.	.	.	.
Richardia brasiliensis	II	.	.	.	.	.	.	.	.	.	.	IV	.	III	.	.	.	.

7.3 ACACIA KARROO IN WETLAND COMMUNITIES

Five wetland communities are recognised (Table 7.3), which are generally associated with sandy soils (communities 1.1-2.1), except for community 2.2 which is associated with vertic clay. The communities are differentiated from the *Acaciatea karroo* riparian communities (Chapter 6) by the absence/poor presence of woody species such as *Rhus pyroides*, *Ziziphus mucronata*, and *Diospyros lycioides*. Grasses are the most prominent species, including *Eragrostis plana*, (Species group G), *Paspalum dilatatum*, *Imperata cylindrica*, and *Hyparrhenia hirta* (Species group K). *Acacia karroo* (Species group L) is the only constantly present woody species.

7.3.1 CLASSIFICATION

The hierarchical classification of the wetland communities is as follows:

1. *Hyparrhenia dregeana* – *Eragrostis plana* Wetland
 - 1.1 *Sporobolus africanus* - *Paspalum dilatatum* Sub-community Robbeson 1998
 - 1.2 *Cyperus esculentus* – *Hyparrhenia hirta* Community
 - 1.3 *Hemarthria altissima* Class Du Preez & Bredenkamp 1991
 - 1.3.1 *Hemarthrio altissimae* - *Miscanthion juncei* Alliance Eckhardt, Van Rooyen & Bredenkamp 1996b
2. *Conyza scabrida* – *Gomphostigma virgatum* Wetland
 - 2.1 *Rhus gerrardii* - *Leersia hexandra* Riparian Community Smit, Bredenkamp, Van Rooyen, Van Wyk & Combrinck 1997
 - 2.2 *Fuirena pubescens* – *Schoenoplectus corymbosus* Wetland Vegetation Siebert *et al.* 2002

7.3.2 DESCRIPTION OF THE PLANT COMMUNITIES

1. *Hyparrhenia dregeana* – *Eragrostis plana* Wetland

The wetlands are associated with rivers and streams, and are distinguished by *Hyparrhenia dregeana*, *Arundinella nepalensis*, and *Eragrostis curvula* (Species group E). The grasses *Hyparrhenia dregeana* (Species group E), *Eragrostis plana* (Species group G), *Paspalum dilatatum*, *Imperata cylindrica*, and *Hyarrhenia hirta* (Species group K) are the most prominent species, and so is *Acacia karroo* (Species group L).

The wetland represents three communities.

1.1 *Sporobolus africanus* - *Paspalum dilatatum* Sub-community Robbeson 1998

This is vegetation of northwestern KwaZulu-Natal, which includes towns such as Estcourt, Colenso and Ladysmith. It was described by Robbeson (1998) as a sub-community of the *Mariscus congestus* - *Arundinella nepalensis* wetland community. It occurs in riverbeds characterised by deep, sandy loam to clayey soils.

The community is distinguished by the dominant species *Conyza bonariensis*, *Mariscus congestus*, and *Brachiaria serrata* (Species group A), while the original diagnostic species by Robbeson (1998) are *Sporobolus africanus* and *Acacia karroo*. Other prominent species are the grasses *Arundinella nepalensis* (Species group E), *Paspalum dilatatum*, *Imperata cylindrica*, and *Hyparrhenia hirta* (Species group K), with *Acacia karroo* (Species group L) dominating the woody layer.

1.2 *Cyperus esculentus* – *Hyparrhenia hirta* Community

This is mountain wetland of the Belfast-Barberton-Piet Retief-Wakkerstroom area, in southeastern Mpumalanga (De Frey 1999). It occurs in valley bottoms associated with sandy clay loam to sandy clay soils dominated by the Katspruit form. The community is distinguished by *Themeda triandra*, *Melinis repens*, *Rhoicissus tridentata*, *Sonchus wilmsii*, *Cyperus esculentus*, *Lippia javanica*, and *Tagetes minuta* (Species group B). The most dominant species are *Themeda triandra* (Species group B), *Diospyros lycioides* (Species group D), *Eragrostis plana* (Species group G), *Hyparrhenia hirta* (Species group K), and *Acacia karroo* (Species group L).

The wetland comprises the following communities (De Frey 1999):

- *Eriosema salignum* – *Hyparrhenia hirta* Short Closed Grassland community is found along drainage lines. It is associated with deep, sandy clay to clay soils that predominantly of the Katspruit form.
- *Schizostylis coccinea* – *Eragrostis plana* Low/Short Bushland community is associated with perennial streams on valley bottoms. Soils are sandy clay loam and moderately deep, with Katspruit being the dominant soil form.

1.3 *Hemarthria altissima* Class Du Preez & Bredenkamp 1991

The *Hemarthria altissima* Class was suggested by Du Preez and Bredenkamp (1991) for the southern and eastern Free State. It is restricted to marshes and stream banks on the plateaux of the Korannaberg and the riverbanks, dam edge and vleis with permanent water, in the Willem Pretorius Game Reserve (Müller 1986).

1.3.1 *Hemarthria altissimae* - *Miscanthion juncei* Alliance Eckhardt, Van Rooyen & Bredenkamp 1996b

This community is interpreted to be part of the *Hemarthria altissima* Class suggested by Du Preez and Bredenkamp (1991). It was originally described by Eckhardt *et al.* (1996b) as an alliance of the *Agrostis lachnantha* – *Eragrostis plana* Wetlands of the Helpmekaar-Utrecht-Louwsburg area in central-northern KwaZulu-Natal. It is associated with rivers and streams, where the soil is alluvial sand and predominantly of the Dundee form.

The grasses *Hemarthria altissima*, *Paspalum urvillei*, and *Agrostis lachnantha* (Species group C), which are characteristic of moist habitats (Oudtshoorn 1999), are the diagnostic species, and so are *Pulicaria scabra*, *Juncus effusus*, *Juncus inflexus*, and *Pycreus betschuanus* (Species group C). The community was originally distinguished by the diagnostic species *Hemarthria altissima* and *Equisetum ramosissimum* (Eckhardt *et al.* 1996b).

The diagnostic species are also the most dominant, and so are *Phragmites australis*, *Diospyros lycioides* (Species group D), *Hyparrhenia dregeana* (Species group E), *Eragrostis plana*, *Leersia hexandra* (Species group G), *Paspalum dilatatum*, *Imperata cylindrica*, and *Hyparrhenia hirta* (Species group K). *Acacia karroo* (Species group L) is equally prominent.

Two sub-associations described by Eckhardt *et al.* (1996b) represent the alliance:

- *Imperato cylindricae* – *Fimbristylidetum ferrugineae senecionetosum achilleifolii* Sub-association is associated with rivers and streams at relatively high altitudes. Alluvial sand constitutes the major part of the substrate.
- *Paspalo urvillei* – *Leersietum hexandrae pycreetosum betschuani* Sub-association is associated with large streams and rivers but may also be encountered on floodplains at relatively lower altitudes. The substrate within the stream beds and river beds consists mainly of alluvial sand and large rocks, whereas soils of the floodplains are relatively deep and clayey.

2. *Conyza scabrida* – *Gomphostigma virgatum* Wetland

This is wetland vegetation of the Northern Province and Mpumalanga. It is found within the Sekhukhuneland Centre of Plant Endemism (Siebert 2001), as well as on the Witbank Nature Reserve (Smit *et al.* 1997). It occurs along rivers and streams, and in the rocky streambeds.

The diagnostic and also prominent species are *Gomphostigma virgatum*, *Conyza scabrida*, and *Verbena bonariensis* (Species group I). Other prominent species are *Miscanthus junceus* (Species group J) and *Acacia karroo* (Species group L).

The wetland vegetation represents two communities.

2.1 *Rhus gerrardii* - *Leersia hexandra* Riparian Community Smit, Bredenkamp, Van Rooyen, Van Wyk & Combrinck 1997

This is a community of the Witbank Nature Reserve, situated east of the town of Witbank in the Mpumalanga Province (Smit *et al.* 1997). It occurs along the banks of the Olifants River and in the rocky streambed. Soils of the Reserve are generally sandy, rocky and shallow, and are predominantly of Glenrosa and Mispah forms.

The community is characterised by species from group F, which are all original diagnostic species by Smit *et al.* (1997). These include *Rhus gerrardii*, *Dicliptera minor*, *Digitaria ternata*, and *Setaria nigrirostris*. *Rhus gerrardii* (Species group F), *Leersia hexandra* (species group G), *Gomphostigma virgatum*, *Verbena bonariensis* (species group I), *Paspalum dilatatum* (Species group K), and *Acacia karroo* (Species group L) are among the prominent species.

2.2 *Fuirena pubescens* – *Schoenoplectus corymbosus* Wetland Vegetation Siebert *et al.* 2002

This wetland vegetation is found throughout the Sekhukhuneland on stream banks in valleys, in seepage areas on mountain slopes, and also in wetlands on the mountain plateaus. It is associated with wet, vertic black clay soils (Siebert *et al.* 2002).

The species that distinguish this community are from group H and include *Cliffortia nitidula*, *Cymbopogon nardus*, *Aristida bipartita*, *Schoenoplectus corymbosus**, and *Artemisia afra**. Forbs are prominent and include *Artemisia afra* (Species group H) and *Conyza scabrida* (Species group I), while frequently occurring grasses include *Cymbopogon nardus* (Species group H) *Miscanthus junceus*, and *Andropogon eucomus* (Species group J). The sedges *Schoenoplectus corymbosus* (Species group H) and *Fuirena pubescens* (Species group J) are also common, and so is the succulent *Faucaria bosscheana* (Species group H). Prominent woody species are *Cliffortia nitidula* (Species group H), *Gomphostigma virgatum* (Species group I), and *Acacia karroo* (Species group L).

The vegetation comprises the following communities, described by Siebert (2001):

- *Fuireno pubescentis* - *Schoenetum nigricantis triraphietosum andropogonoidis* Sub-association represents sparsely wooded moist grassland along mountain streams, in rocky areas lying on gentle to moderate midslopes.
- *Andropogono eucomis* - *Fimbristyletum ferrugineae* Association represents wooded grassland along large rivers in valleys, such as the Steelport River. It is found occurring on permanently moist soils, where the habitat is gently sloping and stony.

Table 7.3: Synoptic table of the <i>Acacia karroo</i> wetland communities								
Vegetation type	1	2	3	4	5	6	7	8
Number of relevés	5	3	3	2	3	2	2	4
Community number	1.1	1.2		1.3		2.1	2.2	
Species group A								
<i>Conyza bonariensis</i>	IV	.	.	.	II	.	.	.
<i>Cyperus congestus</i>	IV	.	II	.	.	.	.	II
<i>Brachiaria serrata</i>	III	.	.	.	.	.	.	.
Species group B								
<i>Themeda triandra</i>	I	V	II	.	.	.	.	.
<i>Melinis repens</i>	II	IV	II	.	.	.	.	.
<i>Rhoicissus tridentata</i>	I	IV	II	.	.	.	.	.
<i>Sonchus wilmsii</i>	.	II	IV	.	.	.	.	.
<i>Cyperus esculentus</i>	.	II	IV	.	.	.	.	.
<i>Lippia javanica</i>	.	II	IV	.	.	.	.	II
<i>Tagetes minuta</i>	.	II	IV	.	.	III	.	.
Species group C								
<i>Hemarthria altissima</i>	.	.	.	V	II	.	V	.
<i>Pulicaria scabra</i>	.	.	.	V	II	.	.	.
<i>Paspalum urvillei</i>	.	.	.	V	II	.	.	.
<i>Agrostis lachnantha</i>	.	.	.	III	IV	.	.	.
<i>Juncus effusus</i>	.	.	.	III	IV	III	.	.
<i>Juncus inflexus</i>	.	.	.	III	IV	.	.	.
<i>Pycreus betschuanus</i>	.	.	.	III	II	.	.	.
Species group D								
<i>Phragmites australis</i>	.	V	.	V	IV	.	V	.
<i>Diospyros lycioides</i>	.	IV	IV	III	IV	.	.	.
<i>Combretum erythrophyllum</i>	.	II	II	III	.	.	.	.
Species group E								
<i>Hyparrhenia dregeana</i>	II	IV	II	III	IV	.	.	.
<i>Arundinella nepalensis</i>	III	.	II	III	II	.	.	.
<i>Eragrostis curvula</i>	II	.	IV	.	II	.	.	II
Species group F								
<i>Rhus gerrardii</i>	.	II	.	.	II	V	.	.
<i>Fimbristylis complanata</i>	.	.	.	.	.	V	.	.
<i>Ornithogalum ornithogaloides</i>	.	.	.	.	.	V	.	.
<i>Dicliptera minor</i>	.	.	.	.	.	V	.	.
<i>Dianthus mooiensis</i>	.	.	.	.	.	V	.	.
<i>Digitaria ternata</i>	.	.	.	.	.	V	.	.
<i>Conyza albida</i>	.	.	.	.	II	V	.	.
<i>Setaria nigrirostris</i>	I	.	.	.	.	V	.	.
Species group G								
<i>Eragrostis plana</i>	III	IV	IV	V	V	III	.	.
<i>Sporobolus africanus</i>	II	.	IV	V	.	III	.	.
<i>Bidens pilosa</i>	I	IV	II	.	.	V	.	.
<i>Leersia hexandra</i>	.	II	.	V	II	V	.	.

CHAPTER EIGHT

CONCLUDING REMARKS

Acacia karroo is an ecologically important species with a wide distribution range and tolerance to wide-ranging habitat conditions. Its easy adaptability to differing habitat conditions has enabled it to encroach into areas outside its distribution range, especially onto valuable grazing land in grassland and savanna areas. Its presence in such areas is ecologically detrimental as it has the capacity to completely dominate and transform grassland communities.

Various phytosociological studies carried out over the years have all indicated that a comprehensive synthesis of *Acacia karroo*-dominated vegetation was urgently needed. The present study was therefore initiated with the aim of syntaxonomically classifying all plant communities in South Africa in which *Acacia karroo* is known to occur.

The methods used in the classification were successful, especially the decision to summarise each plant community (whether it be at community, sub-community, or variant level) into a synoptic relevé proved effective. The resultant classification indicates that the majority of these original communities were retained in the final synoptic table (Table 6.1) as distinct associations. In a few cases, some communities were grouped together to form associations. The other result that came out of this classification was that a majority of communities which had originally been classified together in the original phytosociological studies are still grouped together, many into alliances.

However, because the vegetation synthesis was done on such a broad scale, certain limitations were encountered when dealing with such large data sets. Firstly, limited environmental data were available from some studies and this influenced the interpretation of results. Secondly, as Siebert, Bredenkamp and Siebert (2003) note, plant communities of limited distribution are often consolidated into single synrelevés which are often excluded from synoptic tables. The result of this exclusion is that the floristic and environmental diversity of the vegetation types is not accurately indicated by the tables and descriptions. In the present study, although single

synrelevés were often omitted from the tables, the plant communities are included in the descriptions.

Because of the wide distribution range of *Acacia karroo*, and the fact that it occurs over various biomes, the main concern when approaching this classification process was whether *Acacia karroo*-dominated vegetation represents one or more than one class. The results on Table 6.1 indicate that *Acacia karroo*-dominated vegetation can be regarded as one class, for two reasons. Firstly, the usual companion species to *Acacia karroo*, namely *Ziziphus mucronata*, *Gymnosporia buxifolia*, and *Diospyros lycioides* (Species group 109, Table 6.1) are well represented throughout the *Acacia karroo* Class. This is in accordance with Du Preez and Bredenkamp (1991), whose description of the *Acacia karroo* Riparian Thicket is regarded as diagnostic for the *Acacia karroo* Class.

Secondly, the initial concern that there could be too many hierarchical levels if the classification of a single *Acacia karroo* Class was attempted has proven unfounded. The accepted hierarchy of order, alliance, and association was achievable throughout Table 6.1, except in a few cases where certain orders has to be differentiated into sub-orders, and associations into sub-associations.

All in all, the goal of the study was successfully achieved. The goal was to hierarchically classify the various syntaxonomic units of the *Acacia karroo* Class, upon which the units were eventually described.

CHAPTER NINE

A FLORISTIC ANALYSIS OF THE *ACACIA KARROO* CLASS

The ferns and flowering plants of the South African *Acacia karroo* Class are represented by 136 families, 709 genera, and 2 006 species (Table 9.1). The dicots (Magnoliopsida) comprise approximately 75% of the flora in terms of representation in terms of family, genus and species levels in the *Acacia karroo* Class. The monocots (Liliopsida) comprise about 20% of the flora in terms of representation in terms of family, genus and species levels in the *Acacia karroo* Class. The rest (about 5%) is represented by the listed ferns and moss species. No Gymnosperms were found to occur in the habitats dominated by the *Acacia karroo* Class.

Table 9.1 Relationship between the number of families, genera and species present in the *Acacia karroo* Class

TAXA	Families		Genera		Species	
	Number	%	Number	%	Number	%
Bryophyta	2	1,47	2	0,28	2	0,10
Pteridophyta	9	6,61	11	1,55	22	1,09
Liliopsida	24	17,65	163	22,99	456	22,74
Magnoliopsida	101	74,27	533	75,18	1 526	76,07
Total	136	100	709	100	2 006	100

A checklist of all the species recorded during the different surveys that constitute this study is presented. The checklist is arranged alphabetically according to families of bryophytes, pteridophytes and angiosperms. Within each family the genera and species are also arranged alphabetically. Taxon and author names confirm to those of Germishuisen & Meyer (2003). The taxa names of the TURBOVEG database (Hennekens, 1996a), which differs from those of

Germishuisen & Meyer (2003) are listed as synonyms in brackets []. Naturalised exotic taxa (genera or species) are marked with an **asterisk (*)**.

9.1 BRYOPHYTA

AYTONIACEAE

Asterella P.Beauv.

Asterella species

PALLAVICINIACEAE

Pallavicinia Gray

Pallavicinia species

9.2 PTERIDOPHYTA

ADIANTACEAE

Adiantum L.

Adiantum capillus-veneris L.

Cheilanthes Sw.

Cheilanthes species

Cheilanthes eckloniana (Kunze) Mett.

Cheilanthes hirta Sw.

Cheilanthes involuta (Sw.) Schelpe & N.C. Anthony

Cheilanthes parviloba (Sw.) Sw.

Cheilanthes quadripinnata (Forssk.) Kuhn

Cheilanthes viridis (Forssk.) Sw.

Pellaea Link

Pellaea calomelanos (Sw.) Link

Pellaea rufa A.F. Tryon

ANEMIACEAE

Mohria Sw.

Mohria caffrorum (L.) Desv.

ASPLENIACEAE

Asplenium L.

Asplenium adiantum-nigrum L.

Asplenium aethiopicum (Burm. f.) Bech.

Asplenium cordatum (Thunb.) Desv. [*Ceterach cordatum*]

BLECHNACEAE

Blechnum L.

Blechnum australe L.

DENNSTAEDTIACEAE

Pteridium Gled. ex Scop.

Pteridium aquilinum (L.) Kuhn

EQUISETACEAE

Equisetum L.

Equisetum ramosissimum Desf.

MARSILEACEAE

Marsilea L.

Marsilea macrocarpa C.Presl

Marsilea schelpeana Launert

OPHIOGLOSSACEAE**Ophioglossum L.**

Ophioglossum polyphyllum A. Br.

Ophioglossum reticulatum L.

SELAGINELLACEAE**Selaginella P. Beauv.**

Selaginella kraussiana (Kunze) A. Br.

9.3 MAGNOLIOPHYTA**9.3.1 LILIOPSIDA****AGAPANTHACEAE****Agapanthus L'Hér.**

Agapanthus inapertus P. Beauv.

ALLIACEAE**Tulbaghia L.**

Tulbaghia species

Tulbaghia acutiloba Harv.

Tulbaghia alliacea L. f.

Tulbaghia leucantha Baker

AMARYLLIDACEAE**Ammocharis Herb.**

Ammocharis coranica (Ker Gawl.) Herb.

Boophone Herb.

Boophone disticha (L. f.) Herb.

Brunsvigia Heist.*Brunsvigia* species*Brunsvigia natalensis* Baker**Crinum** L.*Crinum bulbispermum* (Burm. f.) Milne-Redh. & Schweick.*Crinum graminicola* I. Verd.**Gethyllis** L.*Gethyllis spiralis* (Thunb.) Thunb.**Haemanthus** L.*Haemanthus humilis* Jacq.**Nerine** Herb.*Nerine laticoma* (Ker Gawl.) T. Durand & Schinz**Scadoxus** Raf.*Scadoxus* species*Scadoxus puniceus* (L.) Friis & Nordal**ANTHERICACEAE****Chlorophytum** Ker Gawl.*Chlorophytum bowkeri* Baker**ARACEAE****Zantedeschia** Spreng.*Zantedeschia aethiopica* (L.) Spreng.*Zantedeschia albomaculata* (Hook.) Baill.**ASPARAGACEAE****Asparagus** L.*Asparagus* species*Asparagus aethiopicus* L.*Asparagus africanus* Lam.

Asparagus aspergillus Jessop
Asparagus capensis L.
Asparagus cooperi Baker
Asparagus exuvialis Burch.
Asparagus glaucus Kies
Asparagus laricinus Burch.
Asparagus racemosus Willd.
Asparagus retrofractus L.
Asparagus rigidus Jessop
Asparagus rubicundus P.J.Berg.
Asparagus setaceus (Kunth) Jessop
Asparagus striatus (L. f.) Thunb.
Asparagus suaveolens Burch.
Asparagus virgatus Baker

ASPHODELACEAE

Aloe L.

Aloe species
Aloe arborescens Mill.
Aloe barberae T.-Dyer
Aloe broomii Schönland
Aloe cryptopoda Baker
Aloe dabenorisana van Jaarsveld
Aloe ecklonis Salm-Dyck [*Aloe boylei* Baker]
Aloe ferox Mill.
Aloe globuligemma Pole Evans
Aloe grandidentata Salm-Dyck
Aloe greatheadii Schönland
Aloe hereroensis Engl.
Aloe maculata All.
Aloe marlothii A.Berger

Aloe parvibracteata Schönland [*Aloe burgersfortensis* Reynolds]

Aloe pretoriensis Pole Evans

Aloe speciosa Baker

Aloe zebrina Bak. [*Aloe ammophila* Reynolds, *Aloe transvaalensis* Kuntze]

Bulbine Wolf

Bulbine species

Bulbine abyssinica A. Rich.

Bulbine capitata Poelln.

Bulbine frutescens (L.) Willd.

Bulbine narcissifolia Salm-Dyck

Haworthia Duval

Haworthia arachnoidea (L.) Duval

Kniphofia Moench

Kniphofia species

Kniphofia porphyrantha Baker

Trachyandra Kunth

Trachyandra asperata Kunth

Trachyandra laxa (N.E. Br.) Oberm.

Trachyandra reflexipilosa (Kuntze) Oberm.

Trachyandra saltii (Baker) Oberm.

COLCHICACEAE

Androcymbium Willd.

Androcymbium burkei Baker

Androcymbium melanthiodes Willd.

Littonia Hook.

Littonia modesta Hook.

Ornithoglossum Salisb.

Ornithoglossum species

Ornithoglossum viride (L. f.) Aiton

COMMELINACEAE**Commelina** L.

- Commelina* species
Commelina africana L.
Commelina benghalensis L.
Commelina diffusa Burm.
Commelina eckloniana Kunth
Commelina erecta L.
Commelina subulata Roth

Cyanotis D. Don

- Cyanotis pachyrrhiza* Oberm.
Cyanotis speciosa (L. f.) Hassk.

CYPERACEAE**Abildgaardia** Vahl

- Abildgaardia* species
Abildgaardia ovata (Burm. f.) Kral

Bolboschoenus (Asch.) Palla

- Bolboschoenus maritimus* (L.) Palla

Bulbostylis Kunth

- Bulbostylis burchellii* (Ficalho & Hiern) C.B. Clarke
Bulbostylis hispidula (Vahl) R.W. Haines
Bulbostylis oritrephes (Ridl.) C.B. Clarke

Carex L.

- Carex austro-africana* (Kük.) Raymond
Carex glomerabilis Krecz. [*Carex schlechteri* Nelmes]

Coleochloa Gilly

- Coleochloa setifera* (Ridl.) Gilly

Cyperus L.

- Cyperus* species
Cyperus albostriatus Schrad.

- Cyperus capensis* (Steud.) Endl. [*Mariscus capensis* (Steud.) Schrad]
- Cyperus congestus* Vahl [*Mariscus congestus* Vahl]
- Cyperus cyperoides* (L.) Kuntze subsp. *cyperoides* [*Mariscus sumatrensis* (Retz.) J. Raynal]
- Cyperus cyperoides* (L.) Kuntze subsp. *flavus* Lye [*Mariscus cylindristachyus* Steud.]
- Cyperus denudatus* L. f.
- Cyperus difformis* L.
- Cyperus esculentus* L.
- Cyperus fastigiatus* Rottb.
- Cyperus indecorus* Kunth var. *indecorus* [*Mariscus indecorus* (Kunth) Podlech]
- Cyperus indecorus* Kunth var. *decurvatus* (C.B. Clarke) Kük. [*Mariscus rehmannianus* C.B. Clarke]
- Cyperus leptocladus* Kunth
- Cyperus longus* L.
- Cyperus margaritaceus* Vahl
- Cyperus marginatus* Thunb.
- Cyperus obtusiflorus* Vahl
- Cyperus rigidifolius* Steud.
- Cyperus rotundus* L.
- Cyperus rubicundus* Vahl
- Cyperus rupestris* Kunth
- Cyperus sexangularis* Nees
- Cyperus sphaerospermus* Schrad.
- Cyperus squarrosus* L. [*Mariscus squarrosus* (L.) C.B. Clarke]
- Cyperus textilis* Thunb.
- Cyperus usitatus* Burch.

Eleocharis R. Br.

Eleocharis dregeana Steud. [*Eleocharis palustris*]

Ficinia Schrad.

Ficinia nigrescens (Schrad.) J. Raynal

Fimbristylis Vahl

Fimbristylis complanata (Retz.) Link

Fimbristylis ferruginea (L.) Vahl

Fuirena Rottb.

Fuirena pachyrrhiza Ridl.

Fuirena pubescens (Poir.) Kunth

Kyllinga Rottb.

Kyllinga alba Nees

Kyllinga erecta Schumach.

Mariscus Vahl

Mariscus species

Mariscus dregeanus Kunth

Pseudoschoenus (C.B. Clarke) Oteng-Yeb.

Pseudoschoenus inanis (Thunb.) Oteng-Yeb [*Scirpus inanis* (Thunb.) Steud.]

Pycreus P.Beauv.

Pycreus betschuanus (Boeck.) C.B. Clarke

Pycreus chrysanthus (Boeck.) C.B. Clarke

Pycreus permutatus (Boeck.) Napper [*Pycreus oakfortensis* C.B. Clarke]

Pycreus polystachyos (Rottb.) P. Beauv. var. *polystachyos*

Rhynchospora Vahl

Rhynchospora brownii Roem. & Schult.

Schoenoplectus (Rchb.) Palla

Schoenoplectus corymbosus (Roem. & Schult.) J. Raynal

Schoenoplectus decipiens (Nees) J. Raynal

Schoenoplectus muricinux (C.B. Clarke) J. Raynal

Schoenoplectus paludicola (Kunth) J. Raynal

Schoenoxiphium Nees

Schoenoxiphium sparteum (Wahlenb.) C.B. Clarke

Scirpus L.

Scirpus falsus C.B. Clarke

Scirpus varius C.B. Clarke

DIOSCOREACEAE

Dioscorea L.*Dioscorea sylvatica* Eckl.**DRACAENACEAE****Sansevieria Thunb.***Sansevieria* species*Sansevieria aethiopica* Thunb.*Sansevieria hyacinthoides* (L.) Druce**ERIOSPERMACEAE****Eriospermum Jacq. ex Willd.***Eriospermum* species*Eriospermum cooperi* Baker*Eriospermum corymbosum* Baker**HYACINTHACEAE****Albuca L.***Albuca* species*Albuca setosa* Jacq.**Dipcadi Medik.***Dipcadi* species*Dipcadi ciliare* (Zeyh. ex Harv.) Baker*Dipcadi glaucum* (Ker Gawl.) Baker*Dipcadi papillatum* Oberm.*Dipcadi viride* (L.) Moench**Drimia Jacq.***Drimia altissima* (L. f.) Ker Gawl [*Urginea epigea* R.A. Dyer]*Drimia elata* Jacq.*Drimia sanguinea* (Schinz) Jessop [*Urginea sanguinea* Schinz]**Drimiopsis Lindl. & Paxton**

Drimiopsis burkei Baker

Eucomis L'Hér.

Eucomis autumnalis (Mill.) Chitt.

Lachenalia J. Jacq. ex Murray

Lachenalia variegata W.F. Barker

Ledebouria Roth

Ledebouria species

Ledebouria cooperi (Hook. f.) Jessop

Ledebouria floribunda (Baker) Jessop

Ledebouria graminifolia (Baker) Jessop

Ledebouria marginata (Baker) Jessop

Ledebouria ovalifolia (Schrad.) Jessop

Ledebouria ovatifolia (Baker) Jessop

Ledebouria revoluta (L. f.) Jessop

Ledebouria viscosa Jessop

Massonia Thunb. ex Houtt.

Massonia jasminiflora Burch. ex Baker

Merwillia Speta

Merwillia plumbea (Lindl.) Speta [*Scilla natalensis* Planch.]

Ornithogalum L.

Ornithogalum glandulosum Oberm.

Ornithogalum flexuosum (Thunb.) U. Müll.-Doblies & D. Müll.-Doblies [*Ornithogalum ornithogaloides* (Kunth) Oberm.]

Ornithogalum seineri (Engl. & K. Krause) Oberm.

Schizocarpus van der Merwe

Schizocarpus species [*Scilla* species]

Schizocarpus nervosus (Burch.) van der Merwe [*Scilla nervosa* (Burch.) Jessop]

Whiteheadia Harv.

Whiteheadia species

HYPOXIDACEAE**Hypoxis L.**

- Hypoxis* species
- Hypoxis acuminata* Baker
- Hypoxis argentea* Harv. ex Baker
- Hypoxis galpinii* Baker
- Hypoxis hemerocallidea* Fisch. Mey & Ave-Lall.
- Hypoxis iridifolia* Baker
- Hypoxis multiceps* Buchinger ex Baker
- Hypoxis oblonga* Nel
- Hypoxis rigidula* Baker

IRIDACEAE**Aristea Aiton**

- Aristea woodii* N.E. Br.

Babiana Ker Gawl.

- Babiana hypogea* Burch.
- Babiana salteri* G.J. Lewis

Dierama K. Koch

- Dierama* species

Duthiastrum M.P. de Vos

- Duthiastrum linifolium* (E.Phillips) M.P.de Vos

Freesia Klatt

- Freesia laxa* (Thunb.) Goldblatt & J.C. Manning [*Anomatheca laxa* (Thunb) Goldblatt]

Gladiolus L.

- Gladiolus* species
- Gladiolus crassifolius* Baker
- Gladiolus ecklonii* Lehm.
- Gladiolus elliotii* Baker
- Gladiolus longicollis* Baker
- Gladiolus permeabilis* D. Delaroche

Gladiolus woodii Baker

Moraea Mill.

Moraea species

Moraea brevistyla (Goldblatt) Goldblatt

Moraea natalensis Baker

Moraea pallida (Baker) Goldblatt [*Homeria pallida* Baker]

Moraea polystachya (Thunb.) Ker Gawl.

Moraea simulans Baker

Moraea spathulata (L. f.) Klatt

Moraea thomsonii Baker

Tritonia Ker Gawl.

Tritonia nelsonii Baker.

Watsonia Mill.

Watsonia lepida N.E. Br.

JUNCACEAE

Juncus L.

Juncus effusus L.

Juncus exsertus Buchenau

Juncus inflexus L.

Juncus rigidus Desf.

ORCHIDACEAE

Bonatea Willd.

Bonatea speciosa (L. f.) Willd.

Brachycorythis Lindl.

Brachycorythis tenuior Rchb. f.

Eulophia R. Br. ex Lindl.

Eulophia foliosa (Lindl.) Bolus

Eulophia ovalis Lindl.

Satyrium Sw.

Satyrium longicauda Lindl.

POACEAE

Agrostis L.

Agrostis lachnantha Nees

Alloteropsis J.Presl

Alloteropsis semialata (R. Br.) Hitchc.

Andropogon L.

Andropogon species

Andropogon appendiculatus Nees

Andropogon chinensis (Nees) Merr.

Andropogon eucomus Nees

Andropogon schirensis A. Rich.

Antephora Schreb.

Antephora argentea Gooss.

Antephora pubescens Nees

Aristida L.

Aristida species

Aristida adscensionis L.

Aristida aequiglumis Hack.

Aristida bipartita (Nees) Trin. & Rupr.

Aristida canescens Henrard

Aristida congesta Roem. & Schult.

Aristida diffusa Trin.

Aristida junciformis Trin. & Rupr.

Aristida meridionalis Henrard

Aristida mollissima Pilg.

Aristida rhiniochloa Hochst.

Aristida scabrivalvis Hack.

Aristida sciurus Stapf

Aristida stipitata Hack.

Aristida transvaalensis Henrard

Aristida vestita Thunb.

Arundinella Raddi

Arundinella nepalensis Trin.

Bewsia Gooss.

Bewsia biflora (Hack.) Gooss.

Bothriochloa Kuntze

Bothriochloa bladhii (Retz.) S.T. Blake

Bothriochloa insculpta (A. Rich.) A. Camus

Bothriochloa radicans (Lehm.) A. Camus

Brachiaria (Trin.) Griseb.

Brachiaria species

Brachiaria brizantha (A. Rich.) Stapf

Brachiaria deflexa (Schumach.) C.E. Hubb. ex Robyns

Brachiaria eruciformis (Sm.) Grieseb.

Brachiaria marlothii (Hack.) Stent

Brachiaria nigropedata (Ficalho & Hiern) Stapf

Brachiaria serrata (Thunb.) Stapf

***Briza** L.

Briza minor L.

Bromus L.

Bromus **catharticus* Vahl

Bromus leptoclados Nees

Cenchrus L.

Cenchrus ciliaris L.

Centropodia Rchb.

Centropodia glauca (Nees) Cope

Chaetobromus Nees

Chaetobromus involucratus (Schrad.) Nees

Chloris Sw.

Chloris gayana Kunth

Chloris pycnothrix Trin.

Chloris virgata Sw.

Chrysopogon Trin.

Chrysopogon serrulatus Trin.

Cladoraphis Franch.

Cladoraphis cyperoides (Thunb.) S.M. Phillips

Coelachyrum Hochst. & Nees

Coelachyrum yemenicum (Schweinf.) S.M. Phillips

Ctenium Panz.

Ctenium concinnum Nees

Cymbopogon Spreng.

Cymbopogon species

Cymbopogon excavatus (Hochst.) Stapf ex Burtt Davy

Cymbopogon marginatus (Steud.) Stapf ex Burtt Davy

Cymbopogon nardus (L.) Rendle [*Cymbopogon validus* (Stapf) Stapf ex Burtt Davy]

Cymbopogon plurinodis (K. Schum.) C.E. Hubb [*Cymbopogon pospischillii* (Stapf) Stapf ex Burtt Davy]

Cynodon Rich.

Cynodon bradleyi Stent

Cynodon dactylon (L.) Pers.

Cynodon hirsutus Stent

Cynodon incompletus Nees

Dactyloctenium Willd.

Dactyloctenium aegyptium (L.) Willd.

Dichanthium Willemet

Dichanthium annulatum (Forssk.) Stapf

Digitaria Haller

Digitaria argyrograpta (Nees) Stapf

Digitaria brazzae (Franch.) Stapf

Digitaria diagonalis (Nees) Stapf

Digitaria eriantha Steud.

Digitaria eylesii C.E. Hubb.

Digitaria monodactyla (Nees) Stapf

*Digitaria *sanguinalis* (L.) Scop.

Digitaria ternata (A. Rich.) Stapf

Digitaria tricholaenoides Stapf

Digitaria velutina (Forssk.) P. Beauv.

Diheteropogon (Hack.) Stapf

Diheteropogon amplectens (Nees) Clayton

Diheteropogon filifolius (Nees) Clayton

Dinebra Jacq.

Dinebra retroflexa (Vahl) Panz.

Echinochloa P. Beauv.

Echinochloa colona (L.) Link

Echinochloa crus-galli (L.) P. Beauv.

Echinochloa haploclada (Stapf) Stapf

Echinochloa holubii (Stapf) Stapf

Echinochloa jubata Stapf

Echinochloa stagnina (Retz.) P. Beauv.

Ehrharta Thunb.

Ehrharta species

Ehrharta calycina Sm.

Ehrharta erecta Lam.

Ehrharta melicoides Thunb.

Eleusine Gaertn.

Eleusine coracana (L.) Gaertn.

Elionurus Kunth ex Willd.

Elionurus muticus (Spreng.) Kunth

Enneapogon Desv. ex P. Beauv.

Enneapogon cenchroides (Roem. & Schult.) C.E. Hubb.

Enneapogon desvauxii P. Beauv.

Enneapogon scoparius Stapf

Enteropogon Nees

Enteropogon macrostachyus (A. Rich.) Benth.

Eragrostis Wolf

Eragrostis species

Eragrostis acraea De Winter

Eragrostis aspera (Jacq.) Nees

Eragrostis biflora Hack. ex Schinz

Eragrostis capensis (Thunb.) Trin.

Eragrostis chloromelas Steud.

Eragrostis curvula (Schrad.) Nees

Eragrostis echinochloidea Stapf

Eragrostis gummiflua Nees

Eragrostis heteromera Stapf

Eragrostis inamoena K. Schum.

Eragrostis lehmanniana Nees

Eragrostis micrantha Hack.

Eragrostis nindensis Ficalho & Hiern

Eragrostis obtusa Munro ex Ficalho & Hiern

Eragrostis patentipilosa Hack [*Eragrostis pseudosclerantha* Chiov.]

Eragrostis pallens Hack.

Eragrostis plana Nees

Eragrostis planiculmis Nees

Eragrostis porosa Nees

Eragrostis racemosa (Thunb.) Steud.

Eragrostis remotiflora De Winter

Eragrostis rigidior Pilg.

Eragrostis rotifer Rendle

Eragrostis sclerantha Nees

Eragrostis stapfii De Winter

Eragrostis superba Peyr.

Eragrostis trichophora Coss. & Durieu

Eragrostis truncata Hack.

Eragrostis viscosa (Retz.) Trin.

Eriochloa Kunth

Eriochloa species

Eriochloa parvispiculata C.E. Hubb.

Eriochloa stapfiana Clayton

Eulalia Kunth

Eulalia villosa (Thunb.) Nees

Eustachys Desv.

Eustachys paspaloides (Vahl) Lanza & Mattei

Fingerhuthia Nees

Fingerhuthia africana Lehm.

Fingerhuthia sesleriiformis Nees

Harpochloa Kunth

Harpochloa falx (L. f.) Kuntze

Helictotrichon Besser

Helictotrichon turgidulum (Stapf) Schweick.

Hemarthria R. Br.

Hemarthria altissima (Poir.) Stapf & C.E. Hubb.

Heteropogon Pers.

Heteropogon contortus (L.) Roem. & Schult.

Hyparrhenia E. Fourn.

Hyparrhenia anamesa Clayton

Hyparrhenia cymbaria (L.) Stapf ex Stent

Hyparrhenia dregeana (Nees) Stapf

Hyparrhenia filipendula (Hochst.) Stapf

Hyparrhenia hirta (L.) Stapf

Hyparrhenia rufa (Nees) Stapf

Hyparrhenia tamba (Steud.) Stapf

Hyperthelia Clayton

Hyperthelia dissoluta (Nees ex Steud.) Clayton

Imperata Cirillo*Imperata cylindrica* (L.) Raeusch.**Ischaemum** L.*Ischaemum fasciculatum* Brongn.**Koeleria** Pers.*Koeleria capensis* (Steud.) Nees**Leersia** Sw.*Leersia hexandra* Sw.**Leptochloa** P. Beauv.*Leptochloa fusca* (L.) Kunth [*Diplachne fusca* (L.) P. Beauv. ex Roem. & Schult.]**Lintonia** Stapf*Lintonia nutans* Stapf**Loudetia** Hochst ex Steud.*Loudetia flavida* (Stapf) C.E. Hubb.*Loudetia simplex* (Nees) C.E. Hubb.**Megaloprotachne** C.E. Hubb.*Megaloprotachne albescens* C.E. Hubb.**Melica** L.*Melica decumbens* Thunb.*Melica racemosa* Thunb.**Melinis** P. Beauv.*Melinis nerviglumis* (Franch.) Zizka*Melinis repens* (Willd.) Zizka**Merxmuellera** Conert*Merxmuellera disticha* (Nees) Conert**Microchloa** R. Br.*Microchloa caffra* Nees**Miscanthus** Andersson*Miscanthus capensis* (Nees) Andersson*Miscanthus junceus* (Stapf) Pilg.**Monocymbium** Stapf

Monocymbium cerasiiforme (Nees) Stapf

Mosdenia Stent

Mosdenia leptostachys (Ficalho & Hiern) Clayton

Oropetium Trin.

Oropetium capense Stapf

Panicum L.

Panicum coloratum L.

Panicum deustum Thunb.

Panicum dregeanum Nees

Panicum ecklonii Nees

Panicum infestum Peters

Panicum kalaharensis Mez

Panicum maximum Jacq.

Panicum natalense Hochst.

Panicum repentellum Napper

Panicum schinzii Hack.

Panicum stapfianum Fourc.

Paspalum L.

*Paspalum *dilatatum* Poir.

Paspalum distichum L.

*Paspalum *notatum* Flügge

Paspalum scrobiculatum L.

*Paspalum *urvillei* Steud.

Pennisetum Rich.

Pennisetum macrourum Trin.

Pennisetum sphecelatum (Nees) T. Durand & Schinz

Perotis Aiton

Perotis patens Gand.

Phragmites Adans.

Phragmites australis (Cav.) Steud.

Poa L.*Poa* species*Poa *annua* L.**Pogonarthria** Stapf*Pogonarthria squarrosa* (Roem. & Schult.) Pilg.**Schismus** P. Beauv.*Schismus barbatus* (Loefl. ex L.) Thell.**Schizachyrium** Nees*Schizachyrium jeffreysii* (Hack.) Stapf*Schizachyrium sanguineum* (Retz.) Alston**Schmidtia** Steud. ex J.A. Schmidt*Schmidtia kalihariensis* Stent*Schmidtia pappophoroides* Steud.**Setaria** P. Beauv.*Setaria* species*Setaria incrassata* (Hochst.) Hack.*Setaria lindenbergiana* (Nees) Stapf*Setaria megaphylla* (Steud.) Dur. & Schinz*Setaria nigrirostris* (Nees) Dur. & Schinz*Setaria pumila* (Poir.) Roem. & Schult. [*Setaria pallide-fusca* (Schumach.) Stapf & C. E. Hubb.]*Setaria sphacelata* (Schumach.) Moss*Setaria sphacelata* (Schumach.) Moss var. *sphacelata* [*Setaria neglecta* De Wit]*Setaria verticillata* (L.) P. Beauv.**Sorghum** Moench*Sorghum* species*Sorghum bicolor* (L.) Moench*Sorghum versicolor* Andersson

Sporobolus R. Br.

- Sporobolus* species
Sporobolus africanus (Poir.) Robyns & Tournay
Sporobolus conrathii Chiov.
Sporobolus discosporus Nees
Sporobolus festivus A. Rich.
Sporobolus fimbriatus (Trin.) Nees
Sporobolus ioclados (Trin.) Nees
Sporobolus ludwigii Hochst.
Sporobolus nitens Stent
Sporobolus pectinatus Hack.
Sporobolus pyramidalis P. Beauv.
Sporobolus stapfianus Gand.

Stipa L.

- Stipa dregeana* Steud.

Stipagrostis Nees

- Stipagrostis ciliata* (Desf.) De Winter
Stipagrostis namaquensis (Nees) De Winter
Stipagrostis obtusa (Delile) Nees
Stipagrostis uniplumis (Licht.) De Winter

Tetrachne Nees

- Tetrachne dregei* Nees

Themeda Forssk.

- Themeda triandra* Forssk.

Trachypogon Nees

- Trachypogon* species
Trachypogon spicatus (L. f.) Kuntze

Tragus Haller

- Tragus berteronianus* Schult.
Tragus koelerioides Asch.

Tragus racemosus (L.) All.

Tricholaena Schrad. in Schult.

Tricholaena monachne (Trin.) Stapf & C.E. Hubb.

Trichoneura Andersson

Trichoneura grandiglumis (Nees) Ekman

Trichopteryx Nees

Trichopteryx dregeana Nees

Triraphis R. Br.

Triraphis andropogonoides (Steud.) E. Phillips

Triraphis ramosissima Hack.

Tristachya Nees

Tristachya biseriata Stapf

Tristachya leucothrix Nees

Tristachya rehmannii Hack.

Urelytrum Hack.

Urelytrum agropyroides (Hack.) Hack.

Urochloa P. Beauv.

Urochloa brachyura (Hack.) Stapf

Urochloa mosambicensis (Hack.) Dandy

Urochloa panicoides P. Beauv.

PONTEDERIACEAE

Eichhornia Kunth

*Eichhornia *crassipes* (Mart.) Solms

POTAMOGETONACEAE

Potamogeton L.

Potamogeton thunbergii Cham. & Schldl.

RESTIONACEAE

Restio Rottb.

Restio stokoei Pillans

TYPHACEAE

Typha L.

Typha capensis (Rohrb.) N.E. Br.

VELLOZIACEAE

Xerophyta Juss.

Xerophyta humilis (Baker) T. Durand & Schinz

Xerophyta retinervis Baker

9.3.2 MAGNOLIOPSIDA

ACANTHACEAE

Adhatoda Mill.

Adhatoda densiflora (Hochst.) J.C. Manning

Barleria L.

Barleria species

Barleria elegans S. Moore ex C.B. Clarke

Barleria macrostegia Nees

Barleria obtusa Nees

Barleria pretoriensis C.B. Clarke

Barleria repens Nees

Barleria rigida Nees

Barleria senensis Klotzsch

Blepharis Juss.

Blepharis species

Blepharis angusta (Nees) T. Anderson

Blepharis capensis (L. f.) Pers.

Blepharis diversispina (Nees) C.B. Clarke

Blepharis integrifolia (L. f.) E. Mey. ex Schinz

Blepharis longispica C.B. Clarke

Blepharis maderaspatensis (L.) Roth

Blepharis marginata (Nees) C.B. Clarke

Blepharis mitrata C.B. Clarke [*Blepharis villosa* (Nees) C.B. Clarke]

Blepharis subvolubilis C.B. Clarke

Blepharis transvaalensis Schinz

Chaetacanthus Nees

Chaetacanthus burchellii Nees

Chaetacanthus costatus Nees

Chaetacanthus setiger (Pers.) Lindl.

Crabbea Harv.

Crabbea species

Crabbea acaulis N.E. Br.

Crabbea angustifolia Nees

Crabbea hirsuta Harv.

Crabbea nana Nees

Crabbea ovalifolia Ficalho & Hiern

Dicliptera Juss.

Dicliptera clinopodia Nees

Dicliptera fruticosa K. Balkwill

Dicliptera minor C.B. Clarke

Dyschoriste Nees

Dyschoriste fischeri Lindau

Dyschoriste transvaalensis C.B. Clarke

Glossochilus Nees

Glossochilus burchellii Nees

Hypoestes Sol. ex R. Br.

Hypoestes aristata (Vahl) Sol. ex Roem. & Schult.

Hypoestes forskalii (Vahl) R. Br.

Isoglossa Oerst.*Isoglossa eckloniana* (Nees) Lindau*Isoglossa grantii* C.B. Clarke**Justicia** L.*Justicia* species*Justicia anagalloides* (Nees) T. Anderson*Justicia betonica* L.*Justicia flava* (Vahl) Vahl*Justicia orchioides* L. f.*Justicia protracta* (Nees) T. Anderson**Lepidagathis** Willd.*Lepidagathis scabra* C.B. Clarke**Monechma** Hochst.*Monechma debile* (Forssk.) Nees*Monechma divaricatum* (Nees) C.B. Clarke*Monechma genistifolium* (Engl.) C.B. Clarke*Monechma incanum* (Nees) C.B. Clarke**Petalidium** Nees*Petalidium oblongifolium* C.B. Clarke**Pseuderanthemum** Radlk.*Pseuderanthemum subviscosum* (C.B. Clarke) Stapf**Rhinacanthus** Nees*Rhinacanthus xerophilus* A. Meeuse**Ruellia** L.*Ruellia* species*Ruellia cordata* Thunb.*Ruellia patula* Jacq.**Thunbergia** Retz.*Thunbergia atriplicifolia* E. Mey. ex Nees*Thunbergia neglecta* Sond.

AIZOACEAE**Aizoon L.**

Aizoon asbestinum Schltr.

Aizoon glinoides L. f.

Aizoon rigidum L. f.

Galenia L.

Galenia africana L.

Galenia sarcophylla Fenzl

Galenia secunda (L. f.) Sond.

Plinthus Fenzl

Plinthus karooicus I. Verd.

Plinthus sericeus Pax

Tetragonia L.

Tetragonia fruticosa L.

Trianthema L.

Trianthema triquetra Rottler ex Willd.

AMARANTHACEAE**Achyranthes L.**

*Achyranthes *aspera* L.

Achyropsis (Moq.) Hook. f.

Achyropsis avicularis (E. Mey. ex Moq.) J. Cooke & C.H. Wright

Aerva Forssk.

Aerva leucura Moq.

Alternanthera Forssk.

*Alternanthera *nodiflora* R. Br.

*Alternanthera *pungens* Kunth

Amaranthus L.

*Amaranthus *deflexus* L.

*Amaranthus *hybridus* L.

Amaranthus thunbergii Moq.

Centrostachys Wall.

Centrostachys aquatica (R. Br.) Wall. ex Moq.

Cyathula Blume

Cyathula species

Cyathula cylindrica Moq.

Cyathula lanceolata Schinz

Cyathula uncinulata (Schrad.) Schinz

***Gomphrena** L.

Gomphrena celosioides Mart.

***Guilleminea** Kunth

Guilleminea densa (Willd. ex Roem. & Schult.) Moq.

Hermbstaedtia Rchb.

Hermbstaedtia fleckii (Schinz) Baker & C.B. Clarke

Hermbstaedtia linearis Schinz

Hermbstaedtia odorata (Burch.) T. Cooke

Kyphocarpa (Fenzl) Lopr.

Kyphocarpa angustifolia (Moq.) Lopr.

Pupalia Juss.

Pupalia lappacea (L.) Juss.

Sericocoma Fenzl

Sericocoma avolans Fenzl

Sericorema (Hook. f.) Lopr.

Sericorema remotiflora (Hook. f.) Lopr.

ANACARDIACEAE

Lannea A. Rich.

Lannea discolor (Sond.) Engl.

Lannea edulis (Sond.) Engl.

Ozoroa Delile

Ozoroa species

Ozoroa paniculosa (Sond.) R. Fern. & A. Fern.

Ozoroa sphaerocarpa R. Fern. & A. Fern.

Rhus L.

Rhus species

Rhus batophylla Codd

Rhus burchellii Sond. ex Engl.

Rhus chirindensis Baker f.

Rhus ciliata Licht. ex Schult.

Rhus dentata Thunb.

Rhus discolor E. Mey. ex Sond.

Rhus dregeana Sond.

Rhus engleri Britten

Rhus erosa Thunb.

Rhus gerrardii (Harv. ex Engl.) Diels

Rhus glauca Thunb.

Rhus gueinzii Sond.

Rhus horrida Eckl. & Zeyh.

Rhus incisa L. f.

Rhus keetii Schönland

Rhus lancea L. f.

Rhus leptodictya Diels

Rhus longispina Eckl. & Zeyh.

Rhus lucida L.

Rhus magalismontana Sond.

Rhus pallens Eckl. & Zeyh.

Rhus pentheri Zahlbr.

Rhus pondoensis Schönland

Rhus pyroides Burch.

Rhus rehmanniana Engl.

Rhus rigida Mill.

Rhus rogersii Schönland

Rhus tenuinervis Engl.

Rhus tridactyla Burch.

Rhus tumulicola S. Moore

Rhus undulata Jacq.

Rhus zeyheri Sond.

***Schinus** L.

Schinus molle L.

Sclerocarya Hochst.

Sclerocarya birrea (A. Rich.) Hochst.

ANNONACEAE

Annona L.

Annona senegalensis Pers.

APIACEAE

Alepidea F. de la Roche

Alepidea longifolia E. Mey.

Berula J.W.D. Koch

Berula erecta (Huds.) Coville

***Ciclospermum** Lag.

Ciclospermum leptophyllum (Pers.) Sprague

Conium L.

Conium chaerophylloides (Thunb.) Sond.

Deverra DC.

Deverra burchellii (DC.) Eckl. & Zeyh.

Deverra denudata (Viv.) Pfisterer & Podlech

Heteromorpha Cham. & Schtdl.

Heteromorpha arborescens (Thunb.) Cham. & Schtdl.

Peucedanum L.

Peucedanum species

Peucedanum magalismontanum Sond.

Pimpinella L.

Pimpinella transvaalensis H. Wolff

Sium L.

Sium repandum Welw. ex Hiern

APOCYNACEAE**Acokanthera G. Don**

Acokanthera oppositifolia (Lam.) Codd

Ancylobotrys Pierre

Ancylobotrys capensis (Oliv.) Pichon

***Araujia Brot.**

Araujia sericifera Brot.

Asclepias L.

Asclepias species

Asclepias adscendens (Schltr.) Schltr.

Asclepias albens (E. Mey.) Schldt. [*Asclepias affinis* (Schltr.) Schltr.]

Asclepias stellifera Schltr.

Aspidoglossum E. Mey.

Aspidoglossum lamellatum (Schltr.) Kupicha

Carissa L.

Carissa bispinosa (L.) Desf. ex Brenan [*Carissa haematocarpa* (Eckl.) A. DC.]

Carissa macrocarpa (Eckl.) A. DC.

Cryptolepis R.Br.

Cryptolepis oblongifolia (Meisn.) Schltr [*Ectadiopsis oblongifolia* (Meisn.) Benth. ex Schltr.]

Diplorhynchus Welw. ex Ficalho & Hiern

Diplorhynchus condylocarpon (Müll. Arg.) Pichon

Huernia R. Br.

Huernia hystrix (Hook. f.) N.E. Br.

Piaranthus R. Br.

Piaranthus decipiens (N.E. Br.) [*Huerniopsis decipiens* N.E. Br.]

Pachypodium Lindl.

Pachypodium succulentum (L. f.) Sweet

Gomphocarpus R. Br.

Gomphocarpus fruticosus (L.) Aiton f. subsp. *decipiens* (N.E. Br.) Goyder & Nicholas
[*Asclepias decipiens* N.E. Br.]

Gomphocarpus fruticosus (L.) Aiton f. subsp. *fruticosus* [*Asclepias fruticosa* L.]

Orbea Haw.

Orbea cooperi (N.E. Br.) L.C. Leach

Orbea lutea (N.E. Br.) L.C. Leach [*Orbeopsis lutea* (N.E. Br.) L.C. Leach]

Orthanthera Wight

Orthanthera jasminiflora (Decne.) Schinz

Pachycarpus E. Mey.

Pachycarpus schinzianus (Schltr.) N.E. Br.

Pentarrhinum E. Mey.

Pentarrhinum insipidum E. Mey.

Pergularia L.

Pergularia daemia (Forssk.) Chiov.

Raphionacme Harv.

Raphionacme velutina Schltr. [*Raphionacme burkei* N.E. Br.]

Raphionacme galpinii Schltr.

Raphionacme hirsuta (E. Mey.) R.A. Dyer ex E. Phillips

Raphionacme procumbens Schltr.

Riocreuxia Decne.

Riocreuxia picta Schltr.

Sarcostemma R. Br.

Sarcostemma viminalis (L.) R. Br.

Secamone R. Br.

Secamone alpini Schult.

Secamone filiformis (L. f.) J.H. Ross

Secamone parvifolia (Oliv.) Bullock

Stapelia L.

Stapelia gigantea N.E. Br.

Tridentea Haw.

Tridentea gemmiflora (Mass.) Haw.

Tylophora R. Br.

Tylophora anomala N.E. Br.

Xysmalobium R. Br.

Xysmalobium undulatum (L.) Ait. f.

ARALIACEAE**Cussonia Thunb.**

Cussonia natalensis Sond.

Cussonia paniculata Eckl. & Zeyh.

Cussonia spicata Thunb.

Cussonia transvaalensis Reyneke

ASTERACEAE***Acanthospermum Schrank**

Acanthospermum australe (Loefl.) Kuntze

Amellus L.

Amellus strigosus (Thunb.) Less.

Amphiglossa DC.

Amphiglossa triflora DC. [*Pterothrix spinescens* DC.]

Arctotis L.

Arctotis arctotoides (L. f.) O. Hoffm.

Arctotis aspera L.

Arctotis auriculata Jacq.

Arctotis venusta Norl.

Artemisia L.

Artemisia afra Jacq. ex Willd.

Aster L.

- Aster harveyanus* Kuntze
Aster peglerae Bolus
Aster pleiocephalus (Harv.) Hutch.
*Aster *squamatus* (Spreng.) Hieron.

Athrixia Ker Gawl.

- Athrixia elata* Sond.
Athrixia phyllicoides DC.

Berkheya Ehrh.

- Berkheya* species
Berkheya carlinopsis Welw. ex O. Hoffm.
Berkheya discolor (DC.) O. Hoffm. & Muschl.
Berkheya echinacea (Harv.) O. Hoffm. ex Burt Davy
Berkheya insignis (Harv.) Thell.
Berkheya multijuga (DC.) Roessler
Berkheya onopordifolia (DC.) O. Hoffm. ex Burt Davy
Berkheya pinnatifida (Thunb.) Thell.
Berkheya radula (Harv.) De Wild.
Berkheya seminivea Harv. & Sond.
Berkheya setifera DC.
Berkheya speciosa (DC.) O. Hoffm.
Berkheya zeyheri (Sond. & Harv.) Oliv. & Hiern

Bidens L.

- Bidens *bipinnata* L.
*Bidens *biternata* (Lour.) Merr. & Sherff
*Bidens *pilosa* L.

Blainvillea Cass.

- Blainvillea gayana* Cass.

Brachylaena R. Br.

- Brachylaena elliptica* (Thunb.) DC.

Brachylaena huillensis O. Hoffm.

Brachylaena ilicifolia (Lam.) E. Phillips & Schweick.

Brachylaena rotundata S. Moore

Callilepis DC.

Callilepis leptophylla Harv.

***Chrysanthellum** Rich.

Chrysanthellum indicum DC.

Chrysanthemoides Fabr.

Chrysanthemoides monilifera (L.) Norl.

Chrysocoma L.

Chrysocoma ciliata L.

Chrysocoma obtusata (Thunb.) Ehr. Bayer

Cineraria L.

Cineraria species

Cineraria geifolia (L.) L.

Cineraria lobata L'Hér.

***Cirsium** Mill. emend. Scop.

Cirsium vulgare (Savi) Ten.

Conyza Less.

Conyza aegyptiaca (L.) Aiton

Conyza *albida Spreng.

Conyza *bonariensis (L.) Cronquist

Conyza *canadensis (L.) Cronquist

Conyza obscura DC.

Conyza podocephala DC.

Conyza scabrida DC.

***Cosmos** Cav.

Cosmos bipinnatus Cav.

Cotula L.

Cotula anthemoides L.

***Crepis** L.

Crepis hypochoeridea (DC.) Thell.

Denekia Thunb.

Denekia capensis Thunb.

Dicrothamnus Koekemoer

Dicrothamnus rhinocerotis (L.f.) Koekemoer [*Elytropappus rhinocerotis* (L. f.) Less.]

Dicoma Cass.

Dicoma species

Dicoma anomala Sond. subsp. *anomala*

Dicoma anomala Sond. subsp. *gerrardii* (Harv. Ex F.C. Wilson) S. Ortiz & Rodr. Oubiña
[*Dicoma gerrardii* Harv. ex Wilson]

Dicoma capensis Less.

Dicoma macrocephala DC.

Dicoma schinzii O. Hoffm.

Didelta L'Hér.

Didelta spinosa (L. f.) Ait.

Dimorphotheca Vaill. ex Moench

Dimorphotheca caulescens (Harv.) Harv.

Dimorphotheca polyptera DC.

Dimorphotheca zeyheri Sond.

***Dittrichia** Greuter

Dittrichia graveolens (L.) Greuter

Eriocephalus L.

Eriocephalus species

Eriocephalus africanus L. var *africanus*

Eriocephalus africanus L. var *paniculatus* (Cass.) M.A.N. Müller, P.P.J. Henning & H.H. Kolberg [*Eriocephalus sericeus* Gaudich.]

Eriocephalus ericoides (L. f.) Druce

Eriocephalus spinescens Burch.

Erlangea Sch. Bip.

Erlangea misera (Oliv. & Hiern) S. Moore

Euryops (Cass.) Cass.

Euryops annuus Compton
Euryops anthemoides B. Nord.
Euryops empetrifolius DC.
Euryops laxus (Harv.) Burt Davy
Euryops spathaceus DC.
Euryops subcarnosus DC.

Felicia Cass.

Felicia bergeriana (Spreng.) O. Hoffm.
Felicia fascicularis DC.
Felicia filifolia (Vent.) Burt Davy
Felicia hirsuta DC.
Felicia mossamedensis (Hiern) Mendonca
Felicia muricata (Thunb.) Nees

***Flaveria** Juss.

Flaveria bidentis (L.) Kuntze

Foveolina Kallersjö

Foveolina dichotoma (DC.) Källersjö [*Foveolina albida* (DC.) Källersjö]

***Galinsoga** Ruiz & Pav.

Galinsoga parviflora Cav.

Garuleum Cass.

Garuleum latifolium Harv.
Garuleum pinnatifidum (Thunb.) DC.
Garuleum schinzii O. Hoffm.
Garuleum woodii Schinz

Gazania Gaertn.

Gazania krebsiana Less.

Geigeria Griess.

Geigeria aspera Harv.
Geigeria brevifolia (DC.) Harv.
Geigeria burkei Harv.
Geigeria filifolia Mattf.

Geigeria ornativa O. Hoffm.

Gerbera L.

Gerbera species

Gerbera ambigua (Cass.) Sch. Bip.

Gerbera jamesonii Bolus ex Adlam

Gerbera piloselloides (L.) Cass.

Gerbera viridifolia(DC.) Sch. Bip.

Gibbaria Cass.

Gibbaria scabra (Thunb.) Norl.

Haplocarpha Less.

Haplocarpha lyrata Harv.

Haplocarpha scaposa Harv.

Helichrysopsis Kirp.

Helichrysopsis species

Helichrysum Mill.

Helichrysum species

Helichrysum albilanatum Hilliard

Helichrysum arenicola M.D. Hend.

Helichrysum argyrosphaerum DC.

Helichrysum asperum (Thunb.) Hilliard & Burt

Helichrysum athrixiifolium (Kuntze) Moeser

Helichrysum aureonitens Sch. Bip.

Helichrysum caespititium (DC.) Harv.

Helichrysum callicomum Harv.

Helichrysum cephaloideum DC.

Helichrysum cerastioides DC.

Helichrysum chionosphaerum DC.

Helichrysum cymosum (L.) D. Don

Helichrysum dregeanum Sond. & Harv.

Helichrysum felinum Less.

Helichrysum harveyanum Wild

- Helichrysum herbaceum* (Andrews) Sweet
Helichrysum indicum (L.) Grierson
Helichrysum interjacens Hilliard
Helichrysum kraussii Sch. Bip.
Helichrysum krookii Moeser
Helichrysum lineare DC.
Helichrysum miconiifolium DC.
Helichrysum mundtii Harv.
Helichrysum nudifolium (L.) Less. var. *nudifolium* [*Helichrysum gerberifolium* Sch. Bip. ex A. Rich.]
Helichrysum nudifolium (L.) Less. var. *oxyphyllum* (DC.) Beentje [*Helichrysum oxyphyllum* DC.]
Helichrysum nudifolium (L.) Less. var. *pilosellum* (L.f.) Beentje [*Helichrysum pilosellum* (L. f.) Less.]
Helichrysum odoratissimum (L.) Sweet
Helichrysum oreophilum Klatt
Helichrysum paronychioides DC.
Helichrysum rosum (P.J. Bergius.) Less.
Helichrysum rotundatum Harv. [*Helichrysum coriaceum* Harv.]
Helichrysum rugulosum Less.
Helichrysum rutilans (L.) D. Don
Helichrysum setosum Harv.
Helichrysum tricostatum (Thunb.) Less.
Helichrysum uninervium Burt Davy
Helichrysum zeyheri Less.

Hertia Less.

- Hertia* species
Hertia ciliata (Harv.) Kuntze
Hertia pallens (DC.) Kuntze

Hirpicum Cass.

- Hirpicum armerioides* (DC.) Roessler

Hirpicum bechuanense (S. Moore) Roessler

***Hypochaeris L.**

Hypochaeris radicata L.

Kleinia Mill.

Kleinia fulgens Hook. f.

Kleinia longiflora DC.

Lactuca L.

Lactuca species

*Lactuca *serriola* L.

Lactuca tysonii (E.Phillips) C. Jeffrey

Laggera Benth.

Laggera crispata (Vahl) Hepper & J.R.I. Wood [*Blumea alata* of authors, not of (D. Don) DC.]

Launaea Cass.

Launaea rarifolia (Oliv. & Hiern) Boulos

Leysera L.

Leysera gnaphalodes (L.) L.

Macleodium Cass.

Macleodium zeyheri (Sond.) S. Ortiz [*Dicoma zeyheri* Sond.]

Nidorella Cass.

Nidorella anomala Steetz

Nidorella hottentotica DC.

Nidorella resedifolia DC.

Nolletia Cass.

Nolletia arenosa O. Hoffm.

Nolletia ciliaris (DC.) Steetz

Osteospermum L.

Osteospermum grandiflorum DC.

Osteospermum leptolobum (Harv.) Norl.

Osteospermum muricatum E. Mey. ex DC.

Othonna L.

Othonna carnosa Less.

Othonna cylindrica (Lam.) DC.

Othonna pavonia E. Mey.

Pegolettia Cass.

Pegolettia retrofracta (Thunb.) Kies

Pentzia Thunb.

Pentzia species

Pentzia calcarea Kies

Pentzia globosa Less.

Pentzia incana (Thunb.) Kuntze

Pentzia lanata Hutch.

Pentzia punctata Harv.

Pentzia quinquefida (Thunb.) Less.

Pentzia sphaerocephala DC.

Pentzia viridis Kies

Phymaspermum Less. emend. Källersjö

Phymaspermum acerosum (DC.) Källersjö

Phymaspermum athanasioides (S. Moore) Källersjö

Phymaspermum parvifolium (DC.) Benth. & Hook. ex B.D. Jacks.

Pseudognaphalium Kirp.

Pseudognaphalium species

Pseudognaphalium luteo-album (L.) Hilliard & Burtt

Pseudognaphalium oligandrum (DC.) Hilliard & Burtt

Pseudognaphalium undulatum (L.) Hilliard & Burtt

Psiadia Jacq.

Psiadia species

Psiadia punctulata (DC.) Oliver & Hiern ex Vatke

Pteronia L.

Pteronia divaricata (P.J. Bergius) Less.

Pteronia glauca Thunb.

Pteronia ovalifolia DC.

Pteronia pallens L. f.

Pulicaria Gaertn.

Pulicaria scabra (Thunb.) Druce

Rosenia Thunb. emend. Bremer

Rosenia humilis (Less.) K. Bremer

Schistostephium Less.

Schistostephium crataegifolium (DC.) Fenzl ex Harv.

Schistostephium griseum (Harv.) Hutch.

Schistostephium heptalobum (DC.) Oliv. & Hiern

***Schkuhria** Roth

Schkuhria pinnata (Lam.) Cabrera

Senecio L.

Senecio species

Senecio abbreviatus S. Moore

Senecio achilleifolius DC.

Senecio affinis DC.

Senecio apiifolius (DC.) Benth. & Hook. f. ex O. Hoffm.

Senecio barbertonicus Klatt

Senecio brevidentatus M.D. Hend.

Senecio burchellii DC.

Senecio cinerascens Aiton

Senecio consanguineus DC.

Senecio coronatus (Thunb.) Harv.

Senecio erubescens Aiton

Senecio glanduloso-pilosus Volkens & Muschl.

Senecio gregatus Hilliard

Senecio harveianus MacOwan

Senecio hastatus L.

Senecio herreianus Dinter

Senecio hieracioides DC.

Senecio inaequidens DC.

Senecio inornatus DC. [*Senecio lygodes* Hiern]

Senecio isatideus DC.

Senecio latifolius DC.

Senecio lydenburgensis Hutch. & Burtt Davy

Senecio madagascariensis Poir.

Senecio microglossus DC.

Senecio niveus (Thunb.) Willd.

Senecio othonniflorus DC.

Senecio oxyriifolius DC.

Senecio polyodon DC.

Senecio radicans (L. f.) Sch. Bip.

Senecio rosmarinifolius L. f.

Senecio scitus Hutch. & Burtt Davy

Senecio tamoides DC.

Senecio venosus Harv.

Seriphium L.

Seriphium plumosum L. [*Stoebe vulgaris* Levyns]

Sonchus L.

Sonchus species

Sonchus dregeanus DC.

Sonchus nanus Sond. ex Harv.

*Sonchus *oleraceus* L.

Sonchus wilmsii R.E. Fr.

***Tagetes L.**

Tagetes minuta L.

***Taraxacum F.H.Wigg.**

Taraxacum officinale Weber

Tarchonanthus L.

Tarchonanthus camphoratus L.

***Tithonia Desf. ex Juss.**

Tithonia rotundifolia (Mill.) S.F. Blake

Tolpis Adans.*Tolpis capensis* (L.) Sch. Bip.***Tragopogon** L.*Tragopogon dubius* Scop.**Tripteris** Less.*Tripteris aghillana* DC.**Ursinia** Gaertn.*Ursinia nana* DC.***Verbesina** L.*Verbesina encelioides* (Cav.) Benth. & Hook.**Vernonia** Schreb.*Vernonia* species*Vernonia capensis* (Houtt.) Druce*Vernonia fastigiata* Oliv. & Hiern*Vernonia galpinii* Klatt*Vernonia natalensis* Oliv & Hiern*Vernonia oligocephala* (DC.) Sch. Bip. ex Walp.*Vernonia poskeana* Vatke & Hildebr.***Xanthium** L.*Xanthium spinosum* L.*Xanthium strumarium* L.***Zinnia** L.*Zinnia peruviana* (L.) L.**BALANITACEAE****Balanites** Delile*Balanites maughamii* Sprague**BIGNONIACEAE*****Jacaranda** Juss.

Jacaranda mimosifolia D. Don.

Markhamia Seem. ex Baill.

Markhamia zanzibarica (Bojer ex DC.) K. Schum.

Rhigozum Burch.

Rhigozum brevispinosum Kuntze

Rhigozum obovatum Burch.

Rhigozum trichotomum Burch.

BORAGINACEAE

Anchusa L.

Anchusa capensis Thunb.

Cordia L.

Cordia monoica Roxb.

Cynoglossum L.

Cynoglossum hispidum Thunb.

Ehretia P. Browne

Ehretia amoena Klotzsch

Ehretia rigida (Thunb.) Druce

Heliotropium L.

Heliotropium ciliatum Kaplan

*Heliotropium *curassavicum* L.

Heliotropium lineare (A. DC.) Gürke

Heliotropium ovalifolium Forssk.

Heliotropium steudneri Vatke

Heliotropium strigosum Willd.

Lithospermum L.

Lithospermum cinereum A. DC.

Trichodesma R. Br.

Trichodesma africanum (L.) Lehm.

Trichodesma physaloides (Fenzl.) A. DC.

BRASSICACEAE**Erucastrum** (DC.) C. Presl

Erucastrum strigosum (Thunb.) O.E. Schulz

Lepidium L.

Lepidium species

Lepidium africanum (Burm. f.) DC.

*Lepidium *bonariense* L.

Sisymbrium L.

Sisymbrium burchellii DC.

Sisymbrium capense Thunb.

BUDDLEJACEAE**Buddleja** L.

Buddleja auriculata Benth.

Buddleja glomerata H.L. Wendl.

Buddleja loricata Leeuwenb.

Buddleja saligna Willd.

Buddleja salviifolia (L.) Lam.

Gomphostigma Turcz.

Gomphostigma virgatum (L. f.) Baill.

Nuxia Comm. ex Lam.

Nuxia congesta R. Br. ex Fresen.

Nuxia gracilis Engl.

BURSERACEAE**Commiphora** Jacq.

Commiphora species

Commiphora africana (A. Rich.) Engl.

Commiphora glandulosa Schinz

Commiphora marlothii Engl.

Commiphora mollis (Oliv.) Engl.

Commiphora pyracanthoides Engl.

Commiphora schimperi (O. Berg) Engl.

CACTACEAE

**Opuntia* Mill.

Opuntia species

Opuntia aurantiaca Lindl.

Opuntia exaltata A. Berg.

Opuntia ficus-indica (L.) Mill.

Opuntia imbricata (Haw.) DC.

Opuntia stricta Haw.

Opuntia vulgaris Mill.

CAMPANULACEAE

Wahlenbergia Schrad. ex Roth

Wahlenbergia species

Wahlenbergia albens (Spreng. ex A. DC.) Lammers [*Lightfootia albens* Spreng. ex A. DC.]

Wahlenbergia androsacea A. DC.

Wahlenbergia calcarea (Adamson) Lammers [*Lightfootia calcarea* Adamson]

Wahlenbergia denticulate (Burch.) A. DC.

Wahlenbergia lobata V. Brehm.

Wahlenbergia nodosa (H. Buek) Lammers [*Lightfootia nodosa* H. Buek]

Wahlenbergia undulata (L. f.) A. DC.

CAPPARACEAE

Boscia Lam.

Boscia albitrunca (Burch.) Gilg & Gilg-Ben.

Boscia foetida Schinz

Boscia oleoides (Burch. ex DC.) Tölken

Cadaba Forssk.*Cadaba aphylla* (Thunb.) Wild*Cadaba termitaria* N.E. Br.**Capparis** L.*Capparis tomentosa* Lam.**Cleome** L.*Cleome angustifolia* Forssk.*Cleome kalachariensis* (Schinz) Gilg & Gilg-Ben.*Cleome maculata* (Sond.) Szyszyl.*Cleome monophylla* L.*Cleome rubella* Burch.**Maerua** Forssk.*Maerua cafra* (DC.) Pax*Maerua gilgii* Schinz*Maerua juncea* Pax**CARYOPHYLLACEAE****Dianthus** L.*Dianthus basuticus* Burt Davy*Dianthus mooiensis* F.N. Williams**Pollichia** Aiton*Pollichia* species*Pollichia campestris* Aiton**Polycarpaea** Lam.*Polycarpaea *corymbosa* (L.) Lam.**Silene** L.*Silene* species*Silene bellidioides* Sond.*Silene burchellii* Otth*Silene undulata* Aiton

Spergularia (Pers.) J. Presl & C. Presl*Spergularia *media* (L.) C.Presl**Stellaria** L.*Stellaria *media* (L.) Vill.**CELASTRACEAE****Cassine** L.*Cassine* species**Elaeodendron** Jacq.*Elaeodendron transvaalense* (Burr. Davy) Archer [*Cassine transvaalensis* (Burr. Davy) Codd]**Gymnosporia** (Wight & Arn.) Hook. f.*Gymnosporia buxifolia* (L.) Szyszyl. [*Maytenus heterophylla* (Eckl. & Zeyh.) N.K.B. Robson]*Gymnosporia linearis* (L. f.) Loes [*Maytenus linearis* (L. f.) Marais]*Gymnosporia mossambicensis* (Klotzsch) Loes [*Maytenus mossambicensis* (Klotzsch) Blakelock]*Gymnosporia polyacantha* (Sond.) Szyszyl. [*Maytenus polyacantha* (Sond.) Marais]*Gymnosporia senegalensis* (Lam.) Loes [*Maytenus senegalensis* (Lam.) Exell]*Gymnosporia tenuispina* (Sond.) Szyszyl. [*Maytenus tenuispina* (Sond.) Marais]**Lydenburgia** N.Robson*Lydenburgia cassinoides* N. Robson [*Catha transvaalensis* Codd]**Maytenus** Molina*Maytenus* species*Maytenus undata* (Thunb.) Blakelock**Mystroxyton** Eckl. & Zeyh.*Mystroxyton aethiopicum* (Thunb.) Loes [*Cassine aethiopica* Thunb.]**Pristimera** Miers*Pristimera longipetiolata* (Oliv.) N. Hallé [*Hippocratea longipetiolata* Oliv.]**Putterlickia** Endl.

Putterlickia pyracantha (L.) Szyszyl.

CELTIDACEAE

Celtis L.

Celtis africana Burm. f.

Trema Lour.

Trema orientalis (L.) Blume

CHENOPODIACEAE

Atriplex L.

Atriplex species

Atriplex cinerea Poir.

Atriplex lindleyi Moq.

*Atriplex *muelleri* Benth.

*Atriplex *nummularia* Lindl.

Atriplex semibaccata R. Br.

*Atriplex *spongiosa* F. Muell.

Atriplex suberecta I. Verd.

Chenopodium L.

Chenopodium species

*Chenopodium *album* L.

*Chenopodium *ambrosioides* L.

*Chenopodium *carinatum* R. Br.

Chenopodium foliosum Asch.

*Chenopodium *multifidum* L.

*Chenopodium *murale* L.

*Chenopodium *schraderiaum* Roem. & Schult.

Exomis Fenzl ex Moq.

Exomis microphylla (Thunb.) Aellen

Manochlamys Aellen

Manochlamys albicans (Aiton) Aellen

Salsola L.

Salsola species

Salsola aphylla L. f.

Salsola glabrescens Burtt Davy

Salsola kalaharica Botsch.

Salsola kali L.

Salsola rabieana I. Verd.

Salsola tuberculata (Moq.) Fenzl

Suaeda Forssk.ex J.F. Gmel.

Suaeda fruticosa (L.) Forssk.

CHRYSOBALANACEAE**Parinari** Aubl.

Parinari capensis Harv.

COMRETACEAE**Combretum** Loefl.

Combretum apiculatum Sond.

Combretum collinum Fresen.

Combretum erythrophyllum (Burch.) Sond.

Combretum hereroense Schinz

Combretum imberbe Wawra

Combretum molle R. Br. ex G. Don

Combretum zeyheri Sond.

Terminalia L.

Terminalia brachystemma Welw. ex Hiern

Terminalia prunioides M.A. Lawson

Terminalia sericea Burch. ex DC.

CONVOLVULACEAE**Convolvulus L.**

- Convolvulus *arvensis* L.
Convolvulus boedeckerianus Peter
Convolvulus multifidus Thunb.
Convolvulus ocellatus Hook. f.
Convolvulus sagittatus Thunb.

Cuscuta L.

- Cuscuta *campestris* Yunck.

Evolvulus L.

- Evolvulus alsinoides* (L.) L.

Falkia Thunb.

- Falkia oblonga* Bernh. ex C. Krauss

Ipomoea L.

- Ipomoea* species
*Ipomoea *alba* L.
Ipomoea bathycolpos Hallier f.
Ipomoea bolusiana Schinz
Ipomoea crassipes Hook.
Ipomoea magnusiana Schinz
Ipomoea oblongata E. Mey. ex Choisy
Ipomoea obscura (L.) Ker Gawl.
Ipomoea ommaneyi Rendle
Ipomoea pellita Hallier f.
*Ipomoea *purpurea* (L.) Roth
Ipomoea sinensis (Desr.) Choisy

Merremia Dennst.

- Merremia* species
Merremia kentrocaulos (C.B. Clarke) Rendle
Merremia palmata Hallier f.

Merremia verecunda Rendle

Seddera Hochst.

Seddera species

Seddera capensis (E. Mey. ex Choisy) Hallier f.

Seddera suffruticosa (Schinz) Hallier f.

CRASSULACEAE

Adromischus Lem.

Adromischus species

Crassula L.

Crassula species

Crassula alba Forssk.

Crassula capensis (L.) Baill.

Crassula capitella Thunb. subsp. *sessilicymula* (Mogg) Tölken

Crassula cultrata L.

Crassula dependens Bolus

Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp.

Crassula elegans Schönland & Baker f. subsp. *elegans* [*Crassula mesembryanthoides* (Haw.) Dietr.]

Crassula muscosa L.

Crassula obovata Haw.

Crassula ovata (Mill.) Druce

Crassula perforata L.

Crassula sarcocaulis Eckl. & Zeyh.

Crassula sediflora (Eckl. & Zeyh.) Endl. ex Walp.

Crassula tetragona L.

Crassula vaginata Eckl. & Zeyh.

Kalanchoe Adans.

Kalanchoe species

Kalanchoe lanceolata (Forssk.) Pers.

Kalanchoe paniculata Harv.

Kalanchoe rotundifolia (Haw.) Haw.

Kalanchoe thyrsiflora Harv.

CUCURBITACEAE

Acanthosicyos Welw. ex Hook. f.

Acanthosicyos naudinianus (Sond.) C. Jeffrey

Citrullus Eckl. & Zeyh.

Citrullus lanatus (Thunb.) Matsum. & Nakai

Coccinia Wight & Arn.

Coccinia adoensis (A. Rich.) Cogn.

Coccinia rehmannii Cogn.

Coccinia sessilifolia (Sond.) Cogn.

Cucumis L.

Cucumis species

Cucumis africanus L. f.

Cucumis anguria L.

Cucumis hirsutus Sond.

Cucumis zeyheri Sond.

Kedrostis Medik.

Kedrostis africana (L.) Cogn.

Kedrostis capensis (Sond.) A. Meeuse

Kedrostis foetidissima (Jacq.) Cogn.

Momordica L.

Momordica balsamina L.

Momordica foetida Schumach.

DICHAPETALACEAE

Dichapetalum Thouars

Dichapetalum cymosum (Hook.) Engl.

DIPSACACEAE**Cephalaria** Roem. & Schult.*Cephalaria zeyheriana* Szabó**Scabiosa** L.*Scabiosa columbaria* L.**EBENACEAE****Diospyros** L.*Diospyros* species*Diospyros austro-africana* De Winter*Diospyros lycioides* Desf.*Diospyros mespiliformis* Hochst. ex A. DC.*Diospyros pallens* (Thunb.) F. White*Diospyros scabrida* (Harv. ex Hiern) De Winter*Diospyros whyteana* (Hiern) F. White**Euclea** Murray*Euclea* species*Euclea coriacea* A. DC.*Euclea crispa* (Thunb.) Gürke*Euclea divinorum* Hiern*Euclea linearis* Zeyh. ex Hiern*Euclea natalensis* A. DC.*Euclea pseudebenus* E. Mey. ex A. DC.*Euclea racemosa* Murray*Euclea schimperi* (A. DC.) Dandy*Euclea undulata* Thunb.**ERICACEAE****Erica** L.*Erica abbottii* E.G.H. Oliv.

EUPHORBIACEAE**Acalypha** L.

Acalypha species

Acalypha angustata Sond.

Acalypha capensis (L. f.) Prain & Hutch.

Acalypha caperonioides Baill.

Acalypha depressinerva (Kuntze) K. Schum. [*Acalypha schinzii* Pax]

Acalypha indica L.

Acalypha peduncularis E. Mey. ex Meisn.

Acalypha punctata Meisn.

Acalypha villicaulis Hochst.

Acalypha wilmsii Pax ex Prain & Hutch.

Bridelia Willd.

Bridelia mollis Hutch.

Clutia L.

Clutia hirsuta (Sond.) Müll. Arg.

Clutia pulchella L.

Clutia laxa Eckl. ex Sond.

Croton L.

Croton gratissimus Burch.

Erythrococca Benth.

Erythrococca menyharthii (Pax) Prain

Euphorbia L.

Euphorbia species

Euphorbia avasmontana Dinter

Euphorbia clavarioides Boiss.

Euphorbia crotonoides Boiss.

Euphorbia damarana L.C. Leach

Euphorbia epicyparissias E. Mey. ex Boiss.

Euphorbia gueinzii Boiss.

Euphorbia hirta* L. [*Chamaesyce hirta* (L.) Millsp.]

Euphorbia inaequilatera Sond. [*Chamaesyce inaequilatera* (Sond.) Sojak]

Euphorbia ingens E. Mey. ex Boiss.

Euphorbia mauritanica L.

Euphorbia pillansii N.E. Br.

Euphorbia prostrata* Aiton [*Chamaesyce prostrata* (Aiton) Small]

Euphorbia pulvinata Marloth

Euphorbia rectirama N.E. Br.

Euphorbia spicata E. Mey. ex Boiss.

Euphorbia tetragona Haw.

Euphorbia tirucalli L.

Flueggia Willd.

Flueggia virosa (Roxb. ex Willd.) Voigt [*Securinega virosa* (Roxb. ex Willd.) Pax & K. Hoffm.]

Jatropha L.

Jatropha species

Jatropha latifolia Pax

Jatropha schlechteri Pax

Jatropha zeyheri Sond.

Phyllanthus L.

Phyllanthus species

Phyllanthus angolensis Müll. Arg.

Phyllanthus asperulatus Hutch.

Phyllanthus glaucophyllus Sond.

Phyllanthus heterophyllus E. Mey. ex Müll. Arg.

Phyllanthus incurvus Thunb.

Phyllanthus maderaspatensis L.

Phyllanthus parvulus Sond.

Pseudolachnostylis Pax

Pseudolachnostylis maprouneifolia Pax

Spirostachys Sond.

Spirostachys africana Sond.

Tragia L.

Tragia rupestris Sond.

FABACEAE

Acacia Mill.

Acacia species

Acacia ataxacantha DC.

Acacia burkei Benth.

Acacia caffra (Thunb.) Willd.

Acacia **cyclops* A. Cunn. ex G. Don

Acacia **dealbata* Link

Acacia erioloba E. Mey.

Acacia erubescens Welw. ex Oliv.

Acacia galpinii Burt Davy

Acacia gerrardii Benth.

Acacia grandicornuta Gerstner

Acacia haematoxylon Willd.

Acacia hebeclada DC.

Acacia hereroensis Engl.

Acacia karroo Hayne

Acacia luederitzii Engl.

Acacia **mearnsii* De Wild.

Acacia **melanoxylon* R. Br.

Acacia mellifera (Vahl) Benth.

Acacia nigrescens Oliv.

Acacia nilotica (L.) Willd. ex Delile

Acacia permixta Burt Davy

Acacia rehmanniana Schinz

Acacia robusta Burch.

Acacia senegal (L.) Willd.

Acacia sieberiana DC.

Acacia tenuispina I. Verd.

Acacia tortilis (Forssk.) Hayne

Aeschynomene L.

Aeschynomene rehmannii Schinz

Alysicarpus Desv.

Alysicarpus rugosus (Willd.) DC.

Alysicarpus zeyheri Harv.

Argyrobium Eckl. & Zeyh.

Argyrobium collinum Eckl. & Zeyh.

Argyrobium humile E. Phillips

Argyrobium lanceolatum Eckl. & Zeyh.

Argyrobium pauciflorum Eckl. & Zeyh.

Argyrobium rupestre (Eckl. & Zeyh.) Walp.

Argyrobium stipulaceum Eckl. & Zeyh.

Argyrobium transvaalense Schinz

Argyrobium tuberosum Eckl. & Zeyh.

Argyrobium velutinum Eckl. & Zeyh.

Bauhinia L.

Bauhinia galpinii N.E. Br.

Bauhinia petersiana Bolle

Bolusanthus Harms

Bolusanthus speciosus (Bolus) Harms

Burkea Benth.

Burkea africana Hook.

Calpurnia E. Mey.

Calpurnia aurea (Aiton) Benth.

Calpurnia intrusa (R. Br. in W.T Aiton) E. Mey. [*Calpurnia villosa* Harv.]

Cassia L. emend. Gaertn.

Cassia abbreviata Oliv.

Chamaecrista Moench

Chamaecrista absus (L.) Irwin & Barneby

Chamaecrista biensis (Steyaert) Lock

Chamaecrista comosa E. Mey.

Chamaecrista mimosoides (L.) Greene

Chamaecrista stricta E. Mey.

Crotalaria L.

Crotalaria species

Crotalaria capensis Jacq.

Crotalaria laburnifolia L.

Crotalaria lotoides Benth.

Crotalaria pisicarpa Welw. ex Baker

Crotalaria podocarpa DC.

Crotalaria schinzii Baker f.

Crotalaria sphaerocarpa Perr. ex DC.

Cullen Medik.

Cullen tomentosum (Thunb.) J.W. Grimes [*Cullen obtusifolia* (DC.) C.H. Stirton]

Dichrostachys (A. DC.) Wight & Arn.

Dichrostachys cinerea (L.) Wight & Arn.

Dolichos L.

Dolichos species

Dolichos falciformis E. Mey.

Dolichos linearis E. Mey.

Dolichos trilobus L.

Elephantorrhiza Benth.

Elephantorrhiza burkei Benth.

Elephantorrhiza elephantina (Burch.) Skeels

Elephantorrhiza obliqua Burt Davy

Elephantorrhiza praetermissa J.H. Ross

Eriosema (DC.) G. Don

Eriosema species

Eriosema burkei Harv.

Eriosema cordatum E. Mey.

Eriosema ellipticifolium Schinz

Eriosema kraussianum Meisn.

Eriosema salignum E. Mey.

Erythrina L.

Erythrina species

Erythrina lysistemon Hutch.

Erythrina zeyheri Harv.

***Gleditsia L.**

Gleditsia triacanthos L.

Hoffmannseggia Cav.

Hoffmannseggia burchellii (DC.) Benth. ex Oliv.

Indigastrum Jaub. & Spach

Indigastrum costatum (Guill. & Perr.) Schrire [*Indigofera costata* Guill. & Perr.]

Indigofera L.

Indigofera species

Indigofera acanthoclada Dinter

Indigofera adenoides Baker f.

Indigofera alternans DC.

Indigofera arrecta Hochst. ex A. Rich.

Indigofera bainesii Baker

Indigofera charlieriana Schinz

Indigofera comosa N.E. Br.

Indigofera cryptantha Benth. ex Harv.

Indigofera daleoides Benth. ex Harv.

Indigofera dregeana E. Mey.

Indigofera egens N.E. Br.

Indigofera evansiana Burt Davy

Indigofera filipes Benth. ex Harv.

Indigofera flavicans Baker

Indigofera hedyantha Eckl. & Zeyh.

Indigofera heterophylla Thunb.
Indigofera heterotricha DC.
Indigofera hilaris Eckl. & Zeyh.
Indigofera holubii N.E. Br.
Indigofera longebarbata Engl.
Indigofera lupatana Baker f.
Indigofera melenadenia Benth. ex Harv.
Indigofera nebrowniana J.B. Gillett
Indigofera nigromontana Eckl. & Zeyh.
Indigofera obscura N.E. Br.
Indigofera poliotetes Eckl. & Zeyh.
Indigofera rhytidocarpa Benth. ex Harv.
Indigofera sanguinea N.E. Br.
Indigofera sessilifolia DC.
Indigofera tenuissima E. Mey.
Indigofera tristoides N.E. Br.
Indigofera velutina E. Mey.
Indigofera vicioides Jaub. & Spach
Indigofera zeyheri Spreng. ex Eckl. & Zeyh.

Lebeckia Thunb.

Lebeckia macrantha Harv.
Lebeckia multiflora E. Mey.
Lebeckia sericea Thunb.
Lebeckia spinescens Harv.

Lessertia DC.

Lessertia pauciflora Harv.

Lotononis (DC.) Eckl. & Zeyh.

Lotononis species
Lotononis crumanina Burch. ex Benth.
Lotononis foliosa Bolus
Lotononis hirsuta (Thunb.) D. Dietr.

Lotononis laxa Eckl. & Zeyh.

Lotononis listii Polhill

***Lupinus** L.

Lupinus species

Macrotyloma (Wight & Arn.) Verdc.

Macrotyloma axillare (E. Mey.) Verdc.

***Melilotus** Mill.

Melilotus alba Desr.

Melilotus indica (L.) All.

Melolobium Eckl. & Zeyh.

Melolobium species

Melolobium calycinum Benth.

Melolobium candicans (E. Mey.) Eckl. & Zeyh.

Melolobium canescens Benth.

Melolobium macrocalyx Dummer

Melolobium microphyllum (L. f.) Eckl. & Zeyh.

Mundulea (DC.) Benth.

Mundulea sericea (Willd.) A. Chev.

Neorautanenia Schinz

Neorautanenia ficifolius (Benth.) C.A. Sm.

Ormocarpum P. Beauv.

Ormocarpum trichocarpum (Taub.) Engl.

Otholobium C.H. Stirt.

Otholobium polystictum (Benth. ex Harv.) C.H. Stirt.

Otholobium wilmsii (Harms) C.H. Stirt.

Otoptera DC.

Otoptera burchellii DC.

Pearsonia Dummer

Pearsonia aristata (Schinz) Dummer

Pearsonia cajanifolia (Harv.) Polhill

Pearsonia grandifolia (Bolus) Polhill

Pearsonia sessilifolia (Harv.) Dummer

Peltophorum (Vogel) Benth.

Peltophorum africanum Sond.

Philenoptera Frenzl ex A.Rich.

Philenoptera violacea (Klotsch) Schrire [*Lonchocarpus capassa* Rolfe]

***Prosopis** L.

Prosopis glandulosa Torr.

Prosopis velutina Wooton

Pseudarthria Wight & Arn.

Pseudarthria hookeri Wight & Arn.

Pterocarpus Jacq.

Pterocarpus rotundifolius (Sond.) Druce

Requienia DC.

Requienia sphaerosperma DC.

Rhynchosia Lour.

Rhynchosia species

Rhynchosia adenodes Eckl. & Zeyh.

Rhynchosia albissima Gand.

Rhynchosia argentea (Thunb.) Harv.

Rhynchosia caribaea (Jacq.) DC.

Rhynchosia confusa Burt Davy

Rhynchosia holosericea Schinz

Rhynchosia komatiensis Harms

Rhynchosia minima (L.) DC.

Rhynchosia monophylla Schltr.

Rhynchosia nervosa Benth. & Harv.

Rhynchosia nitens Benth.

Rhynchosia reptabunda N.E. Br.

Rhynchosia sordida (E. Mey.) Schinz

Rhynchosia spectabilis Schinz

Rhynchosia totta (Thunb.) DC.

Rhynchosia vendae C.H. Stirt.

Rhynchosia venulosa (Hiern) K. Schum.

Schotia Jacq.

Schotia species

Schotia afra (L.) Thunb.

Schotia brachypetala Sond.

Senna Mill.

Senna italica Mill.

Sesbania Scop.

Sesbania species

*Sesbania *bispinosa* (Jacq.) W. Wight

Sesbania notialis J.B. Gillett.

Sesbania punicea* (Cav.) Benth.

Sphenostylis E. Mey.

Sphenostylis angustifolia Sond.

Stylosanthes Sw.

Stylosanthes fruticosa (Retz.) Alston

Sutherlandia R. Br. ex W.T. Aiton

Sutherlandia species

Sutherlandia frutescens (L.) R. Br.

Sutherlandia microphylla Burch. ex DC.

Tephrosia Pers.

Tephrosia species

Tephrosia acaciifolia Baker

Tephrosia burchellii Burt Davy

Tephrosia capensis (Jacq.) Pers.

Tephrosia elongata E. Mey.

Tephrosia forbesii Baker

Tephrosia grandiflora (Aiton) Pers.

Tephrosia longipes Meisn.

Tephrosia lupinifolia DC.

Tephrosia multijuga R.G.N. Young
Tephrosia natalensis H.M.L. Forbes
Tephrosia polystachya E. Mey.
Tephrosia purpurea (L.) Pers.
Tephrosia rhodesica Baker f.
Tephrosia semiglabra Sond.

Teramnus P. Browne

Teramnus labialis (L. f.) Spreng.

Trifolium L.

Trifolium africanum Ser.
*Trifolium** *pratense* L.
Trifolium **repens* L.

Tylosema (Schweinf.) Torre & Hillc.

Tylosema esculentum (Burch.) A. Schreib.

***Vicia** L.

Vicia sativa L.

Vigna Savi

Vigna species
Vigna vexillata (L.) A. Rich.

Zornia J.F. Gmel.

Zornia species
Zornia capensis Pers.
Zornia glochidiata DC.
Zornia linearis E. Mey.
Zornia milneana Mohlenbr.

FLACOURTIACEAE

Dovyalis E. Mey. ex Arn.

Dovyalis species
Dovyalis caffra (Hook. f. & Harv.) Hook. f.
Dovyalis rhamnoides (Burch. ex DC.) Burch. & Harv.

Dovyalis zeyheri (Sond.) Warb.

Kiggelaria L.

Kiggelaria africana L.

Scolopia Schreb.

Scolopia mundii (Eckl. & Zeyh.) Warb.

Scolopia zeyheri (Nees) Harv.

Trimeria Harv.

Trimeria grandifolia (Hochst.) Warb.

GENTIANACEAE

Chironia L.

Chironia palustris Burch.

Chironia purpurascens (E. Mey.) Benth. & Hook. f.

Sebaea Soland. ex R. Br.

Sebaea grandis (E. Mey.) Steud.

Sebaea leiostyla Gilg

GERANIACEAE

Geranium L.

Geranium harveyi Briq.

Monsonia L.

Monsonia angustifolia E. Mey. ex A. Rich.

Monsonia attenuata Harv.

Monsonia burkeana Planch. ex Harv.

Pelargonium L'Hér.

Pelargonium abrotanifolium (L. f.) Jacq.

Pelargonium bowkeri Harv.

Pelargonium dolomiticum R. Knuth

Pelargonium gilgianum Schltr. ex R. Knuth

Pelargonium luridum (Andrews) Sweet

Pelargonium reniforme Curtis

Sarcocaulon (DC.) Sweet*Sarcocaulon* species*Sarcocaulon inerme* Rehm**GISEKIACEAE****Gisekia** L.*Gisekia africana* (Lour.) Kuntze*Gisekia pharnacioides* L.**GREYIACEAE****Greyia** Hook. & Harv.*Greyia sutherlandii* Hook. & Harv.**HAMAMELIDACEAE****Trichocladus** Pers.*Trichocladus grandiflorus* Oliv.**HETEROPYXIDACEAE****Heteropyxis** Harv.*Heteropyxis natalensis* Harv.**HYPERICACEAE****Hypericum** L.*Hypericum aethiopicum* Thunb.*Hypericum lalandii* Choisy**ICACINACEAE****Cassinopsis** Sond.*Cassinopsis ilicifolia* (Hochst.) Kuntze

KIRKIACEAE**Kirkia** Oliv.*Kirkia acuminata* Oliv.*Kirkia wilmsii* Engl.**LAMIACEAE****Acrotome** Benth.*Acrotome hispida* Benth.*Acrotome inflata* Benth.**Ballota** L.*Ballota africana* (L.) Benth.**Becium** Lindl.*Becium angustifolium* (Benth.) N.E. Br.*Becium burchellianum* (Benth.) N.E. Br.*Becium filamentosum* (Forssk.) Chiov.*Becium obovatum* (E. Mey. ex Benth.) N.E. Br.**Clerodendrum** L.*Clerodendrum* species*Clerodendrum glabrum* E. Mey.*Clerodendrum ternatum* Schinz**Hemizygia** (Benth.) Briq.*Hemizygia* species*Hemizygia canescens* (Gürke) M. Ashby*Hemizygia pretoriae* (Gürke) M. Ashby**Leonotis** (Pers.) R. Br.*Leonotis leonurus* (L.) R. Br.*Leonotis ocymifolia* (Burm. f.) Iwarsson**Leucas** Burm. ex R. Br.*Leucas* species*Leucas capensis* (Benth.) Engl.

Leucas glabrata (Vahl) Sm.

Leucas martinicensis (Jacq.) R. Br.

Leucas neuflizeana Courbon

Leucas sexdentata Skan

Mentha L.

Mentha species

Mentha longifolia (L.) Huds.

Ocimum L.

Ocimum americanum non L.

Orthosiphon Benth.

Orthosiphon tubiformis R. D. Good

Plectranthus L'Hér.

Plectranthus cylindraceus Hochst. ex Benth.

Plectranthus dolichopodus Briq.

Plectranthus grandidentatus Gürke

Plectranthus hereroensis Engl.

Plectranthus madagascariensis (Pers.) Benth.

Plectranthus neochilus Schltr.

Plectranthus rubropunctatus Codd

Rabdosiella Codd

Rabdosiella calycina (Benth.) Codd

Rothea Raf.

Rothea hirsuta (Hochst.) R. Fern. [*Clerodendrum triphyllum* (Harv.) H. Pearson]

Salvia L.

Salvia species

Salvia dentata Aiton

Salvia disermas L.

Salvia namaensis Schhinz

Salvia radula Benth.

Salvia repens Burch. ex Benth.

Salvia runcinata L. f.

Salvia stenophylla Burch. ex Benth.

Salvia verbenaca L.

Satureja L.

Satureja biflora (Buch.-Ham. ex D. Don) Briq.

Stachys L.

Stachys burchelliana Launert

Stachys cymbalaria Briq.

Stachys dregeana Benth.

Stachys kuntzei Gürke

Stachys linearis Burch. ex Benth.

Stachys natalensis Hochst.

Stachys rugosa Aiton

Stachys spathulata Burch. ex Benth.

Syncolostemon E. Mey. ex Benth.

Syncolostemon concinnus N.E. Br.

Tetradenia Benth.

Tetradenia riparia (Hochst.) Codd

Teucrium L.

Teucrium africanum Thunb.

Teucrium kraussii Codd

Teucrium trifidum Retz. [*Teucrium capense* Thunb.]

Tinnea Kotschy ex Peyr.

Tinnea rhodesiana S. Moore

Vitex L.

Vitex obovata E. Mey.

Vitex pooara Corbishley

Vitex rehmannii Gürke

Vitex zeyheri Sond.

LOBELIACEAE

Cyphia Berg.

Cyphia angustifolia Eckl. & Zeyh.

Cyphia assimilis Sond.

Lobelia L.

Lobelia angolensis Engl. & Diels

Lobelia erinus L.

Lobelia flaccida (C. Presl) A. DC.

Lobelia thermalis Thunb.

Monopsis Salisb.

Monopsis decipiens (Sond.) Thulin

LORANTHACEAE

Agelanthus Tiegh.

Agelanthus natalitius (Meisn.) Polhill & Wiens [*Tapinanthus natalitius* (Meisn.) Danser]

Tapinanthus (Blume) Reichb.

Tapinanthus oleifolius (J.C. Wendl.) Danser

Tapinanthus rubromarginatus (Engl.) Danser

LYTHRACEAE

Ammannia L.

Ammannia species

Nesaea Comm. ex Juss.

Nesaea schinzii Koehne

MALPIGHIACEAE

Sphedamnocarpus Planch. ex Benth. & Hook. f.

Sphedamnocarpus pruriens (A. Juss.) Szyszyl.

Triaspis Burch.

Triaspis glaucophylla Engl.

Triaspis hypericoides (DC.) Burch.

MALVACEAE**Abutilon** Mill.*Abutilon* species*Abutilon austro-africanum* Hochr.*Abutilon guineense* (K. Schum.) Baker f. & Exell*Abutilon lauraster* Hochr.*Abutilon sonneratianum* (Cav.) Sweet***Anoda** Cav.*Anoda cristata* (L.) Schldl.**Gossypium** L.*Gossypium herbaceum* L.**Hibiscus** L.*Hibiscus* species*Hibiscus aethiopicus* L.*Hibiscus calyphyllus* Cav.*Hibiscus cannabinus* L.*Hibiscus coddii* Exell*Hibiscus engleri* K. Schum.*Hibiscus lunarifolius* Willd.*Hibiscus marlothianus* K. Schum.*Hibiscus micranthus* L. f.*Hibiscus microcarpus* Garcke*Hibiscus praeteritus* R.A. Dyer*Hibiscus pusillus* Thunb.*Hibiscus sidiformis* Baill.*Hibiscus trionum* L.***Malvastrum** A. Gray*Malvastrum coromandelianum* (L.) Garcke**Pavonia** Cav.*Pavonia burchellii* (DC.) R.A. Dyer

Pavonia senegalensis (Cav.) Leistner

Pavonia transvaalensis (Ulbr.) A. Meeuse

Sida L.

Sida alba L.

Sida chrysantha Ulbr.

Sida cordifolia L.

Sida dregei Burt Davy

Sida ovata Forssk.

Sida rhombifolia L.

Sida spinosa L.

Sida ternata L. f.

***Sphaeralcea A.St-Hil.**

Sphaeralcea bonariensis (Cav.) Griseb.

MELIACEAE

***Melia L.**

Melia azedarach L.

MELIANTHACEAE

Melianthus L

Melianthus comosus Vahl

Melianthus pectinatus Harv.

MENISPERMACEAE

Antizoma Miers

Antizoma angustifolia (Burch.) Miers ex Harv.

Antizoma miersiana Harv.

Cissampelos L.

Cissampelos capensis L. f.

MESEMRYANTHACEAE**Aridaria** N.E. Br.*Aridaria noctiflora* (L.) Schwantes**Carpobrotus** N.E. Br.*Carpobrotus edulis* (L.) L. Bolus**Conicosia** N.E. Br.*Conicosia* species [*Herrea* species]*Conicosia elongata* (Haw.) N.E. Br.**Delosperma** N.E. Br. emend Lavis*Delosperma* species*Delosperma cooperi* (Hook. f.) L. Bolus*Delosperma frutescens* L. Bolus*Delosperma herbeum* (N.E. Br.) N.E. Br.*Delosperma mahonii* (N.E. Br.) N.E. Br.**Drosanthemum** Schwantes*Drosanthemum* species**Erepsia** N.E. Br.*Erepsia ramosa* L. Bolus [*Erepsia roseoalba* L. Bolus]**Faucaria** Schwantes*Faucaria felina* (L.) Schwantes [*Faucaria cradockensis* L. Bolus, *Faucaria longidens* L. Bolus, *Faucaria lupina* (Haw.) Schwantes]*Faucaria bosscheana* (A. Berger) Schwantes [*Faucaria peersii* L. Bolus]**Hereroa** (Schwantes) Dinter & Schwantes*Hereroa* species*Hereroa wilmaniae* L. Bolus**Lithops** N.E. Br.*Lithops lesliei* (N.E. Br.) N.E. Br.**Mesembryanthemum** L.*Mesembryanthemum crystallinum* L.

Mesembryanthemum guerichianum Pax [*Mesembryanthemum squamulosum* (L. Bolus) L. Bolus]

Mestoklema N.E. Br. ex Glen

Mestoklema arboriforme (Burch.) N.E. Br. ex Glen

Mestoklema tuberosum (L.) N.E. Br. ex Glen

Nananthus N.E. Br.

Nananthus species

Psilocaulon N.E. Br.

Psilocaulon coriarium (Burch. ex N.E. Br.) N.E. Br.

Psilocaulon junceum (Haw.) Schwantes

Ruschia Schwantes

Ruschia species

Ruschia griquensis (L. Bolus) Schwantes

Ruschia hamata (L. Bolus) Schwantes

Ruschia namusmontana Friedriech

Ruschia spinosa (L.) Dehn

Ruschianthus L. Bolus

Ruschianthus species

Stoeberia Dinter & Schwantes

Stoeberia beetzii (Dinter) Dinter & Schwantes

Trichodiadema Schwantes

Trichodiadema barbatum (L.) Schwantes

Trichodiadema pomeridianum L. Bolus

MOLLUGINACEAE

Corbichonia Scop.

Corbichonia decumbens (Forssk.) Exell

Hypertelis E. Mey. ex Fenzl

Hypertelis bowkeriana Sond.

Hypertelis salsoloides (Burch.) Adamson

Limeum L.

Limeum species

Limeum aethiopicum Burm.

Limeum arenicolum G. Schellenb.

Limeum argute-carinatum Wawra ex Warwa & Peyr.

Limeum fenestratum (Fenzl) Hiemerl

Limeum sulcatum (Klotzsch) Hutch.

Limeum viscosum (J. Gay) Fenzl

Pharnaceum L.

Pharnaceum lanatum Bartl.

MONTINIACEAE

Montinia Thunb.

Montinia caryophyllacea Thunb.

MORACEAE

Ficus L.

Ficus abutilifolia (Miq.) Miq.

Ficus burkei (Miq.) Miq. [*Ficus thonningii* Blume]

Ficus cordata Thunb.

Ficus craterostoma Warb. ex Mildbr. & Burret

Ficus glumosa Delile

Ficus ilicina (Sond.) Miq.

Ficus ingens (Miq.) Miq.

Ficus natalensis Hochst.

Ficus sur Forssk.

Morus L.

Morus species

*Morus *japonica* Audib.

MYRSINACEAE

Myrsine L.

Myrsine africana L.

MYRTACEAE

**Eucalyptus* L'Hér.

Eucalyptus species

Eucalyptus cladocalyx F.J. Muell.

**Psidium* L.

Psidium guajava L.

Syzygium Gaertn.

Syzygium cordatum Hochst. Ex C. Krauss.

NYCTAGINACEAE

Commicarpus Standl.

Commicarpus fallacissimus (Heimerl) Heimerl ex Oberm., Schweick. & I. Verd.

Commicarpus pentandrus (Burch.) Heimerl

OCHNACEAE

Ochna L.

Ochna pulchra Hook. f.

Ochna serrulata (Hochst.) Walp.

OLACACEAE

Ximenia L.

Ximenia americana L.

Ximenia caffra Sond.

OLEACEAE

Jasminum L.

Jasminum breviflorum Harv. ex C.H. Wright

Jasminum fluminense Vell.

Jasminum quinquatum Schinz

Menodora Humb. & Bonpl.*Menodora africana* Hook.*Menodora heterophylla* Moric. ex DC.**Olea** L.*Olea capensis* L.*Olea europaea* L.**ONAGRACEAE*****Oenothera** L.*Oenothera affinis* Cambess.*Oenothera indecora* Cambess.*Oenothera rosea* L' Hér. ex Aiton*Oenothera stricta* Ledeb. ex Link*Oenothera tetraptera* Cav.**OROBANCHACEAE****Cycnium** E. Mey ex Benth. emend. Engl.*Cycnium adonense* E. Mey. ex Benth.*Cycnium tubulosum* (L. f.) Engl.**Graderia** Benth.*Graderia scabra* (L. f.) Benth.**Sopubia** Buch.-Ham. ex D. Don*Sopubia cana* Harv.**Striga** Lour.*Striga asiatica* (L.) Kuntze*Striga bilabiata* (Thunb.) Kuntze*Striga elegans* Benth.*Striga gesnerioides* (Willd.) Vatke ex Engl.

OXALIDACEAE**Oxalis L.**

Oxalis species

Oxalis ambigua Jacq.

Oxalis bifida Thunb.

*Oxalis *corniculata* L.

Oxalis depressa Eckl. & Zeyh.

*Oxalis *latifolia* Humb., Bonpl. & Kunth

Oxalis obliquifolia Steud. ex Rich.

Oxalis pes-caprae L.

Oxalis purpurea L.

Oxalis semiloba Sond.

PAPAVERACEAE***Argemone L.**

Argemone ochroleuca Sweet

Papaver L.

Papaver aculeatum Thunb.

PASSIFLORACEAE**Adenia Forssk.**

Adenia digitata (Harv.) Engl.

Adenia glauca Schinz

PEDALIACEAE**Ceratotheca Endl.**

Ceratotheca triloba (Bernh.) Hook. f.

Dicerocaryum Bojer

Dicerocaryum eriocarpum (Decne.) Abels

Harpagophytum DC. ex Meissn.*Harpagophytum procumbens* (Burch.) DC. ex Meissn.*Harpagophytum zeyheri* Decne.**Pterodiscus** Hook.*Pterodiscus speciosus* Hook.**Sesamum** L.*Sesamum alatum* Thonn.*Sesamum triphyllum* Welw. ex Aschers.**PENAEACEAE****Saltera** Bullock*Saltera sarcocolla* (L.) Bullock**PHYTOLACCACEAE****Lophiocarpus** Turcz.*Lophiocarpus polystachyus* Turcz.*Lophiocarpus tenuissimus* Hook. f.**Phytolacca** L.*Phytolacca heptandra* Retz.**PITTOSPORACEAE****Pittosporum** Banks ex Sol.*Pittosporum viridiflorum* Sims**PLANTAGINACEAE****Plantago** L.*Plantago *lanceolata* L.*Plantago longissima* Decne.*Plantago major* L.

PLUMBAGINACEAE**Dyerophytum** Kuntze

Dyerophytum africanum (Lam.) Kuntze

Plumbago L.

Plumbago species

Plumbago auriculata Lam.

Plumbago zeylanica L.

POLYGALACEAE**Polygala** L.

Polygala species

Polygala amatymbica Eckl. & Zeyh.

Polygala ericaefolia DC.

Polygala hottentotta C. Presl

Polygala leptophylla Burch.

Polygala ohlendoriana Eckl. & Zeyh.

Polygala rehmannii Chodat

Polygala uncinata E. Mey. ex Meisn.

Polygala virgata Thunb.

Securidaca L.

Securidaca longepedunculata Fresen.

POLYGONACEAE**Oxygonum** Burch. ex Campd.

Oxygonum alatum Burch.

Oxygonum delagoense Kuntze

Oxygonum dregeanum Meisn.

Oxygonum sinuatum (Hochst. & Steud. ex Meisn.) Damm.

Persicaria (L.) Mill.

Persicaria species

Persicaria attenuata (R. Br.) Soják

Persicaria decipiens (R. Br) Wilson [*Persicaria serrulata* (Lag.) Webb & Moq.]

Persicaria hystricula (J. Schust.) Soják [*Polygonum hystriculum* Schuster]

*Persicaria *lapathifolia* (L.) Gray

Polygonum L.

*Polygonum *aviculare* L.

*Polygonum *kitaibelianum* Sadler

Rumex L.

Rumex species

*Rumex *crispus* L.

Rumex lanceolatus Thunb.

Rumex sagittatus Thunb.

PORTULACACEAE

Anacampseros L.

Anacampseros filamentosa (Haw.) Sims

Portulaca L.

Portulaca kermesina N.E. Br.

*Portulaca *oleracea* L.

Portulaca pilosa L.

Portulaca quadrifida L.

Portulacaria Jacq.

Portulacaria species

Portulacaria afra Jacq.

Talinum Adans.

Talinum arnotii Hook. f.

Talinum caffrum (Thunb.) Eckl. & Zeyh.

Talinum crispatum Dinter ex Poelln.

PROTEACEAE

Faurea Harv.

Faurea salicifolia (Vent.) B.L. Burtt [*Faurea saligna* Harv.]

Faurea rochetiana (A. Rich.) Chiov. ex Pic. Serm. [*Faurea speciosa* (Welw.)

Leucadendron R. Br.

Leucadendron spissifolium (Salisb. ex Knight) I. Williams

Protea L.

Protea caffra Meisn.

RANUNCULACEAE**Clematis** L.

Clematis species

Clematis brachiata Thunb.

Clematis oweniae Harv.

Clematis villosa DC. [*Clematopsis scabiosifolia* (DC.) Hutch.]

Knowltonia Salisb.

Knowltonia species

Ranunculus L.

Ranunculus multifidus Forssk.

RHAMNACEAE**Berchemia** Neck. ex DC.

Berchemia zeyheri (Sond.) Grubov

Helinus E. Mey. ex Endl.

Helinus integrifolius (Lam.) Kuntze

Rhamnus L.

Rhamnus prinoides L'Hér.

Scutia (Comm. ex DC.) Brongn.

Scutia myrtina (Burm. f.) Kurz

Ziziphus Mill.

Ziziphus mucronata Willd.

Ziziphus zeyheriana Sond.

ROSACEAE**Cliffortia** L.

Cliffortia nitidula (Engl.) R.E. Fr. & T.C.E. Fr.

Cotoneaster Medik.

Cotoneaster species

Cotoneaster **franchetii* Boiss.

Leucosidea Eckl. & Zeyh.

Leucosidea sericea Eckl. & Zeyh.

Rubus L.

Rubus species

Rubus **cuneifolius* Pursh

Rubus rigidus Sm.

RUBIACEAE**Agathisanthemum** Klotzsch

Agathisanthemum bojeri Klotzsch

Anthospermum L.

Anthospermum species

Anthospermum hispidulum E. Mey. ex Sond.

Anthospermum rigidum Eckl. & Zeyh.

Anthospermum spathulatum Spreng.

Canthium Lam.

Canthium ciliatum (Klotzsch) Kuntze

Canthium gilfillanii (N.E. Br.) O.B. Mill.

Canthium inerme (L. f.) Kuntze

Canthium mundianum Cham.& Schltdl.

Cephalanthus L.

Cephalanthus natalensis Oliv.

Conostomium (Stapf) Cufod

Conostomium natalense (Hochst.) Bremek.

Fadogia Schweinf.

Fadogia homblei De Wild.

Galium L.

Galium capense Thunb.

Galium spurium L.

Galium tomentosum Thunb.

Galopina Thunb.

Galopina circaeoides Thunb.

Gardenia J.Ellis

Gardenia lutea Fresen.

Gardenia volkensii K. Schum.

Kohautia Cham. & Schldl.

Kohautia species

Kohautia amatymbica Eckl. & Zeyh.

Kohautia caespitosa Schnizl.

Kohautia cynanchica DC.

Kohautia virgata (Willd.) Bremek.

Nenax Gaertn.

Nenax microphylla (Sond.) Salter

Oldenlandia L.

Oldenlandia herbacea (L.) Roxb.

Pavetta L.

Pavetta edentula Sond.

Pavetta gardeniifolia A. Rich.

Pavetta zeyheri Sond.

Pentanisia Harv.

Pentanisia angustifolia (Hochst.) Hochst.

Pentanisia prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp.

Psychotria L.

Psychotria capensis (Eckl.) Vatke

Psydrax Gaertn.

Psydrax livida (Hiern) Bridson

Pygmaeothamnus Robyns

Pygmaeothamnus chamaedendrum (Kuntze) Robyns

Pygmaeothamnus zeyheri (Sond.) Robyns

***Richardia** L.

Richardia brasiliensis Gomes

Rubia L.

Rubia species

Rubia horrida (Thunb.) Puff

Rubia petiolaris DC.

Spermacoce Gaertn.

Spermacoce deserti N.E. Br.

Spermacoce natalensis Hochst.

Spermacoce senensis (Klotzsch) Hiern

Tricalysia A. Rich. ex DC.

Tricalysia lanceolata (Sond.) Burtt Davy

Vangueria Comm. ex Juss.

Vangueria cyanescens Robyns

Vangueria infausta Burch.

Vangueria parvifolia Sond. [*Tapiphyllum parvifolium* (Sond.) Robyns]

RUTACEAE

Calodendrum Thunb.

Calodendrum capense (L. f.) Thunb.

Clausena Burm. f.

Clausena anisata (Willd.) Hook. f. ex Benth.

Ptaeroxylon Eckl. & Zeyh.

Ptaeroxylon obliquum (Thunb.) Radlk.

Vepris Comm. ex A. Juss.*Vepris lanceolata* (Lam.) G. Don**Zanthoxylum** L.*Zanthoxylum* species*Zanthoxylum capense* (Thunb.) Harv.*Zanthoxylum davyi* (I. Verd.) P.G. Waterman*Zanthoxylum thorncroftii* (I. Verd.) P.G. Waterman**SALICACEAE****Salix** L.*Salix *babylonica* L.*Salix *fragilis* L.*Salix mucronata* Thunb.**SALVADORACEAE****Azima** Lam.*Azima tetracantha* Lam.**Salvadora** Garcin ex L.*Salvadora australis* Schweick.**SANTALACEAE****Osyris** L.*Osyris lanceolata* Hochst. & Steud.**Thesium** L.*Thesium* species*Thesium costatum* A.W. Hill*Thesium cytisoides* A.W. Hill*Thesium glomeratum* A.W. Hill*Thesium gracilentum* N.E. Br.*Thesium hystrix* A.W. Hill*Thesium lineatum* L. f. [*Thesium rigidum* Sond.]

Thesium magalismontanum Sond.

Thesium multiramulosum Pilg.

Thesium scirpioides A.W. Hill

Thesium strictum P.J. Bergius

Thesium utile A.W. Hill

SAPINDACEAE

Allophylus L.

Allophylus africanus P. Beauv. [*Allophylus melanocarpus* (Sond.) Radlk.]

Cardiospermum L.

Cardiospermum corindum L.

Dodonaea Mill.

Dodonaea viscosa Jacq. var. *angustifolia* (L.f.) Benth [*Dodonaea angustifolia* L.f.]

Dodonaea viscosa Jacq. var. *viscosa*

Hippobromus Eckl. & Zeyh.

Hippobromus pauciflorus (L. f.) Radlk.

Pappea Eckl. & Zeyh.

Pappea capensis Eckl. & Zeyh.

SAPOTACEAE

Englerophytum K. Krause

Englerophytum magalismontanum (Sond.) T. D. Penn.

Mimusops L.

Mimusops zeyheri Sond.

SCHROPHULARIACEAE

Aptosimum Burch. ex Benth

Aptosimum species

Aptosimum albomarginatum Marloth & Engl.

Aptosimum decumbens Schinz

Aptosimum indivisum Burch. ex Benth.

Aptosimum lineare Marloth & Engl.

Aptosimum marlothii (Engl.) Hiern

Aptosimum procumbens (Lehm.) Steud.

Aptosimum spinescens (Thunb.) F.E. Weber

Diclis Benth.

Diclis rotundifolia (Hiern) Hilliard & Burt

Halleria L.

Halleria lucida L.

Hebenstretia L.

Hebenstretia angolensis Rolfe

Hebenstretia dentata L.

Hebenstretia integrifolia L.

Jamesbrittenia Kuntze

Jamesbrittenia atropurpurea (Benth.) Hilliard

Jamesbrittenia filicaulis (Benth.) Hilliard [*Sutera pinnatifida* (Benth.) Kuntze]

Jamesbrittenia pinnatifida (L. f.) Hilliard]

Limosella L.

Limosella grandiflora Benth.

Lindernia All.

Lindernia nana (Engl.) Roessler

Manulea L.

Manulea species

Manulea namibensis (Roessler) Hilliard

Mimulus L.

Mimulus gracilis R. Br.

Peliostomum E. Mey ex Benth.

Peliostomum leucorrhizum E. Mey. ex Benth.

Peliostomum origanoides E. Mey. ex Benth.

Peliostomum virgatum E. Mey. ex Benth.

Selago L.

Selago species

Selago albida Choisy

Selago corymbosa L.

Selago densiflora Rolfe [*Walafrida densiflora* (Rolfe) Rolfe]

Selago geniculata L. f. [*Walafrida geniculata* (L.f.) Rolfe]

Selago nachtigalii Rolfe

Selago paniculata Thunb.

Selago saxatilis E. Mey. [*Walafrida saxatilis* (E. Mey.) Rolfe]

Selago welwitschii Rolfe

Sutera Roth

Sutera caerulea (L. f.) Hiern

Sutera griquensis Hiern [*Sutera burchellii* Hiern]

Sutera halimifolia (Benth.) Kuntze

Sutera patriotica Hiern

Sutera polelensis Hiern

Sutera uncinata (Desr.) Hilliard

Tetraselago Junell

Tetraselago natalensis (Rolfe) Junell

Veronica L.

Veronica anagallis-aquatica L.

Zaluzianskya F.W. Schmidt

Zaluzianskya benthamiana Walp.

Zaluzianskya elongata Hilliard & B.L. Burtt

Zaluzianskya peduncularis (Benth.) Walp.

SOLANACEAE

Cestrum L.

*Cestrum** *laevigatum* Schldl.

Datura L.

Datura **ferox* L.

Datura **stramonium* L.

Lycium L.

Lycium species

Lycium afrum L.

Lycium bosciifolium Schinz

Lycium cinereum Thunb. [*Lycium prunus-spinosa* Dunal]

Lycium ferocissimum Miers

Lycium hirsutum Dunal

Lycium oxycarpum Dunal

Lycium pilifolium C.H. Wright

Lycium schizocalyx C.H. Wright

***Nicotiana** L.

Nicotiana glauca R.C. Grah.

Nicotiana longiflora Cav.

***Physalis** L.

Physalis angulata L.

Physalis viscosa L.

Solanum L.

Solanum species

*Solanum *americanum* Mill. [*Solanum nodiflorum* Jacq.]

Solanum capense L.

Solanum delagoense Dunal

*Solanum *elaeagnifolium* Cav.

Solanum giftbergense Dunal

Solanum giganteum Jacq.

Solanum incanum L.

*Solanum *mauritianum* Scop.

*Solanum *nigrum* L.

Solanum panduriforme E. Mey.

*Solanum *pseudocapsicum* L.

Solanum retroflexum Dunal

Solanum rigescens Jacq.

*Solanum *sisymbriifolium* Lam.

- Solanum supinum* Dunal var. *leucophaeum* (Dunal) Bitter [*Solanum leucophaeum* Dunal]
Solanum tettense Klotsch var. *renschii* (Vatke) A.E. Gonç. [*Solanum kwebense* N.E. Br.]
Solanum tomentosum L. var. *coccineum* (Jacq.) Willd. [*Solanum coccineum* Jacq.]

Withania Pauquy

- Withania somnifera* (L.) Dunal

STERCULIACEAE

Dombeya Cav.

- Dombeya burgesiae* Gerrard ex Harv.
Dombeya cymosa Harv.
Dombeya pulchra N.E. Br.
Dombeya rotundifolia (Hochst.) Planch.

Hermannia L.

- Hermannia* species
Hermannia althaeoides Link
Hermannia amoena Dinter ex Friedr. – Holz.
Hermannia antonii I. Verd.
Hermannia bryonifolia Burch.
Hermannia coccocarpa (Eckl. & Zeyh.) Kuntze
Hermannia comosa Burch. ex DC.
Hermannia cuneifolia Jacq.
Hermannia depressa N.E. Br.
Hermannia disermifolia Jacq.
Hermannia eenii Baker f.
Hermannia filifolia L. f.
Hermannia floribunda Harv.
Hermannia geniculata Eckl. & Zeyh.
Hermannia glabrata L. f.
Hermannia glanduligera K. Schum.
Hermannia lancifolia Szyszyl.

Hermannia linearifolia Harv.
Hermannia modesta (Ehrenb.) Mast.
Hermannia odorata Aiton
Hermannia pulchella L. f.
Hermannia quartiniana A. Rich.
Hermannia spinosa E. Mey. ex Harv.
Hermannia tomentosa (Turcz.) Schinz ex Engl.
Hermannia transvaalensis Schinz
Hermannia vestita Thunb.

Melhania Forssk.

Melhania species
Melhania acuminata Mast.
Melhania burchellii DC.
Melhania didyma Eckl. & Zeyh.
Melhania forbesii Planch. ex Mast.
Melhania prostrata DC.
Melhania randii Baker f.
Melhania rehmannii Szyszyl.

Waltheria L.

Waltheria indica L.

STRYCHNACEAE

Strychnos L.

Strychnos cocculoides Baker
Strychnos madagascariensis Poir.
Strychnos pungens Soler.

TAMARICACEAE

Tamarix L.

Tamarix usneoides E. Mey. ex Bunge

THYMELAEACEAE**Dais L.**

Dais cotinifolia L.

Gnidia L.

Gnidia caffra (Meisn.) Gilg

Gnidia capitata L. f.

Gnidia cuneata Meisn.

Gnidia gymnostachya (C.A. Mey.) Gilg

Gnidia kraussiana Meisn.

Gnidia microcephala Meisn.

Gnidia polycephala (C.A. Mey.) Gilg

Gnidia sericea L.

Gnidia variabilis (C.H. Wright) E. Phillips

TILIACEAE**Corchorus L.**

Corchorus species

Corchorus asplenifolius Burch.

Corchorus confusus Wild

*Corchorus *trilocularis* L.

Grewia L.

Grewia species

Grewia bicolor Juss.

Grewia caffra Meisn.

Grewia flava DC.

Grewia flavescens Juss.

Grewia hispida Harv.

Grewia monticola Sond.

Grewia occidentalis L.

Grewia retinervis Burret

Grewia robusta Burch.

Grewia subspathulata N.E. Br.

Grewia vernicosa Schinz

Grewia villosa Willd.

Sparrmannia L. f.

Sparrmannia ricinocarpa (Eckl. & Zeyh.) Kuntze

Triumfetta L.

Triumfetta sonderi Ficalho & Hiern

TURNERACEAE

Tricliceras Thonn. ex DC.

Tricliceras schinzii (Urb.) R. Fern.

URTICACEAE

Didymodoxa Wedd.

Didymodoxa caffra (Thunb.) Friis & Wilmot-Dear

Urtica L.

*Urtica *dioica* L.

VAHLIACEAE

Vahlia Thunb.

Vahlia capensis (L. f.) Thunb.

VERBENACEAE

Chascanum E. Mey.

Chascanum adenostachyum (Schauer) Moldenke

Chascanum hederaceum (Sond.) Moldenke

Chascanum pinnatifidum (L. f.) E. Mey.

***Duranta** L.

Duranta erecta L.

Lantana L.

*Lantana *camara* L.

Lantana rugosa Thunb.

Lippia L.

Lippia javanica (Burm. f.) Spreng.

Lippia rehmannii H. Pearson

Lippia scaberrima Sond.

***Phyla Lour.**

Phyla nodiflora (L.) Greene

***Verbena L.**

Verbena aristigera S.Moore [*Verbena tenuisecta* Briq.]

Verbena bonariensis L.

Verbena brasiliensis Vell.

Verbena officinalis L.

VISCACEAE**Viscum L.**

Viscum capense L. f.

Viscum menyharthii Engl. & Schinz

Viscum obscurum Thunb.

Viscum rotundifolium L. f.

VITACEAE**Cissus L.**

Cissus cornifolia (Baker) Planch.

Cissus cussonioides Schinz

Cyphostemma (Planch.) Alston

Cyphostemma cirrhosum (Thunb.) Desc. ex Wild & R.B.Drumm.

Cyphostemma humile (N.E. Br.) Desc. ex Wild & R.B.Drumm.

Cyphostemma lanigerum (Harv.) Desc. ex Wild & R.B.Drumm..

Cyphostemma quinatum (Dryand.) Desc. ex Wild & R.B.Drumm.

Cyphostemma stenolobum (Welw. ex Planch.) Desc. ex Wild & R.B.Drumm.

Cyphostemma sulcatum (C.A. Sm.) J.J.M. v.d. Merwe

Rhoicissus Planch.

Rhoicissus tomentosa (Lam.) Wild & R.B. Drumm.

Rhoicissus tridentata (L. f.) Wild & R.B.Drumm.

ZYGOPHYLLACEAE

Sisyndite E. Mey. ex Sond.

Sisyndite spartea E. Mey. ex Sond.

Tribulus L.

Tribulus species

Tribulus terrestris L.

Zygophyllum L.

Zygophyllum flexuosum Eckl. & Zeyh.

Zygophyllum foetidum Schrad. & J.C. Wendl.

Zygophyllum incrustatum E. Mey. ex Sond.

Zygophyllum macrocarpon Retief

Zygophyllum microcarpum Licht. ex Cham. & Schtdl.

Zygophyllum microphyllum L. f.

Zygophyllum morgsana L.

Zygophyllum pubescens Schinz

Zygophyllum retrofractum Thunb.

Zygophyllum simplex L.

Zygophyllum spinosum L.

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